National Aeronautics and Space Administration

BUDGET ESTIMATES

FISCAL YEAR 1964

Volume IV

CONSTRUCTION OF FACILITIES

PART 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

MANNED SPACECRAFT CENTER

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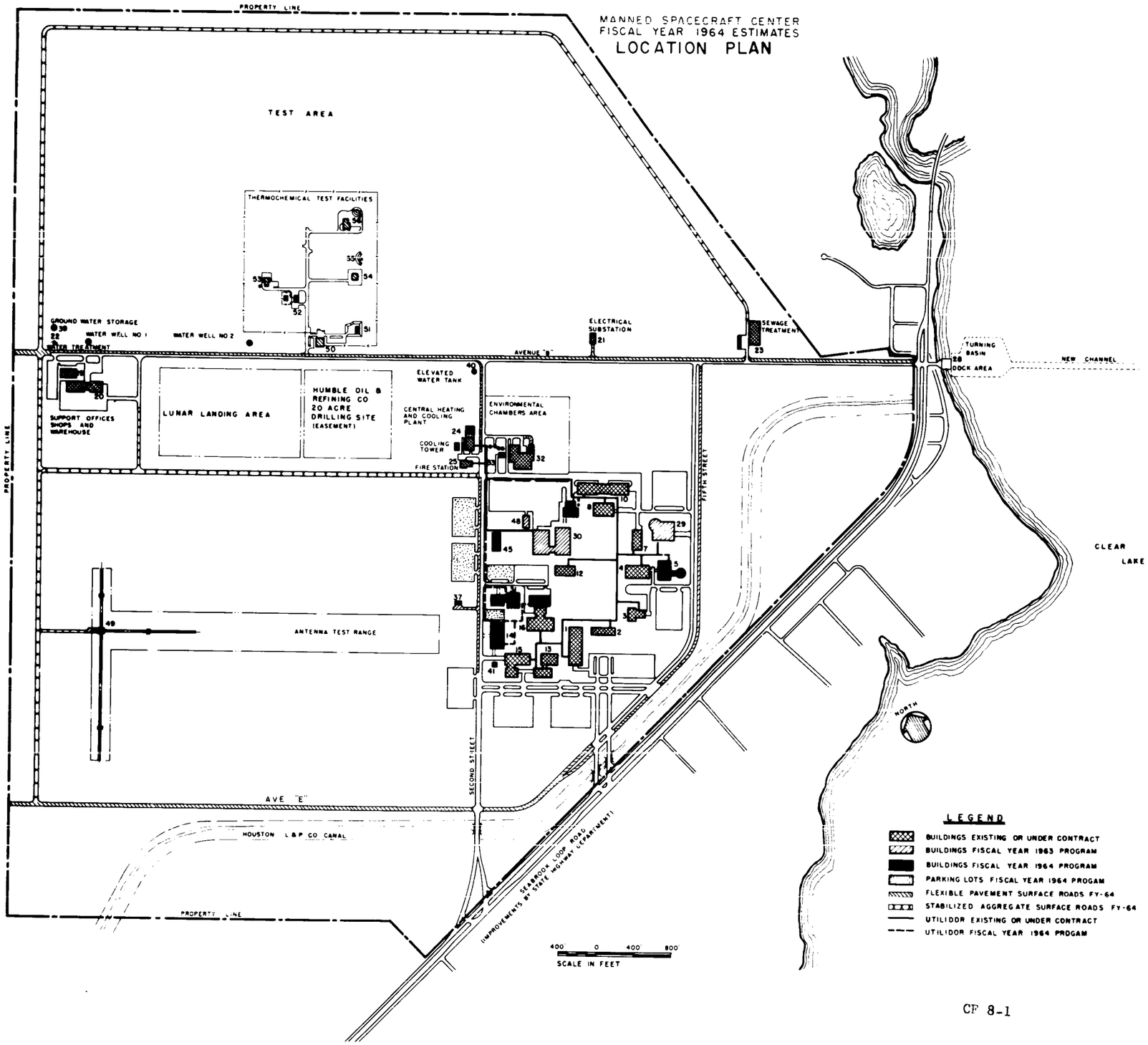
MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN



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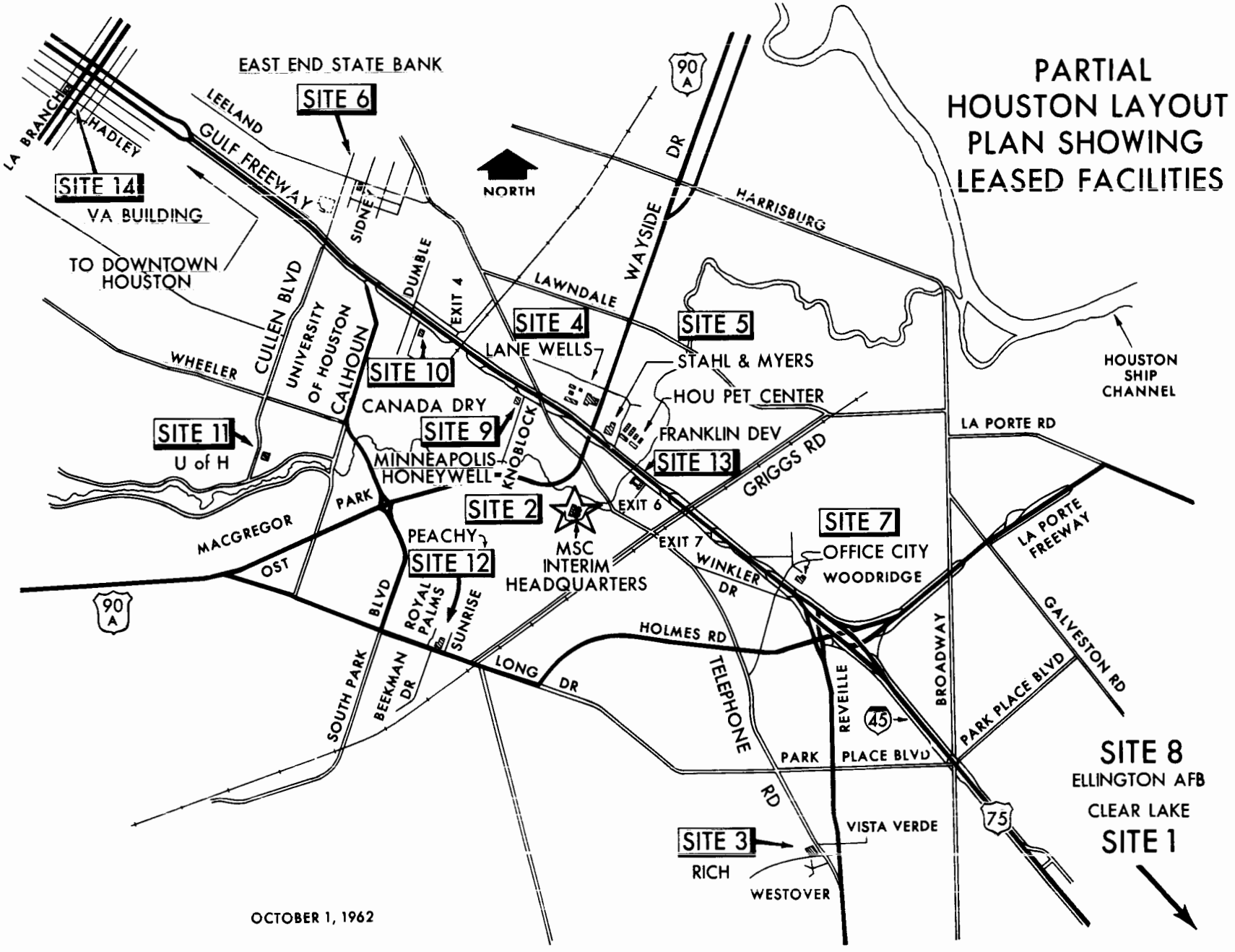
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HOUSTON LAYOUT
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WESTOVER
OCTOBER 1, 1962

MANNED SPACECRAFT CENTER

FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO THE MISSION CONTROL CENTER

DESCRIPTION:

Design funds in the amount of $5,000,000 were provided in the fiscal year 1963 for an Apollo mission control center. After the 1963 budget submission, studies showed that it would be more appropriate from an operational viewpoint to handle Gemini rendezvous missions from the new control center planned for Apollo flights rather than to proceed with the extensive modifications which the Mercury control center would require to handle the two-vehicle rendezvous missions. Since Gemini rendezvous flights are to begin in the fiscal year 1965, and the construction and implementation of a control center to handle both Gemini rendezvous and Apollo flights requires two years, it was necessary to provide additional fiscal year 1963 funding so that extensive construction work could get under way. Through use of the Congressional reprogramming procedures a total sum of $21,956,700 was made available for subject project. These funds provide for all building construction, including site development, utilities installations, and associated design and engineering services, but only for 55 percent of the required equipment. Fiscal year 1964 funding is requested for the remaining equipment.

The Manned Spacecraft Center was chosen as the location of the control center because personnel involved in control center operations will also, with other Manned Spacecraft Center personnel, be involved in mission planning, design, and analysis. Careful studies of personnel utilization; travel requirements; and technical requirements for operational data flow, simulation, and training, indicated the Manned Spacecraft Center to be the ideal location. Another important consideration is that flight controllers will have immediate access during operations to Manned Spacecraft Center spacecraft design personnel for discussions relating to unexpected observed phenomena.

The mission control center will be a three-story building consisting of two wings as follows:

1. Mission operations wing: This wing will contain approximately 113,000 square feet and include the following areas:

a. Computer Complex: Rental computer equipment will be provided to perform the following functions:

(1) Processing in real time of spacecraft telemetry and tracking data, using information provided by the ground instrumentation network.

(2) Provide real-time computer logic to permit the ground-based flight controllers to select alternatives in event of emergency or any necessity to change the flight plan.

(3) Provide real-time antenna acquisition and other remote control data for dissemination to the stations in the ground network.

(4) Provide trajectory and other data signals for use in closed-loop simulation exercises which are necessary for checkout of all ground facilities, including the mission control center itself, and for flight controller training.

b. Communications center: This area will house communications processing and control equipment for directing the flow of the following types of data:

(1) Voice communications to and from the spacecraft via relay through the remote sites.

(2) The transmission of commands, tracking data, and other information to the spacecraft.

(3) Spacecraft telemetry data from remote sites.

(4) Tracking data from remote sites.

(5) Teletype communications to and from the various ground network sites.

(6) Television signals from the Launch Operations Center and one or more remote sites, as required.

c. Mission operation control rooms: Two such rooms will be provided where consoles and displays will be located for the use of flight controller personnel in conducting the missions. One room will be used for a flight mission while the other is engaged in a simulation exercise in preparation for a later mission.

d. Simulation area: This area will contain various types of ground support equipment, such as that located at remote sites in the network, so that various closed-loop simulation exercises may be conducted without use of the actual flight equipment.

e. Meteorological support area: Equipment in this area will provide the means of displaying and evaluating atmospheric weather, cosmic phenomena, radio propagation data, meteorite

storm and space radiation intensity data, and other meteorological information upon which the success of the missions may depend.

f. Recovery area: This area will contain maps and other displays necessary for the centralized control of all recovery forces and equipment, wherever displayed.

2. Laboratory, engineering, and technical services wing: This wing will contain approximately 132,000 square feet and will include the following areas:

a. Laboratories: Support laboratories are required for the analysis of data reduction procedures, the development of computer programs and routines, the evaluation of space-to-ground communications procedures, the evaluation of display and control devices, and the preparation of simulation materials.

b. Technical services areas and engineering offices: Office space for approximately 500 Government and 200 contractor personnel engaged in the flight operations activities will be provided. Technical services areas to be provided include briefing, drafting, and photographic processing areas.

Fiscal year 1963 funds are providing all equipment necessary for the initial operation of the center for early Gemini rendezvous flights using a single mission operations control room. This equipment includes all network termination equipment, nearly all of the communications control and "intercom" equipment, approximately 45 percent of the necessary displays and flight controllers' consoles, approximately 75 percent of the simulation equipment, and a minimum of laboratory and office equipment.

Fiscal year 1964 funds are requested for the balance of the equipment required to give the center the capability of handling a simulation mission and a flight mission simultaneously, and of controlling Apollo missions in addition to the Gemini rendezvous missions. Equipment purchased with these funds will include additional communications control and "intercom" equipment, the balance of the necessary displays and flight controllers' consoles, the remaining 25 percent of the simulation equipment, and nearly all of the total requirement for laboratory and office equipment.

A drawing of the mission control center is shown on the following page.

JUSTIFICATION:

The mission control center will exercise primary responsibility for command of the Gemini and Apollo missions. This function requires that appropriate decisions be made in the mission control center during all phases of flight missions, including earth orbit, cislunar flight, lunar orbit, and return to earth. To perform this critical role, the center

must have immediately available to it tracking and telemetry data as received from the ground network. It must contain a large computing complex whose memory contains pre-planned alternative courses of action for use in event of the development of any of a vast number of contingency situations. This computing complex must be adequate in capacity and speed to permit the computation on real-time from raw data received from the ground network, of flight or spacecraft parameters needed by the flight controllers in reaching decisions. The center must have the means of sending instructions and data to the astronauts to assist them in executing their critical roles. Finally, it must exercise operational control over all ground operational support facilities used during manned space flight missions and during mission simulation and checkout exercises. These facilities include pre-flight checkout, ground network, and recovery facilities.

COST ESTIMATE:		Fiscal Year 1963	Fiscal Year 1964
A. LAND ACQUISITION.....		---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$383,900	---
Underground structure..	$66,000	---	
Heating and cooling distribution.....	39,600	---	
Electrical distribution	16,500	---	
Sanitary sewers.....	3,900	---	
Storm sewer.....	8,800	---	
Water distribution.....	3,300	---	
Gas distribution.....	1,700	---	
Roads.....	20,300	---	
Parking areas.....	200,200	---	
Sidewalks.....	1,600	---	
Soil erosion control...	22,000	---	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		8,511,700	---
Mission control center operational and control wing..(113,000 square feet at $37.40 per square foot)....	4,226,200	---	
Mission control center office, laboratory technical, and administrative wing (132,000 square feet at $30.80 per square foot).....	4,065,600	---	

		Fiscal Year 1963	Fiscal Year 1964
Mechanical and electrical control building (6,300 square feet at $25.30 per square foot).....	$159,400	---	
Additions to central heating and cooling plant..(2,700 square feet at $22.40 per square foot).....	60,500	---	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$11,411,100	$8,409,000
Ground operational support systems termination equipment.....	570,500	---	
Communications processing and control equipment.....	1,301,000	$319,000	
Mission control center internal communications equipment...	395,000	90,000	
Consoles.....	632,600	1,205,000	
Group displays (large screen).....	337,800	730,000	
Time displays.....	44,000	43,800	
Control/display interface equipment.....	2,490,000	2,274,200	
Data transfer equipment.....	1,045,400	2,030,800	
Consoles and interface equipment.....	594,800	165,200	
Logic equipment.....	1,400,000	286,000	
Remote site simulation equipment.....	1,179,800	275,000	
Maintenance equipment.	12,000	3,000	
Control building electrical equipment	610,000	---	
Control building emergency air-conditioning equipment.	200,000	---	
Heating and cooling plant equipment.....	453,200	---	

		Fiscal Year 1963		Fiscal Year 1964
Laboratory equipment..	$70,000		$700,000	
Office equipment.....	75,000		287,000	
E. DESIGN AND ENGINEERING SERVICES.....		$1,650,000		---
Total estimated cost..		$21,956,700		$8,409,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1964 ESTIMATES

ATMOSPHERIC RE-ENTRY MATERIALS AND STRUCTURES EVALUATION FACILITY

DESCRIPTION:

The atmospheric re-entry materials and structures evaluation facility will provide the means for evaluating materials and structural components under high temperatures which simulate the heating and aerodynamic conditions encountered in supercircular re-entry. This project includes the procurement of furnaces, radiant heaters, and an electric arc-heated air stream.

The furnaces will provide temperatures up to 5,000 degrees F with controlled environments. Radiant heaters will employ quartz tube lamps and will have controls which can provide programmed variations of the intensity and distribution of the radiant thermal energy.

The electric arc facility will utilize the same power supply as the radiant heating equipment, and will have capabilities beyond those of existing similar facilities; it will provide enthalpies in the range of 10,000 to 25,000 btu per pound, heat transfer rates of 25 to 1,000 btu per square foot per second and running times of 10 minutes or longer.

As indicated in the sketch on the following page, space for the facility will be made available in the structures laboratory in the systems evaluation facility. The structures laboratory must be capable of supporting structures and materials studies under Apollo re-entry conditions and the project includes certain changes in the original structures laboratory to accommodate the proposed facility.

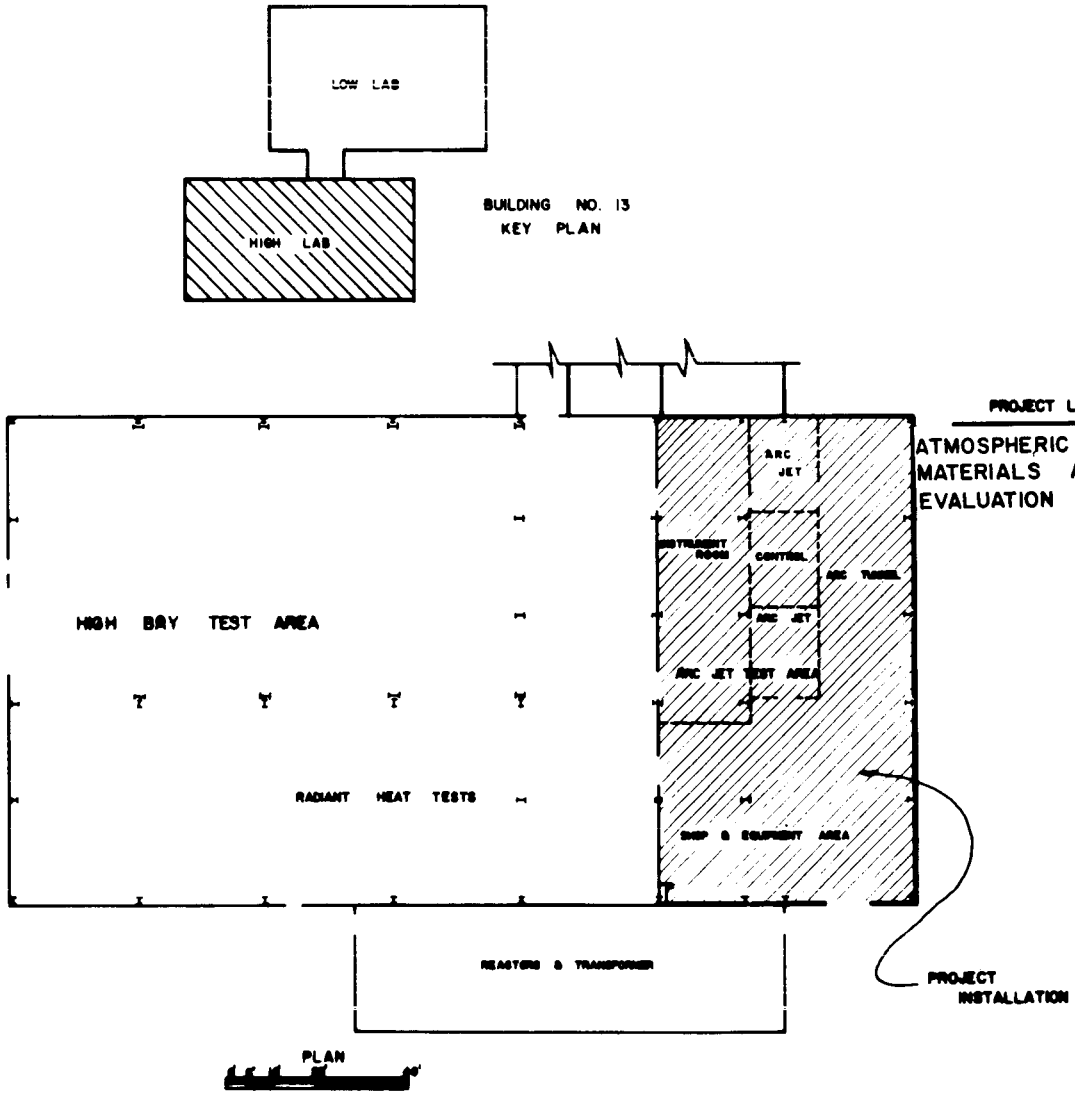
JUSTIFICATION:

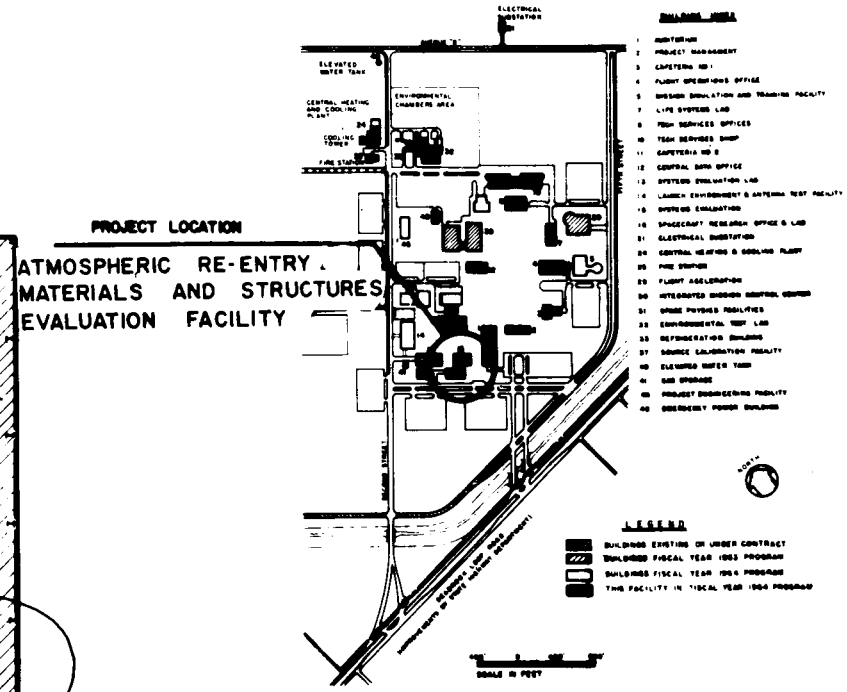
The capability for re-entry into the earth's atmosphere at orbital velocity has been well demonstrated and is reasonably well understood at this time. For the Apollo mission, however, re-entry at half-again orbital velocity (supercircular velocity) is required. The re-entry heat shield structure and materials for the Apollo spacecraft must be thoroughly evaluated on the ground under simulated conditions in advance of the first Apollo flight re-entries at parabolic velocity. This facility will be capable of providing simulation of the Apollo re-entry trajectory and will allow the required tests to be carried out in advance of Apollo lunar missions. The elements of this facility, furnaces, radiant heaters, and the electric arc-heated air stream, will be controlled to permit time phasing of the thermal environment, thus simulating whole portions of the thermal environment time history for Apollo and the resultant thermal stresses due to time phasing.

The facility will consist of a collection of testing devices, each designed for a specific purpose, and each providing in one location the

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

ATMOSPHERIC RE-ENTRY MATERIALS AND STRUCTURES EVALUATION FACILITY





PARTIAL SITE PLAN

capacity to assure the adequacy, integrity, and reliability of the Apollo heat shield structures and materials. Location of this facility, in proximity to facilities used in evaluation of systems and components under acoustic, static load, and simulated deep space environment, is essential in order to make common use of test equipment and to minimize the requirement for transport of spacecraft with delicate development instruments installed.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		---
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		$42,000
	Modifications to the systems evaluation facility	$42,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		2,650,000
	Furnaces	145,000	
	Radiant heaters	120,000	
	Instrumentation	130,000	
	Substation	100,000	
	Power controls	210,000	
	Reactors and rectifiers	800,000	
	Arc chamber	245,000	
	Test section nozzle and diffuser	250,000	
	Vacuum systems	300,000	
	Arc chamber cooling systems	150,000	
	Gas system	100,000	
	Arc chamber control systems	100,000	
E.	DESIGN AND ENGINEERING SERVICES		223,000
	Total estimated cost		$2,915,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1964 ESTIMATES

CENTER SUPPORT FACILITIES

DESCRIPTION:

This project covers the required site development and the modifications to support facilities for the planned fiscal year construction program at the Manned Spacecraft Center. The project includes an addition to the central heating and cooling plant; construction of a cafeteria; and expansion of the sewage treatment plant, the electrical substation, and the electrical distribution system. The site development work will include extension of utility tunnels, storm drainage system, road network, parking areas, street lighting, walkways, and erosion control. Drawings of the work included in this project are presented on the following three pages.

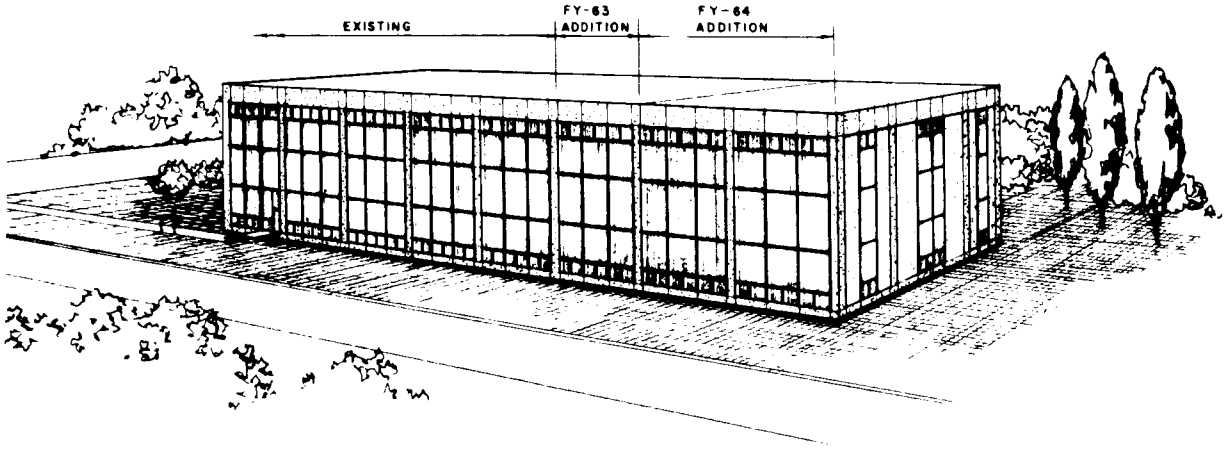
The central heating and cooling plant now under construction was funded in the fiscal year 1962 construction program. An addition to this building is being made in the fiscal year 1963 to provide for the increased heating and cooling load requirement resulting from the planned construction of the mission control center. The addition proposed in this project will increase the area of the building by approximately 8,200 square feet, 96 feet by 56 feet, with a mezzanine of 49 feet by 56 feet. The construction will be steel frame and will match the structural system of the existing plant. The addition will house one 60,000-pounds-per-hour steam boiler, two 2,000-ton centrifugal refrigeration units and will include all related accessory equipment such as cooling towers, operating and safety controls and necessary piping. The existing central mechanical control system will be expanded to accommodate the construction proposed in this budget. The present fire protection system will be expanded to provide the necessary protection required for this extension of the plant.

The construction of a 500-seat cafeteria is required to serve the technical service shops, the thermochemical test facility area, the base support area, the environmental test laboratory, the project engineering facility, and the mission control center. This cafeteria will operate as an auxiliary to the cafeteria currently under construction which was authorized in the 1962 program.

The auxiliary cafeteria will be a single-story building of standard construction, using a rigid steel frame and conforming to the architectural treatment of other buildings at the site. It is designed to provide service for the anticipated personnel on the basis of seating approximately 500 personnel per ½ hour lunch period. Heating and cooling requirements will be supplied from the central heating and cooling plant. A fire alarm system with fire hoses and extinguishers will provide fire protection for the approximate gross area of 15,400 square feet. The building is irregular in configuration and divided into two areas. The dining area is approximately

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

ADDITION TO THE CENTRAL HEATING AND COOLING PLANT



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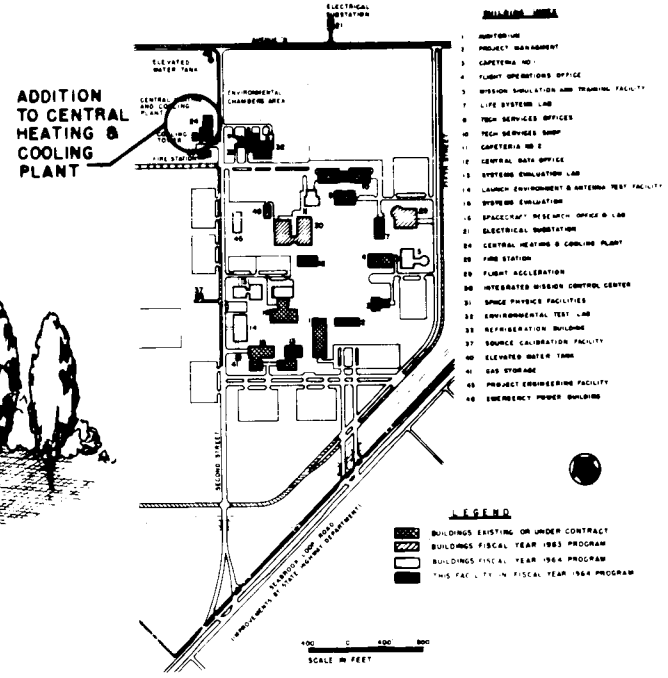
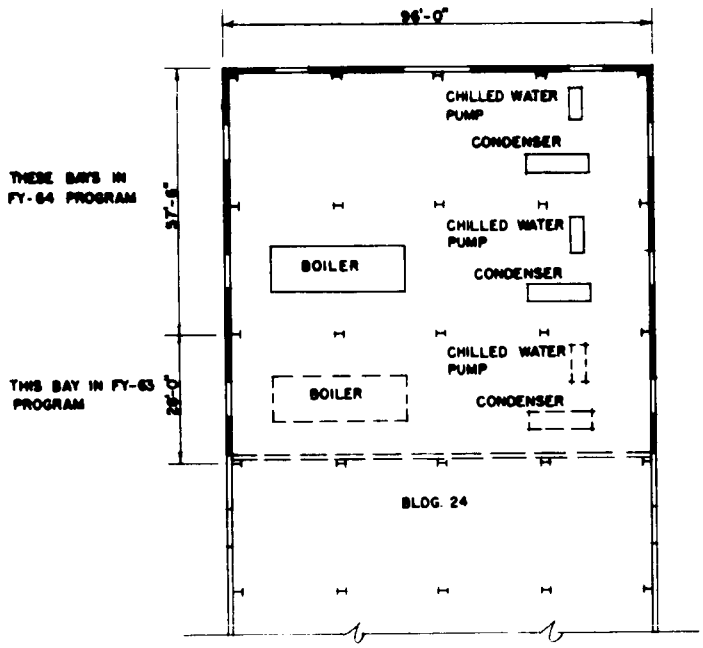


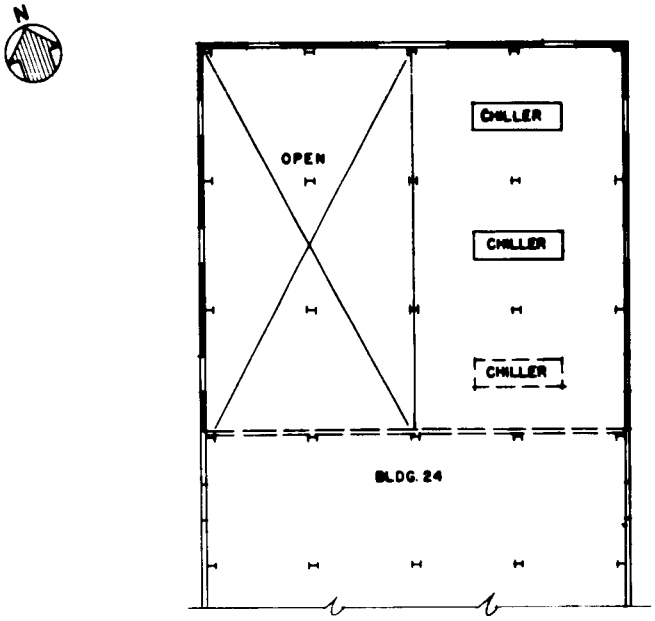
PARTIAL SITE PLAN

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

ADDITION TO THE CENTRAL HEATING AND COOLING PLANT



FIRST FLOOR PLAN

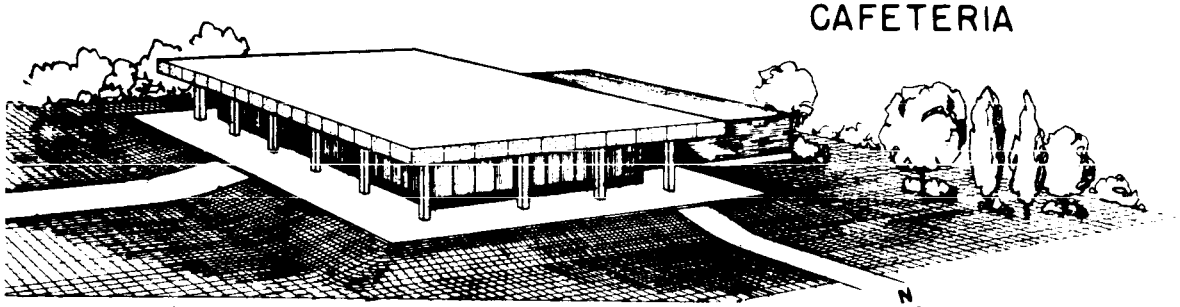


SECOND FLOOR PLAN

PLANS

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

CAFETERIA



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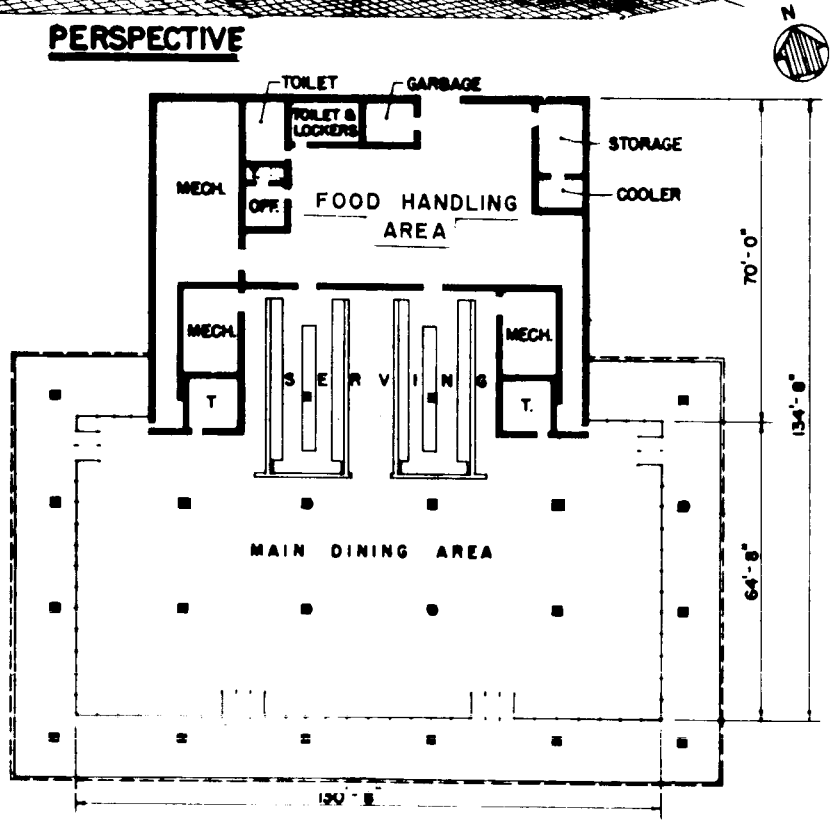

PLAN

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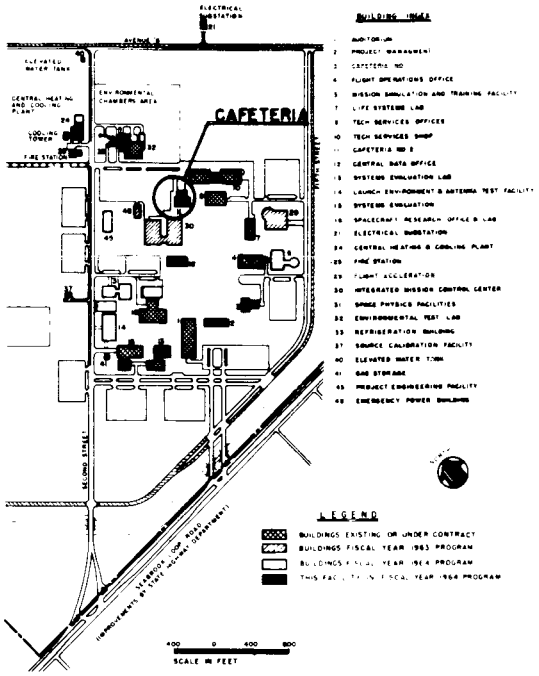
SCALE IN FEET



PARTIAL SITE PLAN

CF 8 15

8,400 square feet with dimensions of 131 feet by 64 feet and the food handling and serving area is approximately 7,000 square feet with dimensions of 100 feet by 70 feet.

The present 160,000 gallons per day capacity sewage treatment plant will be increased to a capacity of 300,000 gallons per day. This expansion requires additional pumps, aeration tanks, settling tanks, and sludge drying beds.

The capacity of the existing substation will be increased by adding secondary 15 kv switchgear and appurtenant controls. The underground electrical distribution power lines will be extended to provide accessible electrical power to the planned fiscal year 1964 facilities. The cost of secondary connecting lines are included in each individual construction project.

Four additional parking lots will be constructed to provide for the increased vehicle requirements generated by the planned facilities. The parking areas will accommodate approximately 800 passenger vehicles. The construction will be flexible pavement with concrete curbs and gutters. Lighting of the parking areas will be provided as required to meet safety and security requirements.

The present main underground concrete utility tunnels will be extended to provide steam, chilled-water, communications, and power to the planned facilities. This extension will be approximately 2,100 linear feet. The cost of extending the lateral tunnels from the buildings to the main tunnel is included as a cost item for each facility.

The road network will be expanded as indicated on the attached site plan. The construction will include approximately 1.9 miles of 24-foot wide primary roads and 4.1 miles of 24-foot secondary roads. The primary roads will be flexible pavement design with curbed gutters and the secondary roads will have a stabilized aggregate surface. Street lighting will be provided as required on main thoroughfares.

Storm drainage must be provided in the areas immediately adjacent to the planned fiscal year 1964 buildings. The system will include underground storm sewers and inlets. The lateral ties for drainage of building sites are included in the cost for each building project. Open ditches will be constructed to carry the surface runoff of open areas as well as the discharge from storm sewers. Soil erosion measures such as grading, seeding, and sodding will be required in the built-up area which comprises approximately 100 acres. Measures will also be provided to protect the banks of the approximately 72,000 feet of open drainage ditches.

JUSTIFICATION:

Several facilities must be modified and new facilities constructed to adequately support the construction program and personnel staffing levels requested in this budget.

Based on an evaluation of the existing central heating and cooling plant, it will be necessary to increase the plant capacity to meet the new heating and cooling load requirements of the proposed additional facilities. The facility authorized by the 1962 program and expanded by the 1963 program included the installation of three 60,000 pounds per hour steam boilers and four 2,000-ton centrifugal refrigeration compressors and chillers. No standby or additional capacity was included in the initial construction. To provide for the new load requirement, one additional 60,000 pound per hour steam boiler and two additional 2,000-ton centrifugal refrigeration units are required. To house this additional equipment the building must be expanded.

Many of the facilities at the Center have critical temperature and humidity requirements which must be maintained. To effectively monitor and control these requirements a central mechanical control system was included in the central heating and cooling plant now under construction. In order to maintain efficient and economical operation of the plant with a minimum number of personnel, it will be necessary to modify the existing control system to accommodate the additional facilities proposed for construction in the fiscal year 1964 budget.

The auxiliary cafeteria is necessary to provide food serving facilities for personnel working in the areas mentioned in the project description, where the projected population density will approximate 2,000 personnel. The total NASA and contractor personnel at the Manned Spacecraft Center will approximate 6,000 by the end of fiscal year 1966. The existing cafeteria, is designed to serve approximately 2,500 persons in a 2½ hour period. The cafeteria to be provided by this project will accommodate an additional 2,500 persons for a total food serving capability for 5,000 people in a 2½ hour period. A longer serving period would be uneconomical and would adversely affect the operating efficiency of the Center.

The existing sewage treatment plant does not have sufficient capacity to support the projected population increase related to the planned construction. The present capacity of the plant is 160,000 gallons per day. To properly treat the sewage and waste, both sanitary and industrial, the plant capacity should be increased to 300,000 gallons per day. This capacity will allow for future personnel increases.

In order to provide necessary electrical power to the new facilities, the power distribution system from the substation must be extended. To accommodate the additional electrical loads a secondary 15 kv switch gear and appurtenant controls must be provided to increase the capacity of the existing electrical substation.

There will be an extremely high concentration of vehicles within the site of the Manned Spacecraft Center, because of its remote location and the absence of public transportation. The road network and parking facilities must be expanded to accommodate approximately 4,000 vehicles per day. This does not include commercial type vehicular traffic. The 800

parking spaces included in this project will increase the present facilities to 3,300. Considering a visitor factor, the 3,300 parking spaces approximate one space for every two people based on an estimated 6,000 personnel figure by the end of the fiscal year 1966.

The existing underground concrete utility tunnels which house steam, chilled water, communications, and power lines must be extended to supply these requirements to the new facilities. The extension will not include the lateral tie-in costs for the individual buildings.

To adequately drain the improved areas, storm sewers and drainage ditches must be constructed. Storm sewers will be utilized in the complex area whereas open ditches will be constructed adjacent to roads and for sewer discharge in undeveloped areas. The annual average rainfall in this area is approximately 45 inches, and the ground water table is close to the surface. Due to the relatively high annual rainfall and high water table the surface runoff will be of large quantities and high velocities. In order to prevent erosion and preclude continual maintenance and repair costs, erosion control measures such as seeding, sodding, and grading must be provided.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$1,859,000
Roads, primary and secondary	$501,000	
Parking areas	167,000	
Utility tunnel extension	383,000	
Sewage treatment plant	158,000	
Electrical substation and distribution system	317,000	
Storm drainage system	89,000	
Erosion control	114,000	
Walkways	14,000	
Street and parking lighting	116,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		563,600
Addition to the central heating and cooling plant (8,200 square feet at $25.50 per square foot)	209,100	
Cafeteria (15,400 square feet at $23.02 per square foot)	354,500	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		2,216,500
Boiler and accessories	358,300	
Chilled water equipment	692,000	
Compressed air system	172,200	

Central mechanical control system.....	$330,000	
Electrical equipment (switch gear, motor controls).....	399,000	
Cafeteria equipment and furniture.....	265,000	
E. DESIGN AND ENGINEERING SERVICES.....		$522,900
Total estimated cost.....		$5,162,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1964 ESTIMATES

LAUNCH ENVIRONMENT AND ANTENNA TEST FACILITIES

DESCRIPTION:

The major facility proposed in this project will consist of a building approximately 140 feet wide, 272 feet long, and 120 feet high to house a vibration laboratory, an acoustic laboratory, and an anechoic chamber. Included in this particular structure are mezzanines totaling approximately 9,500 square feet. The total gross area of the building will be approximately 47,600 square feet. The unit cost of the building reflects provision for the extreme clear ceiling height required. The project also includes an antenna range in an open area adjacent to this building. The range will require a three-story building (antenna service building) with an approximate size of 40 feet wide, 40 feet long, and 45 feet high, to house the antenna test laboratory. The area of this building will be approximately 4,800 square feet. All services will be provided by extending existing services. The project will provide space for a staff of approximately 30 people.

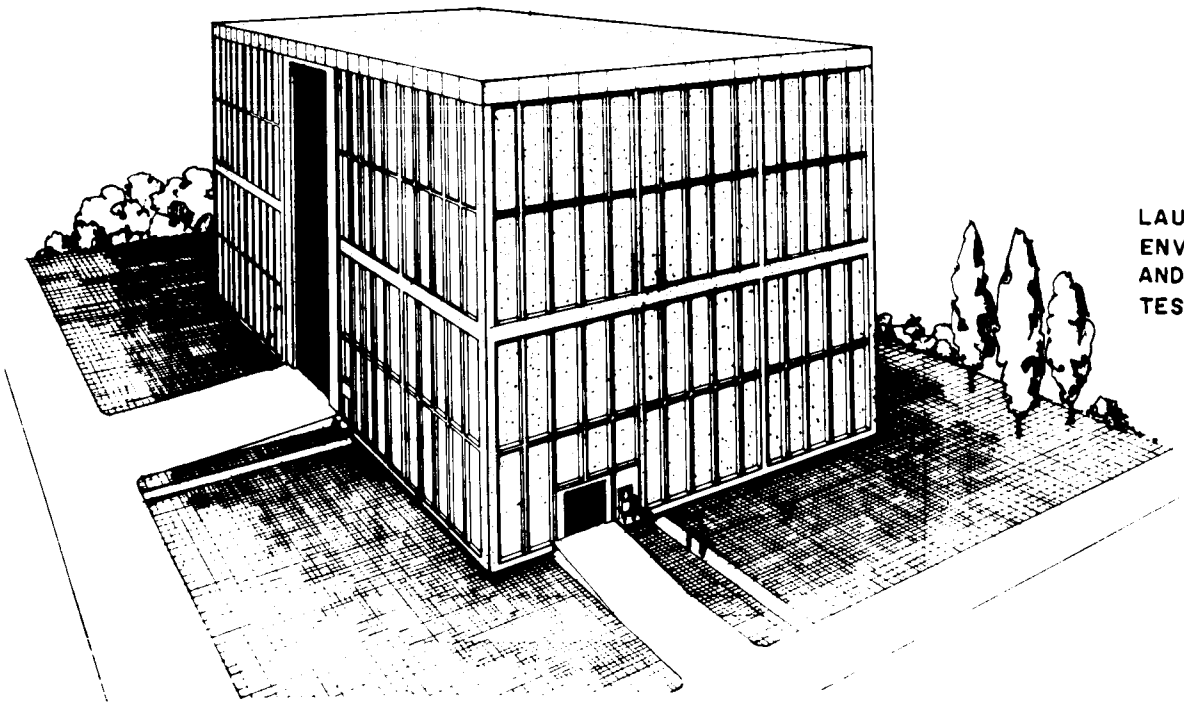
Sketches of the facilities covered by this project are presented on the next two pages. A brief description of the major elements follows below:

Vibration laboratory: The vibration laboratory will consist of six 10,000 force-pound thrusters with matching transformers and mounts, several shakers, three control consoles, two heat exchange systems and field current supply with the necessary auxiliary equipment. Two standard model amplifiers of 120 kva output each will be utilized in this system. Supporting equipment will include one 150-ton vertical lift fixed crane and one 30-ton bridge crane.

Acoustic laboratory: This laboratory will permit the testing of full-scale integrated spacecraft such as the combined Apollo command module, service module and adapter under a wide range of acoustic environments. The facility will contain a test cell with inside dimensions of approximately 25 feet wide, 35 feet long, and 60 feet high. All of the facility walls will be reinforced concrete approximately 18 inches thick. Acoustic generators will provide sound levels to 170 decibels over a wide range of frequencies at random amplitudes.

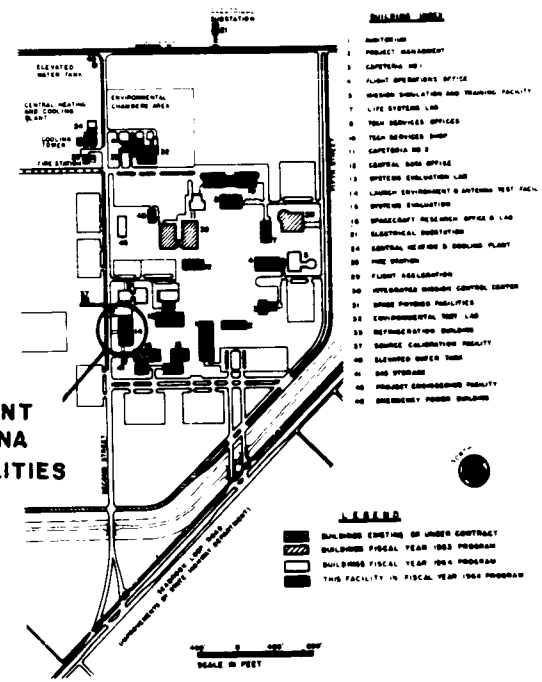
MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

LAUNCH ENVIRONMENT AND ANTENNA TEST FACILITIES



PERSPECTIVE

LAUNCH
ENVIRONMENT
AND ANTENNA
TEST FACILITIES



PARTIAL SITE PLAN

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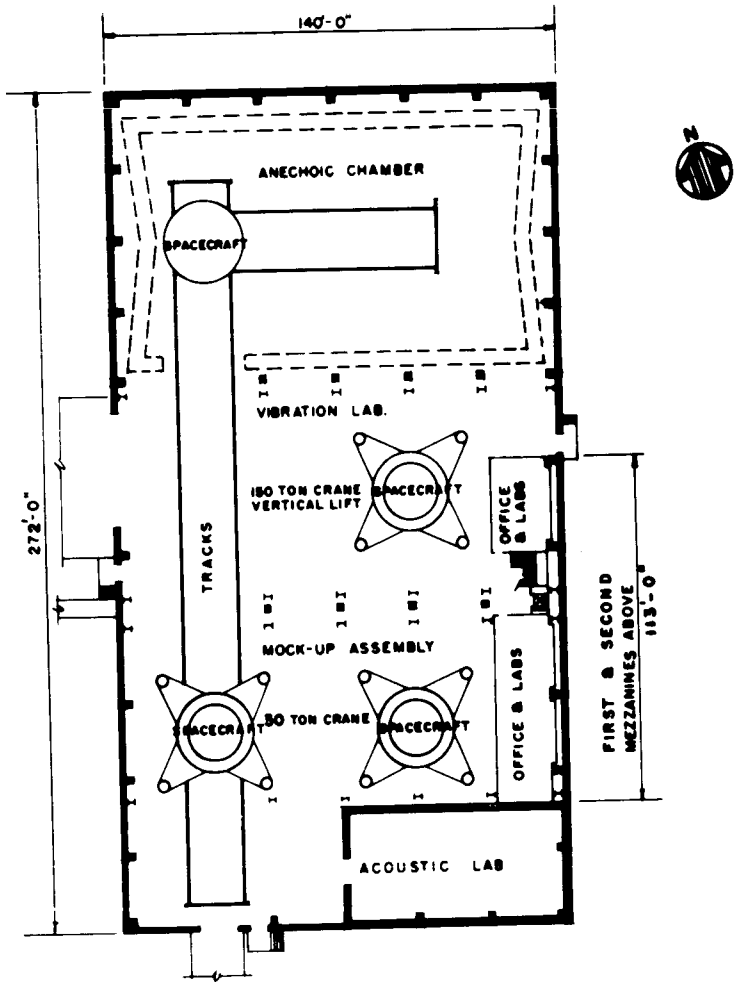
MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

LAUNCH ENVIRONMENT AND ANTENNA TEST FACILITIES



PLAN

15 0 30 60
SCALE IN FEET

Anechoic chamber: The chamber will provide inside dimensions of approximately 85 feet wide, by 140 feet long, by 85 feet high and will be capable of accommodating a full size Apollo vehicle. The chamber will be completely shielded from extraneous interference by means of a lining of special radio frequency absorbent material which provides a full-scale "free space" environment.

Antenna range: This facility will consist of a T-shaped area with the antenna test laboratory located at the crosspoint of the T-shaped area, 3,800 feet from the launch environment facility. The T-shaped area will have three variable pattern ranges having maximum lengths of 1,300, 1,000, and 700 feet, and one fixed range having an approximate length of 3,800 feet.

Antenna service building: A three-story building will provide space for microwave and antenna equipment, office space, transmitting and recording space, and a microwave laboratory. The building will contain means of rotating antennas or Apollo spacecraft modules with built-in antennas. In addition to this main laboratory building, three wooden towers of 30-foot height will be required. Each tower will support a turn-table and 20-foot dielectric columns. All pattern ranges will be on tracks so that the optimum transmitting distance for the particular frequency and size of model may be selected. Undesirable reflections will be minimized by proper range design and by judicious placement of absorption baffles.

JUSTIFICATION:

The launch environment and antenna test facilities are required to assure the capability of the Apollo spacecraft to withstand environmental inputs resulting from vibration and noise and to insure satisfactory operation of all Apollo spacecraft radio frequency equipment under space conditions. It is essential that these facilities be available at the Manned Spacecraft Center on a schedule to support the Apollo missions. The facilities will be used for the over-all qualification testing of all the spacecraft modules and will be jointly utilized by Government and contractor personnel. The associated tests must be performed on the several Apollo spacecraft modules on a continuing basis, and over a period of time prior to lunar missions to assure adequate performance of the individual modules and of the complete assembled spacecraft. A more detailed explanation of the various types of testing that will be done in each of the facilities follows:

Vibration laboratory: The vibration laboratory will be equipped to subject complete Apollo spacecraft modules

to vibration tests which simulate the vibration experienced at launch or in space flight. The vibration system for this laboratory constitutes a unique, integral, large and small test-package vibration facility. The system design incorporates a modular, building block approach to vibration of massive test specimens. A standard table-top shaker is included to test components of a smaller size.

Existing modules of this vibration system are currently in use in support of the Little Joe II vehicle and the early phases of the Apollo development program, and the proposed additional equipment and facilities will provide integrated test capability (assembled vehicle such as escape tower, adapter, and/or service module) in support of the later phases of the Apollo development program and the Apollo spacecraft evaluation program.

This system will provide test data which will answer many questions concerning structural integrity, dynamic response of equipment support structures, dynamic characteristics of interface areas, vibration amplification factors and general mechanical integrity. This system will also allow a realistic vibration test to be performed on integrated, operating systems such as life support, instrumentation, reaction control systems, and guidance and control. Of prime importance, however, is the fact that the facility will provide the means of evaluating the command module, service module, and tower assembly as an integral group in a vibration test.

Acoustic laboratory: Evaluation and proof testing of Apollo spacecraft modules must include testing in noise environments which simulate those generated by launch vehicles. This requires a noise test facility capable of producing random forces, large-scale excitation, and excitation over a wide frequency range. Frequency ranges for desired testing are expected to encompass from one cycle per second to 15,000 cycles per second. Such a facility will permit investigating structural and instrument response, structural damage, and the possibility of exciting resonance in some or all of the natural modes of the system. The proposed facility is unique in that it will be the only one in the United States capable of producing random noise at this amplitude or this range of frequencies.

Anechoic chamber: This chamber will provide full-scale "free space" simulation from very high frequencies through microwave frequencies used on Apollo spacecraft, and will provide around the clock usage independent of

atmospheric conditions and interferring radiation frequencies. The chamber contains walls which will absorb most of the radio frequency energy that strikes the absorbent wall material. These absorbent qualities will permit simulating conditions of radio and radar transmission to and from space vehicles. This chamber is essential to the evaluation and development of Apollo spacecraft in the following areas:

a. The evaluation of antennas operating as single units as well as the whole antenna system on the vehicle.

b. The conduct of radio frequency interference tests in which all equipment in the spacecraft is turned on and the results of interferences on each system are observed and corrected. The chamber will be required to shield the systems under test from extraneous interferring frequencies.

c. The determination of antenna patterns, antenna gains, antenna voltage, and standing wave ratio and propagation characteristics.

d. The evaluation of the performance of spacecraft communications systems and components, including telemetry transmitters, multiplexers, command receivers, C-band beacons, power dividers, phase shifters, and recovery beacons.

The proposed anechoic chamber is unique in that it will be the only one in the United States of sufficient size to accommodate the Apollo spacecraft. It will also be unique in that the electromagnetic absorbing material is to be designed to cover a frequency range from low VHF up through super high frequency.

Antenna range: The antenna range, will be located in an area of minimum electronic interference. It will be used to supplement the anechoic chamber and to carry out testing programs that cannot be handled in the anechoic chamber. Examples of test programs that will be handled by the test range are as follows:

a. The testing of high-gain, narrow-beam microwave antennas where the required separation distance between the transmitting and receiving antennas is prohibitive for anechoic chamber use.

b. The conduct of antenna tests at VHF and SHF

frequencies.

c. The checking of antennas and structures which present a large aperture and require a large separation distance between transmitting and receiving antennas.

The antenna range will be used for checking out and evaluating all of the Apollo telemetry, voice communications, recovery, television, and tracking antenna systems. In addition, the facility will be required to check out and evaluate the rendezvous radar and altimeter for the lunar excursion module.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$315,000
Grading and erosion control	$88,000	
Access road and service area	14,000	
Electrical power and distribution	80,000	
Utility tunnel extension	45,000	
Water and gas connections	13,000	
Storm sewer	13,000	
Chilled water and steam piping	62,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		3,446,000
Launch environment facility..(47,600 square feet at $64.43 per square foot)	3,067,000	
Antenna test facility..(4,800 square feet at $32.08 per square foot)	154,000	
Towers and turntables..(3 at $30,000 each)	90,000	
Tower tracks	135,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		3,119,000
Anechoic chamber	1,000,000	
Thruster system	450,000	
150-ton fixed-point crane	100,000	
30-ton bridge crane	60,000	
Cooling water tower	6,000	
3 sets of transmitting equipment	75,000	
3 sets of receiving equipment	300,000	
Antenna positioner for full-scale vehicle	15,000	
Acoustic generators and systems:		
Noise generators	375,000	
Control systems	215,000	
Instrumentation and data gathering equipment	160,000	

Auxiliary equipment	$323,000	
Office equipment	40,000	
E. DESIGN AND ENGINEERING SERVICES		$602,000
Total estimated cost		$7,482,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1964 ESTIMATES

MISSION SIMULATION AND TRAINING FACILITY

DESCRIPTION:

The facility proposed in this project will house both Gemini and Apollo mission simulators and the peripheral equipment and maintenance facilities required to support their operation. Office space is included for a staff of 30 people.

The building will be irregular in configuration and consist of a high bay laboratory wing, a connecting office wing and a circular wing for the Apollo visual display system. A sketch of the building is shown on the following page.

The high bay laboratory wing will be of standard steel frame construction with precast concrete exterior wall panels and have dimensions of approximately 198 feet by 133 feet with a clear ceiling height of 60 feet in order to accommodate the translation and docking trainer. A second floor office area with dimensions approximately 28 feet by 62 feet will increase the gross area of this wing to approximately 28,070 square feet.

The two-story connecting wing will be an office type structure with first floor dimensions of approximately 42 feet by 46 feet and second floor dimensions of approximately 42 feet by 56 feet providing a gross area of 4,284 square feet.

The circular domed wing, housing the visual display system for the Apollo mission simulator, will have a diameter of approximately 102 feet and a gross area of 8,200 square feet. This wing, because of the nature of its function will be of a more individual design, yet related to surrounding structures and especially to the connected high bay laboratory wing.

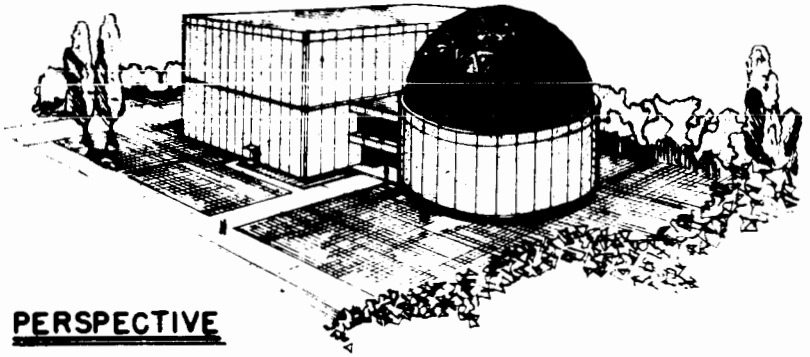
The gross floor area of the project is approximately 40,550 square feet. The building will be completely air-conditioned and heated by the center's central heating and cooling plant. A fire alarm system with fire hoses and extinguishers will be employed for the purpose of fire protection.

JUSTIFICATION:

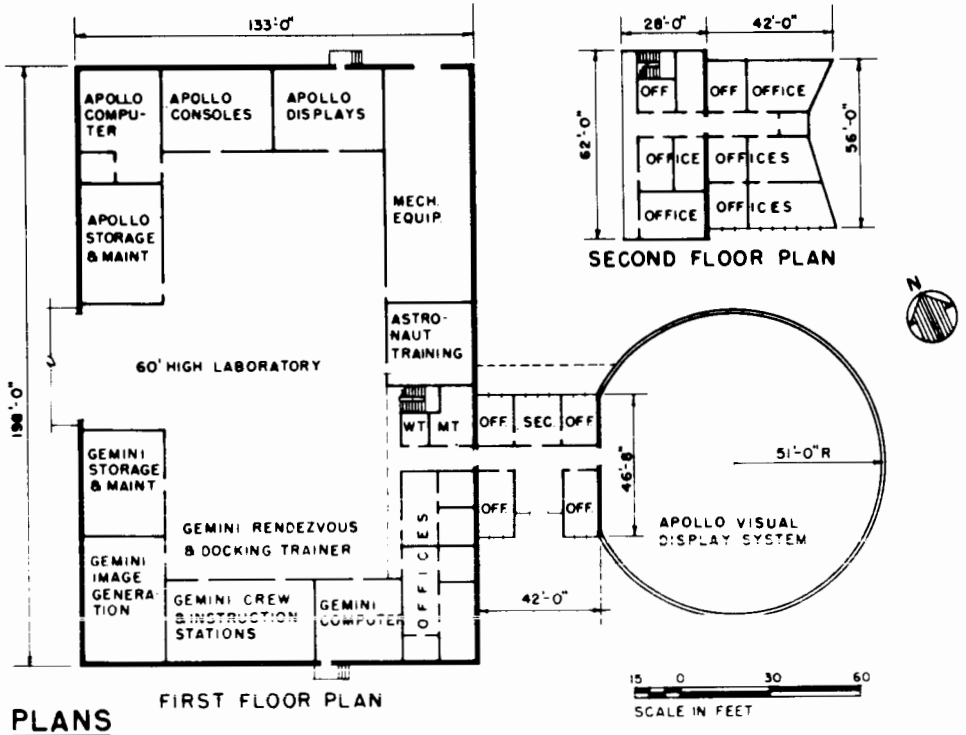
This building, which will be designed specifically for unique simulation equipment, will comprise the primary training complex for flight crews. In this central location flight crews will be able to operate replicas of Gemini and Apollo crew stations with animated displays and controls and realistic window scenes. The crew station displays, controls, and window scenes will be driven by computer complexes in a manner that will reproduce the in-flight situations of all or part of space flight missions. Using these devices,

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

MISSION SIMULATION AND TRAINING FACILITY



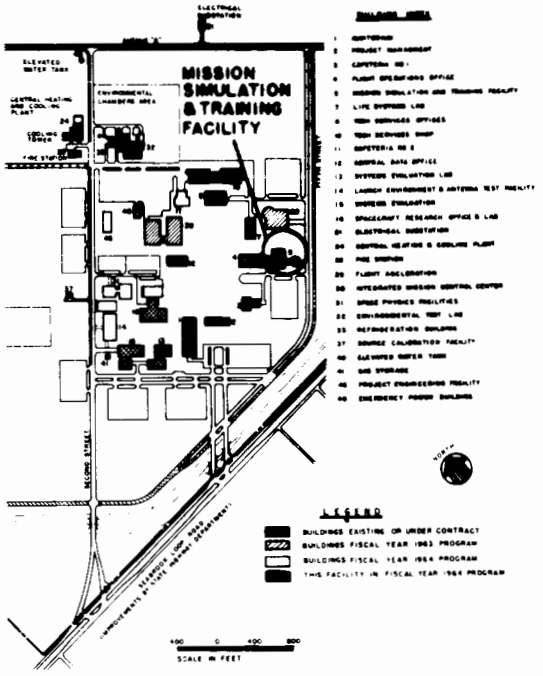
PERSPECTIVE



FIRST FLOOR PLAN

SECOND FLOOR PLAN

PLANS



PARTIAL SITE PLAN

the flight crews will be able to practice the exact procedures and techniques for normal and emergency flight situations while incurring no personal hazard and at a fraction of the cost of actual space flight experience. As has been repeatedly demonstrated by aircraft and initial space flight experience, this form of simulation training greatly increases the probability of successful missions by providing thoroughly prepared and conditioned crews for each flight. The Manned Spacecraft Center has initiated procurement of these simulators which are described as follows:

The Gemini mission simulator will consist of a static crew station, an instructor's station, and a computer complex. The trainer will be capable of simulating the entire mission from "lift-off" through the boost phase, the orbital phase including rendezvous, the re-entry phase to the deployment of the paraglider, and the landing phase to the flare preceding touchdown. In its final form, the simulator will incorporate a visual display system permitting the spacecraft pilot to view the exact images out of his window as he would in the actual flight. The computing complex will be capable of simulating the 6 degrees of freedom motions of the spacecraft as it goes through its entire trajectory. The simulator will be used to bring the flight crews and the ground control teams individually and collectively to the high state of readiness required for successful space flights.

The Gemini translation and docking simulator will be a dynamic trainer that will provide a high fidelity simulation of the docking phase of the Gemini-Agena orbit rendezvous. Incorporating a 6 degree of freedom system, three rotary and one linear in the spacecraft and two linear in the Agena, the trainer will provide simulation of the dynamic motion of the spacecraft in approaching, engaging, and disengaging an Agena target. Using this trainer, flight crews will develop the visual judgment and hand control techniques necessary to guide the Gemini spacecraft to a precise connection with the Agena. In order to reduce computer requirements, this trainer will be installed near the Gemini mission simulator and both machines will be procured to use the same computer complex. For complete operation, the simulator will require an enclosed clear space of 150 feet by 60 feet by 50 feet.

The Apollo mission simulator will be similar in all details to the Gemini mission simulator described above. The computing complex associated with this simulator will be capable of computing the trans-lunar and lunar orbital trajectories of the Apollo mission. The computer complex and instructor station will be located in the rectangular building area. The crew station will simulate the spacecraft's three-man crew station and will require a circular dome-type building with a radius of 51 feet for the visual "out-the-window" simulation. An area of 5,000 square feet is required to house the Apollo mission simulator.

The proposed facility will also house the lunar excursion module mission simulator and such maintenance facilities required to maintain all the trainers described above. The unified location of the trainers will allow centralization and the most efficient usage of test equipment and supplies. Funding for the simulators was included in previous RD&O appropriations.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$167,000
	Grading and erosion control	$14,000	
	Access road	12,000	
	Electrical power and distribution	68,000	
	Utility connections	28,000	
	Utility tunnel extensions	45,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		1,342,000
	Building (40,550 square feet at $33.10 per square foot)	1,342,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		466,000
	Test equipment and recording instrumentation	238,000	
	Stock crib spare parts, scopes, cameras, tube testers, counters, and meters	216,000	
	Office equipment	12,000	
E.	DESIGN AND ENGINEERING SERVICES		241,000
	Total estimated cost		$2,216,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1964 ESTIMATES

PROJECT ENGINEERING FACILITY

DESCRIPTION:

The project engineering facility will be a five-story, steel frame structure of standard construction. The dimensions of the first floor will be approximately 75 feet by 187 feet. The second through fifth floors will have dimensions of 85 feet by 197 feet. A mechanical room of approximately 3,400 square feet will be provided on the roof. The total gross area of this facility will be 84,500 square feet. Sketches of the facility are shown on the following two pages.

The building will have an air-conditioning system served by the central heating and cooling plant. The fire protection system for this structure will consist of an alarm system, fire hoses and extinguishers.

JUSTIFICATION:

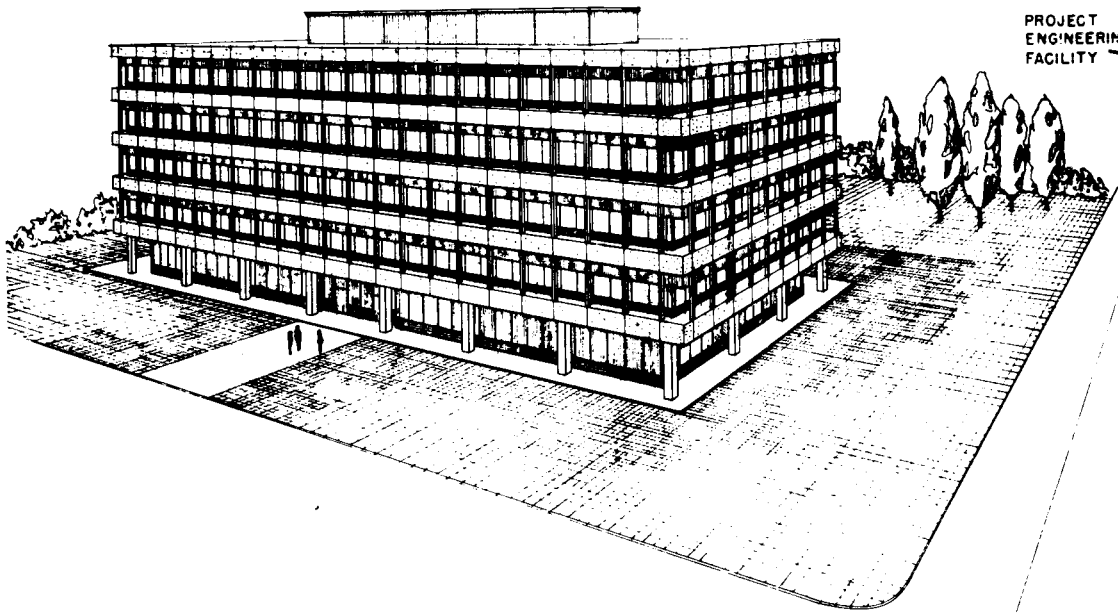
The housing requirements for various project management activities at Manned Spacecraft Center originally were planned to be met in the fiscal year 1962 funded project management building which was designed to accommodate 930 personnel. Present staffing and project workload studies now indicate a requirement to house a project management and engineering staff of approximately 1500 persons, 560 more than can be housed in the authorized project management building which is now under construction. The 560 additional personnel spaces are required for personnel engaged in the Gemini, Apollo, and other advanced programs and will occupy this proposed engineering facility. This increase in personnel is included in proposed personnel ceilings and is a reflection of added programs, accelerated program effort, and the increased complexity in management and engineering operations associated with the more advanced programs.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$71,000
Grading and erosion control.....	$12,000	
Access road.....	3,000	
Utility tunnel extension.....	15,000	
Electrical power and distribution.....	25,000	
Utility connections.....	16,000	

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

PROJECT ENGINEERING FACILITY



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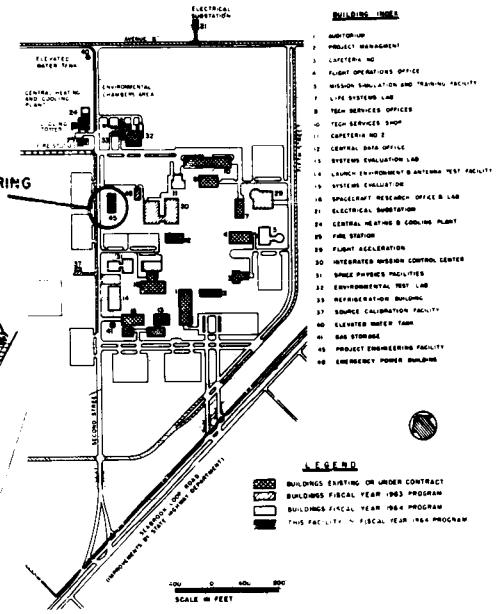
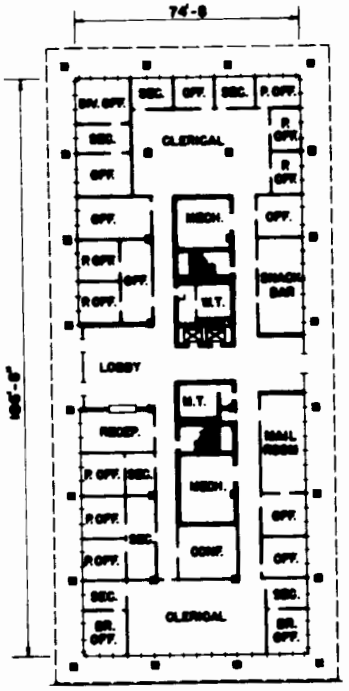


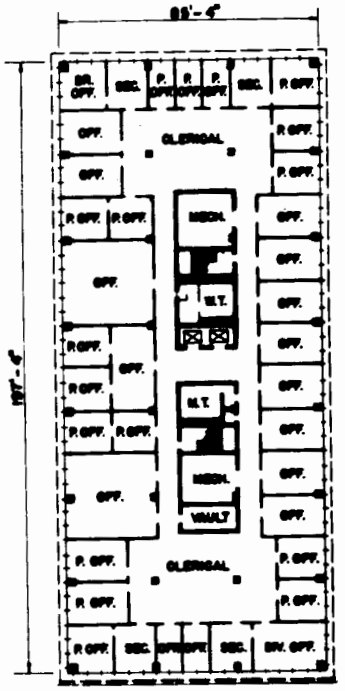
PARTIAL SITE PLAN

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

PROJECT ENGINEERING FACILITY

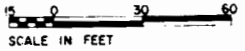


FIRST FLOOR PLAN



SECOND, THIRD, FOURTH AND FIFTH FLOOR PLANS

PLANS



C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		$2,050,000
	Building (84,500 square feet at $24.25 per square foot).....	$2,050,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		300,000
	Office furniture and equipment.....	300,000	
E.	DESIGN AND ENGINEERING SERVICES.....		340,000
	Total estimated cost.....		$2,761,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1964 ESTIMATES

SPACECRAFT CONTROL TECHNOLOGY LABORATORY

DESCRIPTION:

This project presents the requirement for a development facility in which the evaluation of Apollo spacecraft control systems, including those which provide spacecraft navigation and guidance, will be conducted.

The facility will consist of a complex of laboratories and office space for a staff of 66 people. Some of these laboratories will be equipped for the development and evaluation of specialized components of control systems and others will be equipped for the evaluation of the operation of overall control systems. The design of the laboratories will incorporate specific considerations of the requirements for test and evaluation of the Apollo control, navigation, and guidance system. The laboratories which will comprise this facility and a brief statement of their function are as follows:

Inertial components laboratory: Detailed test and evaluation of inertial components.

Airborne computer laboratory: Design, development, test and evaluation of airborne computers, switching logic, etc.

Astro-optical laboratory: Development and evaluation of optical navigation instruments and radiation sensors.

Control and guidance systems laboratory: Evaluation and development of spacecraft control and guidance systems.

Special projects laboratory: Testing of control and guidance systems within large items of flight hardware such as spacecraft command modules.

The project also includes a special development laboratory in which the performance of the Apollo spacecraft control systems can be studied in direct conjunction with participating spacecraft crews. Astronauts will be brought into this facility and will perform simulated mission control operations, so that laboratory personnel can evaluate the performance and adequacy of the displays, control levers, and switches provided for the astronauts in the spacecraft. The simulator itself consists of crew control stations arranged in the manner of the Apollo command module and the lunar excursion module crew compartments. Integral to the simulator will be the visual displays (spacecraft windows, instruments, and controls) upon which spacecraft or module responses can be varied by the crew. The control levers, switches,

and display arrangements can be modified to test a wide range of control parameters. This simulator will use existing computer equipment to complete the basic simulation capability.

In contrast to the facilities being constructed for astronaut operational training, this facility is required for the refinement of the spacecraft systems designs by close study of the human engineering aspects. A vital feature of the facility will be to provide visual and motion cues to the flight crews participating in the development studies, by simulating those characteristics which will be encountered in actual space flight.

All of these laboratories will require specialized equipment designed to carry out the laboratory functions. There will also be required support in the form of component electronic and mechanical repair and modification, simulation model assembly and maintenance, and instrument issue and storage facilities.

The facility to be constructed will be a three-story structure with certain laboratory areas having a clear height of approximately 45 feet. This construction will form a new north wing to the spacecraft research building now under construction. As indicated in the drawings on the following two pages, the dimensions of the proposed new wing will be approximately 198 feet by 114 feet and a total gross area of 45,400 square feet. The structure is to be of steel frame with precast concrete exterior wall panels matching the architectural treatment of the adjacent wing. While there is no requirement per se to simulate the space environment (i.e., vacuum chambers) the precision evaluation of control systems and components requires that the testing conditions be virtually free of undesirable disturbances. Some of the laboratories will, therefore, require rigid control of temperature, humidity, noise, vibration and dimensional stability. The facility will be completely air-conditioned with a system tie-in to the central heating and cooling plant. A fire alarm system and fire hose and extinguishers will be provided for fire protection.

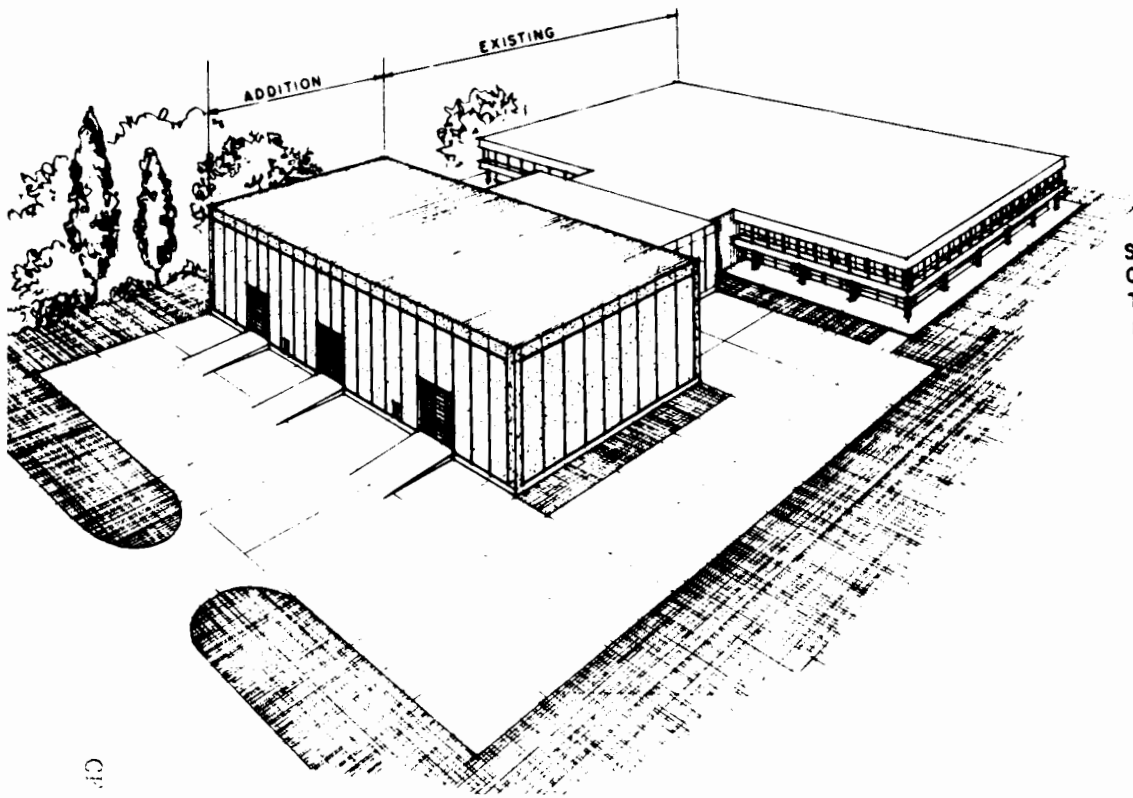
JUSTIFICATION:

The planning, developmental and operational aspects of the Apollo mission require a comprehensive capability in the area of spacecraft control technology. This technology, which includes navigation and guidance, is a direct outgrowth of that technology which evolved from the development of guided missiles and high-performance manned aircraft. However, there are major operational differences in the technology associated with control of the Apollo spacecraft because of the difference of operational requirements, especially that related to the long-duration space character of the Apollo missions.

The proposed spacecraft control technology laboratory will provide the capability required to support the Apollo spacecraft development in the areas of control, guidance and navigation systems development. This capability includes, specifically, the means of studying and evaluating the operation of

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

SPACECRAFT CONTROL TECHNOLOGY LABORATORY



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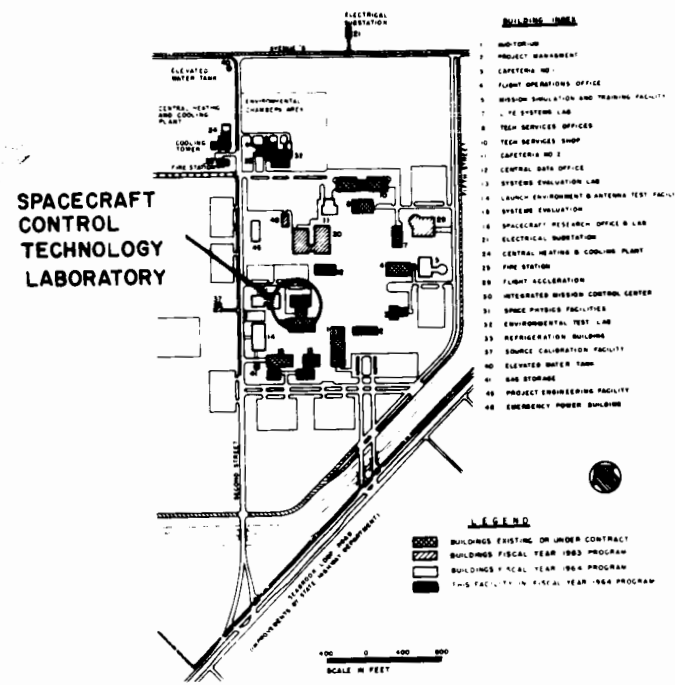
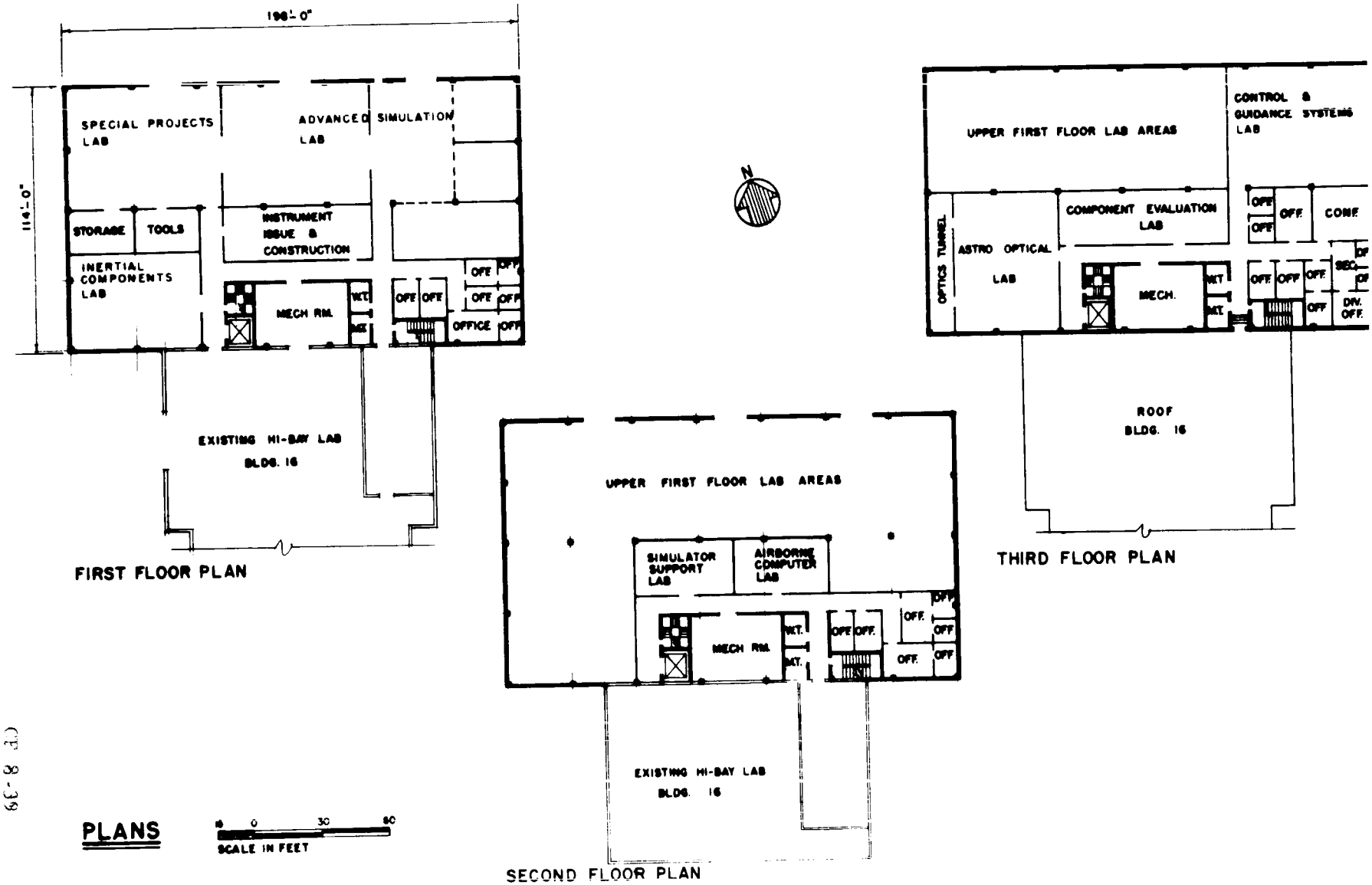


PARTIAL SITE PLAN

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMETES

SPACECRAFT CONTROL TECHNOLOGY LABORATORY



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these systems for the Apollo mission. Past experience with the Mercury project has proven that this capability is vital to successful mission operations through the development of highly reliable systems. The laboratory work will be closely associated with the work of theoretical groups which will provide the mathematical development required for system design and improvement. The inclusion of laboratory facilities to study the crew-related control functions with actual participation of astronaut crews will assure that the Apollo control systems permit optimum utilization of the capabilities of the crew and provide for simpler and, therefore, more reliable control systems.

The construction of the spacecraft control technology laboratory, in conjunction with the computing facilities and the theoretical analysis groups, will provide a unique and vital capability in the field of manned spacecraft control. It will provide the means for necessary spacecraft control technology support to the Apollo program. It is essential that this capability exists close to the environmental test facilities so that satisfactory performance can be verified immediately following system exposure to controlled environmental conditions. This capability must be available on a time schedule to allow vital tests and evaluations to be carried out well in advance of Apollo lunar missions.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$116,000
Grading and erosion control	$15,000	
Access road and service area	12,000	
Utility tunnel extension	52,000	
Water, gas, and sewer connections	11,000	
Chilled water connections	26,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		1,702,000
Building..(45,400 square feet at $37.49 per square foot)	1,702,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		3,897,000
Simulated control station	300,000	
Simulated space scenery display equipment (integrated television projection and special optical devices)	1,750,000	
Special purpose computer equipment	350,000	
Inertial components laboratory equipment	221,000	
Airborne computer laboratory equipment	223,000	
Astro-optical laboratory equipment	270,000	

Control and guidance systems laboratory equipment	$137,000	
Special projects laboratory equipment	646,000	
E. DESIGN AND ENGINEERING SERVICES		$391,000
Total estimated cost		$6,106,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1964 ESTIMATES

ULTRA-HIGH VACUUM SPACE CHAMBER FACILITY

DESCRIPTION:

The facility described in this project is required to provide space for an ultra-high vacuum laboratory, its attendant areas and supporting mechanical equipment room. The facility will have dimensions approximately 80 feet by 40 feet with a height of 60 feet. This 3,200 square foot structure will be located adjacent to and contiguous with the environmental testing laboratory approved in the fiscal year 1962 appropriation.

The project includes an ultra-high vacuum space chamber with internal clear dimensions of approximately six feet diameter. A solar simulator will be mounted at the end of the chamber opposite the door and will irradiate a target area of approximately four feet in diameter. The spectrum, collimation, and uniformity will closely approximate that of the sun at the cislunar distance. The vacuum level will be in the range 1×10^{-12} to 10^{-15} torr (mm of mercury pressure). The walls surrounding the test specimen will be cooled to approximately 20° Kelvin to simulate the heat sink of space and, also, to cryocondense gas particles to attain the desired vacuum levels.

A sketch of the facility is shown on the next page.

JUSTIFICATION:

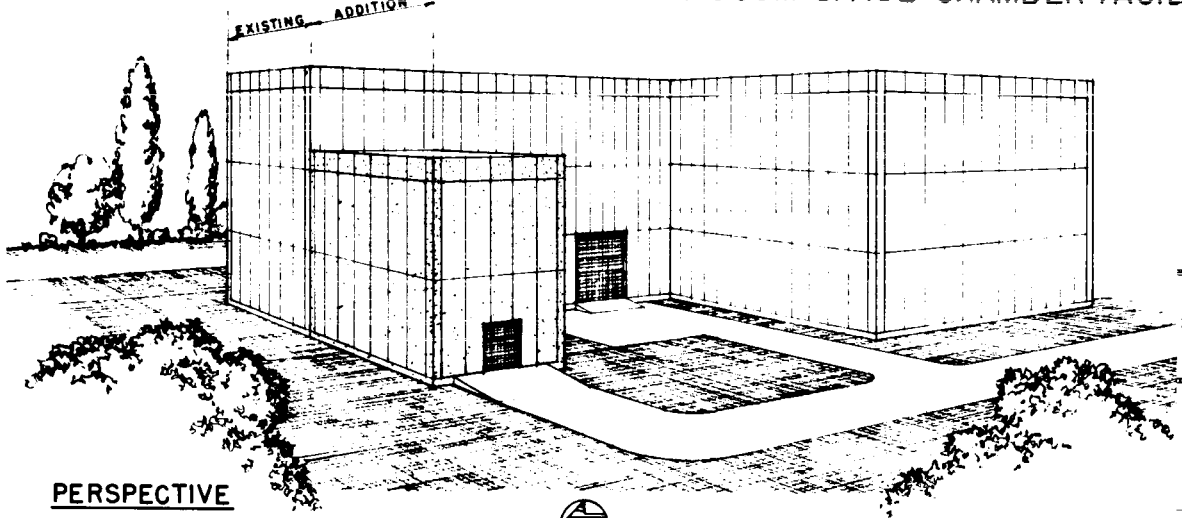
The Apollo spacecraft will operate over extended periods of time in the vacuum conditions of cislunar space. Under these conditions of prolonged exposure to extreme vacuum, small-scale laboratory experiments have indicated the need for extreme care in design and fabrication of mechanical joints, sliding surfaces, and bearings to prevent cold welding of mating surfaces. The Apollo spacecraft will, of necessity, have many of these kinds of joints and bearings. A typical example is the landing gear of the lunar excursion module, which must operate reliably after prolonged space exposure. It is essential that such components be investigated for prolonged periods of time on earth under simulated space conditions before undertaking manned lunar missions.

Unique problems inherent in the design of the Apollo spacecraft will be investigated, in addition to the known problem areas involving cold welding of mechanical joints. The proposed facility will permit the high-vacuum evaluation of the Apollo spacecraft, seals, heat transfer, gas leakage, and material surface phenomena, all of which are essential to the attainment of the high reliability standards required for the Apollo missions.

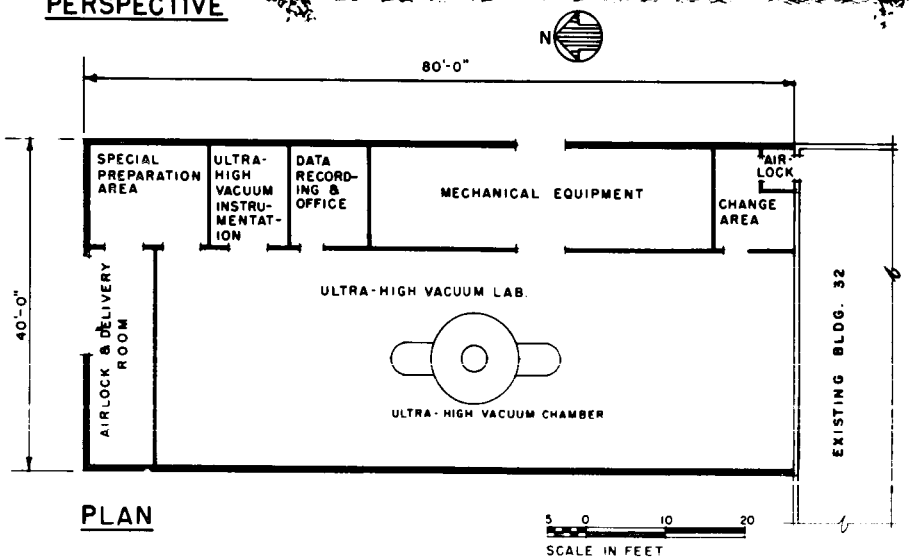
The unit cost of this building is based on the semi-clean design requirement and the 60 feet clear ceiling height.

MANNED SPACECRAFT CENTER
FISCAL YEAR 1964 ESTIMATES

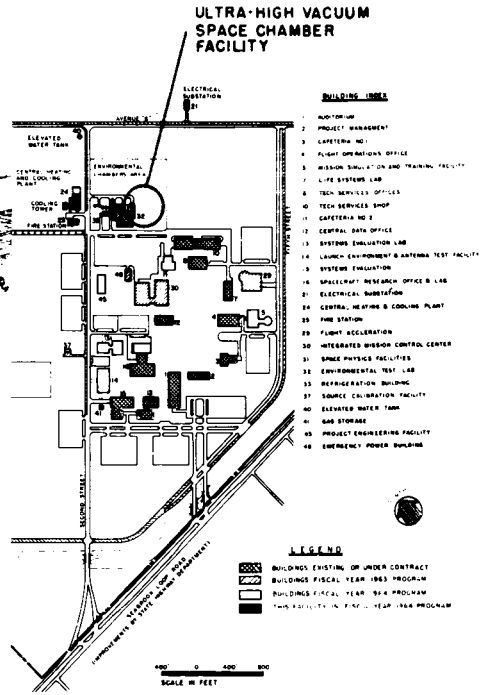
ULTRA-HIGH VACUUM SPACE CHAMBER FACILITY



PERSPECTIVE



PLAN



PARTIAL SITE PLAN

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$68,000
	Grading and erosion control	$18,000	
	Access road	12,000	
	Water and gas connections	8,000	
	Storm sewers	20,000	
	Electric power connections	10,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		240,000
	Building (3,200 square feet at $75.00 per square foot)	240,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		2,051,000
	Ultra-high vacuum chamber (6 feet diameter, 6 feet high, 20° Kelvin)	1,295,000	
	Solar simulator	756,000	
E.	DESIGN AND ENGINEERING SERVICES		326,000
	Total estimated cost		$2,685,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

MARSHALL SPACE FLIGHT CENTER

		Page No.
Location plan		CF 9-1
Acceleration test and calibration facility.....	$1,700,000	CF 9-2
Acoustic model test facility.....	2,000,000	CF 9-6
Additions to the components test facilities....	3,875,000	CF 9-12
Addition to the test support shop.....	1,500,000	CF 9-15
Barge dock and loading facilities.....	800,000	CF 9-18
Expansion and modernization of the high pressure gas and propellant systems.....	4,000,000	CF 9-21
Expansion of computation facilities.....	2,315,000	CF 9-24
Extension to the load test annex.....	3,656,000	CF 9-27
Extension to the propulsion and vehicle engineering laboratory.....	1,900,000	CF 9-32
Hangar for vehicle components.....	2,800,000	CF 9-35
Hazardous operations laboratory.....	500,000	CF 9-39
Modernization of instrumentation and control systems in the East Area.....	3,500,000	CF 9-43
Modification to the vehicle assembly building..	1,800,000	CF 9-46
Project engineer office.....	2,650,000	CF 9-50
Support operations building.....	500,000	CF 9-53
Utility installations.....	5,000,000	CF 9-56
Total.....	$38,496,000	

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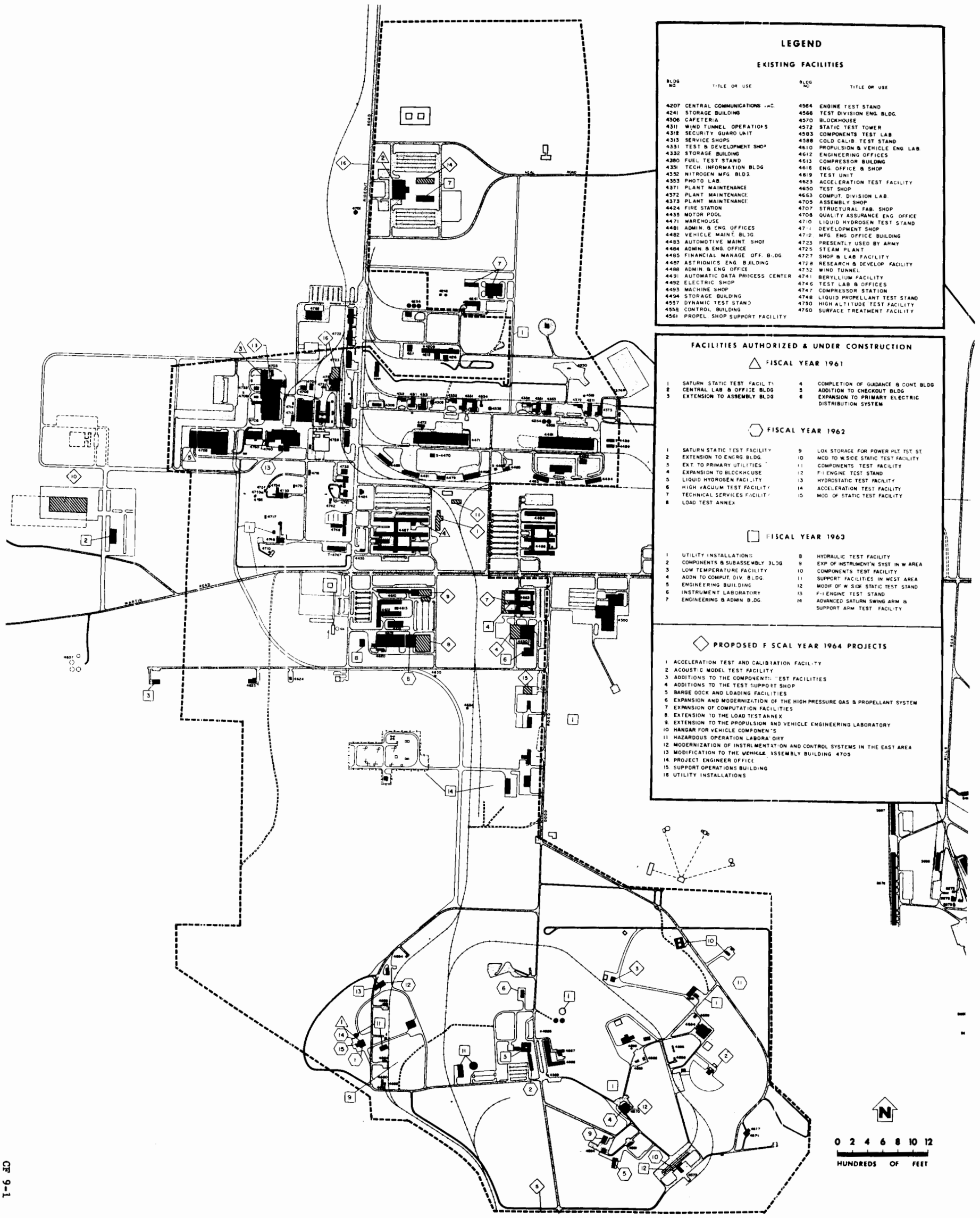
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN



LEGEND

EXISTING FACILITIES

BLDG NO.	TITLE OR USE	BLDG NO.	TITLE OR USE
4207	CENTRAL COMMUNICATIONS FAC.	4564	ENGINE TEST STAND
4241	STORAGE BUILDING	4566	TEST DIVISION ENG. BLDG.
4306	CAFETERIA	4570	BLOCKHOUSE
4311	WIND TUNNEL OPERATIONS	4572	STATIC TEST TOWER
4312	SECURITY GUARD UNIT	4583	COMPONENTS TEST LAB
4313	SERVICE SHOPS	4588	COLD CALIB. TEST STAND
4331	TEST & DEVELOPMENT SHOP	4610	PROPULSION & VEHICLE ENG. LAB.
4332	STORAGE BUILDING	4612	ENGINEERING OFFICES
4380	FUEL TEST STAND	4613	COMPRESSOR BUILDING
4351	TECH. INFORMATION BLDG	4616	ENG. OFFICE & SHOP
4352	NITROGEN MFG. BLDG.	4619	TEST UNIT
4353	PHOTO LAB.	4623	ACCELERATION TEST FACILITY
4371	PLANT MAINTENANCE	4650	TEST SHOP
4372	PLANT MAINTENANCE	4663	COMPUT. DIVISION LAB.
4373	PLANT MAINTENANCE	4705	ASSEMBLY SHOP
4424	FIRE STATION	4707	STRUCTURAL FAB. SHOP
4435	MOTOR POOL	4708	QUALITY ASSURANCE ENG. OFFICE
4471	WAREHOUSE	4710	LIQUID HYDROGEN TEST STAND
4481	ADMIN. & ENG. OFFICES	4711	DEVELOPMENT SHOP
4482	VEHICLE MAINT. BLDG.	4712	MFG. ENG. OFFICE BUILDING
4483	AUTOMOTIVE MAINT. SHOP	4723	PRESENTLY USED BY ARMY
4484	ADMIN. & ENG. OFFICE	4725	STEAM PLANT
4485	FINANCIAL MANAGE. OFF. BLDG.	4727	SHOP & LAB FACILITY
4487	ASTRIONICS ENG. BUILDING	4728	RESEARCH & DEVELOP. FACILITY
4488	ADMIN. & ENG. OFFICE	4732	WIND TUNNEL
4491	AUTOMATIC DATA PROCESS. CENTER	4741	BERYLLIUM FACILITY
4492	ELECTRIC SHOP	4746	TEST LAB & OFFICES
4493	MACHINE SHOP	4747	COMPRESSOR STATION
4494	STORAGE BUILDING	4748	LIQUID PROPELLANT TEST STAND
4557	DYNAMIC TEST STAND	4750	HIGH ALTITUDE TEST FACILITY
4558	CONTROL BUILDING	4760	SURFACE TREATMENT FACILITY
4561	PROPEL. SHOP SUPPORT FACILITY		

FACILITIES AUTHORIZED & UNDER CONSTRUCTION

△ FISCAL YEAR 1961

1. SATURN STATIC TEST FACILITY
2. CENTRAL LAB & OFFICE BLDG
3. EXTENSION TO ASSEMBLY BLDG
4. COMPLETION OF GUIDANCE & CONT. BLDG
5. ADDITION TO CHECKOUT BLDG
6. EXPANSION TO PRIMARY ELECTRIC DISTRIBUTION SYSTEM

⬡ FISCAL YEAR 1962

1. SATURN STATIC TEST FACILITY
2. EXTENSION TO ENGRG. BLDG.
3. EXT. TO PRIMARY UTILITIES
4. EXPANSION TO BLOCKHOUSE
5. LIQUID HYDROGEN FACILITY
6. HIGH VACUUM TEST FACILITY
7. TECHNICAL SERVICES FACILITY
8. LOAD TEST ANNEX
9. LOX STORAGE FOR POWER PLT. TST. ST.
10. MOD. TO W. SIDE STATIC TEST FACILITY
11. COMPONENTS TEST FACILITY
12. F-1 ENGINE TEST STAND
13. HYDROSTATIC TEST FACILITY
14. ACCELERATION TEST FACILITY
15. MOD. OF STATIC TEST FACILITY

□ FISCAL YEAR 1963

1. UTILITY INSTALLATIONS
2. COMPONENTS & SUBASSEMBLY BLDG.
3. LOW TEMPERATURE FACILITY
4. ADDN. TO COMPUT. DIV. BLDG.
5. ENGINEERING BUILDING
6. INSTRUMENT LABORATORY
7. ENGINEERING & ADMIN. BLDG.
8. HYDRAULIC TEST FACILITY
9. EXP. OF INSTRUMENT'N SYST. IN W. AREA
10. COMPONENTS TEST FACILITY
11. SUPPORT FACILITIES IN WEST AREA
12. MODIF. OF W. SIDE STATIC TEST STAND
13. F-1 ENGINE TEST STAND
14. ADVANCED SATURN SWING ARM & SUPPORT ARM TEST FACILITY

◇ PROPOSED FISCAL YEAR 1964 PROJECTS

1. ACCELERATION TEST AND CALIBRATION FACILITY
2. ACOUSTIC MODEL TEST FACILITY
3. ADDITIONS TO THE COMPONENTS TEST FACILITIES
4. ADDITIONS TO THE TEST SUPPORT SHOP
5. BARGE DOCK AND LOADING FACILITIES
6. EXPANSION AND MODERNIZATION OF THE HIGH PRESSURE GAS & PROPELLANT SYSTEM
7. EXPANSION OF COMPUTATION FACILITIES
8. EXTENSION TO THE LOAD TEST ANNEX
9. EXTENSION TO THE PROPULSION AND VEHICLE ENGINEERING LABORATORY
10. HANGAR FOR VEHICLE COMPONENTS
11. HAZARDOUS OPERATION LABORATORY
12. MODERNIZATION OF INSTRUMENTATION AND CONTROL SYSTEMS IN THE EAST AREA
13. MODIFICATION TO THE VEHICLE ASSEMBLY BUILDING 4705
14. PROJECT ENGINEER OFFICE
15. SUPPORT OPERATIONS BUILDING
16. UTILITY INSTALLATIONS

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

ACCELERATION TEST AND CALIBRATION FACILITY

DESCRIPTION:

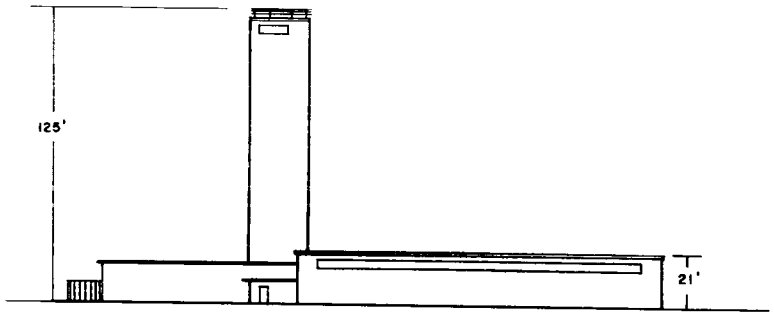
This project will provide capability for subjecting operating Saturn C-5 vehicle hardware to the influences of zero gravity, high level sound pressure, vibration and extremes in temperature and vacuum conditions encountered on long flight programs. The project will provide for the expansion of present laboratory facilities in progressing from the Saturn C-1 program to the Saturn C-5 program and includes relocation of available environmental test equipment into the proposed facilities. The three main components of this project are as follows:

Laboratory building: The building will be approximately 62 feet wide by 245 feet long overall and will provide approximately 13,300 gross square feet of space. Construction of the building will be conventional concrete slab, steel frame, and concrete block masonry walls. The building will be air-conditioned and heated from a central heating plant. A reinforced concrete pit is required for the constant azimuth centrifuge. A seismic block foundation is required for the shock test equipment and sound isolated areas are required for the vibration and acoustical equipment. Most of this area will be high bay since some of the equipment requires extended head room or use of an overhead crane for operation. Vehicle electrical power sources, ground electrical power sources, and instrumentation quality compressed gas are the special utilities required for this facility. The facility will house a constant azimuth centrifuge (approximately 20 feet in diameter) in addition to the following existing environmental test equipment: a shock tester, 10 temperature and vacuum chambers, acoustical test equipment, a long radius centrifuge, three laboratory centrifuges (approximately 6 feet in diameter), a humidity chamber, a salt spray chamber, component reliability test systems, three vibration exciters, power supplies, control equipment, and instrumentation. The currently available equipment will be moved from existing laboratory space to provide additional space for hydraulic gimballed actuator simulator activities.

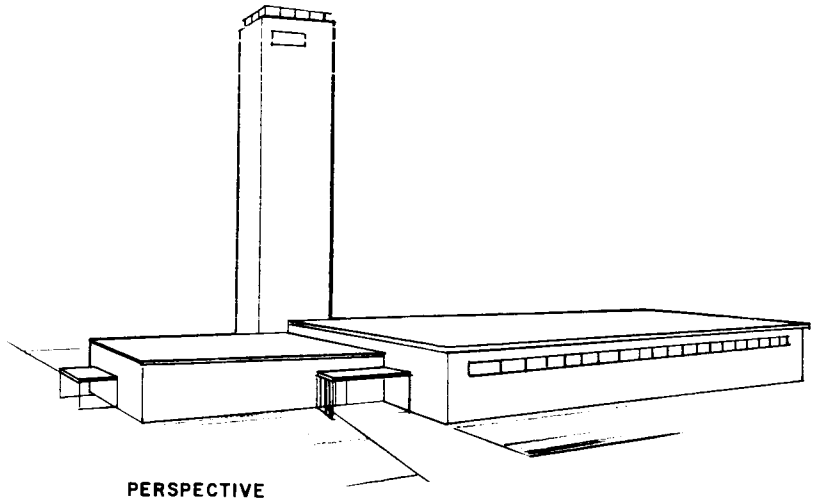
Linear accelerator tower: The linear accelerator will require a tower adjoining the laboratory building approximately 27 feet square and 125 feet high. The accelerator tower will have inner and outer steel frame towers with the

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

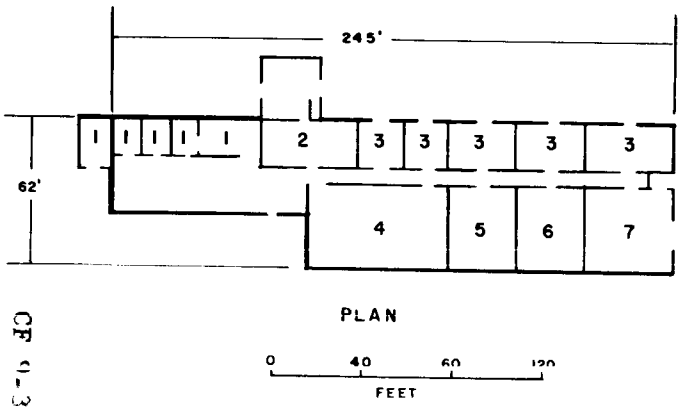
ACCELERATION TEST AND CALIBRATION FACILITY



EAST ELEVATION



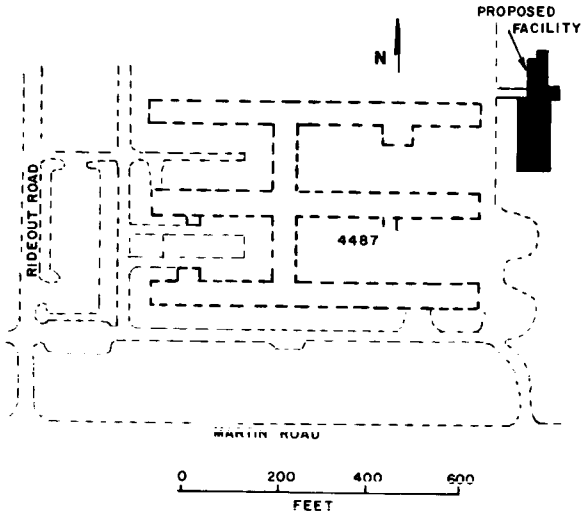
PERSPECTIVE



PLAN

LEGEND

1 ELECTRICAL CONTROL & DISTRIBUTION
2 LINEAR ACCELERATOR TOWER & LAB.
3 VIBRATIONAL TESTING
4 CONSTANT AZIMUTH CENTRIFUGE
5 LONG RADIUS CENTRIFUGE
6 SHOCK TEMP. & VACUUM TESTING
7 ACCOUSTICAL TESTING



outer tower covered with insulated steel panels. An elevator, a stairway, and intermediate floors are required. The uppermost floor and the roof of this tower will be used for radio frequency antenna activities. Intermediate levels will have steel grated floors.

Instrumentation and utility tunnel: A tunnel approximately 150 feet long is required between the laboratory building and the adjoining existing laboratory building for interconnection of vehicle electrical power, ground electrical power, and compressed gas.

A sketch of the proposed facility is shown on the following page.

JUSTIFICATION:

Capability does not exist for some types of environmental tests necessary to assure successful evaluation of flight hardware and components. These additional requirements can be satisfied by the proposed linear accelerator and constant azimuth centrifuge. The linear accelerator is a device using pneumatic actuation as a working principle and having cyclic operation. It will provide the means to subject sensitive components and guidance systems to the influences of linear acceleration and zero gravity. This proposed device will extend the range of acceleration tests with respect to peak acceleration and the time of constant acceleration, and will allow tests on larger and heavier systems. Linear acceleration tests can also be repeated several times without loss of the instrumentation. The constant azimuth centrifuge is a centrifugal acceleration device with a constant-oriented azimuth and vibration equipment. This device will be capable of subjecting gyro stablizer platforms and other guidance equipment to the influence of acceleration and vibration while operating and oriented with a constant azimuth. This is necessary on long flight programs and advanced guidance systems.

Relocation of environmental test equipment will permit the required expansion of hydraulic gimballed actuator simulator activities within existing laboratory space. That increase is required due to the increase in size of the Saturn C-5 activator hardware and simulator over the hardware of the present Saturn C-1 program.

The proposed facility will also house an acoustic test chamber for determining the sound pressure wave effects on various small vehicle components. The system will be capable of producing various acoustic environments with from 20 to 20,000 cycles per second and a sound plane level up to approximately 150 decibels.

COST ESTIMATE:

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

B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$95,000
	Site preparation, roads, and walks.....	$20,000	
	Utility connections and electrical substation..	43,000	
	Utility tunnel..(150 linear feet at $21.33 per linear foot).....	32,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		800,000
	Laboratory building..(13,300 square feet at $35.33 per square feet).....	470,000	
	Linear accelerator tower..(7,300 square feet at $45.20 per square foot).....	330,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		625,000
	Linear accelerator.....	345,000	
	Constant azimuth centrifuge.....	200,000	
	Acoustical chamber and system.....	80,000	
E.	DESIGN AND ENGINEERING SERVICES.....		180,000
	Total estimated cost.....		$1,700,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

ACOUSTIC MODEL TEST FACILITY

DESCRIPTION:

This project provides for the design and construction of a facility for determining the acoustical environment generated by scale model testing of space vehicles. The facility will be capable of accepting scale models of space vehicles and launching deflectors, and of recording the dynamic acoustic pressures generated by hot firings of the scale model engines.

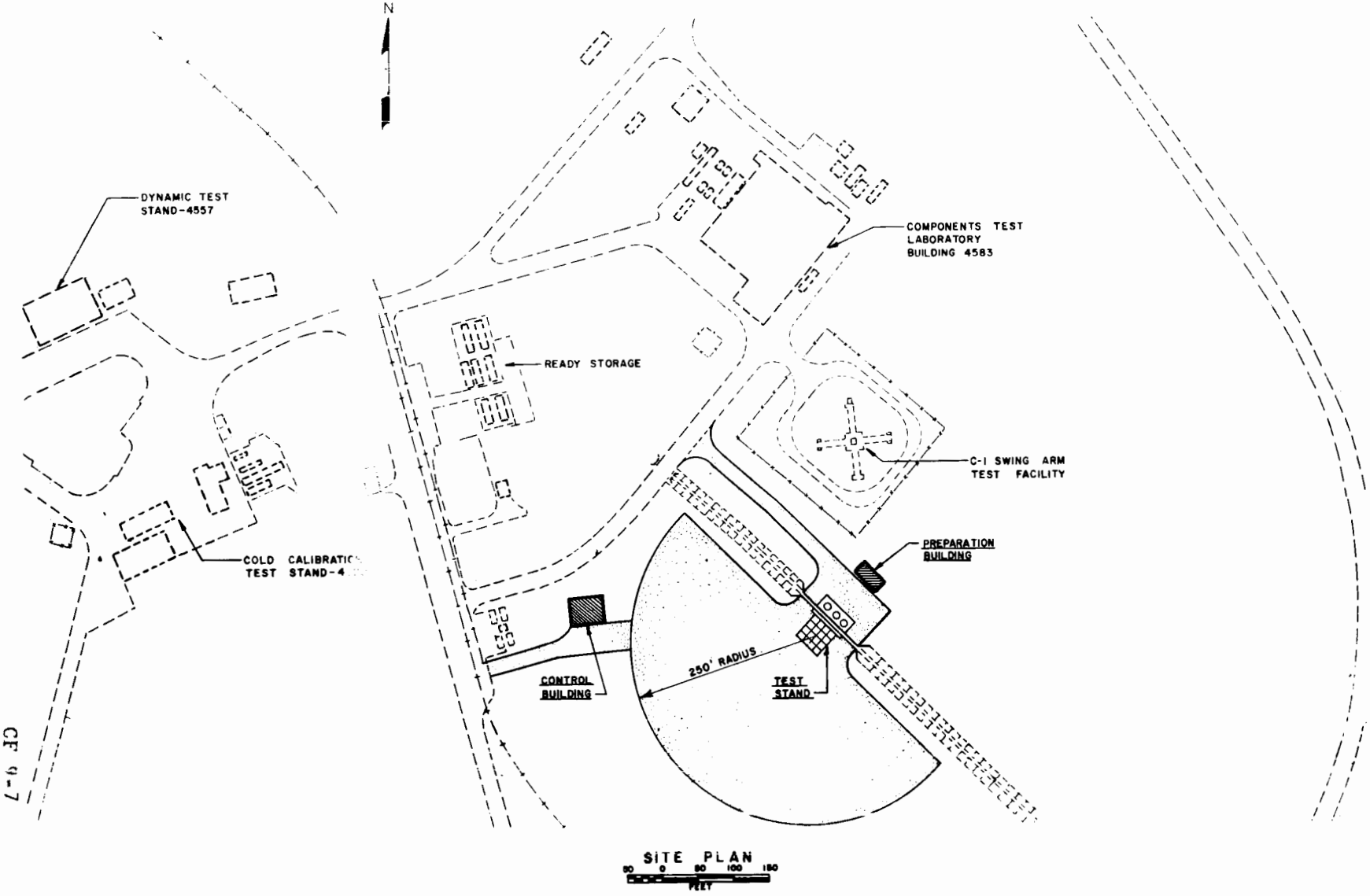
The facility will consist of a reinforced concrete pad approximately 40 feet by 40 feet by 5 feet; a structural steel tower for attachment of scale model vehicles; three 1,500-gallon, 2,000-pounds-per-square-inch run tanks; a semi-circular area of 200 to 250 feet radius leveled to within plus or minus 1 foot of the finished elevation of the concrete pad; a 2,000 square foot control and acoustic instrumentation building constructed of reinforced concrete; underground duct system for cables from acoustic pickups mounted at various points within the leveled semi-circular area; underground duct system for instrumentation cables for the scale model vehicle engine parameter data requirement which will connect the test position to an existing data acquisition center; an 800-square-foot prefabricated metal type preparation building; utilities; access roads and parking area; and extension of the high-pressure gas distribution system.

The concrete foundation will serve as a mounting device for scale launch deflectors. The steel structure will serve as a mounting device for scale vehicles and will allow the distance between the engine chamber exits and the launch deflectors to be varied. The semi-circular leveled area will provide an unobstructed area for the mounting of pickups to determine the acoustic environment generated by scaled vehicles using various propellants. The concrete pad will also be designed to allow horizontal firing of vehicle scale models. The high-pressure run tanks will provide fuel and oxidizers for the scale model engines. The reinforced concrete control and acoustic instrumentation center will provide the necessary equipment for control firing of the test model, and will house the acoustic instrumentation recording equipment.

Sketches of the facility are shown on the following two pages.

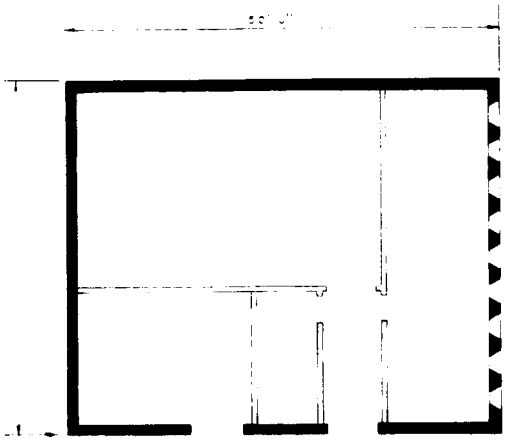
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

ACOUSTIC MODEL TEST FACILITY



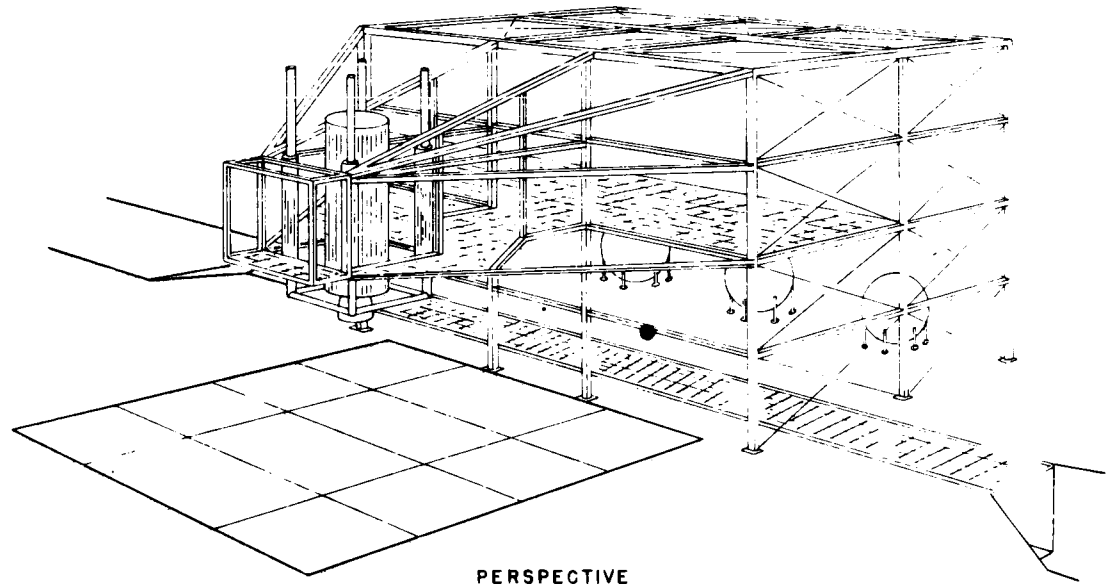
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

ACOUSTIC MODEL TEST FACILITY

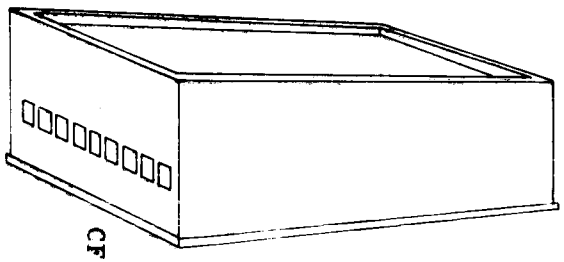


FLOOR PLAN

5 0 5 10 15
FEET

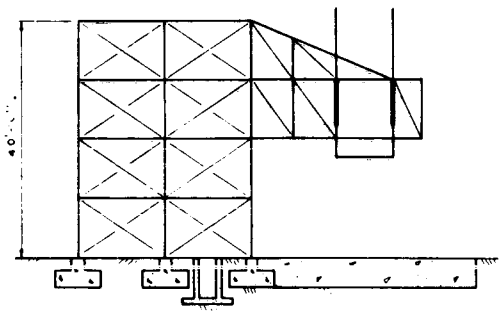


PERSPECTIVE

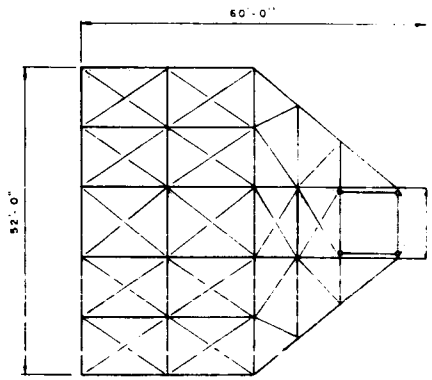


PERSPECTIVE

CONTROL BUILDING



ELEVATION



PLAN.

TEST STAND

5 0 5 10
FEET

JUSTIFICATION:

The sonic environment effects on aerospace vehicles is of critical importance. It has usually been found that the most severe vibratory environment for booster vehicles occurs at lift-off and is a direct result of sonic excitation. With the increasing mechanical thrust of large vehicles, there results an accompanying increase in the generation of sound power. Now, more than ever before, reliable acoustic data for the advance design stage of development is highly important.

The development of analytic methods of predicting the dynamic acoustic pressures surrounding a vehicle is still in process and current methods utilizing various engine parameters are not in themselves sufficient to determine all characteristics of the sound field. Repeated restrained firings of full-scale test vehicles provide the most accurate method to date of obtaining a full description of the acoustic field. However, full-scale tests are extremely expensive. At this stage in the development, the assembly of production items has been initiated and it is very expensive in time and money to incorporate a change in design which may be found necessary. Also, the cost of operation for adequate data gathering purposes is prohibitive. From the theory of models and a survey of the literature, it is known that model scaling of jet engines is feasible. Some work has also been done on rocket engines and the scaled results have shown good correlation with later data from the prototype or developmental full-scale vehicles. It has been proven that tests incorporating scale models may be completed for a fraction of the cost in both time and money than those using full-scale models. The ability to exercise precise control of the engine parameters and related environments in the model area provides an outstanding feature of model testing. A facility for acoustical model rocket testing for present and future Saturn vehicle configurations is urgently needed.

Present model facilities which are available are not suitable from an acoustical viewpoint. The present facilities were not concerned with sonic testing of rocket models, and would have to be extensively modified. One of the most important disadvantages of the present facilities is that there are many obstructions in the area that grieviously distort the sound field and practically no control can be exercised over these obstructions.

The complete definition of the acoustic field is necessary for the following reasons:

1. For the proper launch complex configuration (optimum deflector geometry, optimum location of critical launch componets, etc.) precise knowledge of sound pressures in the ground plane within a radius of twenty effective engine exhaust diameters from the vehicle centerline (near field sound pressures) must be known.

2. Definition of the mid-field acoustic environment which exists between radii of twenty and a hundred effective engine exhaust diameters from the vehicle is a requisite for provision of the proper protection for launching personnel and ground support structure.

3. In determining a community-annoyance factor, knowledge is required of the far-field acoustic levels (the levels beyond a hundred effective exhaust diameters).

Present acoustic instrumentation would allow psuedo-simulation of the full-scale sound field up to 500 cycles per second on a 1/20 scale model. Equipment currently on the market would allow full-scale simulation for this model up to 500 cycles per second and this would include the frequency domain to which human hearing and some electrical components are most sensitive. Necessary data gathering and processing systems may be developed from equipment currently on the market. The major assets of model testing over full-scale testing are as follows:

1. A satisfactory simulation of ground effects due to the launch complex can be accomplished. Differences in the sound field due to changed engine configurations, exhaust deflectors, or complex geometry can be easily defined.

2. The costs of obtaining acoustical data can be reduced by testing on a model basis. At present, acoustic measurements are essentially parasitic; the full-scale testing takes places irrespective of important ambient conditions which make accurate procurement of data difficult.

3. Repeat measurements can be made to increase confidence limits; a larger amount of data necessary for full-scale extrapolation and prediction may be gathered at a relatively low cost.

4. Ambient conditions are most controllable and more precise laboratory-type instrumentation may be used; close control of critical engine parameters can be maintained.

5. Model testing will not have to be confined to Advanced Saturn concepts, but can readily lend itself to any future design.

6. Design changes can be incorporated relatively inexpensively in the model.

7. Improvements in vehicle design which model testing may show to be necessary can be made at early stages in design or development at a minimum of expense.

The costly static firings of future full-scale vehicles and the acquisition of surrounding areas for test sites cannot continue indefinitely as the booster thrust increases and the sonic environment becomes more intense. The cost of installation and operation of an acoustical model test facility will be only a fraction of the cost of a full-scale static test stand and will provide a means of obtaining reliable acoustic inputs at the early design stages of future vehicle concepts. To be of maximum usefulness, acoustic testing must be initiated at the earliest possible date.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$110,000
	Access roads and parking area	$30,000	
	Clearing and grubbing	10,000	
	Electric, water, sewer and steam connections	70,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		460,000
	Test position	300,000	
	Preparation building (800 square feet at $20 per square foot)	16,000	
	Control and acoustic instrumentation building (2,000 square feet at $33 per square foot)	66,000	
	Duct system	78,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		1,161,500
	Special acoustical equipment	20,000	
	Instrumentation on test stand	240,000	
	Control equipment	120,000	
	Propellant system	415,000	
	High-pressure gas system	66,500	
	Instrumentation at control center	300,000	
E.	DESIGN AND ENGINEERING SERVICES		268,500
	Total estimated cost		$2,000,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO THE COMPONENTS TEST FACILITIES

DESCRIPTION:

This project proposes construction of the following additions to the components test facilities: a dual test position incorporating a common terminal structure; a prefabricated metal service building; an underground cable duct system; extension of existing paved access roads to the test position; extension of existing electrical power; potable water system; sewer lines; industrial water to the test position; a liquid hydrogen system; a liquid oxygen system; a fuel system to service the entire components test facilities area; and a 5,000 pound per square inch gas system for all test positions in the complex. The project will also provide for the installation of instrumentation and control systems at the test position; the cable transmission system connecting the test position to an existing data recording center; and the instrumentation and control systems to be installed in the existing data recording center for operation of the test position. The project includes the necessary site grading, roadways, and paved areas.

A sketch of the complex is shown on the following page.

JUSTIFICATION:

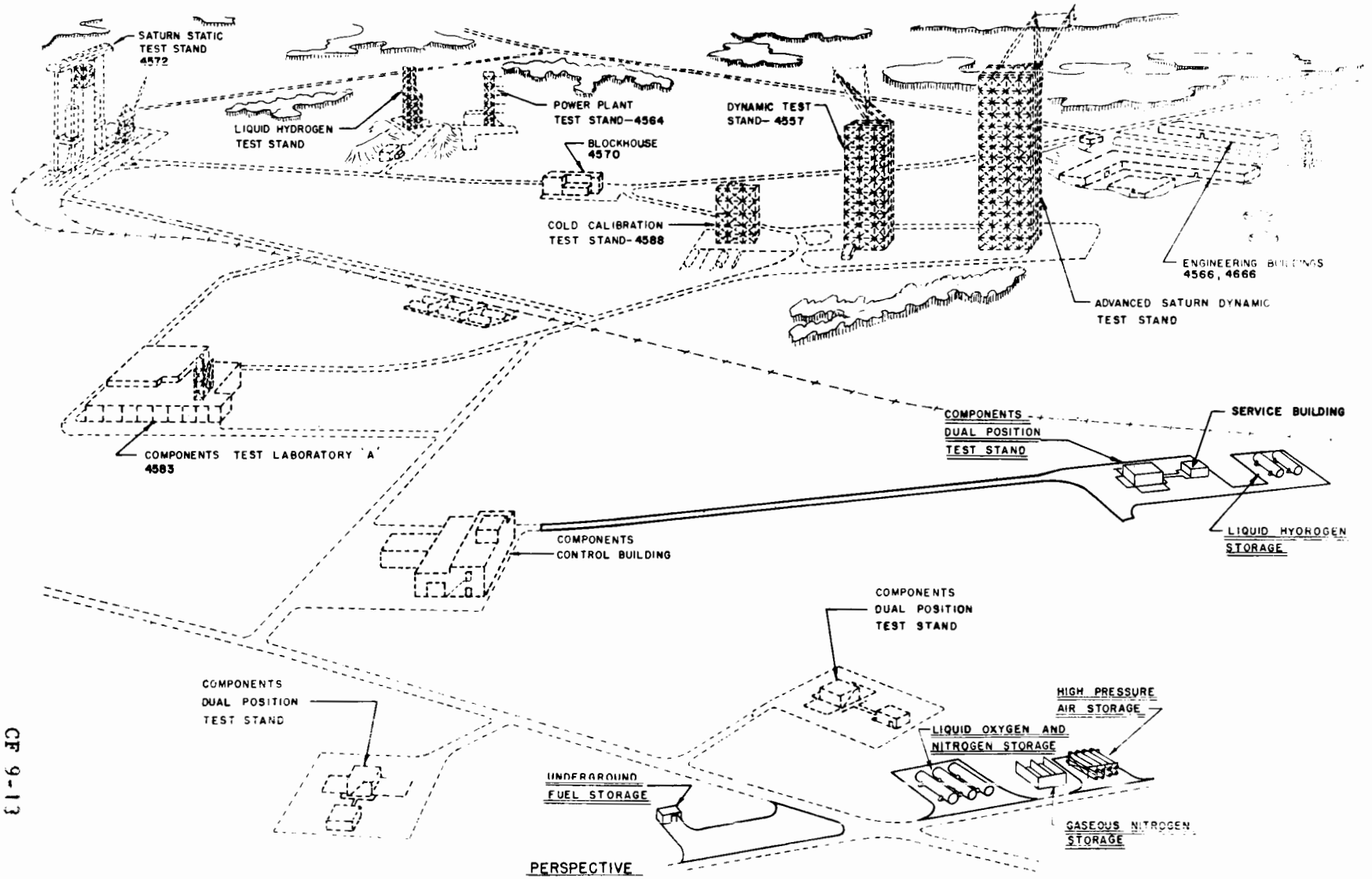
Components test facilities are utilized to restrain components, both as individual units and as parts of systems, in order that full-scale research and development tests can be performed on this hardware during prototype development. These tests are required in support of the Advanced Saturn captive and flight test programs to provide needed engineering data in isolating, analyzing and correcting problems in components and subsystems The tests utilize space vehicle fuels and oxidizers in such quantities that utilization of existing components test cells in the components test laboratory is not possible. Further, the physical size of components precludes the use of existing facilities.

The two previously funded dual test positions were designed and located to provide the capability of testing components utilizing both liquid oxygen/RP-1 fuel mixtures and liquid oxygen/hydrogen mixtures. Present test requirements will utilize these two previously funded test positions for liquid oxygen/RP-1 fuel type hazardous components testing. Since these test positions are scheduled to their capability, the proposed additional test position is required primarily for testing Advanced Saturn components utilizing hydrogen as a fuel.

The terminal structure is required to provide a protective housing for terminating the instrumentation and control cables which connect through an underground duct back to the existing control and service center and data recording center.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO THE COMPONENTS TEST FACILITIES



COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$450,000
	Cleaning and grubbing	$20,000	
	Grading	35,000	
	Utilities extensions	160,000	
	Industrial water supply and distribution	150,000	
	Electrical extensions	60,000	
	Access roads and paved areas (5,000 square yards at $5 per square yard)	25,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		510,000
	Dual test position	400,000	
	Service building (2,500 square feet at $20 per square foot)	50,000	
	Duct bank	60,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		2,465,000
	Instrumentation system at test position	250,000	
	Instrumentation system at central recording center	550,000	
	Control system at test position	200,000	
	Control system at control center	95,000	
	Liquid hydrogen system	540,000	
	Liquid oxygen system	450,000	
	Fuel system	180,000	
	High-pressure gas system	200,000	
E.	DESIGN AND ENGINEERING SERVICES		450,000
	Total estimated cost		$3,875,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

ADDITION TO THE TEST SUPPORT SHOP

DESCRIPTION:

An increase in the work capacity of the existing test support shop is proposed by adding approximately 28,000 square feet of space. Overhead cranes and machine tools, such as lathes, mills, and welding equipment of sufficient capacity to handle the large pieces of hardware required to properly support the Advanced Saturn vehicle program, will be included. The project provides for construction of a structural steel frame building with insulated siding and roof compatible with existing construction, a heavy reinforced concrete slab on-grade floor, large steel vehicle doors (suitable for passing Advanced Saturn test items and support hardware) and the necessary utilities and site work. Heating, ventilating, air-conditioning, and lighting will be provided. The relocation and paving of roads will be necessary to permit access to the building and to provide parking areas. A sketch of the addition is shown on the following page.

JUSTIFICATION:

The successful launching of modern space vehicles requires numerous and varied tests of the complete vehicle as well as component testing. The timely completion of the required tests and the on-schedule launching of such vehicles is contingent on the availability of adequate test facilities. This project is in support of such a testing program.

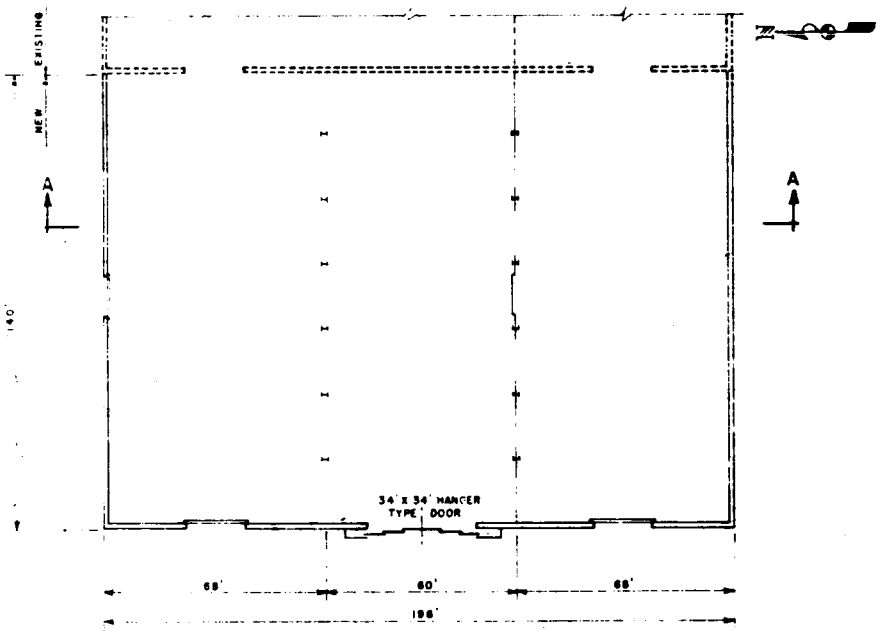
The existing test support shop is currently being utilized to its full capacity in the production and modifications of test assemblies and associated launch ground support equipment related to the Saturn program. In order to support both the Saturn and the Advanced Saturn programs, the test support shop must be expanded and larger equipment provided to handle Advanced Saturn test items and supporting hardware.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$120,000
Grading, compaction, and erosion control	$44,000	
Utility connections	50,000	
Road relocation and parking areas	26,000	

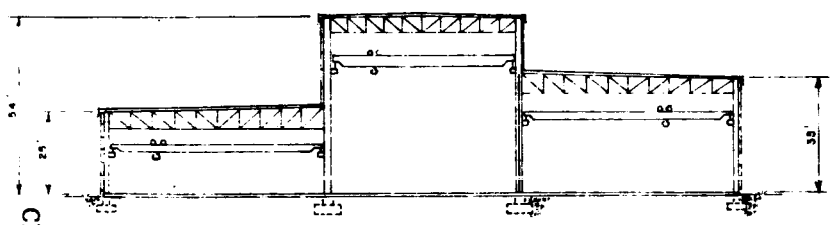
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

ADDITION TO THE TEST SUPPORT SHOP



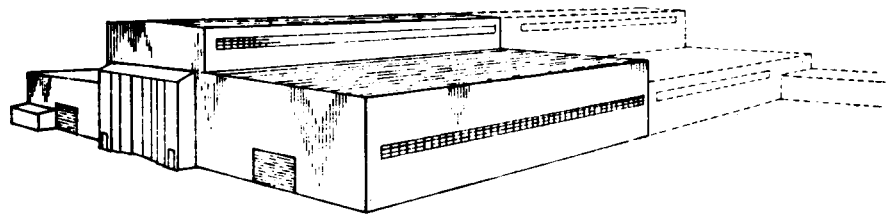
FLOOR PLAN

0 15 30
GRAPHIC SCALE - FEET

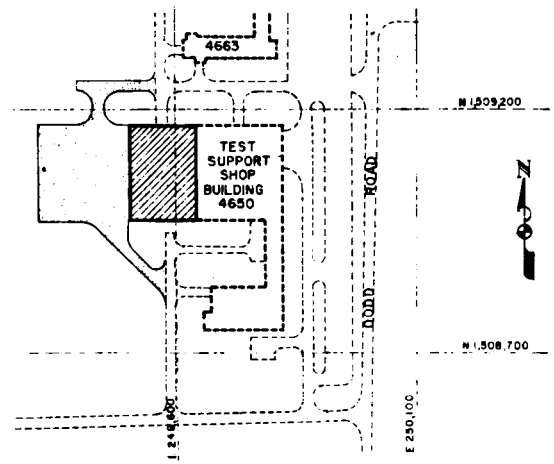


SECTION A-A

0 15 30
GRAPHIC SCALE - FEET



PERSPECTIVE



SITE PLAN

0 100 200
GRAPHIC SCALE - FEET

C.	FACILITY CONSTRUCTION AND MODIFICATIONS		$630,000
	Building addition (28,000 square feet at $22.50 per square foot)	630,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		660,000
	Bridge cranes (one 25-ton, one 20-ton, and one 5-ton)	60,000	
	Machine tools	400,000	
	Welding equipment	100,000	
	Shop equipment	100,000	
E.	DESIGN AND ENGINEERING SERVICES		90,000
	Total estimated cost		$1,500,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

BARGE DOCK AND LOADING FACILITIES

DESCRIPTION:

This project proposes modifications and improvements to the water landing and loading facility for Saturn booster barges on the Tennessee River at Huntsville, Alabama. The required modifications and improvements consist of:

(a) Removal of the existing wharf and piling.

(b) Enlargement and deepening of the present basin by excavation and dredging.

(c) Provision of sheet-pile retaining walls on two sides of the enlarged basin.

(d) Construction of two piers along the end of the basin to permit the transfer of the Saturn booster off or on land transporters to end-loading river barges. Piers will be at different elevations to accommodate high and low water conditions.

(e) Construction of one 400-square-foot storage building adjacent to the facility. The building will be a prefab metal structure 16-feet by 25-feet in size.

(f) Installation of adequate roadways and paved areas to handle transporter loads and traffic between the piers and existing test area roadways. Roadway elevation will be sufficient to preclude flooding during periods of high water level.

(g) Provision of mooring spars and dolphins.

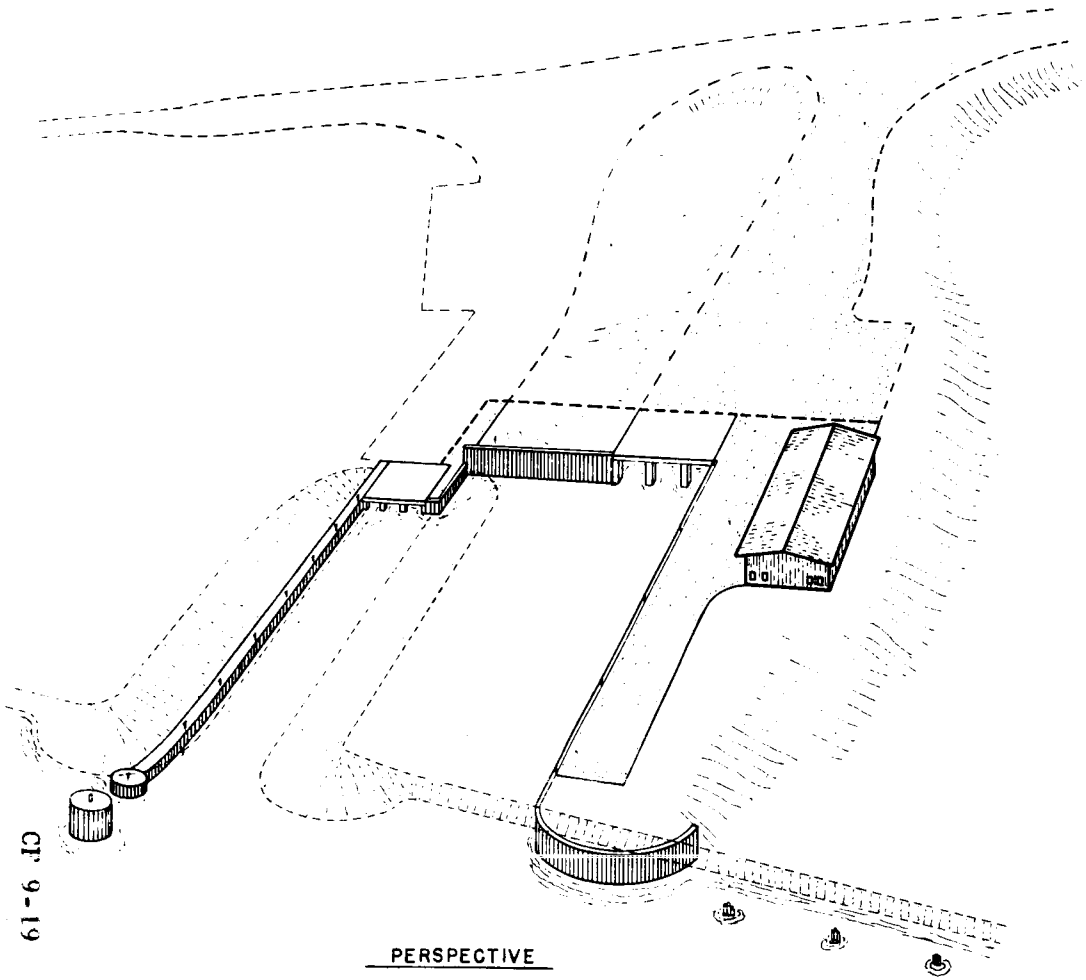
A sketch of the proposed work is shown on the following page.

JUSTIFICATION:

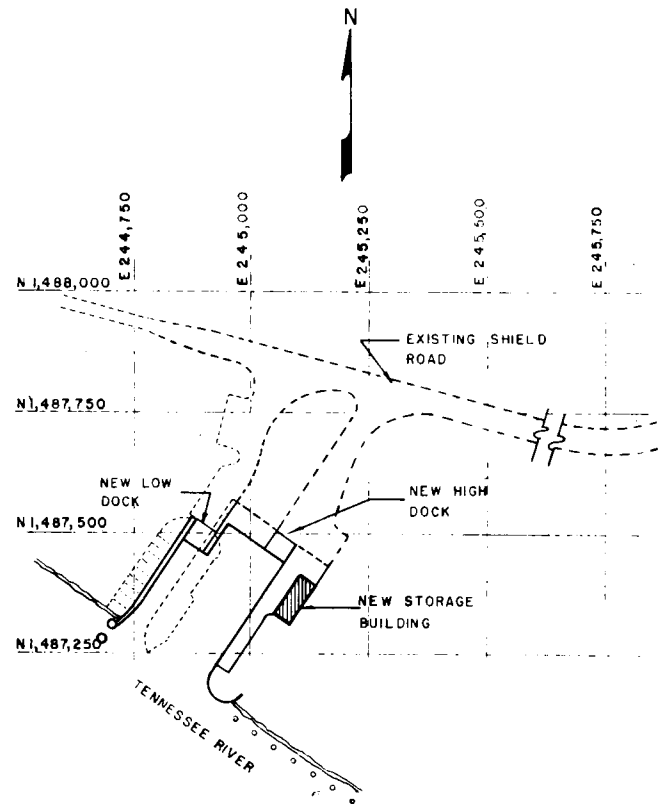
Future Saturn booster barge traffic at the Marshall Center will be increased when the Advanced Saturn booster stage (S-IC) testing program is initiated and will be handled concurrently with requirements of the present Saturn booster program. The increased size and weight of the Advanced Saturn booster requires larger barges with increased draft and greater clearance and wheel load capacities for the Advanced Saturn booster transporters. The

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

BARGE DOCK AND LOADING FACILITIES



PERSPECTIVE



SITE PLAN

0 100 200 300
FEET

increased width and draft of the Advanced Saturn booster barge requires the enlargement and deepening of the present basin. Provision must also be made to accommodate the Advanced Saturn barges simultaneously with the Saturn booster barges.

Sheet pile retaining walls are required to protect the basin against erosion especially during the dredging operation when operation of the facility must be maintained. The two piers located at the end of the basin will be constructed at different elevations to provide for high and low water level conditions to maintain 100 percent utilization of the facility with a capability of handling the Advanced Saturn booster loads.

The storage building is required for storage of marine gear and miscellaneous support equipment and supplies necessary for operation and maintenance of the facility and barge equipment.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$51,200
Roadways and paved areas	$10,000	
Excavation and dredging	41,200	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		645,200
Sheet piling	277,600	
Remove existing piling	1,500	
Remove existing wharf	3,800	
New piers (docks-2 at $135,000 each)	270,000	
Cellular mooring spars	85,900	
Storage building (400 square feet at $16 per square foot)	6,400	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		---
E. DESIGN AND ENGINEERING SERVICES		103,600
Total estimated cost		$800,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

EXPANSION AND MODERNIZATION OF THE HIGH-PRESSURE GAS AND PROPELLANT SYSTEMS

DESCRIPTION:

This project provides for the expansion and modification of the high-pressure gas and propellant systems serving existing facilities and those test facilities under construction or approved for construction. Specifically, the project will include the following: new high-pressure lines (5,000-pounds per square inch) supplying gaseous nitrogen, helium, and air to all test and fabrication facilities serving the Advanced Saturn program; new compressor facilities (addition to the air compressor building and addition to the helium compressor building in the West Area) and storage facilities (liquid hydrogen and liquid oxygen storage tanks, and bottle storage space for high-pressure, gaseous nitrogen, gaseous hydrogen, and air) to support increased pressure and volume requirements; new gaseous nitrogen and gaseous hydrogen rechargers; liquid hydrogen piping systems; new hydrogen peroxide storage facilities; modified deionized water storage tanks; and new liquid oxygen transfer systems. The project will also include control equipment and a leak detection system for the liquid hydrogen and gaseous hydrogen systems; area warning systems; fire-fighting systems; area lighting; and the necessary paving and road extensions. A location plan of the work covered by this project is shown on the following page.

JUSTIFICATION:

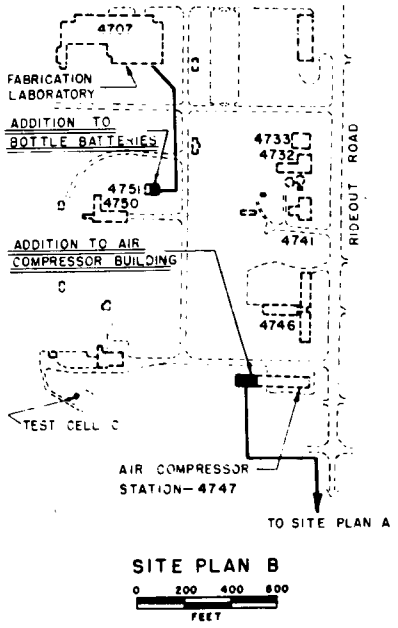
The project is required to provide for the expansion and modernization of systems which are rapidly becoming overloaded or obsolete because of the increased demands of existing programs and the introduction of new requirements in support of the Advanced Saturn program.

The present base utility systems which provide high-pressure air, high-pressure gas, fuel, liquid oxygen, and helium were designed and installed in support of the Jupiter and Redstone programs. During the past three years, portions of these systems have been upgraded and modified in support of the Saturn program. Introduction of the Advanced Saturn program imposes even greater demands on these systems, demands which far exceed existing capacity.

Although many test facilities are being designed and constructed with their own storage and transfer systems to support test runs at these locations, no integrated system exists for providing for the overall storage, compressing, and transferring of gases and propellants. At present, most

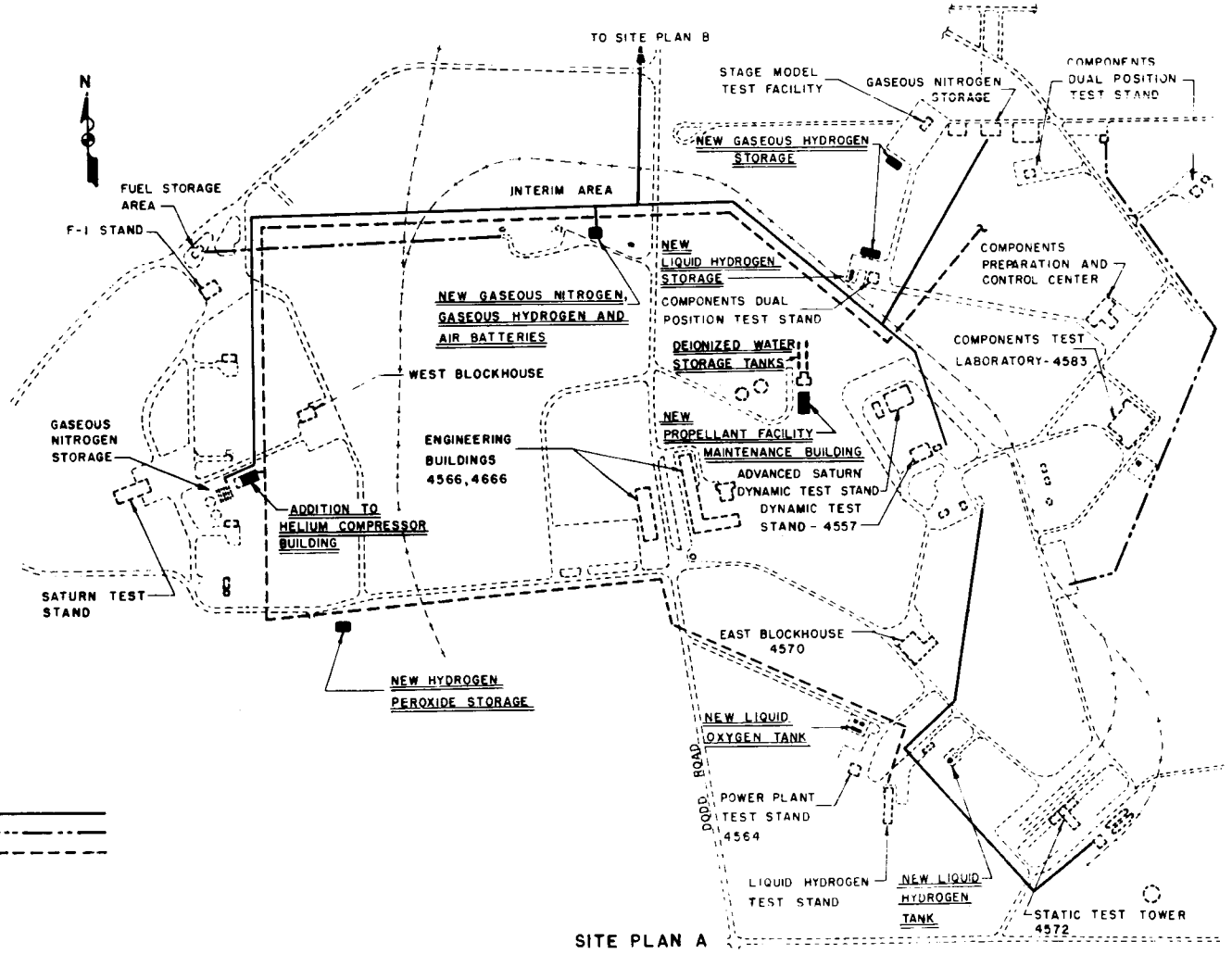
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

EXPANSION AND MODERNIZATION OF THE HIGH PRESSURE GAS AND PROPELLANT SYSTEMS



SITE PLAN B

0 200 400 600 FEET



SITE PLAN A

0 200 400 600 FEET

LEGEND

1. NEW GASEOUS NITROGEN LINE
2. NEW FUEL SUPPLY LINE
3. NEW HIGH PRESSURE HELIUM

CF 9-22

of the existing facilities are serviced by mobile equipment. The provision of new compressor facilities, storage batteries, storage tanks, distribution lines, safety systems, and control equipment is considered essential in support of current programs.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$200,000
	Clearing and grubbing (for three buildings)	$130,000	
	Electric, water and sewage connections (for three buildings)	70,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		265,000
	Addition to air compressor building (2,000 square feet at $20 per square foot)	40,000	
	Addition to gaseous nitrogen and helium compressor building (5,000 square feet at $20 per square foot)	100,000	
	Propellant facility maintenance building (5,000 square feet at $25 per square foot)	125,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		3,135,000
	Relocation of existing equipment	25,000	
	Air compressors	200,000	
	High-pressure gaseous nitrogen, gaseous hydrogen and air storage bottles	1,080,000	
	Liquid hydrogen storage tanks	710,000	
	Hydrogen peroxide drum storage facilities	60,000	
	Liquid oxygen storage tanks	140,000	
	High-pressure gaseous nitrogen lines	252,000	
	Fuel lines	22,000	
	Modification to deionized water storage tanks	21,000	
	Gaseous nitrogen and gaseous hydrogen rechargers	310,000	
	Control equipment	100,000	
	Liquid and gaseous hydrogen leak detection system	215,000	
E.	DESIGN AND ENGINEERING SERVICES		400,000
	Total estimated cost		$4,000,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

EXPANSION OF COMPUTATION FACILITIES

DESCRIPTION:

This project proposes the construction of a 42,000-square-foot addition to the computation division building to allow expansion of computation facilities at the Marshall Center. As indicated in the sketch on the following page, the two-story addition will be along the west end of the building extending each of the wings approximately 60 feet with a new wing across the end approximately 40 feet wide and 316 feet long. The addition will be compatible with the existing structure of concrete frame and masonry block. The addition will be air-conditioned and heated from a central heating plant. Raised floors and additional air-conditioning capacity will be required for computers and other types of electronic equipment. The building will provide space for approximately 90 office-type personnel. Site work will include construction of an additional parking area. Equipment to be purchased as part of this project includes data reduction and key punch equipment.

JUSTIFICATION:

This project is required to permit consolidation of the Marshall Center's computation facilities and the expanded use of computers in the fields of research, development, and administration.

At present, in order to expand the computer operations, it has been necessary to move the automatic data processing center and the data reduction branch into leased areas and other buildings in the Marshall Center. This project will permit the consolidation of activities into one facility for more efficient operations. Space vacated within the Marshall Center will be converted into office space. New requirements are being placed on the computation center as research programs grow. Some of the new requirements are as follows:

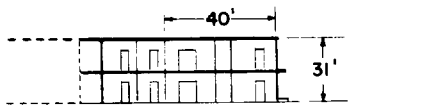
PERT program: Application of the program evaluation and reporting technique (PERT) is being emphasized and implemented in connection with the management of Marshall Center projects. As this program grows, greater demands will be made for computer time which will impose a requirement for the expansion of computer peripheral equipment and for additional space for personnel involved in this program. The additional building space will permit this expansion.

Integrated data center: A small integrated data center is being established in the computation division building for operation on a limited scale. The data center to be provided will permit

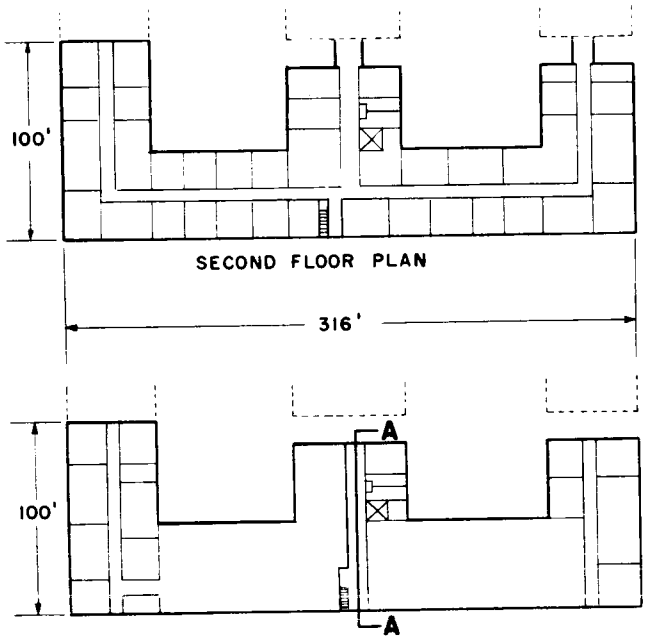
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

EXPANSION OF COMPUTATION FACILITIES

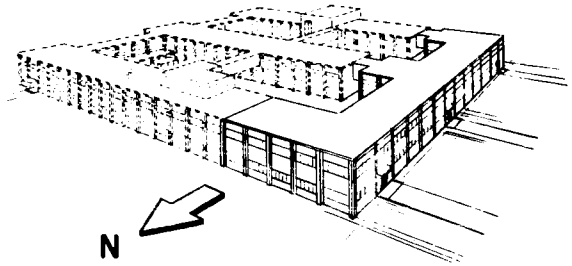


SECTION A-A

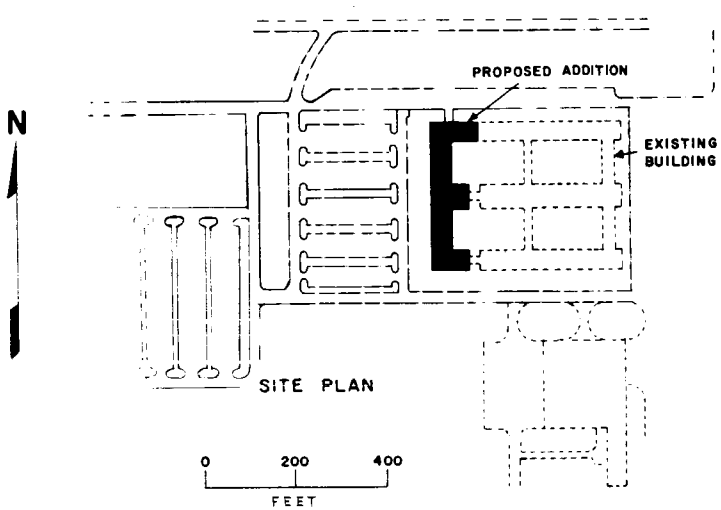


SECOND FLOOR PLAN

FIRST FLOOR PLAN



PERSPECTIVE



SITE PLAN

establishment of a master tape library for compilation of all types of information, of both a scientific and management nature. This information will then be made readily available for use in computers to obtain data upon which to base administrative and scientific decisions.

The proposed facility is also required to accommodate additional computing equipment needed for real-time computation and for high-speed repetitive operation in research and development activities. This equipment will be of the digital type, and of hybrid computer types, as well as the conventional analog computers. Plans are being formulated whereby data reduction information can be fed into the analog computers for the purpose of making more accurate simulations of actual booster vehicle flights. An analog computer tie-in with the digital computers is at present in the study stage. It is anticipated that this combination of equipment will permit real-time simulation of missions with a high degree of accuracy. By 1964, reliable links between these types of computers should permit the interconnection of the systems.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$145,000
	Clearing and erosion control	$60,000	
	Electrical, water, and sewer connections and expansions	60,000	
	Parking area (6,250 square yards at $4.00 per square yard)	25,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		1,050,000
	Building (42,000 square feet at $25.00 per square foot)	1,050,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		925,000
	Data processing equipment	675,000	
	Data reduction equipment	225,000	
	Office furniture and equipment	25,000	
E.	DESIGN AND ENGINEERING SERVICES		195,000
	Total estimated cost		$2,315,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

EXTENSION TO THE LOAD TEST ANNEX

DESCRIPTION:

This project proposes the construction of a 44,000 square foot extension to the east end of the load test annex to provide expanded facilities for structural testing.

The floor area will be approximately 200 feet by 220 feet and the high bay area will have a clearance under the crane hooks of approximately 80 feet and an overall building height of approximately 100 feet. Construction will match the existing building with a steel frame and corrugated cement asbestos siding in the high bay areas, and masonry walls on the lean-to on the north side. The floor will be of reinforced concrete, and will contain special high-force loading points. Ducts for power distribution and instrumentation lines will be installed in the floor. Two 20-ton bridge cranes will be used to locate and move test specimens. Sketches of the extension are shown on the following page.

The major items of equipment required for the proposed facility are:

(a) A 2,000,000-pound testing machine, 30 feet high, with an opening of 10 to 15 feet between the uprights to allow testing of structural components under loads provided with a controlled hydraulic system utilizing hydraulic cylinders, load maintainers, and load measuring equipment.

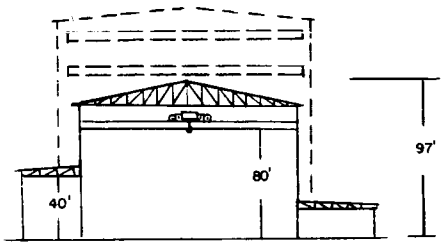
(b) A 100,000-pound force vibration system with a frequency range up to 100 cycles per second to allow the testing of hardware involved with low-frequency high-"g" loads encountered in flight and static testing.

(c) A load ballast system for determining the effect of flight cut-off loads on the vehicle structure. It will consist of a modified lead-shot system (or equivalent) that will impose the expected inertial loads on the vehicle structure, and thereby determine the areas of critical and marginal design.

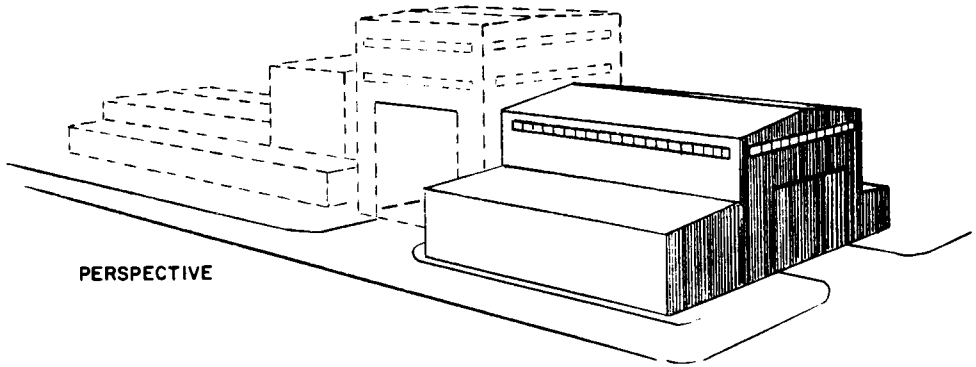
The facility will allow tests to be conducted on structural components involving loads up to 2,000,000 pounds; heat tests on large structures; horizontal load tests on large structures requiring loads up to 5,000,000 pounds by use of load cells; and the vibration testing of structural sections.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

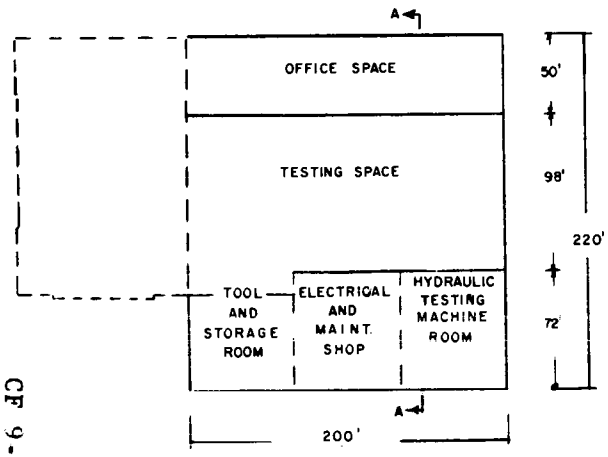
EXTENSION TO THE LOAD TEST ANNEX



SECTION A-A

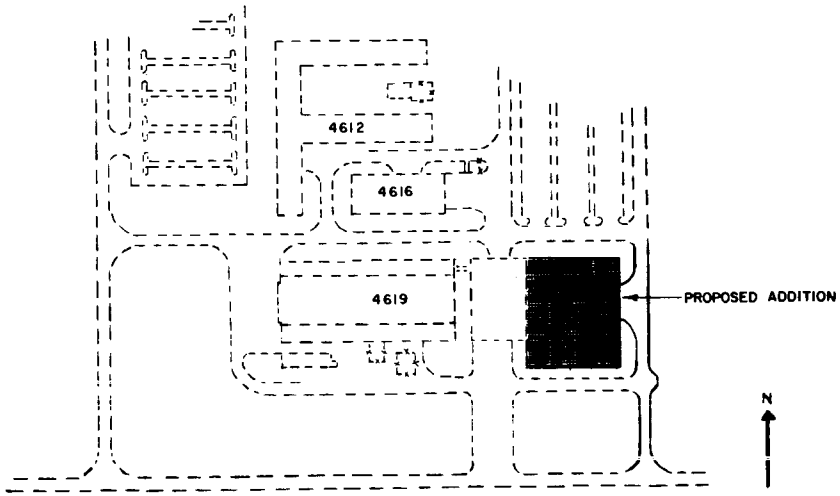


PERSPECTIVE



FLOOR PLAN

0 20 60 100
FEET



SITE PLAN

0 100 200 300
FEET

JUSTIFICATION:

To determine the design parameters which are governed in flight by vibratory, shock, compressive, tensile, torsion and bending loads, it is necessary to analyze all the varied applications of loading which are encountered. Theoretical analysis has not been able to supplant the value of experimental analysis. It has become necessary, therefore, to create more adequate and realistic test loading conditions as a prerequisite of sound design.

With the advent of larger and more complicated vehicles, such as the Advanced Saturn, the complexity of structural testing also has become a serious problem. Existing facilities and equipment were not designed for the magnitude and complex nature of a system of this type. Also, the concept of the clustered booster configuration does not allow the designer to refer to experimental data available from other flight vehicles. The proposed facility will provide the Marshall Center with a recognized capability to perform required experimental investigations and analysis on the Advanced Saturn and larger vehicle structures.

The maximum size machine for tensile or compressive testing of components presently available at the Marshall Center is a 200,000-pound testing machine. Occasions have arisen in the past year requiring capability in the 300,000 and 400,000 pound class. These requirements will continue to rise to the 1,000,000 to 2,000,000 pound class with the advent of the 1,500,000 pound thrust rocket engine. The advantage of the testing machine is that highly accurate loads can be applied to the specimen quickly, easily, and repetitively. Presently a "home made" testing machine, which incorporates specially designed hydraulic cylinders, is used. Many difficulties are involved since loads vary due to physical tolerances and to pressure variations. In order to run tests properly, the various cylinders and associated pressure system must be calibrated between tests. This creates a loss of test time and possible variations in loads from test to test.

At present, no equipment or facility is available to determine the response of structures and component parts at low frequencies and high "g" loads in the direction parallel to the longitudinal axis of the vehicle. Individual components are subjected to vibration tests. However, when an assembly is made, there is no correlation of the response of the individual component to its response in the assembly. Vibration systems are available with only a maximum frequency of 30 cycles per second. The proposed system will allow the testing of the larger and heavier components at an extended range and weight capability.

The structural test schedule shows that the testing requirements on Saturn structural components reach a peak in the latter part of the calendar year 1964. This schedule cannot be fulfilled with existing facilities.

Through the use of fiscal year 1963 advanced design funds, this project can be completed by December 1964, and thereby provide adequate testing facilities for maintaining necessary testing schedules.

One of the major missions of the Marshall Center is the technical management of industrial contractors in the development of launch and space vehicles. In carrying out this mission, the center must be able to qualify, by test, any contractor-developed structure which may be chosen, in order to accept responsibility for adequate and reliable performance of the contractor-developed vehicles. It is also essential that the Marshall Center have adequate experimental structural development facilities, to remain abreast of the state-of-the-art, to exercise proper technical control of contractor developments, and to be able to make technically sound evaluations of proposals from prospective industrial contractors.

The proposed facility will serve two purposes. It will provide expanded structural testing capabilities, and it will permit expansion of the experimental mechanics area. Upon completion of the extension to the load test annex, a total of 14,400 square feet of floor space will be vacated in the experimental structures and mechanics laboratory when the experimental structures section moves into their new building. This will permit the experimental mechanics section to expand into the vacated area in the experimental structures and mechanics laboratory. This section has the responsibility for work on heat management studies, auxiliary propulsion systems, applied research in fluid flow, automatic check-out systems, elements for cryogenic application, zero leakage studies, and other supporting projects. At the present time these efforts are seriously curtailed as a result of insufficient physical space.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$97,000
Excavation.....	$12,000	
Access roads and parking area.....	8,000	
1,500 KVA substation.....	30,000	
Utilities extensions.....	47,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,474,000
Building (44,000 square feet at $31.90 per square foot).....	1,404,000	
Relocate special power supply to accommodate elevated temperature testing.....	70,000	

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$1,720,000
2,000,000-pound universal hydraulic testing machine.....	$500,000	
50,000-pound universal hydraulic testing machine.....	20,000	
Two 20-ton bridge cranes.....	180,000	
Load ballast system.....	360,000	
High force, low frequency vibration system..	150,000	
Signal circuits and control hardware.....	320,000	
Digital data acquisition systems.....	190,000	
E. DESIGN AND ENGINEERING SERVICES.....		365,000
Total estimated cost.....		$3,656,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

EXTENSION TO THE PROPULSION AND VEHICLE ENGINEERING LABORATORY

DESCRIPTION:

This project proposes the construction of an extension to the east end of the present laboratory building with cafeteria facilities attached as a one-story structure on the south side of the extension. The building construction will be steel frame with curtain walls to match the existing five story building, with a small basement, and a penthouse for utilities. The building will be approximately 180 feet long and 70 feet wide. The attached cafeteria will have a seating capacity for approximately 300 persons to serve personnel in the area. The building will be air-conditioned and will be heated from a central steam plant. Site work will include a 250-car parking lot addition. A sketch of the proposed extension is shown on the following page.

JUSTIFICATION:

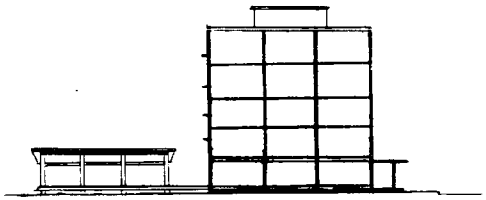
The primary need for this extension is to provide adequate working space for the efficient development, synthesizing, and coordination of scientific, engineering and management data in support of NASA activities at the Marshall Center. The building will be used by the Propulsion and Vehicle Engineering Division to perform its assigned research and development missions in the fields of structures, mechanics, propulsion, chemistry, and materials as related to launch and space vehicles. At the present time, over 600 people assigned to this division are located in leased space in Huntsville, Alabama, 12 miles away from the Marshall Center. This condition presents numerous problems in coordinating the design effort because of the dispersion of personnel, and should be alleviated as rapidly as possible.

The rapid expansion of the Marshall Center since its establishment in July 1960 has had tremendous impact in many areas. To meet the program responsibilities assigned, the Center has increased its working force by 20 to 40 per cent each year in support of the Saturn, Advanced Saturn, and other technical programs. As the personnel complement increases, additional facilities and equipment required for the economical and efficient execution of the work must be provided. Of critical concern is the need for office and engineering space at the Center to improve the flow and correlation of scientific and management data.

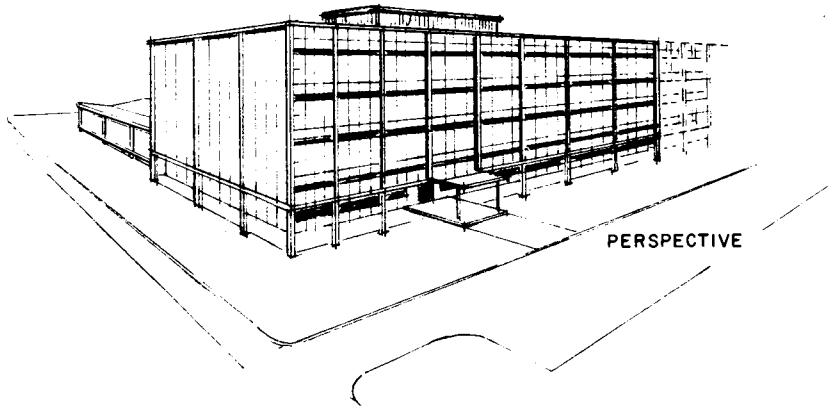
The proposed facility will house approximately 400 people and will provide for better consolidation of the Propulsion and Vehicle Engineering Division staff. Proper coordination of the work being accomplished at the Center with work being done in the leased areas which are 12 miles away, necessitates a constant flow of manpower between the two locations.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

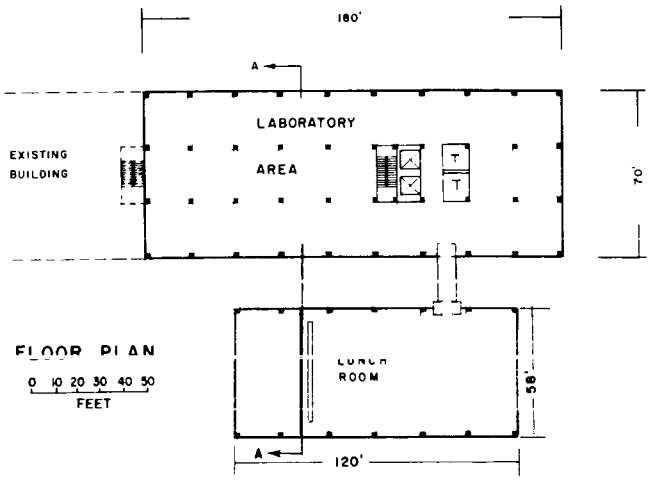
EXTENSION TO THE PROPULSION AND VEHICLE ENGINEERING LABORATORY



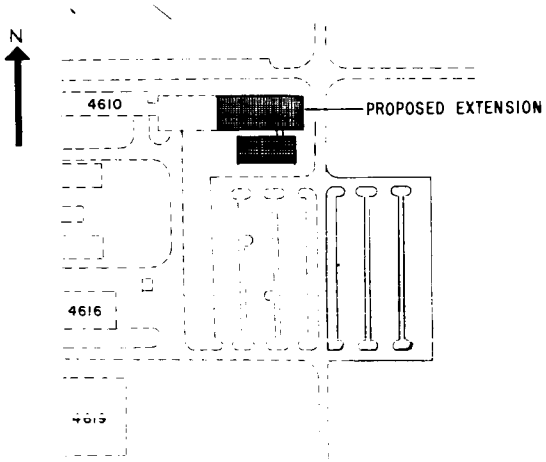
SECTION A-A



PERSPECTIVE



FLOOR PLAN
0 10 20 30 40 50
FEET



SITE PLAN
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FEET

Relocation of elements of the staff from leased areas to the Center will result in a more effective utilization of manpower and an increase in productive man-hours of work.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$170,000
	Excavation and grading	$25,000	
	Drainage	10,000	
	Landscaping and sodding	4,000	
	Side walks	1,000	
	Electrical substation and distribution lines	40,000	
	Other utilities extensions	50,000	
	Parking lot (8,000 square yards at $5.00 per square yard)	40,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		1,470,000
	Building (70,000 square feet at $21.00 per square foot)	1,470,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		100,000
	Office furniture	20,000	
	Cafeteria food-servicing equipment	80,000	
E.	DESIGN AND ENGINEERING SERVICES		160,000
	Total estimated cost		$1,900,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

HANGER FOR VEHICLE COMPONENTS

DESCRIPTION:

This project provides for design and construction of an industrial-type building two hundred and fifty feet long by two hundred feet wide. The building will be steel frame construction using insulated metal siding, a build-up roof, and concrete floors. The building will have two clear-span areas each two hundred and fifty feet long by one hundred feet wide. Four electrically-operated hanger-type doors, each seventy feet high and eighty feet wide, will be installed to provide openings at both ends of the clear-span areas. A sketch of the hanger is shown on the following page.

Four bridge cranes will be installed, two in each bay. Each crane will be equipped with two fifteen-ton hoists, and bridge clearance will be seventy feet. A personnel elevator will be provided for crane operators. Heating will be provided by unit type heaters.

JUSTIFICATION:

This facility is required to provide an area for receiving, checking, and preparing large components for Advanced Saturn S-IC stages.

As the Marshall Center progresses in the field of launch vehicle development, the volume of contractor-furnished components will continue to increase. This will tend to complicate handling operations, such as unpacking, cleaning, and checking. Handling of large bulkheads, fuel and oxidizer tanks, skins, cylinders, and other components of this size can only be accomplished in a high bay clear-span area. Facilities to accommodate these operations are not presently available.

The handling problem is particularly acute in relation to the provision of holding space pending the arrival of all components for a given assembly. For instance, matching and associated components are usually supplied by separate contractors and arrive at different intervals. This situation is accentuated by partial shipments from individual contractors. It is not possible to control delivery dates of items beyond a period ranging from 30 to 45 days.

Existing space cannot be used because all areas in the existing shop buildings are used for fabrication and assembly operations. It is impossible to move components into these buildings before commencing actual processing operations. It is also poor economic practice to expose the costly items made within close tolerances to outdoor storage. Damage

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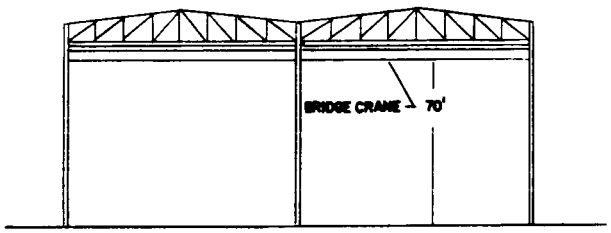
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

HANGAR FOR VEHICLE COMPONENTS



SECTION A-A

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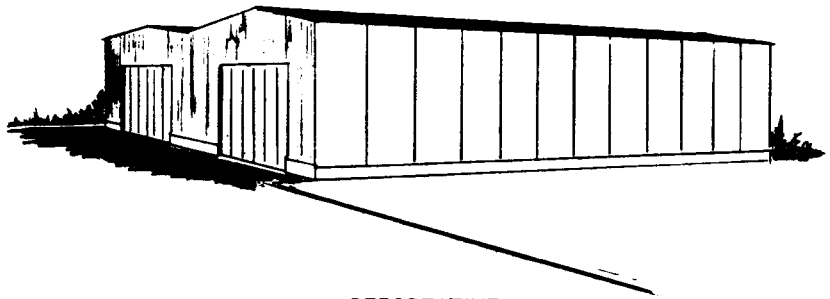
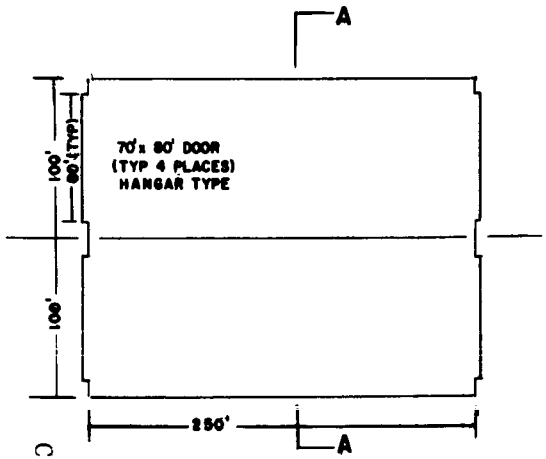
SCALE IN FEET



PERSPECTIVE



FLOOR PLAN

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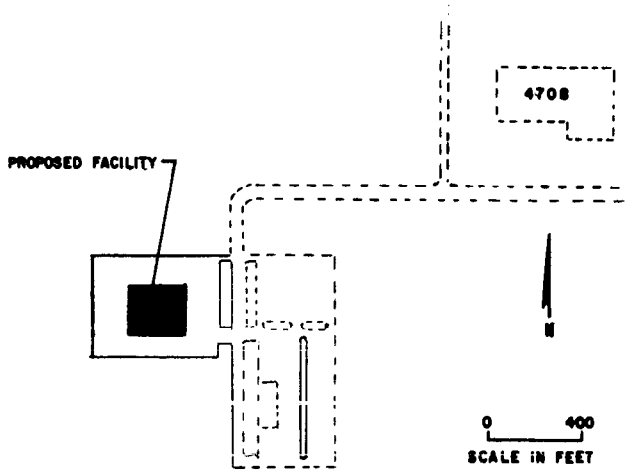
SCALE IN FEET



SITE PLAN

resulting from inadequate protection can render the items useless or necessitate expensive and time-consuming repairs. Problems already exist in the temporary holding and storing of components for the Saturn vehicles. The problems will be compounded with the phase-in of the Advanced Saturn program.

Bulky and weighty components present many handling problems. It is not practical to handle the small items with ordinary boom cranes. Bridge cranes with sufficient capacity and clearance must be available for unloading, positioning and loading components. The size of the components is not the only factor which determines the required crane bridge clearance. It is necessary to load components on transports equipped with special support frames when they are moved to other buildings. The bridge must be high enough to clear the support framework as well as the components when transports are being loaded and unloaded. Other components must be positioned for vertical assembly.

Extensive high bay clear-span areas are necessary for holding matching components until all elements are delivered and are ready for fabrication or assembly. Space must be provided to accommodate in-process components between shops. For instance, as components are welded, they may have to be held until the next sequence of a particular operation is ready. Preliminary forming of components such as bulkhead gores might be accomplished by machine and finished by explosive forming, thus requiring a stop-over in holding areas between processes. Components leaving the structural fabrication shop will in many cases be held over from a few hours to several days enroute to final assembly. It is not possible to hold components in shop areas because of the congestion created by the huge fabrication and assembly fixtures. In addition to the large amount of floor space required for holding operations, sufficient square footage must be available for positioning, loading, unloading, and checking.

No facility is available to fulfill these anticipated requirements. Existing warehouses in areas adjoining the Marshall Center, controlled by the Army, are not equipped with overhead cranes, do not have ample overhead clearance, and have inadequate door openings to meet current requirements.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$150,000
Clearing and grubbing.....	$10,000	
Parking area.....	30,000	
Electric, water, sewer, compressed air and steam connections.....	110,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		2,350,000

	Building (50,000 square feet at $33.20 per square foot)	$1,660,000	
	Bridge cranes (4 each, 30-ton capacity)	400,000	
	Electric-operated doors (4 each, 70 feet by 80 feet)	270,000	
	Elevator (2 each)	20,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		$50,000
	Work platforms and equipment	50,000	
E.	DESIGN AND ENGINEERING SERVICES		250,000
	Total estimated cost		$2,800,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

HAZARDOUS OPERATIONS LABORATORY

DESCRIPTION:

A facility is required to perform environmental and functional tests and calibrations which, because of their hazardous nature and the size of the equipment, cannot be accommodated in existing facilities. The proposed laboratory will consist of a building approximately 88 feet long by 72 feet wide, providing approximately 6,400 square feet of laboratory space and test cells. The laboratory space (approximately 3,500 square feet of the area) will be of concrete block construction with special air-conditioning equipment providing approximately 20 air changes per hour. The laboratory area will be subdivided into separate test preparation rooms. Test cells adjoining the laboratory will be constructed of reinforced concrete walls up to 18 inches thick. Most of the test cells will be approximately 12 feet wide and 16 feet long.

In addition, the project includes the relocation of an existing flow calibration stand from the experimental mechanics and structures building to the hazardous operations laboratory. The relocation is required to permit expanded operations in the experimental mechanics and structure building. The use of the flow calibration stand will be integrated with other operations in the hazardous operations laboratory.

New cryogenic equipment being provided for this facility includes a "cryostat," a device for converting hydrogen from a gaseous to a liquid state; a 50-gallon storage tank; a cryogenic work bench; standard laboratory benches; and dewar containers.

A sketch of the laboratory is shown on the following page.

JUSTIFICATION:

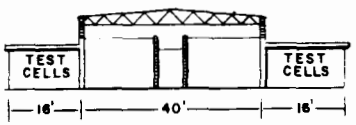
The proposed facility is required to permit expanded testing and calibration of instrumentation components of the Advanced Saturn vehicle and other technical programs. A safety survey indicated that, due to the varying degrees of hazards involved, the operations should be performed in a separate laboratory building. Some of these hazardous operations and facilities to be housed within the proposed building include:

(a) Calibration and testing of high pressure (350 to 10,000 pounds per square inch) valves and gages.

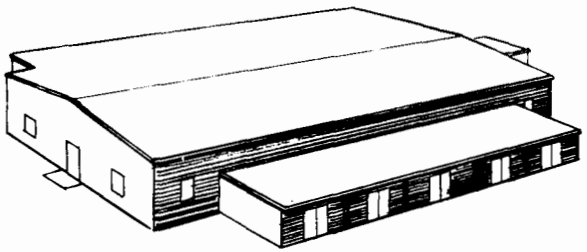
(b) Time response studies of pressure gages, tubing, and systems. These operations result in sudden, loud, and alarming noises caused by bursting diaphrams.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

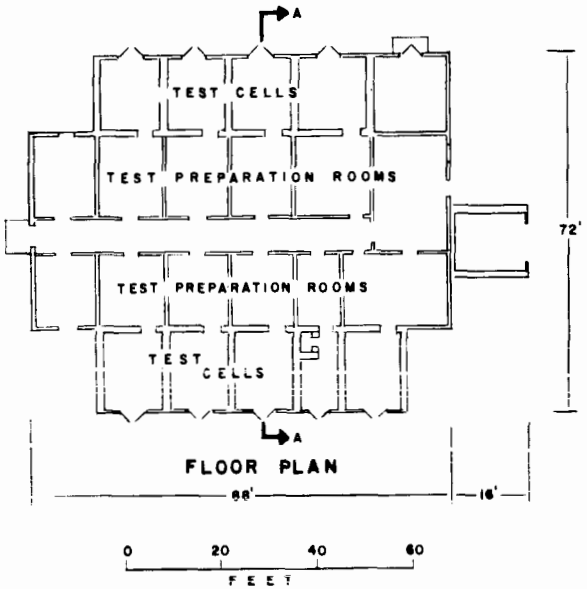
HAZARDOUS OPERATIONS LABORATORY



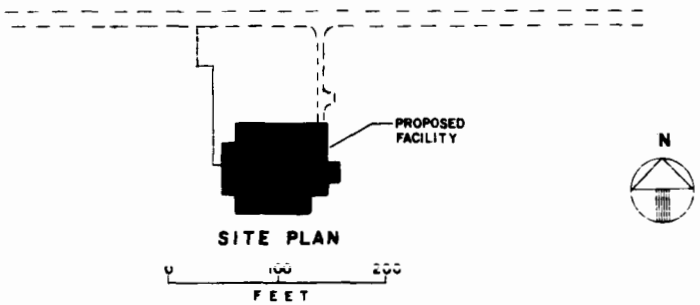
SECTION A-A



PERSPECTIVE



FLOOR PLAN



SITE PLAN

CF 1-40

(c) Functional test and calibration of pressure transducers, and continuous and discrete liquid level probes in RP-1 type fuels and liquid oxygen. These probes are a vital part of the instrumentation system on all the Saturn vehicles in the research and development stage.

(d) Liquid nitrogen calibration facility: This unit has been designed for the calibration of resistance thermometers used to measure liquid oxygen temperatures on the Saturn vehicle. Liquid nitrogen is used for the generation of cryogenic temperatures in lieu of liquid oxygen because of the danger to personnel and facilities that could result from an explosion of gaseous oxygen. The use of nitrogen does not completely remove all of the danger to personnel but it does eliminate the possibility of an explosion. The danger to personnel from this facility occurs when nitrogen gas concentrated in the air is being inhaled. It is possible that suffocation could result if sufficient quantities of gas were present. This danger can be eliminated by providing a well-ventilaged area for this operation. The unit itself measures 2½ feet wide, 7 feet long, and 6 feet high. Additional floor space is needed for the storage of dewars, test records, and auxiliary equipment.

(e) Liquid hydrogen facility: This facility will be used for precision temperature control suitable for calibration of cryogenic temperature measuring probes in the 10 to 30 degree Kelvin range under various flow conditions. A separate cell will be necessary for this purpose. Enough floor space adjacent to the cell is required to accommodate the equipment necessary for the precise control of the hydrogen temperature and the data recording equipment.

(f) Radioactive material calibration room: For future work, an area for the calibration of nuclear measuring devices is required. This room will be lead-shielded to protect personnel from the hazard of radiation.

(g) High-temperature facility: The present and future scope of work includes the testing and calibration of temperature measuring devices up to 5400°F. The methods of generating this temperature present various types of hazards. If an oxy-actylene torch is used, there is a possibility of an explosion due to leakages in the system. In other systems, such as calorimeter calibration, extremely high current is required for the power source necessary to generate the high-heat fluxes expected on the Saturn S-I and S-IC stages. High pressures (3500-pounds per square inch) are often required for the evaluation of gage seals. It is expected

that it will be necessary to go to 6000 pounds per square inch in the near future.

Most of the equipment required for the proposed facilities described above is available at the Center.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$29,000
	Grading and drainage	$9,000	
	Electric, water, and sewer connections	20,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		256,000
	Building (6,400 square feet at $30.00 per square foot)	192,000	
	Special heating, ventilating, and air-conditioning equipment	64,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		170,000
	Relocate flow calibration stand	50,000	
	Cryogenic equipment	120,000	
E.	DESIGN AND ENGINEERING SERVICES		45,000
	Total estimated cost		$500,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

MODERNIZATION OF INSTRUMENTATION AND CONTROL SYSTEMS IN THE EAST AREA

DESCRIPTION:

This project covers the procurement and installation of urgently needed replacement and modernized equipment in the blockhouse serving the East Test Area. Specifically, the following equipment will be installed: two analog-to-digital data acquisition systems; signal conditioning and calibration equipment; data recording devices; signal transmission and distribution systems; automatic checkout equipment; and test control equipment. The project includes all work necessary to completely integrate the new equipment with existing systems as well as complete checkout of all new equipment. The location of the work is indicated in the sketch on the following page.

JUSTIFICATION:

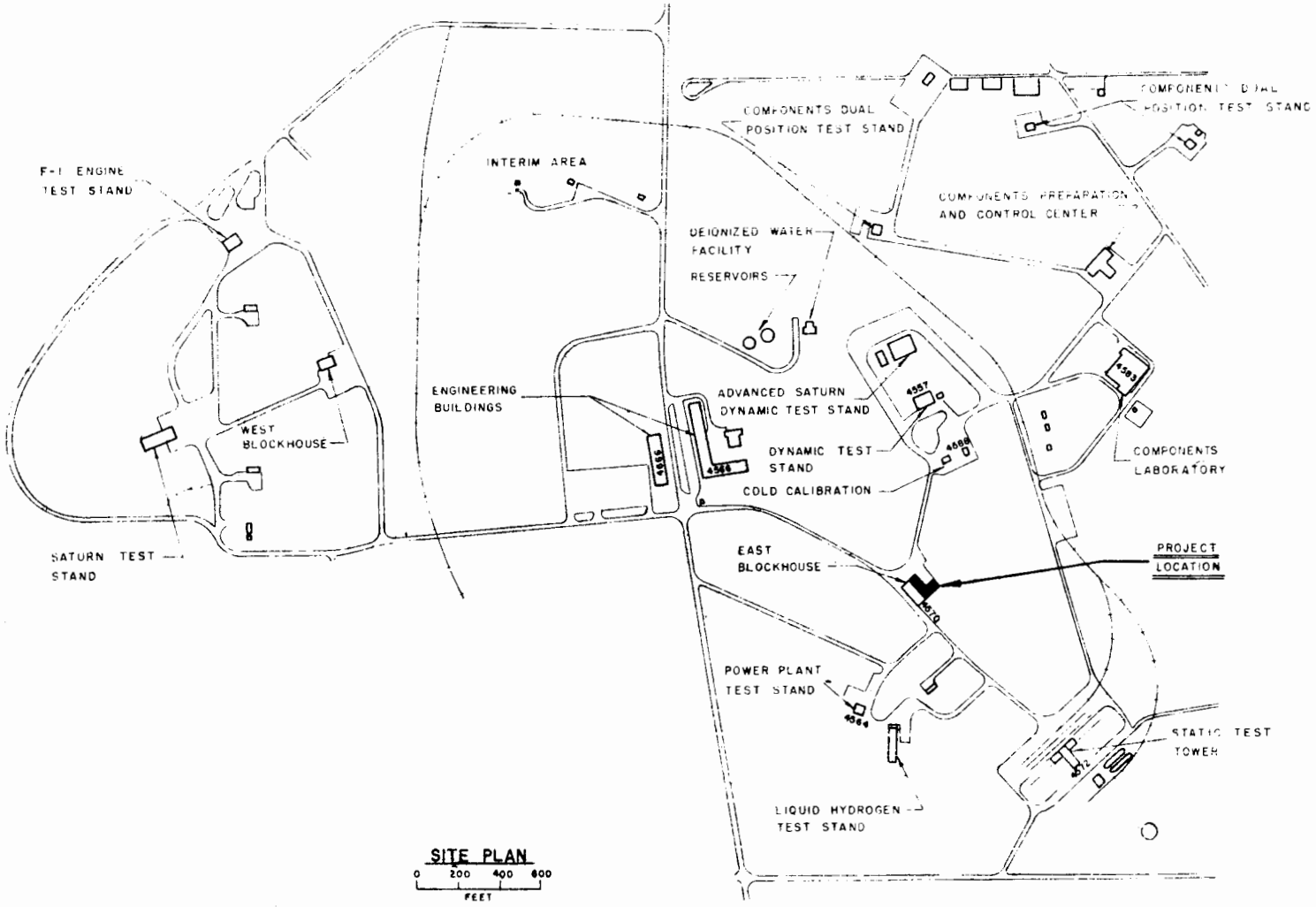
Much of the basic instrumentation and control equipment in the existing blockhouse servicing the East Test Area is outdated and will not support present day test requirements. The blockhouse services the Advanced Saturn dynamic test stand, the static test stands for the Saturn and for Advanced Saturn, the power plant test stand for the H-1 engine, the liquid hydrogen test stand, and the components test laboratory. The quality of recording mediums, the frequency response, the sampling rates, and operational reliability of the existing equipment does not meet present requirements. With each advance in the rapid development of booster art, present equipment becomes less capable of meeting (within the accuracy tolerance range) the extensive data requirements of existing research, development, and flight test programs. Existing equipment presents data much of which is obtained in a form that must be manually read from charts with inherent delays in evaluation of test run records. Immediate steps must be taken to "up date" this equipment if adequate support is to be given to existing programs and to the new programs which will use test positions now under construction. The new equipment will be compatible with the automatic data processing equipment presently in use at the Marshall Center. The new equipment will supplement existing instrumentation and control equipment in the East Test Area. It will make possible greater reliability, the more rapid reduction of data, and greater flexibility in serving test positions by reducing time required to change recording instrumentation from one position to another.

COST ESTIMATE:

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

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

MODERNIZATION OF INSTRUMENTATION AND CONTROL SYSTEMS IN THE EAST AREA



B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		---
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		---
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$3,300,000
	Two new analog-to-digital data acquisition systems.....	$1,400,000	
	Signal conditioning, calibration and special equipment.....	490,000	
	Up-date data recording devices.....	300,000	
	Signal transmission and distributing devices.....	150,000	
	Automatic checkout equipment.....	400,000	
	Up-date control equipment.....	300,000	
	Installation and checkout.....	260,000	
E.	DESIGN AND ENGINEERING SERVICES.....		200,000
	Total estimated cost.....		$3,500,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

MODIFICATION TO THE VEHICLE ASSEMBLY BUILDING

DESCRIPTION:

This project proposes the modification of the existing vehicle assembly building. The project includes the raising of the roof over a portion of the vehicle assembly building and extending into the tie-in area to provide a high bay area approximately 141 feet long by 104 feet wide with approximately 14,700 square feet of floor space.

Construction will conform to the existing structure of steel frame, corrugated asbestos siding, and built-up roof. Two ninety-ton capacity bridge cranes will be installed. Each crane will be equipped with two forty-five ton hoists. Minimum bridge-to-floor clearance will be 65 feet. The overall height of the building will be approximately 85 feet. An elevator for crane operators will be provided.

Relocation of steam lines, utility lines, and bus ducts will be required to provide a door opening on the north end of the high bay area. Additional heating and ventilation will be required. Special high-intensity lighting will be installed. Water, air and power lines will be entrenched in the floor. Utility changes will be planned and performed so that operations will not be interrupted in other areas of the building.

An electrically operated sliding-type door, 66 feet high and 54 feet wide, mounted on rollers and tracks, will be installed in the north end of the high bay area. The door will consist of separate steel panels and will be motor-operated. One personnel door will be installed in the north end of the high bay area.

A sketch of the modification is shown on the following page.

JUSTIFICATION:

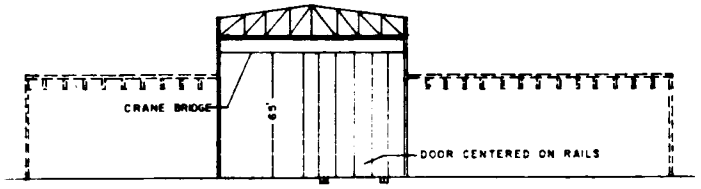
The use of a large diameter, single-tank configuration for the Advanced Saturn vehicle imposes requirements for a high bay through area in the vehicle assembly shop.

With the forthcoming addition to the fabrication building now under construction, facilities will be provided for vertical structural and development work on all types of present and next generation vehicles. The high bay area modification proposed in this project will provide final assembly facilities with a capability equitably related to the capability of the existing structural assembly facilities. Requirements for vehicle assembly differ from structural work. Structural assembly is mainly laid out to perform welding, which is accomplished by the use of automated

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

MODIFICATION TO THE VEHICLE ASSEMBLY BUILDING



SECTION A-A

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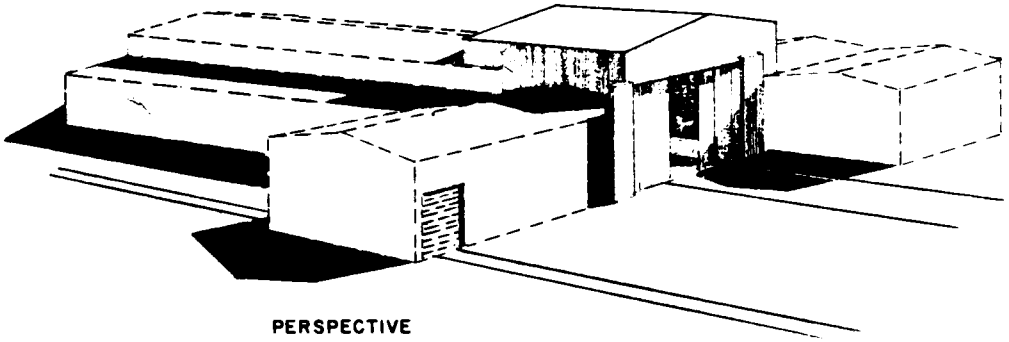
SCALE IN FEET



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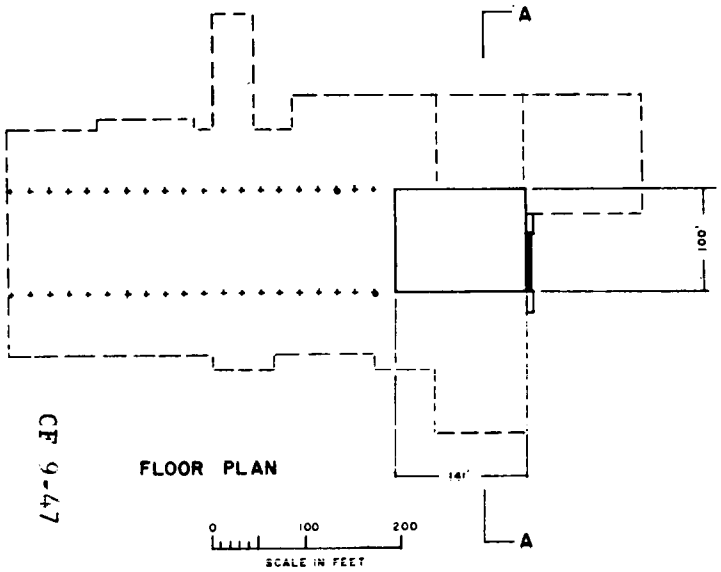

FLOOR PLAN

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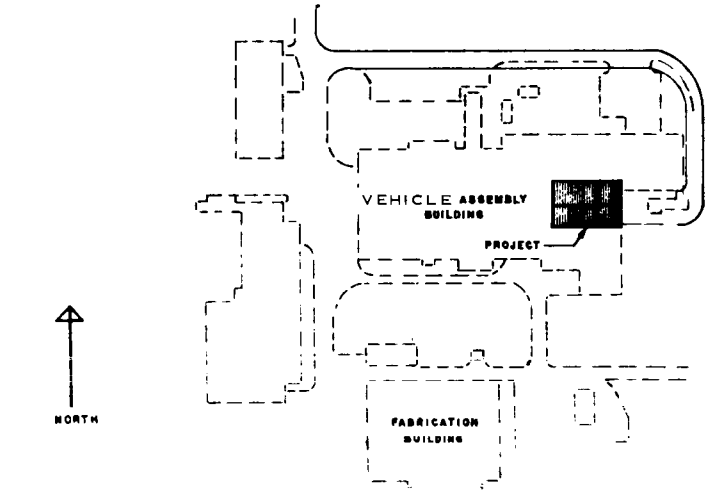
SCALE IN FEET



SITE PLAN

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SCALE IN FEET

CF 9-47

equipment at different high levels. Requirements differ for an assembly facility in that enough space must be provided around the vehicle to feed in large components by crane and verta-lifts.

An area must be provided with adequate overhead clearance to allow large vehicles or components to be moved into the assembly building and loaded onto or unloaded from assembly fixtures. Sufficient overhead clearance must also be provided for mounting, positioning, and optical alignment of various components and boosters. With present clearance it is possible neither to install bridge cranes with sufficient hook height to lift vehicles from transports nor to clear vehicles mounted on fixtures for assembly and optical alignment.

With early approval, this facility modification will provide facilities for adequate handling, assembly, and modification of the four Advanced Saturn vehicles which are to be manufactured at the Marshall Center. The ground test vehicle will be moved repeatedly into and out of the assembly building for modifications, through 1966 at least. The modification will also provide facilities for handling, modifying, and repairing the various vehicles which are to be static tested at the Marshall Center for the Michoud Plant. The first of these vehicles is tentatively scheduled to arrive at the Marshall Center in January 1965.

The present high bay area in the vehicle assembly building is divided into two areas. One area contains the present three Saturn assembly stations, while the other area of the same size serves as an aisle to feed in large components to the assembly stations. By providing the proposed 65 foot high clear area, a through flow of assembly procedures will allow the entire area to be utilized for major assembly work. At present, there is no through area from one end of the building to the other.

The high cost of the building modification is basically caused by overall height of the building, the structural framing required for the 90-ton crane, and the heavy foundation work for the new columns.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$41,000
Cleaning and grubbing	$7,000	
Soil erosion control	2,000	
Roads and parking area	23,600	
Utility extensions	2,400	
Relocation of existing utilities	6,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		1,115,000

Building modification (14,700 square feet at $75.20 per square foot)	$1,105,000	
Elevator	10,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		500,000
Bridge cranes (2 each, 90-ton capacity)	500,000	
E. DESIGN AND ENGINEERING SERVICES		144,000
Total estimated cost		$1,800,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

PROJECT ENGINEER OFFICE

DESCRIPTION:

This project proposes the construction of a six-story office building with a full basement. The structure will be 221 feet by 73 feet and will provide a gross floor area of 112,000 square feet. Construction will be of the permanent type and will consist of a steel frame, metal curtain walls, built-up roofing, concrete floors with vinyl asbestos tile in offices and corridors, and suspended acoustical ceilings. Lighting, air-conditioning, and heat will be provided by a central plant. The building will include a cafeteria with a seating capacity for approximately 300 persons. The project scope also includes site work, utility connections and a 400-vehicle parking lot. The design of this building will be adapted from the engineering and administration building provided in the fiscal year 1963 program.

JUSTIFICATION:

The primary need for this project is to provide adequate working space for the efficient development, synthesizing, and coordination of scientific, engineering and management data in support of NASA activities at Marshall Space Flight Center. This project and other major engineering and office space projects included in the fiscal year 1964 construction program, together with those projects for technical facilities which include incidental engineering areas, will provide space necessary to house additional Marshall Center personnel. In planning these buildings, sites have been carefully selected which will aid in operating proficiency and the close coordination and collaboration between the Marshall Center organization segments and personnel.

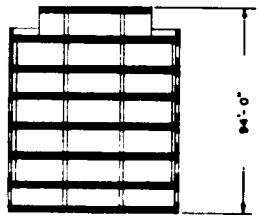
This project will provide working space for 700 personnel in technical project and supporting offices. At the present time these personnel are located in several leased areas, 9 to 12 miles from the Marshall Center necessitating a constant flow of manpower between the two locations. Consolidation of these employees into a centrally located and functionally adapted facility at the Marshall Center will substantially improve the efficiency and coordination of the work, and will result in an immediate increase in productive man-hours.

COST ESTIMATE:

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

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

PROJECT ENGINEER OFFICE



SECTION A-A

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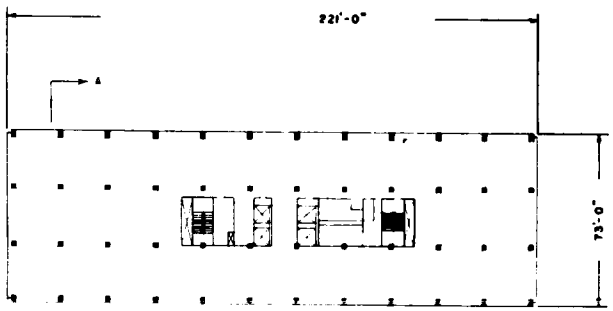
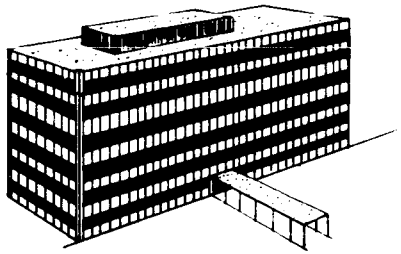
FEET



FLOOR PLAN

0 20 40 60 80
FEET



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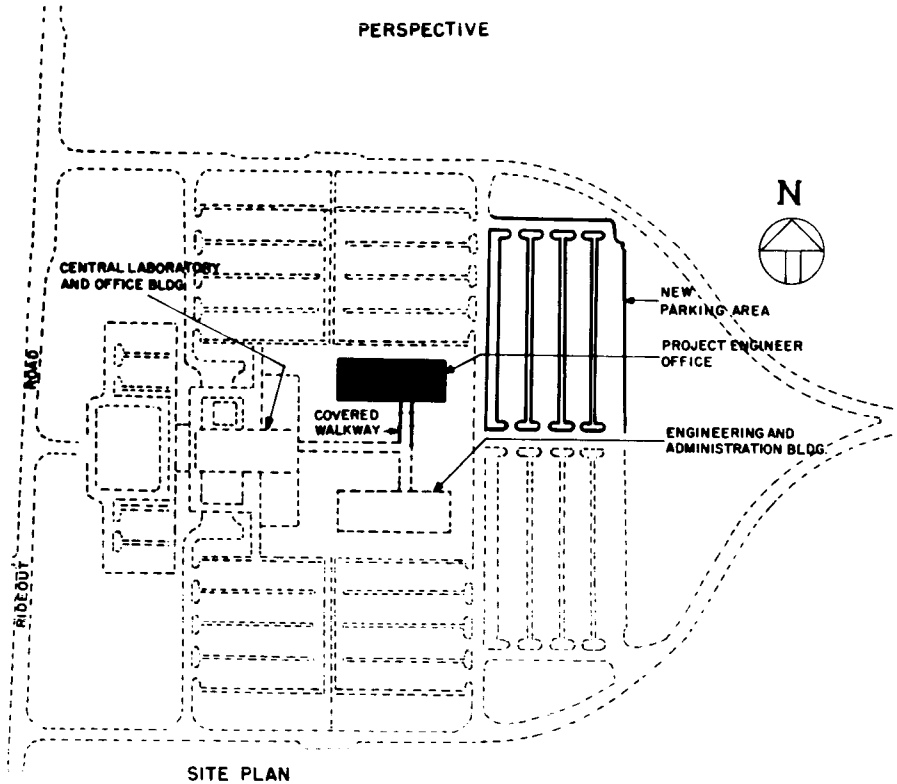


SITE PLAN

0 100 200 300 400
FEET

CF 9-51

B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$180,000
Clearing, grading and erosion control.....	$40,000	
Electrical, water, sewer, and heating connections.....	80,000	
Parking facilities (12,000 square yards at $5.00 per square yard).....	60,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		2,210,000
Building (112,000 square feet at $19.75 per square foot).....	2,210,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		100,000
Office and cafeteria furniture and equipment.....	100,000	
E. DESIGN AND ENGINEERING SERVICES.....		160,000
Total estimated cost.....		$2,650,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

SUPPORT OPERATIONS BUILDING

DESCRIPTION:

This project covers the construction of a shop-type building consisting of a high bay shop area for maintenance functions related to mobile-type equipment; and a two-story lean-to type structure the length of the high bay (two sides) to support electrical, electronic, and office-type functions as required. The building will be of mill-type construction; slab on-grade floor; structural steel frame; insulated metal or masonry unit walls; built-up roof; flourescent and incandescent lighting; air-conditioning for small shop and office areas; heating by means of a steam generating system; and all utilities as required. In addition, the project includes the necessary site work, roads, and parking areas. A sketch of the proposed building is shown on the following page.

JUSTIFICATION:

The presently planned expansion of the Marshall Center in support of the Advanced Saturn development program involves the construction of many new test positions and the modification of existing positions for new programs. The need is recognized for support contractors to assume much of the increased work load in the operation of these facilities. Areas where contracts are and will be negotiated in the near future include data acquisition, control systems, high-pressure gas systems, and propellant systems. The current fiscal year 1963 budget provides for approximately 80 contractor personnel to support Government operations in the above-described areas. Recently completed studies indicate that this requirement will greatly increase in the fiscal year 1964.

Existing facilities do not provide for sufficient engineering space, administrative office space, and small repair and maintenance shops to house and support contractor personnel effectively.

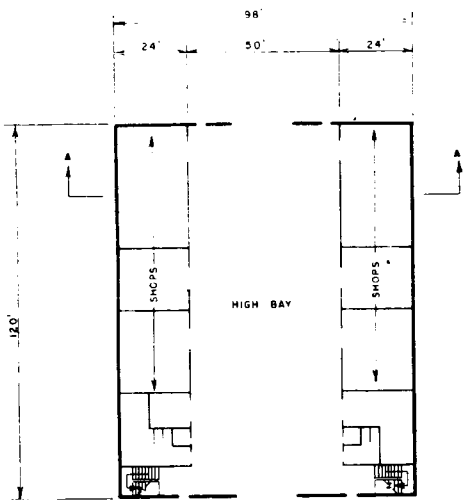
The proposed facility will provide the minimum on-station space requirements for contractor personnel to efficiently discharge the responsibilities of their contracts and the necessary space for Government furnished equipment used by the contractors. The facility will not duplicate facilities that may be required and furnished elsewhere by the contractors.

COST ESTIMATE:

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

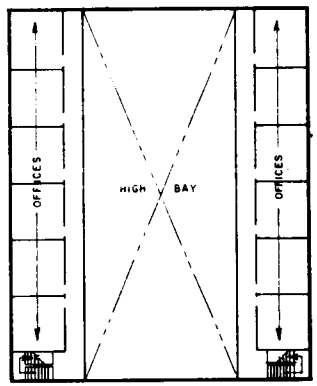
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

SUPPORT OPERATIONS BUILDING



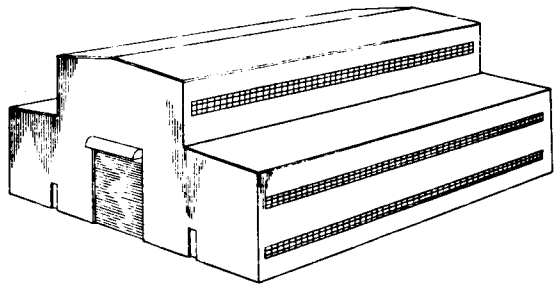
GROUND FLOOR PLAN

15 0 15 30
FEET

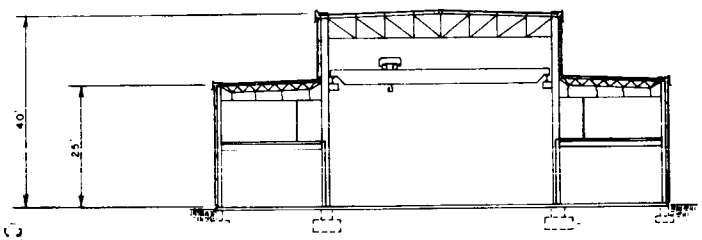


SECOND FLOOR PLAN

15 0 15 30
FEET



PERSPECTIVE



SECTION A-A

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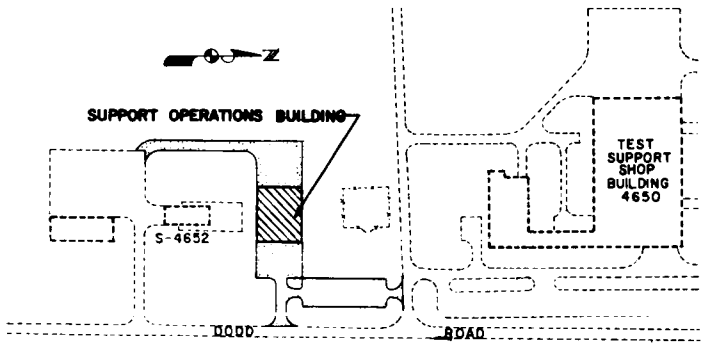
FEET



SITE PLAN

100 0 100 200
FEET

CE 6-54

B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$75,000
	Clearing and grubbing.....	$10,000	
	Access roads and parking area.....	35,000	
	Water, electric, sewage, and steam connections.....	30,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		350,000
	Building (17,500 square feet at $20 per square foot).....	350,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		25,000
	Miscellaneous equipment and furniture.....	25,000	
E.	DESIGN AND ENGINEERING SERVICES.....		50,000
	Total estimated cost.....		$500,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

UTILITY INSTALLATIONS

DESCRIPTION:

This project proposes extensions and modifications of existing utility systems and the construction of new utility systems in support of the expanding Marshall Center plant. The following work is included in the project:

a. Steam supply: A new steam plant with three 1,600-horsepower boilers is required to meet heating and industrial steam requirements. Additional steam lines are required to handle distribution to new areas and to supplement existing capacity of the system.

b. Electrical distribution system: Approximately 20,000 kva additional secondary substation capacity is required to meet the estimated peak electrical demand. New 44 kv and 4,160 kv distribution lines will also be required to serve new facilities.

c. Water: Additional potable and industrial water lines are needed for new areas of construction. A new million-gallon reservoir is required for water storage to balance peak demands on the system and to take care of fire fighting requirements.

d. Sewage lines: Additional sewage lines are necessary to serve new areas and to supplement the capacity of the existing collection system.

e. Roads: Widening of Rideout Road, the entrance highway to the north of the Marshall Center, to a four-lane divided highway is required for increased traffic loads. Widening will be required from the existing four-lane portion of the road to the entrance at State Road 20, a distance of approximately 4.3 miles. In addition, an overpass will be needed at the north of Neal Road to accommodate the heavy traffic entering the north area enroute to new offices to be constructed in that area. Approximately 3.0 miles of new roads along the east side of the Marshall Center will also be required to alleviate a currently congested traffic situation at the Center.

f. Communications distribution system: The work required consists of providing cable duct and multipurpose cable between the major buildings located at the Marshall Center to provide for additional telephones, a data transmission system, a utilities monitoring system, a coded fire alarm system, and an anti-intrusion or secure communications system.

The location plan of the work covered by this project is shown on the following page.

JUSTIFICATION:

The extensive modifications and improvements described above are required to adequately support expanding research and development facilities and the new support facilities currently planned for the Center. The project covers items which cannot specifically be identified with any single facility. Normal utility connections and access roads are included under the applicable projects they serve.

The normal operating capacity of the existing steam plant is 249,000 pounds of steam per hour operating at 150% capacity. This capacity will be exceeded when the facilities approved in the fiscal year 1962 program are completed. On completion of the fiscal year 1963 projects, the steam capacity deficiency will increase to 132,000 pounds per hour. This deficit can be met on a short-time basis only by the combined emergency operation of a standby boiler, operating all boilers at 200 percent of their rated capacity, and by the maximum curtailment of steam consumption to minimum essential loads, a totally inadequate operating procedure. A maximum steam flow rate of 213,000 pounds per hour occured in January 1962, at a time when only two new major projects were in operation. The three 1600 horsepower boilers will provide additional capacity of about 240,000 pounds of steam per hour at 150 percent of rated capacity, eliminating the current capacity deficiency and providing adequate capacity to meet the estimated fiscal year 1964 requirements.

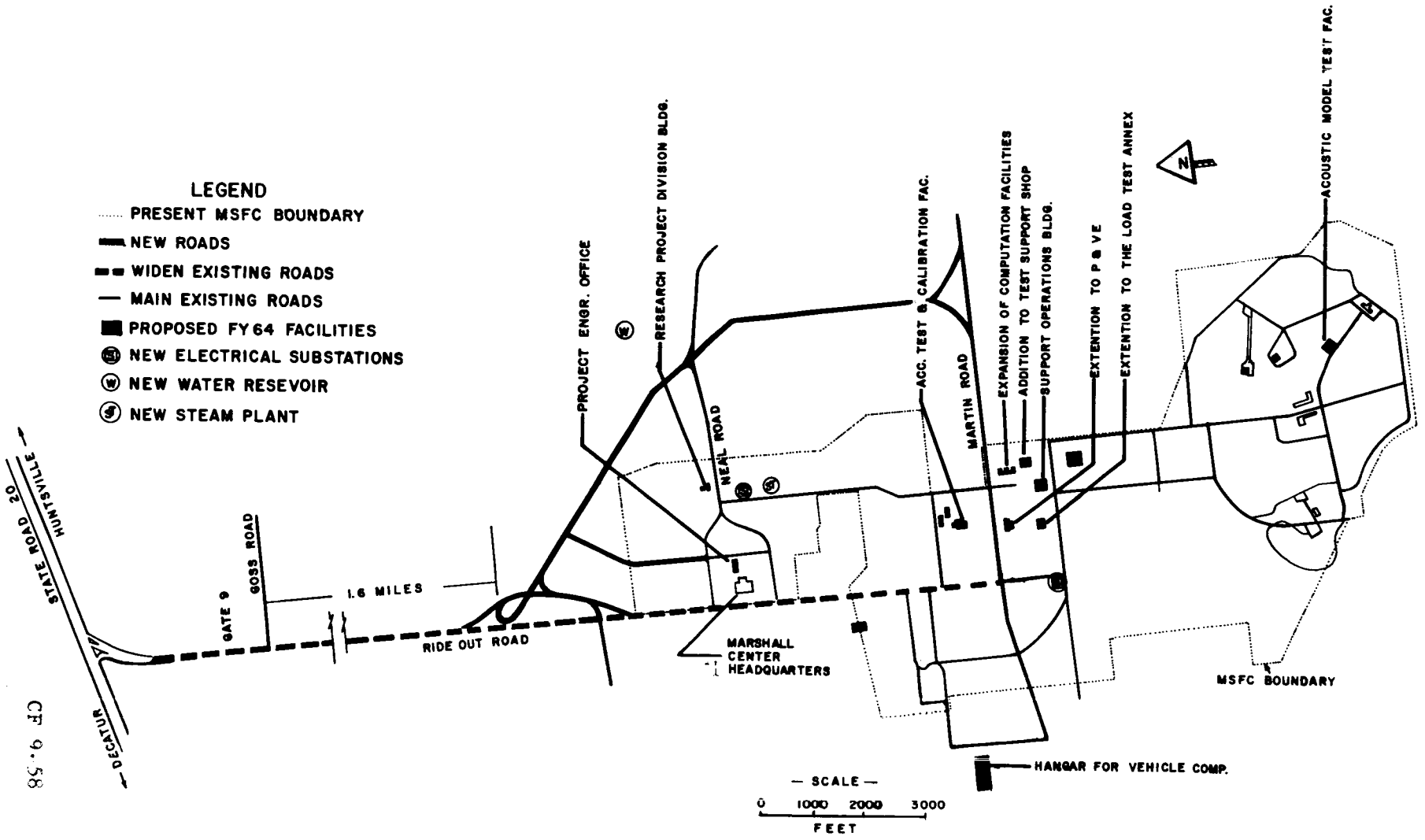
The total capacity of the primary substation is 55,000 kva. This capacity has been increased from 30,000 kva, available at the time the Marshall Center was established, to 55,000 kva to meet the additional peak demand imposed by new facilities approved through the fiscal year 1963 program. The Redstone Arsenal plans another 25,000 kva addition to the primary substation. However, additional transmission lines are required within the Marshall Center to meet the peak demands of projects proposed in the fiscal year 1964 program.

Preliminary studies indicate that the total pumping capacity, both potable and industrial water, is adequate for the estimated demand from the facilities planned through the fiscal year 1964 program. There is, however, a serious shortage in storage capacity for the Center. In July 1962, when

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

UTILITY INSTALLATIONS



CF 9.58

a power failure caused a shut-down of pumps, available system storage was inadequate at one point in meeting fire fighting needs. It was necessary to operate pumps at the full pumping rate of 40,000,000 gallons per day for seven days to return to the optimum storage levels of the system. To rectify this situation, additional storage programmed under this project will be required to provide an adequately balanced system.

At the present time, there are approximately 27,000 vehicles entering Redstone Arsenal every day. About 65 **percent** of these vehicles pass through the Marshall Center. Work shifts have been staggered as much as possible. However, during the morning peak hour the traffic rate reaches 2,400 vehicles per hour on Rideout Road. An increase to approximately 3,600 vehicles per hour has been forecast when the facilities under construction and those planned under the fiscal year 1964 program are completed. Approximately 1,500 vehicles per hour will be turning off north of Neal Road to reach adjacent areas. Congested traffic conditions currently exist at most of the main intersections within the Marshall Center. Construction of new roads along the east side of the Center will alleviate this situation.

Improvements to the communications transmission systems are required to meet the normal and advanced communications requirements of the Center. A discussion of the individual system improvements follows:

(1) A data transmission system is required to relay test data from the blockhouse in the test area to the computations laboratory for faster evaluations of test results and to reduce the required programming time on the computers. The system will also be used for management purposes in transmitting facsimiles, procurement action data, supply action data, and cost accounting data through the data center to other locations.

(2) A utilities monitoring system is required to permit gauge readings from the various utility systems in structures and buildings to be monitored from a central location. This procedure will permit a more efficient utilization of operating and maintenance personnel.

(3) An anti-intrusion system will be used by the security forces to improve the security of the station and to reduce security manpower requirements to a minimum. The system will also provide a means of transmitting inter-station classified information over a closed communication network.

(4) A coded fire alarm system will be installed to tie existing fire alarm systems located in buildings and at test facilities to the Center fire station to insure the automatic location of any fire at the Marshall Center, a capability which currently does not exist.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$2,950,000
	Widening existing road (4.3 miles at $100,000 per mile)	$430,000	
	New road (3.3 miles at $100,000 per mile)	330,000	
	Overpass, two lane	240,000	
	Two 10,000 kva secondary substations	500,000	
	Water reservoir	100,000	
	Additional electrical, steam, water, and sewage lines	450,000	
	Communications systems improvements	900,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		1,400,000
	Steam plant (4,800 boiler horsepower)	1,400,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		---
E.	DESIGN AND ENGINEERING SERVICES		650,000
	Total estimated cost		$5,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

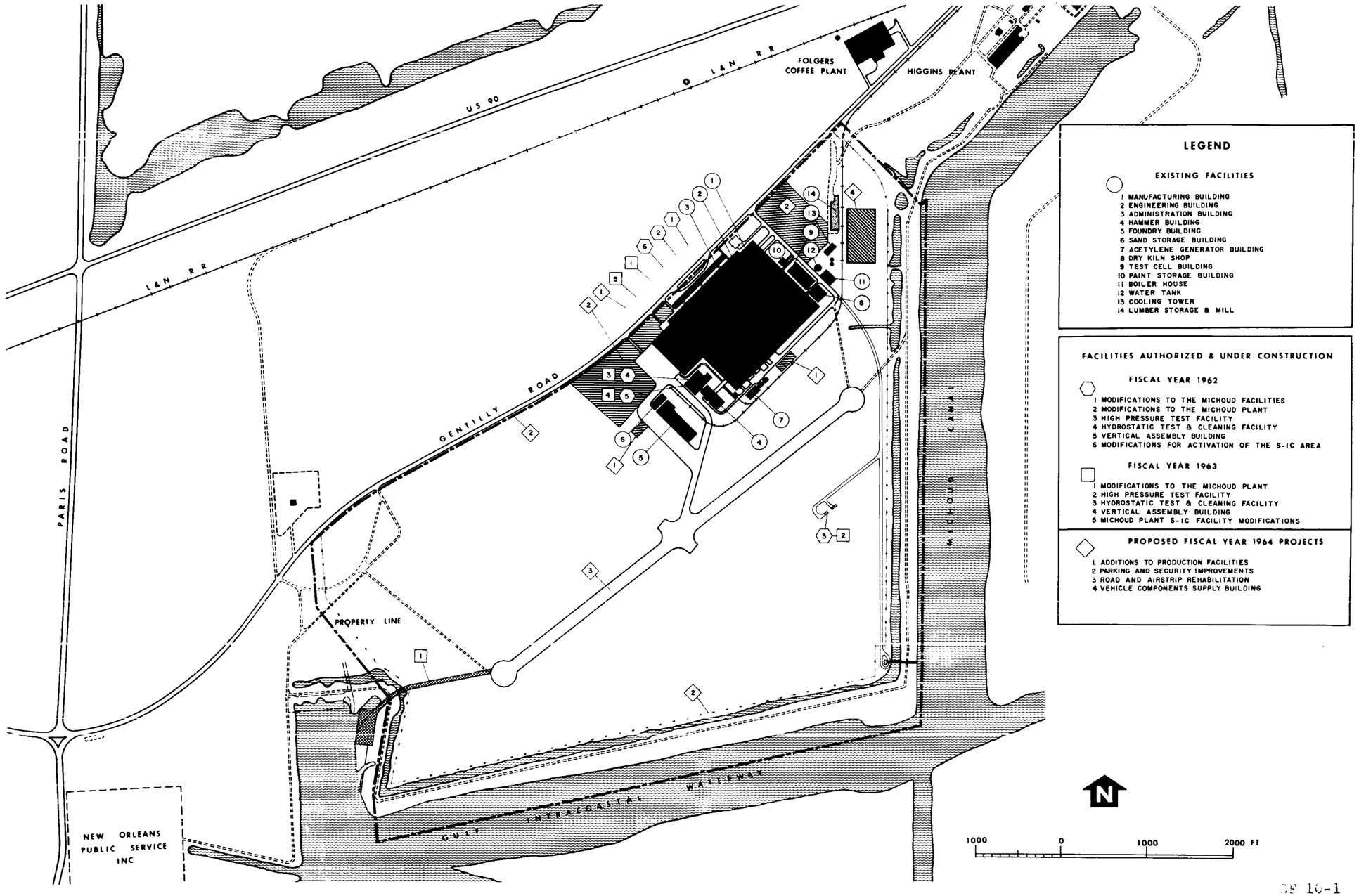
MICHOUD PLANT

		Page No.
Location plan		CF 10-1
Additions to production facilities.....	$6,000,000	CF 10-2
Parking and security improvements.....	610,000	CF 10-15
Road and airstrip rehabilitation.....	760,000	CF 10-18
Vehicle component supply building.....	2,633,000	CF 10-21
Total.....	$10,003,000	

MICHOUD OPERATIONS

FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN



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MICHOUD PLANT

FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO PRODUCTION FACILITIES

DESCRIPTION:

Several additions are required to the production facilities at the Michoud Plant. Included are additions and extensions to the utility systems such as lighting, power distribution, steam, air-conditioning, industrial waste disposal, gas, and water systems (process and potable). Additions required to the facility include machinery foundations, partitions, doors, new structures, and additions to the manufacturing complex required for the production and assembly of the Saturn and Advanced Saturn vehicles.

Included in this project is a new support services building, a new central maintenance shop, a cafeteria on the plant mezzanine, an increase in the master substation and boiler plant capacities, a hazardous test facility, a hydraulic test facility, a structural test facility, a stress coat facility, stage test positions, and various additions to other plant facilities.

Sketches of the various items that make up this project are shown on the following five pages. More detailed descriptions follow below:

Support services building: The support services building of 36,000 square feet will house the reproduction, photography, and communications functions. It will be sited northeast of the manufacturing building, and will consist of a two-story reinforced concrete and brick structure supported by treated timber pilings. A bonded flat roof, heating, air-conditioning, ventilation, lighting, and fire protection will be provided.

Mezzanine cafeteria: The proposed mezzanine cafeteria facility will include 26,000 square feet of floor area and will accommodate approximately 3,200 stage contractor manufacturing personnel. The facility will serve food prepared in the existing central cafeteria. The mezzanine cafeteria will include mechanical, electrical, and air-conditioning systems.

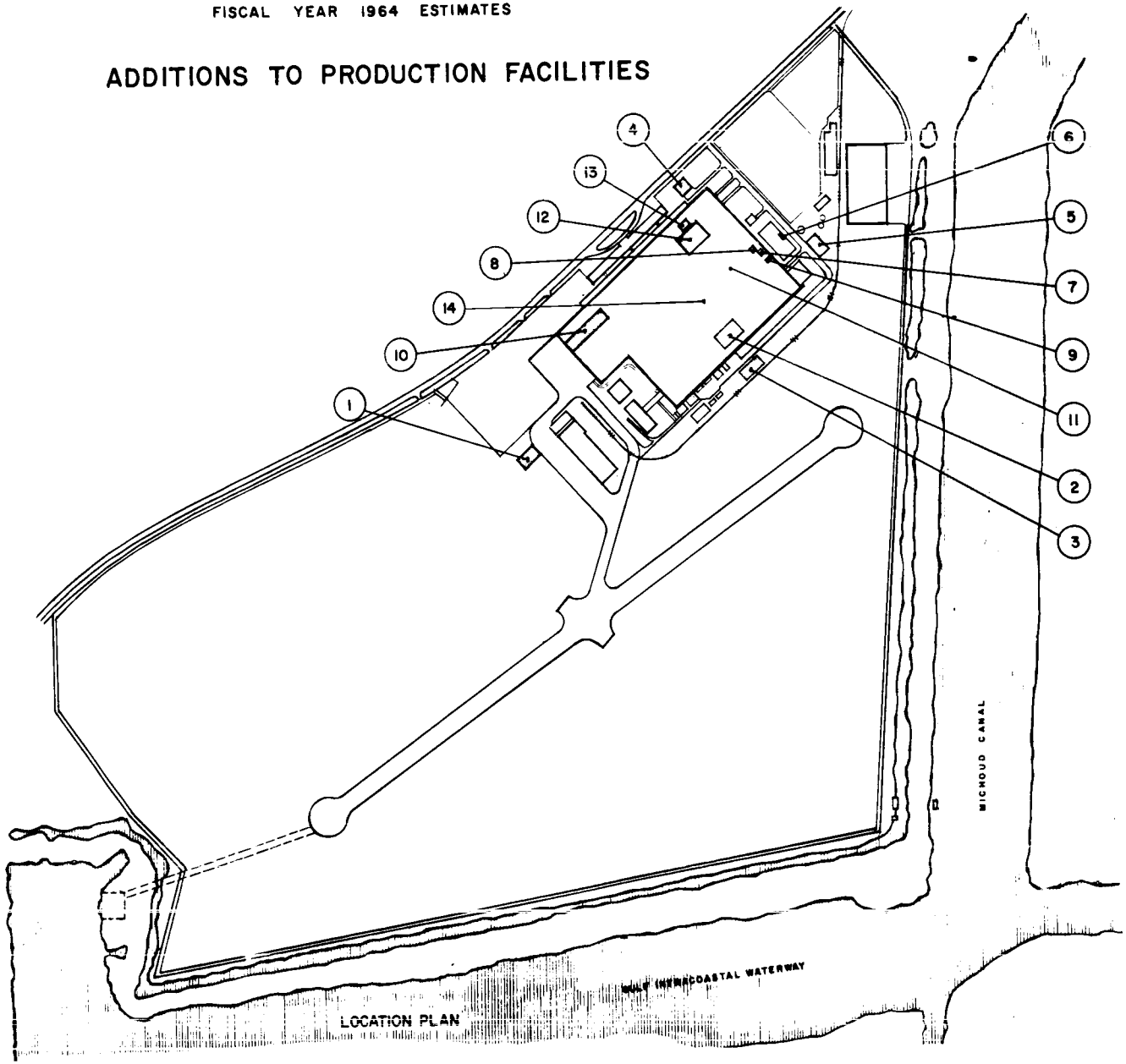
Central maintenance shops: The shop building will consist of 24,000 square feet of floor area and will be a prefabricated steel structure with insulated metal panel roof and siding, and concrete floor on grade beams and piling. Office and storage space, heating, lighting, ventilating and sanitary facilities will be provided.

Increased master substation capacity: The project includes a new 115/13.8 kv, 15,000 kva, transformer to be installed in the

MICHOUD PLANT

FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO PRODUCTION FACILITIES



LEGEND

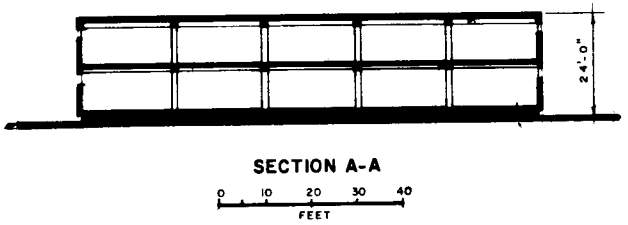
1. SUPPORT SERVICES BUILDING
2. MANUFACTURING AREA MEZZANINE CAFETERIA
3. CENTRAL MAINTENANCE SHOPS
4. INCREASED MASTER SUBSTATION CAPACITY
5. INCREASED BOILER PLANT CAPACITY
6. HAZARDOUS TEST FACILITY (S-I)
7. HYDRAULIC TEST FACILITY (S-I)
8. STRUCTURAL TEST FACILITY (S-I)
9. STRESS COAT FACILITY (S-I)
10. STAGE TEST POSITIONS (S-IC)
11. TRUSS MODIFICATIONS AND CRANE INSTALLATION PHASE II
12. BLAST CURTAINS PHASE II
13. FUNCTIONAL CHECKOUT CONTROL ROOM PHASE II
14. MANUFACTURING AREA OFFICES

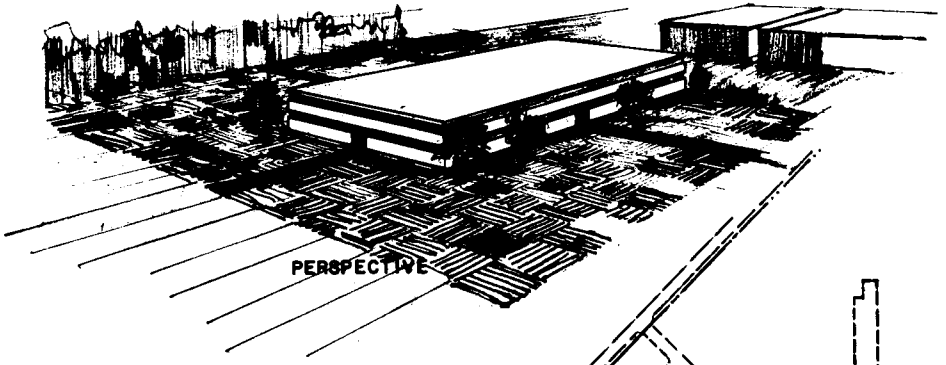
0 600 1200 FEET

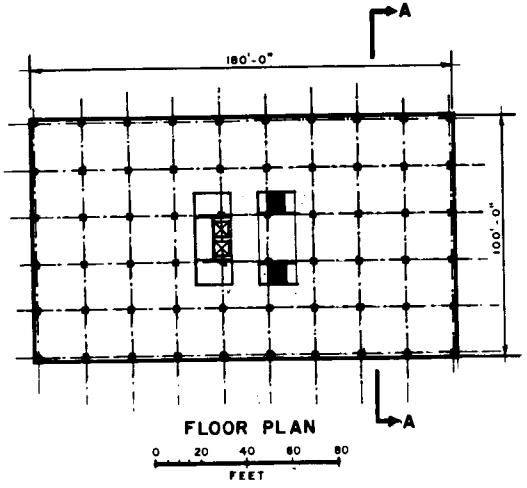
N

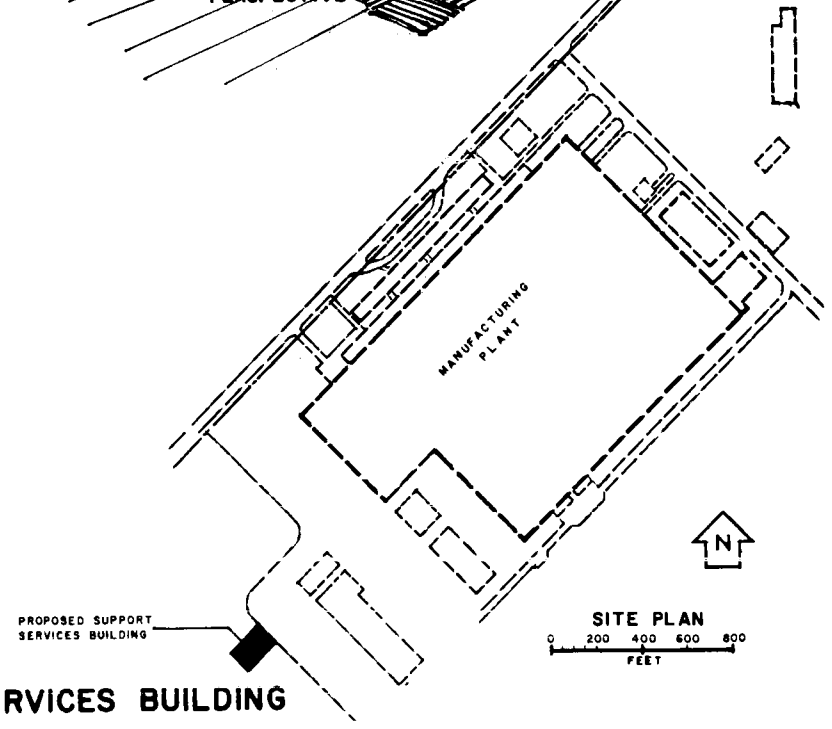
MICHOUD PLANT
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO PRODUCTION FACILITIES







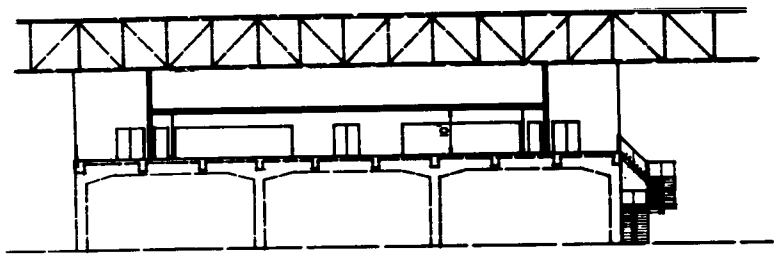


(1.) SUPPORT SERVICES BUILDING

MICHOUD PLANT

FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO PRODUCTION FACILITIES



SECTION A-A

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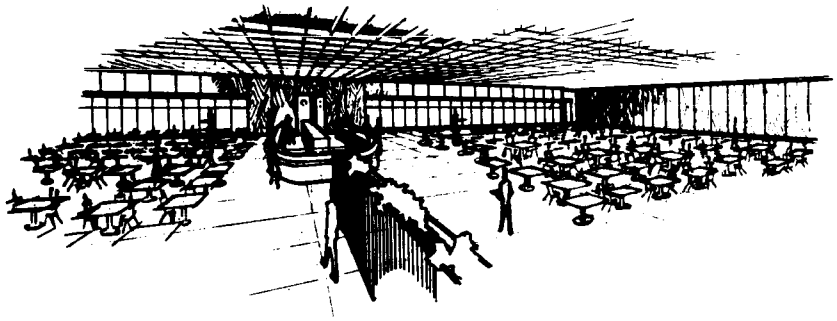
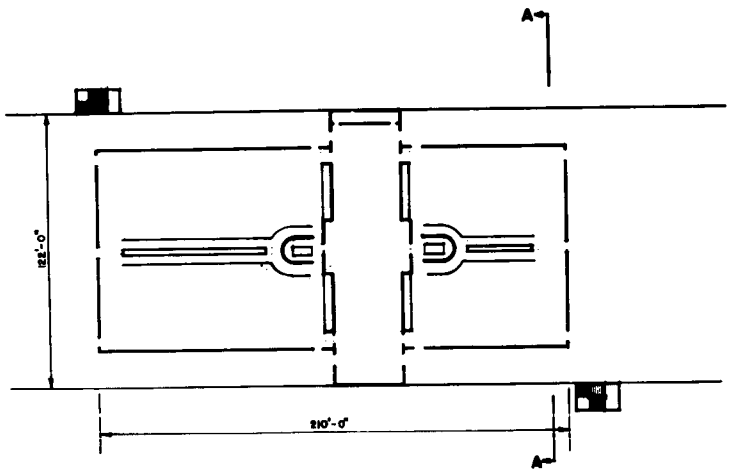
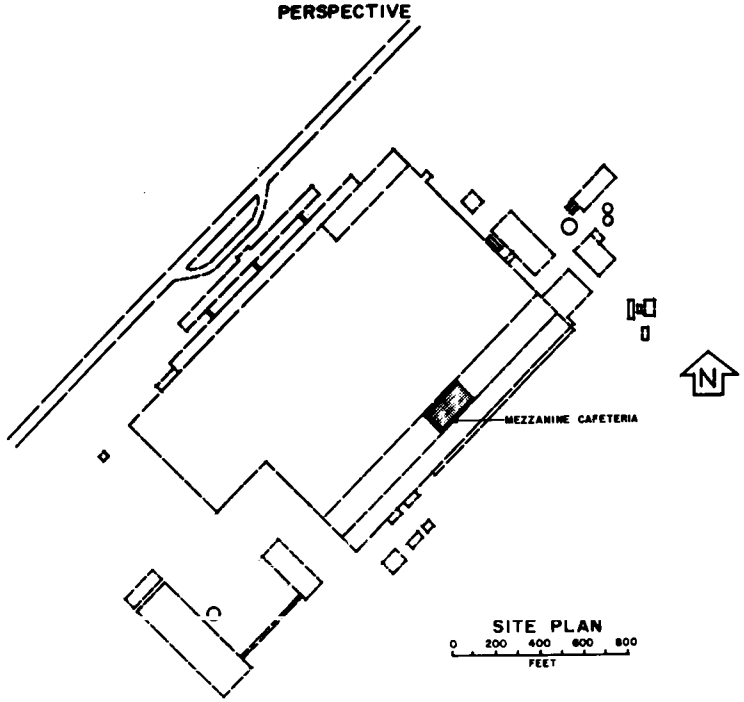


PERSPECTIVE



FLOOR PLAN

0 20 40 60 80 FEET



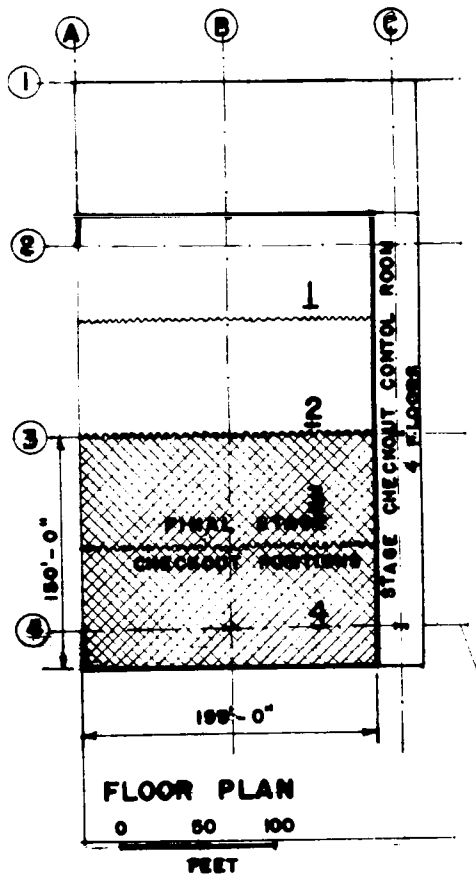
SITE PLAN

0 200 400 600 800 FEET

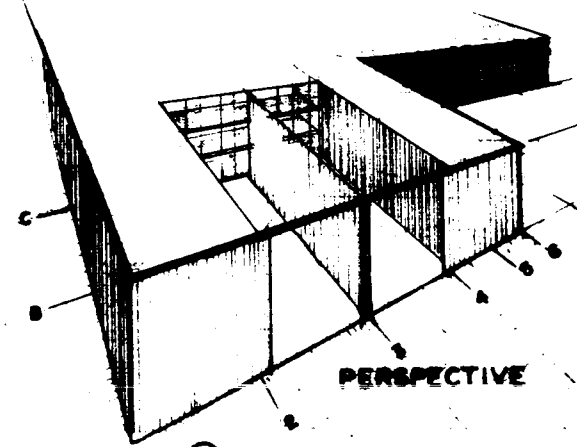
② MANUFACTURING AREA MEZZANINE CAFETERIA

MICHOUD PLANT
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO PRODUCTION FACILITIES

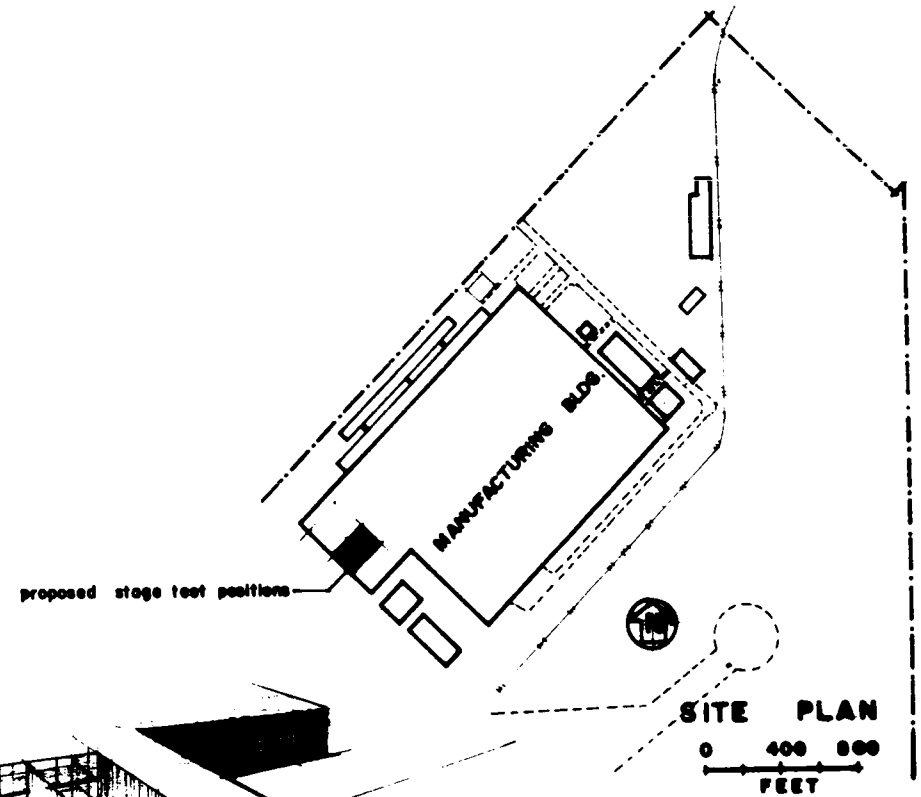


FLOOR PLAN



PERSPECTIVE

(10) STAGE TEST POSITIONS

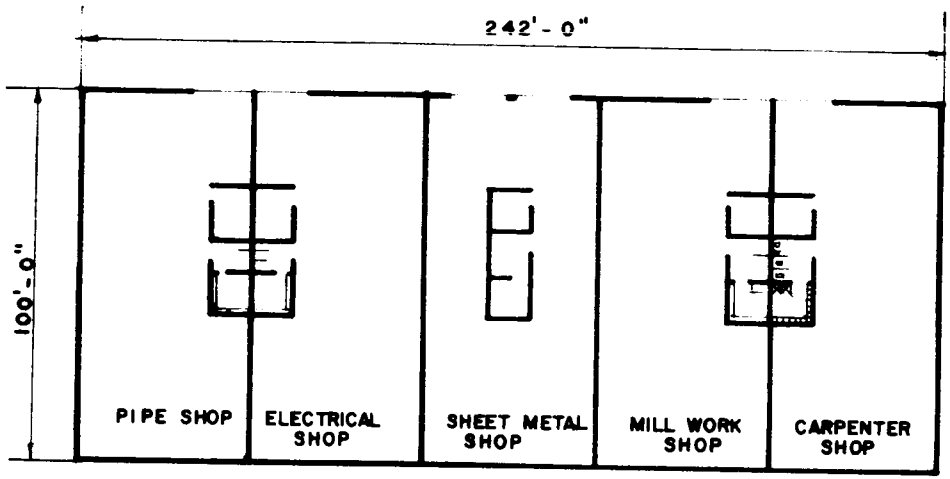


SITE PLAN

MICHOUD PLANT

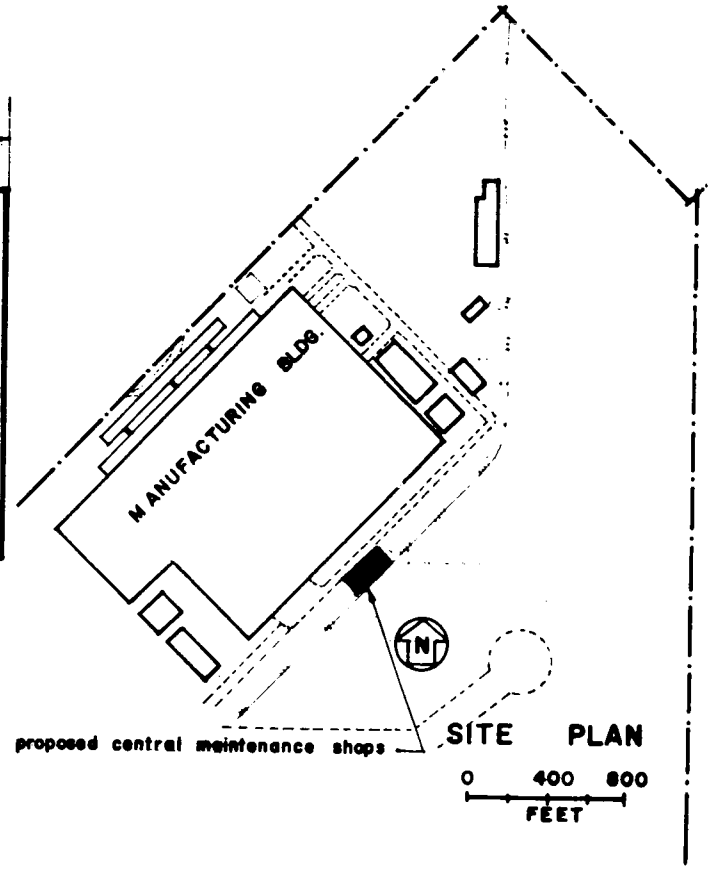
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO PRODUCTION FACILITIES



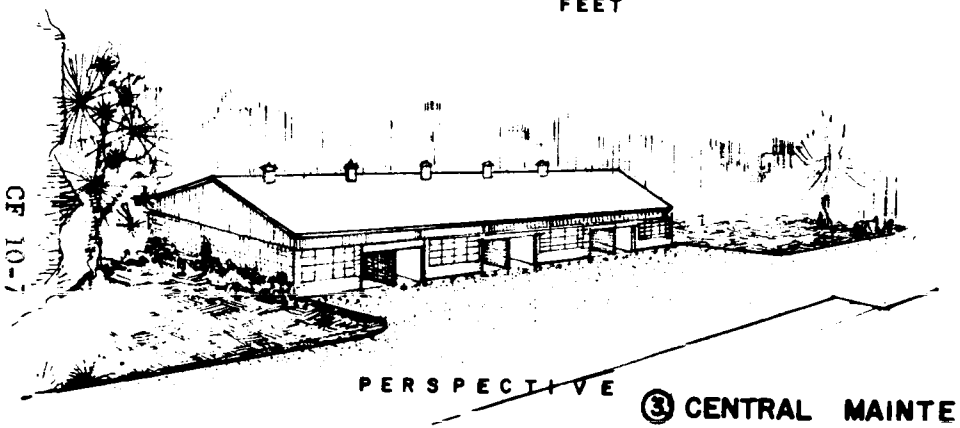
FLOOR PLAN

0 10 20
FEET

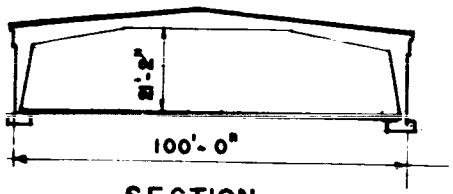


SITE PLAN

0 400 800
FEET



PERSPECTIVE



SECTION

③ CENTRAL MAINTENANCE SHOPS

existing master substation. The transformer will be connected to the existing 115 kv, 3-phase bus. Related 15 kv indoor switchgear will be provided in a 1,000-square-foot extension to the existing switch house.

Increased boiler plant capacity: Increased steam and chilled water capacity is required for the present boiler plant. A new steam boiler and centrifugal turbine-driven refrigeration units, plus necessary ancillary equipment, will be provided. The units will be located in the existing boiler house building and will be connected to the existing system.

Hazardous test facility (Saturn S-I Stage): This facility will occupy approximately 1,800 square feet of floor space in the old engine test cell building. Present cells are approximately 16-feet by 14-feet of reinforced concrete. Portions of two of the walls and the ceiling in each cell must be removed to increase the area to 450 square feet to accommodate various types of tests. Consoles and equipment must be in close proximity to the test area. The utilities in the immediate area will be extended to provide lighting, an exhaust system, ventilation, a fire protection system, water, drainage and air-conditioning. Vibration isolation foundations will be added to existing cells, and acoustical treatment of the walls and ceiling will be provided. Equipment will include test cell control consoles, vibration equipment, associated fixtures, a hydraulic test power unit with console, and an impact tester to make a fully-operable facility.

Hydraulic test facility (Saturn S-I Stage): The facility will occupy approximately 600 square feet of floor space in the manufacturing building and will consist of an insulated, acoustically-treated, environmentally-controlled area. Hydraulic tests performed on pumps, valves, and loaders, inherently create high-heat and high-noise levels and thus require insulation. In addition, fire hazards and possible damage due to spillage of fluids require special materials and construction methods. The facility will include a fire protection system, explosion-proof lighting and power, exhaust, ventilation, and air filtration systems. The air-conditioning requires 12 tons of equipment. To be fully operable, this facility will include a hydraulic test power supply console and related special and standard equipment.

Structural test facility (Saturn S-I Stage): Approximately 2,400 square feet of floor space will be occupied in the manufacturing building by this facility. Due to local inherent foundation problems, it is necessary that the framework, foundations, and seismic blocks be supported on isolated pilings to minimize transmission of forces to adjacent areas and to produce acceptable test results. The existing floor must be broken out to accommodate new pilings and foundations. A

vibration test system will be installed on a special designed foundation for the testing of structural assemblies and panels. Included will be 440-volt 3-phase power, a 3,500-pounds-per-square-inch air line, hydraulic lines, gaseous nitrogen lines, a vacuum system, and necessary hardware for a fully-operable test facility.

Stress coat facility (Saturn S-I Stage): The stress coat facility requires temperature and humidity-controlled, dust-free air. Divided into two rooms, one room will be provided with 100 percent make-up of conditioned air. The other room will require 20 changes per hour. The 100 percent air-conditioned air is necessary due to toxic effects of the vapors used. The approximately 400-square-foot structure will consist of movable type metal partitions and ceilings with explosion-proof lighting; utility services brought to the area include water, drains, power and fire protection systems. Procurement and installation of spraying and drying equipment and related facilities are also included in the project.

Stage test positions (Advanced Saturn S-IC Stage): Two stage test positions will be constructed end-to-end. Each position will be 80-feet wide, 190-feet long and 40-feet high. Construction will be of reinforced concrete. Instrumentation, heating, air-conditioning, and electrical systems are included in the project. The facility will have a gaseous nitrogen system for charging pressurization systems, and a filtered and dryed compressed air system.

Assembly station cranes: The procurement and installation of three cranes and the attachment of new steel members onto the existing roof trusses will be required. Approximately fourteen trusses over two assembly stations require this additional strengthening. Sway bracing and bottom chord struts are to be added to transmit horizontal loadings imposed by cranes.

Blast curtains: The installation of fourteen gauge duplex conveyor belting material mounted on a structural steel frame work supported from the floor and attached to existing roof trusses for lateral support will be used to enclose three sides of the functional checkout area. Separating the stations and enclosing fronts will be roll-up curtains consisting of the same type belting material. The curtains will be electrically operated and extend from the bottom chord of the truss to the floor. Catwalks will be provided for servicing these curtains.

Functional checkout control room additions: It is proposed to extend the existing north mezzanine floor over to the checkout stations and to install a raised floor over the entire area for cable raceways and air-conditioning ducting. There will be two control rooms of 1,500 square feet each and two power rooms of 1,000 square feet each which will be enclosed with removable-

type partitions and ceilings. Air-conditioning, heating, lighting, and high-pressure pneumatic piping will be provided. Catwalks will be installed from the control rooms over the checkout stations for supporting electrical and mechanical facilities and personnel walkways. Windows overlooking the checkout stations will be of safety glass for explosion protection.

Manufacturing area offices: Several office areas will be constructed within the manufacturing building. These include the east wall offices, the safety office, an engine preparation office, and a quality control office. Space will also be provided for material control offices, engineering laboratory offices, NASA inspection offices, and a sheet metal area. The east wall offices will be within the existing structure and will include improvements and rehabilitation to roofs, walls, lighting, and ventilation. The safety office, engine preparation office, and quality control office, include the installation of movable type partitions, ceilings, lighting, electrical facilities, and ventilation. These offices will vary in size from approximately 200 to 1,000 square feet and total approximately 12,500 square feet. All office areas are within the main building structure and require no special foundations or roof. The safety office will be equipped to show safety films.

JUSTIFICATION:

The Michoud Plant is being utilized in the production and assembly of the Saturn and Saturn B S-I stage and the Advanced Saturn S-IC stage. As the plant goes into full production these additions are necessary to utilize the plant's full capabilities to meet production schedules. Also, changes in design of S-I and S-IC stages to incorporate the latest advancements in the state-of-the-art have dictated changes in production and assembly methods necessitating building additions and extensions. Justifications of the specific items to be accomplished under this project follow:

Support services building: The workload and equipment of the communications, photographic, and reproduction departments require a support services building. The present space is inadequate to handle existing equipment and workloads. The support services building will improve existing and future conditions by providing adequate space and more efficient operating services. In view of existing and planned workloads for these services, this building is urgently required. Space presently being utilized in the engineering building must be vacated for engineering personnel. The communications department requires space for existing equipment and future requirements such as private-line telegraphic circuits, a paging system, an enlarged data transceiver, an office area, rest rooms, and a central directory.

The photographic department requires space for an office, film rooms, studios, a fire-proof vault with temperature and humidity control, a walk-in freezer, storage areas, a camera repair room, an editing room, an equipment room, and process film rooms. The reproduction department requires space for existing and future equipment consisting of offset presses, offset print and photo-direct cameras, and collating, cutting, and binding equipment. Space is also required for supply storage and for business offices.

Mezzanine cafeteria: At peak production capacities dining facilities will be required for approximately 3,200 stage contractor manufacturing area personnel. The existing cafeteria is inadequate in size to handle this requirement. Expansion of the existing cafeteria to service manufacturing area personnel is impractical because of its location. A mezzanine facility, being centrally located to service manufacturing personnel, will prevent extensive movement to and from dining areas thereby decreasing lost production time and improving efficiency.

Central maintenance shops: As production approaches peak capacity, the support contractor will need additional shop facilities to provide services to the S-I and S-IC stage contractors. Present service facilities temporarily located in the manufacturing area are inadequate. These areas must be vacated for full production of the S-I and S-IC stages and there are no existing buildings available for this function.

Increased master substation capacity: The increased load on the Michoud Plant with additional shops, storage buildings, battery charging station, test facilities, and laboratories and the addition of better manufacturing equipment, higher lighting levels, air-conditioning, computers and office machines, has increased the demand for electric power. To meet this demand, it is necessary to add additional capacity and feeder capability to the master substation to enable the facility to efficiently carry out its mission.

Increased boiler plant capacity: Required facilities expansion, overload conditions, and increased demands by stage contractors necessitate increasing boiler plant capacities. A recent engineering study of existing facilities indicates deficiencies in steam, water softener, feed water pump, condensate pump, deaerator-chilled water, and refrigerator systems caused by either prolonged idleness or age or by inadequate capacities in the existing systems.

Hazardous test facility: This test laboratory is required to provide increased capacity for product improvement and engi-

neering testing which are essential in supporting the S-I program. The work to be performed will include repetitive environmental tests in pneumatics, cryogenics, vibration and combinations of pneumatics vibration, vacuum, thermal shock, and impact tests. Test cells are required to carry on the hazardous work the laboratory performs for the engineering branches.

Hydraulic test facility: The hydraulic test facility will increase flexibility and capacity for product improvement work, including pressure and flow characteristics tests on hydraulic pumps, valves, filters, motors, lines, and assemblies for the S-I booster.

Structural test facility: This laboratory will increase capacity and flexibility for product improvment. Vibration, static load, and thermal test capabilities and combinations thereof will be provided. Also, a weight reduction program will be performed to increase payload capabilities, which will require extensive structural tests to qualify and prove reliability of new structures. The present structural test area will not be able to handle increased heating, vibration and loading requirements for new structures.

Stress coat facility: This project will provide a stress coat area capability for support of the product improvement programs. Stress coating of components is required to evaluate and analyze dynamic and static tests. At present, no capability exists for stress coating test components.

Stage test positions: To fulfill contractual and schedule requirements, it is necessary to activate (construct and check out) two stage test positions. The control room and test positions will house the equipment necessary to support the checkout phase including telemetry ground stations; radio frequency system test equipment; batteries for emergency power and simulated missile power; instrumentation recording equipment; and data analysis equipment.

Assembly station cranes: Strengthening of the existing roof trusses is required to provide the capability for supporting crane loads over two additional assembly stations. Cranes will provide clustering capability in these two stations which is required to meet present delivery schedules of the S-I stages.

Blast curtains: These curtains will provide protection to personnel and equipment in adjoining areas of the manufacturing plant from flying fragments in the event of a failure of components during a pneumatic test on the assembled booster stage.

Functional checkout control room additions: Control room additions are required to house personnel and equipment engaged in the checkout of the assembled booster stage for verification of circuit continuity and component performances of electrical and pneumatic systems. This is a quality control operation to determine operation parameters of these systems which is necessary to maintain and improve the reliability of the S-I stages.

Manufacturing area offices: Additional offices are required to house administrative and supervisory personnel within the manufacturing area. Enclosures are necessary to provide security for classified materials and acoustic protection for these personnel. The personnel who are responsible for production of the S-I stages must be located in close proximity to personnel under their supervision.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$50,000
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		3,480,000
	Support services building (36,000 square feet at $20.59 per square foot)	$740,000	
	Mezzanine cafeteria (26,000 square feet at $11.54 per square foot)	300,000	
	Central maintenance shop (24,000 square feet at $16.67 per square foot)	400,000	
	Modifications to master substation	100,000	
	Modifications to boiler plant	150,000	
	Hazardous test facility	90,000	
	Hydraulic test facility	35,000	
	Structural test facility (2,400 square feet at $12.50 per square foot)	30,000	
	Stress coat facility	20,000	
	Two stage test positions	730,000	
	Assembly station cranes	130,000	
	Blast curtains	390,000	
	Functional checkout control room additions (12,500 square feet at $14.80 per square foot)	180,000	
	Manufacturing area offices	185,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		1,990,000
	Communications, photographic and reproduction equipment	320,000	

Mezzanine cafeteria equipment.....	$140,000	
Central maintenance shop.....	150,000	
Transformer and switchgear equipment.....	200,000	
Boiler, refrigeration unit and ancillary equipment.....	300,000	
Hazardous test equipment.....	165,000	
Hydraulic test equipment.....	35,000	
Structural test equipment.....	50,000	
Spraying, drying and air-handling equipment.....	5,000	
Stage test position equipment.....	200,000	
Assembly station cranes.....	80,000	
Blast curtains.....	50,000	
Functional checkout equipment.....	140,000	
Manufacturing area offices equipment.....	155,000	
E. DESIGN AND ENGINEERING SERVICES.....		$480,000
Total estimated cost.....		$6,000,000

MICHOUD PLANT

FISCAL YEAR 1964 ESTIMATES

PARKING AND SECURITY IMPROVEMENTS

DESCRIPTION:

This project proposes the construction of new permanent parking facilities and the conversion of existing temporary parking facilities to permanent facilities. New permanent parking facilities to be constructed will consist of 239,000 square feet accommodating 683 vehicles. The parking areas to be converted will consist of 825,000 square feet accommodating 2,360 vehicles.

The construction of the permanent facilities will consist of final grading of existing areas, installation of adequate drainage, and paving of compacted shell base course with an asphalt binder course and an asphalt wearing course. Also included will be concrete bumper aisles and the installation of parking lot flood lighting to cover these areas.

This project includes the installation of 14,000 linear feet of permanent chain link type security fence with security lighting. A 12-foot-wide shell-topped roadway will be constructed along the entire length of security fence.

The scope of the improvements proposed in this project is shown in the drawing on the following page.

JUSTIFICATION:

Based on projected peak capacities by the S-1 and S-1C stage contractors, support, and Government personnel, parking facilities will be required for 3,000 vehicles. It is proposed that parking area be provided based on 350 square feet per vehicle.

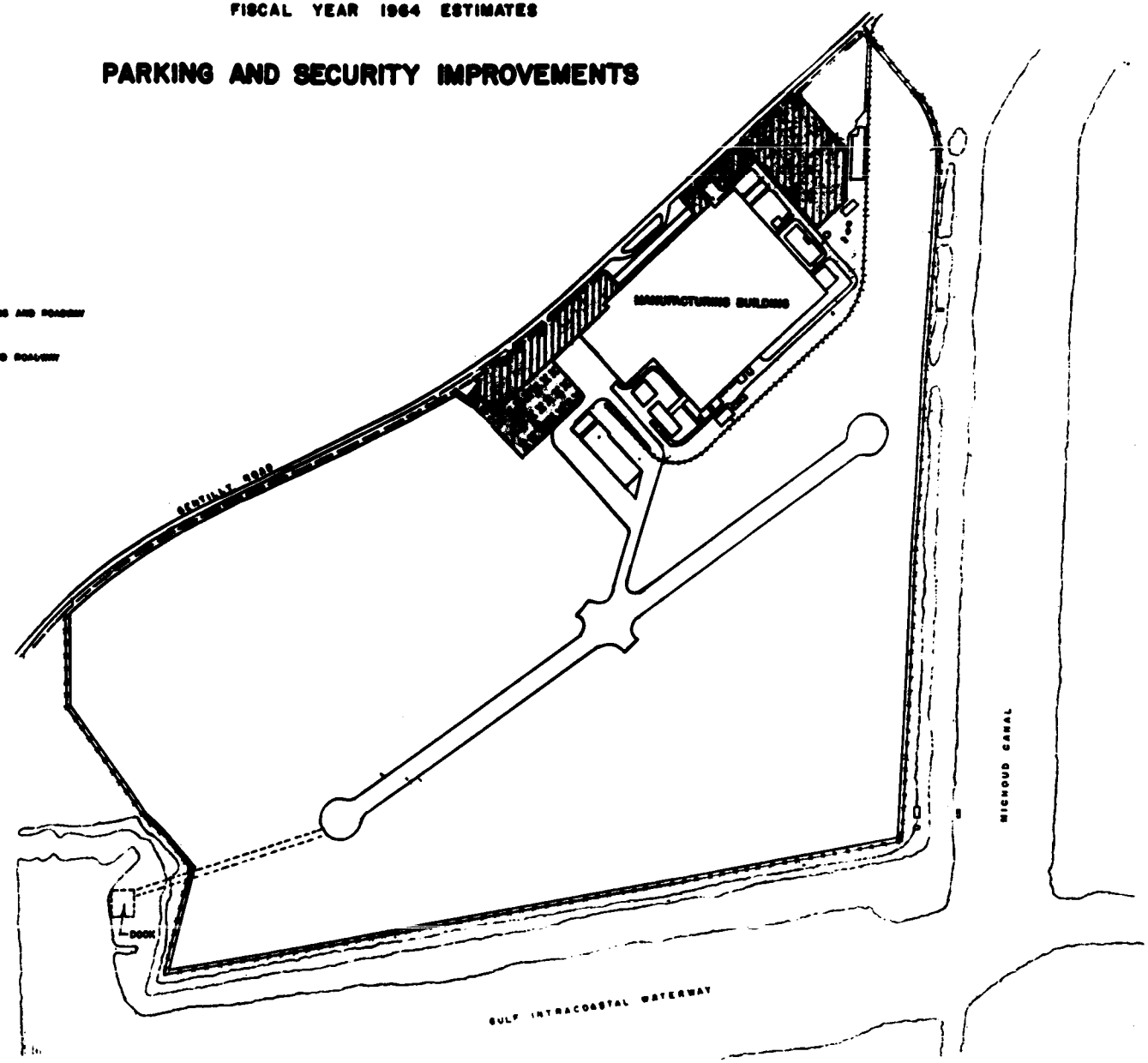
The existing parking lots have a temporary shell surface requiring frequent maintenance to adequately provide for minimum parking convenience. These areas presently require new surface materials and rolling a minimum of twice annually. The permanent type asphalt topping as described herein will reduce maintenance costs by eliminating additional shell fill, allow for proper drainage by reducing water accumulation, and reduce employee walking hazards. Proper flood lighting in these areas will prevent serious night hazards, expedite identification, permit location of vehicles and help eliminate pilferage.

COST ESTIMATE:

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

MICHOUD PLANT
FISCAL YEAR 1964 ESTIMATES

PARKING AND SECURITY IMPROVEMENTS



LEGEND

- NEW PERMANENT PARKING FACILITIES
- CONVERT TEMPORARY PARKING TO PERMANENT
- EXISTING FENCING WITH NEW PERIMETER LIGHTING AND ROADWAY
- NEW FENCING AND NEW PERIMETER LIGHTING AND ROADWAY

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B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$555,000
	Clearing	$4,000	
	Grading	12,000	
	Drainage	32,000	
	Asphalt paving..(118,000 square yards at $2.96 per square yard)	349,000	
	Security road..(18,500 linear feet at $3.00 per linear foot)	56,000	
	Security fence..(14,000 linear feet at $2.30 per linear foot)	32,000	
	Security lighting	70,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		---
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		---
E.	DESIGN AND ENGINEERING SERVICES		55,000
	Total estimated cost		$610,000

MICHOUD PLANT

FISCAL YEAR 1964 ESTIMATES

ROAD AND AIRSTRIP REHABILITATION

DESCRIPTION:

This project includes rehabilitation of the runways, taxiways, aprons, and main plant roads, and the construction of a heliport. Approximately 825,000 square feet of the existing runway and taxiway and approximately 764,500 square feet of main plant roads will be rehabilitated. The runway will be repaired by raising the sunken areas of slab by mud jacking. An asphaltic concrete surface will be applied to all surfaces. The heliport, located in the center of the runway, will include necessary lighting for helicopter operation.

The scope of the work is indicated by the drawing on the following page.

JUSTIFICATION:

Rehabilitation of the present 5,500 foot length of the Michoud Plant airstrip will serve the plant in two important ways: (1) It will form part of the route the S-I and S-IC stages must follow from the manufacturing plant to the proposed dock area; (2) It will provide a heliport and small aircraft facility for use in transporting personnel, critical materials, and small parts from the Mississippi Test Facility, the Slidell Computer Facility, downtown New Orleans, or Moisant International Airport to the plant.

The Moisant International Airport and the New Orleans Airport are remotely located from the Michoud Plant area. Moisant Airport is located thirty miles west of the Michoud operations. Travel time one-way to this airport is one hour and fifteen minutes. The New Orleans Airport is located ten miles from the Michoud operations with travel time of forty minutes each way. Due to the distances and the items required for round trips, these airports cannot, without augmentation, effectively serve the needs of the Michoud Plant.

The roads shown in the drawing must be rehabilitated and strengthened, and the turning radius modified to permit transport of the S-I stage from the northeast end of the manufacturing building to the dock and of the S-IC stage from the southwest end of the manufacturing building to the dock.

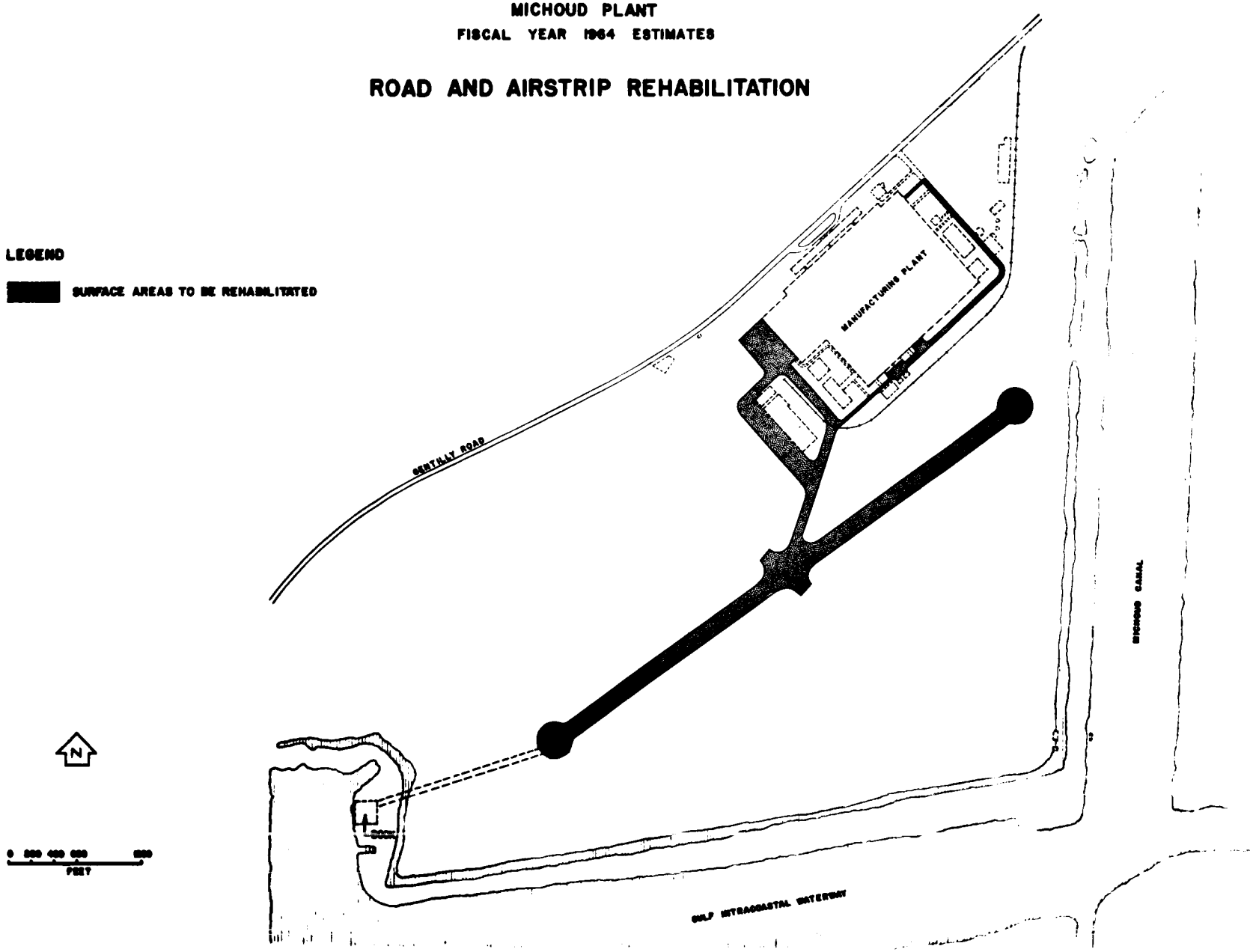
COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$690,000
Utility connections.....	$30,000	

MICHOUD PLANT

FISCAL YEAR 1964 ESTIMATES

ROAD AND AIRSTRIP REHABILITATION



CF 10-19

Asphaltic concrete topping and rehabilitation (177,000 square yards at $3.73 per square yard).....	$660,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		---
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		---
E. DESIGN AND ENGINEERING SERVICES.....		$70,000
Total estimated cost.....		$760,000

MICHOUD PLANT

FISCAL YEAR 1964 ESTIMATES

VEHICLE COMPONENT SUPPLY BUILDING

DESCRIPTION:

This project provides for the construction of a building containing approximately 200,000 square feet, with an inside clear height of twenty feet. Construction will be prefabricated steel frame on a concrete slab floor with grade beams on treated timber pilings. The walls and roof will be metal paneling. Included are heating, ventilating, lighting, and sprinkler and fire detection systems. Humidity control will be provided in special areas.

An existing railroad spur will be extended 1,100 feet along the west side of the building. A loading and unloading dock will be located next to the railroad spur with a canopy overhang to prevent work stoppage in inclement weather. A similar loading dock shall be located on the east side of the building for trucking operations. Service roads and hardstands will be provided.

A sketch of the building is shown on the following page.

JUSTIFICATION:

Plant layouts consistent with planned production schedules indicate that the entire existing plant building will be required for manufacturing operations, leaving no area for storage of components, equipment, or materials required by the stage and support contractors. Adequate storage space must be provided to these contractors if they are to meet the production rates specified in contractual agreements. The requested facility will support program requirements at the Michoud Plant as follows:

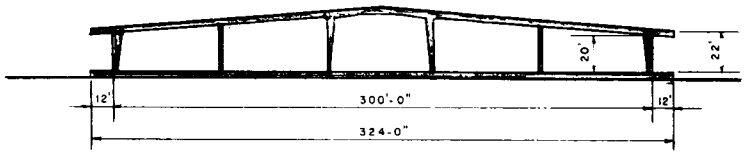
(a) The S-1 stage contractor requires 25,000 square feet for the storage of materials, components, and equipment including such items as stub fins, engine skirts, turbine exhaust fairings, and similar components that are prefitted and held for future installation. Storage space is also required for jigs, fixtures, dies, production materials awaiting Government disposition, and major subassemblies utilized by the engineering test laboratories prior to and after test programs.

(b) The S-IC stage contractor requires 100,000 square feet for the storage of materials and equipment, plus a holding area for large component parts used in the S-IC stage. Due to their large size, these components cannot be moved into the manufacturing area until needed. A holding area, with ready access for movement of components, is required for temporary storage of these items.

MICHOUD PLANT

FISCAL YEAR 1964 ESTIMATES

VEHICLE COMPONENT SUPPLY BUILDING



SECTION A-A

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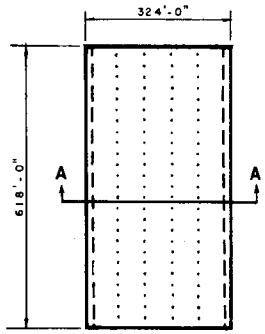

FLOOR PLAN

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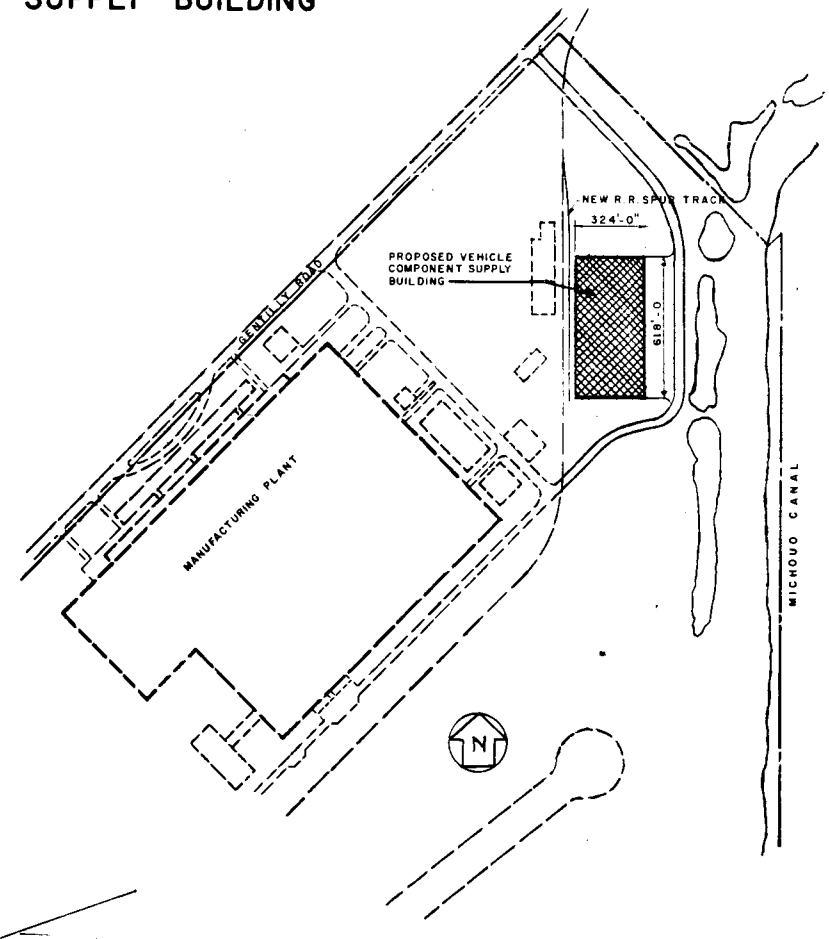

SITE PLAN

0 200 400 600 800
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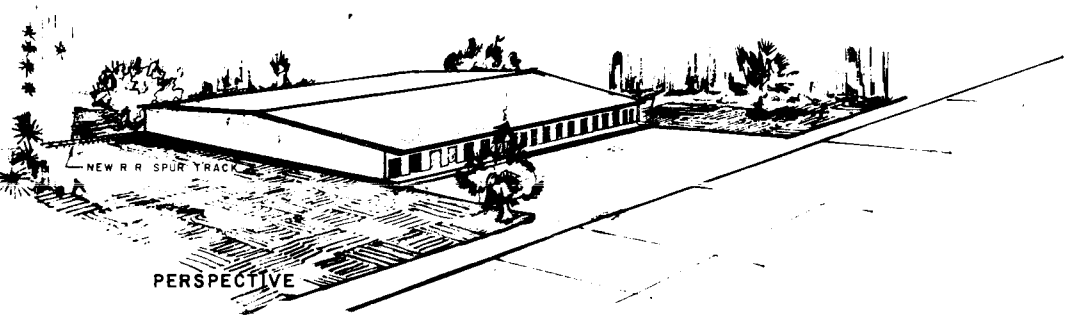

PERSPECTIVE

CF 10-22

(c) The support contractor requires 75,000 square feet for the storage of the materials required to service the stage contractors. These requirements will include lumber (heavy timber and mill items), piping, structural steel, tools, equipment, roofing, siding, insulation, maintenance vehicle parts, electrical conduit parts, lighting fixtures, and all necessary tools which will be required by the stage contractors.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$115,000
	Utility connections	$15,000	
	Roads and paved areas	35,000	
	Railroad siding (1,100 feet)	65,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		2,278,000
	Building (200,000 square feet at $11 per square foot)	2,200,000	
	Loading platforms (15,000 square feet at $5.20 per square foot)	78,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		---
E.	DESIGN AND ENGINEERING SERVICES		240,000
	Total estimated cost		$2,633,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

MISSISSIPPI TEST FACILITY

		Page No.
Location plan		CF 11-1
Advanced Saturn first stage (S-IC) static test facilities	$35,983,000	CF 11-2
Advanced Saturn second stage (S-II) static test facilities	19,148,000	CF 11-14
Bridge for U. S. Interstate Highway No. 10	4,500,000	CF 11-22
Control center and data acquisition and handling facilities	4,613,000	CF 11-25
Electronic, instrumentation, and materials laboratory	2,716,000	CF 11-28
F-1 engine systems test stand	9,000,000	CF 11-30
Maintenance facilities	5,987,000	CF 11-37
Navigation lock	6,604,000	CF 11-44
Security control facilities	675,000	CF 11-47
Sonic measuring facilities	1,760,000	CF 11-52
Transportation and parking facilities	7,585,000	CF 11-57
Utility additions and extensions	6,559,000	CF 11-61
Warehouse addition and storage facilities	2,318,000	CF 11-69
Waterways and docking facilities	4,242,000	CF 11-75
Total	$111,690,000	

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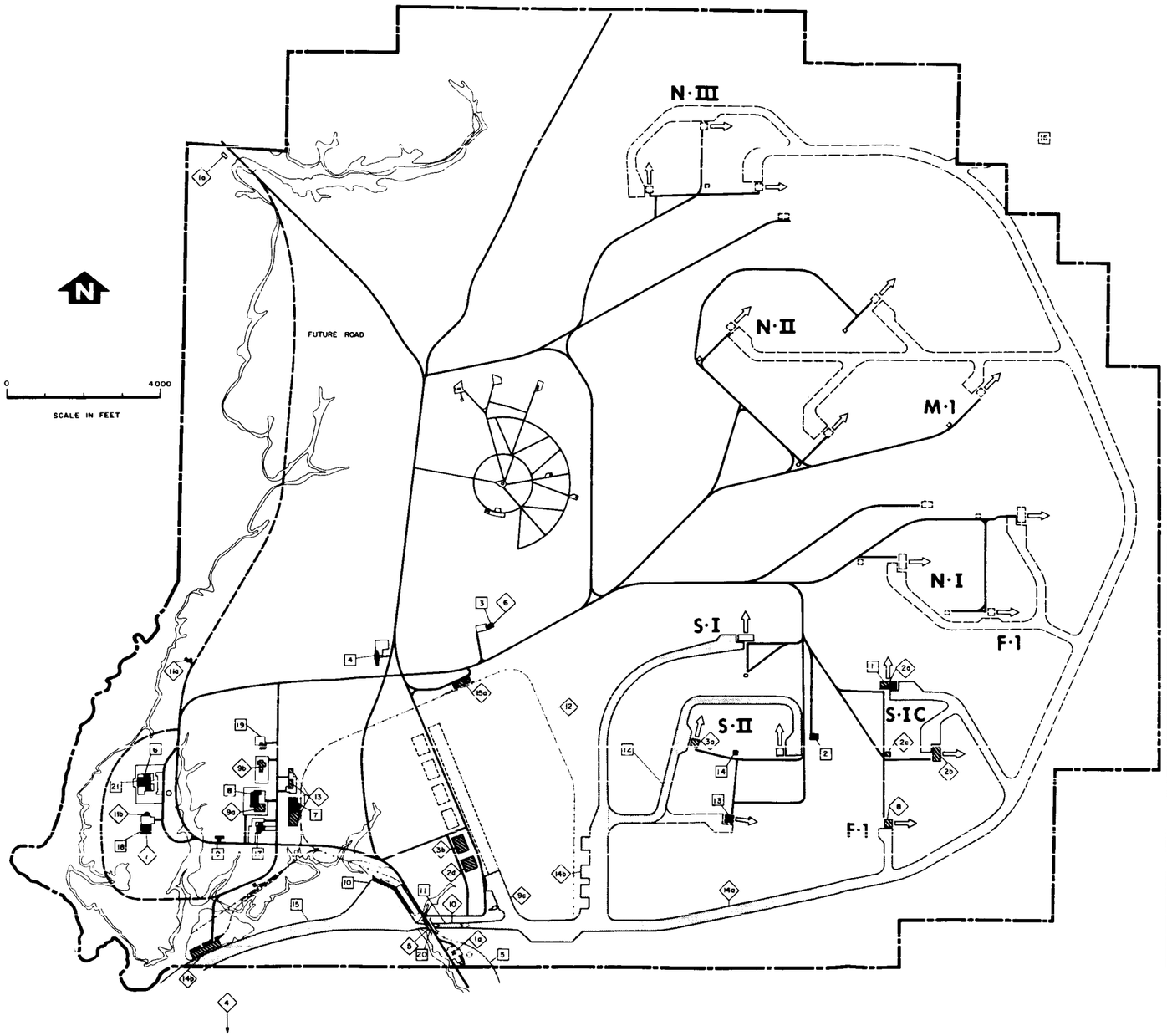
MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN



LEGEND

FACILITIES AUTHORIZED & UNDER CONSTRUCTION

PROJECT NO 3571 ADVANCED SATURN STAGE TEST FACILITIES
1 EXCAVATION & PILES (FOR TEST STAND)
2 DATA ACQUISITION CENTER
3 DATA HANDLING CENTER
4 TEST AREA CONTROL CENTER

PROJECT NO 3573 UTILITY INSTALLATIONS & SUPPORT FACILITIES
5 RAILROADS
6 OFFICE & ADMINISTRATION BUILDING
7 WAREHOUSE
8 MAINTENANCE BUILDING
9 STEAM PLANT
10 DOCKS, RIVER
11 LOCK (EXCAVATION & FOUNDATION)

NOTE UTILITY SYSTEMS, ROADS, RIVER DREDGING & SEVERAL MINOR ITEMS ARE EITHER NOT SHOWN OR FY-63 PORTION NOT DEFINED TO PRESERVE CLARITY OF PRESENTATION

PROJECT NO ADVANCE SATURN SECOND STAGE (S-II) TEST FACILITY
12 WATERWAY EXTENSION
13 TEST STAND
14 TEST CONTROL CENTER

PROJECT NO ADDITIONAL UTILITIES INSTALLATIONS
15 DREDGING HARBOR
16 DAM & RESORVOIR
17 EMERGENCY SERVICE BUILDING
18 ELECTRONIC & INSTRUMENTATION LABORATORY
19 COMMUNICATIONS & TELEPHONE BUILDING
20 BRIDGE, CANAL (EXCAVATION & FOUNDATION)
21 CAFETERIA

PROPOSED FISCAL YEAR 1964 PROJECTS

1. ADMINISTRATIVE FACILITIES
A. SECURITY CONTROL CENTER

2. ADVANCED SATURN FIRST STAGE (S-IC) STATIC TEST FACILITIES
A. TEST STAND
B. TEST STAND FOUNDATIONS
C. TEST CONTROL CENTER
D. STAGE STORAGE BUILDING

3. ADVANCED SATURN SECOND STAGE (S-II) STATIC TEST FACILITIES
A. TEST STAND
B. STAGE SERVICE & STORAGE BUILDING

4. BRIDGE FOR U S INTERSTATE HIGHWAY NO 10 (OFF-SITE NOT SHOWN)

5. CANAL BRIDGE

6. CONTROL AND DATA HANDLING FACILITIES (EQUIP ONLY)

7. ELECTRONICS, INSTRUMENTATION AND MATERIALS LABORATORY (EQUIP)

8. F-1 ENGINE SYSTEMS TEST STAND

9. MAINTENANCE FACILITIES
A. TEST MAINTENANCE SHOP
B. AUTO MAINTENANCE SHOP
C. BARGE TERMINAL AND REPAIR FACILITY

10. NAVIGATION LOCK

11. SONIC MEASURING FACILITIES
A. ACOUSTIC LAB
B. METEOROLOGICAL LAB

12. TRANSPORTATION AND PARKING FACILITIES
A. RAILROADS

13. WAREHOUSE ADDITION AND STORAGE FACILITIES

14. WATERWAYS AND DOCKING FACILITIES
A. CANALS
B. DOCKS

15. UTILITIES
A. RP-1 STORAGE

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MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN FIRST STAGE (S-IC) STATIC TEST FACILITIES

DESCRIPTION:

The Advanced Saturn first stage (S-IC) static test facilities consist of two stands for testing the S-IC stages, a test control center, a stage storage building, and auxiliary systems and equipment. The facilities are shown in the drawings on the following three pages.

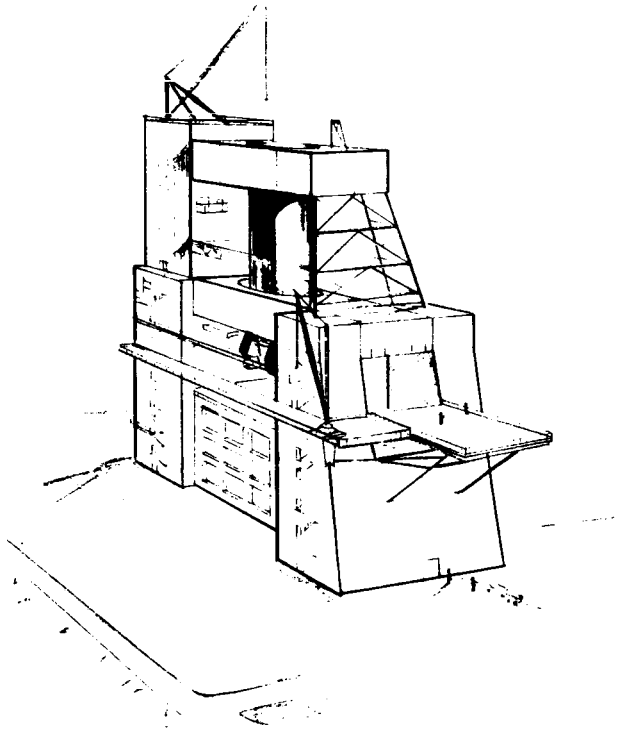
The authorized fiscal year 1963 increment of this project ($15,312,000) plus the requested fiscal year 1964 increment ($35,983,000) constitute approximately 85 percent of the total requirements for the S-IC static test facilities. The balance of the funding requirement will be requested in the fiscal year 1965 program. The scope of work included in the fiscal year 1964 increment of the project is as follows:

Test stands: The test complex includes two test stands for the S-IC stage, each of which has the capability of being expanded to a dual position stand. Each test stand will consist of substructure on piles, reinforced concrete superstructure, aspirator, rolling deck, load frames, elevators, booster placement derricks, and work platforms. The test stand substructure will be of reinforced concrete, cellular construction, and built on piles; it will support the flame deflector and the reinforced concrete superstructure, and provide areas for test and service equipment. The reinforced concrete superstructure will provide areas for test and service equipment, and will support the steel superstructure, load frame, engine work platform, rolling deck, and aspirator. The reinforced concrete superstructure will consist of two piers, one on each side of the flame deflector. Space will be provided within the piers for the various offices, shops, and equipment pertinent to the testing operations. Elevators and stairways will be provided in the piers for access to the various levels.

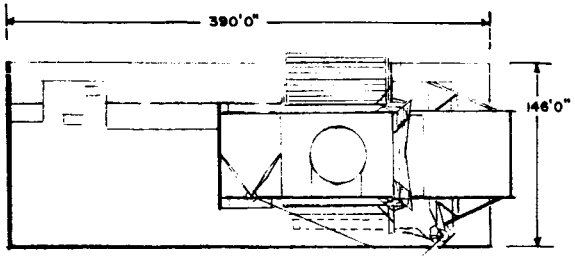
An aspirator will be provided to create a differential pressure and will consist of two horizontal steel plates separated by steel supporting members and a rectangle covering the top of the flame deflector. Within the confines of this rectangle will be an opening large enough to permit the passage of engine exhaust gases without impingement on the steel around the edge of the opening while engines are gimballed. The aspirator will be cooled and shielded so that it will suffer no deleterious effect due to high temperatures caused by radiation from the exhaust flame.

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

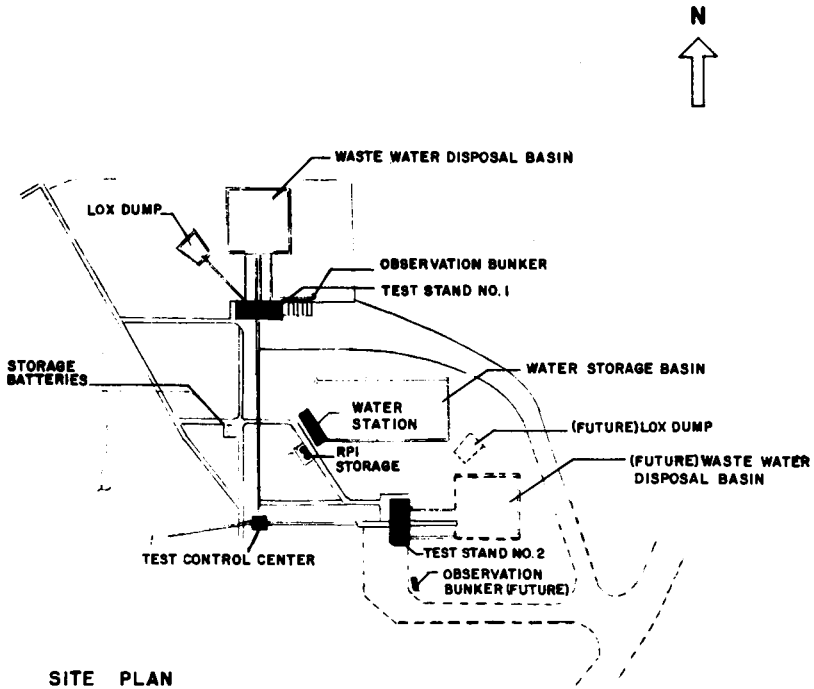
ADVANCED SATURN FIRST STAGE (S-IC) STATIC TEST FACILITIES



PERSPECTIVE



FLOOR PLAN TEST STAND

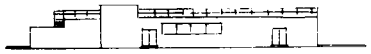


SITE PLAN

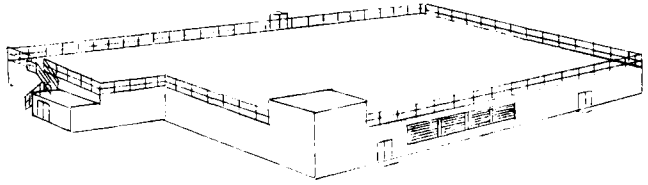
TEST STAND

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN FIRST STAGE (S-IC) STATIC TEST FACILITIES



SOUTH ELEVATION



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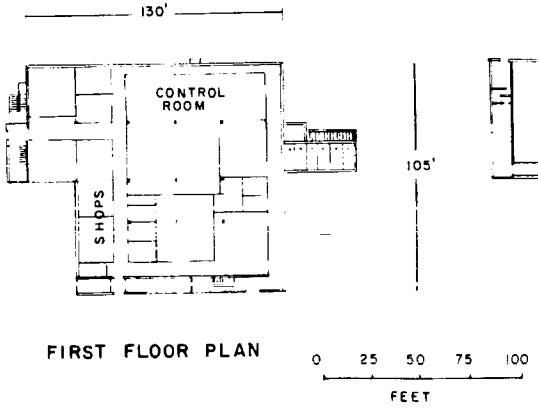
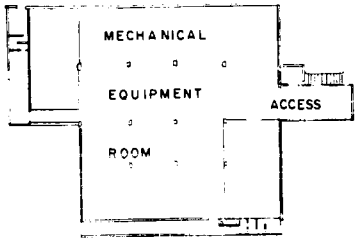
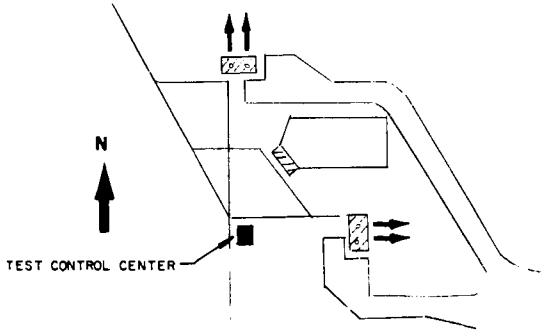


FIRST FLOOR PLAN



BASEMENT PLAN



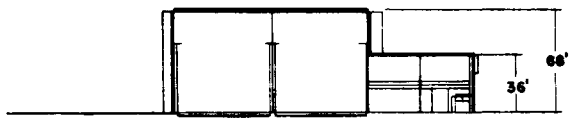
SITE PLAN

0 1000 2000 3000
FEET

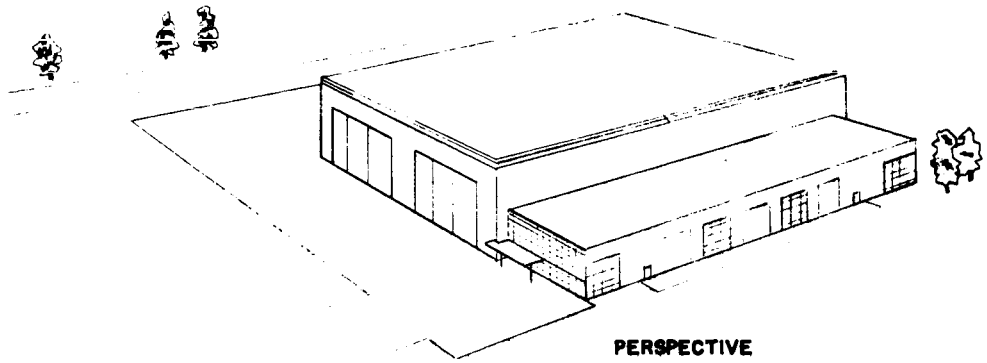
TEST CONTROL CENTER

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN FIRST STAGE (S-IC) STATIC TEST FACILITIES



SECTION A-A



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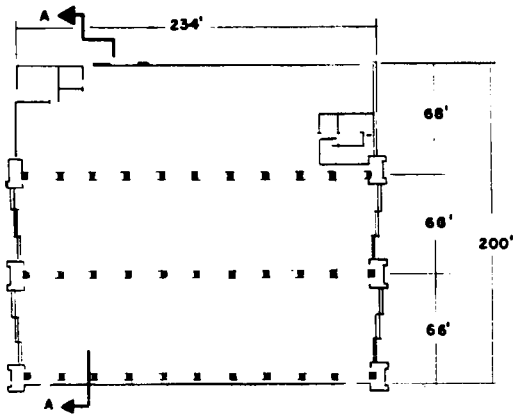
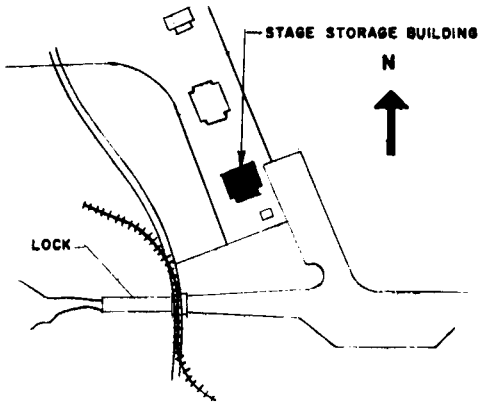


FLOOR PLAN

0 30 60 90 120
FEET



SITE PLAN

0 1000 2000 3000
FEET

STAGE STORAGE BUILDING

Tunnels will be provided from each test stand to the test control center for instrumentation and control transmission cable routing between these structures.

A rolling deck will be provided to furnish a surface upon which one engine may be transported from its position below the booster to a location where it can be picked up by a derrick and lowered to the ground. During firings, the rolling deck is rolled clear of the flame area. Heating, ventilation, air-conditioning, and fire protection compatible with the utilization of each area will be provided.

Test control center: The major function of the test control center is to house equipment and personnel required to control, observe, supervise, and monitor the operation of the complex. The test control center will be reinforced flat slab construction on a mat or raft foundation. The gross floor area will be approximately 30,000 square feet. The basement floor will be utilized as a service area containing the heating and air-conditioning equipment for the two test stands, special power, and electrical equipment rooms. The first floor will contain a control room, red-line instrumentation room, a control computer room, complex coordinator's office, various special purpose shop areas, viewing area and miscellaneous office space. A tunnel will be provided from the test control center to the data acquisition facility for instrumentation and control transmission cable routing between these buildings.

Observation bunkers: Each observation bunker will be a blastproof, protective enclosure with self-contained air supply from which test personnel can visually observe test firings at close range. The observation bunker will be located 350 feet from the test stand at an angle of 75 degrees from the direction of firing. Three viewing windows and one periscope will be provided for observation. The observation bunker will be a reinforced concrete, boxlike structure, 12 feet by 12 feet in inside plan dimensions, with an 8-foot floor-to-ceiling height.

Propellant and gas storage: The project will include (for the first test stand) barge-mounted liquid oxygen storage, land-based storage batteries, and RP-1 fuel storage.

Stage storage building: The program will provide a stage storage building to provide facilities for:

(1) Pretest and/or post-test storage of two Advanced Saturn S-IC stages. (No pretest or post-test functional checkout work will be done in this building.)

(2) Service, modification, and repair of booster vehicles while mounted on their transporters.

(3) Storage, repair, removal, and reinstallation of stage engines and associated hardware.

The stage storage building will consist of one high bay and one low bay area with mezzanine. The high bay area will have two identical sections, each with facilities for stage storage, service, and modification work. A motorized gantry frame and floor rails in one section will facilitate service and modification operations. The structure will be designed to permit the future installation of a 150-ton bridge crane in each high bay section. One 25-ton bridge crane will be installed at the outset. The low bay area will be used primarily for engine maintenance, repair, and storage; however, support facilities will also be provided for the overall stage service functions. The building frame will be structural steel. Exterior concrete walls will be precast concrete made hurricane-proof by special reinforcing. The entire building will be heated and certain areas will be air-conditioned. The low bay area will be protected with a wet-pipe automatic sprinkler system. Compressed air and gaseous nitrogen will be provided in the building.

Propellant dump system: The program will provide emergency means for the disposal of propellants from the stage. RP-1 fuel will be returned to the complex storage tanks. Liquid oxygen will be dumped to a holding pond and allowed to vaporize.

Deflectors: The flame deflector will be provided to divert the booster engines exhaust away from the test stand to prevent injury to the test stand or the vehicle itself. The deflector will consist of the open bucket, water-film cooler type, and will be constructed of interconnected segments of closed steel box sections. High-pressure water will be supplied to the underside of the steel boxes, or manifolds, and will be sprayed into the flame area through holes drilled through the manifold top plates.

Adaptation hardware: The project includes adaptation hardware for the first S-IC test stand. This equipment will be provided to attach the stage to the load frame and will be designed to safely sustain the stage during test operations and firings.

Instrumentation systems: These systems will incorporate test stand distribution cables and test-stand-to-data-acquisition facility transmission cables and their terminal boxes for ready adaptation to missile and stand transducers; interconnecting terminal racks; patch panels for minimization of time in specific transducer-to-channel assignments in different test runs; and conduit and cable trays. Inherent attenuation of high frequency data and low power data signals and slow response to high volume in closed air systems, necessitates that some conditioning and calibration subsystems be included in these systems. Instrumentation systems will be provided for over one thousand hard wire data channels.

Control and communication systems: These systems will include all on-stand and near-stand devices, test stand and control center distribution cables, test stand to control center transmission cables, and their boxes, terminal racks, jumper racks and patch boards, conduits, and cable trays. Local control panels and service consoles and their support equipment racks will be located in, on, or near the test stand; all other panels, racks, and consoles will be installed in the control center. The major components and functions of these systems are special power systems; facility and service controls and displays; support subsystems for remote control and indication; time recording of control systems events; red-line readout instruments; test coordinator control; communication and display devices; prime data quick-look readout devices; go, no-go, and test termination logic, interlocks, and controls; camera and television timing, controls and monitors; area paging and communication; and visual, oral, and aural warning controls and displays.

High-pressure water pumping station and supply: The project includes the storage basin, pumps, pump station, and equipment to provide the deflector cooling water for the first S-IC test stand. The pumping station will have a capacity of 400,000 gallons per minute for normal operation, plus adequate additional capacity for emergency deluge and off-stand fire protection systems.

Propellant transfer system: The project includes the pumps, motors, switchgear, and auxiliary devices to off-load the liquid oxygen from the barge-mounted storage vessels to the stages in the S-IC test stands and the RP-1 fuel from the off-stand tanks to the vehicle stage tanks.

High-pressure gas distribution systems: Necessary valves, distribution piping within the complex, on-site storage, and the on-stand connections of the gaseous nitrogen and helium will be provided for the S-IC test stands.

High-pressure water distribution: The project includes the piping, valving, and on-stand connections for the deflector cooling, deluge and off-stand fire fighting high-pressure water systems for the S-IC test stands.

Waste water disposal: A flume, a discharge basin, and valving for deflector waste water will be provided.

Structure test equipment: Equipment is required to proof-load the test stand to assure the structural integrity of the stand components and equipment whose complexity and critical function require more than theoretical justification of their safety capacity. The hold-down clamps for booster support arms will be tested by applying a load from a 42-inch 3,000-pound-per-square-inch hydraulic cylinder. The cylinder will be mounted on a frame that is fastened to the load frame. A mechanical shaker will be operated on the load frame as an auxiliary input to this test. The horizontal staying system that links the booster to the load frame will be tested by applying loads from an array of large diameter, high-pressure, hydraulic cylinders positioned to form a square pattern in the plane of the staying system. By adjusting pressures and push-pull combinations this array will duplicate the horizontal loads that the booster presents to any horizontal stay. A mechanical shaker shall also be conducted to determine the natural frequencies and responses to vibratory forces of the flame deflector.

Canal docks: A dock will be constructed adjacent to the test stand for docking propellant barges and the stage transport barge. The dock will consist of a sheet pile retaining wall with earth backfill and mooring bits, fenders, and dolphins as required.

Guard house: A guard house will be constructed at the entrance to the S-IC test complex. The facility will be approximately 160 square feet about half of which will be constructed as a blast-proof protective enclosure with self-contained air supply for protection of the guard staff during test firings. Included will be toilet facilities, heating, control and warning systems, and a 300-square-foot canopy over both the entering and leaving lanes of the road.

JUSTIFICATION:

The present Advanced Saturn program envisions the need for three static test stands for the S-IC stage vehicle. The first S-IC stand is presently under construction at the Marshall Space Flight Center, Huntsville, Alabama. The other two stands are planned for the Mississippi Test Facility.

The stand at the Marshall Space Flight Center will be activated in time to permit the acceptance testing of the first two S-IC flight stages. After the stands at the Mississippi Test Facility are completed, the stand at the Marshall Center will be used as a back-up and as a stand for product improvement.

According to planned production schedules, delivery of vehicles to the Mississippi Test Facility will be increased from one to three per quarter in early 1966. During this transition of from one vehicle per quarter to three vehicles per quarter it is expected that the on-stand time for vehicles can be reduced from approximately four months to about six to eight weeks. This reduction in on-stand time will be made possible through training and experience gained with the S-IC stage.

Since the S-IC is the booster stage of the Advanced Saturn system which will be a manned vehicle, the checkout of the system must be thorough and complete. As a minimum in establishing a confidence level for the system, a load test and two static firings will be performed. One of the static firings will be a duration run. Each complete Advanced Saturn vehicle will cost several millions of dollars which makes it impractical to rely on flight tests only for vehicle development information. If difficulties are encountered during static testing the malfunctioning components can be replaced or corrected at a minimum of expenses. These same difficulties in a flight vehicle would probably mean the loss of the entire vehicle.

As indicated above, two test positions for the S-IC stage will be required at the Mississippi Test Facility to meet projected launch schedules. The location of the stands at the Mississippi Test Facility, which is close to the production facilities at the Michoud Plant, will reduce transportation costs and wear and tear on the vehicles.

COST ESTIMATE:

		Fiscal Year 1963		Fiscal Year 1964
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$375,000		$2,635,000
Foundations and excavations.....	$85,000		$295,000	
Grading.....	50,000		50,000	
Waterway extension.....	---		495,000	
Roads.....	---		125,000	
Parking areas.....	---		25,000	
Hardstands.....	---		50,000	
Electrical systems.....	240,000		650,000	

		Fiscal Year 1963		Fiscal Year 1964
Canal docks.....	---		$450,000	
Area lighting.....	---		75,000	
Potable water supply and distribution....	---		100,000	
Heat distribution.....	---		180,000	
Sewage disposal.....	---		85,000	
Complex fencing.....	---		55,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$10,012,000		$15,545,000
Test stand structures (Substructure for stand No. 1 in 1963; completion of stand No. 1 plus substructure for stand No. 2 in 1964).....	$8,512,000		5,700,000	
Test stand deflector...	1,500,000		---	
Piles and pile cap.....	---		4,150,000	
Test control center (30,000 square feet at $35.50 per square foot).....	---		1,065,000	
Radio frequency interference suppression grounding.....	---		20,000	
Observation bunkers (2 - 360 square feet at $139 per square foot).....	---		100,000	
Water storage (38,000,000 gallons).....	---		340,000	
Propellant storage barges (20 at 93,000 gallons each).	---		1,100,000	
Gas storage batteries 20,000 cubic feet (water volume)	---		1,100,000	
Stage storage building (53,450 square feet at $26.50 per square foot).....	---		1,415,000	
Radio frequency interference suppression grounding.....	---		45,000	

	Fiscal Year 1963	Fiscal Year 1964
Guard house (310 square feet at $32,30 per square foot).....	---	$10,000
High-pressure water pumping station.....	---	500,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	---	$15,385,000
Stage storage building equipment.....	---	200,000
Test stand deflectors....	---	1,875,000
Adaptation hardware.....	---	520,000
Instrumentation systems:		
Signal conditioning equipment.....	---	980,000
Automatic calibration equipment.....	---	950,000
Terminal racks, receptacle boxes, and patch panels.....	---	750,000
Distribution cable and cable trays.....	---	320,000
Control and communication equipment systems:		
Control consoles, terminal racks, and boxes.....	---	700,000
Communication and warning systems (fire alarm, aural, oral and visible warning, public address, intercommunication).....	---	750,000
Test and facility monitoring system (TV, photo and event recorder).....	---	250,000
Special power supply...	---	955,000
Control and communication cable.....	---	255,000
High-pressure water pumps (20 pumps plus additional pumps for standby)..	---	2,620,000

		Fiscal Year 1963		Fiscal Year 1964
Propellant transfer system.....	---		$500,000	
Propellant dump system.....	---		600,000	
High-pressure gas distribution systems.	---		500,000	
High-pressure water distribution (deflector cooling, on-stand deluge and off-stand fire protection system).....	---		2,250,000	
Waste water disposal.....	---		260,000	
Structure test equipment..	---		150,000	
E. DESIGN AND ENGINEERING SERVICES.....		$4,925,000		$2,418,000
Total estimated cost.....		$15,312,000		$35,983,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN SECOND STAGE (S-II) STATIC TEST FACILITIES

DESCRIPTION:

The Advanced Saturn second stage (S-II) static test facilities will consist of two test positions for acceptance testing of the S-II stage. Support facilities include a test control center, stage service and storage facility, propellant storage facilities, auxiliary systems, and equipment. At the time this project was being prepared for inclusion in the NASA fiscal year 1964 budget submission, the funding shown in the fiscal year 1963 cost estimate column was being proposed for approval under the Congressional reprogramming procedures. The fiscal year 1963 funding increment plus the funds requested in this project will provide an operable two test stand facility and will complete the funding of the Advanced Saturn second stage (S-II) static test facilities. The facilities are shown in the sketches on the following two pages and are described in detail as follows:

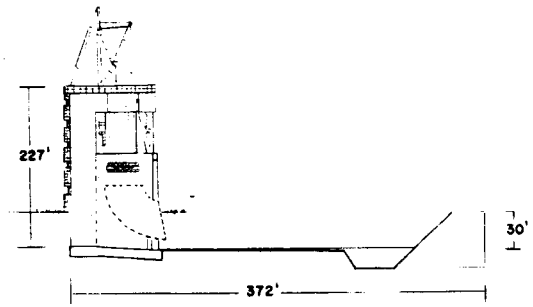
Test stand: Each test stand will consist of a substructure, a reinforced concrete superstructure, and a steel superstructure. The test stand substructure will consist of a reinforced concrete pile cap supported on sufficient piles to withstand the static and dynamic loading forces occurring during the loading and static firing of the S-II stage. A reinforced concrete superstructure will support the load frame, to which the stage under test will be mounted, as well as supporting the steel superstructure. The superstructure will support stage handling derricks and equipment, work platforms, and walkways which will provide access to the upper part of the stage mounted on the stand. The superstructure will enclose instrumentation and control terminal rooms, shops, and space for test support functions.

Stage service and storage building: A building will be provided for servicing and storing stages before and after test firing and during severe weather conditions. The building will be a one-story structure with three high bay areas and one low bay area as indicated on the attached sketch. The building will be designed for three 150-ton bridge cranes. The building frame will be structural steel on pile foundation. Exterior concrete walls will be precast concrete made hurricane-proof by special reinforcing. The entire building will be heated and certain specific areas air-conditioned. The building will be protected with a wet-pipe automatic sprinkler system. Compressed air and gaseous nitrogen will be provided in the building. Equipment for this facility will be used for pretest and post-test handling and checkout of stage vehicles and will include heavy hoisting

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN SECOND STAGE (S-II) STATIC TEST FACILITIES



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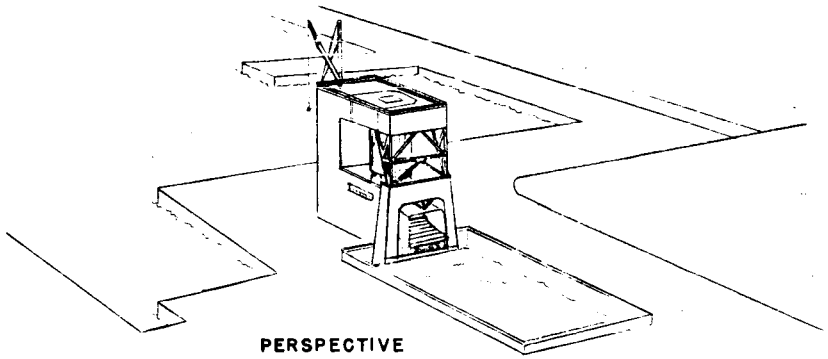

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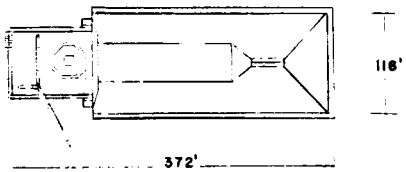
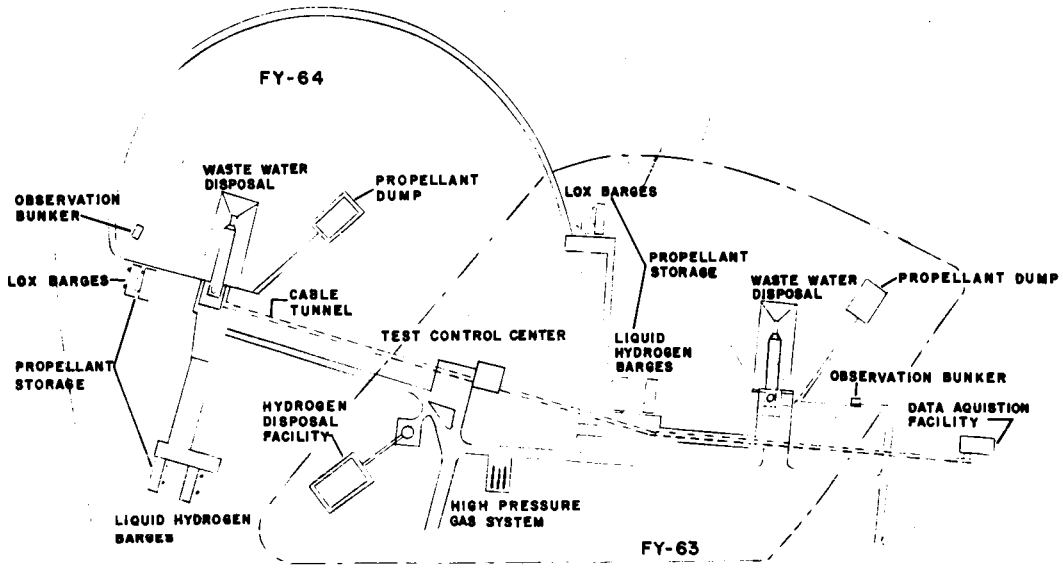


FLOOR PLAN

0 50 100 150 200

FEET



SITE PLAN

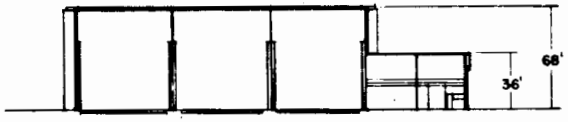
0 500 1000

FEET

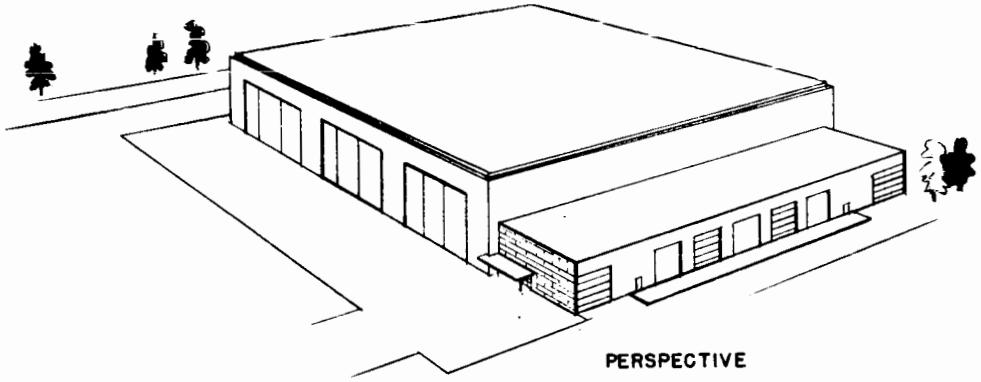
TEST STAND

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN SECOND STAGE (S-II) STATIC TEST FACILITIES



SECTION A - A



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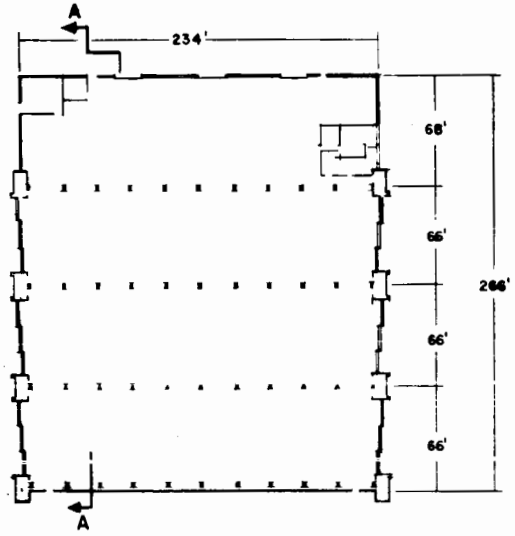
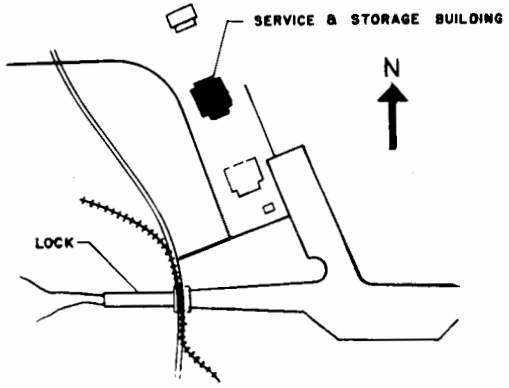


FLOOR PLAN

0 30 60 90 120
FEET



SITE PLAN

0 1000 2000 3000
FEET

SERVICE AND STORAGE BUILDING

equipment, data acquisition equipment, and manual check-out instruments.

Propellant storage: Barges will be provided for storing liquid hydrogen and oxygen in the proximity of each test stand. Provisions will be made to connect the propellant storage tanks on the barges to the propellant transfer systems. The barges will be equipped with sufficient control and indicating devices to insure maximum safety when in use.

Test stand support building: The support building will provide office, laboratory, and shop space in support of test stand operations. The building will be of insulated metal construction and will provide 3,600 square feet of space.

Deflector: The flame deflector will divert the engine's exhaust away from the test stand to prevent injury to the test stand or to the stage undergoing test. The deflector will be an open-bucket, water-film type, and will be constructed of interconnected segments of closed steel box sections. High-pressure water will be supplied to the underside of the steel boxes, or manifolds, and will be sprayed into the flame area through holes drilled through the manifold top plates.

Adaptation hardware: Adaption hardware is required for the S-II test stands. The equipment will be provided to attach the stages to the load frame in the test stand and will be designed to safely sustain the stages during test operations and firings.

Instrumentation systems: The test stand components will include receptacle boxes for ready adaptation to stage vehicle and stand transducers, patch panels for connection flexibility, conditioning equipment to modify certain types of data signals to a form capable of being transmitted to and received by data acquisition equipment with a minimum of degradation of data intelligence, and the transmission and distribution cables and terminal equipment to interconnect the components into an operable system.

High-pressure gas system: This system will consist of the necessary valves, distribution piping within the complex, on-site storage, and the on-stand connections of the gaseous nitrogen and helium for the first S-II test stand.

Waste water disposal: This system will consist of a flume, a discharge basin, and valving for deflector waste water.

Observation bunker: This structure will consist of a blast-proof, protective enclosure with self-contained air supply from which test personnel can visually observe test firings at close range. The observation bunker will be located 350 feet from the test stand at an angle of 75 degrees from the direction of firing. Three viewing windows and one periscope will be provided for observation. The observation bunker will be a reinforced concrete, box-like structure, 12 feet by 12 feet in inside plan dimensions, with an 8-foot floor-to-ceiling height.

Propellant dump system: This system will provide an emergency means of dump disposal of liquid oxygen from the stage to a holding pond for vaporization.

Hydrogen disposal system: The project includes a system for the dump disposal of hydrogen from the stage during emergency conditions. The dump system will permit controlled untanking of the liquid hydrogen into an underground tank, from which the hydrogen will be vented to the atmosphere in a manner that will permit controlled continuous burning of the air-hydrogen mixture.

Guard house: A guard house will be provided at the entrance to the S-II test complex. The building will be approximately 160 square feet in floor area, half of which will be constructed as a blast-protective enclosure with self-contained air supply. Included will be toilet facilities, heating, control and warning systems, and a canopy extending over both entering and leaving lanes of the road.

Controls and communications: Control and communication components and circuitry will include terminal boxes to facilitate connections to the stage vehicle and portable test stand equipment; patch panels for time saving connection flexibility; batteries and special power supply systems; special adaptation and control equipment for test monitoring devices; aural and visual warning systems; public address and sound-powered communication systems; control and indication systems for deflector cooling water, test stand deluge, and high-pressure gas and propellant transfer; and transmission and distribution cables and terminal equipment to interconnect the components into operable systems.

JUSTIFICATION:

The present Advanced Saturn program envisions the need for four static stands for the S-II stage. The research and development program will require two stands at Santa Susana, California and the acceptance test program will require two stands at the Mississippi Test Facility. One stand at the Mississippi Test Facility is being funded in the fiscal year 1963 budget.

The accelerated pace of the Advanced Saturn program dictates that research and development efforts and acceptance testing efforts be performed concurrently for the first eight vehicles. In this connection, when the first S-II stage is delivered at the Mississippi Test Facility, only six months of testing on the all-systems stand at Santa Susana will have been accomplished.

According to planned production schedules, delivery of vehicles to the Mississippi Test Facility will be increased from one to three per quarter in early 1966.

Since the S-II stage is part of a system that will be man-rated, the checkout of the system must be thorough and complete. As a minimum in establishing a confidence level for the vehicle, a load test and two static firings will be performed. One of the static firings will be a duration run. Time on stand for the first vehicles will be approximately four months, but through training and experience this time should decrease to about six weeks for later stages. As indicated by the above, one test position at the Mississippi Test Facility would be incapable of meeting test schedules; a second stand is therefore required as proposed in this project.

Utilization of the research and development stands at Santa Susana is limited due to restrictions placed on their operations. The restrictions result from the proximity of privately-owned residences, the shortage of land, and the nearness of other test facilities to the S-II test positions. For safety reasons (blast and acoustics), the Santa Susana stands cannot be fully utilized for acceptance testing. The additional static test stands proposed for construction at the Mississippi Test Facility are accordingly essential to the Advanced Saturn development program.

COST ESTIMATE:

		Fiscal Year 1963	Fiscal Year 1964
A. LAND ACQUISITION.....		---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$2,260,000	$660,000
Grading.....	$70,000	---	
Foundation excavation.....	90,000	---	
Waterway extension.....	800,000	---	

		Fiscal Year 1963		Fiscal Year 1964
Roads and parking areas....	$125,000		$125,000	
Hardstands.....	50,000		125,000	
Electrical systems.....	240,000		150,000	
Potable water system.....	---		50,000	
Complex fencing.....	35,000		50,000	
Canal docks.....	750,000		---	
Area lighting.....	50,000		75,000	
Heat distribution.	50,000		50,000	
Sewage collection.....	---		35,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$6,670,000		$7,920,000
Test stands (two).....	3,870,000		3,740,000	
Test control center.....	750,000		---	
Stage service and storage building (68,900 square feet at $36 per square foot).....	---		2,500,000	
Test stand support building (3,600 square feet at $33 per square foot)..	120,000		120,000	
Observation bunkers (two; 360 square feet at $111 per square foot).....	30,000		50,000	
Guard house (including blast-proof enclosure and canopy, 310 square feet at $32.30 per square foot).....	10,000		10,000	
Propellant storage barges (three; 200,000 gallons of liquid hydrogen each).	---		1,500,000	
Propellant dump system.....	100,000		---	
High-pressure gas storage tanks.....	1,750,000		---	
Water storage tank.....	40,000		---	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		7,720,000		9,585,000
Deflectors (two).....	520,000		575,000	
Adaptation hardware.....	200,000		200,000	
Instrumentation systems....	800,000		2,000,000	
Control and communication systems.....	1,000,000		950,000	

		Fiscal Year 1963	Fiscal Year 1964
High-pressure water system.....	$1,950,000	$700,000	
Propellant transfer systems.....	1,800,000	---	
Hydrogen disposal system.....	---	2,500,000	
High-pressure gas system.....	1,050,000	750,000	
Propellant dump system.....	---	50,000	
Waste water disposal..	200,000	60,000	
Structure test equipment.....	200,000	---	
Stage service and storage building equipment.....	---	1,800,000	
E. DESIGN AND ENGINEERING SERVICES.....		$3,353,000	$983,000
Total estimated cost.		$20,003,000	$19,148,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

BRIDGE FOR U.S. INTERSTATE HIGHWAY NO. 10

DESCRIPTION:

This project requests funding for the difference in cost between the low-level fixed-bridge originally planned for the East Pearl River crossing of U.S. Interstate Highway No. 10 and the special design bridge required to provide waterway access to the Mississippi Test Facility. The special design bridge will consist of a four-lane bridge with a 73-foot vertical clearance between the bottom members of the bridge and the river channel during high water. The bridge will have a bascule (or opening type) center section, but machinery for operating the center section will not be installed. Higher clearances will not be required until larger stages than those of the Advanced Saturn vehicle are developed, which is anticipated to be after 1970. At that time, operating machinery will be installed to provide unlimited vertical clearance at a present-day estimated cost of $150,000.

Funds will be transferred to the Bureau of Public Roads who will accomplish design and construction of the bridge. The total cost of the bridge, as estimated by the Bureau of Public Roads, will be $5,300,000. The Bureau of Public Roads will fund the cost of the low-level bridge originally planned for the East Pearl River crossing, $800,000; and the National Aeronautics and Space Administration will fund the balance of the special bridge costs, $4,500,000. A sketch of the bridge is shown on the following page.

JUSTIFICATION:

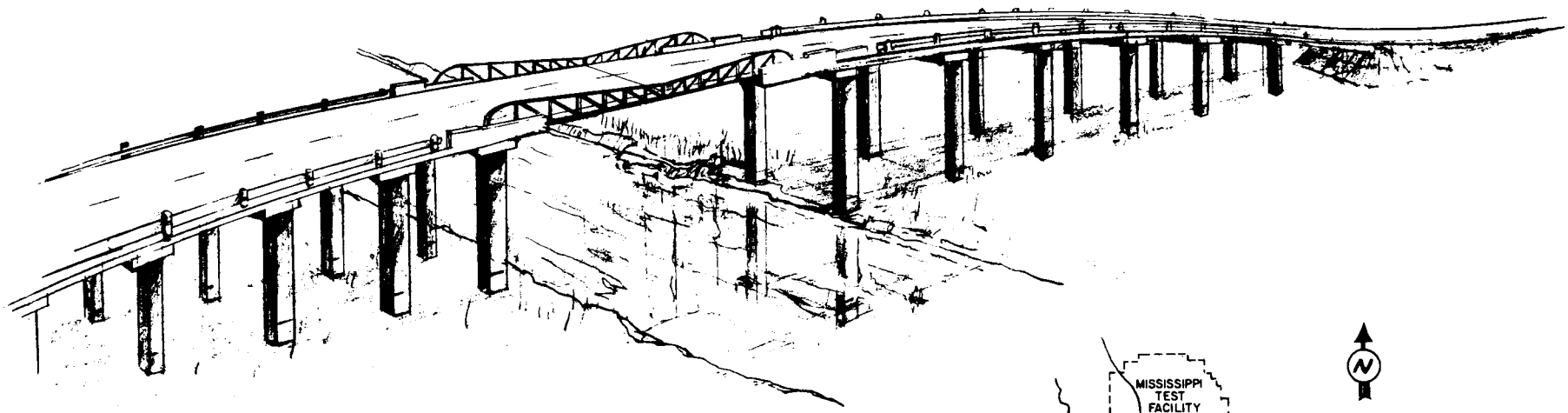
The Mississippi Test Facility is located approximately 30 miles north of the Gulf Intracoastal Waterways. Vehicles will be transported to the site by means of barges traveling the intracoastal waterway and up the East Pearl River. The proposed Interstate Highway No. 10, as presently planned, will cross the access waterway south of the test site.

The Interstate Highway bridge originally proposed for construction on the East Pearl River would not permit passage of stage transport barges up river to the Mississippi Test Facility due to the vertical clearance required. At meetings with the Bureau of Public Roads, it was agreed that the NASA would request funds for the difference in cost between the originally proposed bridge and the bridge now required to provide uninterrupted flow of highway traffic while stage transport barges are passing. The bascule center section will allow the movement of barges and future stages which may have vertical heights in excess of 73 feet.

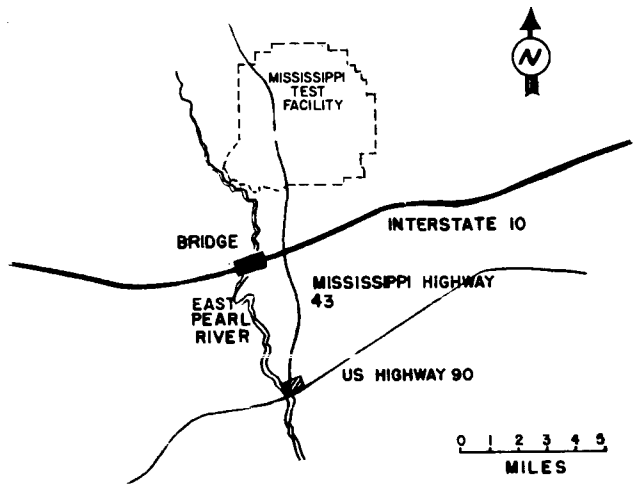
MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

BRIDGE FOR U.S. INTERSTATE HIGHWAY NO. 10



BRIDGE HEIGHT - 73 FEET
ABOVE HIGH WATER



SITE PLAN

COST ESTIMATE:

A.	LAND ACQUISITION.....		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		---
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		$4,500,000
	Bridge construction.....	$4,500,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		---
E.	DESIGN AND ENGINEERING SERVICES.....		---
	Total estimated cost.....		$4,500,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

CONTROL CENTER AND DATA ACQUISITION AND HANDLING FACILITIES

DESCRIPTION:

Funding in the fiscal year 1963 program provided a basic control center and a data acquisition and handling facility together with some related equipment which could be determined at that time. The proposed fiscal year 1964 increment of this project requests funding for the remaining equipment items required to complete these facilities, as follows:

Control center equipment: Major equipment items are required for radio communication to local mobile traffic (land and water) and remote ship-to-shore communication (ultimately Mississippi Test Facility to Cape Canaveral), traffic displays, facility safety control systems, facility coordination, selective television monitoring from all complex and area cameras, test countdown paging and operational intercom, security control, and emergency frequency control to all components of the Mississippi Test Facility.

Data acquisition equipment: This system will provide an initial channel end device capability for conditioning, calibration, and readout of analog data and digital data. Digitized data will be directly recorded or tabulated as raw data, surveyed for time entrance into and retention within preselected limits, checked and converted to a best-fit to the known curve for the transducer used, and converted to engineering units. The system will be expanded to accommodate the S-II static test instrumentation requirements. Static and low response (slow changing) data will be display-recorded on single trace strip chart recorders and recorded by an analog/digital unit (analog to digital, high speed, data acquisition controller, converter, and recorders system). Medium response (mid-frequency) data will be graphically recorded by oscillographs and digitally by analog/digital units. Fast response (high frequency) data will be analog-recorded on magnetic tape. Analog/digital units provide for cathode-ray tube quick-look bargraph representation of selected data channels and retransmitting of selected data units. Strip chart recorders also provide for retransmitting of data by analog signals to remote indicators for quick-look and/or red-line instrumentation. Programmable patch and automatic switching have been included for optimization of equipment utilization. Time-pulse generation for synchronization of recorded data during processing and detailed analysis will be included. Automation of pretest and post-test calibration and test simulation of selected data channels and their transducers, conditioning and calibration subsystems, and readout or recording devices will also be included as part of the instrumentation systems.

Data handling center equipment: This equipment will be used in the processing and reduction of data accumulated at a test area data acquisition facility for quick-look adequacy of test data. Where necessary, raw or engineering digitized data will be translated for specific computer languages necessary in the off-site computations and evaluations in a detailed anlaysis for missile acceptance. Vibration data acquired on magnetic tape will be played through spectral analysis equipment to obtain power spectral densities. Missile telemetered data and transmitter testing outputs will be received directly in this center in real-time; all other data will be brought to the center in the form of strip chart and oscillogram analog data, magnetic tape analog or digital data, and punched tape, punched card, and teletypewriter tabulated digitized data.

JUSTIFICATION:

Data acquisition and handling facilities are required to receive and process informformation acquired through instrumentation channels in support of the S-IC and S-II test complexes. The control center equipment is necessary to establish control of security and safety, and to permit the scheduling of operations for the test complexes.

The centralized data acquisition and handling facilities support the test program with the minimum amount of equipment and facilities. This concept does away with the necessity of having duplicate equipment for every test position. No other facilities or equipment are available to perform this function.

COST ESTIMATE:		Fiscal Year 1963		Fiscal Year 1964
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		1/		---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$2,600,000		---
Data acquisition center	$900,000		---	
Data handling center...	800,000		---	
Control center.....	900,000		---	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		10,700,000		4,100,000
Data acquisition center equipment:				
Analog digital system	2,600,000		650,000	
Oscillograph, stock chart systems.....	2,700,000		150,000	

		Fiscal Year 1963	Fiscal Year 1964
Magnetic tape recorders and telemetry receivers.....	$880,000	---	
Conditioning equipment and special systems.....	1,100,000	---	
Cable, cable trays, terminal equipment, switch and patch systems.....	720,000	---	
Data handling center equipment:			
Digital tape reduction system.....	500,000	$800,000	
Oscillograph and strip chart reduction systems.....	500,000	800,000	
Telemetry systems.....	500,000	900,000	
Control center equipment:			
Area-wide oral, aural, and visual warning systems.....	600,000	400,000	
Intercommunication systems.....	300,000	200,000	
Facilities systems control.....	300,000	200,000	
E. DESIGN AND ENGINEERING SERVICES.....		$700,000	$513,000
Total estimated cost.....		$14,000,000	$4,613,000

1/ Funds for site development and utility installations attributable to the facilities provided in the initial 1963 funding increment are contained in the fiscal year 1963 utilities project, and are reflected in the figures shown in the fiscal year 1963 cost estimate column in the fiscal year 1964 project entitled "Utility Additions and Extensions."

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

ELECTRONIC, INSTRUMENTATION, AND MATERIALS LABORATORY

DESCRIPTION:

The electronic, instrumentation, and materials laboratory will be used in support of the Advanced Saturn stage test facilities to service and calibrate electronic and instrumentation equipment, maintain and service television and still cameras, process film, and provide laboratory space and equipment for the vehicle stage contractors at the Mississippi Test Facility. At the time this project was included in the NASA fiscal year 1964 budget request, the funding shown in the fiscal year 1963 cost estimate column was being proposed for approval under the Congressional reprogramming procedures. The fiscal year 1963 funding increment plus the funds requested in this project will complete the funding for the facility. The fiscal year 1964 increment of the project includes the following:

Materials laboratory equipment: Laboratory equipment and apparatus is required to perform routine functional tests in the field of analytical chemistry and minor tests in the field of metallurgy.

Electronic and instrumentation equipment: Equipment and apparatus will be provided to maintain, service, and calibrate electronic and instrumentation equipment used throughout the test site.

Photographic optical equipment: Equipment and apparatus is required to process and edit both black and white and color still and motion picture film and prints, to make photographic copies, to store film and cameras, and to service cameras and optics.

JUSTIFICATION:

The electronic, instrumentation, and materials laboratory is required to provide facilities and equipment for the calibration of test instruments attached to the vehicle. TV monitoring and photographic equipment require the servicing and processing facilities included in this building. The facility will house standards which have been checked against the standards of the National Bureau of Standards, and which will be kept at this facility under controlled conditions to assure that test equipment will be calibrated to optimum accuracy.

COST ESTIMATE:

		Fiscal Year 1963		Fiscal Year 1964
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		---		$135,000
Clearing and grading.....	---		$30,000	
Access roads and parking areas.....	---		90,000	
Utility connections.....	---		15,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$1,790,000		---
Electronics, instrumentation and materials laboratory building....	$1,790,000		---	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		409,000		2,256,000
Transducer service and calibration equipment..	409,000		800,000	
Test and monitoring instrument repair and standardization equipment.....	---		300,000	
Environmental and special bench laboratory equipment.....	---		516,000	
Materials laboratory.....	---		140,000	
Photographic optical equipment.....	---		500,000	
E. DESIGN AND ENGINEERING SERVICES.....		238,000		325,000
Total estimated cost....		$2,437,000		$2,716,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

F-1 ENGINE SYSTEMS TEST STAND

DESCRIPTION:

This project includes construction of a test stand, an extension of the waterways (or canal) from the main canal to the test stand, a cable tunnel, a high-pressure gas system, an observation bunker, and lighting and warning systems. The facility will be located in the vicinity of the S-IC complex and will utilize the S-IC test control center, propellant storage facilities, and stage storage building. A sketch of the facility is shown on the following page.

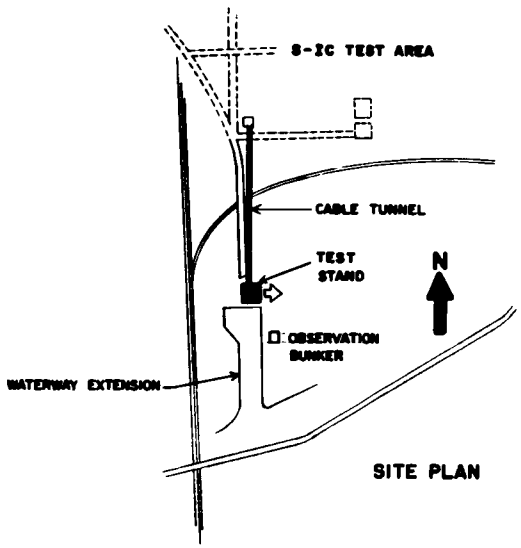
More detailed descriptions of the items that make up the project follow:

Test stand: The F-1 engine test stand will be a single position test stand with test evaluation and calibration capabilities for the full-duration static test firing of a single-unit F-1 engine of the 1.5-million-pound thrust class. The test stand will consist of substructure on piling, reinforced concrete superstructure, steel superstructure, aspirator, rolling deck load platform, elevators, booster placement derrick and work platform. The test stand substructure will be of reinforced concrete, cellular construction, founded on piling, will support the flame deflector and the reinforced concrete superstructure, and will provide areas for test service equipment and instrumentation cable tunnels. The reinforced concrete superstructure will support the steel superstructure, load platform, engine work platform, rolling deck and aspirator, and will house equipment pertinent to the testing operations. Elevators and stairways will be provided for access to the various levels.

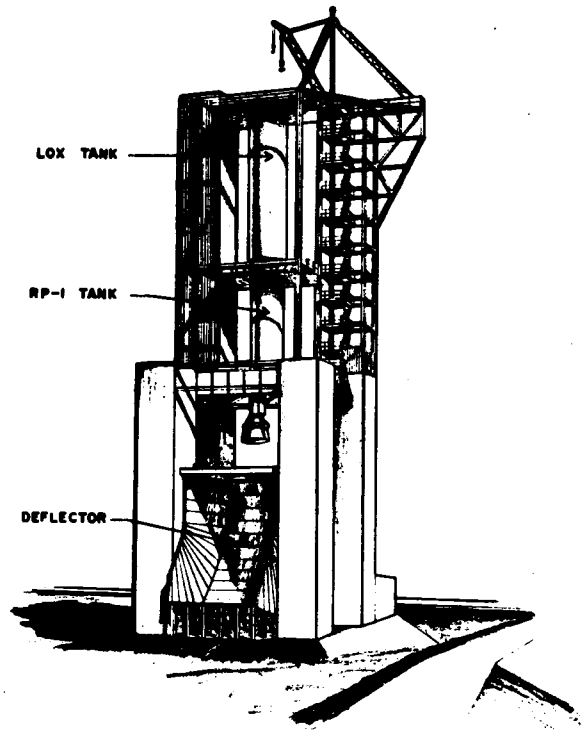
An aspirator will provide a pressure differential for the removal of combustion gases from around the engine area and will consist of two horizontal steel plates separated by steel supporting members. A rolling deck will provide a surface upon which the engine may be transported from its position to a location where it can be picked up by a derrick and lowered to the ground. During firings the rolling deck will be rolled clear of the flame area. Lighting, warning system, and fire protection compatible with the utilization of the area will be provided.

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

F-1 ENGINE SYSTEMS TEST STAND



SITE PLAN



Cable tunnel: A reinforced concrete underground cable tunnel will connect the F-1 engine test stand with the test control center in the S-IC complex and the data acquisition center.

Observation bunker: A reinforced concrete bunker will be provided for close-up observation of F-1 engine test firings.

Equipment, instrumentation and support systems:

High-pressure gas distribution systems: Valves, connections, distribution piping, and storage batteries are required to supply high-pressure gaseous nitrogen and helium to the test stand.

Propellant storage and transfer systems: Pumps, motors, switchgear, and auxiliary devices will be provided to off-load liquid oxygen from barge-mounted storage vessels to the vehicle tanks. Land-based RP-1 fuel storage vessels and the necessary pump, valves, and piping to transfer the RP-1 fuel from the storage vessel to the vehicle tanks are included in the project.

Propellant emergency dump system: An emergency means of disposal of propellants from vehicle tanks is required. RP-1 fuel will be returned to the storage vessels and the liquid oxygen will be dumped to a holding pond and allowed to vaporize.

High-pressure water: Valves, piping, and connections are required to supply high-pressure water for deflector cooling and off-stand and on-stand fire fighting systems.

Deflector: A flame deflector will be provided to divert the booster engine's exhaust away from the test stand so as to prevent injury to the test stand. The deflector will be of the open bucket, water-film cooled type and will be constructed of interconnected segments of closed steel box sections. High-pressure water will be supplied to the underside of the steel boxes, or manifolds, and will be sprayed into the flame area through holes in the manifold top plates.

Special systems: These systems will include conduits, cable trays, hardware cables, terminal racks, relay

racks and incidentals necessary for the ground support equipment which will support the power plant. The exact requirements cannot be determined until the final design stage, but the systems will be required at or near the end of the fiscal year 1964.

Recording units: These units will consist of strip chart recorder bay groups for the Advanced Saturn data acquisition facilities and will be primarily assignable to the F-1 test stand but may be used at other test stands. Their function will be to record static to low frequency signals generated by the test item. All additional quasi-static support equipment will be installed in the data acquisition facility.

Tape units: These units will consist of tape recorder bay groups for the Advanced Saturn data acquisition facility and will be primarily assignable to the F-1 test stand but may be used at other test stands. Their function will be to record medium to high frequency signals generated by the test item.

Oscillograph bay groups: These units will contain oscillograph recorders and associated control equipment for the Advanced Saturn data acquisition facility. They will be primarily assignable to the F-1 test stand and will record low and medium frequency signals generated by the item under test.

Patch and automatic switching: A system is required to provide for program patching and the selection of channels to readout devices. The system will also provide interselectivity of conditioning equipment. Automatic switching will provide means for rapid transfer of specific readout devices between the F-1 stand and other stands. Support for automation of both pretest and post-test, plus simulation testing, will be provided.

Analog/Digital system: A high-speed analog-to-digital data system capable of handling 150 channels is included in the project. The system is required for the updating and support of the F-1 stand. It will have the capability of recording on magnetic tape, punched tape, punched card, and teletype tabulation. It will be capable

of surveying, and preselecting alarm limits and performing the necessary logic deductions therefrom. Direct raw data recording which directly compares and converts the best fit characteristic curves to engineering units is possible with this system. Cathode ray tube bar graph readout on selectable channels will be included which will allow digital retransmission to remote indicators.

Cables, transmission, and distribution: The cable system will include the test stand and data acquisition facility distribution cables and the test stand to the data acquisition facility transmission cables and their terminal boxes, terminal racks, conduit, cable trays, and associated items. The system will provide the interconnecting circuitry between transducers, patch facilities, conditioning equipment and readout devices.

Conditioning and automatic calibration equipment: This equipment will provide means for passive transducer power supplies, zero and range adjustments, and a prechosen percentage of range-simulated voltages for pretest and post-test of transducers and readout devices.

Test and checkout equipment: This equipment will consist of portable laboratory devices utilized in preventive and corrective maintenance of electronic devices and equipment used in the instrumentation system.

Control equipment: Equipment is required to provide area coordinator control and displays; facility, service, and support services control circuitry; program sequential control and interlock indicator and control circuitry; remote instrumentation and red-line instrumentation of critical controls and parameters; camera and closed-circuit television controls and monitors; area operational intercommunications and paging; and visual, aural, and oral warning systems.

JUSTIFICATION:

The S-IC stage of the Advanced Saturn vehicle will be powered by five F-1 engines. Each independent engine comprises a separate subsystem. The compatibility of these subsystems with each other in all aspects is mandatory.

A single-engine F-1 stand is necessary for the stage contractor to solve problems arising with the individual engines by isolating and testing the one responsible for the malfunction. In the past, problems have arisen when engines are operated in clusters. Problems resulting from mating engines and stages, such as rerouting inlet or discharge lines from each engine, usually arise as the cluster is assembled. To determine whether the engine performance is affected, the new piping arrangement must be tested with the individual engine on the engine test stand.

The location of the single-engine stand at the Mississippi Test Facility will permit the stage contractor to locate and correct difficulties with his product at the stage assembly site. Other test stands in existence or which will become available are five stands located at the Edwards Air Force Base and one stand at the Marshall Space Flight Center. Because of workload, none of these stands can accommodate the work resulting from stage testing at the Mississippi Test Facility. The stands at Edwards will be completely committed to the development and acceptance testing of engines. The stand at Marshall will also be used to capacity in connection with the construction of three Advanced Saturn vehicles at the Marshall Center and the need to conduct long-range engine investigations on the F-1 engine. The movement of engines from the Mississippi Test Facility to alternate locations for tests would involve long-distance transportation, the possibility of damage to the engines, and would constitute a costly operation.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$500,000
Site preparation.....	$25,000	
Waterway extension.....	300,000	
Utility connections	100,000	
Roads.....	75,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		2,000,000
Foundation excavation	100,000	
Piles and pile cap.....	700,000	
Test stand.....	1,150,000	
Observation bunker (360 square feet at $139 per square foot).....	50,000	

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS...		$5,400,000
Deflector.....	$600,000	
Propellant transfer system.....	220,000	
Propellant emergency dump system.....	100,000	
High-pressure gas distribution systems	100,000	
High-pressure water.....	80,000	
Special systems.....	100,000	
Recording units.....	300,000	
Tape units.....	200,000	
Oscillograph bay groups.....	300,000	
Patch & automatic switching.....	400,000	
Analog/digital systems.....	650,000	
Cables, transmission and distribution.	200,000	
Conditioning and automatic calibration equipment.....	500,000	
Test checkout equipment.....	800,000	
Control equipment.....	850,000	
E. DESIGN AND ENGINEERING SERVICES.....		1,100,000
Total estimated cost.....		$9,000,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

MAINTENANCE FACILITIES

DESCRIPTION:

The facilities described herein will serve the general maintenance needs of the entire Mississippi Test Facility. A test maintenance shop, an automotive maintenance shop, and a marine terminal and repair facility will be constructed. Sketches of the facilities are shown on the following three pages. Equipment for all three facilities is included in the project. The facilities are described in greater detail below:

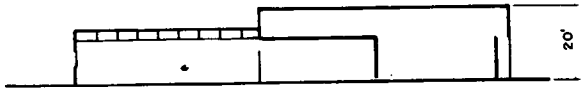
Test maintenance shop: This new facility will contain 32,800 square feet of gross building area and will be used for the maintenance of test stand equipment. The shop will consist of a high bay single-story structure with a lean-to on each side. Construction will be of a standard unprotected non-combustible-type consisting of a structural steel frame with precast concrete panel and insulated metal walls, concrete masonry partitions, concrete roof, and concrete floor slab. Space will be provided for a machine shop, a sheet metal shop, a welding shop, a pipe and tube shop, and a millwright shop. The shop will be heated and ventilated and will contain a sprinkler system for fire protection.

Automotive maintenance shop: This facility will be used for the repair, servicing, and fueling of vehicles and material handling equipment. The facility will consist of a single-story structure with a mezzanine. The total gross floor area will be 35,076 square feet consisting of 31,677 square feet of ground floor area plus 3,399 square feet of mezzanine floor area. Construction will be of a standard unprotected noncombustible-type consisting of a structural steel frame with insulated metal and concrete panel walls, concrete roof, concrete masonry partitions, and concrete floor slab. The facility will contain a repair and service section, a wash rack, a grease rack, a tire repair section, a heavy equipment section, a battery service area, storage areas, a parts and tool room, a welding shop, a body shop, a paint shop, offices, toilet and locker rooms, and a vending machine-equipped lunch room. In addition, an exterior steam cleaning area and a covered fuel pump area will be provided. The office area and lunch room will be air-conditioned and heated. The remainder of the building will be heated and ventilated.

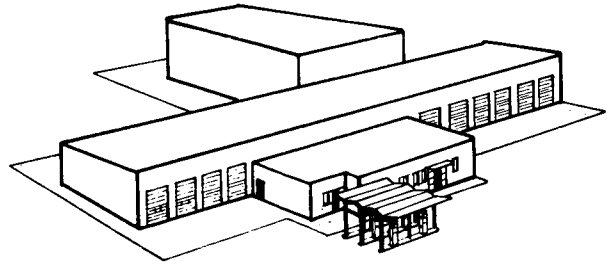
MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

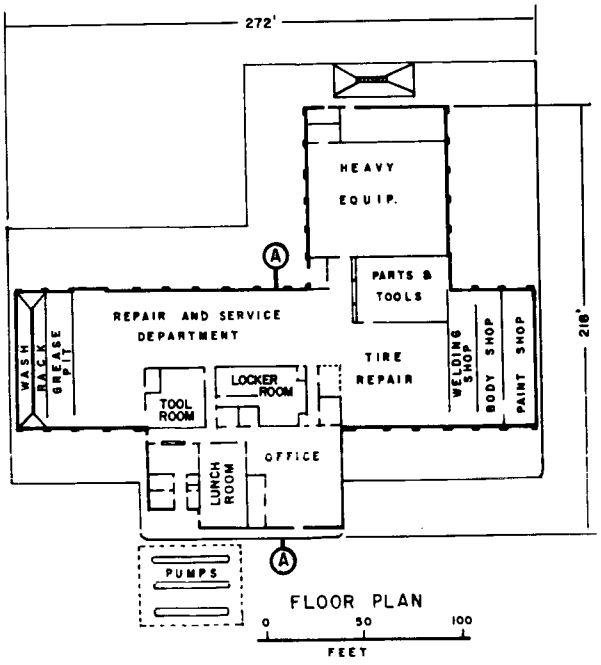
MAINTENANCE FACILITIES



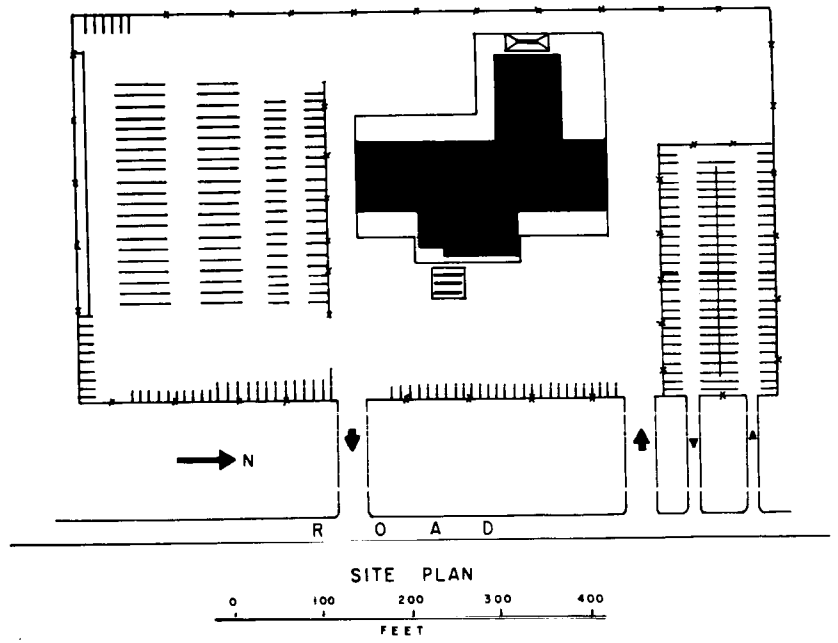
SECTION A-A



PERSPECTIVE



FLOOR PLAN

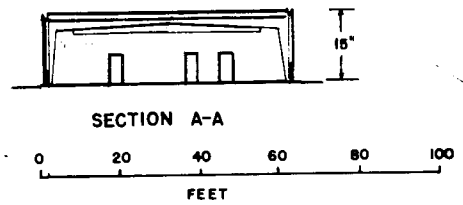


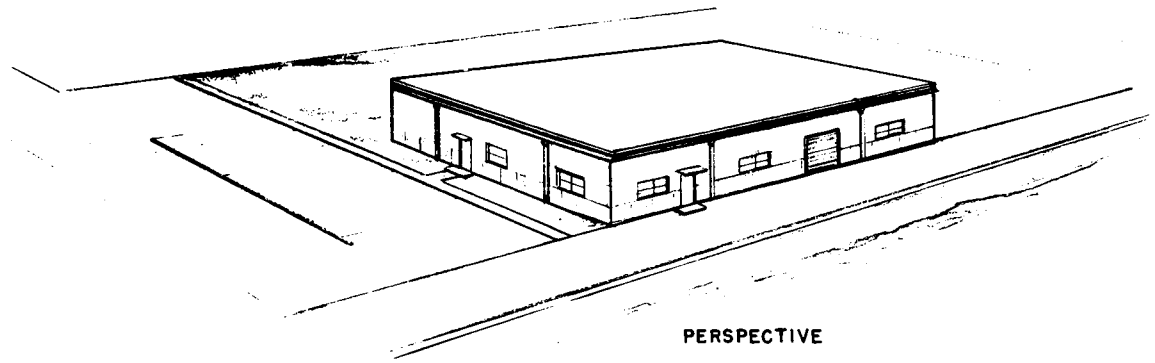
SITE PLAN

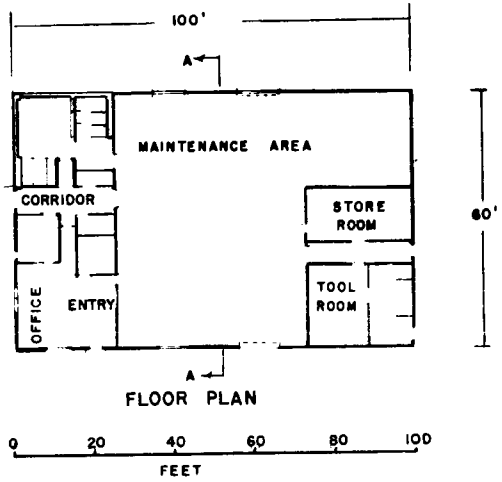
AUTOMOTIVE MAINTENANCE SHOP

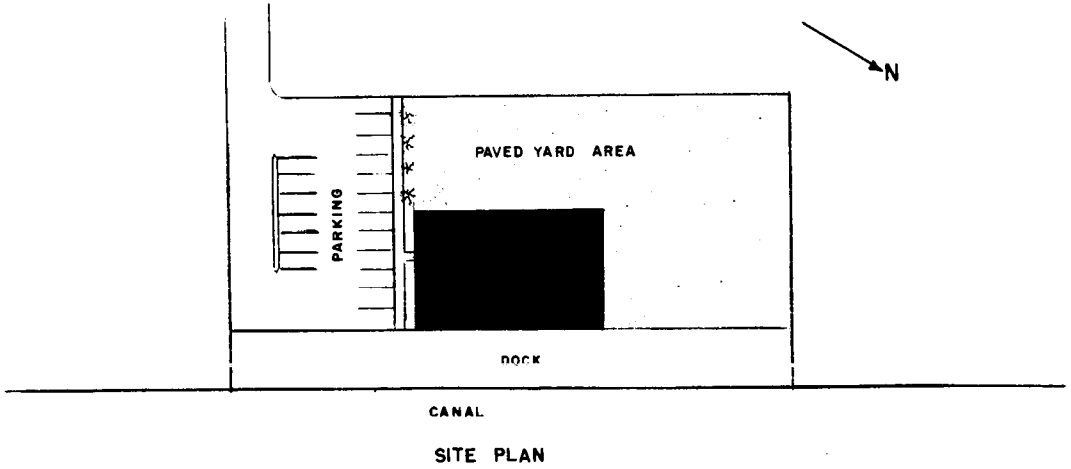
MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

MAINTENANCE FACILITIES







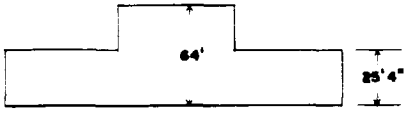


MARINE TERMINAL AND REPAIR FACILITIES

MISSISSIPPI TEST FACILITY

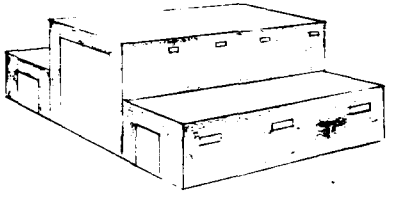
FISCAL YEAR 1964 ESTIMATES

MAINTENANCE FACILITIES

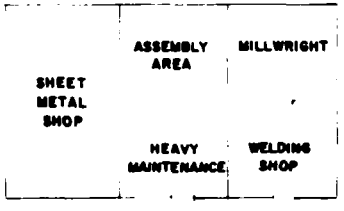


SECTION A-A

0 20 40 80 120 160
FEET

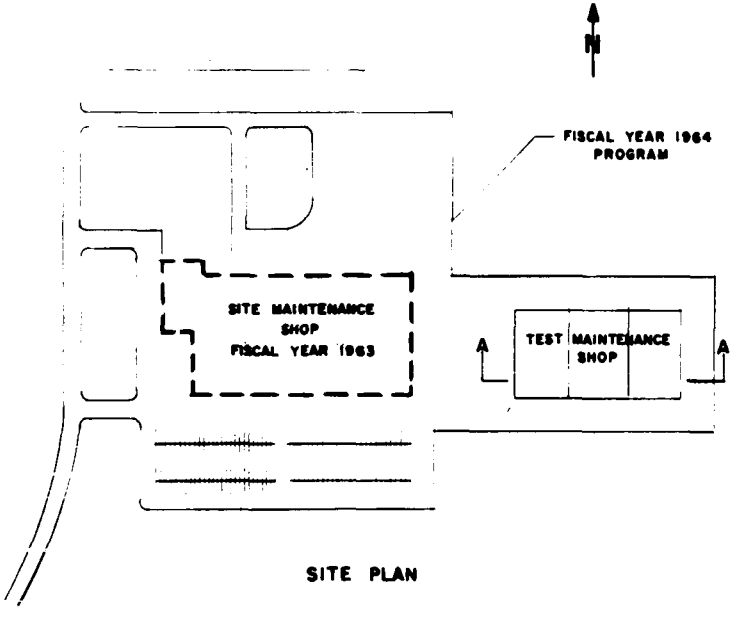


PERSPECTIVE



FLOOR PLAN

0 20 40 80 120 160
FEET



SITE PLAN

0 100 200 400
FEET

TEST MAINTENANCE SHOP

The grease pit, repair service, tire repair, welding shop and heavy equipment areas will be provided with an under floor exhaust system. The building will contain a sprinkler system for fire protection.

Marine terminal and repair facility: This building will provide facilities for minor repair work and will serve as a base for dispatching barge and tug personnel. The facility will consist of a single-story structure of 6,530 square feet of gross floor area. Construction will be of a standard unprotected noncombustible-type consisting of a structural steel frame with precast concrete panel and insulated metal walls, concrete masonry and wire mesh partitions, concrete roof and concrete floor slab. The facility will contain offices, toilet room, shower and locker rooms, maintenance area, store room, tool room and welding room. The office area will be air-conditioned and heated and the remainder of the facility will be heated and ventilated. A sprinkler system will be installed for fire protection. A dock will be provided adjacent to the facility.

JUSTIFICATION:

For the first phase of development the Mississippi Test Facility is comprised of the support area and the Advanced Saturn S-IC and S-II test complexes. The site is designed as a general base with self-contained service facilities.

Test maintenance shop: Test stands and their associated operations require maintenance space for equipment and other items required to meet test schedules. The test maintenance shop is necessary to provide this capability. The building will house equipment and personnel to support and maintain the facilities in the test complexes. Maintenance performed will be of a specialized nature that could not reasonably be expected to be obtained on the local market.

Automotive maintenance shop: The automotive maintenance shop is necessary to house all maintenance and repair facilities, as well as dispatching and administrative offices, for all mobile vehicles on the Mississippi Test Facility site. It is imperative that equipment be available when needed and that maximum utilization be obtained without delays. Such delays would be encountered if the equipment had to be towed or transported to outlying repair shops.

Marine terminal: The marine terminal is required to provide facilities for the repair of barges and tugs and as a base for dispatching barge and tug personnel. Using outlying local repair shops for such maintenance would result in serious delays and poor utilization of canal transportation.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$651,000
Site clearing and grading	$95,000	
Access roads, parking areas, and vehicle and equipment storage areas for the:		
Test maintenance shop	182,000	
Automotive maintenance shop	190,000	
Marine terminal and repair facility	33,000	
Electrical distribution	100,000	
Electrical substation	51,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		2,665,000
Test maintenance shop (65,500 square feet at $27.50 per square foot)	1,800,000	
Radio frequency interference suppression grounding	58,000	
Automotive maintenance shop (35,076 square feet at $17.75 per square foot)	623,000	
Radio frequency interference suppression grounding	19,000	
Marine terminal and repair facility (6,530 square feet at $24.60 per square foot)	161,000	
Radio frequency interference suppression grounding	4,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		2,195,000
Marine terminal and repair shop equipment	65,000	
Machine shop equipment	1,550,000	
Sheet metal shop equipment	160,000	

Welding shop equipment.....	$90,000	
Pipe and tube shop equipment.....	80,000	
Millwright shop equipment.....	160,000	
Automotive maintenance shop equipment..	90,000	
E. DESIGN AND ENGINEERING SERVICES.....		$476,000
Total estimated cost.....		$5,987,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

NAVIGATION LOCK

DESCRIPTION:

A navigation lock is required for the canal system serving the Mississippi Test Facility. The lock will be a masonry structure utilizing gravity or mass concrete walls and gate sills. The clear inside dimensions of the lock will be 110 feet by 600 feet. The lock is a standard size for river traffic prevalent in that area of the country and can accommodate normal commercial tows consisting of a tow boat and six commercial barges. The maximum lift will be 23 feet. A culvert-port type emptying and filling system utilizing reversed tainter valves will be incorporated in the design of the lock. Both the tainter valves and the miter gates will be hydraulically operated. Upper and lower guide walls, each 400 feet long, will extend upstream and downstream from one side of the structure to facilitate ingress to the lock.

A control house, complete with all necessary mechanical, electrical and fire protection equipment, will be constructed on an earth mound near one side of the lock. The control house will also control operation of the canal bridge. Two operating booths, one at the upper miter gate and one at the lower miter gate, will be installed on the lock wall adjacent to the mound. Construction of an access road, power line to the site, excavation for the lock and procurement of miter gates, tainter valves, and control equipment and machinery are also included in this project. Funding provided in the fiscal year 1963 budget is being used for the excavation for the lock, lock foundations, and for the procurement of control equipment for the gates and valves. The remainder of the project will be completed with the funds requested in this budget. Sketches of the lock are shown on the following page.

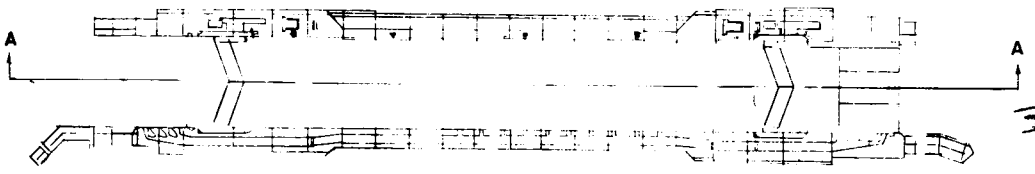
JUSTIFICATION:

The navigation lock is required to permit water craft to be raised and lowered between the East Pearl River and canal water levels. The lock is a necessary feature of the waterway system which will be used for transportation, by barge, of large space vehicle boosters, fuels, materials, and supplies from the East Pearl River to the test complexes at the Mississippi Test Facility. Road transportation of the stages within the Mississippi Test Facility is not feasible because of the increased risk to the stages by the unnecessary handling and transfer from barges to trailers. The use of barges, whereby the stages are loaded directly onto the test stands, will greatly minimize the handling risks.

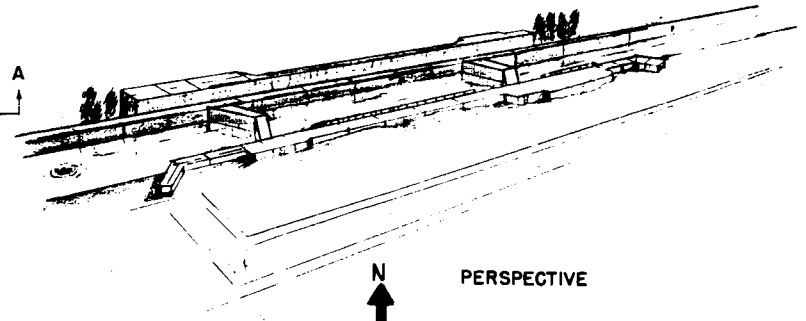
MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

NAVIGATION LOCK

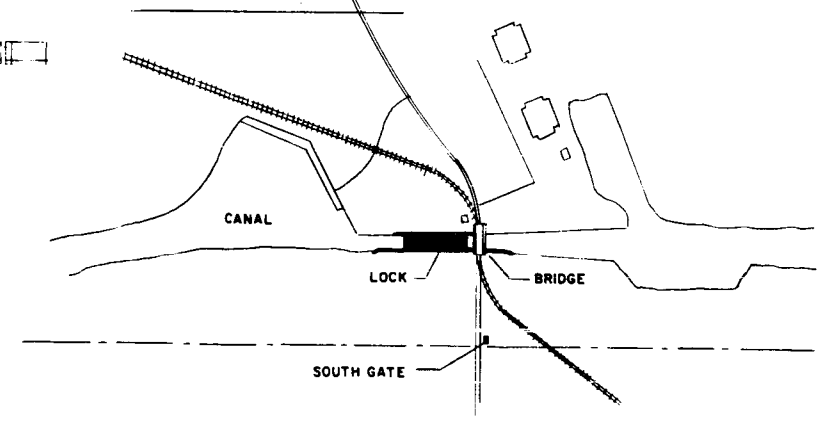


HALF PLAN AND SECTION THRU CULVERT



PERSPECTIVE

SECTION A-A

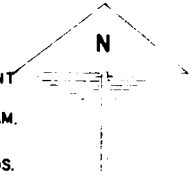


SITE PLAN

NOTE:

EXCAVATION FOR THE LOCK AND PROCUREMENT OF GATES, VALVES, AND MACHINERY WERE INCLUDED IN THE FISCAL YEAR 1963 PROGRAM.

THE REMAINDER OF THE PROJECT WILL BE ACCOMPLISHED WITH FISCAL YEAR 1964 FUNDS.



COST ESTIMATE:

		Fiscal Year 1963		Fiscal Year 1964
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$885,000		$565,000
Clearing and grading.	$25,000		---	
Excavation.....	750,000		---	
Backfill and surface protection.....	---		$100,000	
Access roads.....	10,000		---	
Drainage and under-seepage system.....	---		165,000	
Dewatering system....	100,000		---	
Electrical system....	---		300,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		450,000		4,590,000
Foundation piling....	450,000		---	
Concrete floors and walls.....	---		3,950,000	
Steel wing-walls and bulkheads.....	---		600,000	
Operating booths (two, 100 square feet each at $25.00 per square foot).....	---		5,000	
Control house (1,175 square feet at $30.00 per square foot).....	---		35,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		165,000		799,000
Hydraulic system.....	---		145,000	
Gates and valves.....	---		500,000	
Gate and valve control equipment.....	165,000		104,000	
Fire-protection system..	---		50,000	
E. DESIGN AND ENGINEERING SERVICES..		188,000		650,000
Total estimated cost.....		$1,688,000		$6,604,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

SECURITY CONTROL FACILITIES

DESCRIPTION:

Security control centers and guard buildings are proposed to be constructed at the main entrances to the Mississippi Test Facility. The major items in the project are described below and are shown in the drawings on the following two pages:

Security control centers: These buildings will provide reception and security facilities for clearance requirements of personnel working in or visiting the test area. The south entrance security control center will consist of a single-story structure containing approximately 6,535 square feet of gross floor area. Construction will be standard unprotected noncombustible type consisting of a structural steel frame with precast concrete panel walls, concrete masonry partitions, concrete roof and concrete floor slab. The building will be designed for 0.95-pounds-per-square-inch blast pressure. The facility will contain a waiting area, offices, file room, badging area, public telephone room, visitors' toilet rooms, employee toilet and locker rooms, and vending machine-equipped lunch rooms. The building will be air-conditioned and heated. The north entrance security control center will be similar to the south entrance security control center except there will not be any provisions for badging. The building will be about 3,790 square feet in area.

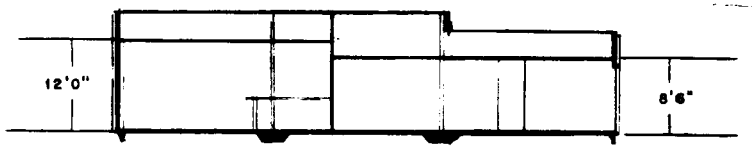
Guard buildings: Four new buildings will be constructed to provide personnel and vehicle traffic control at the main gates. Guards housed in the buildings will admit authorized persons and direct persons not possessing personnel badges and car passes to the security control center, and will direct traffic. The facilities will consist of two guard buildings at the north entrance and two guard buildings at the south entrance. Construction will be standard unprotected noncombustible type consisting of a structural steel frame, metal and concrete walls, concrete roof and concrete floor. One building at both main gates will have 15-foot roof extensions on two opposite sides over the traffic lanes.

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

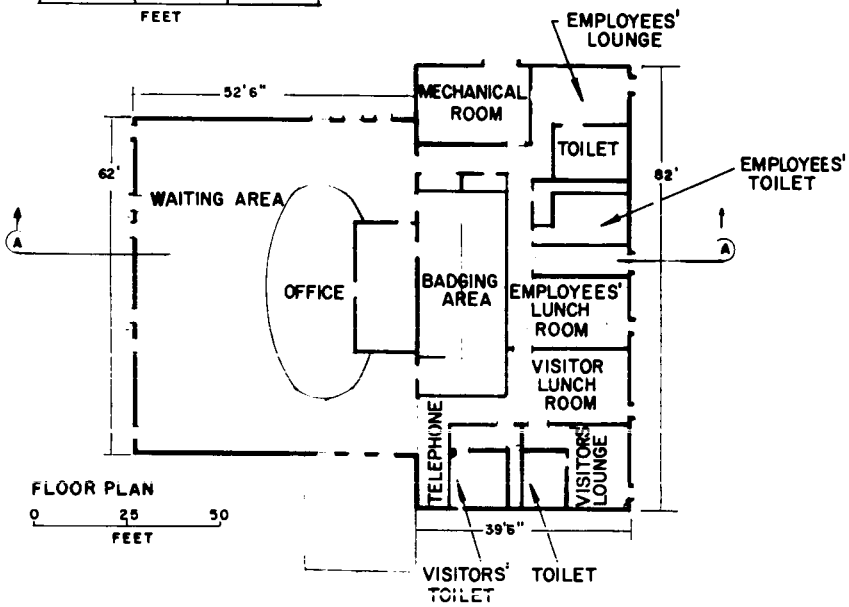
SECURITY CONTROL FACILITIES

PERSPECTIVE



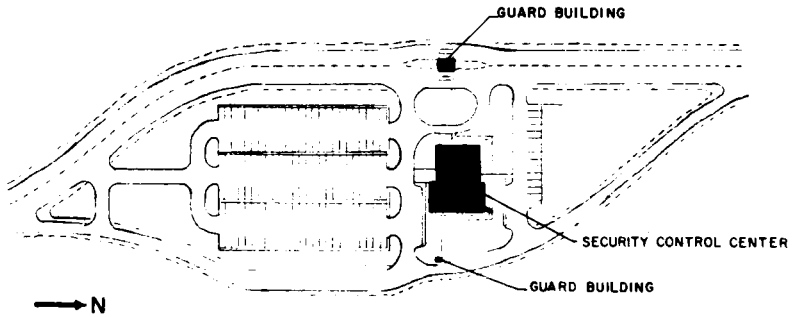
SECTION A-A

0 25 50 75
FEET



FLOOR PLAN

0 25 50
FEET



SITE PLAN

0 50 100 200 300
FEET

SECURITY CONTROL CENTER (SOUTH)

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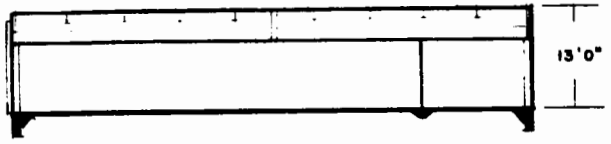
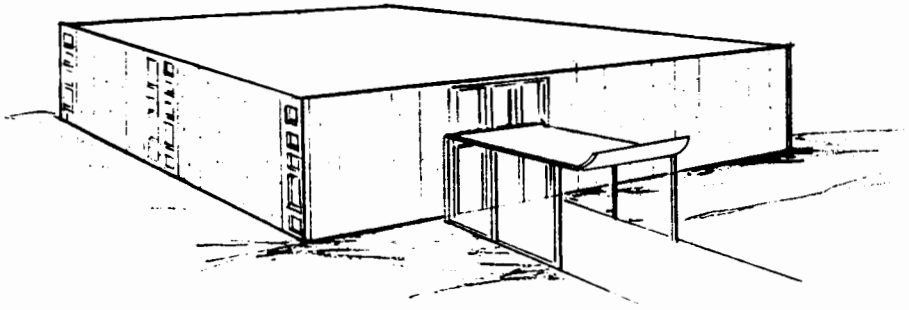
MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

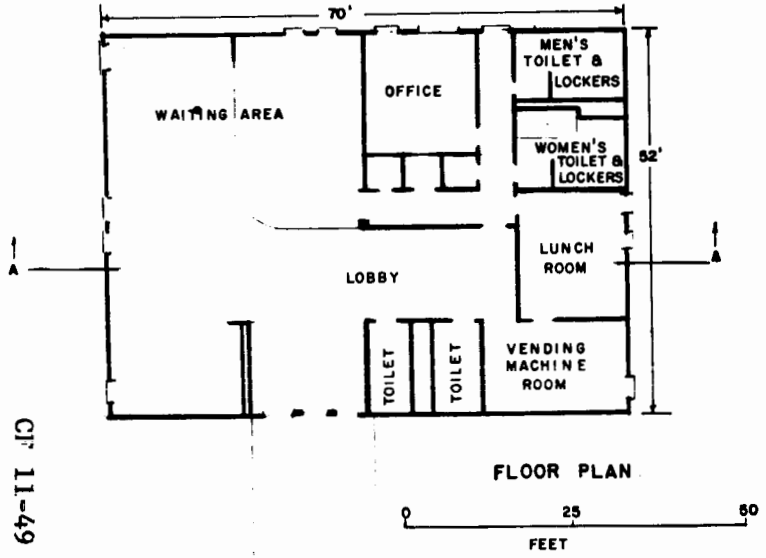
SECURITY CONTROL FACILITIES



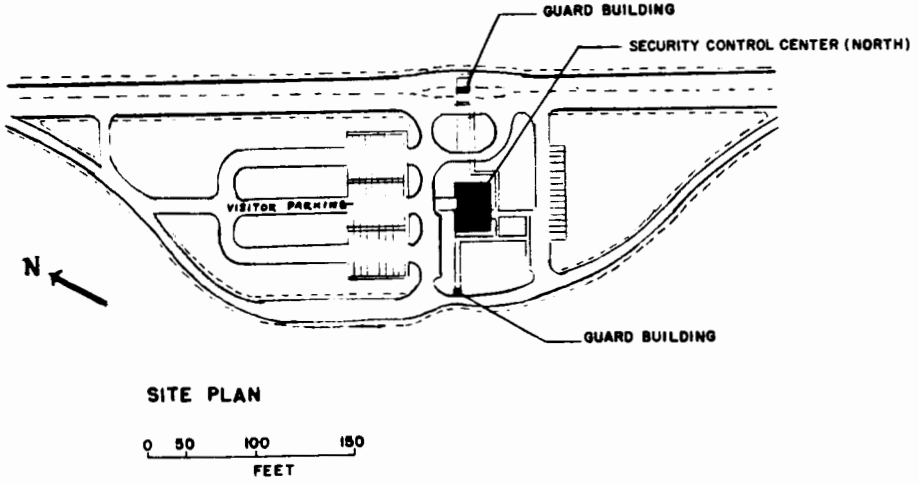
SECTION A-A



PERSPECTIVE



FLOOR PLAN



SITE PLAN

SECURITY CONTROL CENTER (NORTH)

JUSTIFICATION:

The Mississippi Test Facility is grouped into two general areas, one for operating test complexes and one for administrative and support buildings, and laboratories for stage contractors and other technical personnel. Support facilities and provisions for operational security are necessary for proper site management.

The security control centers at the main gate are required as operation offices for security police, as waiting rooms for visitors, and as pass issuance facilities. No other space is provided for this control. Visitors' control and pass issuance to the various stage test complexes and support facilities will require accommodations at each main gate for 150 persons. These people will consist of government or stage contractor official visitors, manufacturers' representatives and salesmen, employment seekers, deliverymen and messengers from companies located outside the test area, tourists and unofficial visitors unaware of security regulations, and cleared personnel awaiting transportation. Due to the distances involved, it is anticipated that, in many cases, personnel assigned to the Mississippi Test Facility will meet with visitors at the security control center instead of having the visitors cleared and transported into the test area, thereby increasing the load on security control center accommodations. Four guard buildings are required at the gate entrances to the area. These small structures are necessary to house guards who check the credentials of incoming and outgoing employees and visitors.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$272,000
Clearing and grading	$75,000	
Roads	107,000	
Parking areas	50,000	
Lighting	40,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		311,000
North entrance security control center (3,790 square feet at $26.10 per square foot)	100,000	
Radio frequency interference suppression grounding	2,000	
South entrance security control center (6,535 square feet at $28.35 per square foot)	192,000	
Radio frequency interference suppression grounding	4,000	
Guard building (Four; 216 square feet at $15.00 per square foot)	13,000	

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$17,000
Office equipment.....	$17,000	
E. DESIGN AND ENGINEERING SERVICES.....		75,000
Total estimated cost.....		$675,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

SONIC MEASURING FACILITIES

DESCRIPTION:

The facilities described herein will be used to determine and predict noise propogation and to schedule rocket test firings. An acoustic laboratory and a meteorological building will be provided. Sketches of the facilities are shown on the following two pages. The major items in the project are described below:

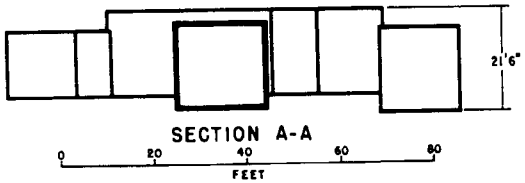
Acoustic laboratory: A new structure will be constructed to provide facilities for the testing, repair, and calibration of instruments used for measuring sound phenomena, and for the housing and dispatching of acoustic vans. The laboratory will consist of a one-story facility of approximately 7,990 square feet of gross floor area contained in two separate structures joined by a covered passage. Construction will consist of a structural steel frame with precast concrete panel walls, concrete and concrete masonry partitions, concrete roof and concrete floor slab. The facility will contain office space, laboratory areas, equipment storage, data reduction laboratory, anechoic room, toilet facilities, acoustic van room, vending machine-equipped lunch room, and a separate high-intensity sound testing annex complete with office and toilet room. The anechoic room within the main building will be completely insulated structurally from the remainder of the building. The facility will be air-conditioned and heated and will contain a sprinkler system for fire protection.

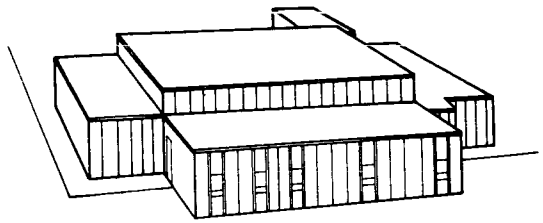
Meteorological building: This building will provide facilities for securing, recording, evaluating, and transmitting accurate meteorological data. The building will consist of a one-story structure of 4,113 square feet of gross floor area. Construction will be standard noncombustible-type consisting of precast concrete panel walls (insulated metal siding for balloon inflation room), concrete masonry partitions, concrete roof and concrete floor slab. The facility will contain an office, data receiving room, far-field acoustics room, maintenance room, storage room, balloon inflation room, and a toilet and locker room. The building will be air-conditioned and heated and a sprinkler system will be installed for fire protection.

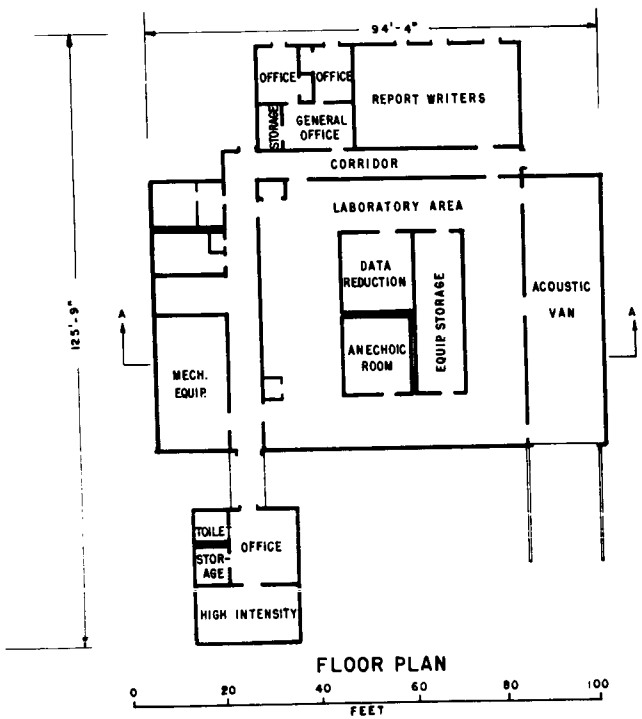
Acoustic laboratory equipment: Laboratory equipment for the testing, calibration, and repair of instruments used for the measurement of sound phenomena will be provided.

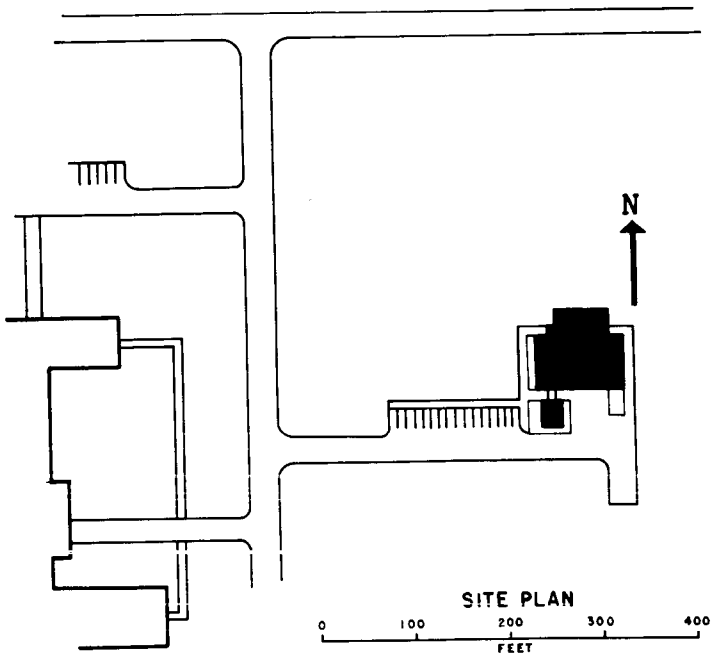
MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

SONIC MEASURING FACILITIES





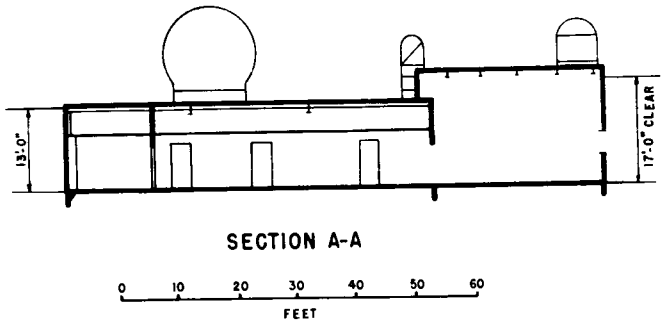




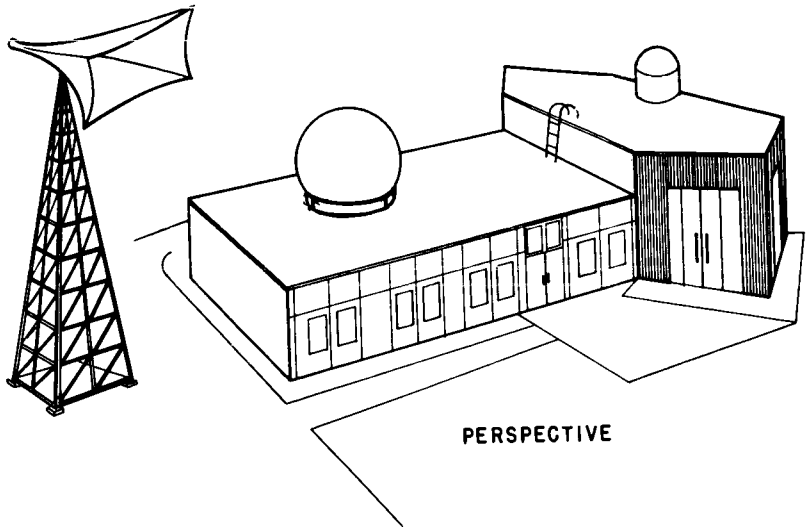
ACOUSTICS LABORATORY

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

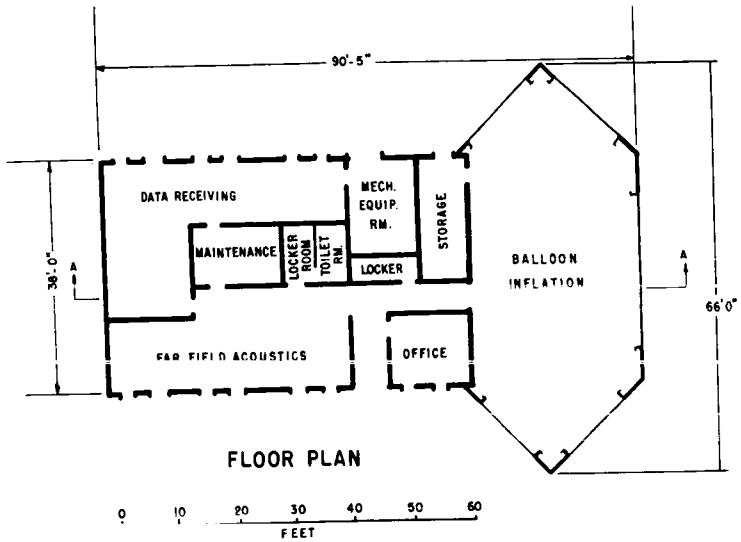
SONIC MEASURING FACILITIES



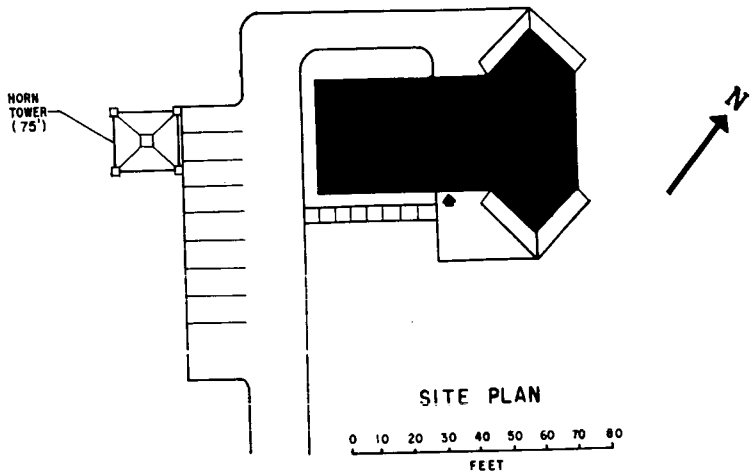
SECTION A-A



PERSPECTIVE



FLOOR PLAN



SITE PLAN

METEOROLOGICAL BUILDING

Meteorological equipment: Equipment is required for releasing weather balloons; obtaining, receiving, recording, and evaluating meteorological data; transmitting data to other areas at the test site; generating and propogating noise for correlation with meteorological conditions; and for receiving, recording, and evaluating acoustic data from remote locations.

JUSTIFICATION:

During certain atmospheric conditions, sounds generated during static firings of rocket engines and boosters could be harmful to operating personnel and to people residing in nearby areas. Consequently, selective firing under favorable weather conditions is a requirement to preclude injury to personnel and equipment. The meteorological and acoustic laboratories are required for gathering weather and sound data that can be used to schedule tests during favorable conditions. The acoustic laboratory will be equipped to check performance of equipment at various sound levels. In order to monitor the sounds at various points in the fee area and in populated areas nearby, trucks with sound data-gathering equipment will be stationed at various points during test firings. The proposed facility will be required prior to activation of the S-II test stand.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$185,000
Grading and filling	$25,000	
Access roads and parking areas	85,000	
Lighting	15,000	
Electric substation	60,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		510,000
Acoustic laboratory (7,990 square feet at $38.00 per square foot)	305,000	
Radio frequency interference suppression grounding	10,000	
Meteorological building (4,113 square feet at $39.00 per square foot)	160,000	
Radio and radar circuits	5,000	
Radio frequency interference suppression grounding	5,000	
Compressor building (300 square feet at $8.30 per square foot)	2,500	
Horn tower	22,500	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		870,000

Acoustic laboratory equipment:		
Data acquisition system.....	$110,000	
Data reduction system.....	240,000	
Microphone calibration system.....	30,000	
High-intensity room equipment.....	25,000	
Ancillary electronic equipment and instrumentation.....	30,000	
Meteorological equipment:		
Tape recorder system.....	75,000	
Radar system.....	135,000	
Far-field acoustic monitoring system....	150,000	
Acoustic horn system.....	50,000	
Compressor building equipment.....	25,000	
E. DESIGN AND ENGINEERING SERVICES.....		$195,000
Total estimated cost.....		$1,760,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

TRANSPORTATION AND PARKING FACILITIES

DESCRIPTION:

Additional roads, railroads, and parking facilities are required for the Mississippi Test Facility. The location of the roads and railroads is shown in the sketch on the following page. Descriptions of the required items follow:

Roads: The roads to be constructed in the fiscal year 1964 program will consist of approximately 70 miles of additional primary, secondary, tertiary, and patrol roads. Primary roads serve as main distribution arteries for all types and weights of vehicles. Secondary roads supplement the primary roads by providing access to, between, and within various areas and accommodate a reasonable volume of light-weight vehicles and an occasional maximum size vehicle. Tertiary roads supplement the secondary roads by providing access to individual units of facilities in an area and accommodate the traffic expected at the individual facility served. Patrol roads provide access to various areas for surveillance and security and will accommodate light traffic.

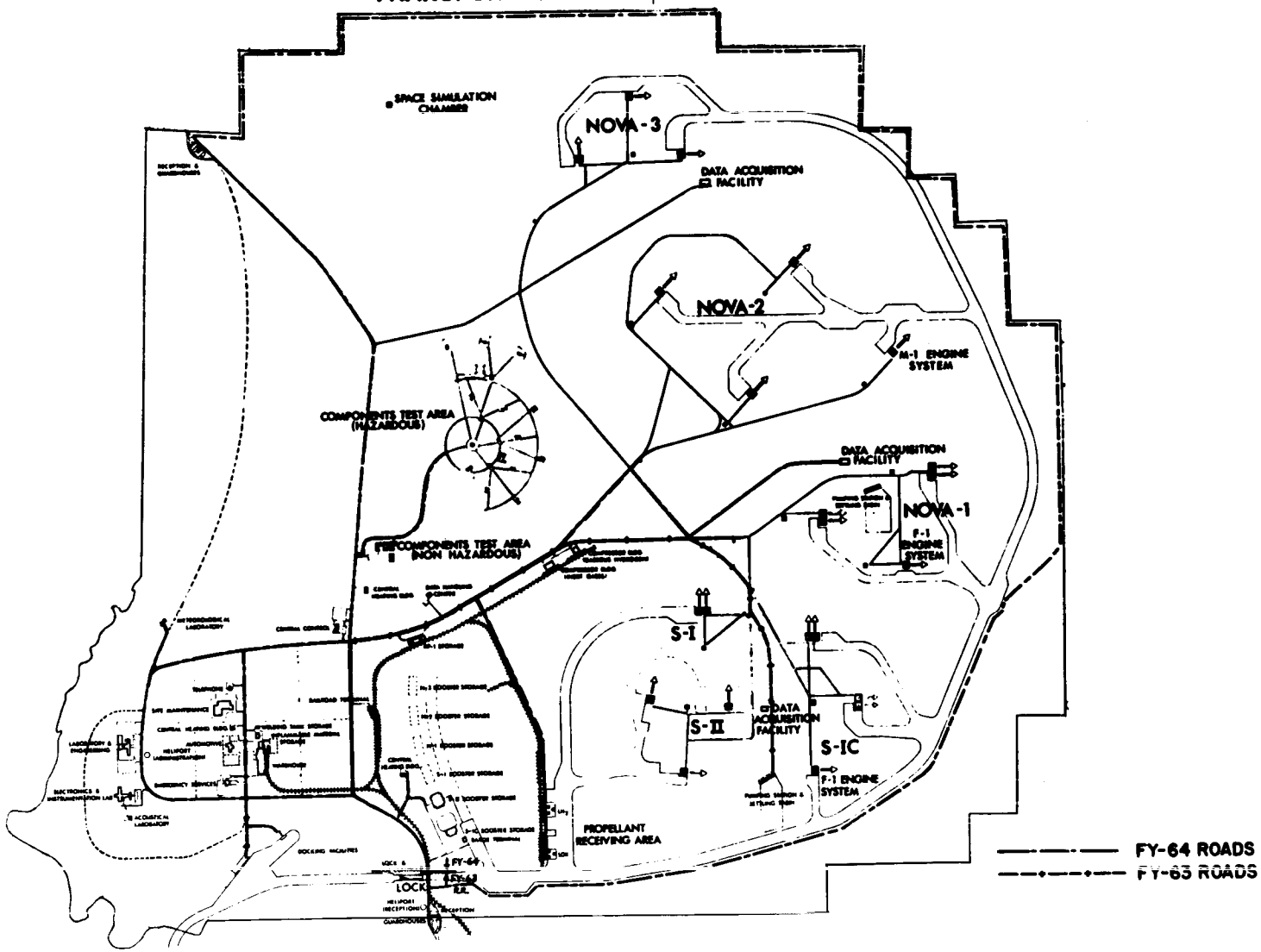
Railroads: The railroads to be constructed in the fiscal year 1964 program will consist of approximately 5 miles of internal railroad, railheads and spurs, including earthwork, ballast, ties, track and accessories. These railroads will connect warehouses, propellant storage areas, cryogenic areas, fuel storage areas, river docks, and offsite railroads. All this work will be within the fee area since offsite railroads were provided in the fiscal year 1963 program.

Parking facilities: Paved areas for parking approximately 2,800 vehicles will be provided for 5,200 employees and visitors in the vicinity of the administrative facilities of the Mississippi Test Facility.

Relocation of State highway No. 43: A new highway with 24-foot pavement width and 10-foot shoulders, and all necessary clearing and grubbing, embankments, storm drainage systems, and bridges will be constructed around the eastern side of the Mississippi Test Facility, a distance of approximately 12 miles. Funds will be transferred to the State of Mississippi Highway Department which will accomplish standard design and construction of the highway.

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

TRANSPORTATION AND PARKING FACILITIES



ROADS AND RAILROADS

JUSTIFICATION:

The Mississippi Test Facility is located in an area of approximately 13,500 acres in which the facilities will be widely scattered because of the high noise levels which will exist during test firing, and because of the potential danger of explosions. Stage contractors and their related test facilities have been placed in separate test complexes. The complexes have been grouped for maximum provision for early utilization and with provisions for future expansion to accommodate Nova-type vehicles. Administrative laboratory facilities have been grouped outside the maximum noise level.

Adequate roads must be constructed for the transportation of operating personnel and material for the technical areas, and administrative and technical personnel for the support complexes associated with the activation of the S-IC and S-II test complexes.

Railroads within the fee area are required to provide rail services for handling construction equipment, building materials, propellants, gases, and general supplies.

On-site parking must be provided due to the remote location, which makes the use of private vehicles the most practicable means of transportation for employees, contractor representatives and visitors.

Mississippi State Highway No. 43 presently crosses the fee area in a north-south direction. In order to provide maximum usage and security during the operation of the Mississippi Test Facility, it will be necessary to close the site to public traffic. Funds are being requested to cover the costs of relocating the State Highway No. 43. The existing highway will then serve as the main access road to the site in the north-south direction.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$6,895,000
Patrol roads (50 miles at $ 6,000 per mile).....	$300,000	
Primary dual-lane roads (5 miles at $300,000 per mile).....	1,500,000	
Primary single-lane roads (10 miles at $150,000 per mile).....	1,500,000	
Secondary and tertiary roads (5 miles at $125,000 per mile).....	620,000	
Railroads (5 miles at $94,000 per mile).....	470,000	
Vehicle parking (2,800 spaces).....	555,000	
Relocation of State Highway No. 43 (12 miles at $160,000 per mile)....	1,950,000	

C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....	---
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	---
E.	DESIGN AND ENGINEERING SERVICES.....	$690,000
	Total estimated cost.....	$7,585,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

UTILITY ADDITIONS AND EXTENSIONS

DESCRIPTION:

Fiscal year 1963 funding provided the basic initial requirements for utility installations at the Mississippi Test Facility. The fiscal year 1964 increment requested in this project consists of additions, expansions, and extensions to round out and complete the various utilities required to serve the Advanced Saturn stage test and support facilities requested under another project heading. The scope of work includes:

Potable water system additions and extensions: Additional wells, storage reservoirs, water distribution mains, valves, building service lines, and treatment facilities will be installed.

Electrical distribution system extensions: This item extends the 13.8 kv three-phase distribution system using overhead lines on wood poles except in radio frequency interference critical areas, catastrophic explosion areas, and at canal crossings. In these areas, underground construction will be necessary.

Natural gas distribution system extensions: The gas distribution system will be extended via underground pipes.

Sanitary sewer collection and treatment additions and extensions: This item consists of additional sewage treatment facilities, pumping stations, sanitary sewer mains, and branches.

Area lighting: The project includes area lighting for three-shift operation and will include the lighting of streets, parking areas, storage facilities, and other ancillary items.

Communication and telephone lines: Underground duct systems will be extended for the following systems: fire alarm, operational intercommunications, site-wide control, telephone, test instrumentation, and television.

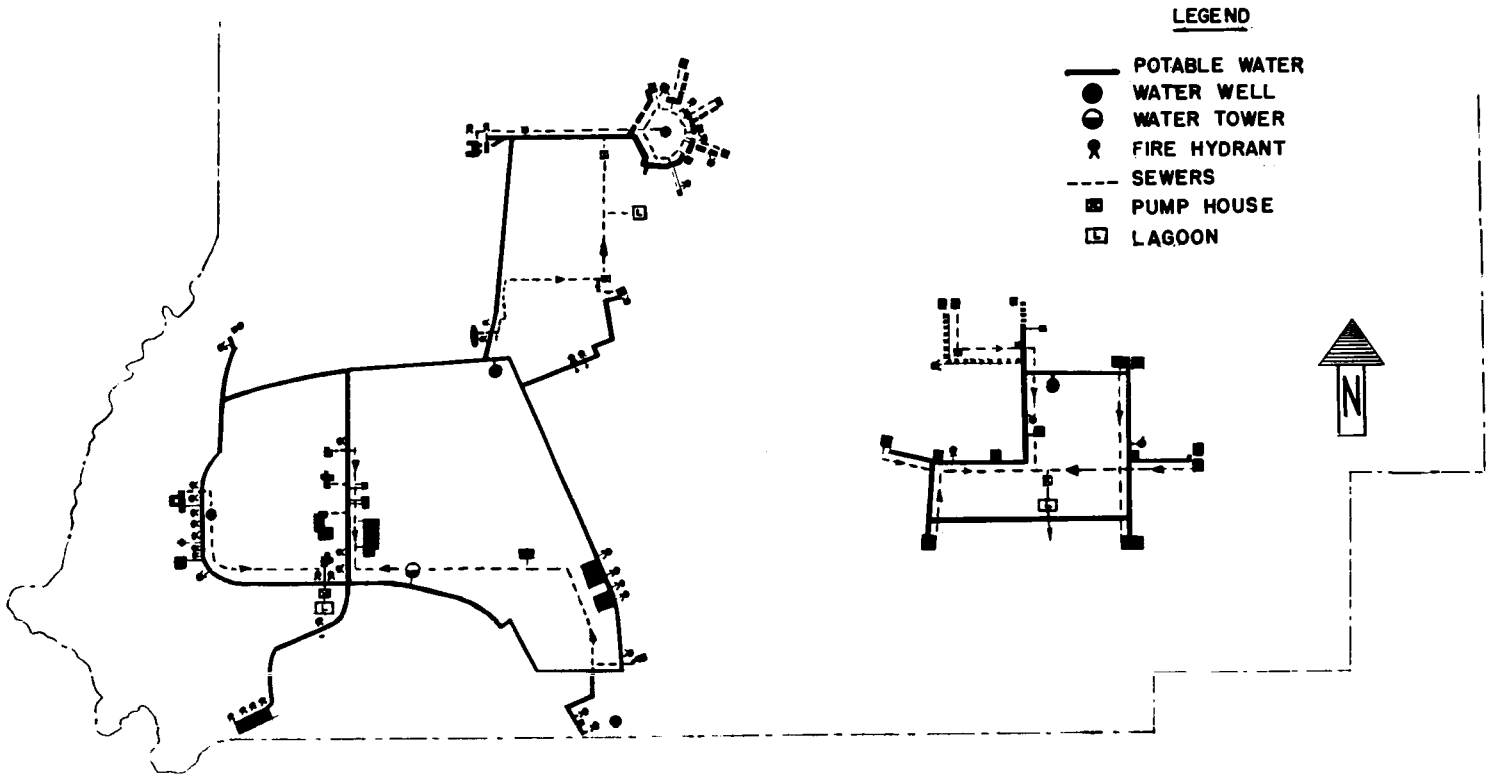
High-pressure air and nitrogen distribution: A centralized pumphouse and vaporizer will be installed to receive liquid nitrogen from railroad tank cars, and to convert the nitrogen into a gas at 6,000 pounds per square inch for distribution to storage tanks located at each site.

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

UTILITIES

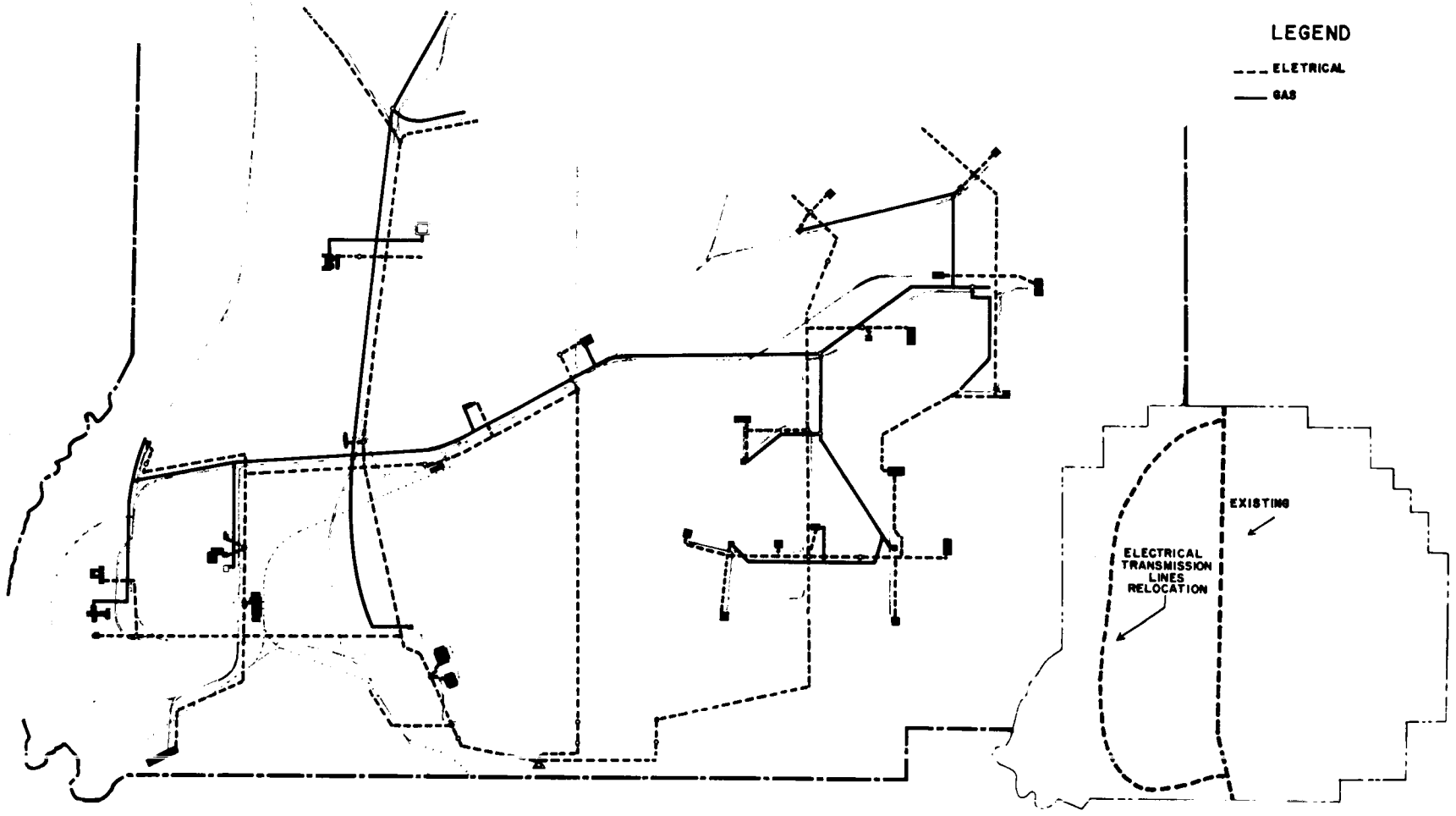
POTABLE WATER SYSTEM
SANITARY SEWER COLLECTION AND TREATMENT



MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

UTILITIES

ELECTRICAL DISTRIBUTION SYSTEM
NATURAL GAS DISTRIBUTION SYSTEM
RELOCATE ELECTRICAL TRANSMISSION LINES



ELECTRICAL RELOCATION

CF 11-63

Heating plant and distribution: Additional boilers, equipment, and heating distribution systems will be required.

Cryogenic transfer station: This item covers the facilities required to transfer liquid oxygen and liquid hydrogen from the supplier to barge-mounted storage facilities.

RP-1 fuel transfer station, storage, and distribution: The project includes facilities for the unloading of RP-1 fuel from barges, tank trucks, and railroad tank cars to a central storage area. The central storage area will be used to distribute fuel to all the test stands in the Mississippi Test Facility. The barge unloading dock will be near the border of the fee area. The trucks and railroad tank cars will unload next to the central storage area. The storage tanks will have a capacity of approximately 1,500,000 gallons, one third of the monthly fuel demand during maximum testing operations.

Communication and warning system: This item provides for the installation of cables, area visual and oral warning systems, and interconnections to the control center.

Central compressor equipment: The project includes funding for the procurement and installation of compressors for the liquid nitrogen, gaseous helium, and liquid hydrogen equipment to be installed in the central compressor houses. Liquid nitrogen will be pumped and vaporized to 6,000 pounds per square inch. **Gaseous helium will be compressed to 600 pounds per square inch. Liquid hydrogen will be pumped and vaporized to 6,000 pounds per square inch. Distribution will be to the individual complex storage tanks.**

Relocate underground telephone: It will be necessary to relocate telephone company-owned 115 kv and 46 kv transmission lines traversing the site because of interference with new facilities being constructed.

JUSTIFICATION:

The Mississippi Test Facility site is located in a rather remote area approximately 30 miles from the nearest major city. Hence, many on-site utility services are required. Especially important is the necessity for providing utilities to each facility and building upon their activation. Justification of the various features of this project follow:

Potable water system: An adequate supply of potable water in all buildings and working areas is required to safeguard the health, safety, and comfort of all personnel. Potable water will be used for fire protection in all buildings. Completion of an operating potable water system in each building and at each area is required prior to occupancy.

Electrical distribution system: The electrical distribution system is required to serve all buildings and areas for use in lighting, for the operation of instrumentation and control equipment, and for power for all principal equipment.

Natural gas distribution system: Natural gas is the most economical source of energy for space heating, and for air conditioning, if absorption units are utilized.

Sanitary sewer collection and treatment: A sanitary sewer system serving each building, including a sewage treatment system, is required prior to occupancy.

Area lighting: Because of the need to produce and test the space vehicles as fast as possible, much of Mississippi Test Facility will be operated on a twenty-four hour basis. For this reason, each work area will require adequate lighting for night operation. Certain other areas also require lighting for safety or security reasons.

Communication and telephone lines: Good communication is essential for efficient operation. Because of the relatively remote location of the Mississippi Test Facility and the wide dispersal of buildings, telephone and radio will provide the most efficient and economical means of communication.

High-pressure air and nitrogen distribution and central compressor equipment: High-pressure air and nitrogen will be needed in all areas for operation, testing, or purging of equipment. A centrally-located compressor and storage station with distribution to all areas is the most efficient and economical means of providing this service.

Heating plant and distribution: A central plant with undergrcund distribution lines to the individual buildings is proposed.

Cryogenic transfer station: Liquid oxygen and liquid hydrogen are cryogenic propellants used in test-firing rocket engines. The primary delivery and storage system is by water barge. An alternate method of delivery of these propellants to the site will be by truck or rail to a central transfer station

which will house pumps and equipment for transfer of the propellants to the barges. Cyrogenics can be delivered by truck or by rail to meet emergency situations, or to accommodate regular shipments from small suppliers who cannot ship in sufficient quantities to justify barge delivery.

RP-1 fuel transfer station, storage and distribution: Large quantities of RP-1 fuel will be used in test firing the rocket engines. The fuel will be delivered by barge, rail, or truck and will then be transferred to underground tanks for storage. The fuel will then be transferred to the booster tanks on the test stands as needed. Completion of the transfer station, storage, and distribution system will be required prior to activation of the S-II test stand.

Communication and warning system: A communication and warning system is needed to provide operational intercom and oral warning systems. The oral warning system will consist of essentially independent loud speaker subsystems within each complex area and each support building. These facilities are necessary to issue oral and aural announcements, warnings, and operational instructions. The operational intercom system will require twenty channels common to all stations within an operational area. Trunk lines need to be installed to permit site-wide intercom. An all-electronic system with station amplifiers is required.

Relocate underground telephone and electrical transmission lines: Underground telephone and transmission lines are presently crossing the Mississippi Test Facility fee area and areas where construction will require deep excavation. In order to prevent damage and disruption of service, it will be necessary to relocate these lines away from these areas prior to the start of construction.

COST ESTIMATE:		Fiscal Year 1963	Fiscal Year 1964
A. LAND ACQUISITION.....		---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$4,140,000	$4,170,000
Roads.....	$600,000	---	
Dredging, river..	200,000	---	
Parking, vehicle.	140,000	---	
Railroads.....	1,200,000	---	

		Fiscal Year 1963		Fiscal Year 1964
Potable water supply and distribution...	$370,000		$670,000	
Electrical distribution system.....	1,050,000		1,550,000	
Natural gas distribution.....	100,000		150,000	
Sanitary sewer collection and treatment.....	480,000		225,000	
Area lighting....	---		125,000	
Communication and telephone lines.	---		400,000	
High-pressure air and nitrogen distribution system.....	---		500,000	
Relocate underground telephone lines.....	---		50,000	
Heating distribution system.....	---		500,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$3,635,000		$710,000
Office and administration building.....	1,560,000		---	
Docks, river.....	500,000		---	
Central heating plant.....	300,000		---	
Maintenance building.....	1,000,000		---	
Emergency service building.....	275,000		---	
Fuel transfer station, storage, and distribution.	---		210,000	
Cryogenic transfer station.....	---		500,000	

		Fiscal Year 1963		Fiscal Year 1964
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$550,000		$950,000
Maintenance shop equipment.....	$450,000		---	
Emergency service equipment.....	100,000		---	
Communication and warning system.	---		$400,000	
Central compressor equipment.....	---		250,000	
Heating plant equipment	---		300,000	
E. DESIGN AND ENGINEERING SERVICES.		392,000		729,000
Total estimated cost..		$8,717,000		$6,559,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

WAREHOUSE ADDITION AND STORAGE FACILITIES

DESCRIPTION:

The facilities described herein will serve the entire Mississippi Test Facility. Initial funding was provided in the 1963 program and the facilities will be completed with the funding proposed in this project. Storage, work, and office areas for receiving, inspecting and storing all materials and supplies, except missile-related materials, will be provided. Sketches of the facilities are shown on the following two pages. The major items that make up this project are described below:

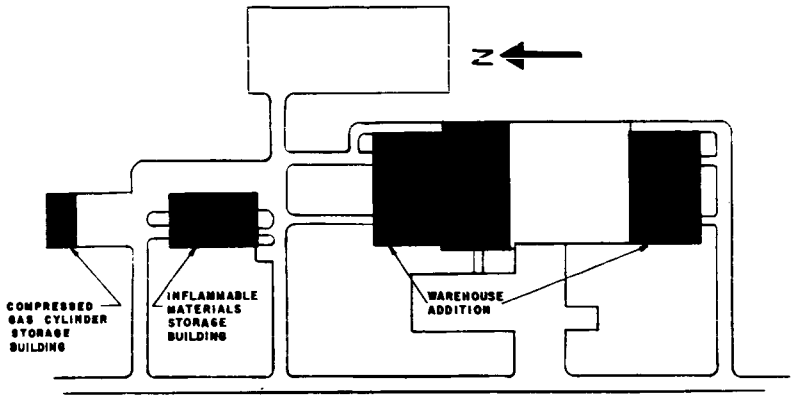
Warehouse addition: An additional 108,200 square feet of building area affixed to the warehouse funded in the fiscal year 1963 program is required. Approximately 32,400 square feet will be added to the south end and 75,800 square feet to the north end of the facility. The addition will be a single-story structure with a mezzanine. The mezzanine will provide approximately 6,500 square feet of floor area for mechanical and electrical equipment. Construction will be of the standard unprotected noncombustible type consisting of a structural steel frame with insulated metal and concrete panel walls, concrete roof, concrete masonry and metal partitions, and concrete floor slab. Concrete masonry fire walls will divide the structure into separate areas of approximately 33,000 square feet each. The addition will contain storage areas, offices, toilet and locker rooms, and a vending machine-equipped lunch room. A covered loading and unloading dock for rail freight will be provided. The office area, lunch room and approximately 21,600 square feet of storage area will be air-conditioned and heated. The remainder of the facility will be heated and ventilated. A sprinkler system will be provided for fire protection for the entire warehouse.

Inflammable materials storage building: This new facility will be used for the storage of inflammable liquids and acids. The facility will consist of a single-story structure of 18,200 square feet of gross floor area. Construction will be of the standard unprotected noncombustible type consisting of a structural steel frame with insulated metal and concrete panel walls, concrete masonry partition, concrete roof and concrete floor slab. Space will be provided for drum storage, paint storage, acid storage, and office and toilet facilities. The sprinkler system will be installed for fire protection. Emergency eye bath and shower installations will be provided for personnel safety.

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

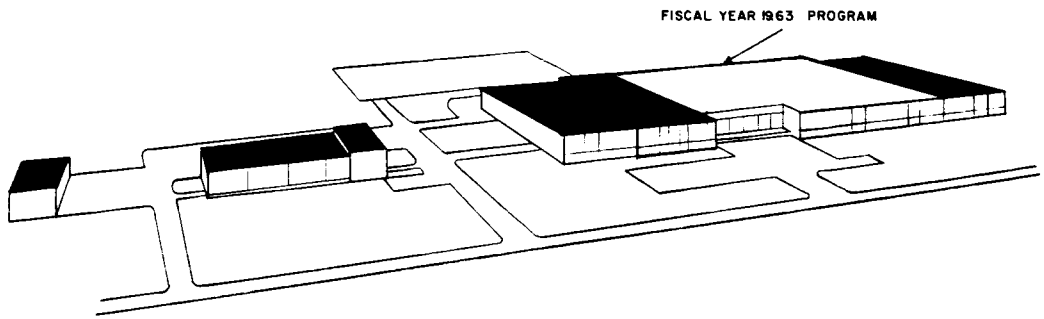
WAREHOUSE ADDITION AND STORAGE FACILITIES



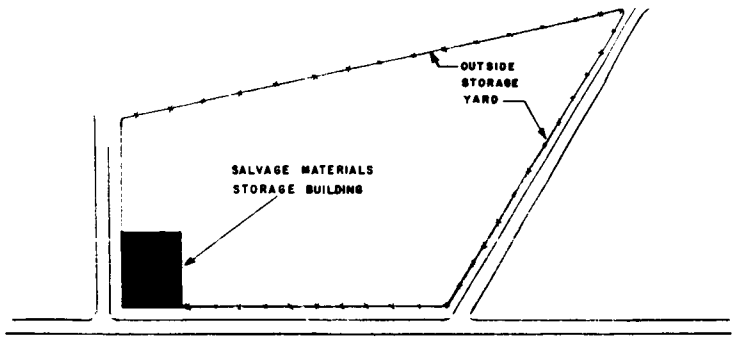
SITE PLAN

0 200 400 600 800

FEET



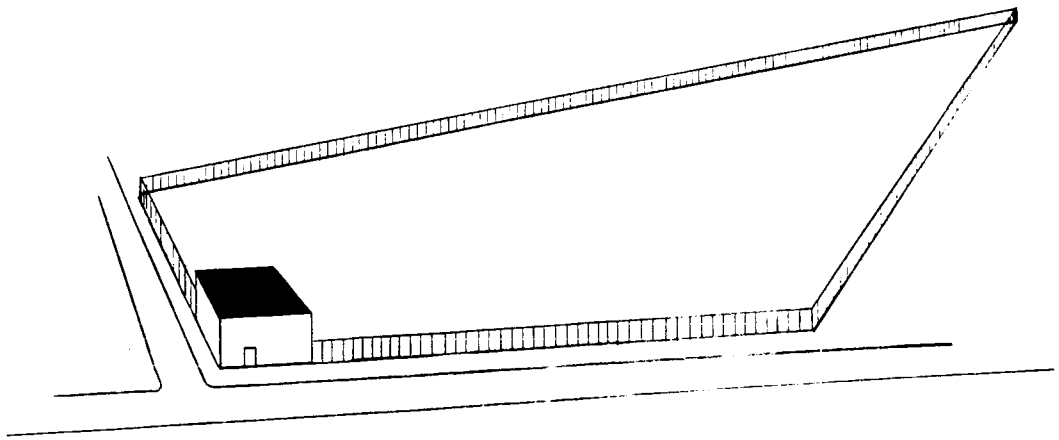
PERSPECTIVE



SITE PLAN

0 100 200 300 400

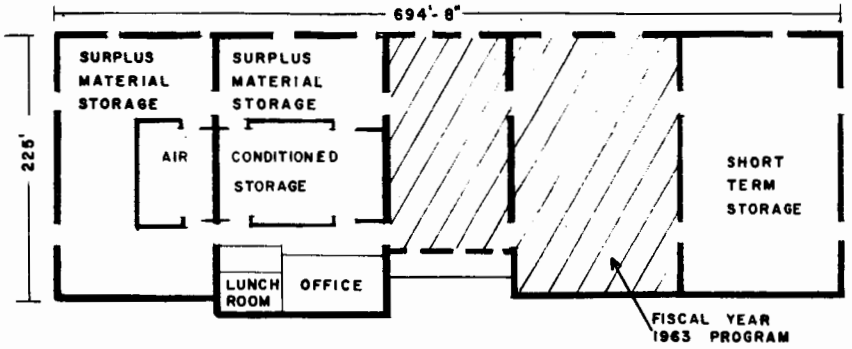
FEET



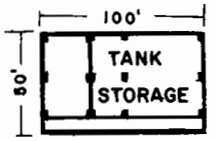
PERSPECTIVE

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

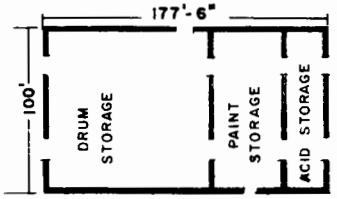
WAREHOUSE ADDITION AND STORAGE FACILITIES



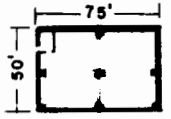
FLOOR PLAN
WAREHOUSE



FLOOR PLAN
COMPRESSED GAS CYLINDER STORAGE
BUILDING



FLOOR PLAN
INFLAMMABLE MATERIALS STORAGE
BUILDING



FLOOR PLAN
SALVAGE MATERIALS STORAGE
BUILDING

Compressed gas cylinder building: This new facility will be used for storage of compressed gases (fuels, oxidizers, and inert gases). The facility will consist of a single-story structure of 5,100 square feet of gross floor area. Construction will be of the standard unprotected noncombustible type consisting of a structural steel frame with concrete panel walls on three sides, concrete roof, and concrete floor slab. No heating, cooling or sprinkler systems will be provided.

Salvage materials storage building: This new facility will be used for the storage of salvageable materials. The facility will consist of a single-story structure of 4,000 square feet of gross floor area. Construction will be of the standard unprotected noncombustible type consisting of a structural steel frame with insulated metal walls on three sides, concrete roof and concrete floor slab. An office of approximately 118 square feet will be provided within the facility. Heating will be provided for the office area only. No cooling or sprinkler systems will be installed.

JUSTIFICATION:

The Mississippi Test Facility site is approximately five miles square, surrounded by a six mile buffer zone. Major deliveries of operating supplies will be by rail or truck to the site. As the site is remotely separated from sources of supplies, warehousing facilities are required for the regular support of operations. The additional warehouse space proposed in this project is required to support the expanding fiscal year 1964 test activities.

Materials to be stored in the warehouse will have a high dollar value and for the most part will be critical items requiring a long-lead time for delivery. A portion of the materials will require storage facilities where temperature and humidity can be regulated. The warehouse will provide this requirement. Materials to be stored in the section of the warehouse not having environmental controls will be provided adequate protection by the building design.

A facility separate from the main warehouse for the storage of flammable materials will be required. The proposed separation of these materials conforms to fire code standards. A facility for the storage of compressed gases will also be required. These gases, fuels, oxidizers, and inert gases have a high-usage rate which requires a relatively-high stocking level. The salvage materials storage facility is necessary to provide protective storage for certain salvaged materials that deteriorate in open storage.

COST ESTIMATE:

		Fiscal Year 1963		Fiscal Year 1964
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		1/		$225,000
Outside storage yard.....	---		$70,000	
Site clearing and grading.	---		40,000	
Access roads, parking areas, and loading and unloading dock areas....	---		115,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$600,000		1,615,000
Warehouse (108,600 square feet at $11.60 per square foot).....	$600,000		1,260,000	
Inflammable materials storage building (18,500 square feet at $15.35 per square foot).	---		285,000	
Compressed gas cylinder storage (5,460 square feet at $6.56 per square foot).....	---		35,000	
Salvage materials storage (4,100 square feet at $8.60 per square foot)..	---		35,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		---		220,000
Material handling equipment.....	---		163,000	
Packaging equipment.....	---		32,000	
Packing and coating equipment.....	---		25,000	
E. DESIGN AND ENGINEERING SERVICES.....		30,000		258,000
Total estimated cost.....		$630,000		$2,318,000

1/ Funds for site development and utility installations attributable to the basic warehouse structure were contained in the fiscal year 1963 initial utilities project. This is reflected in the fiscal year 1963 cost estimate column shown in the fiscal year 1964 project entitled "Utility Additions and Extensions."

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

WATERWAYS AND DOCKING FACILITIES

DESCRIPTION:

The major items in this project, as identified in the location plans on the following two pages, are described below:

Dredging: The dredging included in the fiscal year 1964 program will consist of widening, deepening, and straightening the East Pearl River waterway access to the Mississippi Test Facility from Little Lake to a point 0.8 miles south of Gainesville, Mississippi, a distance of approximately 19 miles. Dredging, where required for a minimum channel 150 feet wide and 12 feet deep with widening on bends, will be provided across Little Lake and up the East Pearl River. Dredged material will be disposed of in spoil areas adjacent to the channel and in cut-off areas created by straightening the alignment of the channel.

Canals: Canals included in the fiscal year 1964 program consist of a system of new channels, 200 feet wide and 15 feet deep, from the dredged harbor to each test area, stage storage and propellant handling area. The water in the canals will be maintained at an elevation of 20 feet. The channels will be of levee construction in areas with low ground elevations and trench construction in areas of higher ground elevations. This project provides for the construction of the main canal to the vicinity of each test complex. Funds for canal extensions to the individual test stands are included in the funds for the stands which they will serve.

Docks: Two new unloading docks will be constructed. One dock will be located in the harbor area.

JUSTIFICATION:

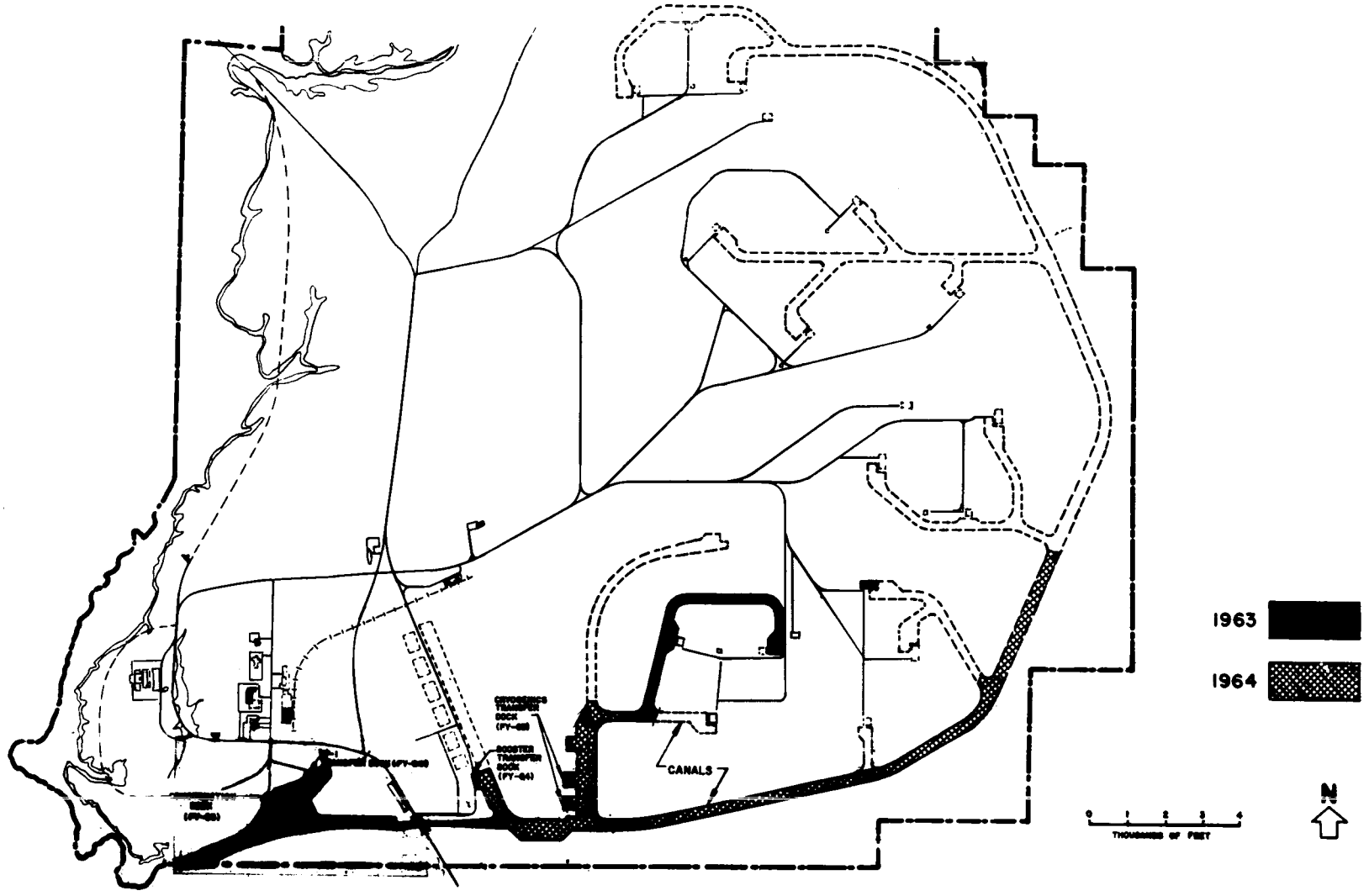
Waterways are required to provide transportation of large stages from the point of manufacture and assembly to the test complex sites at the Mississippi Test Facility and then to Cape Canaveral, Florida, for launching. The waterways will also provide economical transportation for the large volumes of propellants required in test firings.

The dredging of the East Pearl River is required to deepen, widen, and straighten the channels from the Intracoastal Waterway to the fee area of the Mississippi Test Facility since the existing river channel is not adequate for the type of water craft proposed for use. Canals from the

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1964 ESTIMATES

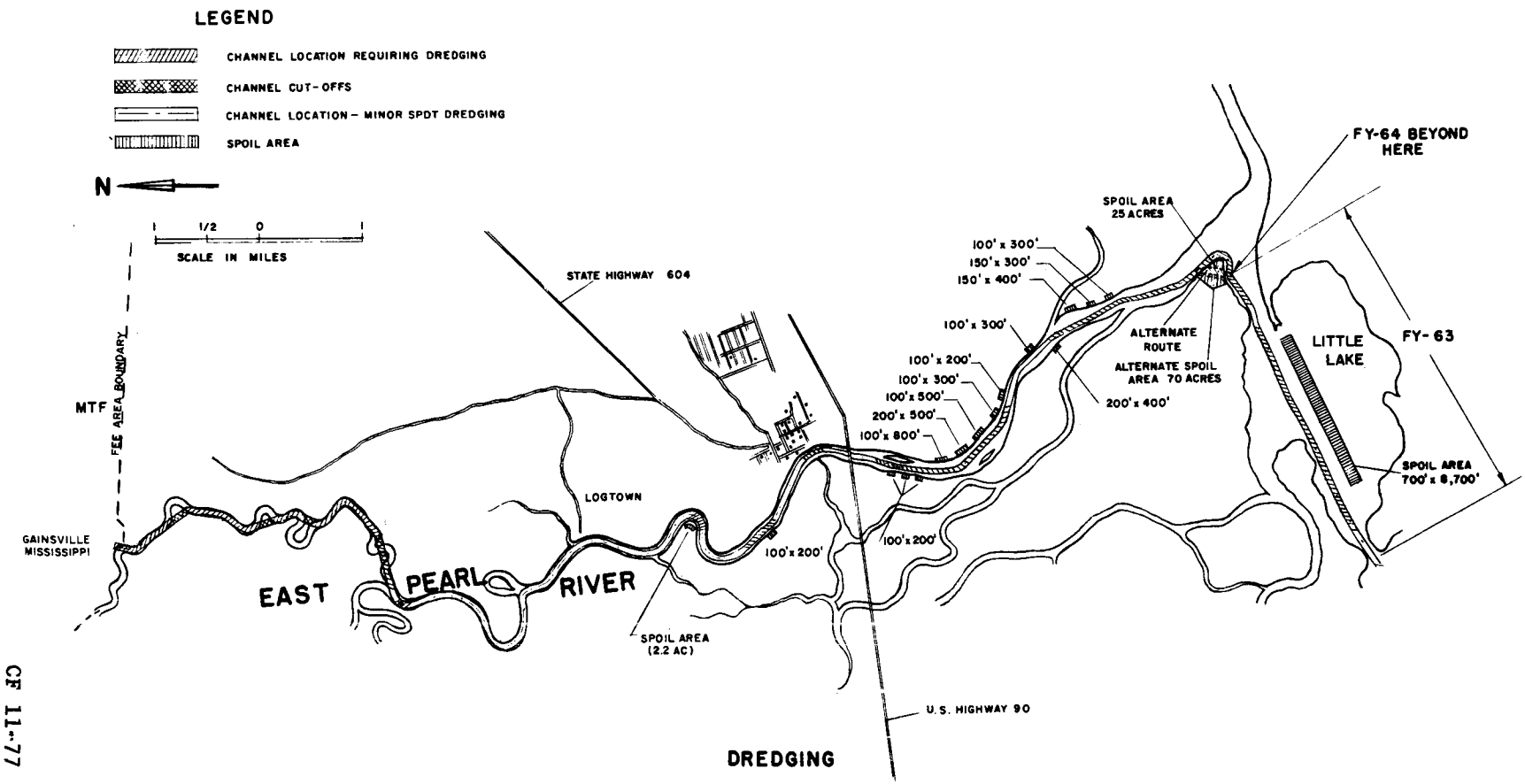
WATERWAYS AND DOCKING FACILITIES



CANALS & DOCKS

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1964 ESTIMATES

WATERWAYS AND DOCKING FACILITIES



CF 11-77

harbor area to the test stand, stage storage, and propellant handling areas are required to deliver the large stages to the test stands, and to deliver propellants to the propellant transfer station. A booster transfer dock is required in the booster storage area for the transfer of boosters from barges to land adjacent to the storage building. A RP-1 fuel transfer dock is required in the harbor for transferring fuel from barges to the storage area.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$3,400,000
	Dredging river	$700,000	
	Canals	2,700,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		370,000
	RP-1 fuel transfer dock	100,000	
	Booster transfer dock	270,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		---
E.	DESIGN AND ENGINEERING SERVICES		472,000
	Total estimated cost		$4,242,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

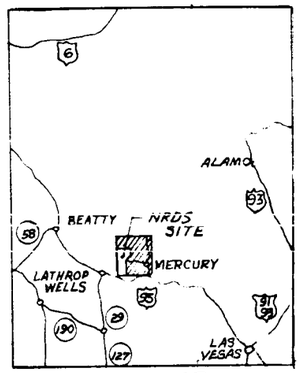
NUCLEAR ROCKET DEVELOPMENT STATION

		Page No.
Location plan		CF 12-1
Additions to engine test stand No. 1.....	$1,700,000	CF 12-2
Additions to engine test stand No. 2.....	5,000,000	CF 12-8
Additions to the engine maintenance, assembly, and disassembly building.....	4,500,000	CF 12-14
Radioactive material handling, decontamination, and storage complex.....	4,250,000	CF 12-19
Support facilities.....	5,040,000	CF 12-27
Total.....	$20,490,000	

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN



KEY MAP

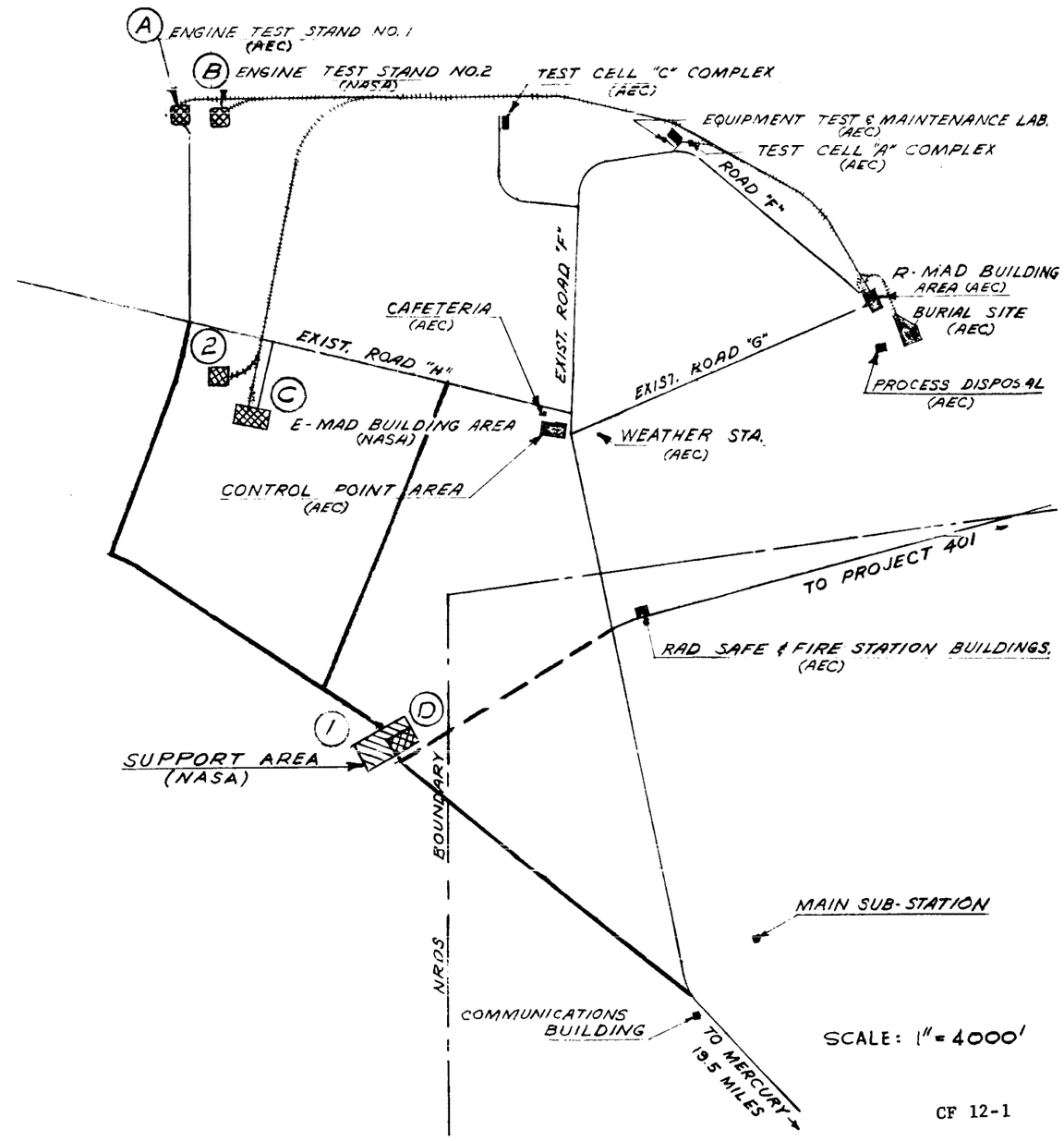
NO SCALE

FACILITIES AUTHORIZED AND UNDER CONSTRUCTION

A. ENGINE TEST STAND NO. 1
B. ENGINE TEST STAND NO. 2
C. E-MAD BUILDING
D. SUPPORT FACILITIES

PROPOSED 1964 PROJECTS

1. SUPPORT FACILITIES
   ADMINISTRATION AND ENGINEERING BUILDING
   TECHNICAL SHOP
   TECHNICAL STORAGE
   MAINTENANCE SHOP AND STORAGE
2. RADIOACTIVE MATERIAL HANDLING COMPLEX



LEGEND

- EXIST. FACILITY
- FAC. AUTHORIZED & UNDER CONSTRUCTION FY. 63
- PROPOSED FY. 64 PROJECTS.

CF 12-1

671615 O - 63

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO ENGINE TEST STAND NO. 1

DESCRIPTION:

This project involves construction modifications and equipment additions to engine test stand No. 1. The facility consists of a structural aluminum engine stand, concrete substructure, access roads, railroad spur, utilities, instrumentation, and process liquids and gas supplies. The stand is being initially equipped to test the NERVA engine at all conditions from start-up to full power.

The requested modifications and additions are made up almost entirely of instrumentation and control items. They will serve to facilitate the acquisition of data during closely scheduled test operations and to reduce the time necessary to prepare and check-out an engine before firing. The addition of a closed-circuit television system will provide visual access to the stand during a firing and the engine removal period.

The most important facility modification is the addition of a decontamination system for cleansing the exhaust duct. This will provide an automated means of removing many of the deposits plated-out on the duct during a test and thereby will reduce the radiation hazard on the stand during preparation of following tests.

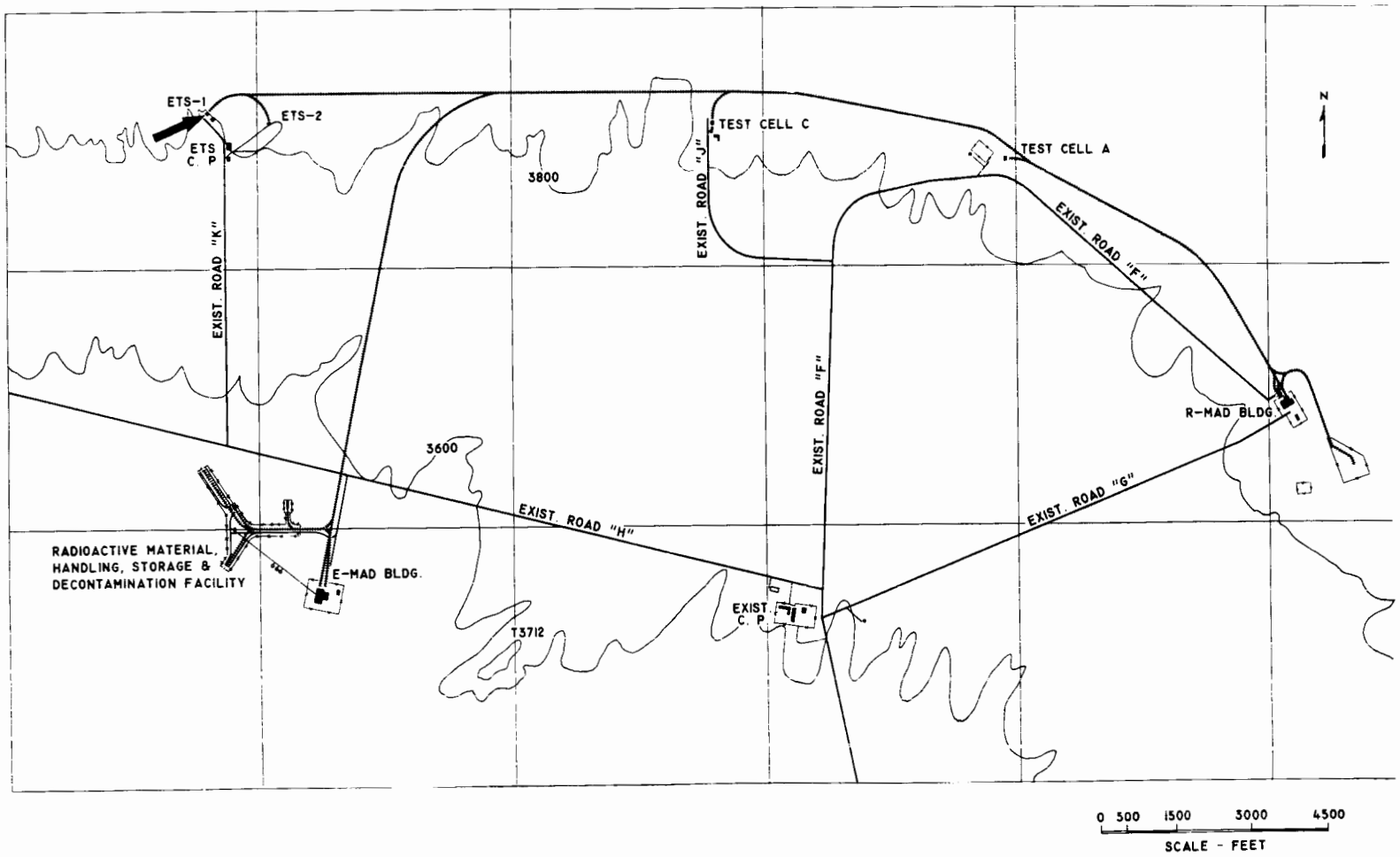
Location plans and sketches of the stand are shown on the following four pages.

JUSTIFICATION:

The construction of this stand is proceeding under contracts issued by the Atomic Energy Commission. The stand will serve as the first facility capable of down-firing a nuclear rocket engine. During the first phases of the program, the stand will accomplish all scheduled operations as funded. However, as test schedules become more frequent in the 1965 period, it will be necessary to reduce test preparation and check out times to a minimum. The proposed additions will increase the testing frequency capability of the stand to comply with program requirements. Also, as a result of a safety review of the design, it has been determined that instrumentation and tunnel ventilation control must be added to protect personnel and equipment. Additional engine instrumentation and controls are needed for the complete test operation and data acquisition requirements of the engines following those used in the initial tests. More data channels are needed for this purpose.

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

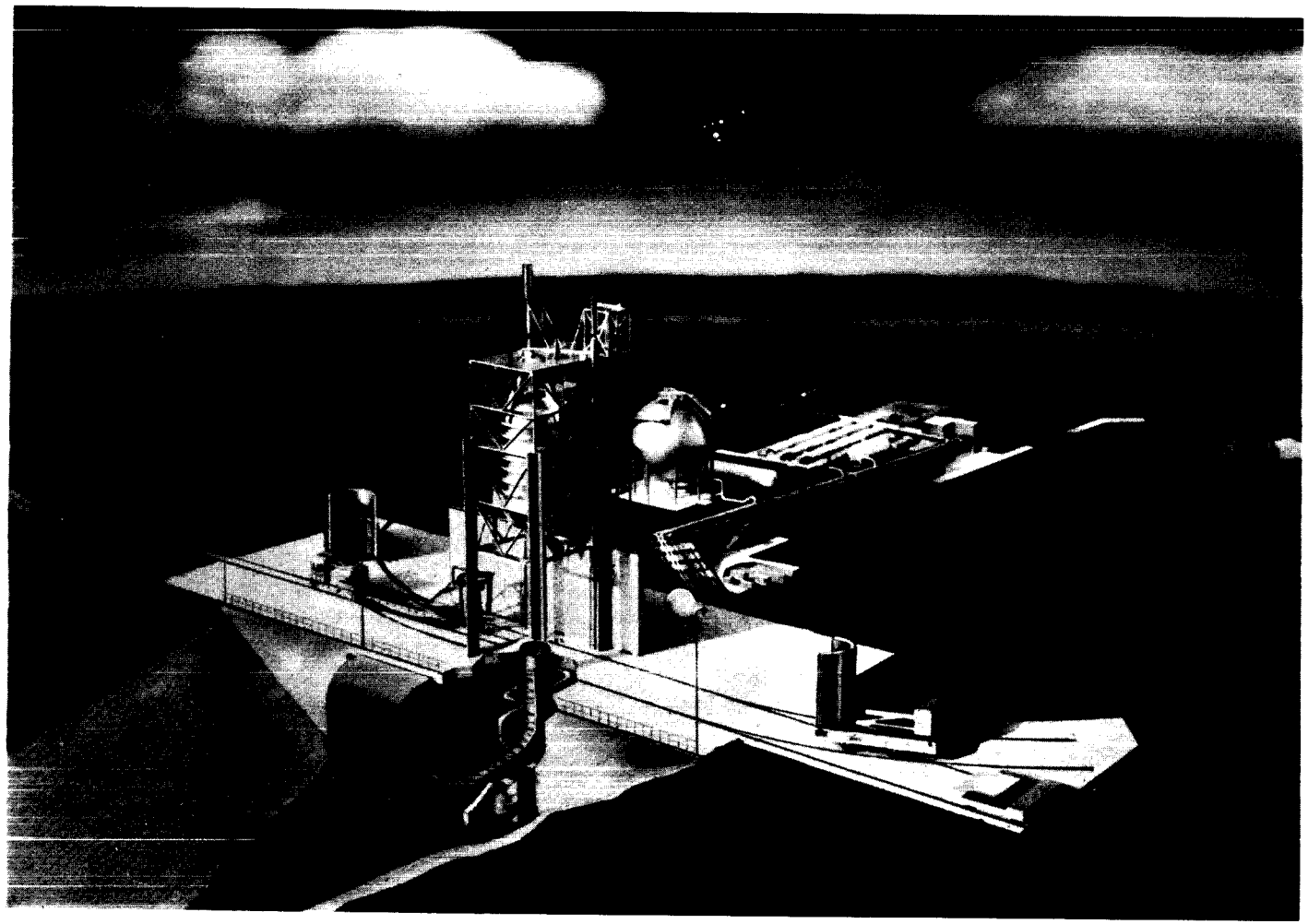
ADDITIONS TO ENGINE TEST STAND NO.1



LOCATION PLAN

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO ENGINE TEST STAND NO.1



ENGINE TEST STAND NO.1

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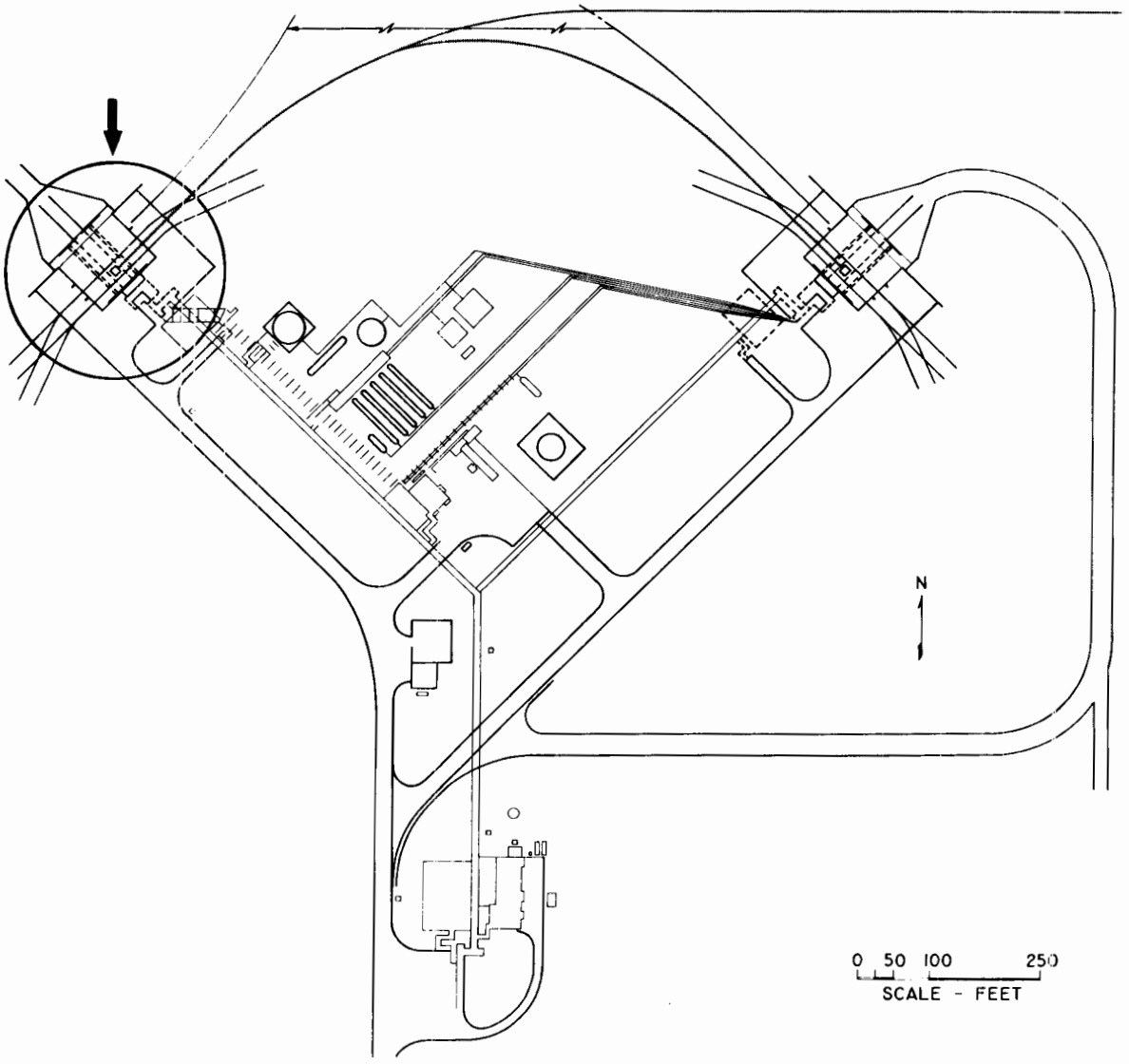
NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO ENGINE TEST STAND NO.1



PLOT PLAN

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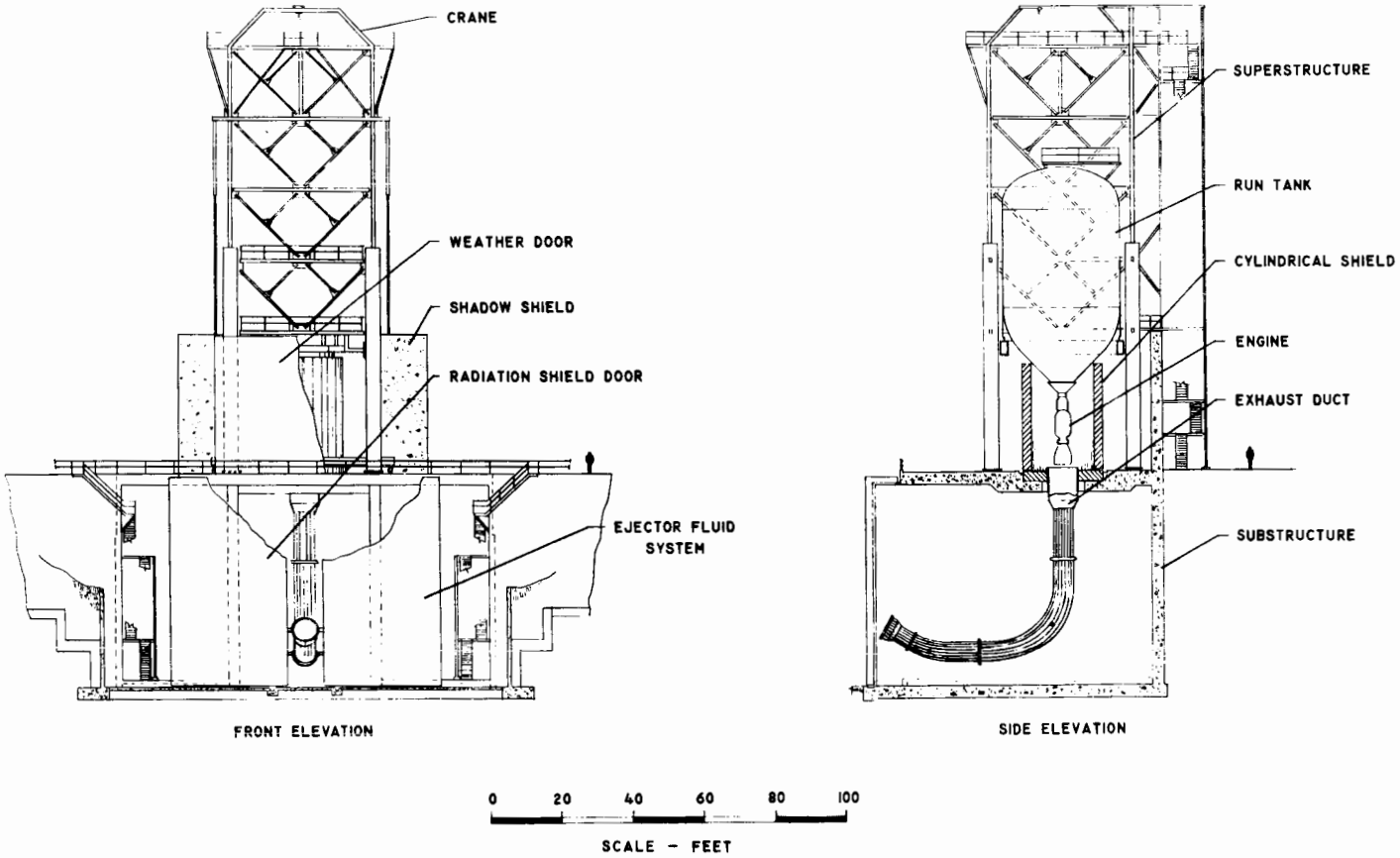
NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO ENGINE TEST STAND NO.1



ELEVATIONS

COST ESTIMATE:

A.	LAND ACQUISITION.....		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		---
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		$424,000
	Piping, valving, and storage of high pressure gas.....	$117,000	
	Modification to stand to accommodate instrumentation and control systems.....	28,000	
	Access tunnel modification.....	9,000	
	Forward control room modification.....	33,000	
	Television pads and bunker.....	41,000	
	Exhaust duct decontamination system.....	196,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,126,000
	Additions to remote engine control system.	204,000	
	Digital data system.....	320,000	
	Liquid hydrogen instrumentation system....	41,000	
	Power system additions.....	561,000	
E.	DESIGN AND ENGINEERING SERVICES.....		150,000
	Total estimated cost.....		$1,700,000

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO ENGINE TEST STAND NO. 2

DESCRIPTION:

This project describes additions and improvements required to be made on engine test stand No. 2. The stand will be equipped to perform developmental testing of nuclear rocket engines for the Nerva program and possible follow-on engines presently under study. The facility will be initially equipped to test the NERVA engine at full power. However, the substructure and basic support facilities have been designed to accommodate an uprated nuclear engine.

The facility consists of a structural aluminum engine stand and associated ancillary equipment and all necessary roads, railroads, utilities, and access tunnels. Necessary additions will provide the capability of utilizing this stand as a separate facility, more independent of operations being conducted on engine test stand No. 1 with the exception of the period during actual firings.

To provide more independent capability, it will be necessary to make extensive additions to the control and instrumentation systems now planned for co-use with engine test stand No. 1. Concurrent with these additions, an increased liquid hydrogen and process gas storage capacity must be made available.

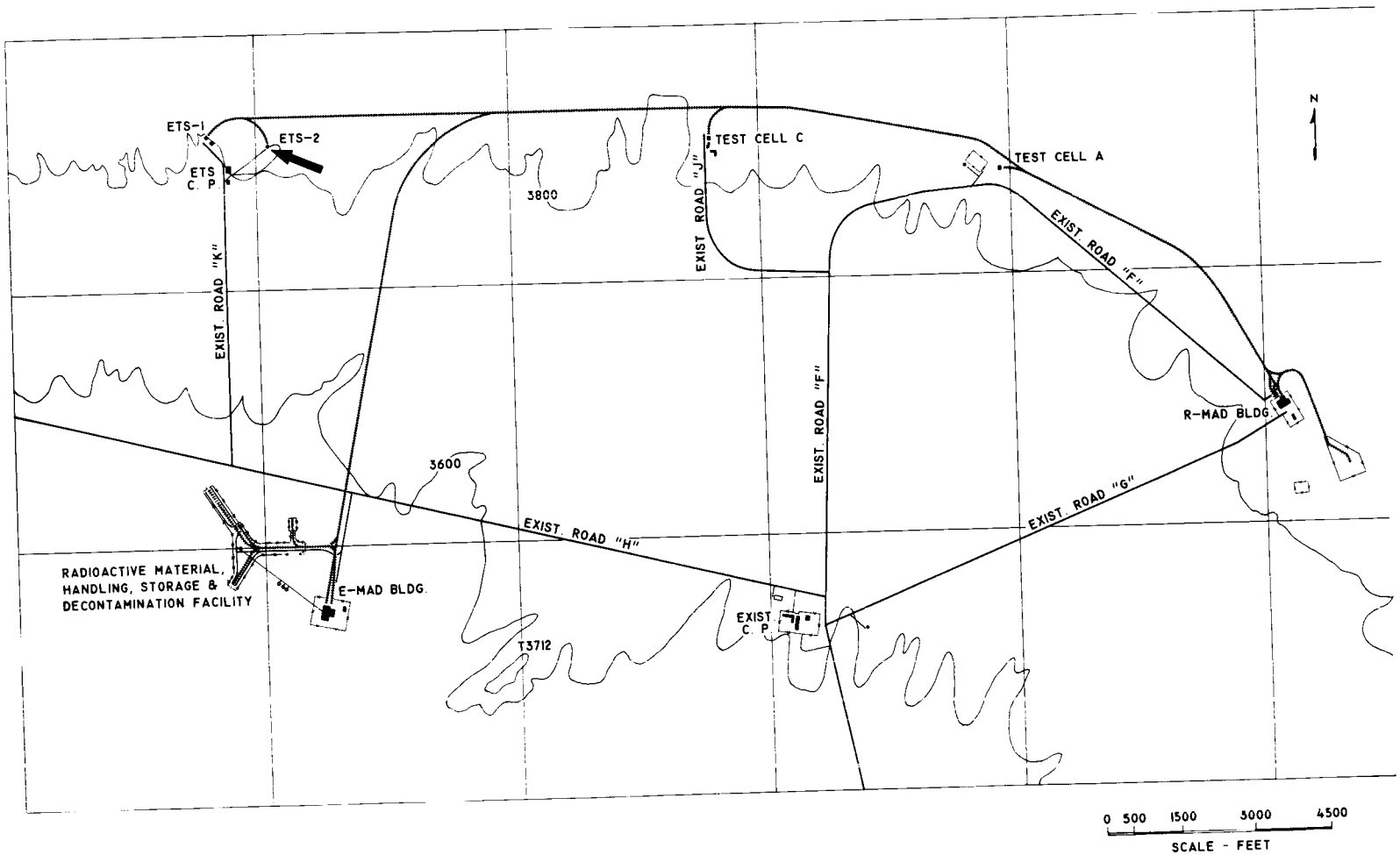
This capability will be accomplished by installation of separate high-pressure storage bottles similar to those used at engine test stand No. 1 for gaseous hydrogen, helium and nitrogen. The necessary liquid hydrogen supply can be made available by installation of a single 250,000-gallon vacuum-jacketed vessel and associated piping and control valves. In addition, a close-coupled run tank will be fabricated for use in tests which require simulation of neutron heating in the propellant supply. In its initial phase, engine test stand No. 2 will be using hydrogen stored in a large dewar at engine test stand No. 1.

The required instrument additions will consist of service and support systems, remote engine controls, facility controls, and increased data acquisition channels to supplement those now co-used with those installed for engine test stand No. 1.

Location plans and sketches of the stand are shown on the following four pages.

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO ENGINE TEST STAND NO.2



LOCATION PLAN

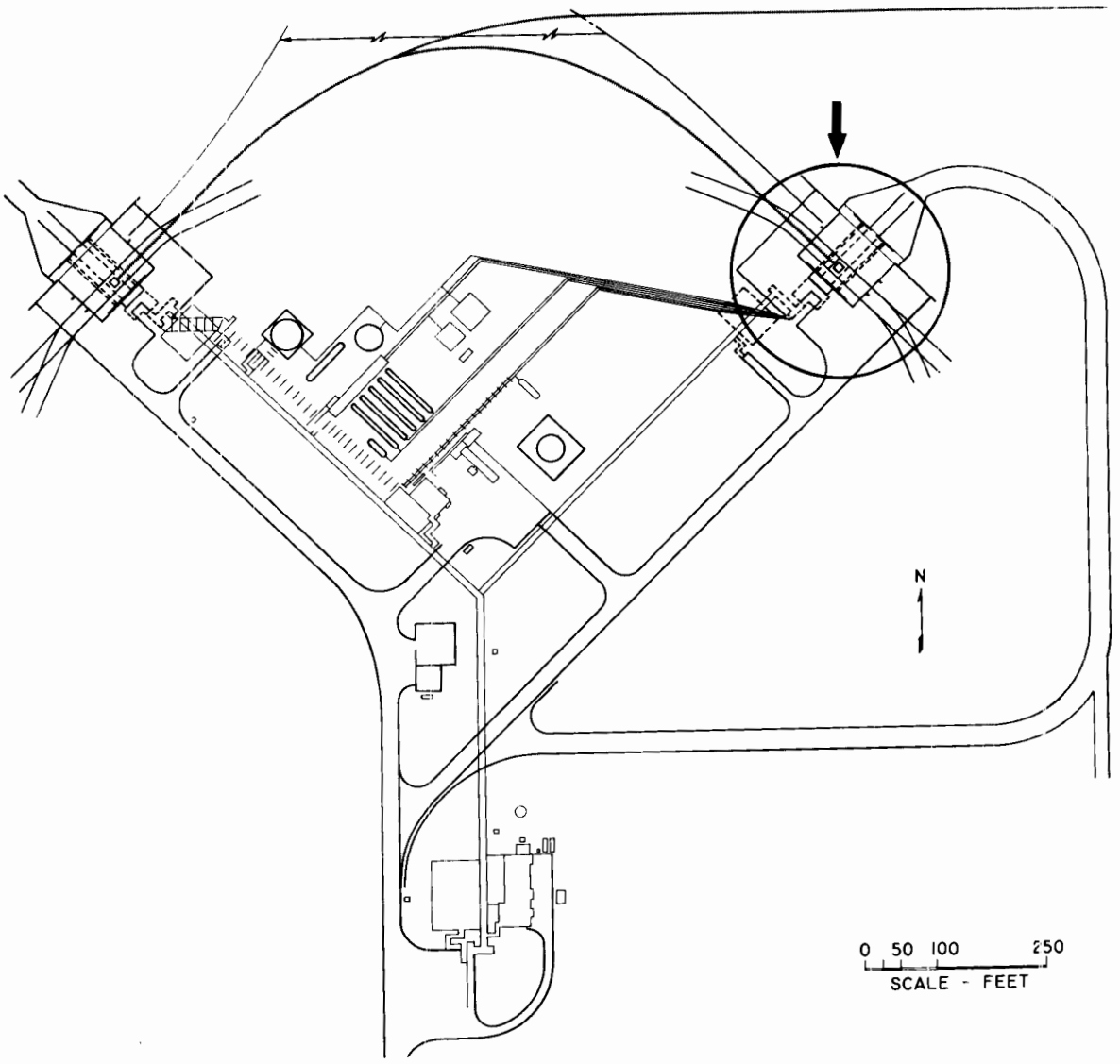
NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO ENGINE TEST STAND NO.2

ENGINE TEST STAND NO.2

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO ENGINE TEST STAND NO.2



PLOT PLAN

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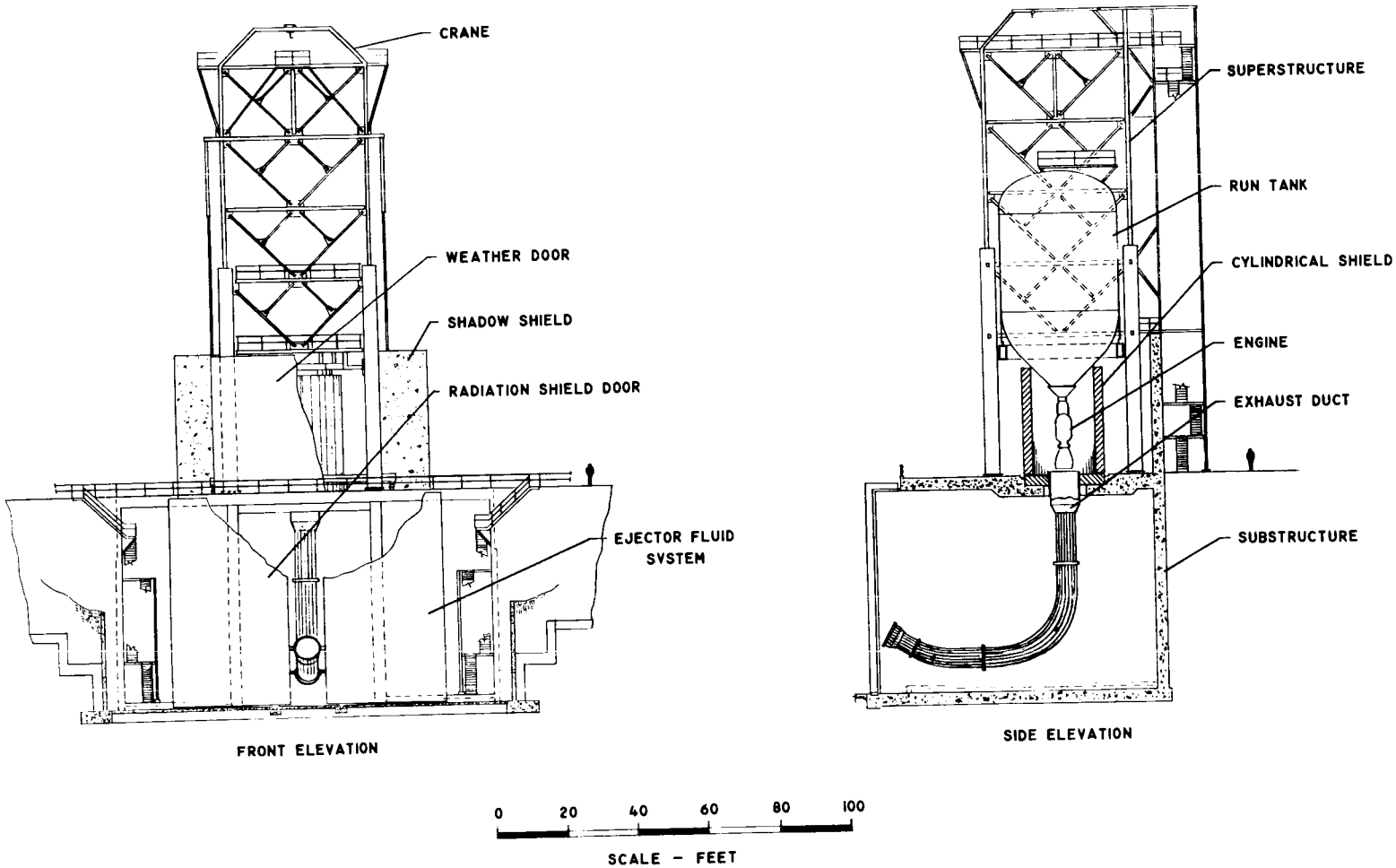
NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO ENGINE TEST STAND NO.2



ELEVATIONS

CF 12-12

JUSTIFICATION:

The NERVA program is aimed at developing a safe and reliable nuclear rocket engine. Program plans currently call for approximately ninety static tests to be performed on thirty different engines. The goal of this program is the early development of a reliable engine.

The program plans indicate that it will be necessary that the two available test stands operate more independently to increase the test frequency required by the program. This provision will make it possible for delays to occur on one stand without affecting the scheduled operation of the other. Without this capability, not only the time involving the delay, but the time lost to shift instrumentation and control equipment will be directly additive to the planned engine test and operational date.

An additional justification for the proposed modifications is the back-up capability which the modifications provide in the event of a catastrophic engine failure on engine test stand No. 1. At present, a failure of such a nature could inactivate both stands due to shared services and support systems.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		---
C. FACILITY CONSTRUCTION AND MODIFICATIONS		$50,000
Shielding, barricades, and dikes	$50,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		4,438,000
High-pressure gas storage and associated piping	250,000	
Liquid hydrogen storage and piping	750,000	
Close-coupled liquid hydrogen run tank	563,000	
Service instrumentation systems	458,000	
Remote engine control system	478,000	
Facility operation and control systems	899,000	
Pulse code modulation data acquisition system	1,040,000	
E. DESIGN AND ENGINEERING SERVICES		512,000
Total estimated cost		$5,000,000

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO THE ENGINE MAINTENANCE, ASSEMBLY, AND DISASSEMBLY BUILDING

DESCRIPTION:

This project is directed to the need for an addition to the engine maintenance, assembly and disassembly building. The building will become a major center for the Nerva engine development program.

Engine assembly operations will be conducted in a large unshielded work bay of the engine maintenance, assembly, and disassembly building. Here the nuclear engine will be built up from subassemblies and components, using overhead cranes, movable fixtures, and hand tools. After completion of assembly and check-out, the engine will be placed in the engine installation vehicle and moved to the test stand. Adjoining the assembly area will be a large shielded hot bay. This bay will have five to six-foot thick concrete walls, oil-filled leaded glass windows, and various manipulator systems. After testing, the engine can be remotely returned to this bay for disassembly. The major subsystems will be removed using floor, wall and overhead mounted manipulators, aided by special tooling. These will then be sent to twelve small hot cells in the south end of the building for complete disassembly, close examination, and nuclear survey operations.

Construction modifications that are necessary consist of adding windows in both the large hot bay and small evaluation cells. These windows will provide increased visual access for conduct of remote operations. Special shielding doors will also be installed in the high and low level cells to provide greater isolation during post-run evaluations. A sheet metal building will be constructed to allow critical engine parts to be received and held on hand without using premium space in the assembly area.

The equipment modifications requested are mainly specialized nuclear survey instruments and automated manipulator systems. The balance of requested equipment is items that complete the readiness of the facility for designed capability, such as, special lighting fixtures, emergency generators, and fire protection equipment.

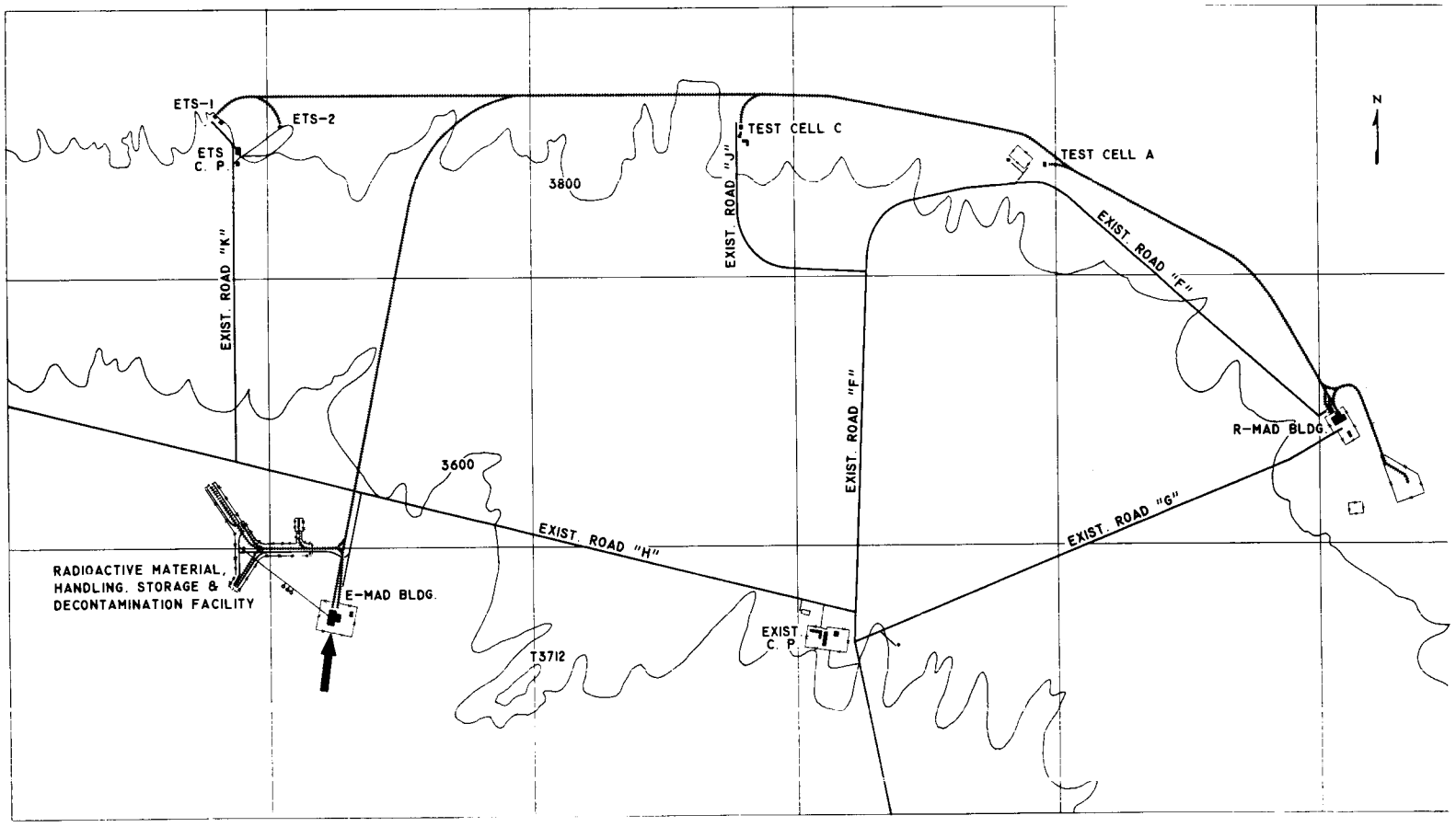
The location plan and the scope of the work covered by this project are shown in the drawings on the following two pages.

JUSTIFICATION:

The Nerva nuclear rocket engine is now under development. Much of the development work in this program will be based on evaluations conducted after test firing. To perform the required evaluations, a facility is being constructed which will allow the radioactive engine to be disassembled and inspected on site, as near as practical to the test area. Construction of the

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO THE ENGINE MAINTENANCE, ASSEMBLY, AND DISASSEMBLY BUILDING

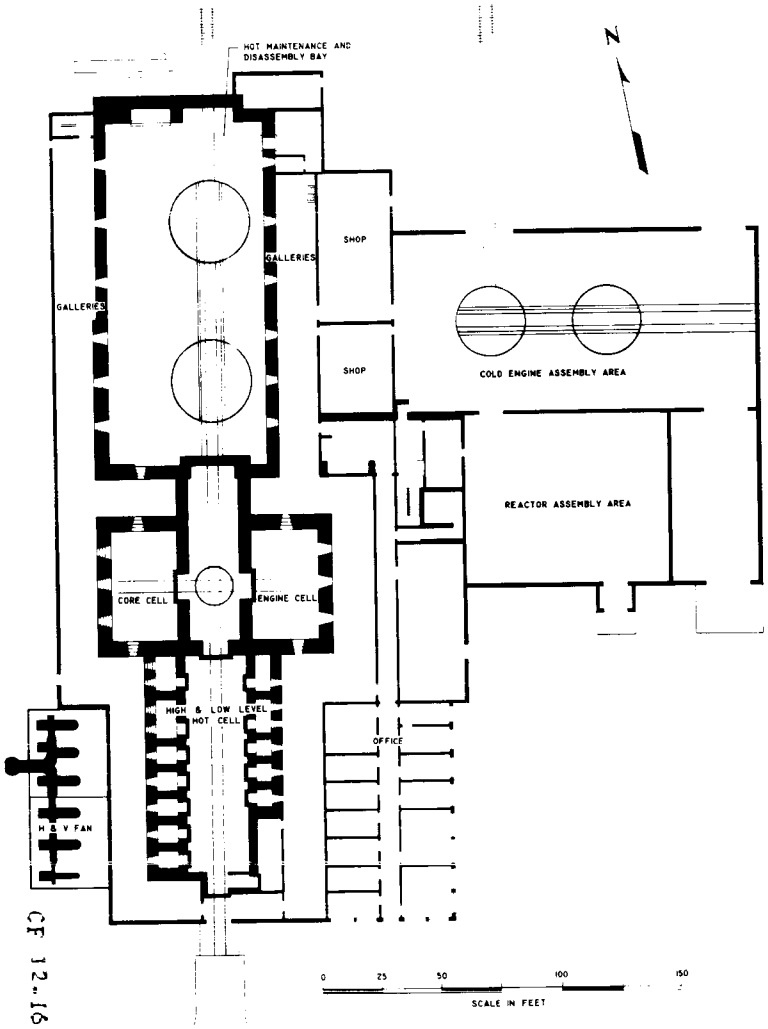


LOCATION PLAN

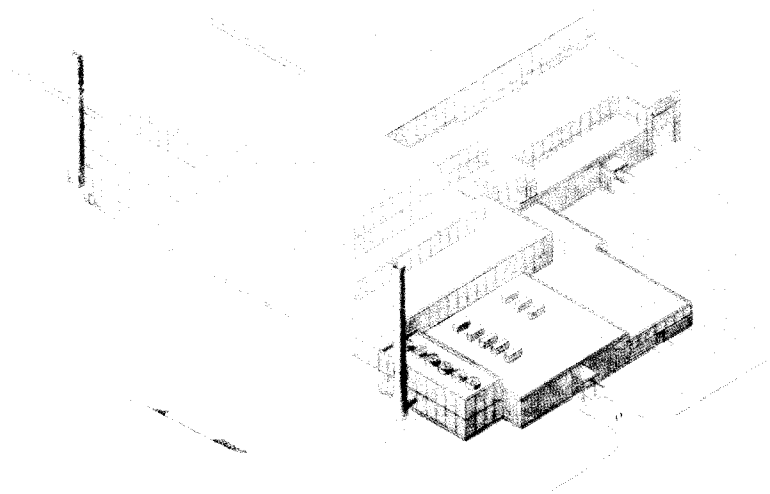
0 500 1500 3000 4500
SCALE - FEET

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

ADDITIONS TO THE ENGINE MAINTENANCE, ASSEMBLY, AND DISASSEMBLY BUILDING



PLAN



PERSPECTIVE

CF 12-16

engine, maintenance, assembly, and disassembly building is now under way.

The building will be able to perform all operations planned for the early phases of the engine program. However, as scheduled tests become more frequent in the 1965 and 1966 period, it will become necessary to augment the capability of the facility to accommodate the increased workload.

The requested equipment additions are those necessary to complete the capability of the building and to add to the flexibility required to perform all disassembly operations in shortened time periods. Requested items fall mainly in the category of specialized manipulators. These are both wall-mounted and overhead types. Their addition will permit operations to be scheduled so that delays or breakdowns on one particular phase will not interfere with follow-on processing.

Construction modifications consist of adding windows in the hot disassembly bay and high-low radiation level evaluation cells. These serve to increase the flexibility and efficiency of disassembly and post-run examinations by expanding the direct visual access to the work area. The separate sheet metal building is required to provide on-hand storage space for engine parts and tooling items. This will be located immediately outside the main building and will serve as a receiving and warehouse area for components and materials used directly in test preparation and engine assembly. This feature will make premium space inside the building available for actual assembly operations and yet allow frequent and repeated try-out of hardware prior to final assembly.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$184,000
Clearing, grading, and drainage.....	$8,000	
Utility connections.....	10,000	
Switches, operators and trackage (Engine turn-around spur).....	80,000	
Roads, walks and paving.....	86,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		850,000
Cirtical parts storage building (5,000 square feet at $15.00 per square foot).....	75,000	
Viewing windows.....	400,000	
High-low level cell shield doors.....	375,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		2,711,000
Jib cranes.....	15,000	

Emergency air compressor	$16,000
Hot water heating boiler	40,000
Heat ventilating and air-conditioning fans	24,000
Chilled water with condenser pumps	20,000
Emergency diesel generator	110,000
Lighting fixtures with associated conduit and wiring	156,000
Wall-mounted handling system (manipulators,2)	1,200,000
General health and safety equipment	100,000
General purpose fire protection equipment	15,000
Fork lifts	20,000
Machine shop equipment	320,000
Vault storage equipment	10,000
Physical counting room equipment	12,000
Industrial cleaning equipment	16,000
Personnel counting room equipment	100,000
Miscellaneous shop tools and equipment	12,000
Assay laboratory equipment	10,000
Main bay radiation monitoring equipment	140,000
Master-slave manipulators	230,000
Rectilinear manipulators	130,000
Office equipment	15,000

E. DESIGN AND ENGINEERING SERVICES	$755,000
Total estimated cost	$4,500,000

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1964 ESTIMATES

RADIOACTIVE MATERIAL HANDLING, DECONTAMINATION, AND STORAGE COMPLEX

DESCRIPTION:

Planned operations at the Nuclear Rocket Development Sation during the 1960-1970 period indicate the need for centralized facilities for the handling and storage of radioactive materials which will accumulate as a result of nuclear tests. It is necessary that a facility be constructed to accommodate all radioactive cleaning and storage operations resulting from the Rover, NERVA, and RIFT programs not specifically performed in individual building complexes. The facility will be designed for expansion to be compatible with future growth engines and associated vehicle components.

The facility will consist of a spent fuel storage area, a hot engine hold area, a warm engine parts storage building, a decontamination building, and a temporary burial site. Sketches of the complex are shown on the following four pages. A more detailed description of various parts of the complex follows below:

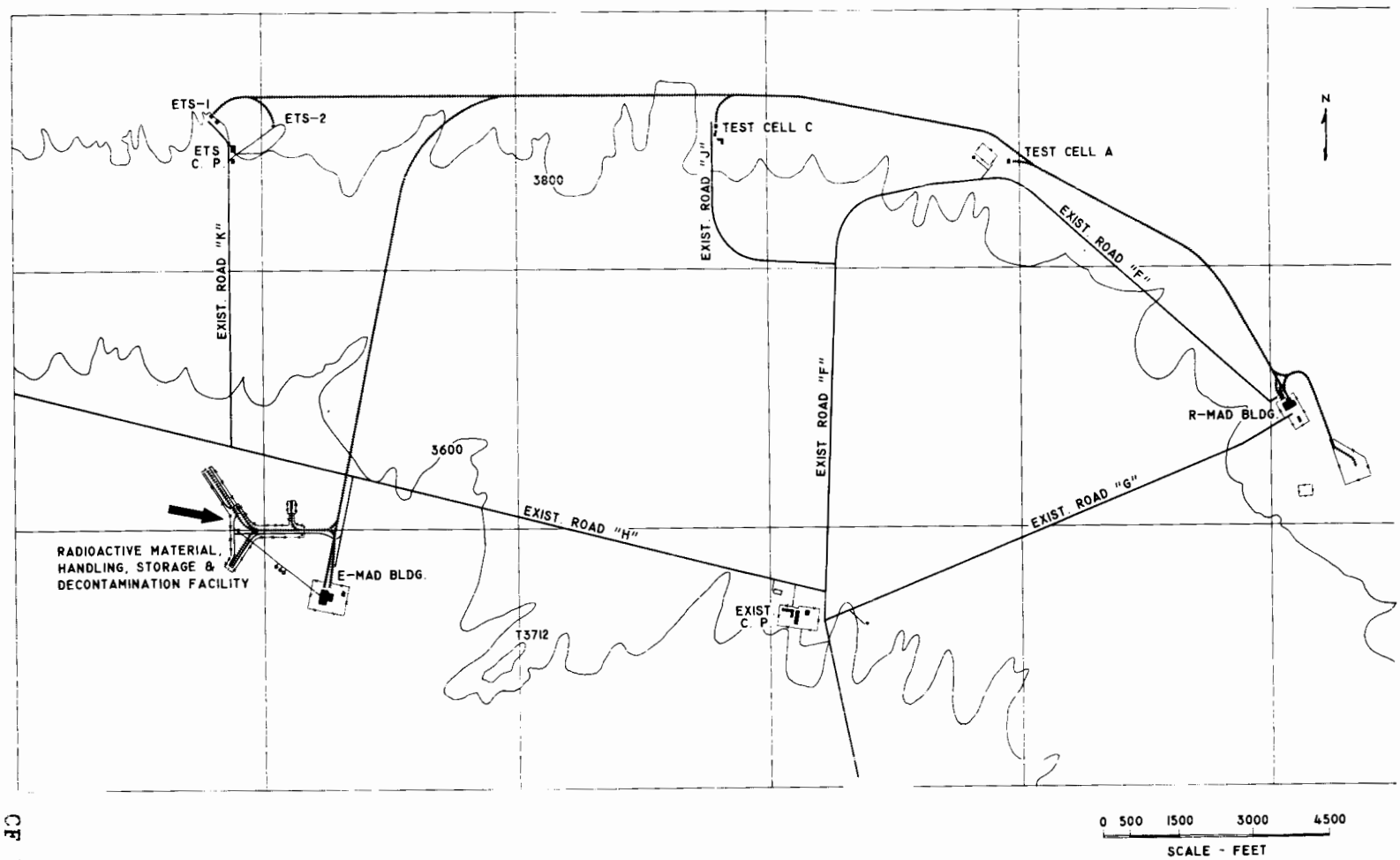
Spent fuel storage: This facility will be designed to store entire or partial reactor cores and highly radioactive engine components. Spent fuel or cores placed in this facility may remain in storage for many months or even years. The actual time will be determined by the need for re-examination of cores from early runs and the availability of an AEC fuel reprocessing plant. Such a plant is now anticipated for operation in 1967 or 1968. Highly radioactive engine components would be held in this facility until decay of radioactivity permits close examination of the part or possible re-use in future testing.

The design of such a facility must provide a shielded space for approximately fifty cores. The space must have a dry environment to prevent hydrolysis of the core material and the possibility of a critical incident due to flooding of the storage space. Forced-air cooling will be provided to remove the heat generated in the fuel due to the decay of fission products. Coolant air will be filtered to remove solid contaminates and exhausted through a stack to disperse entrained gaseous poisions. The area will be monitored to prevent personnel from receiving overdoses of radiation and secured to safeguard classified fuel elements and components.

Hot engine hold area: When an engine has been run, it is necessary to remove it from the test stand in as short a time as possible. This precludes prolonged heating and radiation damage to the stand and associated components. It also allows ready access to the

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

RADIOACTIVE MATERIAL HANDLING, DECONTAMINATION, AND STORAGE COMPLEX



LOCATION PLAN

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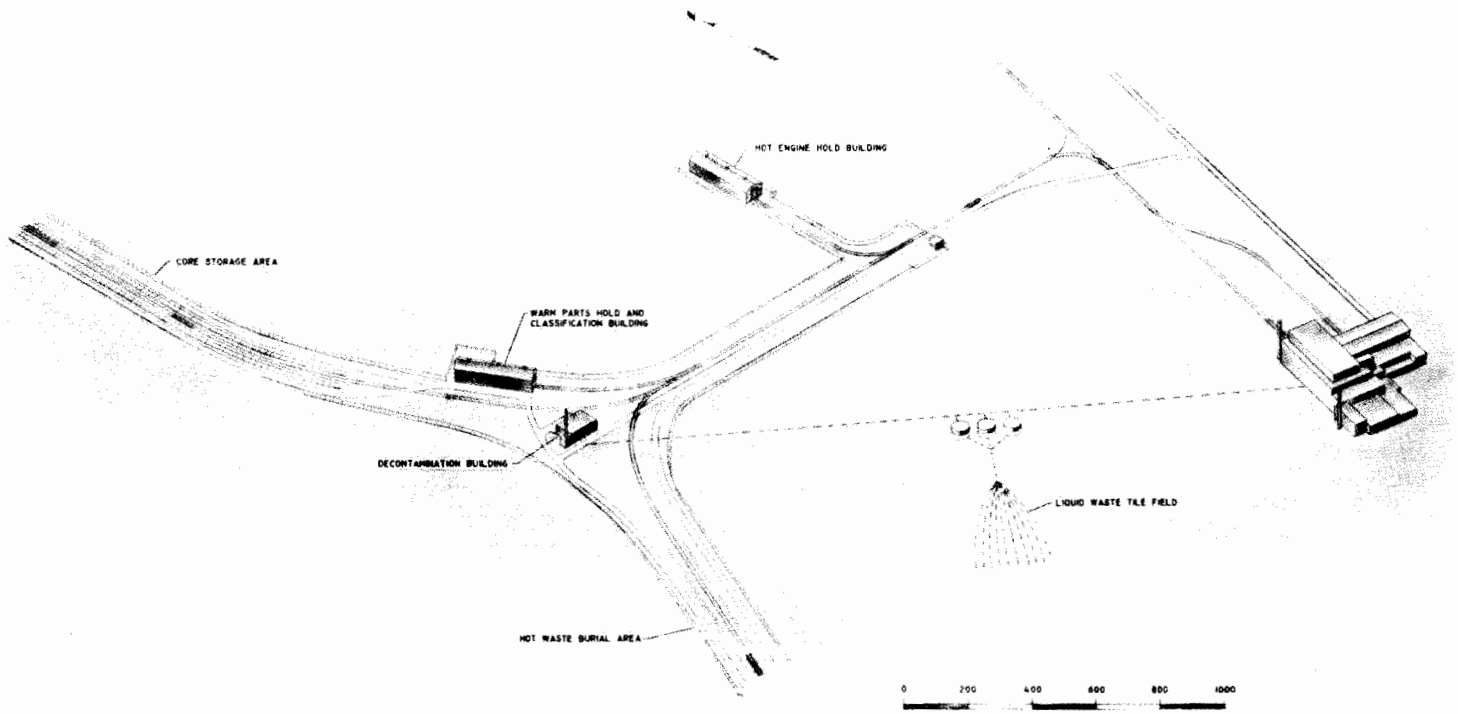
NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

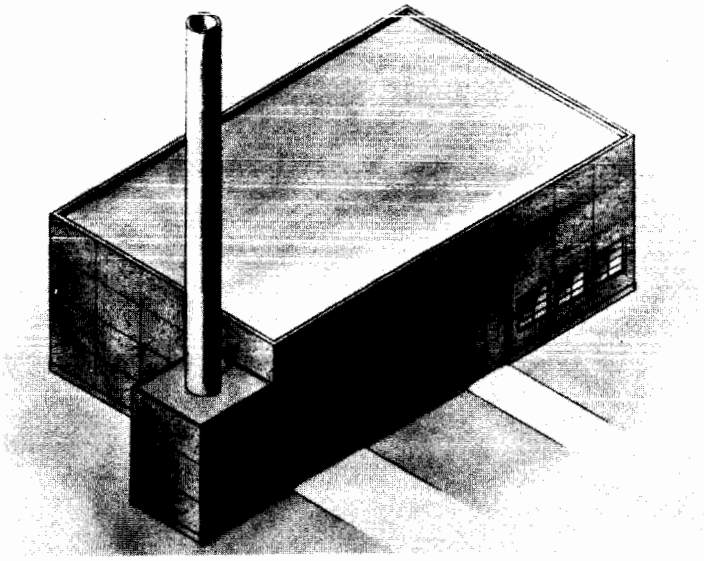
RADIOACTIVE MATERIAL HANDLING, DECONTAMINATION, AND STORAGE COMPLEX

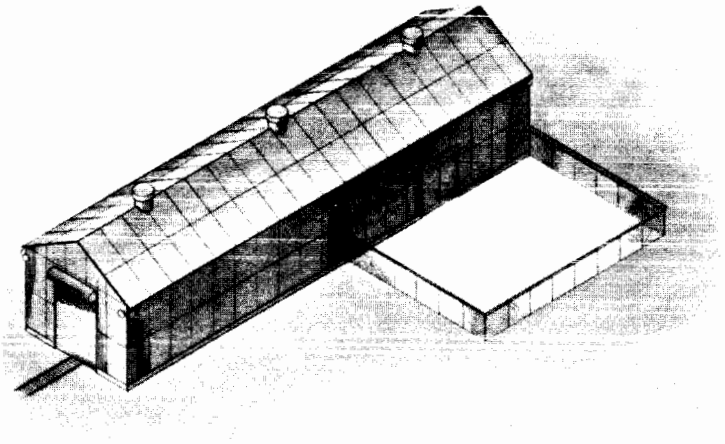


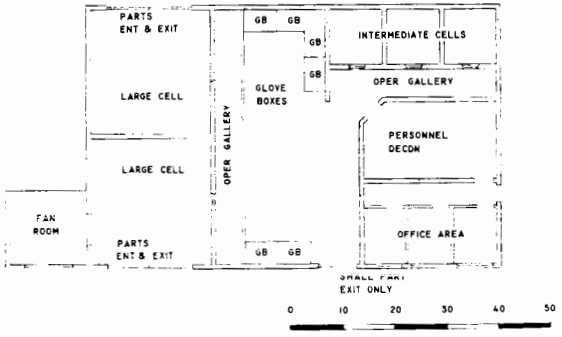
CF 12-21

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

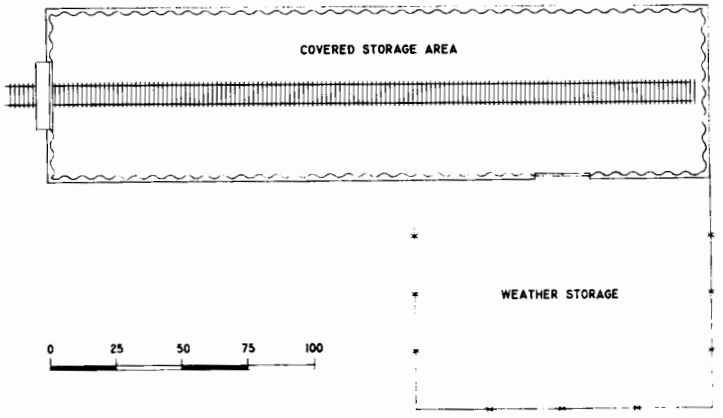
RADIOACTIVE MATERIAL HANDLING, DECONTAMINATION, AND STORAGE COMPLEX







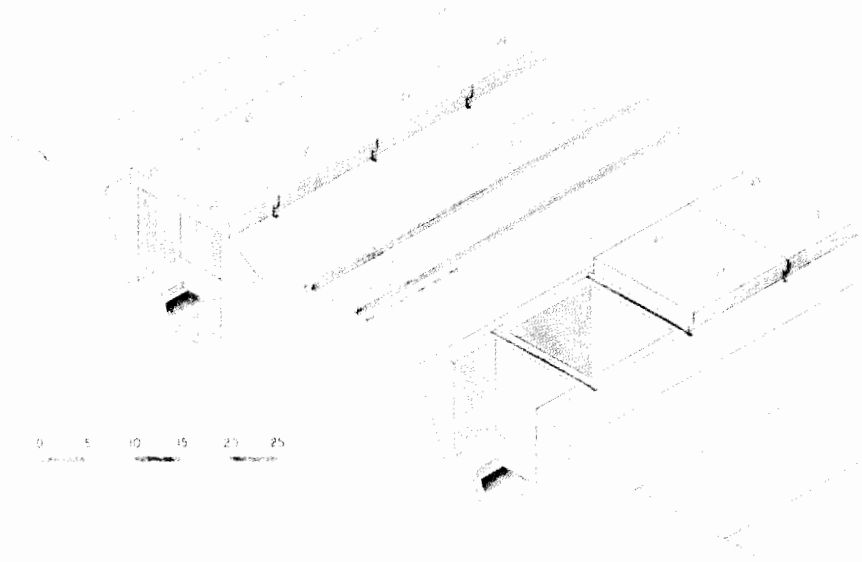
DECONTAMINATION BUILDING



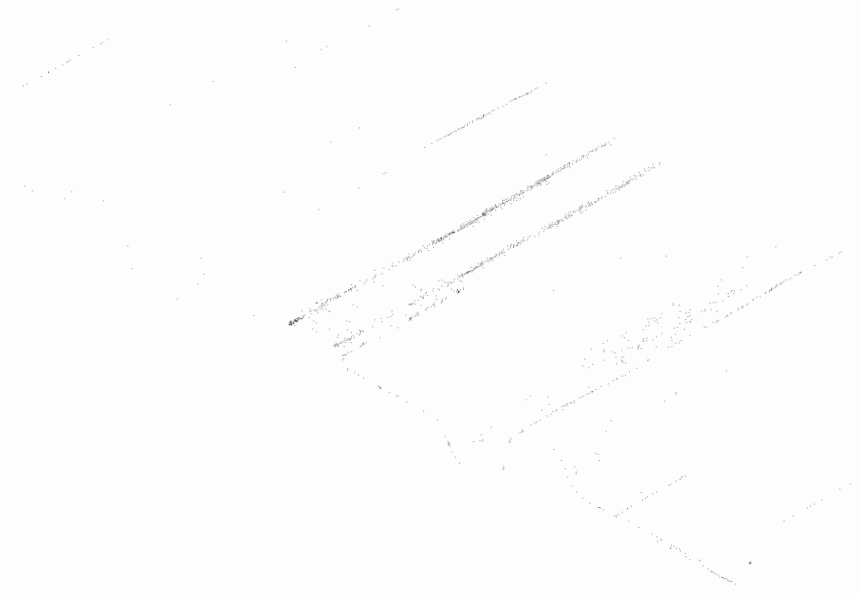
WARM PARTS HOLD AND CLASSIFICATION BUILDING-
HOT ENGINE HOLD BUILDING

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES

RADIOACTIVE MATERIAL HANDLING, DECONTAMINATION, AND STORAGE COMPLEX



TYPICAL HIGH LEVEL PARTS & CORE STORAGE VAULTS



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TYPICAL RADIOACTIVE WASTE BURIAL AREA

stand for preparation of follow-on tests. It therefore becomes necessary to provide an area to hold a hot engine in event of unforseen work overload in the engine maintenance, assembly, and disassembly building. This area will consist of a prefabricated sheet metal building large enough to house the engine, engine installation vehicle, and the manned control car. The building will be located roughly 3,000 feet from normally occupied areas to eliminate a need for shielding. Provision will be made within the building for cooling the engine to prevent damage from "after glow heating."

Warm engine parts storage: An area will be provided to allow aboveground storage of "warm" engine components. These may be parts which will be re-used later in the test series or which must be treated with more than ordinary care if they are being held for later evaluation. The facility required consists of a sheet metal building to provide inside storage and a surfaced outside yard for items which do not require weather protection. This area would be located near the decontamination center and serve secondarily as a classification point for incoming and released material.

Decontamination building: A concrete building will be constructed to contain the close contact decontamination work carried on at the station. Bulky materials will enter the building through either of two large hot cells. Here, large components, such as nozzles and pressure vessels, will be cleaned by wipe down and detergent spray. These operations will be conducted remotely by manipulators. Smaller components and subsystems which are to be retained will be further processed in three intermediate sized cells. A group of glove boxes will allow hand cleaning of tools and small items which are to be returned to other on-site operations.

The building will contain a personnel decontamination station, a radioactive-safe office, and an office space for catalog and file information on the material stored within the total facility. A major feature of the facility will be the exhaust system. The air from within the decontamination building must be collected and exhausted through suitable filters. These will be designed so that contaminants which do pass through may be safely dispersed by a high stack. Liquid wastes will be piped to holding tanks outside the building. Liquids will be retained here until the gross activity decreases to a level at which they can be drained off safely into a tile field.

Temporary burial site: Located adjacent to the classification and decontamination areas will be a trenched section to serve as a burial site for radioactive wastes. The concept is minimal in that materials for disposal will be placed in trenches and fill dirt placed over the waste by bulldozing. Access to the area

will be rail and road. The actual position of specific burials will be marked so that future removal would be possible if desired.

JUSTIFICATION:

The designation of the Nuclear Rocket Development Station as the only location for static testing nuclear rocket engines and vehicles has consolidated the associated problems into a single problem area. To operate successfully and efficiently the Station must provide facilities to permit independent operation.

To maintain this working independence, it is necessary to provide a facility to accommodate radioactive materials. These materials consist of reactor core elements, reflector sections, feed system components, and control devices which have become radioactive during test runs. Many of these items may be re-used provided they are allowed time for activity to decay to a tolerable level. Other items will be preserved for re-examination predicated on findings in later test runs. Present plans indicate that a fuel reprocessing plant will be available in the 1967-1968 period. By this time the KIWI and NERVA programs alone will have generated approximately forty to fifty spent cores. Each of these cores will contain roughly $2,000,000 in unconsumed enriched uranium. If storage capability is not provided the cores must be destroyed and dispersed to comply with health and hazard requirements imposed on this operation.

The many nonnuclear parts of the engine system will not be highly activated during a run. However, without a facility for hold and clean-up, these parts would be used in one test only as the necessary precautions and time increases associated with re-use are not compatible with program schedules.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$889,000
Walkways and parking area (4,000 square yards at $2 per square yard)	$8,000	
Surfaced outside storage (6,000 square yards at $3 per square yard)	16,000	
Road construction (8,000 feet at $15 per foot)	120,000	
Rail trackage and spurs (3,000 feet at $30 per foot)	90,000	
Railroad switches and controls (4 at $5,000)	20,000	
Remote cabling and indicators	180,000	
Perimeter fence, markers and lighting (20,000 feet at $7 per foot)	140,000	
Excavation and grading	60,000	
Revetments and foundations	110,000	
Utilities (water tower, well, and power)	130,000	

Tile farm excavation.....	$15,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$1,450,000
Decontamination building (4,000 square feet at $70 per square foot).....	280,000	
Warm storage building (10,000 square feet at $15 per square foot).....	150,000	
Classification and hold area building (10,000 square feet at $15 per square foot).....	150,000	
Storage trenches and vaults (20,000 square feet at $21 per square foot).....	420,000	
Liquid wastes tanks.....	240,000	
Tile farm.....	150,000	
Piping and valving.....	60,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,411,000
Manipulators (Heavy duty, 4 at $15,000 each)	60,000	
Manipulators, (Medium and light duty, 6 at $12,000 each).....	72,000	
Remote detergent washdown equipment.....	35,000	
Glove and dry boxes.....	30,000	
Radiation monitors.....	185,000	
Semi-shielded storage containers-core (50 at $4,000 each).....	200,000	
Semi-shielded storage containers-hot parts (50 at $1,500 each).....	75,000	
Material handling equipment.....	83,000	
Vault ventilating and sump pumps.....	85,000.	
Decontamination ventilating.....	60,000	
Effluent air and gas filter.....	326,000	
Dead storage crushing and burning equipment..	200,000	
E. DESIGN AND ENGINEERING SERVICES.....		500,000
Total estimated cost.....		$4,250,000

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1964 ESTIMATES

SUPPORT FACILITIES

DESCRIPTION:

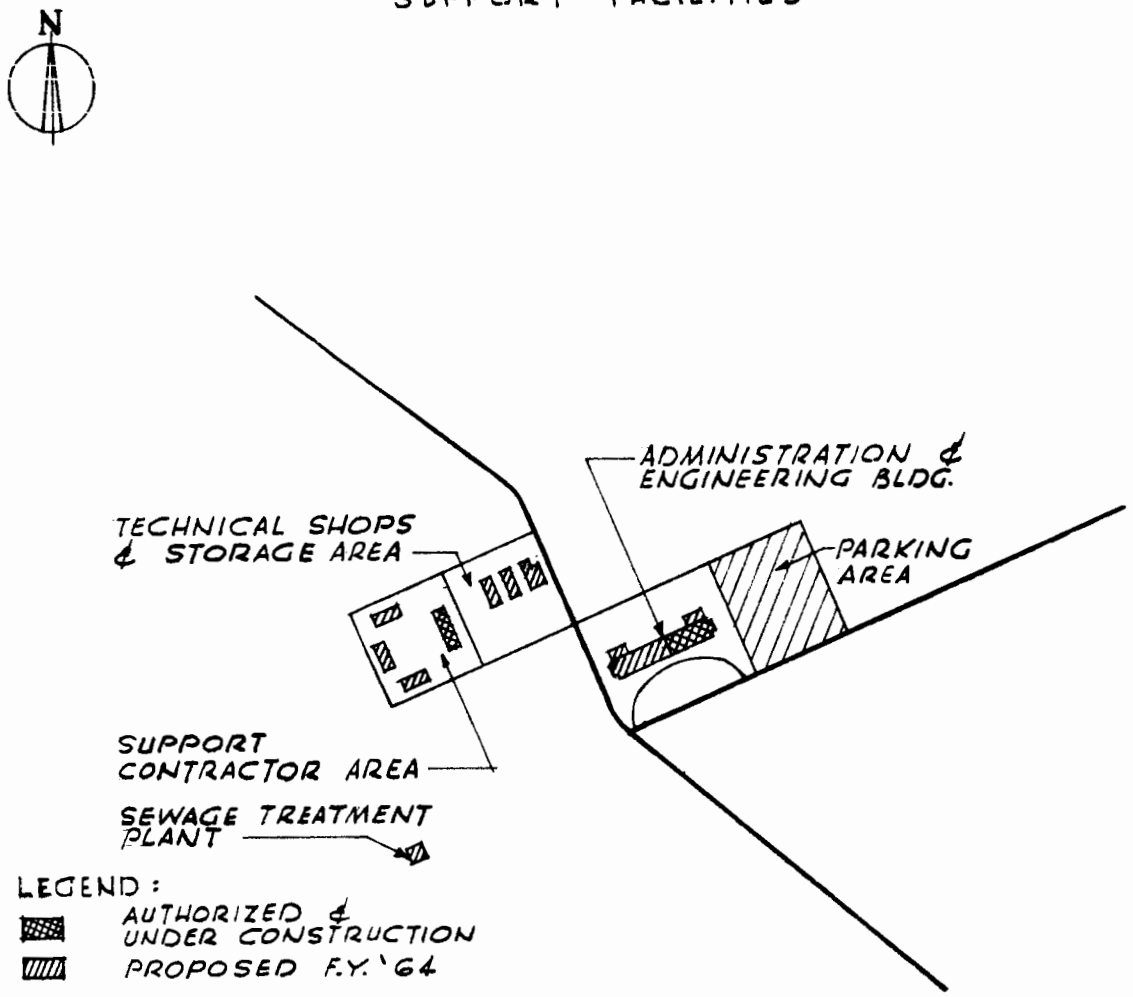
This project proposes the construction of support facilities required for operation of the Nuclear Rocket Development Station. A location plan and sketches of the required facilities are shown on the following five pages. The facilities will be located in an area remote from the nuclear test area, and will include:

Administration and engineering building: This building will be a 60,000 square foot steel frame addition to the administration building which was authorized in the fiscal year 1963. It will consist of a two-story office wing and a one-story laboratory wing and will be heated and air-conditioned from an integral plant. The exterior walls will be of reinforced precast concrete panels and window-wall construction. The roof will be built up over insulation on a metal deck. This building will house the governmental and operating technical contractors and support contractor personnel and equipment necessary to perform the functions of administration, security, engineering, reproduction, radiation monitoring, micrometeorology, secondary standards, automatic data processing, and limited technical research and development activities.

Technical shops building: The technical shops building will consist of an 11,400 square foot steel frame structure composed of a low bay area having exterior walls of concrete block and a high bay area enclosed by metal insulated siding. The high bay area will be provided with an overhead bridge crane of 7½-ton capacity. Approximately 80 percent of the building will be heated and air-conditioned from an integral plant. This building will provide space for machine and electrical-electronics shops.

Technical storage building: Technical equipment will be stored in a storage building approximately 148 feet by 48 feet providing a total gross storage area of 7,104 square feet. The building will be a concrete block structure with composition built-up roofing on a metal deck. It will be air-conditioned and heated by integral plants to maintain a constant atmosphere for preservation of the stored technical equipment.

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES
SUPPORT FACILITIES

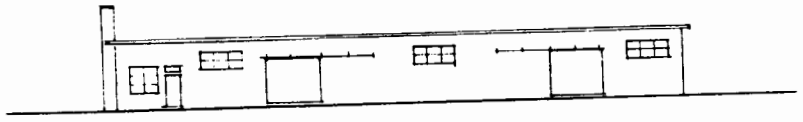


CF 12-28

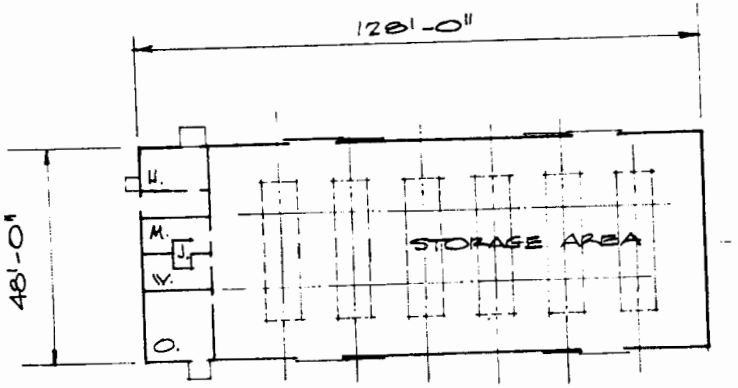
LOCATION PLAN

SCALE: 1" = 800'

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES
SUPPORT FACILITIES



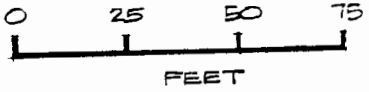
FRONT ELEVATION



PLAN

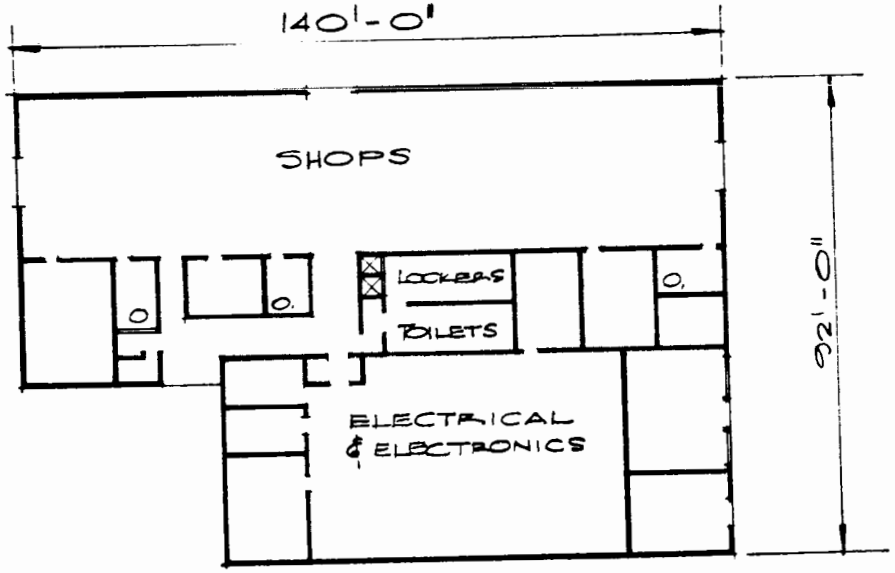
TECHNICAL STORAGE BUILDING

GRAPHIC SCALE

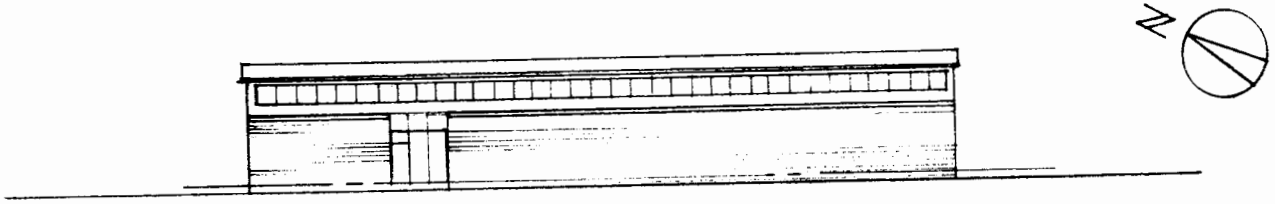


CR 12-29

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES
SUPPORT FACILITIES



PLAN



ELEVATION

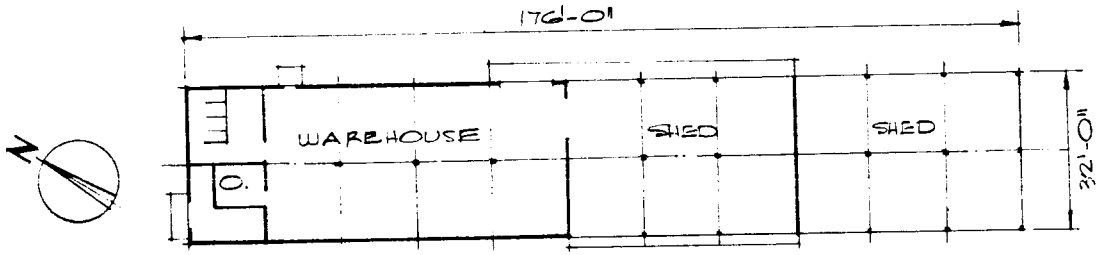
TECHNICAL SHOP BUILDING

GRAPHIC SCALE 0 25 50 75 FEET

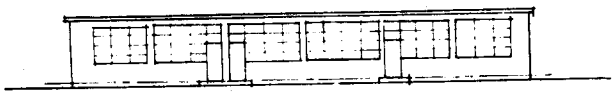
CF 12-31

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES
SUPPORT FACILITIES

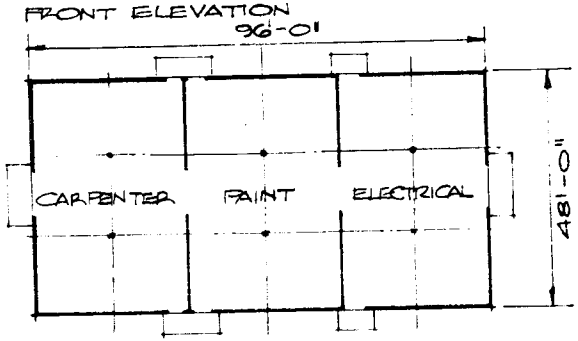
ELEVATION



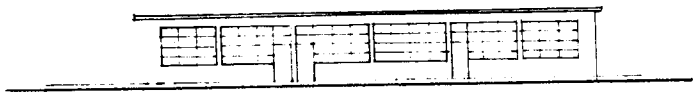
PLAN
STORAGE BUILDING



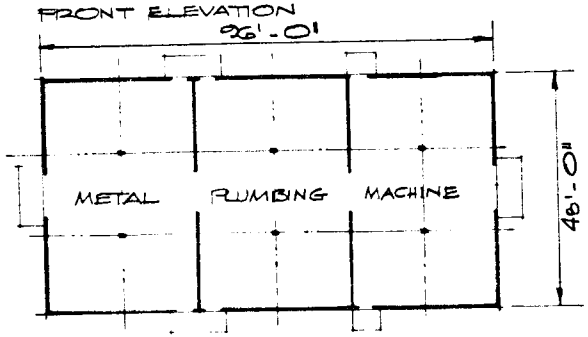
FRONT ELEVATION



PLAN - SHOP #1



FRONT ELEVATION



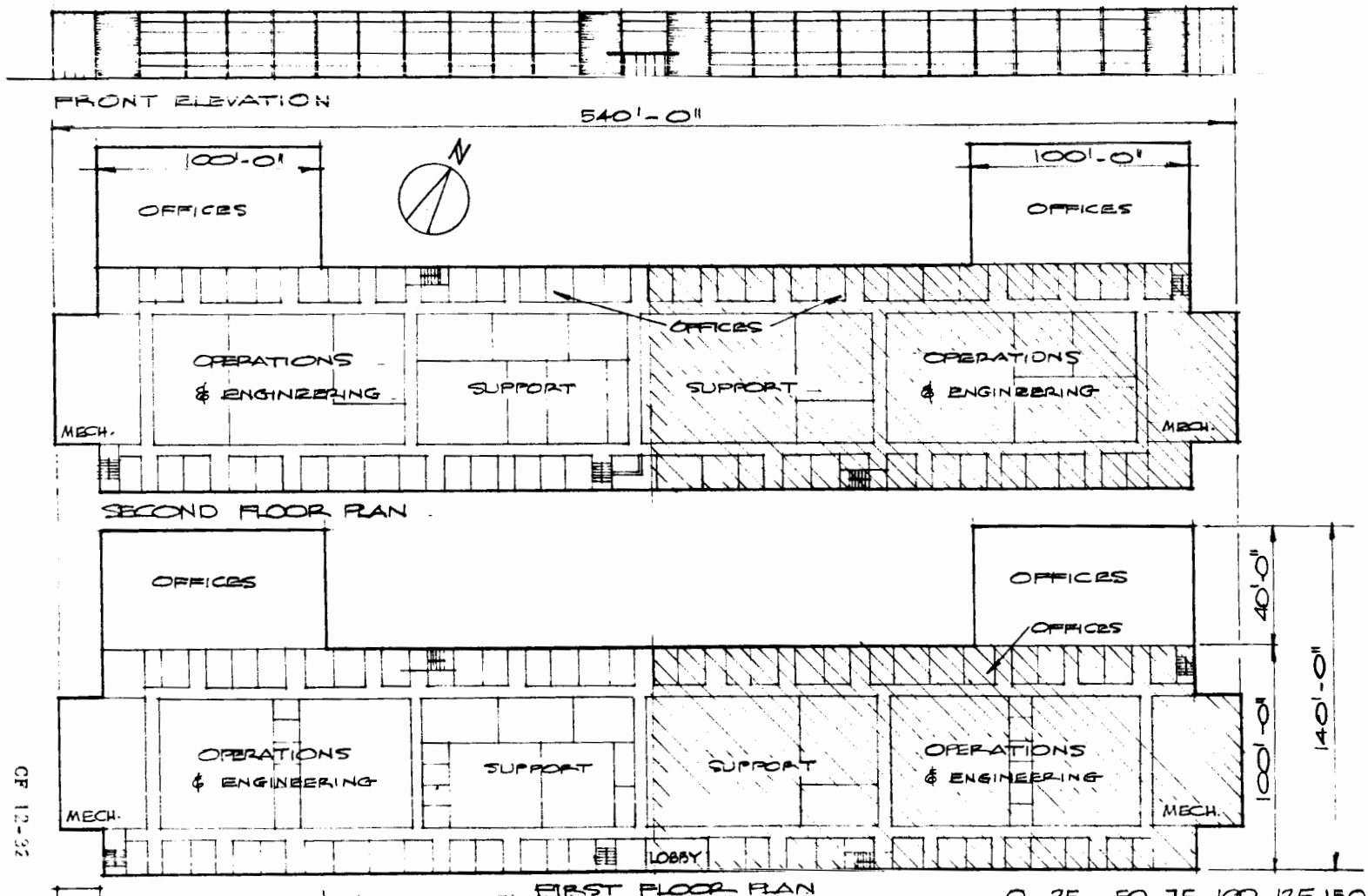
PLAN
SHOP #2

GRAPHIC SCALE 0 25 50 75
FEET

CF 12-31

MAINTENANCE SHOPS & WAREHOUSE

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1964 ESTIMATES
SUPPORT FACILITIES



ADMINISTRATION & ENGINEERING BUILDING

CF 12-32

Maintenance shops: To provide the operating support contractor facilities necessary to maintain, service, and operate the Nuclear Rocket Development Station, two maintenance shop buildings will be provided. Each building will be approximately 96 feet by 48 feet providing a total gross shop area of 4,600 square feet. The shops will be concrete block structures with composition built-up roof on a metal deck.

Maintenance warehouse: To store maintenance material and equipment, a warehouse approximately 80 feet by 32 feet enclosing 2,560 square feet will be constructed with a covered shed extension 96 feet long and 32 feet wide. The warehouse will be of concrete block construction and the shed will be steel framework, each with a composition built-up roof on a metal deck.

Utilities installation and road system extension: To make the proposed new construction useable, utilities and roads are required. The project includes the installation of a new well and pump; extensions to the existing water and sanitary sewer systems; extensions to the existing communications and electrical distribution systems; and extensions to the road system to serve the additional buildings.

JUSTIFICATION:

Several technical facilities including engine test stand No. 1, and the the engine maintenance, assembly, and disassembly facility are scheduled to go into operation during the fiscal year 1964. Engine test stand No. 2 is scheduled to go into operation in the fiscal year 1965. It is necessary to provide support facilities necessary for the operation of these technical facilities by providing laboratory, engineering, shop, warehouse, and administrative space.

Additional space will have to be provided in the administration and engineering building. Only a limited amount of space was provided from the fiscal year 1963 funding. Office space provided in the technical facilities is planned at the minimum necessary for technical operation of the facility; consequently, additional space will have to be provided in the support area for technical contractor staffs, the support contractor's staff, and NASA personnel. This facility provides space for laboratory work such as chemical, calibration, quality control, secondary standards, and analytical and counting activities pertaining to radiological conditions at the Station. Space must also be provided for the use by personnel of the engineering, security, administration, planning, coordinating, and scheduling activities. Personnel projections indicate that space requirements for 501 people will exist by June of 1964 and will increase to 650 people by the second quarter of the fiscal year 1965. These figures do not include personnel engaged in activities not requiring administrative space.

The technical shops will provide facilities for modifications, repairs, and the fabrication of pieces of special equipment. Because of the remote location of the Station, program delays would be inevitable if off-site facilities were used for this work.

The technical storage facility provides space for the storage of the technical equipment earmarked for installation in test facilities, and for supplies for the technical shops.

The maintenance shops and storage facilities will provide space for the support-contractors' use, who furnish electrical, carpenter, welding, and plumbing services. Present facilities for these activities are either non-existent or grossly inadequate, but will be used to the extent that location and suitability will permit. Storage space is needed to provide for items used in the shops and for maintenance activities.

The communication system will have to be extended to provide for expanded support facilities. The power distributor system will be extended through the Station to tie in with the new line the Atomic Energy Commission is running into the area. This tie-in is essential to improve reliability of the power supply to minimize the possibility of having to abort tests which would result in added costs through scheduling delays plus the possibility of damage to test components and facilities. Additionally, some long-lead items such as substations are required, and it is essential to begin construction and procurement of such items as early as possible to assure their readiness for use when required.

Extension of the road system is required within the support area to provide ready access to shops and storage areas within the Station, and to improve access to engine test stands Nos. 1 and 2. Access to the support area itself must be improved and additional parking supplied to provide for the increased facility space and the number of personnel using it.

The site safety equipment consisting of monitoring and meteorological equipment is required to maintain safe operation of the facilities at the Station.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$1,098,000
Well (1,500 feet at $45 per foot).....	$67,500	
Pump and controls.....	32,500	
Water distribution connections.....	7,000	
Septic tank.....	100,000	
Sewer line connections.....	26,400	
Substation.....	250,000	
Electrical primary lines.....	60,000	

Electrical secondary line connections.....	$20,000	
Telephone connections.....	44,600	
Primary road network (7 miles at $50.00 per mile).....	350,000	
Secondary area streets (2.28 miles at $39,500 per mile).....	90,000	
Parking areas (7,500 square yards at $6.70 per square yard).....	50,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$2,474,600
Administration and engineering building addition (60,000 square feet at $30.50 per square foot).....	1,903,200	
Technical shops building (11,400 square feet at $23.00 per square foot).....	264,000	
Technical storage building (7,140 square feet at $20.05 per square foot)....	142,400	
Two maintenance shop buildings (9,200 square feet at $14.00 per square foot)....	128,800	
Maintenance warehouse (2,560 square feet at $9.00 per square foot; 3,072 square feet at $4.30 per square foot).....	36,200	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		959,400
Office equipment and furniture.....	40,000	
Laboratory analysis equipment.....	145,000	
Radiation monitoring equipment.....	100,000	
Meteorological measuring equipment.....	100,000	
Industrial X-ray equipment.....	50,000	
Radiographic equipment.....	8,000	
Physical test equipment.....	20,000	
Bridge crane - 7½ ton.....	10,000	
Facility component test and repair equipment.....	245,000	
High-pressure gas compression, storage and distribution equipment.....	61,500	
Laboratory furnaces.....	20,000	
Machine and bench tools.....	40,000	
Carpentry shop equipment.....	15,000	
Sheet metal shop equipment.....	14,900	
Machine shop equipment.....	25,000	
Pipe shop equipment.....	25,000	
Electrical shop equipment.....	25,000	
Paint shop equipment.....	15,000	
E. DESIGN AND ENGINEERING SERVICES.....		508,000
Total estimated cost.....		$5,040,000

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

VARIOUS LOCATIONS

		Page No.
Electronics Research Center.....	$5,000,000	CF 13-1
Facilities for F-1 engine program.....	14,238,000	CF 13-3
Facilities for H-1 engine production.....	1,500,000	CF 13-12
Facilities for J-2 engine program.....	6,900,000	CF 13-14
Facilities for M-1 engine program.....	16,000,000	CF 13-21
Facilities for S-IVB stage program.....	5,300,000	CF 13-27
Improvements to the RL-10 A-3 engine test facility.....	500,000	CF 13-30
Instrumentation ships.....	90,000,000	CF 13-32
Lunar excursion module test facility.....	15,000,000	CF 13-36
Manned space flight data acquisition and tracking facilities.....	21,000,000	CF 13-43
Telemetry station.....	600,000	CF 13-46
Total.....	$176,038,000	

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

ELECTRONICS RESEARCH CENTER

DESCRIPTION:

This project proposes the acquisition of land and the intiation of design and engineering services for an NASA Electronics Research Center. In response to a critical need for research and development effort in space-related electronics and control, NASA proposes the establishment of a research center in close proximity to a concentration of the nation's electronics industry and allied university research effort. It is planned that the initial cadre of personnel for the Center will be located in temporary quarters in the greater Boston area during the fiscal years 1963 and 1964, moving into buildings at the Center when they become available. It is planned to erect, at a future date, facilities which will accommodate scientific laboratories, specialized research instrumentation, and space simulation equipment.

Land will be acquired at a site that is conveniently located in relation to the electronics research and development industry and to universities having special competence in physics and engineering. The combined influence of the Center staff, the university community, and the industrial users of electronics technology will be conducive to the most productive research and development atmosphere.

Design and engineering services will be procured for master site planning, site development, utility installations, and for the initial buildings proposed for the Center. Funding for building construction will be included in the fiscal year 1965 budget.

JUSTIFICATION:

The NASA's commitments and missions in aeronautics and space require that the agency have a solid and well-balanced technical research program. NASA research personnel located at existing centers are primarily oriented towards the propulsion and aeronautical aspects of spacecraft and vehicle systems. In order to provide a capability to foresee and meet the electronics requirements of future space systems, NASA proposes to establish an Electronics Research Center. The Center will provide the focal point and the facilities for scientists, engineers, technicians, and supporting personnel participating in electronics and related physics research required for future space missions and projects.

The new Center will house the laboratories, tools, offices, and equipment necessary to build and sustain a competent technical organization capable of carrying out specified in-house research and development, and of advising and directing related space activities in industry and universities.

The Electronics Research Center will provide NASA with a firm research base in electronics and related physics disciplines, a technological facet vital to assuring that all the important and allied sciences are exploited to assist NASA and the nation in meeting its goals in aeronautics and in space.

COST ESTIMATE:

A.	LAND ACQUISITION		$3,000,000
	(Estimate based on 1,000 acres at $3,000 an acre)	$3,000,000	
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		---
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		---
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		---
E.	DESIGN AND ENGINEERING SERVICES		2,000,000
	Total estimated cost		$5,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR F-1 ENGINE PROGRAM

DESCRIPTION:

This project consists of the construction at Edwards Air Force Base, California of three (3) single-position static test stands and associated control center, propellant, electrical, water storage and other support facilities; and the construction of facilities and the procurement of additional manufacturing, research and development, and testing equipment required at the contractor's (Rocketdyne) plants in Canoga Park, California and in Santa Susana, California. The facilities and equipment at these three locations are required for the production of F-1 engines and for the support of a continuing development program.

The initial increment of $15,523,000 for this project in the fiscal year 1962 program provided for the design and the initial increments of construction and equipment for the three static test stands at Edwards Air Force Base ($11,468,000); the installation of facilities and equipment for development work at this same location ($2,055,000); the procurement of equipment for development work at Canoga Park ($670,000); and the design, facility modifications, and procurement of equipment for the expansion of the liquid oxygen system at Santa Susana ($1,330,000). Funding in the fiscal year 1963 appropriation program in the amount of $21,985,000 provides for additional structural and supporting facilities and equipment at Edwards Air Force Base required to supplement the fiscal year 1962 program at this location in order to provide the necessary lead time to phase in with the current schedule of engine delivery rates.

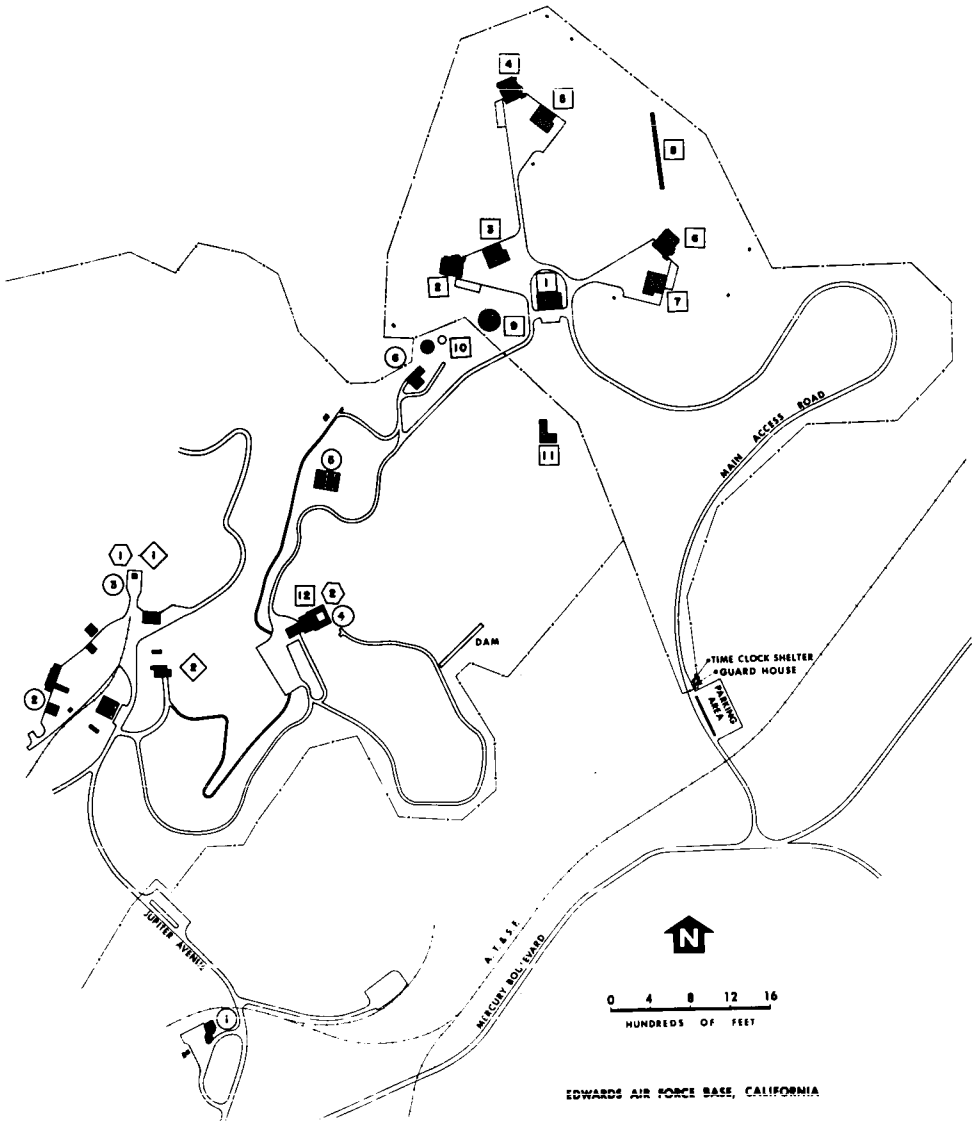
This project virtually completes the construction of the production and research and development test facilities at the three locations. It provides the capability to continue research and development work in F-1 engine production reliability improvement, and for the additional improvement of equipment and of facilities to support the recently approved Saturn production program. Future requirements for testing and production facilities may be required to support planned peak delivery rates of F-1 engines, or for the continuing need to modify or replace facilities which may become incapable of sustaining production rates or quality standards.

The facilities to be provided under this project at the Edwards Air Force Base test site, where research, development, and production acceptance static testing is accomplished, include improvements and additions to the test stand 1-A deflector; test stand 1-C environmental capability; liquid nitrogen vaporization distribution system; support building cranes; propellant storage and transfer modifications; and equipment; all at an estimated cost of $2,775,000.

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR F-1 ENGINE PROGRAM



EDWARDS AIR FORCE BASE, CALIFORNIA

LEGEND

EXISTING FACILITIES

1. LIQUID OXYGEN STORAGE (PARTIAL)
2. TEST STAND 2-A
3. TEST STAND 1-A
4. TEST STAND 1-B
5. FUEL STORAGE
6. WATER FACILITIES

FACILITIES AUTHORIZED & UNDER CONSTRUCTION

FISCAL YEAR 1962

1. MODIFICAYION TO TEST STAND 1-A
2. MODIFICATION TO TEST STAND 1-B
3. DESIGN LONGLEAD PROCUREMENT & EARTHWORK

FISCAL YEAR 1963

1. CONTROL CENTER
2. TEST STAND 1-C
3. PRE-TEST BUILDING 1-C
4. TEST STAND 1-D
5. PRE-TEST BUILDING 1-D
6. TEST STAND 1-E
7. PRE-TEST BUILDING 1-E
8. RECLAMATION DAM
9. 3,000,000 GAL. DEFLECTOR WATER TANK
10. 400,000 GAL. FIRE TANK
11. PUMP HOUSE AREA
12. MODIFICATION OF TEST STAND 1-B

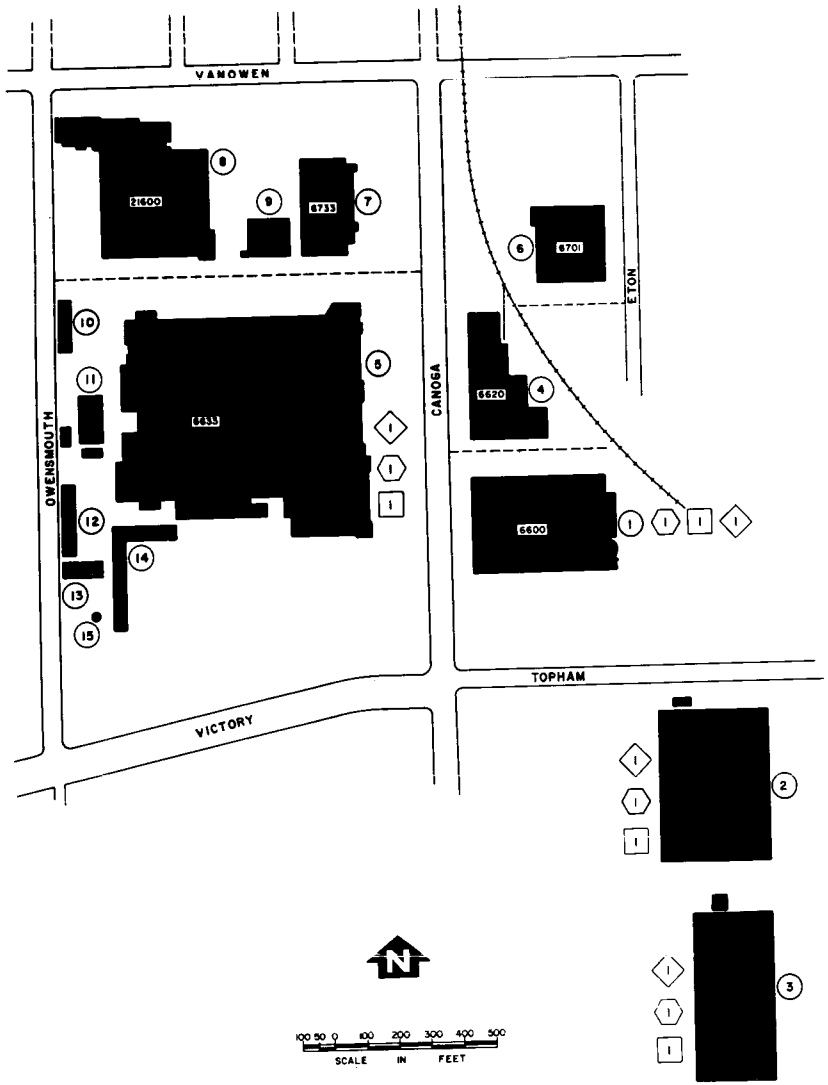
PROPOSED FISCAL YEAR 1964 PROJECT

1. MODIFICATION OF TEST STAND 1-A
2. NEW VALVE SERVICING AREA & MISC. ITEMS

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR F-1 ENGINE PROGRAM



CANOGA PARK, CALIFORNIA

LEGEND

EXISTING FACILITIES

1. MANUFACTURING BUILDING NO. 1
2. MANUFACTURING BUILDING NO. 2
3. MANUFACTURING BUILDING NO. 3
4. MATERIAL BUILDING
5. MAIN BUILDING
6. WAREHOUSE
7. ANNEX
8. VANOWEN
9. CAFE
10. NORTH SHED
11. MAINTENANCE BUILDING
12. SOUTH SHED
13. PAINT & CHEMICAL STORAGE
14. SHED
15. INCINERATOR

FACILITIES AUTHORIZED & UNDER CONSTRUCTION

FISCAL YEAR 1962

(1) EXPANSION OF R&D PRODUCTION MANUFACTURING EQUIPMENT

FISCAL YEAR 1963

[1] EXPANSION OF R & D PRODUCTION MANUFACTURING EQUIPMENT

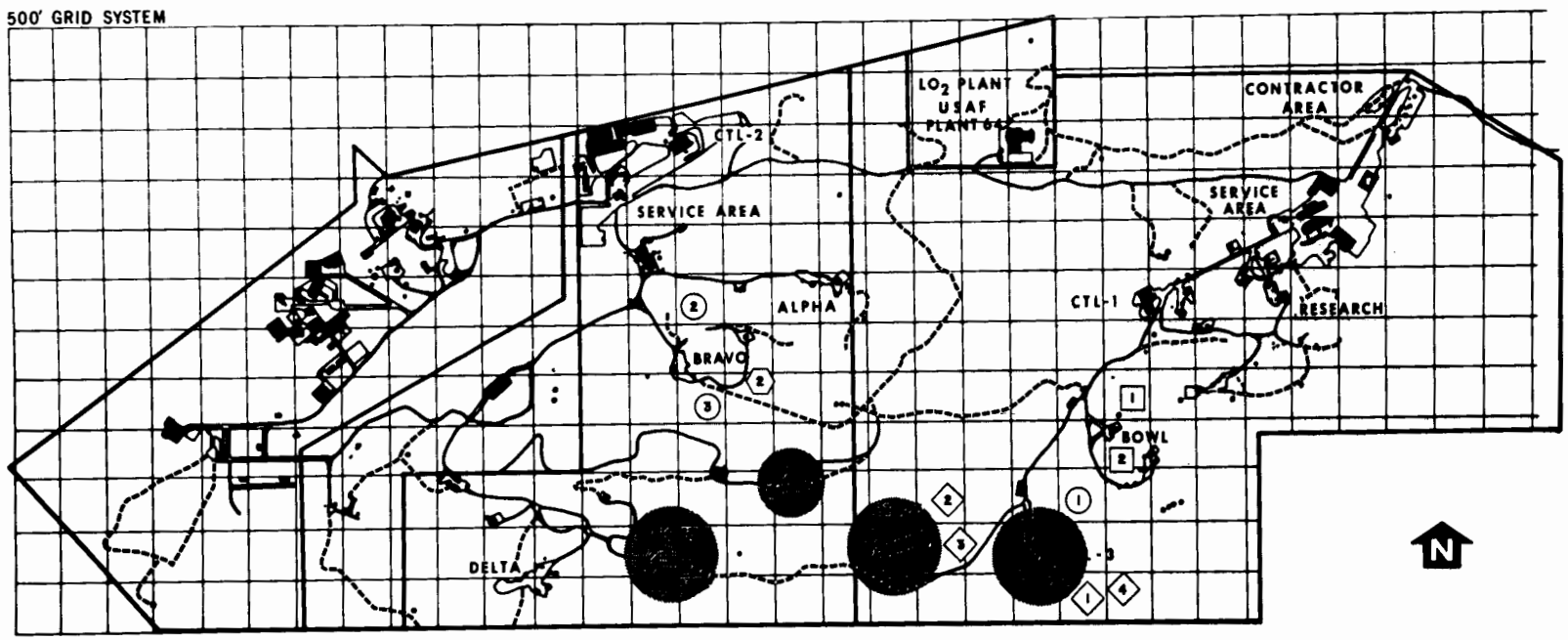
PROPOSED FISCAL YEAR 1964 PROJECT

◇1 EXPANSION OF R. & D. PRODUCTION MANUFACTURING EQUIPMENT

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR F-1 ENGINE PROGRAM



SANTA SUSANA, CALIFORNIA

LEGEND

EXISTING FACILITIES	FACILITIES AUTHORIZED & UNDER CONSTRUCTION		PROPOSED FISCAL YEAR 1964 PROJECT
	FISCAL YEAR 1962	FISCAL YEAR 1963	
1 CTL - 3	1 LN_2 LOX BUFFER STORAGE	1 ADDITIONAL INSTRUMENTATION CENTRAL RECORDING	1 ADDITIONAL STORAGE TANKS CTL-3
2 BRAVO 1	2 MODIFICATION TO BRAVO AREA	2 BOWL AREA	2 ADDITIONAL STORAGE BOTTLES CTL-3
3 BRAVO 2			3 MISC. ITEMS FOR CTL-3 & CTL-5
			4 ADDITIONAL INSTRUMENTATION

At Canoga Park, where research, development, and production manufacturing are performed, manufacturing, quality control and test equipment will be provided together with the necessary modifications of the existing space to house such equipment suitably; all at an estimated cost of $9,240,000.

At Santa Susana, where research, development and testing of components is predominantly performed, the additions and improvements include instrumentation, test equipment such as gas generator full-duration run tanks, and improvements to the support complex.

Sketches of the proposed facilities at the three locations are shown on the following three pages.

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, the most powerful single-chamber booster vehicle engine under development. It will be used in the space vehicles for the manned lunar landing mission and for other manned exploration space missions. The size of these engines and their components produces unique and specialized requirements for their fabrication and testing and precludes the modification of previously existing test facilities. In addition, laboratory, environmental, production and tooling equipment are required at the contractor's plant for manufacturing, inspection, and testing of the F-1 engine components.

The need for the additional manufacturing facilities has resulted from studies undertaken to assure maximum utilization of existing and expanded facilities in maintaining quality and delivery rates as required by existing engine contracts. It should be noted that contractor's proposals and construction budgets for the F-1 and J-2 engine programs are based upon joint usage of many of the existing and planned facilities.

The additional test facilities are based upon the necessity for reducing down time and reptition of tests to obtain adequate data for corrective measures to be taken before delays occur in the hardware programs. The current project together with those programmed in fiscal years 1962 and 1963 represent the buildup in facilities to initiate and support current schedules of engine deliveries.

COST ESTIMATE:

Acceptance Static Test Facility Flight Research Center (Edwards Air Force Base):	Fiscal Year 1962	Fiscal Year 1963	Fiscal Year 1964
A. LAND ACQUISITION.....	---	---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	$2,000,000	$4,224,000	$40,000
Site development.....	1,500,000	944,000	---
Utility installation (electrical).....	300,000	168,000	---
Utility installation (water).....	200,000	3,112,000	---
Erosion control.....	---	---	40,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	---	13,270,000	2,134,000
Three (3) single-position test stands and control center:			
Stand foundation.....	---	1,929,000	---
Stand superstructures...	---	7,134,000	---
Flame deflector structures.....	---	1,470,000	---
Control center.....	---	939,000	---
Underground passageways.....	---	543,000	---
Pretest buildings (4; 10,000 square feet at $27.40 per square foot).....	---	1,095,000	---
Observation bunkers; blast proof (8).....	---	160,000	---
Increased water pumping capacity.....	---	---	50,000
Propellant storage and transfer modifications	---	---	469,000
Support building cranes and modifications.....	---	---	95,000
Environmental test complex.....	---	---	220,000

	Fiscal Year 1962	Fiscal Year 1963	Fiscal Year 1964
Turbopump clean room (5,650 square feet at $20.00 per square foot).....	---	---	$113,000
Test stand 1-A deflector	---	---	782,000
Nitrogen vaporizative system.....	---	---	405,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	$8,168,000	$4,176,000	436,000
Pressurizing systems.....	1,400,000	42,000	---
Fuel systems.....	4,000,000	2,332,000	---
Instrumentation and controls.....	2,100,000	1,731,000	---
Electrical system.....	278,000	---	---
Fire protection and water system.....	390,000	---	---
Miscellaneous.....	---	65,000	135,000
Water system.....	---	6,000	---
Manufacturing equipment	---	---	172,000
Test equipment.....	---	---	129,000
E. DESIGN AND ENGINEERING SERVICES.....	1,300,000	315,000	165,000
Total.....	$11,468,000	$21,985,000	$2,775,000
Deepened Existing R&D Program - Flight Research Center (Edwards Air Force Base):			
A. LAND ACQUISITION.....	---	---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	$20,000	---	---
Site preparation and erosion control, test stands 1-A and 1-B.....	20,000	---	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	75,000	---	---
Construction of second position test stand 2-A..	75,000	---	---

	Fiscal Year 1962	Fiscal Year 1963	Fiscal Year 1964
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	$1,835,000	---	---
Equipment.....	1,310,000	---	---
Instrumentation.....	275,000	---	---
Support systems.....	250,000	---	---
E. DESIGN AND ENGINEERING SERVICES.....	125,000	---	---
Total.....	$2,055,000	---	---
Development Equipment - Canoga Park (Rocketdyne):			
A. LAND ACQUISITION.....	---	---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	---	---	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	$55,000	---	$1,615,000
Modification to brazing and assembly room.....	55,000	---	---
Environmental test complex	---	---	255,000
Bearing test complex.....	---	---	310,000
Clean areas (5,400 square feet at $20.00 per square foot).....	---	---	108,000
Engine check-out cells....	---	---	180,000
Adaptation and activation of production areas (50,400 square feet at $15.00 per square foot..	---	---	762,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	610,000	---	7,275,000
Equipment.....	290,000	---	---
Support systems.....	320,000	---	---
Manufacturing equipment...	---	---	6,215,000
Quality equipment.....	---	---	800,000
Test equipment.....	---	---	260,000

	Fiscal Year 1962	Fiscal Year 1963	Fiscal Year 1964
E. DESIGN AND ENGINEERING SERVICES.....	$5,000	---	$350,000
Total estimated cost....	$670,000	---	$9,240,000
Liquid Oxygen System Expansion - Santa Susana Air Force Plant No. 56 (Rocketdyne):			
A. LAND ACQUISITION.....	---	---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	3,000	---	---
Site preparation.....	2,000	---	---
Utility connections.....	1,000	---	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	20,000	---	95,000
Facility modifications....	20,000	---	---
Liquid oxygen fill modifications.....	---	---	78,000
Lubrication oil facility..	---	---	17,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	1,302,000	---	2,128,000
Equipment.....	32,000	---	---
Liquid oxygen system expansion.....	370,000	---	---
Liquid oxygen and liquid nitrogen buffer storage system.....	900,000	---	---
Manufacturing equipment...	---	---	17,000
Test equipment.....	---	---	410,000
Instrumentation.....	---	---	1,701,000
E. DESIGN AND ENGINEERING SERVICES.....	5,000	---	---
Total.....	$1,330,000	---	$2,223,000
Total estimated cost.....	$15,523,000	$21,985,000	$14,238,000

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR H-1 ENGINE PRODUCTION

DESCRIPTION:

This project provides for the design, fabrication and installation of a brazing furnace approximately 15 feet square and 12 feet high. The installation is to be accomplished in the existing Air Force-owned H-1 engine production facility at Neosho, Missouri and will include the furnace, the electrical substation, and those utility services required for operation.

JUSTIFICATION:

The H-1 engine, using liquid oxygen and RP-1 fuel, is a vital element in the propulsion system for the Saturn S-I stage. Engine operation and experience have established that the present thrust chamber is not acceptable because of cracking and splitting of the nickel alloy tubing which results in fuel coolant loss and possible initiation of combustion instability. The breakdown of the tubing is caused by sulfur embrittlement. This tube splitting is a serious problem, and modification of the thrust chamber using a tubing which is not subject to sulfur embrittlement is necessary. Stainless steel tubing has this capability. However, the high-brazing temperature and long-exposure time required for stainless steel makes it impossible to braze the stainless steel thrust chambers by hand as is done on the present nickel alloy chamber. As a result, it is necessary that a furnace-braze technique be used to obtain satisfactory results. A brazing furnace is required for this purpose.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$90,000
Electrical substation.....	$70,000	
Electrical and gaseous helium services...	20,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,290,000
Braze furnace foundation.....	60,000	
Brazing furnace	400,000	
Electrical switchgear.....	390,000	
Furnace control systems.....	400,000	
Thrust chamber handling mechanism.....	40,000	

D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	---
E.	DESIGN AND ENGINEERING SERVICES.....	$120,000
	Total estimated cost.....	$1,500,000

VARIOUS LOACTIONS

FISCAL YEAR 1964 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; modifications of production and development test facilities at the same location; and modifications and construction of facilities at the Rocketdyne Plant, Canoga Park, California. These facilities are required in the acceptance and development of the 200,000-pound thrust liquid hydrogen - liquid oxygen (J-2) engine to be used in the Saturn B and Advanced Saturn vehicle programs. The existing test stand complexes were previously used for the Air Force Atlas program and 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 $6,300,000 for modifications to the two (2) Delta 2 static test stands at Santa Susana to provide a full-duration engine test capability; and the initiation of the modifications 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 increment of this project will provide funds in the amount of $4,950,000 at the Propulsion Field Laboratory, Santa Susana, for modifications to the vertical test stand no. 3; design and first increment of construction of the liquid hydrogen flow calibration facility; production acceptance test facilities; and development and production equipment (such as low-temperature vibration chamber, analysis apparatus, brazing equipment and concentricity and certification system).

The fiscal year 1964 increment requested herein will provide for modifications to the Delta 3 static test stand complex, the completion of construction of the liquid hydrogen flow calibration facility at the Propulsion Field Laboratory, Santa Susana; and the procurement and installation of development and production equipment for utilization at Canoga Park. Additional funds for completion of modifications to the Delta 3 test stand at Santa Susana (propellant storage, transfer and recovery systems) and for additional development, production and test equipment at Canoga Park will be programmed in the fiscal year 1965 construction program to meet planned increased delivery rates of the J-2 engines.

The modifications to the Delta 3 stand complex include the design and construction of foundation modifications; five additional monitors; and

related items. Additional items such as liquid and gaseous hydrogen storage, transfer, and recovery systems and propellant tankage will be included in the fiscal year 1965 construction program. This project will complete the design and construction of the liquid hydrogen flow calibration facility, a highly-instrumented tank with a flow system on the magnitude of the J-2 liquid hydrogen consumption rate to calibrate liquid hydrogen flow meters accurately. The development and production equipment consists of vertical turret lather, radial drill presses, grinders, milling machines, cranes, air compressors and welding equipment and will be utilized at Canoga Park. The test equipment includes environmental chambers and will be located at the Propulsion Field Laboratory in Santa Susana.

A location plan and sketches of the proposed facilities are shown in the drawings on the following four pages.

JUSTIFICATION:

The J-2 (200,000-pound thrust liquid hydrogen - liquid oxygen) engine is a high-specific impulse rocket engine which will be used to support the Saturn B and the Advanced Saturn vehicle programs. Existing test positions are inadequate for acceptance testing of engines at the currently planned delivery rate; modification of an additional test stand to be operational in March 1966 will be required. This stand will be used to support testing of the production engines which will reach a rate of six per month at that time.

The construction of the liquid hydrogen flow calibration facility began in 1963. There is no calibration facility currently available to measure with sufficient accuracy the flow of liquid hydrogen in the quantities consumed by the J-2 engine. The development, production and test equipment included under this project is the fiscal year 1964 increment required to support the engine delivery schedule for the Saturn B and the Advanced Saturn vehicles.

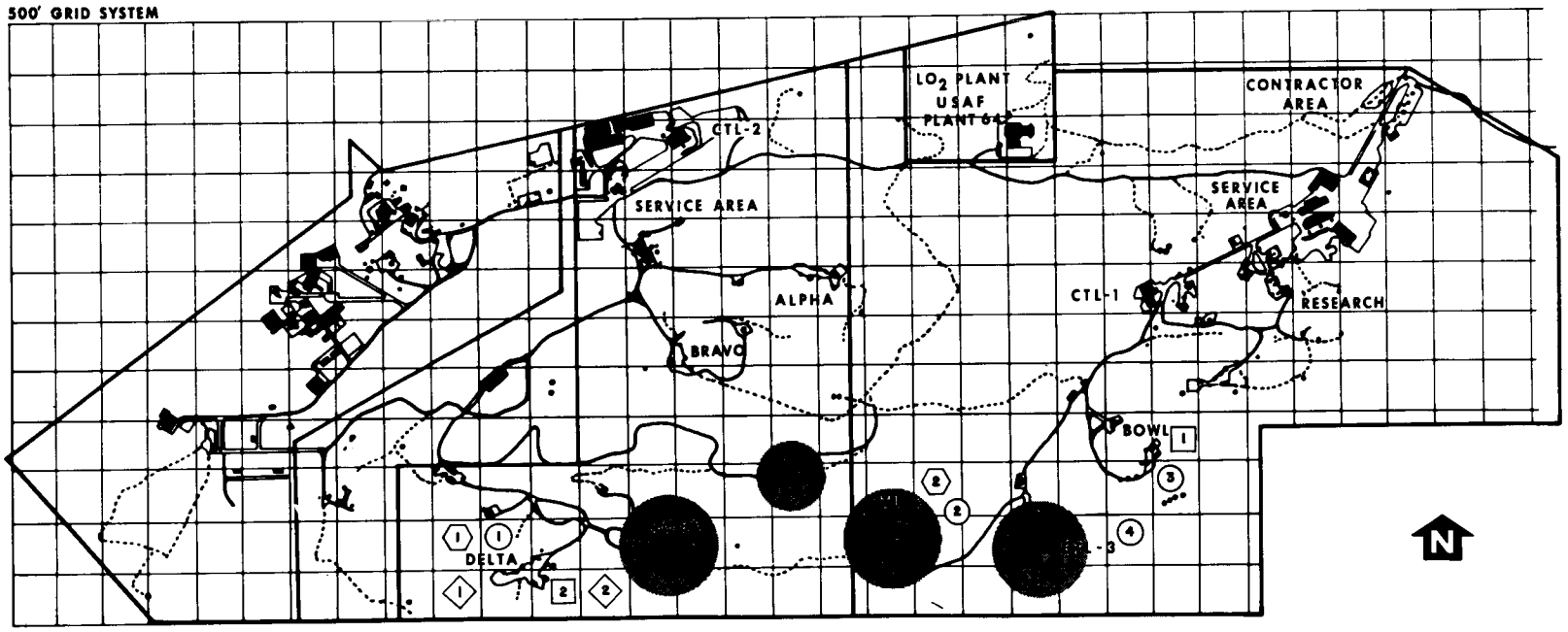
To meet flight dates with an engine of the reliability required for manned flight missions, the facilities in this project are essential to support development and acceptance testing of the J-2 engines. During late fiscal year 1963 and early fiscal year 1964, the development effort will reach its peak and testing will progress at an accelerated rate to prove reliability and performance, and to detect and correct design and fabrication deficiencies.

The presently-funded development, production, and test equipment from the fiscal year 1962 and fiscal year 1963 projects will support the delivery schedule for the calendar year 1965 of three engines per month. The fiscal year 1964 increment will support an increase in the delivery rate for the calendar year 1966 to five engines per month. Future increments will be necessary to meet the planned increase in the delivery of J-2 engines to six per month.

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM



SANTA SUSANA, CALIFORNIA

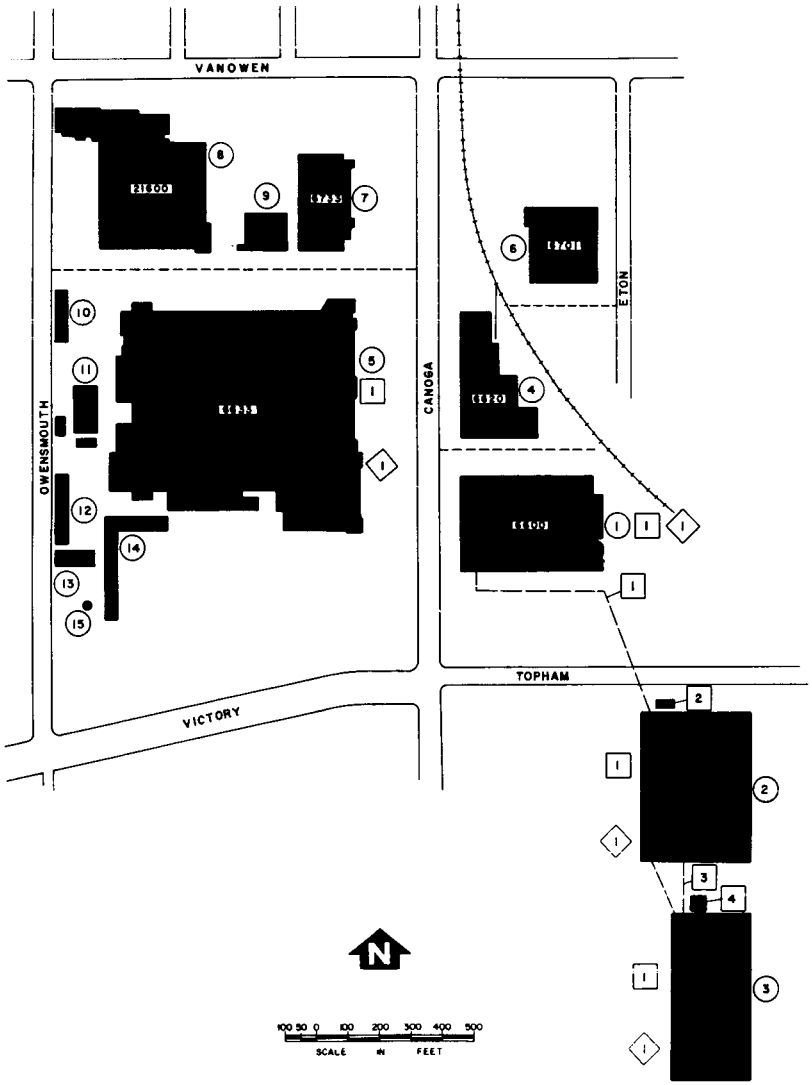
LEGEND

EXISTING FACILITIES	FACILITIES AUTHORIZED & UNDER CONSTRUCTION		PROPOSED FISCAL YEAR 1964 PROJECT
	FISCAL YEAR 1962	FISCAL YEAR 1963	
(1) DELTA	(1) DELTA 2 - 2 TEST STANDS	[1] VTS-3 MODIFICATION	(1) DELTA-3 MODIFICATION
(2) CTL-5	(2) CTL-3 MODIFICATION	[2] LIQUID HYDROGEN FLOW CALIBRATION FACILITY	(2) LIQUID HYDROGEN FLOW CALIBRATION FACILITY
(3) BOWL			
(4) CTL-3			

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM



LEGEND

EXISTING FACILITIES

1. MANUFACTURING BUILDING NO.1
2. MANUFACTURING BUILDING NO.2
3. MANUFACTURING BUILDING NO.3
4. MATERIAL BUILDING
5. MAIN BUILDING
6. WAREHOUSE
7. ANNEX
8. VANOWEN
9. CAFE
10. NORTH SHED
11. MAINTENANCE BUILDING
12. SOUTH SHED
13. PAINT & CHEMICAL STORAGE
14. SHED
15. INCINERATOR

FACILITIES AUTHORIZED & UNDER CONSTRUCTION

1. 1.5 INCH DIAMETER NITROGEN LINE
2. NITROGEN GAS CYLINDER & COMPRESSOR
3. 1 INCH DIAMETER HELIUM LINE
4. HELIUM K-BOTTLE BANK

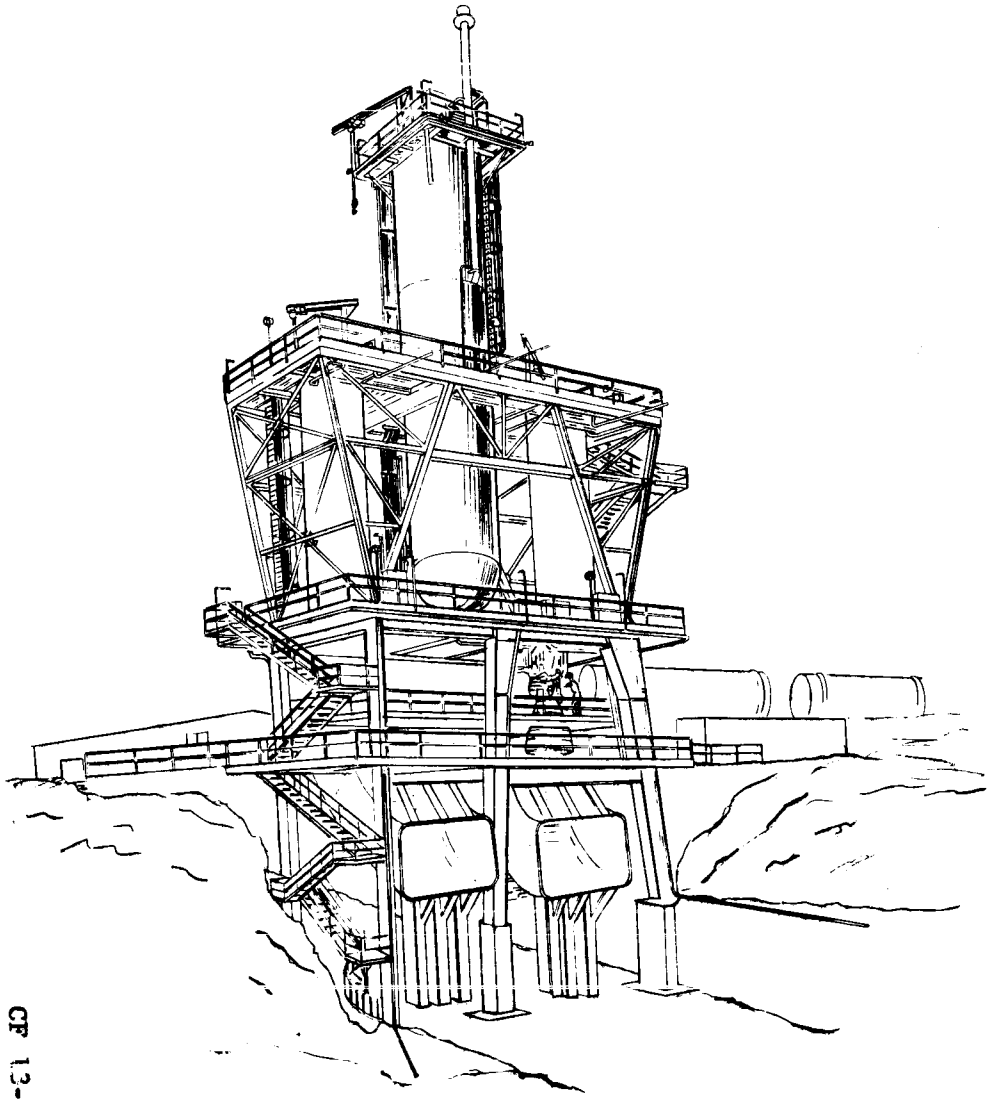
PROPOSED FISCAL YEAR 1964 PROJECTS

1. EXPANSION OF R & D PRODUCTION MANUFACTURING EQUIPMENT

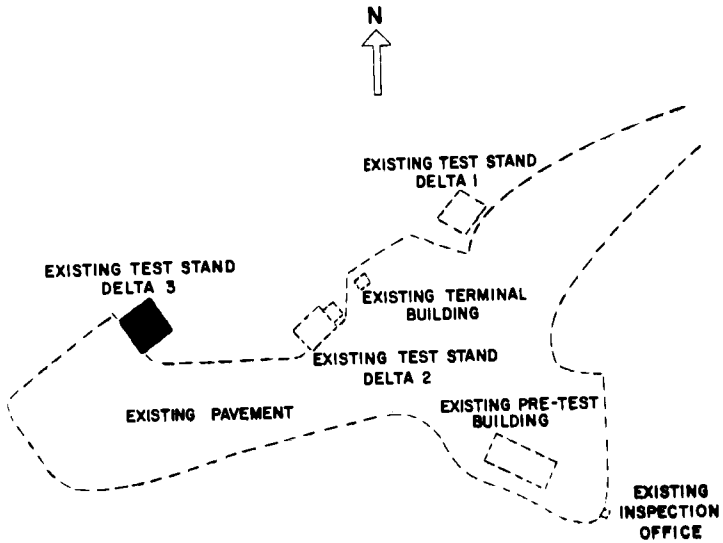
CANOGA PARK, CALIFORNIA

VARIOUS LOCATIONS
FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM



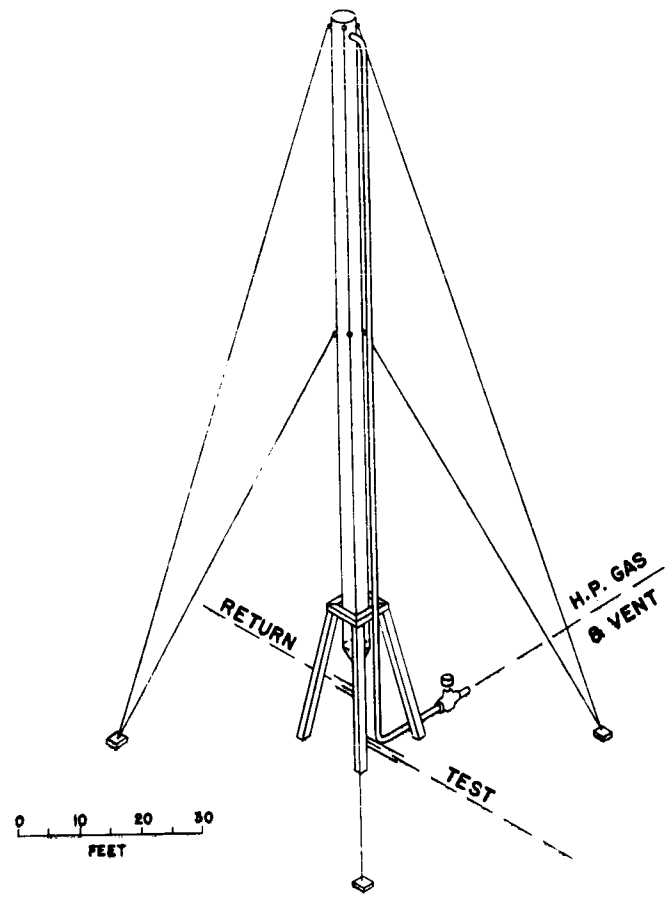
DELTA 3 TEST STAND



SITE PLAN

VARIOUS LOCATIONS
FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM



LIQUID HYDROGEN FLOW CALIBRATION FACILITY
SANTA SUSANA, CALIFORNIA

COST ESTIMATE:

	Fiscal Year 1962	Fiscal Year 1963	Fiscal Year 1964
A. LAND ACQUISITION.....	---	---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	$38,000	---	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	3,259,960	$2,320,000	$1,000,000
Delta 2 test stand modification.....	547,600	---	---
Liquid hydrogen storage and transfer systems.....	1,105,000	---	---
Liquid oxygen systems.....	7,000	---	---
Gaseous hydrogen recovery system.....	217,700	---	---
Altitude equipment support...	608,360	---	---
Components test laboratory III tankage and modifications.....	774,300	---	---
Modifications to vertical test stand No. 3.....	---	570,000	---
Liquid hydrogen flow calibration facility.....	---	730,000	400,000
Production test facilities...	---	1,020,000	---
Delta 3 test stand modifications.....	---	---	600,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	2,621,420	2,370,000	5,700,000
High-frequency instrumentation and support systems...	177,140	---	---
Laboratory and shop equipment.....	104,280	---	---
Production laboratory and shop equipment.....	2,340,000	---	---
Development and production equipment (Santa Susana)...	---	2,370,000	---
Development and production equipment (Canoga Park)....	---	---	5,500,000
Test equipment.....	---	---	200,000
E. DESIGN AND ENGINEERING SERVICES.	380,620	260,000	200,000
Total estimated cost.....	$6,300,000	$4,950,000	$6,900,000

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR M-1 ENGINE PROGRAM

DESCRIPTION:

The modification of existing facilities and the construction of new facilities are required for the development of the M-1 (1,200,000-pound-thrust liquid hydrogen,liquid oxygen) engine. The facilities will be located at the Aerojet General Corporation's liquid rocket plant near Sacramento, California. The cost of nonseverable facilities is being borne by Aerojet General since they are located on company-owned property; the cost of severable facilities and special test equipment and instrumentation is being furnished by the Government.

Funds for facilities for the M-1 engine program in the amount of $13,794,000 were allocated in the fiscal year 1962 for modifications to existing test stands and for special test equipment and instrumentation for the stands and in the contractor facilities.

The fiscal year 1963 authorized program in the amount of $13,000,000 will provide additional design funds; the initiation of the construction of the new test zone "J"; structural modifications to existing test positions; and instrumentation, controls, and propellant systems.

The funding requested in this project will provide for the continuation of the previous programs including the procurement of industrial and test equipment; further modifications of existing test facilities; and the continuation of construction in test zone "J". Ultimately, this area will contain four test stands to provide for all phases including full-duration testing of the complete engine. In this project, work will be started to equip one of the four test stands with altitude simulation capability during the initial and continuous-run operation.

The control rooms in the zone "J" test complex must be completely fitted with instrumentation and controls for M-1 engine tests. The engine firing console area will be constructed to allow easy and rapid determination of the engine operation at any time during a firing. Visual displays representing critical parameters such as thrust, pressure, flow, temperature and stability will be displayed in a manner to help the test conductor analyze the firing progress. Signal conditioning equipment, amplifiers, tape recorders, analog-to-digital systems and patching systems are required to support the tests. Also included in this instrumentation are remotely controlled TV systems for actual firing viewing, and cameras on stands to record data on both normal speed and high speed film.

Area support items include propellant storage tankage and transfer lines; on-stand propellant tankage; gaseous hydrogen and gaseous nitrogen cascade systems; water deluge system for fire control, both on-stand and within the area; water supply system for deflector cooling water; and an area warning system.

A test shop will be installed to provide the capability in the vicinity for accomplishing repair work and modifications without the necessity of transporting items several miles to other shops. Included in this shop will be tube benders, tube flaring machines, various types of machine-shop equipment, welders, power saws and sheet-metal tooling.

Additional funds for the construction of a fourth test stand in zone "J" and for the completion of the third stand (J-3) in order to meet the M-1 research, development and production schedules will be programmed in the fiscal year 1965.

Additional industrial-type equipment will be required in the fabrication, engineering and hydraulics laboratory, the material engineering laboratory, and the materials division and quality control laboratory. In addition, test equipment will be required for the cryogenics laboratory, physics and chemistry laboratory, transducer laboratory, vibration laboratory, and existing test areas. Funds for these items will also be programmed in the fiscal year 1965 construction program and in future programs. Consideration must be given to the necessary replacement in future programs of both test equipment and industrial equipment either as the equipment wears out or as advances in the state-of-the-art allow better testing results to be obtained by improvements in the testing equipment.

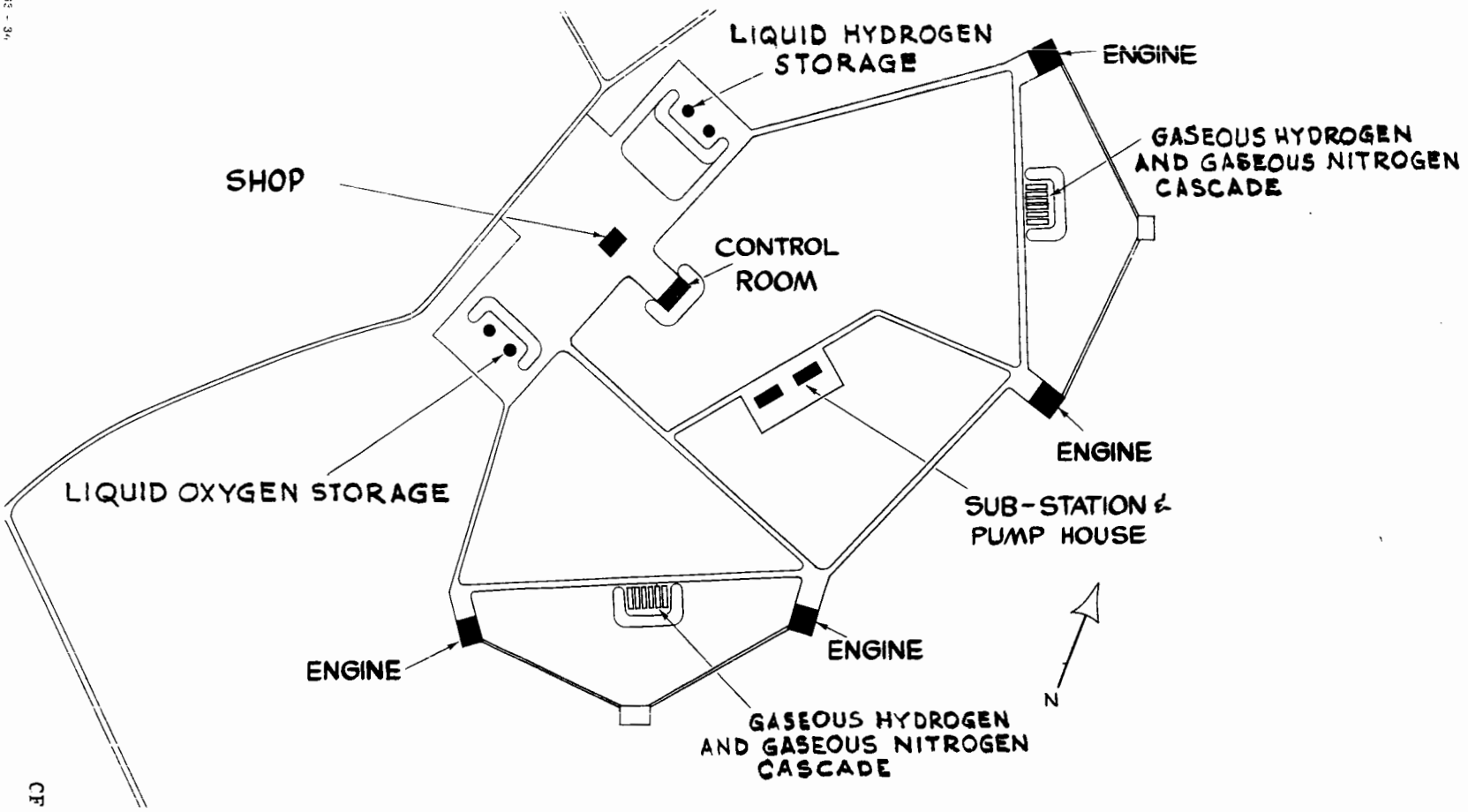
The locations of the proposed facilities are shown in the drawings on the following two pages.

JUSTIFICATION:

Developmental and testing facilities are required in support of the M-1 engine development program to detect and eliminate design and fabrication malfunctions and deficiencies. Four dual static test stand complexes are required to meet research, development, and production schedules.

Prior years' programs have provided the initial component and limited duration engine test stands, instrumentation, controls, and test equipment propellant systems in the existing areas. The facilities included in this project will provide for an intermediate testing range of 300 seconds, a full-duration capability of 500 seconds, and a stand equipped with an altitude simulation capability which is considered essential to meet the number and kind of tests required to develop the M-1 engine. The number of stands required is based upon previous experience with the development of the J-2 and F-1 engines.

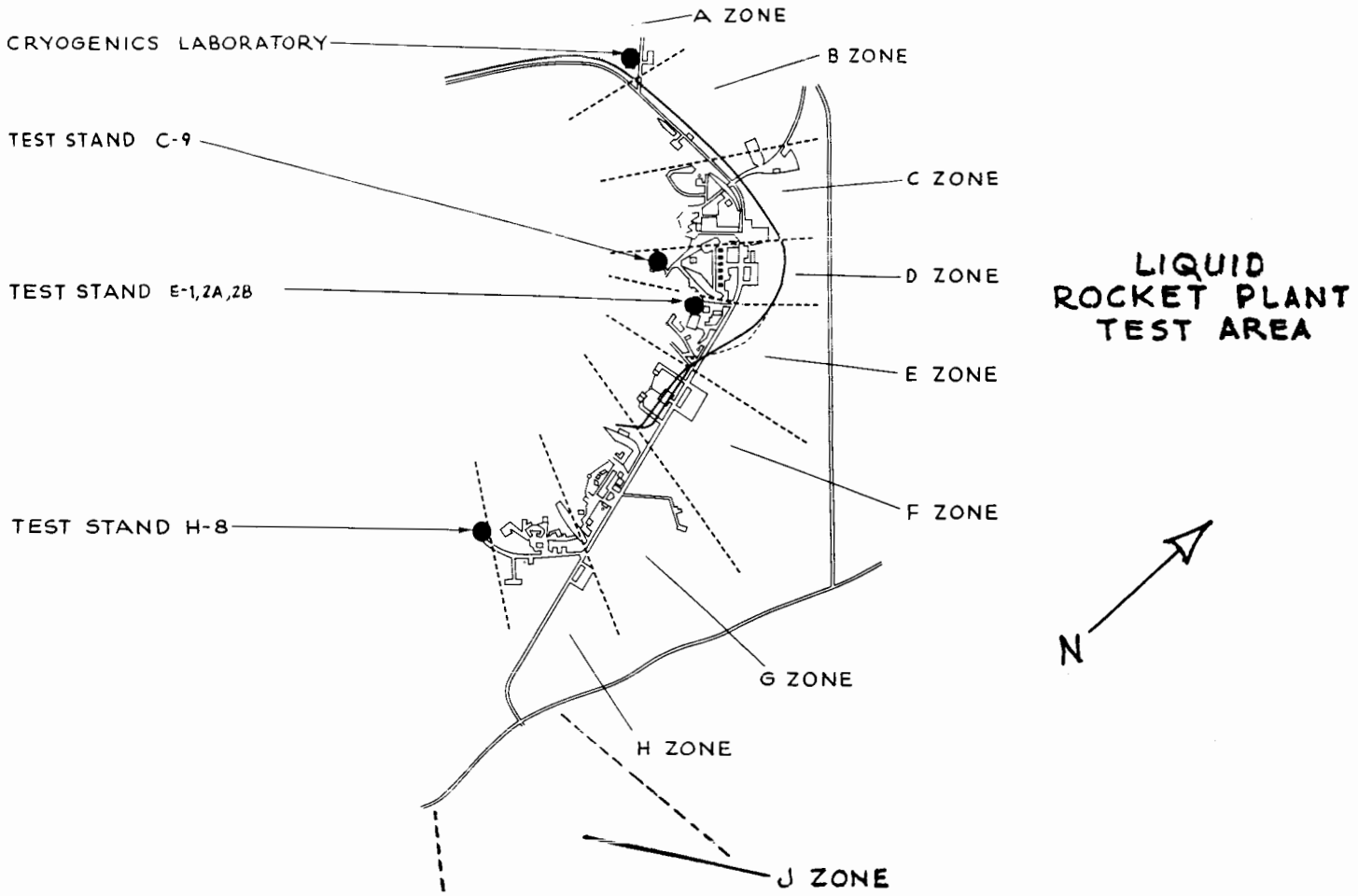
VARIOUS LOCATIONS
FISCAL 1964 ESTIMATE
FACILITIES FOR M-1 ENGINE PROGRAM



(ZONE J)

671865 O - 32 - 34

VARIOUS LOCATIONS
FISCAL 1964 ESTIMATE
FACILITIES FOR M-1 ENGINE PROGRAM



MODIFICATIONS AND ADDITIONS TO EXISTING TEST FACILITIES

The facilities for the M-1 engine program are complex and costly due to the six-fold increase in engine size beyond the present state-of-the-art for liquid hydrogen, liquid oxygen engines. The J-2 (200,000 pound thrust) engine now nearing production is the largest liquid hydrogen, liquid oxygen engine on which facilities' experience is available. Due to the increased engine size, existing facilities designs cannot be duplicated for the M-1 engine development. Since the facilities, particularly the large thrust stands also constitute a developmental effort, construction must be initiated immediately and funded substantially to assure availability for testing M-1 engines beginning in the calendar year 1964.

The M-1 engine development program is based on completion of preflight rating tests in 60 months with the accomplishment of at least 400 engine system tests. This is considered to be the minimum engine system test effort needed to develop an engine of this size and is based on experience with the F-1 engine of similar size and complexity. The time schedule of 60 months through the preflight rating tests is considered to be a realistic time for an economical program; extending this time would raise the total cost of the program. Current program schedules require the use of the third and fourth (J-3 and J-4) test stands to achieve the necessary testing within the 60 month time period. Even considering the use of the four test stands the number of tests per test stand-month must be nearly 50 percent higher than that currently being achieved on F-1 test stands. This testing rate is possible because the M-1 engineering and fabrication operations are within a few miles of the engine test facilities.

COST ESTIMATE:

	Fiscal Year 1962	Fiscal Year 1963	Fiscal Year 1964
A. LAND ACQUISITION.....	---	---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	---	---	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	$432,000	$1,433,000	$2,029,000
Construction modifications.	212,000	---	80,000
Test stand modifications...	220,000	433,000	---
New J-1 and J-2 stands.....	---	1,000,000	1,599,000
New J-3 stand.....	---	---	350,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	10,768,000	9,463,000	12,249,000
Controls.....	200,000	160,000	837,000
Propellant systems.....	6,947,000	4,346,000	4,863,000
Other.....	---	157,000	371,000

	Fiscal Year 1962	Fiscal Year 1963	Fiscal Year 1964
Instrumentation.....	$1,726,000	$1,745,000	$1,987,000
Fabrication equipment.....	500,000	2,052,000	1,150,000
Test equipment.....	1,395,000	728,000	2,041,000
Quality control equipment...	---	275,000	---
Altitude simulator.....	---	---	1,000,000
E. DESIGN AND ENGINEERING SERVICES.	2,594,000	2,104,000	1,722,000
Total estimated cost...	$13,794,000	$13,000,000	$16,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

FACILITIES FOR S-IVB STAGE PROGRAM

DESCRIPTION:

The construction of additional facilities for the S-IVB program is required at the Douglas Aircraft Company's Santa Monica, California plant. The facilities to be provided include machinery and equipment as well as support utilities, such as increased electrical capacity. Machinery and equipment items will include circuit and continuity test equipment, certification and calibration equipment, processing equipment, supporting test equipment, instrumentation, environmental test cells, and production machinery.

JUSTIFICATION:

The S-IVB will be the third stage of the Advanced Saturn vehicle and the second stage of the Saturn B vehicle. The fiscal year 1963 program included $1,993,000 for machinery and equipment for the Douglas Aircraft Company's Santa Monica, California plant and $16,582,000 for research, development and static testing facilities at the Douglas Sacramento Field Station, for a total of $18,575,000. (An additional $375,000 for advance design was allocated from fiscal year 1962 and 1963 funds.) This project completes the machinery and equipment requirement at the Santa Monica plant for additional productive capacity to meet combined production rates for both the Saturn B and the Advanced Saturn programs. Additional facilities in the estimated amount of $4,200,000 for a third static test stand at the Sacramento Field Station to meet current acceptance and R&D testing schedules will be programmed in the fiscal year 1965 construction program.

COST ESTIMATE:

	Fiscal Year 1963		Fiscal Year 1964	
A. LAND ACQUISITION		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$195,000		$500,000
Substations (3,000 kva)	$70,000		$200,000	
Area and utility electrical power	125,000		300,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		35,000		800,000

	Fiscal Year 1963		Fiscal Year 1964	
Shielded enclosure (800 square feet).....	$35,000		---	
Shielded enclosures (four--800 square feet each.....	---		$100,000	
Building modifications (50,000 square feet at $14.00 per square foot).	---		700,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$1,626,000		$3,500,000
Manufacturing equipment...	435,000		---	
Materials research equipment.....	10,000		---	
Production test equipment.	---		450,000	
Calibration equipment.....	---		625,000	
Qualification and environmental simulation control.....	315,000		---	
Propulsion systems manufacturing and test equipment.....	32,000		---	
Power system and controls manufacturing and test equipment.....	85,000		---	
Structural analysis equipment.....	500,000		---	
Navigation guidance and control system manufacturing and test equipment.....	33,000		---	
Electromagnetic radiation equipment.....	111,000		---	
Systems integration equipment.....	80,000		---	
Coast and attitude control equipment.....	25,000		---	
Production machinery.....	---		810,000	
Supporting test equipment and instrumentation....	---		680,000	
Fixtures and environmental test cells.....	---		450,000	
Processing equipment.....	---		485,000	

	Fiscal Year 1963	Fiscal Year 1964
E. DESIGN AND ENGINEERING SERVICES.....	$137,000	$500,000
Total estimated cost.....	$1,993,000	$5,300,000

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

IMPROVEMENTS TO THE RL10 A-3 ENGINE TEST FACILITY

DESCRIPTION:

Improvements and renovations are required to the existing facilities located at the Pratt and Whitney-owned engine test facility near West Palm Beach, Florida. The facility consists of seven static test stands with their associated equipment and facilities used for the production engine acceptance test and the research and development follow-on test programs. The nonseverable facilities were contractor-furnished, and the severable facilities consisting of above-ground facilities and equipment at a cost of approximately $30 million were government furnished under Air Force contracts from 1959 to 1962 in connection with the Air Force Centaur vehicle program. The project includes improvements consisting of modifications to test stand fuel supply systems to conform with actual flight vehicle conditions, and renovations such as the replacement of defective liquid oxygen valves.

JUSTIFICATION:

The liquid hydrogen/oxygen-fueled RL10 A-3 engine is used in the Saturn S-IV stage, the second stage of the Saturn configuration. The engines are produced in the Pratt and Whitney Plant at Hartford, Connecticut and acceptance-tested in their test stands at West Palm Beach, Florida. Each engine is put through a rigorous test program before being flight rated. The majority of the existing test stands have been in operation for approximately two years and due to normal use certain facility items require renovation and improvement. It is necessary that the facility improvements and renovations provided in this project be undertaken to prevent a facility breakdown that would jeopardize the Saturn flight schedule.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		---
C. FACILITY CONSTRUCTION AND MODIFICATIONS		$452,000
Test stand renovations	$180,000	
Diffuser modifications	60,000	
Liquid gas storage modifications	162,000	
Gaseous nitrogen system modifications	50,000	

D.	EOUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	---
E.	DESIGN AND ENGINEERING SERVICES.....	$48,000
	Total estimated cost.....	$500,000

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

INSTRUMENTATION SHIPS

DESCRIPTION:

This project consists of three virtually identical instrumentation ships to provide precision tracking, data acquisition, command, and communications support to the NASA manned and unmanned flight programs. These ships will provide coverage over the broad ocean areas where no land mass exists to permit the establishment of a ground station.

Each instrumentation ship is planned to be based upon an available hull from the Maritime Commissions' Reserve Fleet; these hulls will be selected, activated and modified in conjunction with the Navy Department's Bureau of Ships. The ships will be based on C-2 or C-4 class hulls, depending upon availability and condition. A C-2 is 455 feet long and displaces 11,000 tons while a C-4 is 520 feet long and displaces 13,000 tons. The hulls chosen will have to be modified to accept the heavy instrumentation complex, to provide adequate quarters for both the ship handling crews and the instrumentation operations, to include a central mission control room, and to permit the longest practicable station-keeping time. A precise inertial navigation and ship motion data correction system will be installed.

The spacecraft support instrumentation to be installed will be identical to that at existing ground stations, thus easing the problems of logistics, personnel training, data utilization, and integration of the ships as network stations. A C-band radar, of the FPQ-6 class, will operate in conjunction with the spacecraft C-band beacon to provide highly accurate tracking data. Provision for the installation of an S-band doppler and ranging system specifically for later Apollo missions will also be made. Two acquisition aid antennas will act both as telemetry and voice receiving antennas and as signed detectors to give the narrow-beam radar its required pointing information. The telemetry receiving equipment itself will be the same dual pulse-code modulated system being new installed at the manned flight network ground stations. A dual ten kilowatt command transmitting system, including a separate antenna, will be tied in with a command encorder and the ship's central computer to allow sending complete coded and computed instructions to the spacecraft. The central high-speed digital computer will be used to determine orbital elements, to make velocity vector determinations, to adjust radar data for ship motion and location, to compute retrofire times and landing points, and to derive data display systems. The communications systems will permit ultra-high frequency and high-frequency voice communication with manned spacecraft and will provide teletype, voice, and high speed data links with the rest of the ground networks and the missions control centers.

The three ships will be delivered at approximately 3-month intervals, with the first ship being available some 27 months after initiation of the project. This will permit meeting the earliest Apollo injection requirement in late 1965. It is planned to operate the ships through the Military Sea Transport Service; the instrumentation, however, will be operated by the network contractor.

JUSTIFICATION:

In the manned lunar landing and return missions, in the unmannd lunar and planetary flight missions, and in some of the manned orbital missions, certain critical phases in the flight sequence that require tracking, telemetry, and command coverage must take place over the broad ocean areas of the earth. The events, which occur at altitudes of 80 to 150 miles and at locations beyond the reach of any land-based stations, must therefore be covered by instrumentation ships.

One phase of flight for which such coverage must be provided is the period of the Advanced Saturn powered flight terminating with the insertion of the Apollo spacecraft into an earth orbital trajectory. Tracking during this period is essential in the event of a premature burnout, in order to determine the proper abort trajectory, and to transmit the necessary commands to the spacecraft. The latter periods of this phase of flight occur beyond sight of any possible land-based stations.

Another critical event is the re-entry of the Apollo spacecraft into the top of the earth's atmosphere upon return from lunar flight. Here the spacecraft is coming in at hyperbolic reentry speeds, much faster than re-entry from earth orbit. It may "skip" and maneuver during this period in order to place itself into the proper path for approaching the landing areas. Tracking is essential to determine the actual re-entry trajectory and to predict an impact area if the flight path cannot be adequately controlled by the astronauts. Since these events take place some 5,000 miles away from the land landing area, they will have to occur over the ocean. With a primary landing area in southern United States and an alternate area in Australia, two ocean locations will have to be covered for each mission.

In the Apollo lunar missions and in the unmanned lunar and planetary flights, the injection of the spacecraft into its lunar or planetary transfer trajectory must be covered in order to obtain tracking data as quickly as possible on this phase of the flight. In Apollo flights, this is essential in order to verify the performance of the on-board guidance and computer system, and to obtain data for immediate decisions and commands in the event of a mission abort. In unmanned flights, this tracking data is essential to compute trajectory corrections needed to execute a midcourse maneuver. The earlier this maneuver can be executed, the more efficient it is in terms of propulsion utilization. Effective tracking data obtained at the time of injection and immediately thereafter will improve trajectory determination accuracy by as much as a factor of five for the early midcourse corrections.

Another factor which affects tracking requirements for both the manned and unmanned missions is the necessity to have the capability of launching over a wide span of launch azimuths from Cape Canaveral, so as to have an acceptable "launch window" or period of time each day in which a launch is technically feasible. A certain trajectory in space, relative to the center of the earth and the lunar or planetary target, must be achieved for each launching; the specific location over the surface of the earth that must be reached in order to get into this desired trajectory is influenced by the daily rotation of the earth on its axis and by the monthly and seasonal changes in relative positions and declinations of the moon and planets. On a given day, for example, in order to have a two-hour launch window available, the critical point over the surface of the earth for injection into a proper planetary trajectory may swing over a 2,000-mile east-to-west distance. To restrict launch azimuths so that the injection point always falls over a land-based tracking station would result in an intolerable constraint on launch opportunities. Tracking ships must therefore be available to fill the gaps.

The insertion, injection, and re-entry coverage required by NASA manned flight missions imposes severe operational constraints on instrumentation ships. Ships must be on station for an average of 30 days for each manned launching to provide for the necessary prelaunch integrated network checkouts and "dry runs" and to allow for a reasonable day-to-day slippage in the launch. The successful Mercury operations with the present network have well demonstrated the validity of the requirement for these extensive network checkouts prior to each flight. It is such operational requirements, coupled with the specialized ship-borne equipment necessary, that makes the long-term use of existing general-purpose range ships impossible.

To the extent that the ships' geographical locations and time available permit, these three ships will add to the support of unmanned missions provided by general-purpose range ships.

The three instrumentation ships requested in this project will provide the minimum initial support required for insertion and injection coverage of manned missions; they will provide no coverage for the manned re-entry phase. It is felt that several additional ships will be required in succeeding years for this critical task.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$9,000,000
Ship activation, repair, and modification (estimate based on Navy Department's Bureau of Ships experience with range vessels).....	$9,000,000	

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$20,500,000
Navigation and stabilization system.....	$2,500,000	
C-band radar.....	5,000,000	
Unified S-band system.....	4,250,000	
Dual PCM telemetry system.....	500,000	
10-kw command transmitting system.....	1,300,000	
Dual acquisition aid and telemetry antennas.....	200,000	
High-speed digital computer.....	2,500,000	
Control room consoles, displays, intercommunication equipment, and recorders.....	1,100,000	
Spacecraft-to-ship voice communication system.....	150,000	
Ship-to-shore data, voice and teletype communication system.....	1,000,000	
Systems integration, documentation, and test.....	2,000,000	
E. DESIGN AND ENGINEERING SERVICES.....		500,000
Total estimated cost (per ship)		30,000,000
Total estimated cost.....		$90,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

LUNAR EXCURSION MODULE TEST FACILITY

DESCRIPTION:

A combined propulsion test and flight test facility is required for the development of the lunar excursion module of the Apollo spacecraft. The project includes related administrative and service facilities. The test facilities, which will be located at the White Sands Missile Range, New Mexico, will consist of two functionally distinct areas, a propulsion testing area, and a tethered and hover flight testing area. The administrative and service facilities will be integrated with the planned administrative facilities to be constructed as part of the contractor-operated Apollo spacecraft propulsion development facility now under construction. In addition, the propellant storage and transfer facilities to be constructed for that project will serve the lunar excursion module test facility. Sketches of the facilities included in this project may be found on the following two pages.

The facilities to be constructed in the test areas are as follows:

Control center: This will be an underground structure of reinforced concrete with approximately 6,000 square feet gross area designed for maximum protection against explosion and toxic fumes which may result from test operations. The building will house instrumentation, data acquisition systems, control consoles and checkout equipment. It will be used to monitor both the testing on the propulsion test stands and tethered and hover flights.

Test stands: Four test stands will be constructed to support the propulsion testing of the lunar touchdown engine and the lunar take-off. One test stand will be capable of taking both the lunar touchdown and the lunar take-off engine assembly in a mated position during combined systems static firings. One stand will be provided with an elevator and movable "clean room" for checkout and crew entry into the lunar excursion module. Steel towers and booms will be erected at each stand to support propellant lines, instrumentation and control cables, and other items necessary for static firings. Each stand will be provided with a flame deflector, a fire control system, public address system, intercom, television and motion picture cameras, flood lighting, fume sensing, and miscellaneous equipment. A mobile crane will be used to serve the test stands.

Ground control stations: A ground control station will be required for each test stand. The stations will be reinforced concrete structures to house propellant transfer, metering, and

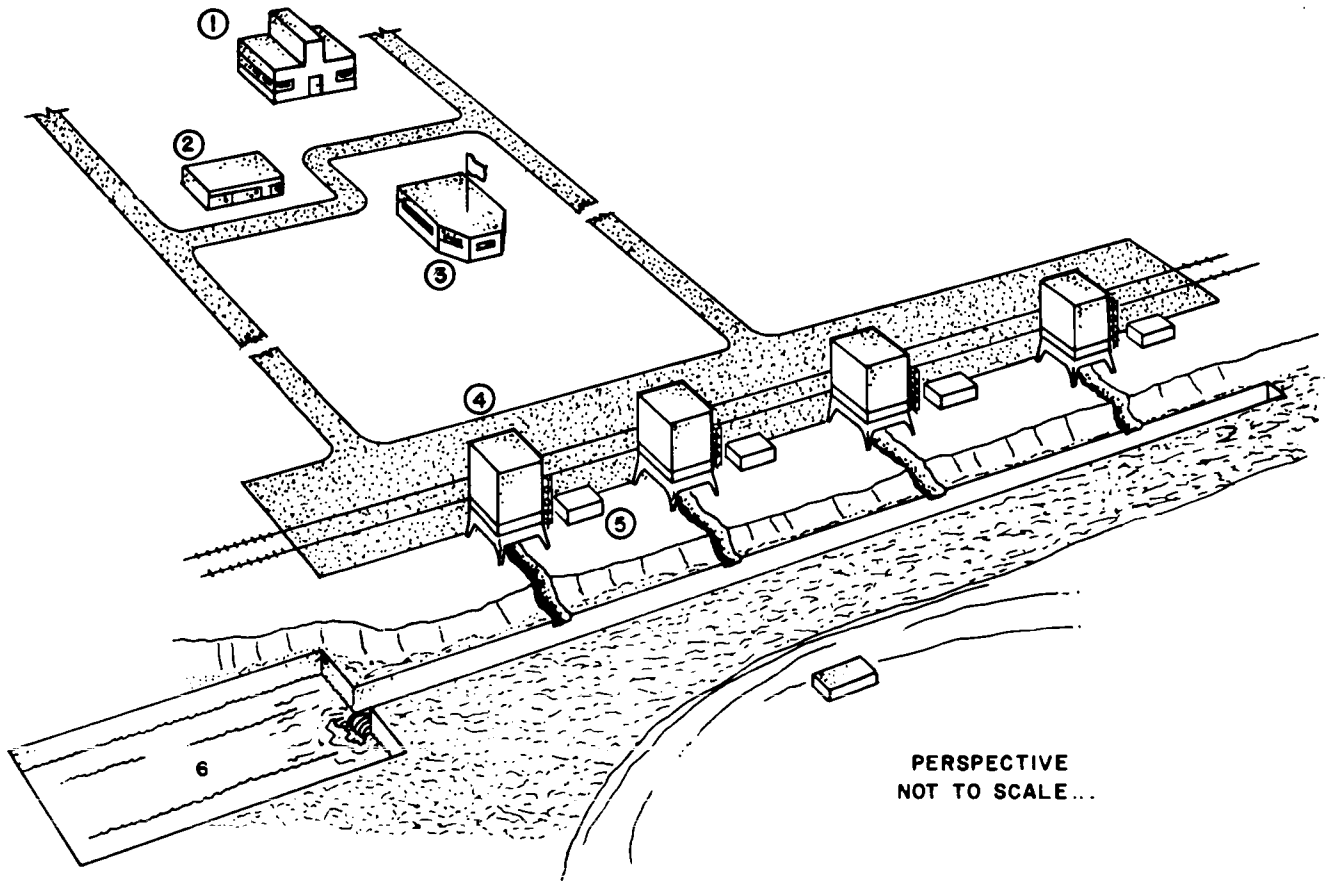
VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

LUNAR EXCURSION MODULE TEST FACILITY

·LEGEND·

1. SPACECRAFT PREPARATION BUILDING
2. FIRE STATION
3. CONTROL CENTER
4. TEST STANDS
5. GROUND CONTROL STATIONS
6. WASTE POND

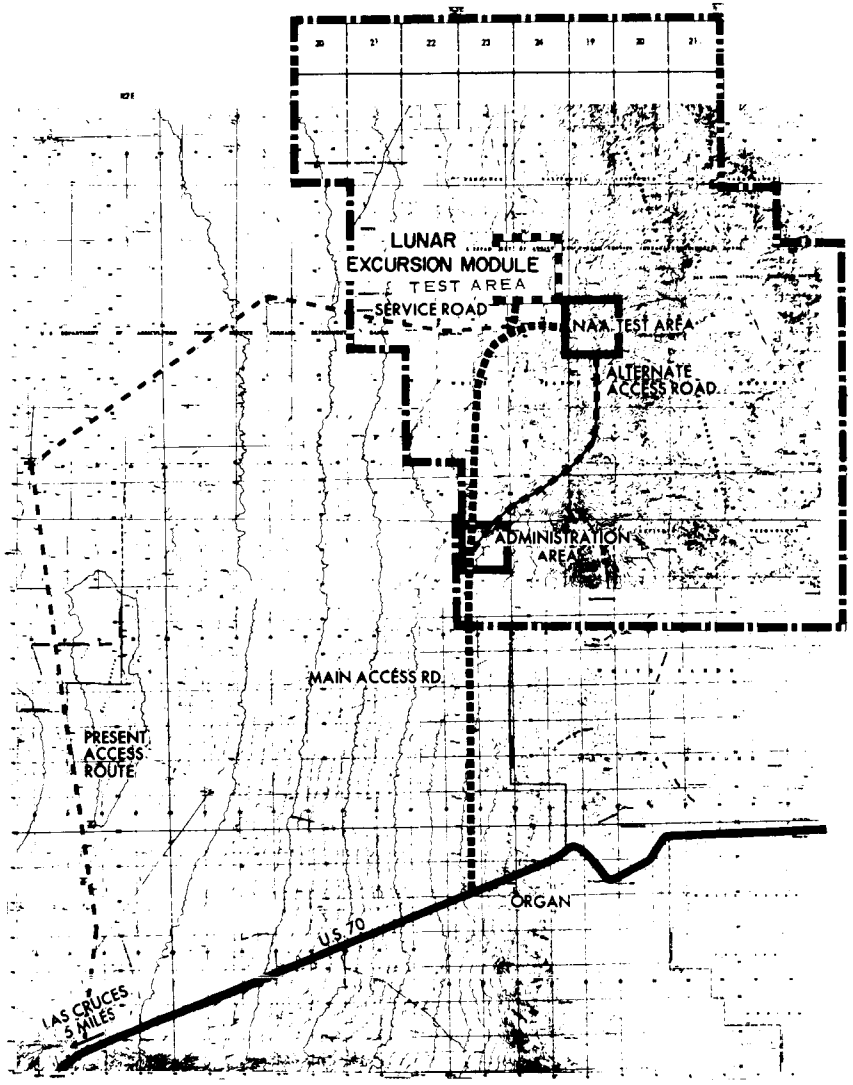


PERSPECTIVE
NOT TO SCALE...

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

LUNAR EXCURSION MODULE TEST FACILITY



SITE PLAN
NOT TO SCALE

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control equipment.

Concrete tunnels and cableways: Reinforced concrete tunnels will be constructed for long-run control and instrumentation cables connecting the control center building with the test stands. In addition, cableways will be constructed from the control center building to serve the flight test area.

Spacecraft preparation building: This building of structural steel and concrete masonry structure will provide approximately 24,500 square feet gross area. The building will be used for servicing, modifying, instrumenting, and preparing the lunar excursion modules for delivery to the test stands. Shops will be provided for the maintenance of electrical, mechanical, and electronic checkout and test equipment. Limited space will be provided for ground support equipment, heavy equipment, and emergency and safety equipment.

Fire station: A structural steel and concrete masonry structure, with approximately 2,400 square feet gross area, will be constructed to house fire trucks required to support the test program. Storage space will be provided for special emergency and safety equipment as well as conventional fire fighting equipment. Limited office, locker room, and first-aid facilities will be included.

Hover flight test pad: Of concrete, approximately 200 feet in diameter, this pad will be constructed to support hover-flight tests of the lunar excursion module.

Tethered flight test structure: This structure will be constructed adjacent to the hover test pad to support tethered flight tests of the lunar excursion module. The module will be suspended in the structure in such a manner as to provide a vertical lifting force of 5/6 of the weight of the module without the addition of restraining forces in other directions.

Utility installations: Basic utilities will be provided to furnish domestic and industrial water, low-pressure gas, electrical power, and telephone facilities throughout the project. Waste lines and disposal facilities will be provided for domestic and industrial wastes. The deep water wells to be provided in the Apollo spacecraft propulsion development facility will be utilized in this facility. Roads and parking areas will be constructed to serve security check points, buildings, storage areas, and test areas. Perimeter fencing and flood lighting will be provided for the propulsion and flight test areas.

Instrumentation equipment: Sufficient equipment will be supplied

to handle approximately 1,000 cable measurements on static tests. Telemetry, receiving, and instrumentation lines will be installed. A basic digital data recorder will be supplied and installed complete with patch panels, cabling, and signal transmitting equipment. Range instrumentation equipment sites will be provided to accommodate optical, television, radio-frequency data acquisition, and electronic tracking instruments for unmanned and manned flight tests of the engine assemblies. Consoles, monitoring equipment, strip chart recorders, data handling equipment, and other necessary equipment as required to support the propulsion and flight development systems will be installed.

Communication equipment: Facilities will be provided for data transmission, intercommunication and voice link with the lunar excursion module. Areas will be provided to house radio command control equipment for radio control of the unmanned module to simulate and checkout astronaut control functions.

The administrative and service facilities will include the following:

Administrative building wing: A wing with approximately 35,000 square feet gross area will be added to the planned administrative building to provide office space for NASA and contractor personnel.

Warehouse building bay: A bay with approximately 7,800 square feet gross area will be added to the planned warehouse building to provide general warehousing facilities to support the lunar excursion module program. The area will be provided for the specific use of the contractor and security will be his responsibility.

JUSTIFICATION:

The ultimate objective of the Apollo spacecraft program is to land men on the moon for limited observation and exploration and to return them safely to the earth. The lunar excursion module of the three-man Apollo spacecraft will actually effect the landing on the moon. The two-man module will detach from the Apollo spacecraft command and service modules while in lunar orbit and descend to the lunar surface. In order to make a safe touchdown, the lunar module touchdown engine will be throttled over a thrust range of 1,000 to 10,000 pounds. The take-off engine with a thrust capability of 4,000 pounds will return the two men to the command-service modules, to which they will transfer for returning to the earth. The lunar excursion module will be left in lunar orbit.

The contractor who is building the lunar excursion module will be responsible for the detailed design, development and test demonstration of the module to meet the performance and reliability requirements under all conditions of environmental testing, handling, shipment, and operational use.

The development of the propulsion system utilizing hypergolic propellants in the touchdown and take-off engines will be one of the most difficult technical jobs in the contract. The facility proposed in this project is necessary since there are no existing facilities which have combined capabilities for the static and flight tests necessary for development of this module. Because of the hazards involved in using hypergolic propellants, the prime consideration in site selection was that of minimizing these hazards. The White Sands Missile Range site was selected for the proposed facility because of its remote location as required by safety considerations, the ability to conduct round-the-clock testing without interference from other activities, and because of its close proximity to the Apollo propulsion systems development facility required for the command and service modules.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$1,732,000
Clearing and grading	300,000	
Erosion control	60,000	
Storm drainage	90,000	
Roads	290,000	
Parking areas	50,000	
Industrial water distribution system	130,000	
Domestic water distribution system	85,000	
Low-pressure gas distribution system	33,000	
Sanitary sewer lines and domestic waste disposal facilities	85,000	
Industrial waste treatment and disposal facilities	92,000	
Electrical power system	237,000	
Communications system	220,000	
Fencing	60,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		6,982,300
Control center (6,000 square feet at $66 per square foot)	396,000	
Test stands (four)	2,300,000	
Ground control stations (four)	60,000	
Concrete tunnels and cableways	293,000	
Spacecraft preparation building (24,500 square feet at $33 per square foot)	808,500	
Fire station (2,400 square feet at $22 per square foot)	52,800	
Hover flight test pad	200,000	
Tethered test support structure	1,880,000	
Addition to administrative building (35,000 square feet at $25 per square foot)	875,000	

Addition to warehouse building (7,800 square feet at $15 per square foot).....	$117,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$5,019,700
Fume detection systems.....	200,000	
Cabling and wiring for static tests.....	450,000	
Signal transmitting and checkout equipment...	325,000	
Data handling equipment.....	545,000	
Communications equipment.....	376,000	
Timing and synchronization equipment.....	180,000	
Range instrumentation equipment.....	936,000	
Fixed-telemetry station equipment.....	424,000	
Control room wiring and patch panels.....	30,000	
Fire protection systems.....	150,000	
Mobile crane module transporter and propellant transporters for handling and servicing test activities.....	300,000	
Meteorological-equipped van.....	150,000	
Mobile telemetry van.....	480,000	
Emergency vehicles (fire trucks, rescue vehicle, and ambulance).....	250,000	
Ten-ton crane for spacecraft preparation building.....	25,000	
Propellant transfer systems.....	198,700	
E. DESIGN AND ENGINEERING SERVICES.....		1,266,000
Total estimated cost.....		$15,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

MANNED SPACE FLIGHT DATA ACQUISITION AND TRACKING FACILITIES

DESCRIPTION:

The construction of three high-gain, wide-band data and tracking facilities is required in support of the Apollo manned lunar missions. The facilities will be located approximately 120 degrees of longitude apart and will be interconnected with the existing Deep Space Network and the Mercury Network. Sites for these facilities have not been selected and will be subject to international negotiations. It is expected that all land will be made available at no cost to the Government. The sites must be free of electromagnetic radiation interference, readily accessible for initial construction and subsequent logistic support, and of sufficient area for the installation of an 85-foot paraboloidal antenna, operations and utilities buildings, and associated structures such as collimation towers and the ancillary transmitter buildings.

The antenna system will consist of an 85-foot paraboloid with a Cassegrain feed, installed on an X-Y type mount adequately supported on deep foundations. Auto-tracking capability will be provided. The servo-system and associated tracking electronics will permit antenna control either automatically by sensing the direction of spacecraft signal arrival or by slaving to an acquisition antenna or by programmed search.

The electronics will consist of telemetry receivers, range and range-rate tracking equipment, tape recorders for recording telemetry data, transmitting equipment and the necessary time standard for correlation with tracking data. General purpose pulse code modulation (PCM) de-modulating equipment will be provided, including real-time data displays.

The physical facilities will include a 13,000-square-foot operations building to house antenna control, receiving equipment, transmitting equipment, data recording and reduction equipment, laboratory and utility areas, and general office space. A generator building of approximately 1,800 square feet will house the diesel generators and distribution panels. An 800-square-foot structure will contain the antenna hydraulic drive system. Two collimation towers, complete with small transmitter buildings at the bases, will be located 1 to 5 miles from the 85-foot antenna. The project will include fencing, hard-surface roads, power distribution, and communication lines.

JUSTIFICATION:

The manned space program is divided into several distinct stages of development (Mercury, Gemini, and Apollo) to accomplish prescribed advances into space exploration, and culminating in a manned lunar landing and safe

return to Earth. The existing Mercury Network was designed to meet the requirements of orbiting spacecraft at low altitudes and does not have the necessary data acquisition capabilities nor the accuracy required for spacecraft at lunar distances. Accuracy requirement of the order of 50 feet in range at lunar distances and 0.5 feet per second in radial velocities are required to meet program objectives. To obtain voice, telemetry and television from the spacecraft at lunar distances will require large aperture antennas coupled to low-noise pre-amplifiers. Both of these requirements can be achieved by using 85-foot aperture antennas in conjunction with the range and range-rate system for position and velocity determinations. Dual receiving systems will also be employed in order to communicate with both the lunar excursion and command modules when they are within mutual visibility.

The spacing of the three facilities at approximately 120 degrees of longitude around the earth will permit electronic visibility of the spacecraft at all times except when it is behind the moon by at least one of the stations, thus assuring continuous voice communications and ranging and data links.

The stations will be interconnected with the existing Deep Space Network and the Mercury Network in order to utilize the reliable high-speed communications links developed in support of the lunar and planetary satellite program and the Mercury program. The existing Deep Space Network will provide a backup capability to the proposed three antennas so that a failure of any one antenna will not affect the mission.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$415,000
Site preparation and roads	$100,000	
Power generating equipment	220,000	
Power distribution systems	45,000	
Water and sanitation systems	50,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		2,140,000
Antenna foundation	$125,700	
Antenna mount and installation	1,490,000	
Operations building (13,000 square feet at $33.50 per square foot)	435,500	
Generator building (1800 square feet at $28.00 per square foot)	50,400	
Hydraulics building (800 square feet at $23.00 per square foot)	18,400	
Collimation towers	20,000	

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$4,049,000
Antenna feed.....	$150,000	
Tracking receivers.....	420,000	
Parametric amplifier system.....	100,000	
Telemetry receivers.....	525,000	
Recorders.....	250,000	
Antenna servo-system.....	420,000	
Antenna data system.....	475,000	
Transmitter system.....	300,000	
Support systems.....	280,000	
Test equipment and initial spares.....	245,000	
Demodulation equipment.....	400,000	
Real-time data displays.....	274,000	
Range and range-rate system.....	210,000	
E. DESIGN AND ENGINEERING SERVICES.....		396,000
Total estimated cost (per facility).....		$7,000,000
Total estimated cost.....		$21,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1964 ESTIMATES

TELEMETRY STATION

DESCRIPTION:

The construction of a telemetry station at Town Hill, Bermuda is proposed to house all telemetry equipment required to support the Mercury, Apollo, Gemini, and Scout programs. The station will be located within the present boundary of the Town Hill site, part of the Mercury Network.

A one-story electronic building (50 by 120 feet and 16 feet high) will be constructed of reinforced concrete footings, columns, and roof girders; a floor slab on grade, and a roof designed for water catchment as a source of potable water. All strength members and footings will be designed to accept the load of a second story at some future date. Air-conditioning will be required for both equipment cooling and personnel comfort. Sectional, removable floor panels will be used for easy access to cable racks underneath. False acoustical ceilings will shield air-conditioning and utilities.

A one-story reinforced concrete and masonry power building (24 by 60 feet and 14 feet high), located within the site boundaries, will be constructed to house diesel generating sets. One end of this building will be over underground cisterns permitting all pumping equipment to be inside. Bridge cranes capable of handling the generator sets will be installed.

JUSTIFICATION:

Existing telemetry equipment of the Mercury Network is located in various buildings and vans at both Town Hill and on Cooper's Island, Bermuda. The buildings are prefabricated and were originally installed to support a project of two years' duration. They are presently incurring high maintenance costs due to the salt- and moisture-laden atmosphere to which they are subjected. The expanding telemetry requirements for the Apollo and Gemini programs cannot be accommodated in existing structures.

Construction of the proposed facility will offer the following additional advantages:

(a) A suitable, low-maintenance structure will be available to house expensive electronic gear.

(b) The facility will be capable of expansion without excessive disruption of its function.

(c) A more efficient operation will be obtained by the consolidation of power, air-conditioning, and utility requirements.

(d) It is operationally advantageous to separate receiving equipment (telemetry) at Town Hill from the transmitting (radar) equipment at Cooper's Island, as it reduces interference and permits more efficient installation, operation, and maintenance practices.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$113,000
Grading, excavation, soil compaction, and fencing	$ 35,000	
Deep well system	9,000	
Septic system	13,000	
Utility connections	56,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		285,000
Generator building (1440 square feet at $31.00 per square foot)	45,000	
Telemetry building (6000 square feet at $37.50 per square foot)	225,000	
Fire alarm system	15,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		164,000
Air-conditioning for high-heat loss electronic equipment	88,000	
Electric power cables and racks	76,000	
E. DESIGN AND ENGINEERING SERVICES		38,000
Total estimated cost		$600,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

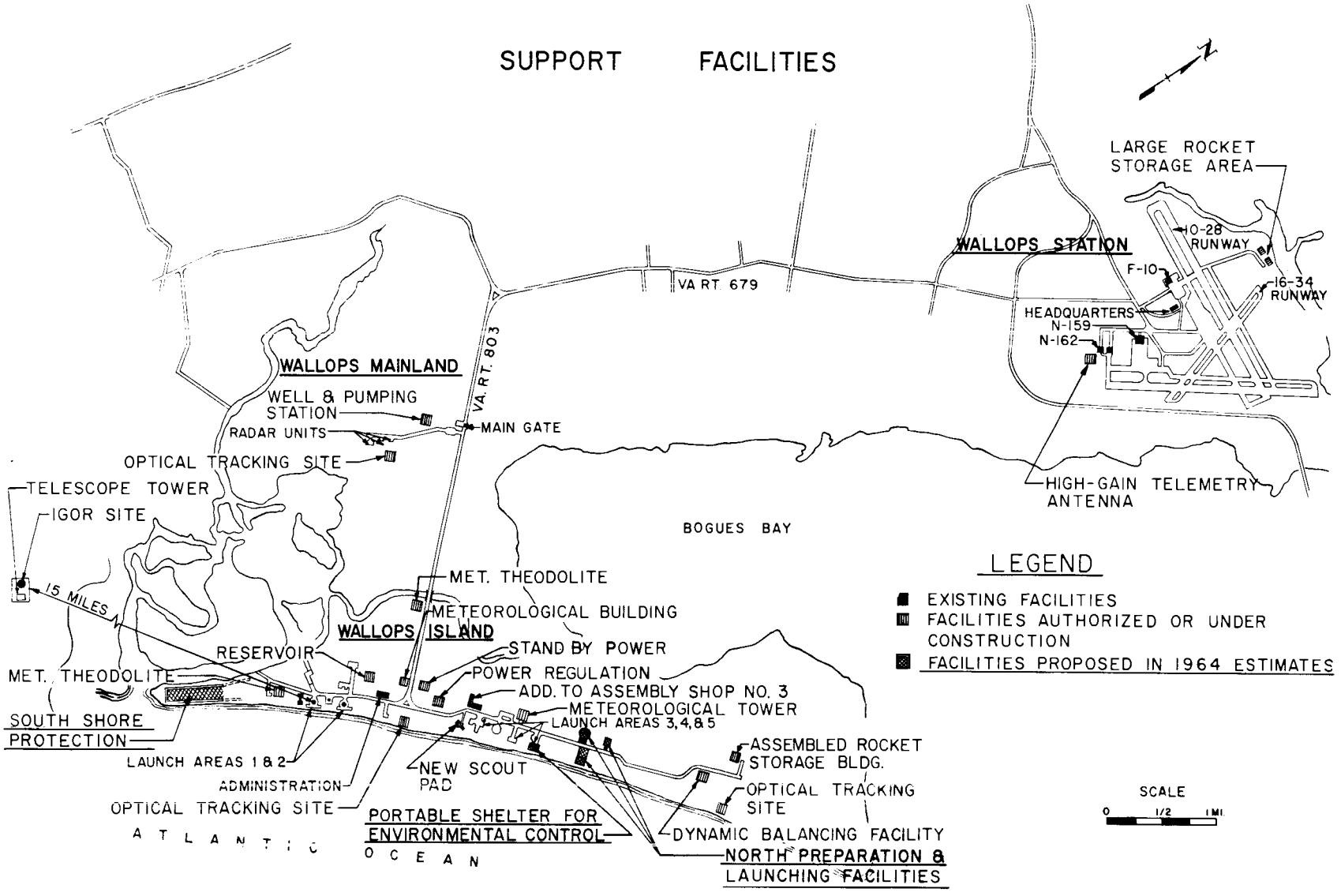
WALLOPS STATION

		Page No.
Location plan		CF 14-1
Support facilities.....	$2,000,000	CF 14-2
Total.....	$2,000,000	

WALLOPS STATION

FISCAL YEAR 1964 ESTIMATES

SUPPORT FACILITIES



LOCATION PLAN

WALLOPS ISLAND

FISCAL YEAR 1964 ESTIMATES

SUPPORT FACILITIES

DESCRIPTION:

This project presents the need for additional support facilities on Wallops Island to protect the considerable capital investment in existing plant against storm damage by the extension of the beach protection system; to increase the launch and launch support capabilities; and to modernize existing facilities to improve operational efficiency.

The project includes the following items:

Beach protection: The extension of the beach protection system approximately 2,000 feet south to Assawaman Inlet, utilizing the seawall, groin, and dyke design recommended by the Beach Erosion Board of the Corps of Engineers, United States Army.

Facility construction: The construction of a general-purpose sounding rocket launch complex consisting of a concrete pad and terminal building, a universal launcher equipped with a hydraulic system remotely controlling launch azimuth and elevation angles, a roll-back shelter, and a heavily reinforced, blast-resistant concrete launch control center protected by revetments; and the construction of an assembly shop supporting the northern launch areas on Wallops Island.

Facility modernization: The installation of retractable shelters at existing launchers to provide environment control for launcher-mounted vehicles and to modernize the existing control systems and associated equipment.

Sketches and location plans of the proposed facilities are shown on the following three pages.

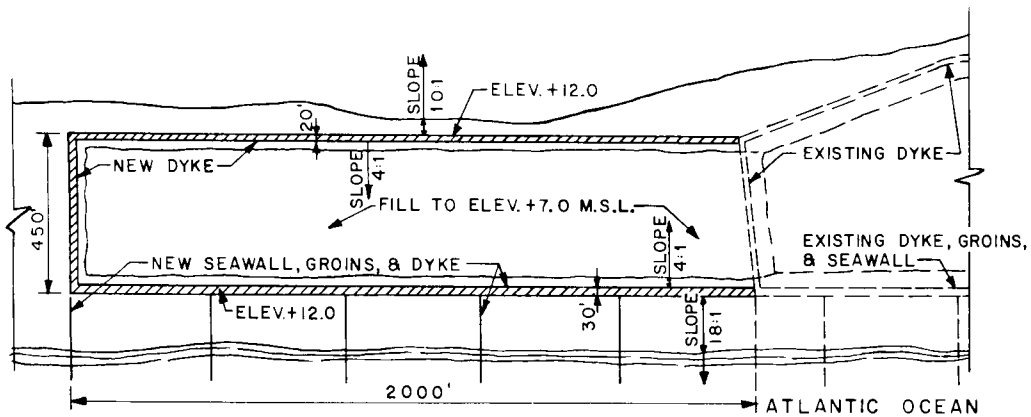
JUSTIFICATION:

The March 1962 storms demonstrated the value of a beach protection system where it was installed. Because the unprotected portions suffered severe damage the beach protection system was extended to encompass all existing facilities at the south end of the island. Subsequently, several storms have eroded the southern end of the island beyond the existing protective system, and have also created two shallow inlets which are being widened and deepened by successive storms. This is the most suitable area for future development as the restrictions on launch azimuths imposed by

WALLOPS STATION

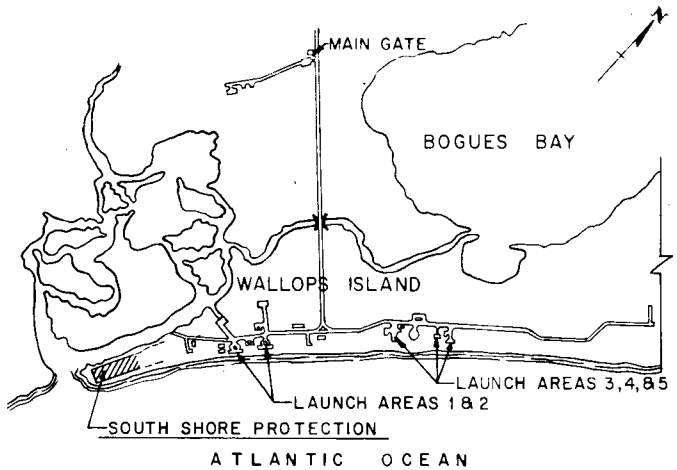
FISCAL YEAR 1964 ESTIMATES

SUPPORT FACILITIES



DYKE EXTENSION PLAN

SCALE 100' 0 100' 300' 500'



LOCATION PLAN

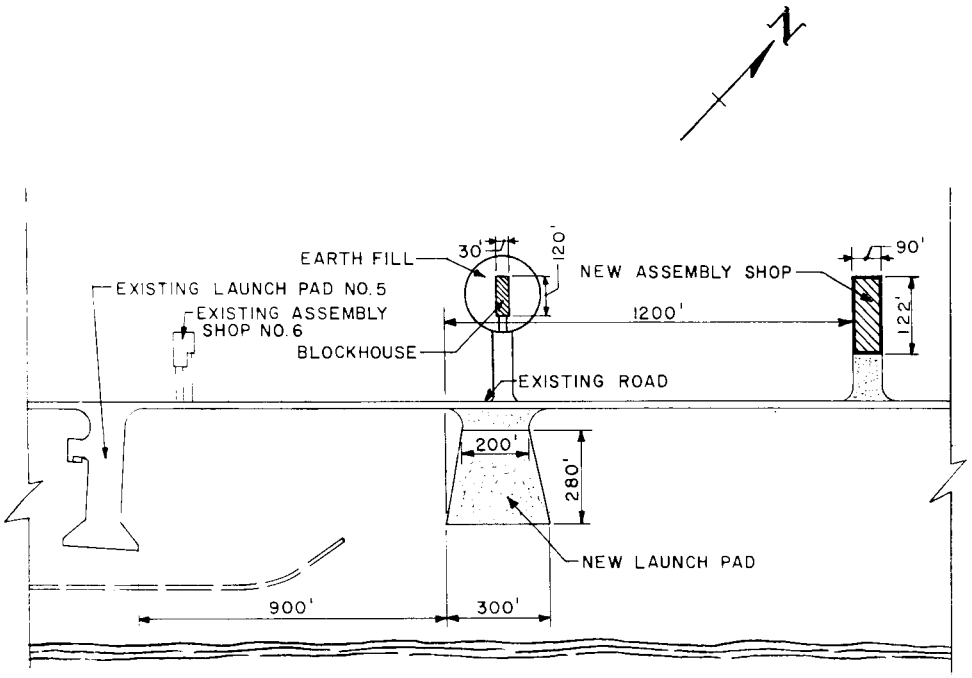
SCALE 0 1/2 1MI.

SOUTH SHORE PROTECTION

WALLOPS STATION

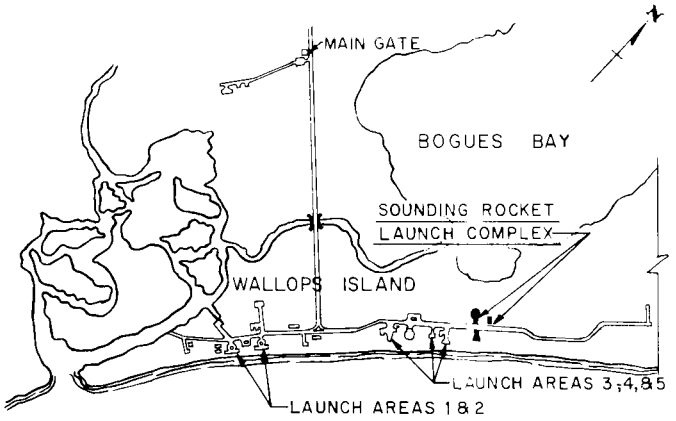
FISCAL YEAR 1964 ESTIMATES

SUPPORT FACILITIES



LAUNCH FACILITY PLAN

SCALE 100' 0' 100' 300' 500'



LOCATION PLAN

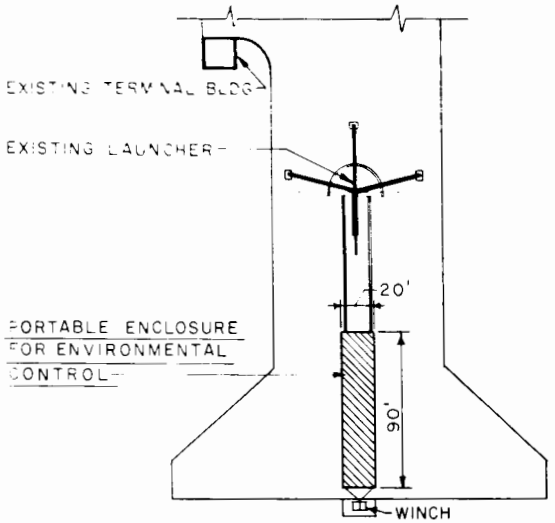
SCALE 0 1/2 1 MI.

SOUNDING ROCKET LAUNCH COMPLEX

WALLOPS STATION

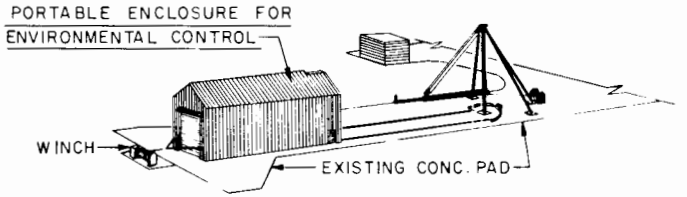
FISCAL YEAR 1964 ESTIMATES

SUPPORT FACILITIES



PLAN

SCALE 0 20' 50' 75' 100'



PERSPECTIVE

PORTABLE ENCLOSURE FOR ENVIRONMENTAL CONTROL

nearby Assateague Island grow progressively less the further operations are shifted to the south. The extension of the beach protection will eliminate the new inlets, restore Wallops Island to its original contours, and protect valuable real estate for future use.

Current and planned programs based on the Javelin-Journeyman-Trailblazer-class vehicles have saturated the capabilities of the existing facilities. This is further compounded by the frequent necessity of holding these vehicles on the launcher for prolonged periods awaiting acceptable meteorological conditions (local or downrange), launch windows, or other range clearances. In addition, existing blockhouse No. 3 is congested with check-out and launch control equipment serving launch pads No. 3, 4 and 5, and will be further congested with the completion of the second Scout launch pad now under construction.

The new pad and launcher will not only lend greater flexibility to launch scheduling, but will also provide backup insurance against complete interruption of programs based on this class of vehicle in case of a catastrophic pad explosion. In addition, the new control center will accommodate control equipment associated with launch pad No. 5, relieving the congestion in blockhouse No. 3 and freeing it for Scout-class vehicles for which it was designed.

The assembly shop will provide a general support facility servicing the northernmost launch areas. These areas are frequently isolated when traffic on the access road is interrupted for prolonged periods, as a safety measure, during critical periods of the launches from adjoining pads. A facility north of established roadblocks will permit launch preparations on the northernmost pads to continue without interruption.

Due to the exposed location and severe winter climate of Wallops Island, portable (roll-back) vehicle enclosures are required at the launchers. Many solid-propellant vehicles and payloads are sensitive to ambient atmospheric conditions. The enclosure will reduce the effects of cold, soaking, freezing precipitation, and high winds upon the vehicle while it is mounted on the launcher, and upon the personnel servicing the vehicle. The accompanying modernization of the control system and handling equipment will improve the overall efficiency of the facility.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$625,000
Beach protection system.....	$450,000	
Grading and pilings.....	55,000	
Utility connections.....	120,000	

C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$785,000
Launch control center (3,600 square feet at $120 per square foot).....	$430,000	
Assembly shop (11,000 square feet at $24 per square foot).....	265,000	
Pad (300 by 280 feet).....	90,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		460,000
General purpose launcher.....	150,000	
Roll-back shelters	180,000	
Instrumentation cabling.....	130,000	
E. DESIGN AND ENGINEERING SERVICES.....		130,000
Total estimated cost.....		$2,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

		Page No.
Facility Planning and Design.....	$10,000,000	CF 15-1
Total.....	$10,000,000	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

FACILITY PLANNING AND DESIGN

DESCRIPTION:

The funds requested under this project are required for advanced facility planning and design on projects for which construction funds may be requested in subsequent budgets.

JUSTIFICATION:

Long-range plans in several program areas must anticipate the need for the construction of facilities beyond the budget year for which estimates are being submitted. A considerable saving in time and an increase in the accuracy of construction cost estimates is possible with the availability of an advanced facility planning and design fund which can be used to initiate the design of high-priority facilities prior to the enactment of project authorization and the appropriation of funds. Without this project, the only method by which such advanced design work can be initiated is through the use of the Congressional reprogramming procedures provided in the authorization act. The provision of the separate and identifiable advanced planning and design fund proposed by this project allows the reprogramming authority to be conserved for projects requiring the prompt initiation of construction, and permits advanced planning and design to be funded without the necessity of reprogramming funds provided for other projects.

COST ESTIMATE:

Total estimated cost..... $10,000,000

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