National Aeronautics and Space Administration

BUDGET ESTIMATES

FISCAL YEAR 1965

Volume V

MANNED SPACE FLIGHT PROGRAMS

RESEARCH AND DEVELOPMENT

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RESEARCH AND DEVELOPMENT

SUMMARY BY BUDGET ACTIVITY

Budget Activities and Programs	Fiscal Year 1963	Fiscal Year 1964	Fiscal Year 1964 Supplemental	Fiscal Year 1965
MANNED SPACE FLIGHT..	$1,503,583,000	$2,649,800,000	$141,000,000	$3,011,900,000
Gemini.....	288,090,000	383,800,000	---	308,400,000
Apollo.....	1,183,965,000	2,243,900,000	141,000,000	2,677,500,000
Advanced missions...	11,391,000	22,100,000	---	26,000,000
Completed missions..	20,137,000	---	---	---
SPACE APPLICATIONS...	$96,958,000	$103,300,000	---	$86,100,000
Meteorology.....	54,051,000	67,800,000	---	37,500,000
Communications.....	32,075,000	13,500,000	---	12,600,000
Other applications..	10,832,000	22,000,000	---	36,000,000
UNMANNED INVESTIGATIONS IN SPACE.....	$489,951,000	$602,700,000	---	$649,800,000
Spacecraft development and operations.....	384,222,000	477,600,000	---	521,600,000
Launch vehicle development.....	105,729,000	125,100,000	---	128,200,000
SPACE RESEARCH AND TECHNOLOGY.....	$255,962,000	$298,100,000	---	$283,300,000
Launch vehicles and spacecraft.....	88,547,000	111,900,000	---	104,400,000
Propulsion and space power.....	167,415,000	186,200,000	---	178,900,000
AIRCRAFT TECHNOLOGY..	$15,598,000	$22,100,000	---	$37,000,000
SUPPORTING OPERATIONS	$152,742,000	$250,000,000	---	$313,900,000
Tracking and data acquisition.....	122,142,000	210,000,000	---	267,900,000
Facility training, and research grants.....	30,600,000	40,000,000	---	46,000,000
TOTAL PLAN.....	$2,514,794,000	$3,926,000,000	$141,000,000	$4,382,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1965 ESTIMATES

RESEARCH AND DEVELOPMENT SUMMARY
OF BUDGET ACTIVITIES BY PROGRAM

Budget Activities and Programs	Fiscal Year 1963	Fiscal Year 1964	Fiscal Year 1964 Supplemental	Fiscal Year 1965
MANNED SPACE FLIGHT	$1,503,583,000	$2,649,800,000	$141,000,000	$3,011,900,000
Gemini.....	288,090,000	383,800,000	---	308,400,000
Apollo.....	1,183,965,000	2,243,900,000	141,000,000	2,677,500,000
Advanced missions	11,391,000	22,100,000	---	26,000,000
Completed missions	20,137,000	---	---	---
SPACE APPLICATIONS	$96,958,000	$103,300,000	---	$86,100,000
Meteorology.....	54,051,000	67,800,000	---	37,500,000
Communications...	32,075,000	13,500,000	---	12,600,000
Other applications	10,832,000	22,000,000	---	36,000,000
Advanced technological satellites...	(8,668,000)	(18,500,000)	---	(31,000,000)
Technological utilization..	(2,164,000)	(3,500,000)	---	(5,000,000)
UNMANNED INVESTIGATIONS IN SPACE	$489,951,000	$602,700,000	---	$649,800,000
Spacecraft development and operations.....	384,222,000	477,600,000	---	521,600,000
Geophysics and astronomy....	(147,689,000)	(186,200,000)	---	(190,200,000)
Lunar and planetary exploration..	(222,802,000)	(270,800,000)	---	(300,400,000)
Bioscience.....	(13,731,000)	(20,600,000)	---	(331,000,000)
Launch vehicle development....	105,729,000	125,100,000	---	128,200,000

Budget Activities and Programs	Fiscal Year 1963	Fiscal Year 1964	Fiscal Year 1964 Supplemental	Fiscal Year 1965
SPACE RESEARCH AND TECHNOLOGY	$255,962,000	$298,100,000	---	$283,300,000
Launch vehicles and spacecraft.	88,547,000	111,900,000	---	104,400,000
Space vehicle systems.....	$(43,990,000)	$(49,000,000)	---	$(38,800,000)
Electronic systems.....	(17,071,000)	(28,700,000)	---	(28,400,000)
Human factor systems.....	(9,790,000)	(13,200,000)	---	(16,200,000)
Basic research..	(17,696,000)	(21,000,000)	---	(21,000,000)
Propulsion and space power.....	167,415,000	186,200,000	---	178,900,000
Nuclear-electric systems.....	(39,893,000)	(44,700,000)	---	(48,100,000)
Nuclear rockets.	(69,465,000)	(82,700,000)	---	(58,000,000)
Chemical propulsion....	(49,722,000)	(45,800,000)	---	(59,800,000)
Space power.....	(8,335,000)	(13,000,000)	---	(13,000,000)
AIRCRAFT TECHNOLOGY	$15,598,000	$22,100,000	---	$37,000,000
SUPPORTING OPERATIONS	$152,742,000	$250,000,000	---	$313,900,000
Tracking and data acquisition.....	(122,142,000)	(210,000,000)	---	(267,900,000)
Sustaining university program	(30,600,000)	(40,000,000)	---	(46,000,000)
TOTAL.....	$2,514,794,000	$3,926,000,000	$141,000,000	$4,382,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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SUMMARY OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY PROGRAM

	Fiscal Year 1963	Fiscal Year 1964	Fiscal Year 1964 Supplemental	Fiscal Year 1965
MANNED SPACE FLIGHT..	$1,503,583,000	$2,649,800,000	$141,000,000	$3,011,900,000
Gemini.....	288,090,000	383,800,000	---	308,400,000
Apollo.....	1,183,965,000	2,243,900,000	141,000,000	2,677,500,000
Advanced missions..	11,391,000	22,100,000	---	26,000,000
Completed missions.	20,137,000	---	---	---
SPACE SCIENCE AND APPLICATIONS.....	$615,345,000	$742,500,000	---	$776,900,000
Geophysics and astronomy.....	147,689,000	186,200,000	---	190,200,000
Lunar and planetary exploration.....	222,802,000	270,800,000	---	300,400,000
Sustaining university program.....	30,600,000	40,000,000	---	46,000,000
Launch vehicle development.....	105,729,000	125,100,000	---	128,200,000
Bioscience.....	13,731,000	20,600,000	---	31,000,000
Meteorological satellites.....	54,051,000	67,800,000	---	37,500,000
Communications satellites.....	32,075,000	13,500,000	---	12,600,000
Advanced technological satellites	8,668,000	18,500,000	---	31,000,000
ADVANCED RESEARCH AND TECHNOLOGY.....	$271,560,000	$320,200,000	---	$320,300,000
Basic research.....	17,696,000	21,000,000	---	21,000,000
Space vehicle systems.....	43,990,000	49,000,000	---	38,800,000
Electronic systems.	17,071,000	28,700,000	---	28,400,000
Human factor systems.....	9,790,000	13,200,000	---	16,200,000
Nuclear-electric systems.....	39,893,000	44,700,000	---	48,100,000
Nuclear rockets....	69,465,000	82,700,000	---	58,000,000
Chemical propulsion	49,722,000	45,800,000	---	59,800,000
Space power.....	8,335,000	13,000,000	---	13,000,000
Aeronautics.....	15,598,000	22,100,000	---	37,000,000

	Fiscal Year 1963	Fiscal Year 1964	Fiscal Year 1964 Supplemental	Fiscal Year 1965
TRACKING AND DATA ACQUISITION.....	$122,142,000	$210,000,000	$141,000,000	$267,900,000
TECHNOLOGY UTILIZATION.....	$2,164,000	$3,500,000	---	$5,000,000
TOTAL PLAN.....	$2,514,794,000	$3,926,000,000	$141,000,000	$4,382,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 COLUMN OF FISCAL YEAR 1965 BUDGET ESTIMATES

CONVERSION CHART FOR MANNED SPACE FLIGHT PROGRAM STRUCTURE

PRIOR STRUCTURE		CURRENT STRUCTURE														
		GEMINI				APOLLO										
PROGRAM/PROJECT	Total	Total	Spacecraft	Launch Vehicle	Support	Total	Spacecraft	H-1 Eng	RL-10 Eng	F-1 Eng	J-2 Eng	Saturn I	Saturn IB	Saturn V	Support	Adv Missions Studies
TOTAL	2,649,800	383,800	252,300	110,000	21,500	2,243,900	870,900	11,100	20,000	62,300	56,600	204,200	149,900	689,600	179,300	22,100
MANNED SPACECRAFT SYSTEMS	1,283,900															
Spacecraft technology	18,700					18,700									18,700	
Mercury	-0-															
Gemini																
Spacecraft	273,300	273,300	252,300		21,000											
Launch vehicle procurement	110,000	110,000		110,000												
Apollo																
Spacecraft	798,100					798,100	795,200								2,900	
Launch vehicle procurement																
Little Joe II	6,800					6,800	6,800									
Saturn I	21,500					21,500						21,500				
Saturn IB	3,000					3,000							3,000			
Saturn V	-0-					-0-										
Mission control systems	52,500					52,500									52,500	
LAUNCH VEHICLES AND PROPULSION	1,192,900															
Launch vehicle technology	12,900					12,900									12,900	
Propulsion technology	12,800					12,800									12,800	
Launch operations technology	2,100					2,100									2,100	
Saturn I development	182,200					182,200						182,200				
Saturn IB development	139,400					139,400							139,400			
Saturn V development	657,000					657,000								657,000		
H-1 Engine development	11,100					11,100		11,100								
RL-10 Engine development	20,000					20,000			20,000							
F-1 Engine development	62,300					62,300				62,300						
J-2 Engine development	56,600					56,600					56,600					
Launch instrumentation	17,500					17,500									17,500	
Launch operations	19,000					19,000									19,000	
INTEGRATION, CHECKOUT AND RELIABILITY	125,000					125,000	58,400					500	7,500	32,600	26,000	
SPACE MEDICINE	11,000	500			500	10,500	10,500									
SYSTEMS ENGINEERING	37,000															
Systems	14,900					14,900									14,900	
Advanced studies	22,100															22,100

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 COLUMN OF FISCAL YEAR 1965 BUDGET ESTIMATES

CONVERSION CHART FOR MANNED SPACE FLIGHT PROGRAM STRUCTURE

PRIOR STRUCTURE		CURRENT STRUCTURE														
		GEMINI				APOLLO										Adv Missions Studies
PROGRAM/PROJECT	Total	Total	Spacecraft	Launch Vehicle	Support	Total	Spacecraft	H-1 Eng	RL-10 Eng	F-1 Eng	J-2 Eng	Saturn I	Saturn IB	Saturn V	Support	
TOTAL	2,649,800	383,800	252,300	110,000	21,500	2,243,900	870,900	11,100	20,000	62,300	56,600	204,200	149,900	689,600	179,300	22,100
MANNED SPACECRAFT SYSTEMS	1,283,900															
Spacecraft technology	18,700					18,700									18,700	
Mercury	-0-															
Gemini																
Spacecraft	273,300	273,300	252,300		21,000											
Launch vehicle procurement	110,000	110,000		110,000												
Apollo																
Spacecraft	798,100					798,100	795,200								2,900	
Launch vehicle procurement																
Little Joe II	6,800					6,800	6,800									
Saturn I	21,500					21,500						21,500				
Saturn IB	3,000					3,000							3,000			
Saturn V	-0-					-0-										
Mission control systems	52,500					52,500									52,500	
LAUNCH VEHICLES AND PROPULSION	1,192,900															
Launch vehicle technology	12,900					12,900									12,900	
Propulsion technology	12,800					12,800									12,800	
Launch operations technology	2,100					2,100									2,100	
Saturn I development	182,200					182,200						182,200				
Saturn IB development	139,400					139,400							139,400			
Saturn V development	657,000					657,000								657,000		
H-1 Engine development	11,100					11,100		11,100								
RL-10 Engine development	20,000					20,000			20,000							
F-1 Engine development	62,300					62,300				62,300						
J-2 Engine development	56,600					56,600					56,600					
Launch instrumentation	17,500					17,500									17,500	
Launch operations	19,000					19,000									19,000	
INTEGRATION, CHECKOUT AND RELIABILITY	125,000					125,000	58,400					500	7,500	32,600	26,000	
SPACE MEDICINE	11,000	500			500	10,500	10,500									
SYSTEMS ENGINEERING	37,000															
Systems	14,900					14,900									14,900	
Advanced studies	22,100															22,100

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1965 ESTIMATES

SUMMARY OF CONSTRUCTION OF FACILITIES BUDGET PLAN
BY BUDGET ACTIVITY

Budget Activity	Fiscal Year 1963	Fiscal Year 1964	Fiscal Year 1965
1. Manned Space Flight.....	$543,809,100	$495,179,000	$234,330,000
2. Space Applications.....	193,605	3,933,000	---
3. Unmanned Investigations in Space.....	47,261,650	18,574,200	7,018,000
4. Space Research and Technology	106,849,300	56,832,800	26,620,000
5. Aircraft Technology.....	1,697,000	100,000	4,001,000
6. Supporting Operations.....	42,608,495	98,881,000	9,031,000
Total Plan.....	$742,419,150	$673,500,000	$281,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1965 ESTIMATES

SUMMARY OF CONSTRUCTION OF FACILITIES BUDGET PLAN BY LOCATION BY PROGRAM OFFICE

	Fiscal Year 1963	Fiscal Year 1964	Fiscal Year 1965
Office of Manned Space Flight...	$543,809,100	$488,315,000	$224,910,000
John F. Kennedy Space Center, NASA.....	296,479,100	279,236,000	89,520,000
Manned Spacecraft Center.....	25,369,500	35,172,000	25,166,000
Marshall Space Flight Center..	41,740,500	28,980,000	15,288,000
Michoud Plant.....	28,910,000	8,688,000	6,534,000
Mississippi Test Facility.....	78,407,000	93,656,000	61,991,000
Various Locations.....	72,903,000	42,583,000	26,411,000
Office of Space Science and Applications.....	$47,455,255	$21,710,700	$7,359,000
Ames Research Center.....	930,000	---	---
Goddard Space Flight Center...	18,902,355	17,032,500	500,000
Jet Propulsion Laboratory.....	10,208,050	2,998,200	3,314,000
John F. Kennedy Space Center, NASA.....	8,659,000	1,680,000	1,741,000
Lewis Research Center.....	1,186,500	---	---
Various Locations.....	6,799,350	---	---
Wallops Station.....	770,000	---	1,804,000
Office of Advanced Research and Technology.....	$110,378,650	$56,179,300	$27,591,000
Ames Research Center.....	13,711,000	11,044,000	6,081,000
Electronics Research Center...	---	---	10,000,000
Flight Research Center.....	1,757,000	1,157,000	---
Jet Propulsion Laboratory.....	---	---	400,000
Langley Research Center.....	10,094,300	8,204,300	4,454,000
Lewis Research Center.....	44,630,000	18,634,000	810,000
Nuclear Rocket Development Station.....	14,835,000	3,240,000	---
Various Locations.....	25,351,350	13,900,000	5,846,000

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	Fiscal Year 1963	Fiscal Year 1964	Fiscal Year 1965
Office of Tracking and Data Acquisition	$40,776,145	$96,805,000	$6,140,000
Goddard Space Flight Center	2,915,000	---	800,000
John F. Kennedy Space Center, NASA	---	4,000,000	---
Various Locations	34,470,395	92,300,000	5,340,000
Wallops Station	3,390,750	505,000	---
Facility Planning and Design	---	10,490,000	15,000,000
TOTAL PLAN	$742,419,150	$673,500,000	$281,000,000

OFFICE OF MANNED SPACE FLIGHT — GEMINI PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The Gemini program objectives are to develop an extended operational capability for manned space flight and through this capability to conduct specific experiments and tests which support Apollo, Department of Defense programs and scientific investigations. To accomplish this objective long-duration and rendezvous missions have been planned for a two man spacecraft. During the long-duration missions, the astronauts will control and maneuver the spacecraft thus providing performance data (on both systems and astronaut) after long exposures to space flight. The astronauts will perform a series of experiments generated by NASA, Department of Defense and the scientific community. The first long-duration flight is planned for 1965.

The rendezvous missions begin with the launch of the target vehicle, a modified Agena D, which is boosted into orbit by a standard Atlas launch vehicle. Approximately 24 hours later, the Gemini spacecraft is inserted into orbit where it is positioned close to the Agena. The astronauts then mate the spacecraft with the target vehicle through a docking maneuver. The Gemini spacecraft and Agena target vehicle permit a variety of rendezvous techniques to be explored and provide a test bed for various phases of Apollo mission. Great importance is placed on the intelligence, and piloting ability of the astronauts to accomplish complex missions with the Gemini spacecraft.

Early rendezvous flights will develop optimum techniques and evaluate man's abilities as compared to automatic controls, thus greatly extending the present knowledge of manned space flight technology and operational procedures. As operational proficiency increases and flight techniques are developed, Gemini will simulate situations comparable to future space missions. The simulation of the lunar orbit rendezvous of the Apollo lunar excursion module with the command and service modules is of particular importance; however, Gemini will also provide data for other missions such as rendezvous with a space station or inspection of unmanned satellites. The rendezvous missions are defined in detail and planned to lead logically into the next mission without duplication.

The reentry trajectory is normally controlled by the astronauts by lift force orientation. In contrast to Mercury which could only make a ballistic reentry, Gemini can descend to a chosen recovery zone within an area of several thousand square miles. In addition, the paraglider, which may be introduced later in the program, allows the fine control required for landing at a specific preselected land site.

SUMMARY OF RESOURCES REQUIREMENTS:

	1963	1964	1965
Spacecraft	$205,045,000	$252,300,000	$168,900,000
Launch vehicles	79,109,000	110,000,000	111,300,000
Gemini support	3,936,000	21,500,000	28,200,000
Total costs	$288,090,000	$383,800,000	$308,400,000

BASIS OF FUND REQUIREMENTS:

Spacecraft

	1963	1964	1965
Spacecraft	$205,045,000	$252,300,000	$168,900,000

The two-man Gemini spacecraft, which is the successor to Mercury and draws heavily on proven Mercury technology, reflects major advances in spacecraft design. Mercury demonstrated the feasibility of manned space systems and man's usefulness therein. Gemini is a far more advanced, complex and versatile spacecraft and will provide a transition from the pioneering achievements of Mercury to the lunar program goals of Apollo.

A highly refined and sophisticated design is required to conduct the missions specified for Gemini. Gemini is larger than Mercury and is divided into three basic sections: the reentry, the retrograde and the equipment adapter sections. This arrangement provides a larger spacecraft for the longer and more complex missions while still keeping the reentry section relatively small. Modularized equipment is located in a series of equipment bays around the pressurized cabin to provide for accessibility during testing and checkout, thus minimizing launch delays. Many access doors and external check points are provided for use by the launch crew to quickly locate and service a faulty item. New subsystems have been introduced: fuel cells to replace batteries; ejection seats; on-board spacecraft propulsion for maneuvering in space; and rendezvous radar and an inertial guidance system for rendezvous with the Agena. The inertial guidance system also provides alternate guidance capability during launch in the event of failure of the Gemini launch vehicle's primary guidance system.

The Gemini spacecraft contract was awarded to the McDonnell Aircraft Corporation in December 1961. Over 50 percent of this contract effort is placed with subcontractors. Major subsystems are being supplied by 18 subcontractors in various specialized areas. There are also many other subcontractors, vendors and suppliers performing additional work on the Gemini program. North American Aviation Corporation, as associate contractor, is developing the paraglider for land landing.

Approximately one-third of the total Gemini program funding will be for production of deliverable hardware. Under the McDonnell contract major items being delivered to the Gemini program include: (1) 12 flight spacecraft; (2) 5 non-flying "boilerplate" spacecraft for use in development and qualification testing of subsystems; (3) 4 static articles, non-flying, spacecraft used primarily for various structural, thermal and flotation tests; (4) a complete flight-quality spacecraft for simulated space missions in an environmental chamber (Project Orbit); (5) an electrical systems test unit (for integrated testing of engineering models of electrical and electronic equipment); (6) a compatibility test unit, (a non-flying spacecraft configured so that flight-qualified models of all subsystems can be fully checked for operation and compatibility with the ground equipment before the all-systems test flight); (7) 2 mission simulators; (8) a docking trainer; (9) several systems trainers; (10) 9 docking adapters; and (11) specialized ground equipment, test hardware, and spares.

All of the non-flying spacecraft and related units will be delivered by the end of the current fiscal year. These were funded in fiscal years 1963 and 1964. The first flight spacecraft was delivered to Kennedy Space Center in October 1963; the second is scheduled for delivery in the last quarter fiscal year 1964. Six additional spacecraft, now in manufacturing and assembly, will be delivered in fiscal year 1965 and construction of the remaining four will be started during that year. The major portion of the fiscal year 1965 funding will be for the production, testing, and launch of the spacecraft and its components.

The Mercury program testing requirements dictated that each component, subassembly, assembly, subsystem and system, be carefully and extensively tested to assure a flight-worthy spacecraft. The requirements for reliability and performance dictated by the Gemini missions are even more stringent and the testing program has been increased accordingly. Whenever possible, tests are performed under actual environmental and operating conditions. Components and subsystems undergo exhaustive development testing to certify that the design requirements have been fully met under all anticipated conditions (Qualification Tests). Vendor procured production components must pass a pre-delivery acceptance test before shipment to McDonnell. Every component undergoes a pre-installation acceptance test at McDonnell to re-verify required quality standards.

To assure spacecraft flight readiness, approximately 176 working days (two shifts) are spent in systematically testing and verifying the spacecraft and its many subsystems after completion of manufacturing. This includes 93 working days of testing at McDonnell to insure that the spacecraft components and subsystems are compatible and perform as installed in the spacecraft. Included in these spacecraft tests are several simulated flights, including one in an altitude chamber with an astronaut, to insure that procedures and equipment are flight ready. At Kennedy Space Center an additional 56 working days of testing is performed to insure integrated operation of the spacecraft and the checkout and launch instrumentation. At the launch complex, the spacecraft and launch vehicle are mated and

tested to insure their compatibility. A simulated countdown and boost flight phase is performed as a final check for flight readiness. These tests require approximately 27 working days.

During fiscal year 1964, the major portion of the development testing, as well as the qualification testing of all subsystems of the spacecraft will be completed and spacecraft #1 and #2 will be certified as flight ready. In fiscal year 1965, four spacecraft will undergo the four months spacecraft system tests at McDonnell and the three months of testing after delivery to Kennedy Space Center in preparation for flight.

Launch Vehicles

	1963	1964	1965
Gemini	$63,709,000	$76,900,000	$66,900,000
Atlas	---	6,300,000	19,500,000
Agena	15,400,000	26,800,000	24,900,000
Total costs	$79,109,000	$110,000,000	$111,300,000

The Gemini Launch Vehicle is a Titan II ICBM booster modified for greater reliability and astronaut safety. These modifications "man-rate" the Titan II and include: redundant electrical power and flight control systems for greater reliability; a malfunction detection system to warn the astronauts of launch vehicle failures requiring abort; replacement of the Titan II inertial guidance system by the radio guidance system used successfully in Mercury; and removal of items useful only to the Titan II ICBM. These modifications necessitate an extensive test program. Components used in the Gemini launch vehicle are subjected to more severe test conditions than those of the Titan II (ICBM) since manned flight requires a higher safety standard. In most cases, this requires re-qualification tests of Titan II components and systems. All Gemini-peculiar components and systems will complete the full developmental and qualifications tests by March 1964.

NASA is procuring fifteen Gemini Launch Vehicles through the Air Force Space Systems Division. The Air Force has implemented this procurement program under five major contracts: Martin-Marietta for the Launch Vehicle, Aerojet for the engines; General Electric for the guidance system; Burroughs for the computer; and Aerospace Corporation for technical assistance.

The launch vehicles are subjected to the same type of comprehensive testing after manufacturing as the spacecraft. Prior to delivery to the launching site, functional system tests are conducted at Martin-Marietta in Baltimore on all systems with the complete vehicle installed in the vertical test facility with the same type of ground equipment used at the launch site. All systems are thoroughly tested except for actual engine firing. This provides test procedure experience, comparability of test data and an opportunity to uncover problems early. The first Gemini Launch

Vehicle was tested for five months in the vertical test facility prior to delivery to Kennedy Space Center in October 1963.

Subsequent to delivery to Kennedy Space Center, the Gemini Launch Vehicles undergo comprehensive testing at Launch Complex 19, (this complex has been modified for the Gemini mission) to establish compatibility and to verify flight readiness. This includes the complete systems check-out of the vehicle with the launch complex ground equipment and a static firing of the first and second stage engines. Following these tests, the spacecraft is mated with the launch vehicle and complete space vehicle tests are conducted in preparation for launch. The test period for the first Gemini Launch Vehicle, including the initial check-out of Launch Complex 19, is approximately 113 working days.

During fiscal year 1965, four launch vehicles will be delivered. Each of these vehicles will undergo 55 working days of systems test in the vertical test facility prior to delivery, followed by approximately 60 working days of testing and check-out at the Kennedy Space Center.

The Gemini Launch Vehicle development is benefiting from the Air Force's Titan II program. Over 20 Titan II launchings by the Air Force have provided valuable launch operations experience and flight test data directly applicable to the Gemini Launch Vehicle. The Gemini Launch Vehicle malfunction detection system is being tested on 6 Air Force Titan II flights. Some problems in the Titan II have been encountered primarily with the rocket engines which are of concern to the Gemini Launch Vehicle development. The Air Force has undertaken an improvement program. Design improvements from that program are being incorporated into the Gemini Launch Vehicle. For example, (as of December 1963) the surge chamber fix for a longitudinal oscillation has been tested on 2 Titan II launches. The fix will be installed on Gemini Launch Vehicle #1.

In fiscal year 1965, effort will be largely related to launch vehicle production, testing and launch support. The fiscal year 1965 funding requirement was developed jointly by NASA and the Air Force through detailed analysis of experience with the Titan II program, the launch vehicle contractors, Mercury experience, and the specific work programmed for the budget year. The funding requirement takes into account such factors as the extensive quality control and test effort required to assure man-rating standards.

ATLAS/AGENA

The complete Gemini target vehicle and launching system consists of a modified Agena D and the Atlas standard launch vehicle. Eight Atlas/Agena target vehicle systems are being procured through Air Force Space Systems Division.

Atlas - The Atlas standard launch vehicle is being developed by the Air Force to achieve greater reliability during countdown and flight.

The experience gained from over one hundred Atlas launchings has been used as a basis for the improvement program. NASA is contributing to the development costs of this program. The first Gemini Atlas is scheduled for delivery in the second quarter of fiscal year 1965. The second will be delivered in the first quarter of fiscal year 1966. Four more Gemini Atlas vehicles will be in fabrication by the end of fiscal year 1965. The fiscal year 1965 funding requirement for the Gemini Atlas is primarily for the fabrication and testing of these vehicles and includes a proportionate share of the standard launch vehicle development and testing cost.

Agena - The modifications to the basic Agena D to make it a Gemini target vehicle provide: (1) additional maneuverability in orbit; (2) command and communications compatible with the Gemini spacecraft and the ground station network; and (3) a docking mechanism. These modifications, to be accomplished by the Lockheed Missiles and Space Division, consist of changes to the electrical power supply, telemetry, spacecraft command recorder and decoder subsystems and major modifications to the propulsion system. The main engine is being given a multiple restart capability so that it may be started as many as five times in orbit for rendezvous and post-rendezvous maneuvers. A secondary propulsion system is also being added to provide small velocity changes and propellant orientation for main engine start. The docking capability is achieved by adding to the Agena an adapter, built by McDonnell, and provided as government furnished equipment to Lockheed.

The Gemini target vehicle modifications make it far different from the Agenas used in other NASA programs or by the Air Force. It is a versatile, orbiting space vehicle, as well as a powerful second stage booster, that requires man-rating of the flight article. The development and qualification testing required is correspondingly severe.

Fiscal year 1964 is devoted to heavy effort in testing. The engines will undergo four months of combined systems hot firing at Lockheed Sunnyvale. The engines also will be subjected to a preliminary flight rating test for four months at Bell Aircraft. Two months of structural tests will be concluded in January 1964. Qualification tests will be completed on the command and control system, the guidance and flight control units, and the pulse code modulation telemetry system.

Systems testing of the first flight vehicle will be conducted in fiscal year 1965. Integrated systems testing will be followed by radio frequency interference tests. Static firing tests of the assembled vehicle will be conducted at the Santa Cruz Test Base in October and November 1964. The first flight article will then be shipped to the Kennedy Space Center for prelaunch test and check-out in mid fiscal year 1965. By the end of Fiscal Year 1965, four Gemini target vehicles will be in various stages of production and test.

Gemini Support

	1963	1964	1965
Gemini Support.....	$3,936,000	$21,500,000	$28,200,000

Gemini support includes funds for the conduct of perations and for supporting development. Operations encompasses the areas of flight and crew operations while supporting development includes those activities directly supporting the Gemini Program, but not contained within the spacecraft, launch vehicle or target vehicle contracts.

Operations

The budget for Gemini Operations is divided into Flight Operations and Crew Operations.

Flight Operations includes the planning, support, and actual flight test of manned space systems from lift-off to recovery. Three main functional areas are included: Flight Control and Mission Planning; Recovery; and Test and Evaluation.

Recovery funds in fiscal year 1965 will support the Department of Defense recovery forces and Weather Bureau services required for four Gemini flights. These services include deployment of ships, aircraft and rescue personnel; airlifting of medical and communications equipment; providing a capability of spacecraft location in the event of contingency landings; and worldwide weather information coverage. Funds are required for procurement and maintenance of retrieval and location equipment issued to Department of Defense recovery forces. Additional funds are included in fiscal year 1965 for the completion of the test and evaluation of this retrieval and electronic location equipment.

A typical Gemini recovery force includes approximately 18 ships, and 100 aircraft and is comparable to the number used for a Mercury mission. A modification in recovery force employment concept has permitted the use of a comparable force size even though Gemini mission complexity has increased.

Four Gemini flights will require funds for flight control in fiscal year 1965. These funds will be used for: continuation of the contractor support personnel required for flight monitoring and remote site operation; flight controller training; purchase of auxiliary equipment for flight controllers; and development of flight control procedures.

Fiscal year 1965 funds for mission planning will continue the development of real time computer programs required for each mission, booster closed loop guidance equations and the highly sophisticated mathematical techniques required for trajectory programs and mission analysis begun in fiscal year 1964.

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Fiscal year 1965 funding for Crew Operations includes those monies necessary to conduct the required space crew training. This funding will pay for the operation and modification of the various training and simulation devices, such as the Gemini Mission Simulator, the Part Task Trainer, and the Docking Trainer as well as for academic, acceleration and survival training. In addition, a Launch Vehicle Abort Simulator will be purchased and placed into operation.

Supporting Development

Supporting Development consists of essential activities used in conjunction with the spacecraft or launch and target vehicle contracts and is conducted under separate contract or in-house at the various NASA field centers. In fiscal year 1965, the major portion of pilot support systems and components will be delivered. This is comprised of pressure suits; food and waste management systems; various bio-instrumentation devices, including electrocardiogram instruments, oral temperature devices, impedance pneumographs, blood pressure devices and bio-medical recorders. The fiscal year 1965 funding will also support development of extra vehicular equipment. Reimbursement to the Department of Defense for support is also in the fiscal year 1965 estimates. These support activities consist of such items as aircraft and facilities for the parachute and paraglider development program and facilities for conducting ejection seat sled tests.

OFFICE OF MANNED SPACE FLIGHT — APOLLO PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The ultimate objective of the manned space flight program is to provide the capability for a broad program of exploration which will achieve and maintain a position of space leadership for the United States. A specific goal in acquiring this capability is the landing of men on the Moon and returning them safely to Earth; this goal will be realized through the Apollo program.

The overall program requires three flight phases: (1) unmanned suborbital and Earth-orbital flights; (2) manned Earth-orbital, long-duration flights and Earth-orbital rendezvous flights; (3) manned lunar flights.

Unmanned suborbital flights will qualify the spacecraft abort propulsion landing systems, and test the lunar excursion module (LEM) propulsion systems. Unmanned Earth-orbital flights of the command module and service modules and the LEM will qualify spacecraft systems and structure in the actual space environment. Manned Earth-orbital flights and LEM rendezvous flights will follow the unmanned spacecraft qualification phase of the program. The manned long-duration missions will verify the system endurance capabilities and will develop operational techniques essential for the conduct of lunar missions. Rendezvous missions, utilizing the command and service modules and the LEM to simulate the lunar orbit rendezvous phase of the lunar mission, will extend the experience gained in the Gemini program and flight qualify the systems for the lunar mission.

Lunar missions may include manned circumlunar and lunar-orbital flights to develop operational techniques in the lunar environment and to conduct scientific experiments in the cislunar space. Lunar landing missions will be made to explore the Moon's surface and to conduct scientific experiments.

Funds requested in fiscal year 1965 for the Apollo program will initiate the delivery of spacecraft and launch vehicles in support of the "all-up" concept of flight testing. This concept emphasizes the flight testing of the flight weight structures consisting of the complete spacecraft and launch vehicle systems that will duplicate subsequent equipment to be used for lunar missions. The Apollo program presented in this justification for fiscal year 1965 is based on the assumption that the funds received in fiscal year 1964 will include a supplemental appropriation of $141 million.

SUMMARY OF RESOURCES REQUIREMENTS:

Project:	1963	1964	1964 Supplemental	1965
Spacecraft.....	$363,962,000	$870,900,000	$31,000,000	$945,800,000
H-1 Engine.....	6,260,000	11,100,000	---	9,800,000
RL-10 Engine....	29,645,000	20,000,000	---	17,900,000
F-1 Engine.....	53,703,000	62,300,000	---	64,100,000
J-2 Engine.....	46,769,000	56,600,000	---	61,600,000
Saturn I.....	256,887,000	204,200,000	---	120,600,000
Saturn IB.....	21,271,000	149,900,000	---	260,100,000
Saturn V.....	343,442,000	689,600,000	110,000,000	988,400,000
Apollo support...	62,026,000	179,300,000	---	209,200,000
Total costs...	$1,183,965,000	$2,243,900,000	$141,000,000	$2,677,500,000

BASIS OF FUND REQUIREMENTS:

Spacecraft

	1963	1964	1964 Supplemental	1965
Command and service modules	$269,450,000	$508,300,000	$19,000,000	$520,500,000
Lunar excursion module.....	13,000,000	144,500,000	12,000,000	189,900,000
Guidance and navigation.....	31,846,000	91,500,000	---	83,800,000
Instrumentation and scientific equipment.....	2,380,000	5,600,000	---	7,500,000
Spacecraft support.....	47,286,000	121,000,000	---	144,100,000
Total costs...	$363,962,000	$870,900,000	$31,000,000	$945,800,000

Command and Service Modules. In December 1961, the Space and Information Systems Division of the North American Aviation Corporation (NAA) was selected as prime contractor to design, develop, and fabricate the command and service modules of the Apollo spacecraft. In addition, NAA was assigned responsibility for design and fabrication of the spacecraft - launch vehicle adapter, integration of test, scientific, and other government-furnished equipment into the spacecraft, assembly and test of the spacecraft, and support of spacecraft preparation for flight tests.

During fiscal year 1964, development hardware for command and service module components and subsystems will be fabricated and subjected to extensive testing. All major command and service module subsystem contracts will be definitized.

In the ground and flight testing program both developmental and production flight-configuration spacecraft will be used. During fiscal year 1964, 3 developmental spacecraft will be delivered for the ground test program, which includes static, dynamic and thermal structural tests, and operational and environmental testing of the spacecraft with all its subsystems installed.

Ground testing will continue on 6 developmental spacecraft, delivered in prior years, to improve the water recovery and handling capabilities; to develop the Earth-landing impact attenuation provisions; to improve the reliability of the parachute recovery system; and to verify the dynamic stability of the command and service module with a prototype Saturn I launch vehicle.

During fiscal year 1964, 3 developmental spacecraft will be delivered to the White Sands Missile Range and 3 to Kennedy Space Center for flight tests. Flight test activity at the White Sands Missile Range (WSMR) will use pad abort and Little Joe II launch facilities. One of these spacecraft was used to successfully test the launch escape system and Earth-landing system in August 1963. Another of the developmental spacecraft delivered to WSMR will be used with a Little Joe II launch vehicle in a high dynamic-pressure abort test. The third developmental spacecraft will be used for high-altitude abort tests on a Little Joe II. Two of the developmental spacecraft, delivered to Kennedy Space Center, will be used for launch environmental tests on the Saturn I (SA-6 and SA-7). The third spacecraft combined with a micrometeoroid experiment will be the payload for the SA-9, Saturn I flight.

At the close of fiscal year 1964, 3 additional developmental and 10 production spacecraft will be in various stages of manufacture.

In fiscal year 1965, the majority of testing on developmental spacecraft will be completed, and manufacture and qualification testing of production flight-configuration spacecraft will be underway. All major subsystems for the command and service modules will be in the final stages of reliability and qualification testing.

The ground test program will be implemented in fiscal year 1965 with the delivery of 6 production spacecraft for propulsion system tests, vibration and acoustics tests, environmental proof tests, complete static structural tests, thermal tests on structures, and a verification of the water impact and flotation capabilities derived from previous developmental tests.

During fiscal year 1965, 3 developmental spacecraft for flight tests will be delivered. One spacecraft will be flight-tested at Kennedy Space Center carrying micrometeoroid and scientific experiments. A high-altitude abort test will be conducted at White Sands Missile Range with the second spacecraft. The third spacecraft will be delivered to Kennedy Space Center for structural qualification tests. In fiscal year 1965, 4 production spacecraft for flight test will be completed. Two of these spacecraft will be delivered to White Sands Missile Range to qualify the critical launch escape system. The other two production spacecraft will be delivered to Kennedy

Space Center for launch on Saturn IB. These flights will initiate the "all-up" test concept. At the end of fiscal year 1965, 12 production spacecraft will be in various stages of construction. Each of these spacecraft will be equipped for "all-up" systems tests.

Lunar Excursion Module. The lunar excursion module (LEM) has been under development by the Grumman Aircraft Engineering Corporation. This contract, let in December 1962, is managed by the Manned Spacecraft Center. The LEM will have the capability of separating from the command and service modules and performing lunar descent, landing, ascent, and rendezvous and docking with the mother spacecraft which will remain in lunar orbit.

During fiscal year 1964, preliminary design of the lunar excursion module will be completed and the detailed design and development effort will be under way. Grumman will complete contracting for all major subsystems and will begin the fabrication of 4 ground test LEMs and one flight test LEM. In fiscal year 1964, the first mockup was delivered and manufacturing was initiated on 4 other mockups. These mockups, used extensively for design and operational studies, contribute uniquely to the development of the LEM. Tests of landing stability have been made on scale models. In addition, 4 LEM test models were fabricated to determine crew mobility, to conduct thermal and antenna radiation tests, and to study the interface between the descent and ascent stage. For propulsion system tests, fourteen test rigs were manufactured for development tests at Rocketdyne, Bell Aerospace Systems, Space Technology Laboratories, the Arnold Engineering Development Center, and the White Sands Missile Range.

By the end of fiscal year 1965, ground based qualification tests of the ascent engine will be complete, and qualification testing of the descent engine at Arnold Engineering Development Center and the contractor's plant will be approximately 80 percent complete. The LEM ground test programs, on the mockup and test models, will be 90 percent complete.

In fiscal year 1965, 3 lunar excursion module articles will be delivered for use in subsystems integration tests, structural tests, and dynamic tests. Fabrication will be complete on the first LEM to be used for an unmanned propulsion development flight. Four LEM's for propulsion development flights will be in manufacture in fiscal year 1965 and delivered in fiscal year 1966. In fiscal year 1965 Grumman will initiate the system integration test program with LEM test article No. 1. Vibration testing on the Saturn V vehicle will be under way at the Marshall Space Flight Center with LEM test article No. 2 and dynamic and static tests will be in process at Grumman on LEM test article No. 3.

Guidance and Navigation. The functions of the Apollo guidance and navigation system are to determine the position, velocity, and trajectory of the spacecraft and to control the spacecraft's engines and reentry lift for the precise maneuvers necessary during all phases of the flight development effort and finally for the flight to the Moon and Earth return.

The contractor team selected to provide the Apollo guidance and navigation system, under the direction of the Manned Spacecraft Center, is:

(1) The Instrumentation Laboratory of the Massachusetts Institute of Technology - develop the system, fabricate initial prototypes, and provide technical assistance to NASA in the direction of the industrial manufacturers of production systems.

(2) The AC Spark Plug Division of General Motors Corporation, of Milwaukee, Wisconsin, and of Wakefield, Massachusetts - produce the inertial platforms, assemble and test the entire guidance and navigation system, and provide ground support equipment.

(3) The Raytheon Corporation of Bedford, Massachusetts - produce the Apollo guidance computer and its associated ground support equipment.

(4) The Kollsman Instrument Corporation of Elmhurst, New York - provide the optical subsystem.

This team of contractors will provide guidance and navigation equipment for both the command module and the lunar excursion module. To a large degree, identical types of equipment will be used in both modules.

During fiscal year 1964, sub-components of the command module's guidance and navigation system will be extensively tested and qualified. Five of the functional guidance and navigation systems will be completed and will undergo a variety of mechanical, electrical, thermal, and vibration tests. Two additional systems will be delivered for integration and checkout in Apollo spacecraft.

In fiscal year 1965, development, qualification, and reliability testing of the guidance and navigation hardware for the command module will be completed. Fourteen command module guidance and navigation systems, including four flight qualified systems, will be delivered in support of the developmental ground and flight testing programs.

Contract negotiations for the LEM's guidance and navigation systems will be completed in fiscal year 1964. During this time, designs for LEM equipment will be finalized and construction of experimental and developmental models of its guidance and navigation system will be started.

Developmental and functional guidance and navigation systems for the LEM will be delivered in fiscal year 1965. The sub-components will undergo reliability and environmental testing and the first pre-production systems will be delivered.

Instrumentation and Scientific Equipment. Funds requested for instrumentation and scientific equipment will be used to develop and procure the specialized flight research and test instrumentation equipment required during the spacecraft developmental flight testing. (The development and procurement of scientific equipment for in-space and lunar scientific experiments is funded in the Space Sciences budget and is not included as a part of the Manned Space Flight requirement.) Typical instrumentation includes signal conditioners, sensors, transducers, telemetry transmitters, transmitting antennas, and ground support equipment. (Typical scientific equipment includes special cameras, magnetometers, seismographs, and radiation measuring devices.)

During fiscal year 1964, emphasis was on the design, procurement, fabrication, test and qualification of instrumentation (and scientific equipment) needed for 8 Apollo spacecraft tests, including spares. Deliveries of instrumentation hardware were made to North American Aviation for installation and checkout in developmental spacecraft.

Fiscal year 1965 funds will be employed to design, procure, fabricate, and test additional flight research and development instrumentation for 5 Apollo spacecraft flight tests, 6 Apollo spacecraft ground tests, and 3 LEM ground tests.

Spacecraft Support. Spacecraft support for Apollo includes the requirement for Little Joe II launch vehicles, supporting development, pre-flight automatic checkout equipment (PACE) and aerospace medicine.

The Convair Division of the General Dynamics Corporation was selected in May 1962 to design, develop, and fabricate six Little Joe II launch vehicles. In June 1963, 2 additional Little Joe II vehicles were added to the contract, bringing the total to eight vehicles. Fabrication of the first 4 vehicles will be completed in fiscal year 1964, as will development and flight testing of the Little Joe II attitude control system. The Little Joe II provides the capability to obtain necessary flight test data on the spacecraft abort and propulsion systems at much lower cost than using the full-scale Saturn. The funds required in fiscal year 1965 will complete production of the eight Little Joe II launch vehicles and will purchase rocket motors and attitude control systems for all tests now planned.

Funds are also required for utilization of other government installations and for special test equipment at NASA installations in direct test support of the spacecraft development effort. The funds will also cover hardware development and technical effort in direct support of the spacecraft not funded in the prime contract. Also included are funds for propellants for the various spacecraft engine development tests and the special tooling required to support the subcontractors' manufacturing effort.

The spacecraft checkout (pre-flight) program includes engineering studies conducted by General Electric and other qualified contractors for the Apollo program office at NASA Headquarters and related Centers. The

fiscal year 1964 and fiscal year 1965 funding program also includes funds required to procure or fabricate the checkout hardware for 9 Pre-Flight Automatic Checkout Equipment (PACE) stations.

Aerospace medicine support for Apollo includes test and evaluation of specific items of hardware or systems, developed or proposed for use, which are related to the maintenance, protection, and effective performance of the astronauts before, during, and following a space mission. The following tasks will be supported with funds allocated to this area in fiscal year 1965:

(1) Effort will be continued on the manned testing of complete command module and LEM environmental control (life support) systems, as well as testing of individual components. Current problems involve extending mission time, providing automatic controls, and increasing the reliability of the system within the given weight limitations.

(2) Prototype Apollo space-suit assemblies for use in the first manned Apollo mission and for the lunar landing mission will be produced. This effort includes establishment of design requirements for the extra-vehicular and lunar suit assembly, qualification and evaluation programs, and validation of the suit to assess its capability to meet total mission requirements. Apollo biosensors will also be developed, with the primary development objectives of miniaturization and a standard clinical approach. In addition, a study will be initiated on visual problems associated with activity on the lunar surface and with critical maneuvers, such as rendezvous. Glare and distortion in the space environment will be the primary variables investigated and preventive measures or aids will be developed as necessary.

(3) The Apollo mission requires the ability to identify the effects of radiation on crew members. Development will be initiated on sensitive and reliable indicators of radiobiological effects and methods of measuring progress in medical recovery from radiation.

(4) Medical operations activities include the implementation of the medical recovery plan and the medical selection of the astronauts, their training in the physiological bases for the life support systems, and the reduction and analysis of medical data obtained from training and simulation programs, in the same manner as the Mercury data, to provide a consistent base for comparison and analysis with data obtained in flight.

H-1 Engine

	1963	1964	1965
Engine development.....	$5,610,000	$9,100,000	$8,200,000
Propellants.....	650,000	2,000,000	1,600,000
Total costs.....	$6,260,000	$11,100,000	$9,800,000

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The H-1 engine, which is being developed by the Rocketdyne Division of North American Aviation, is used in the first stage of Saturn I and Saturn IB vehicles. Eight of these engines are used in the stage. This engine uses liquid oxygen and RP-1 (kerosene) as propellants to produce up to 200,000 pounds of thrust.

Development of a 165,000-pound thrust H-1 engine was initiated by the Department of Defense in September 1958 as an improved version of Thor-Jupiter engines. Responsibility for development of this engine was transferred to NASA in 1960. The engine has been used successfully in the first four Saturn I launches. A 188,000-pound thrust version will be used in the remaining six flights of Saturn I. A 200,000-pound version will be developed and used in all Saturn IB vehicles. Although the H-1 has been flown successfully at the 165,000-pound thrust level, certain components required modification to assure reliable performance at higher thrust levels. In particular, the nickel thrust chamber tubes have been replaced by stainless steel tubes to compensate for the reduced service life caused by the increase in thrust chamber pressure required by the up-rating of the engine.

Development of a 200,000-pound thrust version of the engine for the Saturn IB is necessary to insure attainment of the required payload capability. This additional development effort will begin in fiscal year 1964 and continue in fiscal year 1965. The fiscal year 1964 effort will include a complete stress analysis for critical engine components at increased flight loads created by the higher engine thrust operating level and a program of engine system tests to determine operating limits. Only those components found to be marginal during stress analysis and 200,000-pound thrust level testing will be redesigned. The fiscal year 1965 up-rating effort will consist of a development and testing program to complete engine qualification at the 200,000-pound thrust level by the end of the second quarter of fiscal year 1965. The development program will continue to provide support to the Saturn I/IB flight program.

RL-10 Engine

	1963	1964	1965
Engine development.....	$22,436,000	$16,000,000	$13,900,000
Propellants.....	7,209,000	4,000,000	4,000,000
Total costs.....	$29,645,000	$20,000,000	$17,900,000

The RL-10 A-3 engine is being developed by Pratt and Whitney for use in a cluster of six in the second stage of the Saturn I vehicle, (and a slightly modified version of the engine in pairs in the second stage of the Centaur vehicle). Each engine, using liquid hydrogen and liquid oxygen as propellants, develops 15,000 pounds of thrust.

Development of the RL-10 A-3 engine, the responsibility of the NASA in 1961, followed the RL-10 A-1 engine program initiated by the Air Force in

1958. The RL-10 A-3 successfully completed its Preliminary Flight Rating Tests (PFRT) in July 1962 and is ready for flight use. The first ground test firing of a cluster of 6 RL-10 A-3 engines was made in January 1963. A pair of engines was flown successfully in the Centaur vehicle in November 1963. The qualification testing program for the RL-10 A-3 engine will continue into fiscal year 1965.

During the fiscal year 1965, approximately 900 ground tests will be performed. The test program will require the rebuilding of 7 engines and the fabrication of 6 new engines during the year. Developmental effort will also continue in the following areas: Saturn and Centaur vehicle flight support, production support and product improvement.

Accomplishments in fiscal year 1965 will include completion of qualification of the pressurant heater and the increased expansion nozzle, completion of the evaluation of the hastelloy chamber, and completion of the propellant utilization valve contamination test.

F-1 Engine

	1963	1964	1965
Engine development.....	$50,082,000	$55,300,000	$55,100,000
Propellants.....	3,621,000	7,000,000	9,000,000
Total costs.....	$53,703,000	$62,300,000	$64,100,000

The F-1 engine, which is being developed by the Rocketdyne Division of North American Aviation at Canoga Park, California, will be used in a cluster of five in the first stage of the Saturn V vehicle. Each engine is capable of producing 1,500,000 pounds of thrust using liquid oxygen (LOX) and RP-1 (kerosene) as propellants.

Development of the F-1 engine was begun in January 1959 when NASA awarded a contract to Rocketdyne for development, through Preliminary Flight Rating Tests (PFRT), of a 1,500,000-pound thrust LOX-RP-1 rocket engine. In June 1961, the test firing of the first F-1 engine was accomplished. Since that time, F-1 engines have achieved rated thrust and duration (150 seconds) many times. During the latter part of 1962, a developmental problem of combustion instability reached serious proportions. This instability problem has been attributed to difficult detailed design problems associated with extremely large injectors and turbopumps. A task force composed of NASA, Department of Defense, University and Industry experts was assigned to attack this problem and recommend solutions. As a result of this activity, several injector designs were evolved which produce stable combustion. However, a substantial program of testing must still be accomplished to prove that other engine requirements such as performance, durability, and pressure drop are not compromised by an injector of satisfactory stability. The final release of the design of the PFRT engine was made in the first quarter of fiscal year 1964, and testing is scheduled for

completion in the third quarter of the same fiscal year. The design for the qualification engine will be released in fiscal year 1965.

During fiscal year 1965, 300 separate engine ground tests will be performed. These tests are part of the 1,289 planned engine system tests that will be performed to qualify the engine for manned flight. Major test effort programmed for fiscal year 1965 includes:

(1) Demonstration of highly improved pump performance;

(2) Completion of the engine flight-rating tests;

(3) Demonstration of the engine's ability to recover from rough (unsteady) combustion without harm;

(4) Initiation of testing of the engine under simulated flight-environment conditions.

Four new engines will be built and 12 engines will be rebuilt during the budget year as part of the total test program.

J-2 Engine

	1963	1964	1965
Engine development	$38,779,000	$48,350,000	$47,600,000
Propellants	7,990,000	8,250,000	14,000,000
Total costs	$46,769,000	$56,600,000	$61,600,000

The J-2 engine is being developed by the Rocketdyne Division of North American Aviation at Canoga Park, California, for use in upper stages of the Saturn IB and Saturn V vehicles. The engine is designed to develop 200,000 pounds of thrust, using liquid oxygen and liquid hydrogen propellants. One J-2 engine will be used in the second stage of the Saturn IB vehicles. In the Saturn V vehicle, a cluster of five J-2 engines will be used in the second stage and a single engine in the third stage.

Development of the J-2 engine began in September 1960 with the award of the development contract to Rocketdyne. By October 1962, the engine achieved its first full-thrust (250-second duration) run. The first 500-second duration run as required for the S IV B stage of the Saturn V was successfully conducted on November 27, 1963.

In fiscal year 1965, 500 of the total of 1,470 engine system tests currently planned to complete the J-2 engine qualification, will be conducted. During the year, the engine will complete its flight rating test and will be qualified for unmanned flight. Testing for qualification of the fuel turbopump, gas generator, LOX turbopump, engine controls and engine flight instrumentation will be started in the budget year. In the process of accomplishing

these tests, seven new engines will be built and fourteen engines will be rebuilt during fiscal year 1965.

Saturn I

	1963	1964	1965
S-I stage	$103,850,000	$59,000,000	$20,600,000
S-IV stage	64,667,000	82,100,000	55,400,000
Vehicle instrument unit	20,862,000	14,200,000	3,600,000
Ground support equipment	17,766,000	4,400,000	3,700,000
H-1 engine procurement	9,561,000	3,200,000	---
RL-10 engine procurement	14,950,000	4,900,000	---
Vehicle support	25,231,000	36,400,000	37,300,000
Total costs	$256,887,000	$204,200,000	$120,600,000

The Saturn I is a two-stage, multi-purpose launch vehicle. The first stage, S-I, is being developed and produced by the Marshall Space Flight Center and the Chrysler Corporation. Chrysler is manufacturing this stage at the Michoud Plant of the NASA. A cluster of eight H-1 engines, using kerosene and liquid oxygen propellants, gives the S-I stage a capability of 1,500,000 pounds of thrust. The H-1 engines are being developed and produced by the Rocketdyne Division of North American Aviation. The second stage, S-IV, is being developed and produced by the Douglas Aircraft Company and will be powered by a cluster of six RL-10 liquid oxygen and liquid hydrogen engines with a total thrust of 90,000 pounds. The RL-10 engines are produced by Pratt and Whitney Aircraft.

The Saturn I development program has advanced into the second phase of hardware development which involves flight testing with live second stages. Four successful launches of the first stage, "Block I" configuration, have been conducted. Flight tests with "Block II" vehicles, composed of live first and second stages, will commence in fiscal year 1964 with the launching of SA-5 and SA-6. The remaining "Block II" launches are scheduled for fiscal year 1965.

Saturn I development has contributed significantly to the development concurrently in progress on the Saturn IB launch vehicle. The first stages of both of these vehicles have similar basic structural configurations with the exception of redesigned tail fins and the supporting structure for the Saturn IB's larger second stage (S-IVB). The first stages of both vehicles are powered by eight Rocketdyne H-1 engines with similar accompanying propellant feed and pressurization systems. Propellant tanks on the Saturn IB first stage (S-IB) have been lengthened to increase propellant capacity, however, tooling and assembly methods have remained the same. An improvement in the thrust of the H-1 engine for the Saturn IB is planned with a minor change in engine design. Virtually all the support equipment for the first stages can be utilized on either vehicle.

S-I Stage. By the end of fiscal year 1964 fabrication of all stages will be in process or completed. The funds required in fiscal year 1964 reflect the heavy ground testing workload at the Marshall Space Flight Center and heavy manufacturing and ground testing workload at the Michoud Plant. Fiscal year 1965 will be the peak year, to date, for Saturn I launches and the majority of the funds requested will be used in the completion and preparation of stages for launch. Funds are also included for reduction of post-flight data, support of the housekeeping contractor at Michoud, and support of the Slidell Computer Facility.

S-IV Stage. The first live S-IV stage will be launched in fiscal year 1964. This flight test will be the first of two flights planned for the fiscal year. Four S-IV stages will be flown in fiscal year 1965. Funding prior to fiscal year 1964 was used for development engineering, fabrication of ground test stages and early flight stages, an extensive ground test program, and long lead-time stage procurement. Fiscal year 1964 funds support a major fabrication, assembly, and testing program affecting all stages to be used for the flight program. Fiscal year 1965 represents the culmination of manufacturing of S-IV stages and funding is geared to the completion and delivery of the four remaining stages to Kennedy Space Center for pre-launch checkout with the entire launch vehicle. As with the S-I stage, funds are provided for reduction of post-launch data and propellants for testing the stages.

Vehicle Instrument Unit. The Saturn I instrument unit, under development by the Marshall Space Flight Center, includes an inertial guidance system, a flight control system, a tracking system and a telemetry and measuring system. The major electronic components are being provided by Bendix and International Business Machines Corporation (IBM). In fiscal year 1964, basic development for all instrument units to be used in the Saturn I vehicle was essentially completed. In addition, fabrication and checkout of the four remaining instrument units for the Saturn I project will take place. As part of this effort, a new nonpressurized instrument unit (the design to be used on the Saturn IB and V), to be flown on the last three Saturn I vehicles, will be assembled and tested. Procurement of hardware for the ST-124 inertial platform, the guidance computer, and the guidance signal processor will be completed. Fiscal year 1965 funds will also support the cost of materials, tooling and special test equipment, and parts necessary to assemble the four remaining instrument units.

Ground Support Equipment. Ground support equipment (GSE) is non-facility hardware required to handle, operate, and checkout assembled vehicles. In fiscal year 1964, the initial GSE development for Launch Complexes 34 and 37 at the Kennedy Space Center and procurement and delivery of major sets of GSE were essentially completed. Fiscal year 1965 funds will be used to provide for maintenance of electrical support equipment, handling equipment, and other vehicle - GSE associated with the launch complexes.

H-1 Engine Procurement. The last H-1 engines required for Saturn I development were procured with fiscal year 1963 funds. Fiscal year 1964 funds were for support hardware, spares, and support services. No procurement funds are required in fiscal year 1965.

RL-10 Engine Procurement. Procurement of RL-10 engines required for Saturn I development will be completed in fiscal year 1964 with the delivery of 20 engines. No procurement funds are required in fiscal year 1965.

Vehicle Support. Vehicle support funds are required to provide research analysis, equipment, combined system testing, and other various services that are common to more than one stage or system of the vehicle. Fiscal year 1964 funding includes computer systems analysis; wind-tunnel tests; hardware standardization tests, tooling and special test equipment; quality assurance and inspection services; propellant testing; barge and air transportation services and equipment, and component testing. In fiscal year 1965, effort will continue in these areas, and funding will include special equipment for liquid hydrogen testing; tooling and special equipment for improvement of advanced checkout techniques applicable to Saturn IB and V operations; critical vehicle component testing; instrumentation of the dynamic vehicle; electronic computer hardware parts for special modification and interfaces of equipments; transportation of all stages and payloads; launch support services at the Kennedy Space Center in support of Saturn I launches including refurbishment of the pad after launch, and post-launch vehicle analysis; personnel training; systems analysis and studies; documentation; and propellant for launches.

Saturn IB

	1963	1964	1965
S-IB stage	$4,745,000	$39,200,000	$79,100,000
S-IVB stage	4,500,000	21,600,000	57,000,000
Vehicle instrument unit	311,000	14,200,000	28,400,000
Ground support equipment	6,926,000	33,000,000	31,500,000
H-1 engine procurement	1,700,000	8,000,000	12,400,000
J-2 engine procurement	2,050,000	6,400,000	11,000,000
Vehicle support	1,039,000	27,500,000	40,700,000
Total costs	$21,271,000	$149,900,000	$260,100,000

The Saturn IB is essentially an uprated version of the Saturn I vehicle and is required as a test bed for Saturn V components and to provide the capability for Earth-orbital flight testing of the Apollo spacecraft. The first stage, the S-IB, is a modified version of the S-I stage of the Saturn I vehicle and is being developed by the Chrysler Corporation Space Division. It will be powered by an uprated set of eight H-1 engines capable of developing a sea-level thrust of approximately 1.6 million pounds. The second stage, the S-IVB, is being developed by the Douglas Aircraft Company. Its basic design characteristics are common to the S-IV stage of the Saturn I vehicle.

The significant differences between the S-IV stage and the S-IVB stage are increased propellant capacity and replacement of a cluster of six RL-10 engines with a single J-2 engine. With some modifications, the S-IVB will also be used as the third stage of the Saturn V vehicle.

S-IB Stage. Development of the S-IB stage was started in fiscal year 1963. Fiscal year 1963 funding provided for stage redesign required to reduce structural weight and to accommodate a new interface with a larger diameter second stage, the S-IVB. Fiscal year 1963 funds also provided for necessary long lead-time procurement of stage hardware. In fiscal year 1964, S-IB design and fabrication activity increases greatly. The first two flight stages will be in manufacturing; and long lead-time hardware will be procured for the first four stages. During fiscal year 1965, the first flight stage (S-IB-1) will be assembled and static tested. Fabrication and assembly of S-IB-2 and S-IB-3 will be completed and assembly of the S-IB-4 will be under way. At the same time component testing as a check on systems reliability will be increased. In addition, long lead-time hardware required for S-IB-5 through S-IB-9 will be procured.

S-IVB Stage. The primary developmental effort for the S-IVB stage is being funded in the Saturn V project. Funds requested for the S-IVB stage include the engineering design effort and modifications required to adapt the stage for use in the Saturn IB; the actual hardware used in the project; and the cost of accelerating development to make the stage available for the Saturn IB flight schedule. A relatively low level of effort was maintained in fiscal year 1963 and consisted for the most part of preliminary design work on the stage and associated ground support equipment. In fiscal year 1964, considerable progress is planned for major tooling, fabrication, and stage tank structural testing. Battleship and structural testing will start late in the fiscal year. Fabrication of stages for the dynamic, all-systems, structural, and facility checkout ground tests will be in process and production of the first two flight stages will be under way. In fiscal year 1965, the fabrication, assembly, and checkout of the remaining ground test stages will be completed. Structural tests will be completed and all-systems tests will be under way. The first flight stage will be completed and a static test firing will be conducted. Structural fabrication, assembly, and checkout of the second flight stage will be completed and fabrication and assembly of the third and fourth flight articles will be under way. Procurement of long lead-time items for S-IVB-5 through S-IVB-9 will be funded.

Vehicle Instrument Unit. Fiscal year 1964 instrument unit funds provide for continuing design and development of Saturn IB-peculiar equipment, procurement of long lead-time items for the first four Saturn IB units (S-IU-1 through S-IU-4), and the start of fabrication of the first flight unit. During fiscal year 1965, incremental funding of the first four flight units will continue. The first flight unit will be completed and assembled; fabrication of the second one will be completed and assembly will be started; fabrication of subsystems for the next two instrument units will be initiated. In addition, long lead-time procurement will begin for five additional units.

Ground Support Equipment. In March 1963 it was decided to provide an automatic checkout system for the Saturn IB as a test unit for Saturn V checkout procedures. Fiscal year 1963 funding initiated the development of a checkout prototype (breadboard) for this purpose. Funding of the prototype will be essentially complete by the end of fiscal year 1964. The design effort will be intensified and procurement will be initiated during fiscal year 1964. Additional engineering development and component testing for computers and associated equipment will be required during fiscal year 1965. Two computers for the breadboard and two for Launch Complex 37 at the Kennedy Space Center will be delivered during the budget year and procurement of the instrument unit checkout station will be completed. Outfitting of the west side of the static test stand at Marshall Space Flight Center will be finished. In addition, provision is made for maintenance of Saturn IB test and checkout equipment.

H-1 Engine Procurement. Fiscal year 1964 funding provides for 12 engines that will be delivered in fiscal year 1964 and for procurement of long-lead hardware deliveries in fiscal year 1965. The fiscal year 1965 estimate includes 42 engines to be delivered in fiscal year 1965, and procurement of long-lead hardware for 38 engines to be delivered in fiscal year 1966. Estimates for both fiscal years include support hardware, services, and propellants for acceptance testing of the engines to be delivered.

J-2 Engine Procurement. Fiscal year 1964 funding provides for procurement of long-lead hardware for deliveries in fiscal year 1965. The current request covers 8 engines to be delivered in fiscal year 1965 and procurement of long-lead hardware for 7 engines to be delivered in fiscal year 1966. Estimates also include requirements for support hardware and services.

Vehicle Support. Vehicle support includes funds necessary to provide studies, services, or equipment that are common to more than one stage or system of the vehicle. Fiscal year 1964 funding includes system analysis of the Saturn IB vehicle and associated ground support equipment (GSE). Other areas of investigations are performance, weight control, stage and payload separation, emergency detection studies, wind tunnel testing, reliability testing, and vehicle control and simulative tests. Also included are a pro-rated share of computer services used by all Saturn-class vehicles, and engineering support services not specifically identified with individual stages or vehicle units. In fiscal year 1965, funds are required for the maintenance, logistic support, addition to ground telemetry equipment; procurement of instrumentation, an RF system, telemetry and GSE measuring equipment; direct engineering support in such areas as test program preparation and test analysis; additional wind tunnel and dynamic testing; and transportation.

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Saturn V

	1963	1964	1964 Supplemental	1965
S-IC stage.....	$129,388,000	$218,300,000	$31,100,000	$271,600,000
S-II stage.....	95,088,000	134,600,000	30,500,000	189,900,000
S-IVB stage.....	51,359,000	95,600,000	20,400,000	126,800,000
Vehicle instrument unit.....	12,045,000	69,900,000	---	78,100,000
Ground support equipment.....	6,425,000	25,800,000	---	70,100,000
F-1 engine procurement.....	14,601,000	45,000,000	11,200,000	67,400,000
J-2 engine procurement.....	14,450,000	24,900,000	16,800,000	45,300,000
Vehicle support.....	20,086,000	75,500,000	---	139,200,000
Total costs.....	$343,442,000	$689,600,000	$110,000,000	$988,400,000

The Saturn V is a three-stage launch vehicle with the capability of placing into low Earth orbit a payload in excess of 120 tons and providing for escape trajectories for payloads of about 45 tons. The Saturn V project was approved in January 1962, following an extensive series of studies on vehicle configurations for the manned lunar landing. The Boeing Company, Aerospace Division, was selected as contractor for the first stage (S-IC); North American Aviation, Inc., Space and Information Division, for the second stage (S-II); and the Douglas Aircraft Company, Missiles and Space Division, for the third stage (S-IVB). Work was initiated with North American in October 1961, with Douglas in December 1961, and with Boeing in February 1962. F-1 and J-2 engines, produced by the Rocketdyne Division of North American Aviation, are provided as government furnished equipment to the stage contractors. Major contractor effort has been reoriented to include the recent decision to adapt the "all-up" concept of flight testing. On the first launch of the flight test program all stages will be live.

S-IC Stage. The Marshall Space Flight Center, with Boeing's assistance, will assemble and test the first ground test stages at Huntsville, Alabama. During fiscal year 1962 and continuing into fiscal year 1963, major effort was placed on design, facility planning, research studies, and acquisition of tooling and test equipment. Component testing was started in fiscal year 1963 and fabrication was initiated on the first ground test stages. Fiscal year 1964 will complete the major portion of fabrication and assembly of the all-systems stage and will mark the start of fabrication and assembly of the dynamic test stage. The fabrication and assembly of some structural test components will be completed and fuel tank testing will begin. Long lead-time hardware for the last ground test stage and the first flight stage will be funded. In fiscal year 1965, the dynamic test stage will be completed and all-systems and structural tests will be started. In addition, the facility checkout and the first flight stage, S-IC-501, will be assembled and fabrica-

tion of succeeding flight stages, S-IC-502 and S-IC-503, will be started. Long lead-time hardware procurement for the fourth flight stage, S-IC-504, will also begin.

S-II Stage. In fiscal years 1962 and 1963, the major S-II efforts were concerned with preliminary and detailed designs, procurement of special tooling and test equipment, procurement of components for design verification and qualification testing, and long lead-time hardware procurement for early stages. During fiscal year 1964, fabrication of the battleship stage and the structural stage continued. In addition, fabrication and assembly of the all-systems dynamic, and facility checkout stages were initiated. Procurement of long lead-time hardware for the first two flight stages began. In fiscal year 1965, major stage testing, such as battleship and structural testing, will be initiated. The all-systems stage fabrication and assembly will be completed and checkout will be inaugurated. Both the dynamic and facility checkout stages will be partially assembled. Fabrication of four flight stages will be in progress and long lead-time procurement will be initiated on the fifth flight article.

S-IVB Stage. The S-IVB stage is a modified version of the S-IV. Although it will be used also in the Saturn IB, the basic development costs are being charged to the Saturn V. As with the S-IC and S-II stages, funding in fiscal years 1962 and 1963 was used to provide design, facilities planning and tooling, and procurement of long lead-time hardware. Qualification testing of components was also started during this period. Initiation of major stage testing, including battleship and structural tests, was provided for in fiscal year 1964. During fiscal year 1964, the Douglas Aircraft Company began the fabrication and assembly of the all-systems, dynamic and facility checkout stages. Long lead procurement of hardware and fabrication for the first flight stage was also started. Ground testing will be intensified in fiscal year 1965 and the last ground test stage, the facility checkout stage, will be delivered. Fabrication of the first flight stage will continue and long lead procurement for the next flight stages will be initiated.

Vehicle Instrument Unit. The vehicle instrument unit includes an all-inertial guidance system, a control system, and telemetry and measuring capabilities. It is being developed and assembled by the Marshall Space Flight Center. The major electronic components are provided by the Bendix and IBM corporations. Fiscal year 1962 and 1963 funds provided for initial design, component testing and a continuance of guidance system research and development, based on experience with the Saturn I project. In fiscal year 1964, the design and engineering of components will continue and the first two ground test units vibration and structural, will be delivered. Structural testing will be performed. During fiscal year 1965, the procurement, fabrication, and acceptance testing of components will continue and the procurement of long lead-time items for SA-501 and SA-502 will be started. The remaining four ground test units (the breadboard, facility checkout unit, dynamic unit, and flight systems unit) will be delivered. Vibration testing will be completed and the dynamic and flight systems tests will begin.

Ground Support Equipment. Ground support equipment (GSE) is non-facility hardware required to handle, operate, and checkout the assembled vehicles. Fiscal year 1964 funds were used almost exclusively for the development of automatic checkout equipment to facilitiate pre-launch countdowns and to improve launch reliability. Fabrication of a prototype set of equipment (breadboard) was also started and procurement was initiated for equipment to be installed in Launch Complex 39 facilities. The Saturn V breadboard will be completed in fiscal year 1965 and procurement actions will continue to provide the minimum checkout equipment essential for the first facility checkout and launch of a Saturn V vehicle. Fiscal year 1965 funds will also be used to develop and procure special test equipment and components.

F-1 Engine Procurement. The fiscal year 1964 funding provides for 2 engines to be delivered in the current year, and procurement of long-lead hardware for 19 engines. The fiscal year 1965 estimate provides for engines to be delivered in fiscal year 1965, and procurement of long-lead hardware for 30 engines. Funds in both fiscal years provide for procurement of support hardware and services and propellants for acceptance testing.

J-2 Engine Procurement. The fiscal year 1964 estimate provides for 11 engines to be delivered in the current year and procurement of long-lead hardware for 26 engines to be delivered in fiscal year 1965. Fiscal year 1965 funding provides for engines to be delivered in fiscal year 1965 and procurement of long-lead hardware for 41 engines to be delivered in fiscal year 1966. Funds in both fiscal years also provide for support hardware, support services and propellants for acceptance testing of the engines.

Vehicle Support. Vehicle support funds are required to provide services and equipment that are common to more than one stage or system of the vehicle. Fiscal year 1964 funding includes instrumentation, recording, and data reduction equipment for the Saturn V dynamic test stand; development of transportation capabilities, such as modifications of marine vessels for stage transportation; use of a special airplane, the "Pregnant Guppy," for emergency movement of out-sized cargo; a pro-rata share of computer services used by all Saturn vehicle projects; range safety devices and tracking beacons for use during Saturn V flights; and engineering support. In fiscal year 1965, these basic activities will be continued. Fiscal year 1965 funding includes special tooling and fabrication of test hardware and fixtures; procurement of special test equipment for calibration and support of component testing; expansion of wind tunnel testing to determine acoustical environment, pressure distribution, static stability, vehicle flutter analysis and heat transfer; a cryogenic flow calibration stand, hybrid simulation facilities; real time digital simulation equipment; an analog flight simulator; data reduction equipment; control system hydraulic simulation equipment; dimensional and non-destructive testing equipment for assembly and quality verification; vehicle propellant blast hazard testing; activation and operation of dynamic test stand.

Apollo Support

	1963	1964	1965
Systems engineering.....	$20,425,000	$40,900,000	$46,000,000
Launch operations and instrumentation.....	7,672,000	36,500,000	51,300,000
Mission control systems.....	7,989,000	52,500,000	41,400,000
Apollo space operation.....	370,000	2,900,000	21,600,000
Supporting technology.....	25,570,000	46,500,000	48,900,000
Spacecraft technology.....	(7,963,000)	(18,700,000)	(20,200,000)
Launch vehicle technology....	(6,299,000)	(12,900,000)	(13,000,000)
Propulsion technology.....	(9,004,000)	(12,800,000)	(12,200,000)
Launch operations technology.	(2,304,000	(2,100,000)	(3,500,000)
Total costs.....	$62,026,000	$179,300,000	$209,200,000

Apollo support consists of the supporting technology and engineering effort related to total mission requirements, including space vehicle reliability and development and maintenance of the launch and flight operations necessary for the accomplishment of the Manned Lunar Landing program.

Systems Engineering. This activity provides for the program-wide technical support needed for the successful accomplishment of Apollo. It is designed to provide assurance that the functional and performance requirements placed upon all elements of the program are compatible with each other and with the mission objectives. Studies undertaken in early fiscal year 1963 reaffirmed the selection of the lunar orbital rendezvous (LOR) mode for the Apollo mission. Recent systems engineering activities include development of specifications for Apollo that insure that each subsystem element will be developed in accordance with the overall system requirement. Fiscal year 1964 funding provided for the initiation of studies concerning mission description and planning, test objectives and integration, systems specifications, guidance and navigation, communications and tracking networks, checkout effectiveness, and documentation. Systems engineering receives principal support from both Bellcomm and General Electric. Fiscal year 1965 funding provides for an extension of most of the analyses now under way and initiation of new efforts, where required, as the program advances. There will be some shift of emphasis to reliability studies, including mission safety analysis, mathematical model development, and failure effects analysis.

Launch Operations and Instrumentation. The funds in this category provide for the launch instrumentation necessary to measure and record the launch performance of space vehicles used in the Manned Lunar Landing program; the support provided by range contractors and the Air Force; basic equipment, supplies and stock material required by the range contractors or the Air Force in support of the program; and the maintenance and necessary alteration of facilities in the Merritt Island Launch Area and at Launch Complexes 34 and 37 at the Kennedy Space Center. The division of responsi-

bilities between NASA and the Air Force were delineated in an agreement between the Administrator and the Secretary of Defense on January 17, 1963.

Mission Control Systems. Mission control systems activities include development, operation, and maintenance of the Integrated Mission Control Center (IMCC) at the Manned Spacecraft Center and associated interface equipment at the Kennedy Space Center. It also provides for the technical integration of the IMCC with the world-wide manned space flight network.

The IMCC building is nearly complete and beneficial occupancy is scheduled for March 1964. Implementation of the real-time computer complex by IBM has progressed rapidly. Three of the four large digital computers required are temporarily in a rented building and are being used for preparation of computer programs and operational planning. The balance of the technical systems within the IMCC, under contract to Philco, are being developed and procured and all major equipment is scheduled to be available by the end of fiscal year 1964. Integrated testing of the IMCC with the manned space flight network will be conducted in fiscal year 1965. Fiscal year 1965 funds are needed for the completion of the IMCC and for operation and maintenance of the IMCC. Also included is the Apollo launch data system, consisting of equipment at Kennedy Space Center for data format conversation and signal conditioning prior to transmission to the IMCC at the Manned Spacecraft Center.

Apollo Space Operation. Apollo space operations required for the support of flight missions can be classified into three major categories: Pre-flight, flight, and crew.

Pre-flight operations include the effort required to check-out the spacecraft at the launch area prior to launching. Fiscal year 1965 funds will be utilized to carry on the effort initiated in the fiscal year 1964. These funds will provide for the contractor services required for collecting, recording and evaluating the checkout telemetry data; the connecting of the ground support equipment to the facilities; the engineering and design effort required for connecting the ground support equipment; the cryogenic and hypergolic consummables required for testing and flight loading the spacecraft; and the common-use spacecraft consummable spares utilized by Apollo contractors.

Flight operations includes the planning, support and actual accomplishment of manned missions from lift-off to recovery. Flight operations may be divided into three distinct areas: Mission planning; flight control; and operational support.

Fiscal year 1964 funding for mission planning supported development of real time computer programs, booster closed-loop guidance equations, mathematical techniques for trajectory programs, and the procurement of a hybrid computer to provide an analytical capability for the development of real time computer programs for mission analysis and support. Fiscal year 1965 funds will be used to continue the support of these mission planning functions.

The fiscal year 1964 funds allocated for flight control were used to provide contractor support personnel for flight monitoring and remote site operation, flight controller training aids, and accessory and auxiliary equipment for flight controllers. Fiscal year 1965 funds will be used to continue support of the above items and, in addition, provide engineering studies of flight control techniques.

Fiscal year 1965 funds will be used to continue studies begun in fiscal year 1964 on recovery operation techniques, tests of spacecraft landing and recovery systems, and procurement of handling and retrieval equipment for Apollo.

Crew operations provides for crew training and integration of crew activities with the engineering design and development of Apollo spacecraft and with flight mission planning and training. The equipment requirements for crew training include a free-flight lunar lander, a crew procedures development trainer, in-flight test systems hardware, and centrifuge cockpit equipment.

Fiscal year 1964 funds provide for astronaut academic, survival, and mission training. Fiscal year 1965 crew operations funding will provide for fabrication and testing of the crew procedures development trainer and will continue crew training commensurate with trainer availability.

Supporting Technology. This is a project of individually selected engineering tasks primarily supporting the broad Apollo program. The project includes studies and hardware developments which will provide increased assurance of meeting the performance and reliability requirements of the Apollo program. This effort includes investigations of improved or alternate systems, subsystems, components and materials which can be phased into the present Apollo program in a timely fashion as required.

The tasks fall into four general categories -- spacecraft, launch vehicles, propulsion, and launch operations.

Apollo spacecraft technology deals with materials and structures, flight systems development, and human factors. Alternate structural subsystems will be designed and evaluated under the specific launch and flight environments to be encountered by the spacecraft. Effort will be continued to improve spacecraft seals and sealing techniques. Improved protective systems will be investigated to provide flight crews with an environment which is as safe and comfortable as can be provided. Development of alternate hardware, based on new technology will be started, to make improved equipment available on a timely basis.

In the launch vehicles category, primary emphasis is being placed on the improvement of structures and propulsion systems, and the integration of the engines into the launch vehicles. Problems associated with vehicle aerodynamics, and guidance and control requirements will be investigated. Recent advances in the state-of-the-art will be applied to alternate approaches for the mainstream hardware development.

Propulsion technology effort is directed toward current development problems as well as improved engine system components. Investigations will be continued into the problems of combustion instability and propellant pump stalls during start up. Effort is also being directed into the area of pulse-operated reaction control engines, on tankage and components for small pressure-fed systems, and on propellant performance for application to spacecraft propulsion systems.

In the launch operations, tasks relating to the fueling system, for the handling of liquid oxygen and kerosene, hypergolic fuels and oxidizers, and the simultaneous handling of liquid oxygen and liquid hydrogen will be studied. Ground support equipment and techniques, will also be studied in an effort to reduce the time required for checkout.

OFFICE OF MANNED SPACE FLIGHT — ADVANCED MISSIONS PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

From the experience and technological advancement gained to date with Mercury, Gemini, and Apollo missions, advanced manned space flight mission concepts are examined through advanced studies designed to determine the logical extension of the national space capability. Development of the capability for manned lunar landing and return provides to the nation the scientific and technical knowledge of the space and lunar operations necessary to undertake long-term Earth-orbiting satellite missions, scientific exploration of the Moon, and ultimately, exploration of the planets. Planning of this type is essential to provide information upon which to base future program decisions.

SUMMARY OF RESOURCES REQUIREMENTS:

	1963	1964	1965
Advanced studies.....	$11,391,000	$22,100,000	$26,000,000

BASIS OF FUND REQUIREMENTS:

	1963	1964	1965
Advanced studies.....	$11,391,000	$22,100,000	$26,000,000

The objectives of the advanced studies are to analyze present hardware systems for growth potential; to develop requirements for future systems; to provide guidance for research and technology activity; and to provide information upon which future program decisions can be based.

This activity will enable the NASA to advance technology in required areas, provide a sound basis for future programs, and permit near optimum scientific and technical programs. Advanced planning is necessary and essential to enable full consideration of the foregoing factors and of the resource requirements for future missions.

Advanced studies involve the continuing effort leading to the definition and preliminary design and specification of possible future manned space flight missions, based on the fact that exploration of the Moon is but the first major step in manned exploration of space. Specific areas of investigation include manned satellites, manned lunar missions, and manned planetary missions.

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Manned Satellites

During the past, studies have been directed toward (1) the demonstration of the technical feasibility of manned Earth-orbiting satellites, (2) establishment of the characteristics of orbiting manned laboratories, and (3) definition of major subsystems, such as life support system, power supplies, scientific and experimental instrumentation, data processing equipment, and stabilization systems. In addition, studies have been initiated to analyze logistic requirements for operational maintenance of manned satellites. This included launch facility requirements, refueling, resupply and emergency rescue methods, and configuration requirements for ferry and supply vehicles.

The fiscal year 1965 effort for manned satellites studies will place emphasis on optimization, specification preparation and preliminary plans for design of the various subsystems and configurations. The results of this effort will permit a detailed appraisal of the requirements for such a program beyond the approved military effort and will provide a sound basis for a hardware development program decision if required in the future.

Manned Lunar Missions

The prime objective of the Apollo program is to place two men on the lunar surface and to return them safely within this decade. This achievement will constitute the beginning of lunar exploration. Therefore, the principal emphasis of the manned lunar studies is to identify and define the most effective systems to support lunar exploration missions following the initial Apollo landings.

Studies are now underway involving systems to support initial surface reconnaissance operations in the immediate post-Apollo period and systems suited to more extensive lunar operations and scientific exploitation of the moon.

Systems being investigated for use in the period following the initial landing include the Apollo Logistic Support System (ALSS) and the Stay Time Extension Module (STEM). The ALSS would consist of an unmanned Apollo Lunar Excursion Module (LEM) descent stage, modified to be capable of landing approximately 7,000 pounds on the lunar surface, to include an appropriate family of surface equipment. This equipment would include surface vehicles and shelters to extend the mobility, stay time, and capability of Apollo astronauts. The STEM would consist of a modified Apollo LEM capable of providing modest extension of lunar surface stay time for the astronauts beyond that presently provided.

The principal system being investigated for subsequent, more extensive operation is the Lunar Exploration System for Apollo (LESA), a flexible system which in its growth capability could provide a lunar base. LESA is conceived as a modular set of lunar surface hardware which can be quickly tailored to support a wide range of lunar exploration missions. The system

includes surface vehicles, shelters, nuclear power plant, appropriate support equipment, and regenerative systems to reduce resupply requirements. From the family of LESA modules, sets of equipment could be assembled to meet the needs of either small or large groups of astronauts (up to 18 men) for lunar surface missions of either short or long duration.

Emphasis in the lunar study program is on laying a sound base for development of the ALSS, the most probable system for support of early lunar exploration missions. Following program definition studies during fiscal year 1964, it is anticipated that preliminary engineering work will be initiated in fiscal year 1965. This will include essential supporting development, detail design, preliminary mockups, and test articles.

Manned Planetary Missions

Considerable scientific and technical interest has centered around manned planetary missions; however, it is too early to define in detail either mission concepts or schedules. Primarily, the fiscal year 1964 studies are directed toward a better understanding of such a program.

In fiscal year 1965, the manned planetary mission effort will place primary emphasis on analysis of system feasibility and concept. Studies of scope, objective, schedules and cost will be necessary to select the most promising mission profiles for detailed engineering analysis in later years.

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

ADDITIONS TO MANNED SPACECRAFT OPERATIONS AND CHECKOUT BUILDING

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: John F. Kennedy Space Center, NASA

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT NASA INSTALLATION: John F. Kennedy Space Center, NASA

TYPE OF CONSTRUCTION PROJECT: Extension

FUNDING:

FY 1963 and Prior Years	$15,816,000
FY 1964 Estimate	4,964,100
FY 1965 Estimate	16,316,000
Total Funding Through FY 1965	$37,096,100

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$13,152,800
Building	Sq. Ft.	278,787	$43.48	12,121,700
Site preparation	LS	---	687,300	687,300
Utilities	LS		343,800	343,800
Equipment				$2,971,200
Office, shop, & laboratory, equipment	LS	---	1,121,000	1,121,000
Systems to connect ground support equipment	LS	---	695,400	695,400
Air-conditioning, power, supplies, cooling systems	LS	---	485,300	485,300

	Unit of Measure	Quantity	Unit Cost	Total Cost
Communications systems	LS	---	$669,500	669,500
Design	---	---	---	---
		SUBTOTAL		$16,124,000
Fallout Shelter				192,000
		TOTAL		$16,316,000

PROJECT DESCRIPTION:

This project provides for the following expansions to the Operations and Checkout Building: (1) two three-story additions to the administrative and engineering wing to provide approximately 156,850 square feet of office space; (2) a five-story office and trainer addition containing approximately 34,400 square feet, consisting of office space on the first two floors, test areas on the third floor, a lunar excursion module (LEM) trainer room on the fourth floor, and a trainer control room on the fifth floor; (3) a single story addition to the service area containing approximately 2,250 square feet, to house mechanical equipment; and (4) an addition of approximately 85,287 square feet to the low-bay assembly and test area. The latter will be divided into four basic areas: (a) a service area, containing approximately 10,250 square feet, to house switchgear, LEM spare parts and tool rooms, modification shop, and mechanical equipment; (b) an assembly and test area of approximately 15,610 square feet; (c) cable and utility tunnels containing approximately 6,927 square feet, for communications and power cabling; and (d) a four-story test area containing approximately 52,500 square feet, to house test equipment and spacecraft shops.

PROJECT JUSTIFICATION:

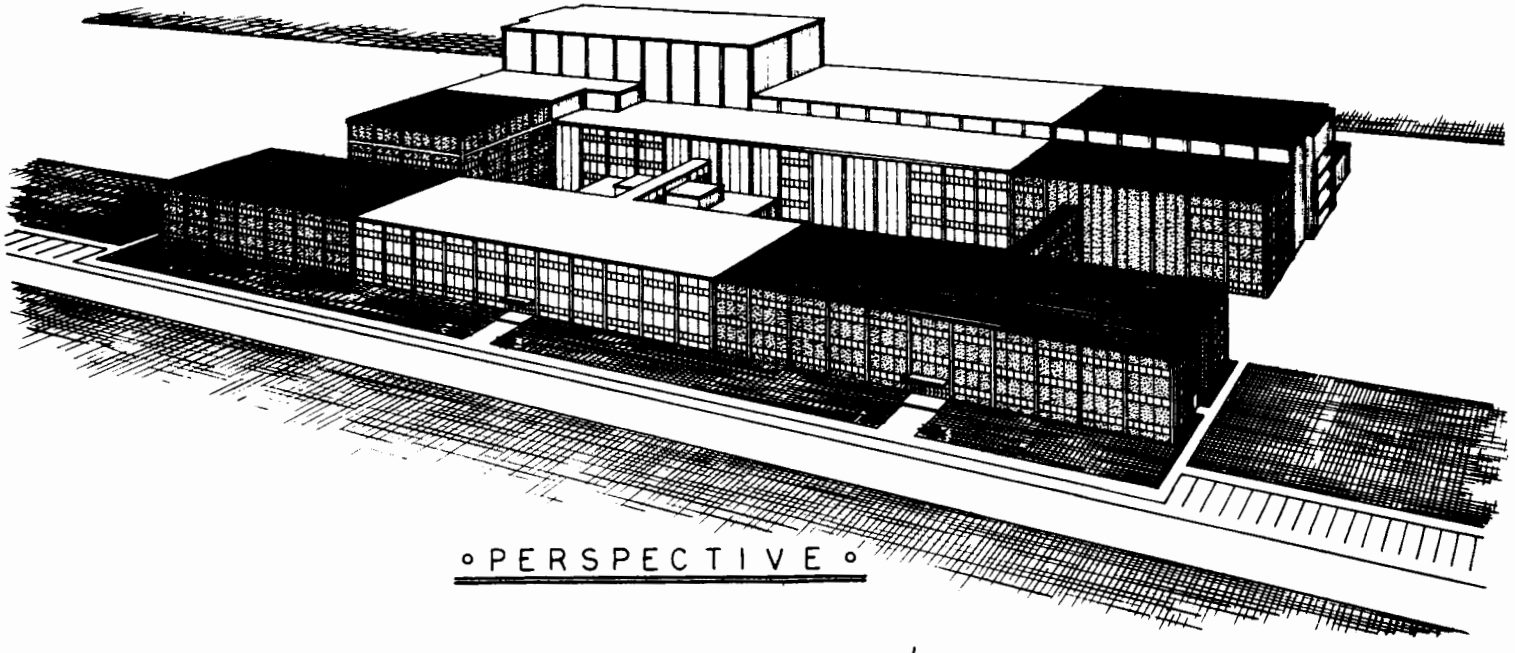
The lunar excursion module of the Apollo spacecraft configuration, coupled with the growth in activity associated with the command and service modules, requires additional assembly and checkout, office, test, and service areas for contractor and NASA personnel. The existing Operations and Checkout Building contains work areas for engineering, administration, checkout, and modification of the Gemini and Apollo command and service modules. Previously authorized construction of this facility provided only for the initial buildup of NASA and contractor personnel. The proposed additions are required to: (a) house the phased increase in personnel, and (b) perform the complete preflight checkout of non-hazardous manned spacecraft systems in order to prove the flight worthiness of all modules of the spacecraft.

ESTIMATED FUTURE YEAR FUNDING: None

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

ADDITIONS TO MANNED SPACECRAFT OPERATIONS & CHECKOUT BUILDING



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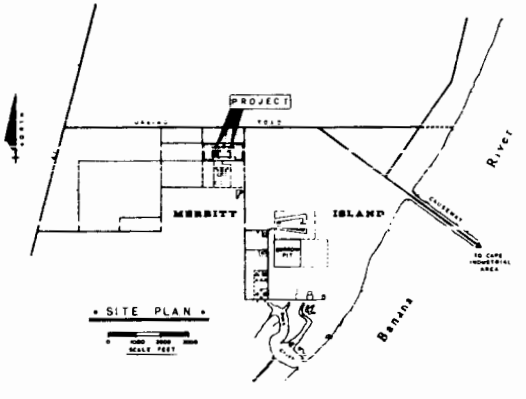


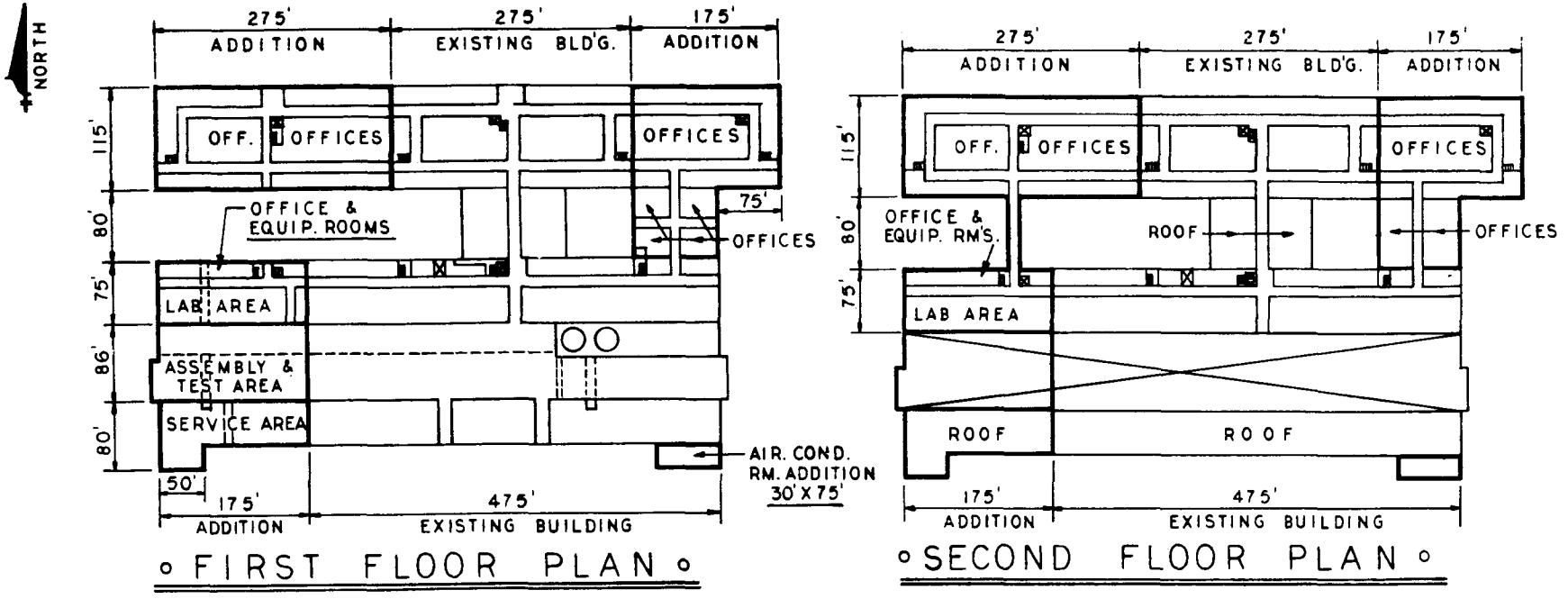
° SITE PLAN °

CF 5-6

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

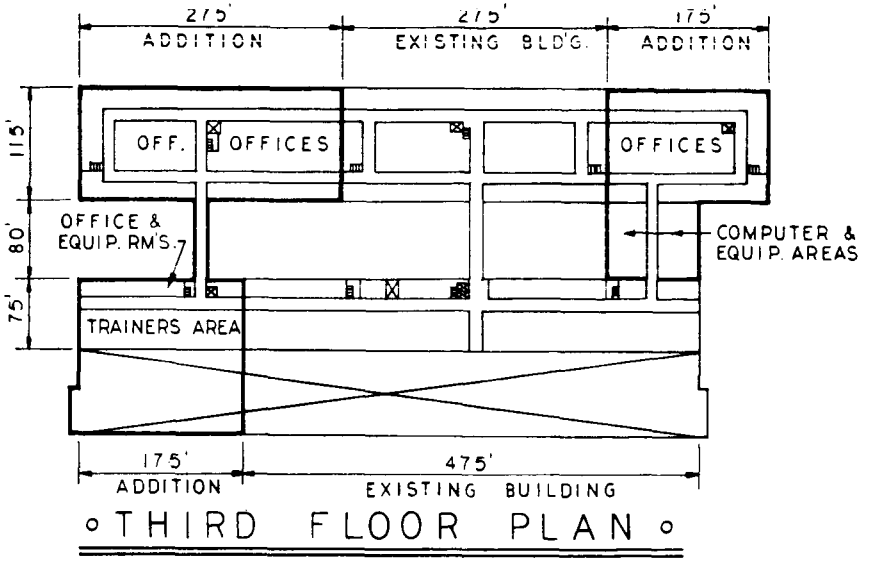
ADDITIONS TO MANNED SPACECRAFT OPERATIONS & CHECKOUT BUILDING



JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

ADDITIONS TO MANNED SPACECRAFT OPERATIONS & CHECKOUT BUILDING



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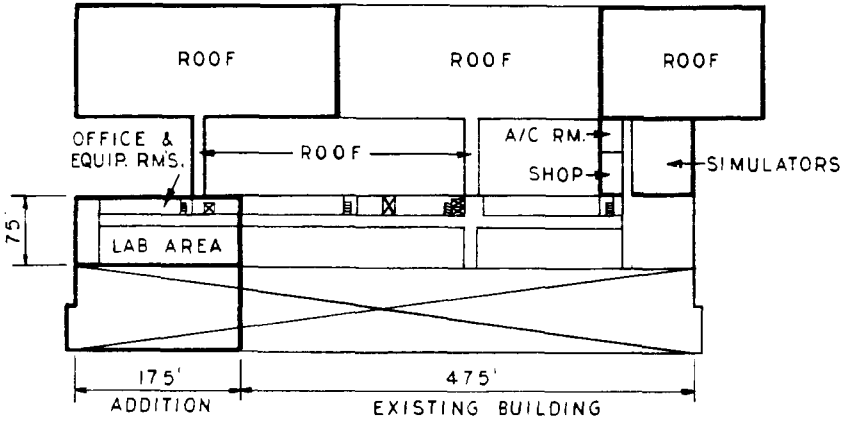

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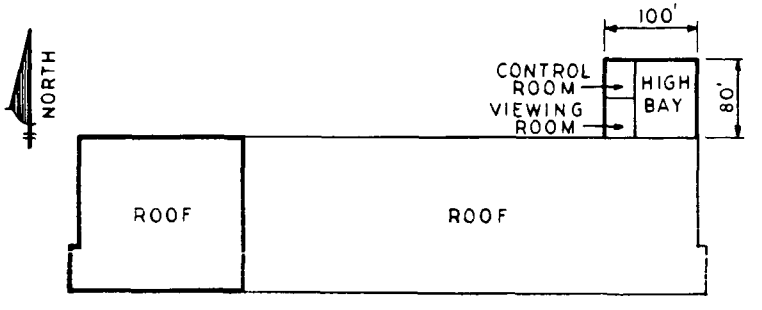

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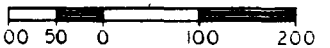

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

ADVANCED SATURN LAUNCH COMPLEX NO. 39

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: John F. Kennedy Space Center, NASA

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT NASA INSTALLATION: John F. Kennedy Space Center, NASA

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	$169,550,000
FY 1964 Estimate	193,980,000
FY 1965 Estimate	63,284,000
Total Funding Through FY 1965	$426,814,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$674,000
Railroad spurs	LS	---	$674,000	674,000
Equipment				$57,069,000
Propellant services	LS	---	23,490,000	23,490,000
Communication, TV and cabling	LS	---	6,660,000	6,660,000
Firing accessories	LS	---	17,304,000	17,304,000
General support	LS	---	3,350,000	3,350,000
Instrumentation	LS	---	5,835,000	5,835,000
Launch controller status panels	LS	---	430,000	430,000

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	Unit of Measure	Quantity	Unit Cost	Total Cost
Design				$5,541,000
For construction	LS	---	$35,000	35,000
For equipment	LS	---	5,508,000	5,508,000
Fallout Shelter	---	---	---	---
		TOTAL		$63,284,000

PROJECT DESCRIPTION:

This project provides for the continuation of design and construction of facilities to be used for assembling, readying, and launching the Saturn V vehicle. Prior funding provided for the design, incremental costs of the construction of the major structures, and long procurement lead time items for the complex, such as the vertical assembly building, launch control center, two launch pads, one arming tower, four launcher-umbilical towers, two crawler-transporters, crawlerways, and associated facilities and equipment. This increment provides funds for the shorter lead time items necessary to support the initial launch requirements for the Apollo program as well as the capability of supporting the present launch schedules.

PROJECT JUSTIFICATION:

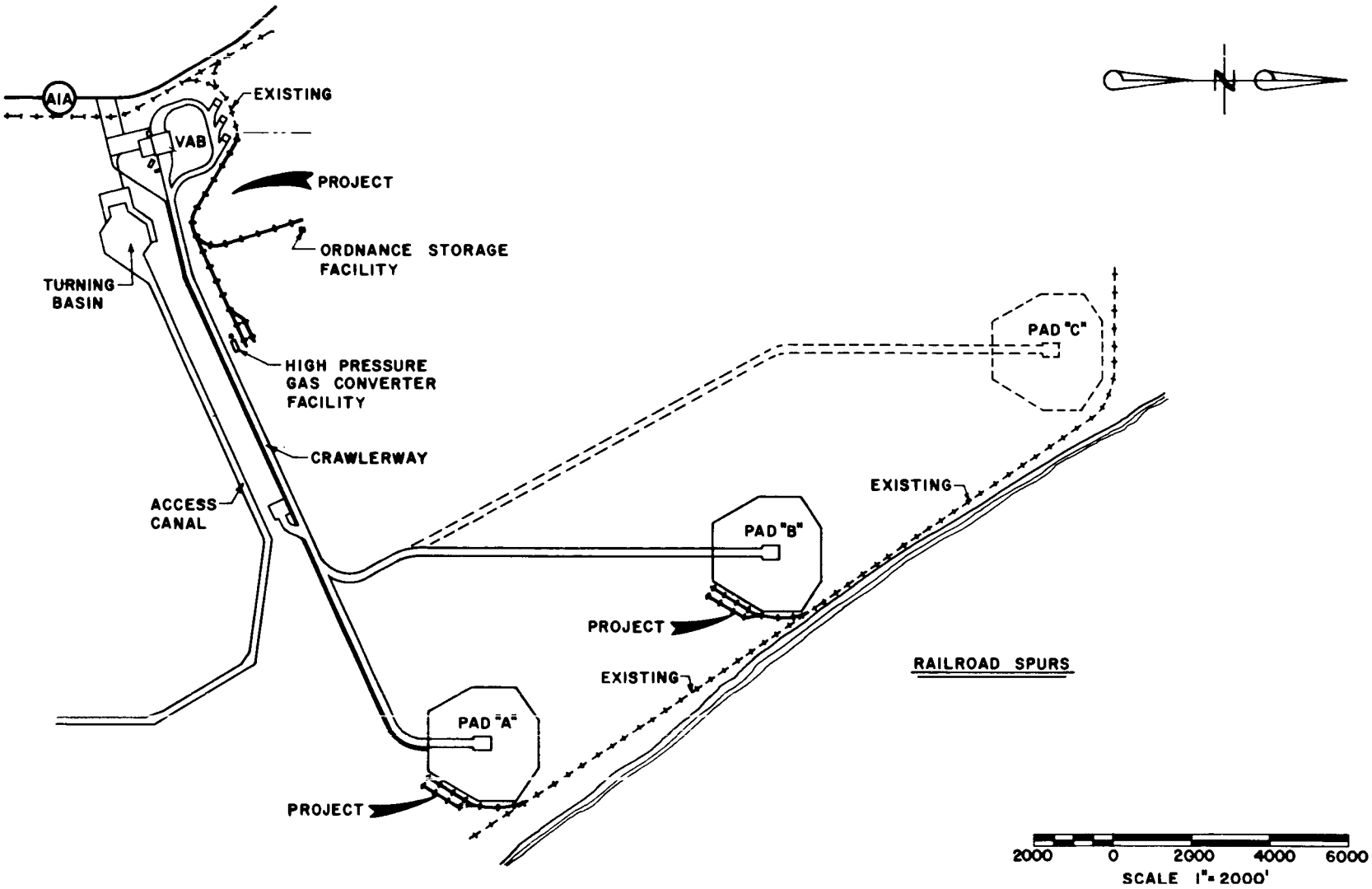
This project will continue the work started in prior years and provide such items as outfitting the launcher umbilical towers and the second launch pad. Railroad spurs are required to provide rail access to the launch pads, the ordnance storage facilities and the gas compressor/converter facility in order to eliminate double handling of large explosive ordnance, helium and propellants.

ESTIMATED FUTURE YEAR FUNDING: None

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

ADVANCED SATURN LAUNCH COMPLEX NO. 39



CF 5-11

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

EXTENSION TO CENTRAL SUPPLY COMPLEX

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: John F. Kennedy Space Center, NASA

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT NASA INSTALLATION: John F. Kennedy Space Center, NASA

TYPE OF CONSTRUCTION: Extension

FUNDING:

FY 1963 and Prior Years	$710,000
FY 1964 Estimate	2,093,600
FY 1965 Estimate	952,000
Total Funding Through FY 1965	3,755,600

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$902,000
Building	Sq. Ft.	50,000	$13.16	658,000
Site preparation	LS	---	107,000	107,000
Roads and parking	LS	---	100,000	100,000
Utilities	LS	---	37,000	37,000
Equipment				$50,000
Storage racks	LS	---	4,350	4,350
Bins, shelving, fixtures, and equipment	LS	---	21,350	21,350
Material handling equipment	LS	---	24,300	24,300

	Unit of Measure	Quantity	Unit Cost	Total Cost
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$952,000

PROJECT DESCRIPTION:

This project provides for a combination warehouse and manned spacecraft spares building. The warehouse portion will be used for storage of electronic components and equipment, missile vehicle components and spares, photographic equipment and supplies, communication supplies, furniture and office supplies. The manned spacecraft spares portion will furnish space for receiving, inspection, and holding components of the Lunar Excursion Module of the Apollo spacecraft. The building will have a total area of approximately 50,000 square feet of enclosed storage space and will be a rigid frame structure with masonry curtain walls. An area of approximately 12,000 square feet will have a controlled environment. The building will have a loading dock with dimensions of approximately 200 feet by 10 feet. An adjacent paved open operating area of 12,550 square yards will be provided. In addition, 6,200 square yards of open storage will be constructed adjacent to an existing warehouse in the same complex.

PROJECT JUSTIFICATION:

With the expansion of launch activities in the Merritt Island Launch Area, this facility is required in addition to the existing supply complex and the existing manned spacecraft storage facilities.

Warehouse Portion: This provides a capacity to handle approximately 1,000 tons of supplies per month that will move through this area in this time frame. Existing facilities can handle only 750 tons of materials per month. The additional requirements are based on studies of the supply requirements of the Mercury and Saturn programs correlated with the anticipated needs of the Apollo program during this time frame. The Central Supply Complex will handle all administrative equipment and supplies necessary to support the John F. Kennedy Space Center, NASA, Manned Spacecraft Preflight Operations, and other NASA elements and all supporting contractors. The paved open operating area adjacent to this warehouse is required to serve the vehicles going to and from this supply facility. Also, an additional open paved area of 6,200 square yards is needed for outside storage and loading/unloading operations of vehicular equipment shipped by rail.

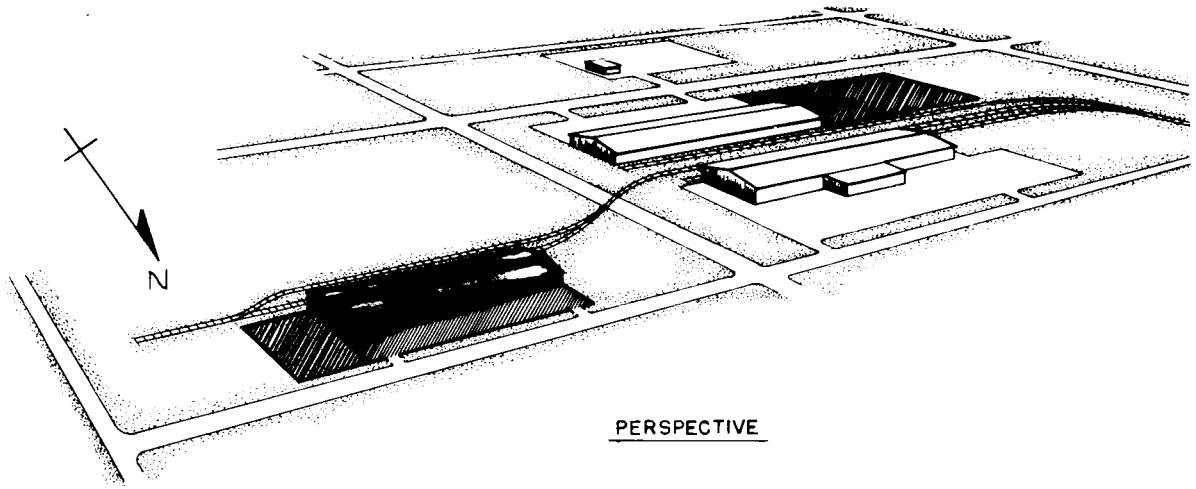
Manned Spacecraft Spares Portion: The complexity of the Lunar Excursion Module of the Apollo spacecraft requires that the spare parts for the module be stored and maintained under rigidly controlled conditions. This facility will furnish the space needed to properly receive, ship, inspect, issue and store these parts. Spare spacecraft parts must be available on a continuing basis to assure quick and reliable replacement in the event of a breakdown during either the checkout or launch operations. Existing manned spacecraft facilities are being used to their capacity for handling parts of the Gemini spacecraft and the Service and Command Modules of the Apollo spacecraft.

ESTIMATED FUTURE YEAR FUNDING: None

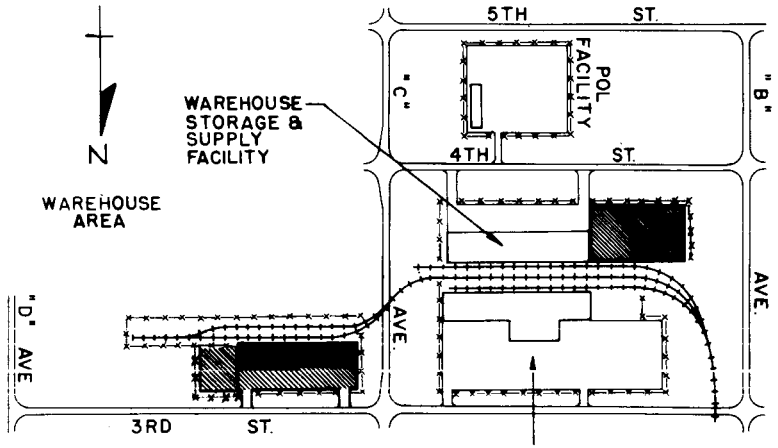
JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

EXTENSION TO CENTRAL SUPPLY COMPLEX



PERSPECTIVE



SITE PLAN

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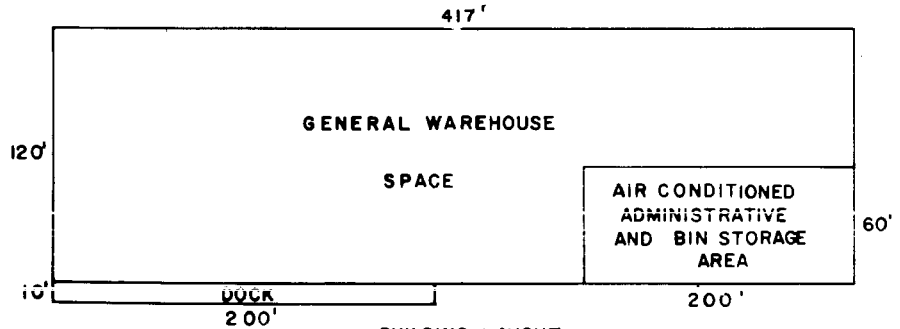
SCALE IN FEET



BUILDING LAYOUT

50 0 50 100

SCALE IN FEET

CF 5-15

PD 65-0510

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

MANNED SPACECRAFT STATIC TEST FACILITY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: John F. Kennedy Space Center, NASA

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT NASA INSTALLATION: John F. Kennedy Space Center, NASA

TYPE OF CONSTRUCTION PROJECT: Extension

FUNDING:

FY 1963 and Prior Years	$5,000,000
FY 1964 Estimate	93,000
FY 1965 Estimate	2,780,000
Total Funding Through FY 1965	$7,873,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$519,500
Test pad and supporting items	LS	---	$147,800	147,800
Four supporting buildings	LS	---	85,000	85,000
Site preparation	LS	---	44,300	44,300
Roads and parking	LS	---	7,300	7,300
Utilities	LS	---	235,100	235,100
Equipment				$2,260,500
Altitude simulation equipment	LS	---	1,142,000	1,142,000
Supporting equipment	LS	---	1,118,500	1,118,500

	Unit of Measure	Quantity	Unit Cost	Total Cost
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$2,780,000

PROJECT DESCRIPTION:

This facility will provide a second static test stand, its related buildings, and the necessary equipment, instrumentation, and support systems for the static testing of the propulsion systems of both the Ascent and Descent Stages of the Apollo Lunar Excursion Module. This static test stand will be located approximately 800 feet south of the first Static Test Facility (Apollo Service Module Static Test Stand). It will be constructed on a 35-foot high earth fill over a diffuser and steam ejector system which will be utilized to simulate high altitude conditions. A flume will extend to a catch basin which will be connected to a leaching area. An altitude chamber, which will house the module during static testing, will be located on the test pad. A Ground Service Equipment and Transfer Building will have an area of approximately 1,000 square feet. A Mechanical Equipment Building, which will house vacuum pumps and air-conditioning equipment, will have an area of approximately 640 square feet. A Water Treatment Plant, which will house neutralizing solution tanks, equipment to treat cooling water, and other associated equipment, will have an area of approximately 1,000 square feet. A Steam Generating Plant will have an area of 1,405 square feet. All buildings will be single story steel frame structures with metal exterior walls.

An existing Control Building, Fuel Building, Oxidizer Building, and Pump House, which support the existing Static Test Facility, will be used jointly by the second facility.

PROJECT JUSTIFICATION:

This facility is required for final checkout of the Lunar Excursion Module, prior to manned flights, under conditions closely simulating actual flight conditions. Significant technical differences between the Service Module and the Lunar Excursion Module preclude the possibility of utilizing a single static test facility for both modules. This additional Static Test Facility must accommodate (1) servicing and static firing of the Lunar Excursion Module propulsion systems on an integrated basis, to ensure flight readiness, (2) validation testing, and hypergolic servicing of the Lunar Excursion Module propulsion systems, and (3) verification and practice of procedures to be used at the launch site.

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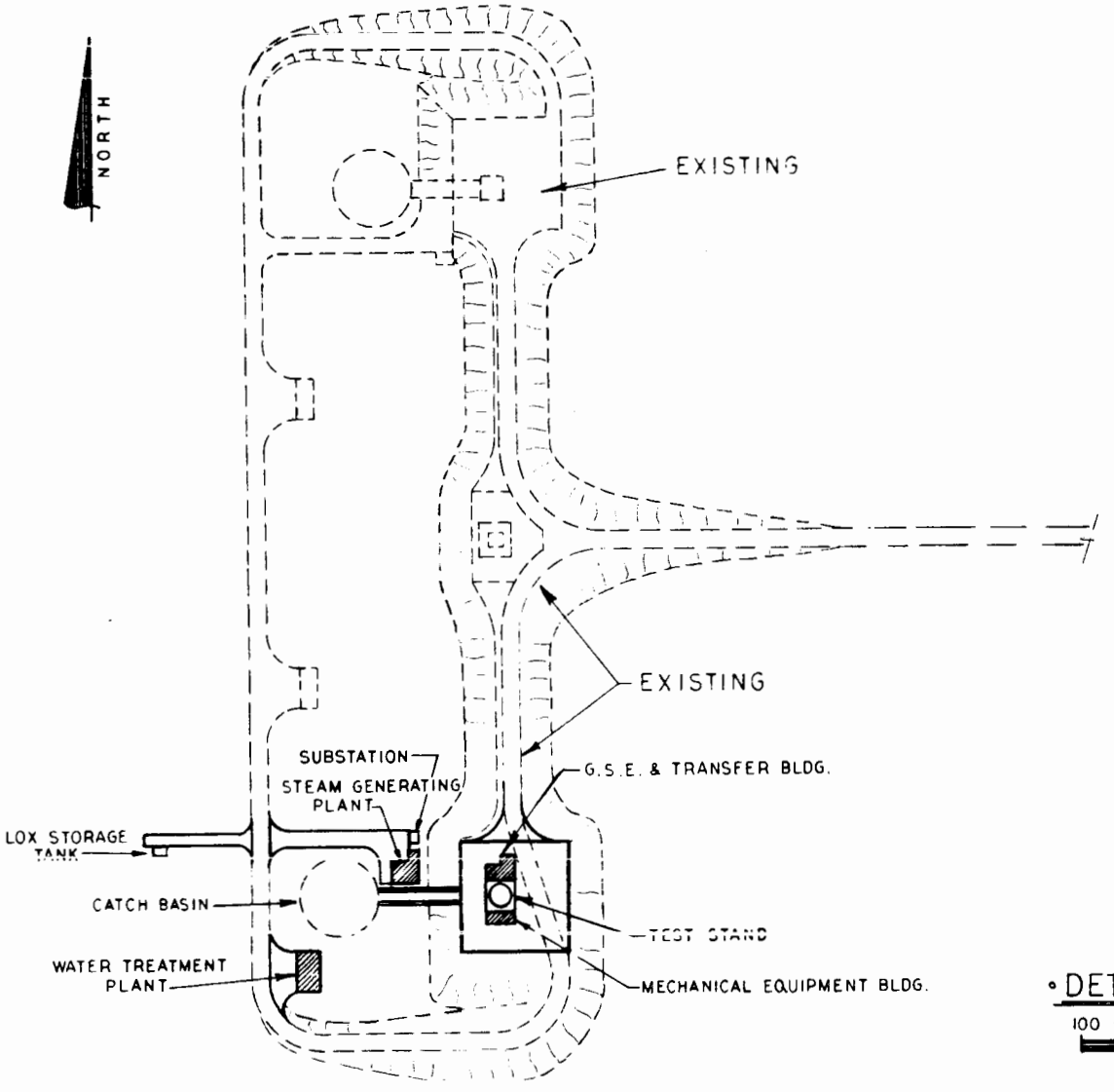
The Ground Service Equipment and Transfer Building is required to house the electrical and electronic transfer equipment and the ground service equipment related to the static testing operations. The Mechanical Equipment Building is required to house equipment for controlling the environment within the Altitude Chamber. The Water Treatment Plant is required to provide conditioned water for the diffuser and steam generator, and to prepare neutralizing solutions for washing down after a fuel or oxidizer spill. The Steam Generator Plant is necessary to house the large capacity and high rate steam generating equipment required to maintain altitude simulation pressure in the diffuser.

ESTIMATED FUTURE YEAR FUNDING: None

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

MANNED SPACECRAFT STATIC TEST FACILITY



DETAIL SITE PLAN

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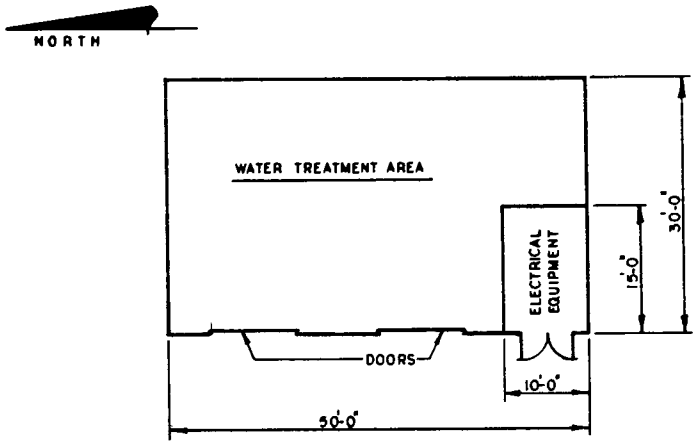
SCALE-FEET

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

MANNED SPACECRAFT STATIC TEST FACILITY



•FLOOR PLAN•

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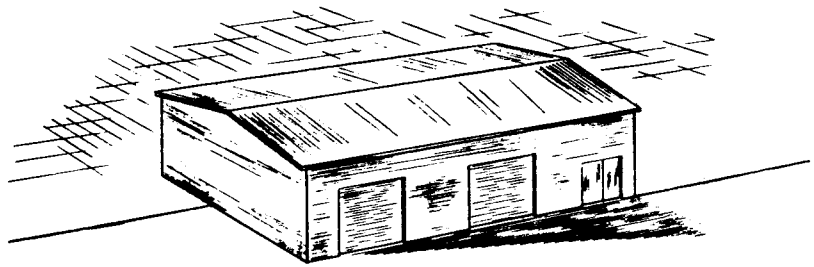
SCALE - FEET



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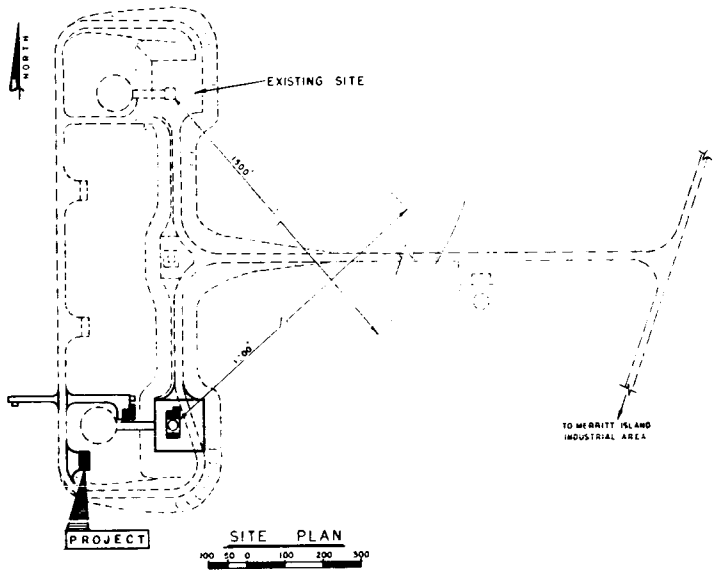


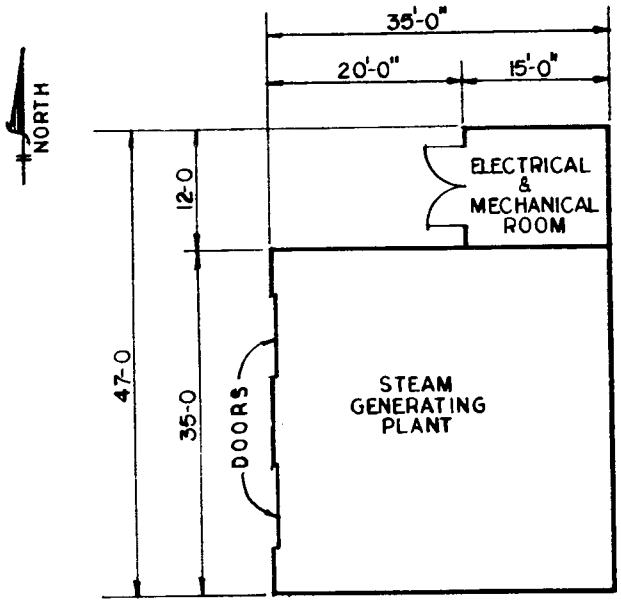
WATER TREATMENT PLANT

CF 5-20

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

MANNED SPACECRAFT STATIC TEST FACILITY



FLOOR PLAN

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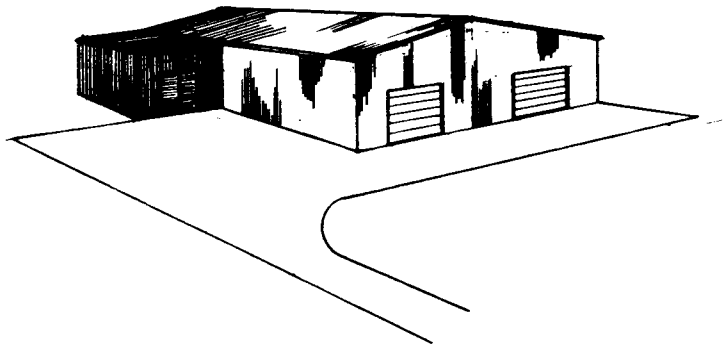
SCALE FEET



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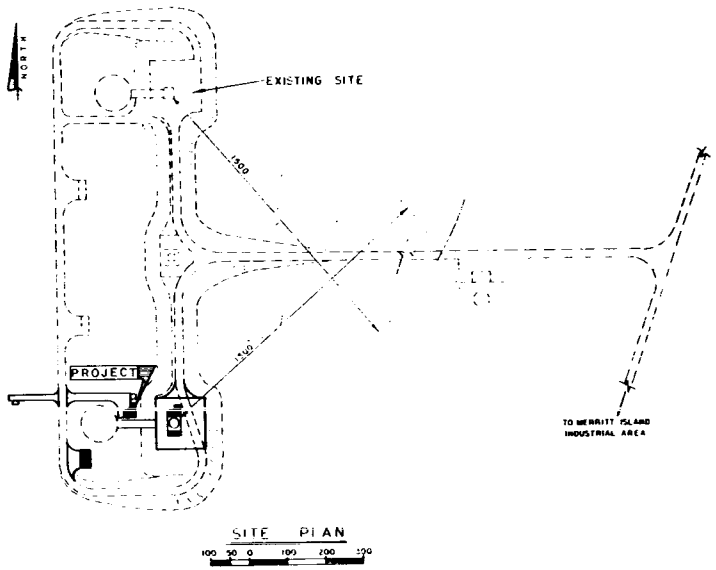


SITE PLAN

100 50 0 100 200 300

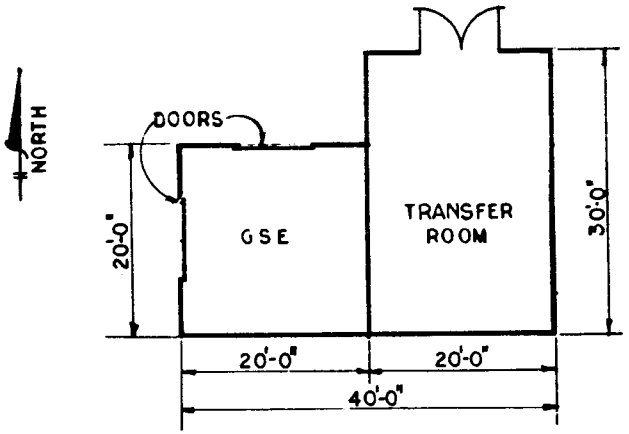
STEAM GENERATING PLANT

CF 5-21

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

MANNED SPACECRAFT STATIC TEST FACILITY



FLOOR PLAN

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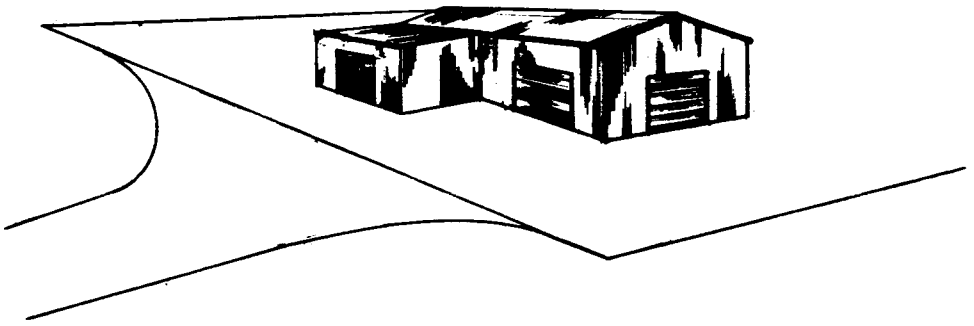
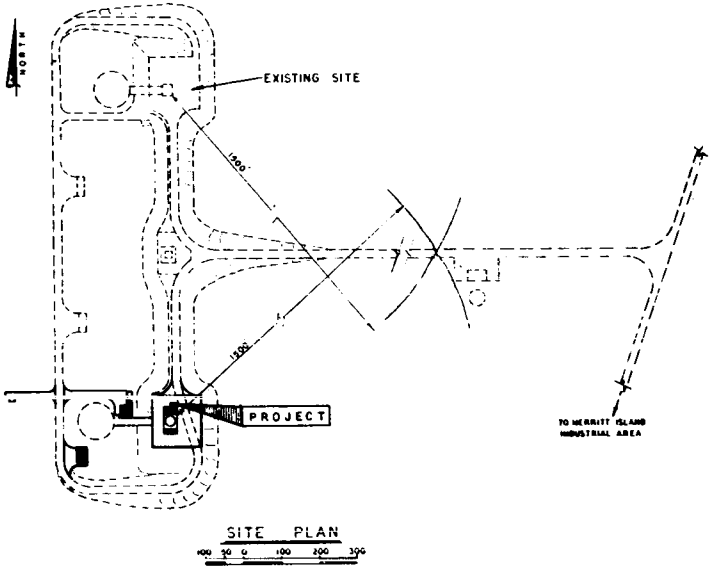
SCALE FEET



PERSPECTIVE



SITE PLAN

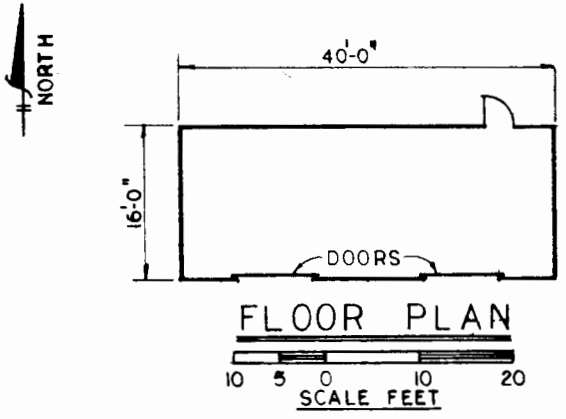
CF 5-22

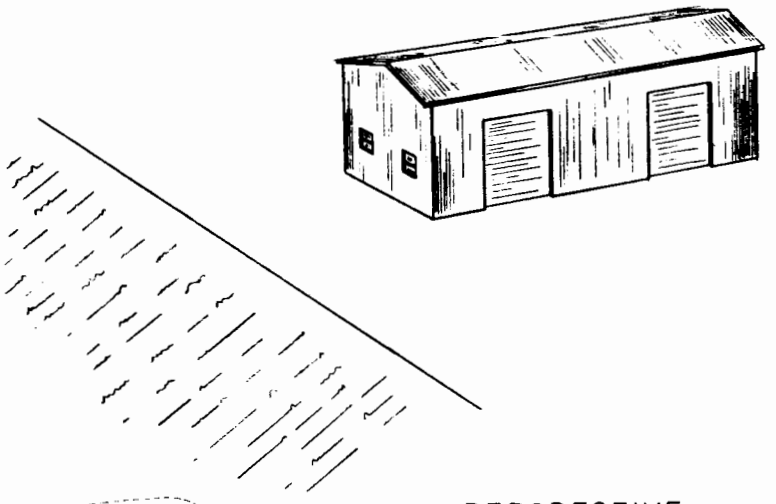
G. S. E. & TRANSFER BUILDING

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

MANNED SPACECRAFT STATIC TEST FACILITY





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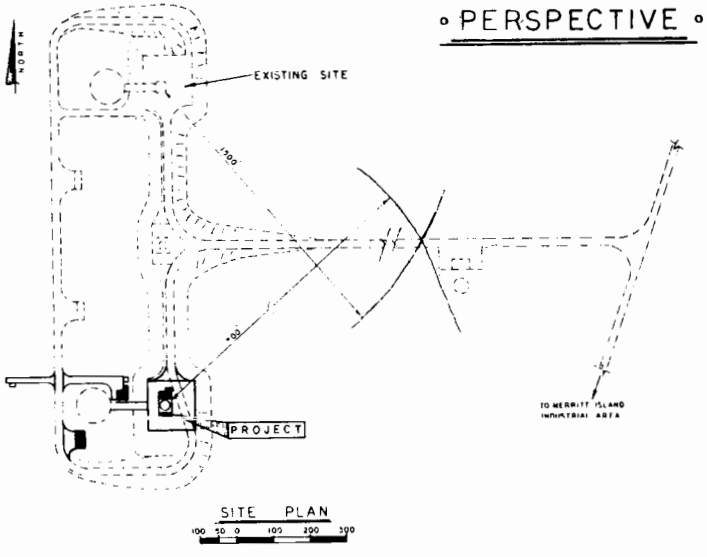

MECHANICAL EQUIPMENT BUILDING

CF 5-23

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

PROPELLANT SYSTEMS COMPONENTS LABORATORY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: John F. Kennedy Space Center, NASA

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT NASA INSTALLATION: John F. Kennedy Space Center, NASA

TYPE OF CONSTRUCTION PROJECT: Extension, Alteration

FUNDING:

FY 1963 and Prior Years	---
FY 1964 Estimate	$12,000
FY 1965 Estimate	588,000
Total Funding Through FY 1965	$600,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$256,300
Laboratory addition	Sq. Ft.	4,100	$30.93	126,800
Repair and maintenance shed	Sq. Ft.	4,800	10.78	51,800
Site preparation	LS	---	23,300	23,300
Roads and parking	LS	---	31,400	31,400
Utilities	LS	---	23,000	23,000
Equipment				331,700
Equipment for laboratory	LS	---	242,900	242,900
Equipment for maintenance shed	LS	---	88,800	88,800

	Unit of Measure	Quantity	Unit Cost	Total Cost
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$588,000

PROJECT DESCRIPTION:

This project provides for extension and alterations to the Propellant Systems Components Laboratory, which will be used for cleaning, analyzing, repairing, and testing of hardware and components of all NASA launch vehicles and complexes and the manned spacecraft facilities. This addition will have a gross area of approximately 4,100 square feet, of which 3,000 square feet will have precise humidity and dust control. The building addition will be constructed of concrete block with steel joist roof framing. Also included is a Propellant Transporter Repair and Maintenance Shed to be used in the cleaning, purging, and repair of propellant transporters. This shed-type structure will have a gross area of approximately 4,800 square feet. Enclosed within this structure will be an administrative and storage area with an approximate area of 960 square feet.

PROJECT JUSTIFICATION:

Addition to the Laboratory - The existing facility provides space for cleaning, analysis, and repair of components and hardware such as valve assemblies and interconnecting piping related to Launch Complexes 34 and 37 and the manned spacecraft facilities. The Saturn V and the Saturn IB programs will more than double the hardware cleaning and testing requirements in this time frame. This operation must be performed in an environment of a high level of cleanliness to preclude microscopic contamination which could result in the malfunction of an entire system.

Propellant Transporter Repair and Maintenance Shed - A building is needed to provide space for the necessary cleaning, purging and neutralization processes required to maintain 50 propellant transporters and other support equipment. This servicing will include the cleaning and maintenance of the vacuum systems and heat exchangers on the cryogenic transporters, as well as the valving and piping on both the cryogenic and helium bottle transporters.

ESTIMATED FUTURE YEAR FUNDING: None

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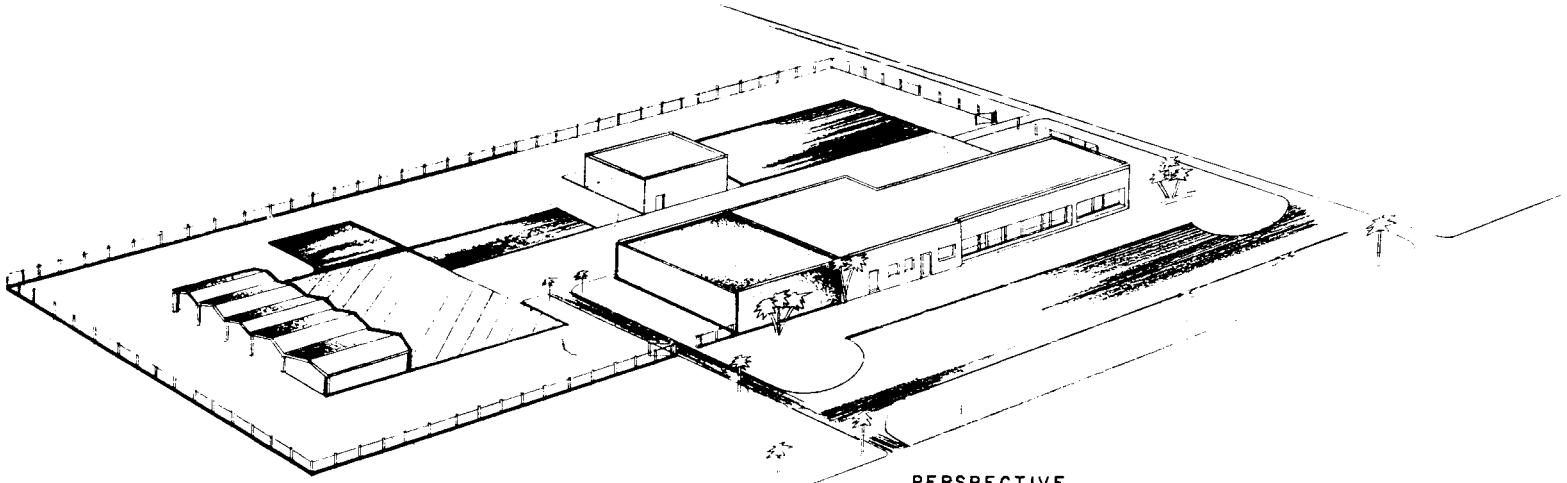
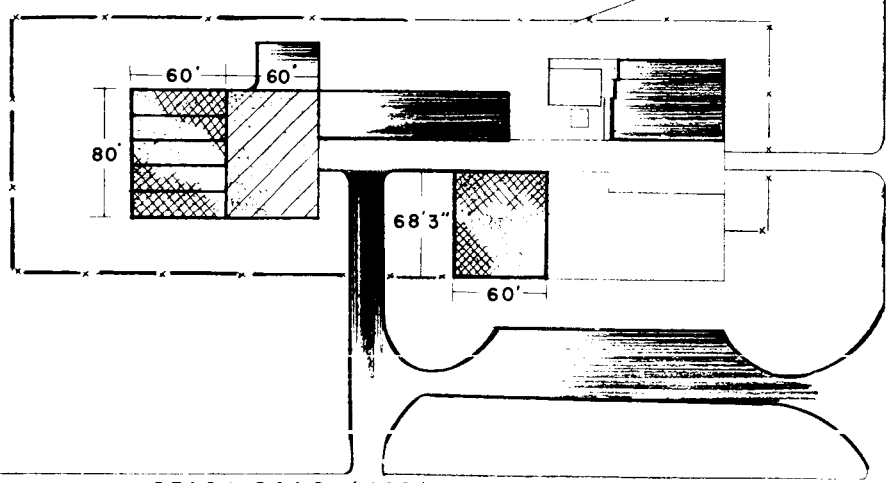
JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

PROPELLANT SYSTEMS COMPONENTS LABORATORY



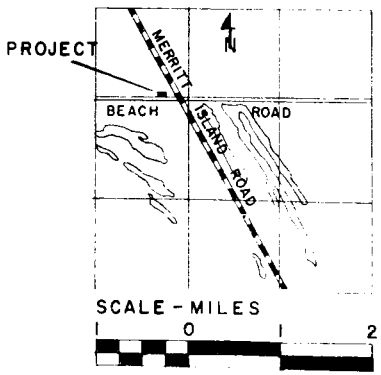
PERSPECTIVE



PLAN

60 0 60 120

SCALE - FEET

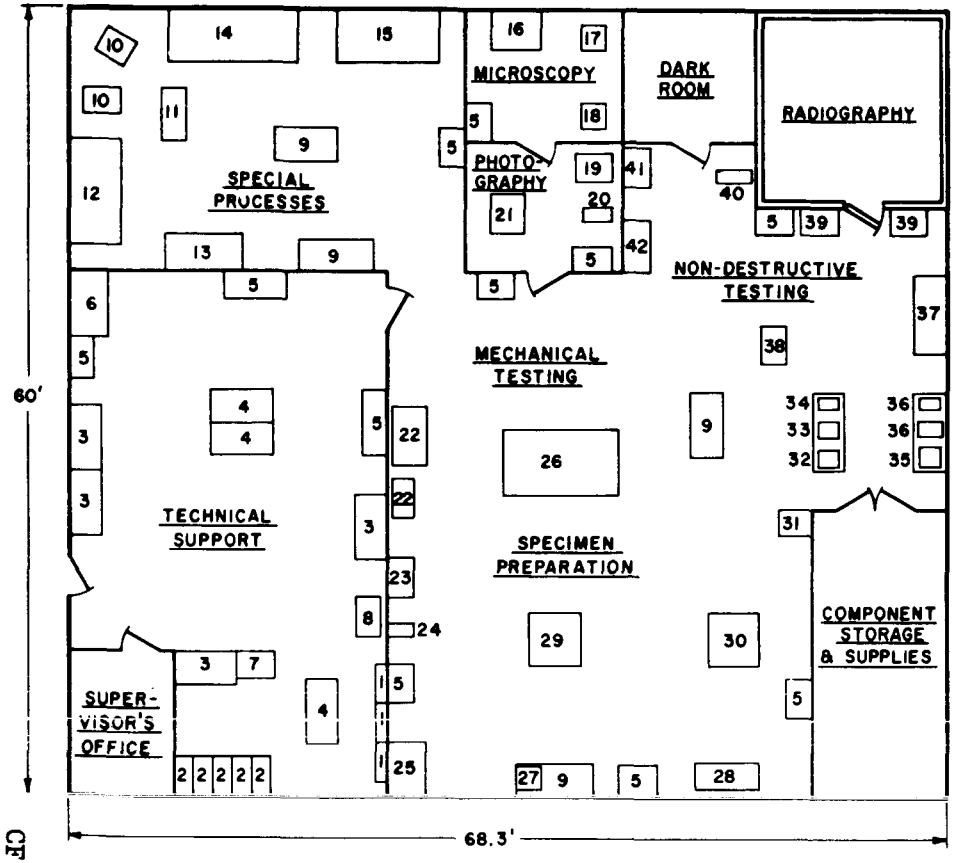


CF 5-26

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

PROPELLANT SYSTEMS COMPONENTS LABORATORY



BUILDING ADDITION AND EQUIPMENT LAYOUT

TECHNICAL SUPPORT
1. 3-BOOKCASES
2. 5-FILE CABINETS
3. 3-DESKS
4. 3-WORK TABLES
5. 3-STORAGE CABINETS
6. 1-DRAFTING TABLE
7. 1-TYPEWRITER
8. 1-COPY MACHINE

SPECIAL PROCESSES
5. 1-STORAGE CABINET.
9. 2-WORK BENCHES
10. 2-HEAT TREAT FURNACES
11. 1-QUENCH TANK
12. 1-BAKING OVEN
13. 6-CLEANING TANKS
14. 1-SALT SPRAY CABINET
15. 1-SPRAY HOOD

MICROSCOPY
5. 1-STORAGE CABINET
16. 1-METALLOGRAPH
17. 1-STEREO MICROSCOPE
18. 1-TOOLMAKERS MICROSCOPE

PHOTOGRAPHY
5. 1-STORAGE CABINET
19. 1-MICRO HARDNESS TESTER
20. 1-COMBINATION HARDNESS
21. 1-MICRO CAMERA

MECHANICAL TESTING
5. 2-STORAGE CABINETS
22. 1-PROOF LOAD TESTER
23. 1-PHOTO ELASTIC STRESS
24. 1-STRAIN GAGE INDICATOR
25. 1-FIXTURE STORAGE RACK
26. 1-UNIVERSAL TENSILE MACHINE

SPECIMEN PREPARATION
5. 2-STORAGE CABINETS
9. 2-WORK BENCHES
27. 1-DRILL PRESS
28. 1-BENCH LATHE
29. 1-BAND SAW
30. 1-MILLING MACHINE
31. 1-BELT SANDER
32. 1-SPECIAL STORAGE CABINET
33. 1-MOUNTING PRESS
34. 1-BENCH GRINDER
35. 1-WET REPOLISH
36. 2-DRY REPOLISH
37. 1-POLISHING TABLE
38. 1-CUT-OFF WHEEL

NON-DESTRUCTIVE TEST
5. 1-STORAGE CABINET
39. 2-X-RAY CONTROL UNITS
40. 1-DYE PENETRANT
41. 1-ULTRA SONIC TEST
42. 1-MAGNETIC PARTICLE

10 0 10 20

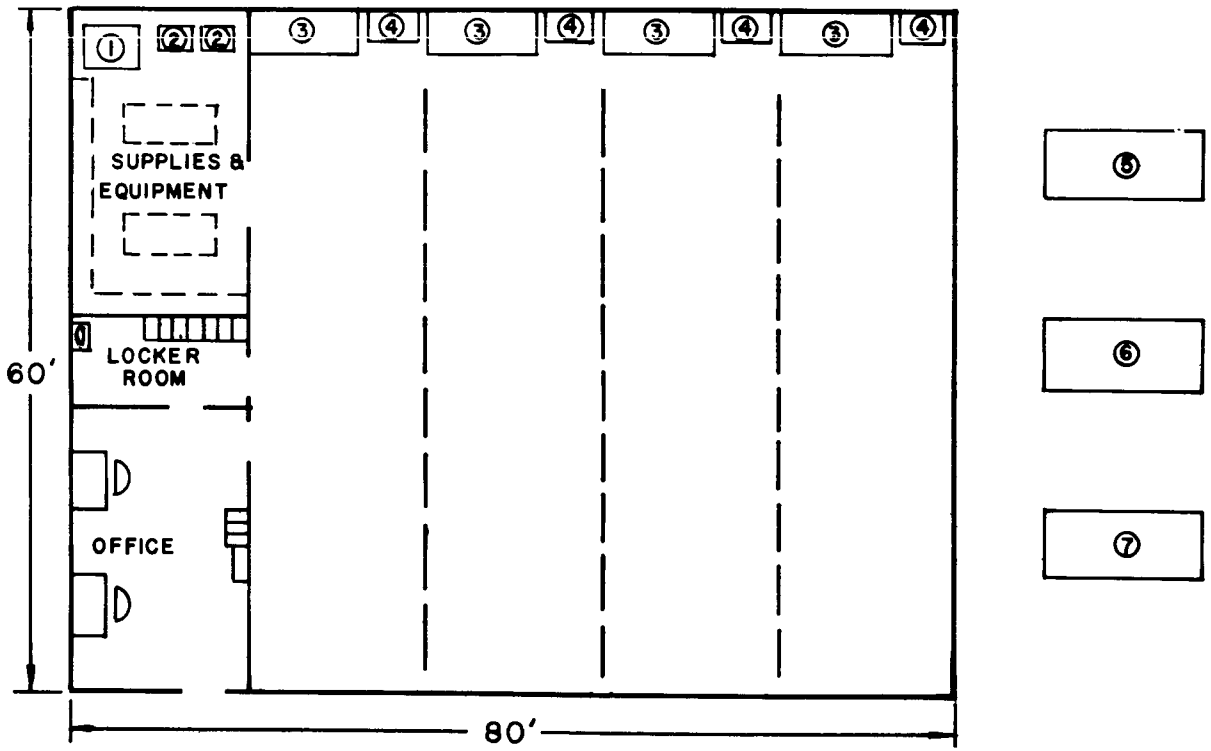
SCALE IN FEET

CF 5-27

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

PROPELLANT SYSTEMS COMPONENTS LABORATORY



PROPELLANT TRANSPORTER REPAIR AND MAINTENANCE SHED

① COMPRESSOR
② PUMP
③ WORK BENCH
④ TOOL BOX
⑤ TRICHLOROETHYLENE TANK
⑥ DETERGENT TANK
⑦ FLUSHING TANK

12 0 12 24 36

SCALE — FEET

CF 5-28

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

UTILITY INSTALLATIONS - NEW AREA

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: John F. Kennedy Space Center, NASA

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT NASA INSTALLATION: John F. Kennedy Space Center, NASA

TYPE OF CONSTRUCTION PROJECT: New, Extension

FUNDING:

FY 1963 and Prior Years	---
FY 1964 Estimate	$256,000
FY 1965 Estimate	5,600,000
Total Funding Through FY 1965	$5,856,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$3,391,300
Supporting structures	LS	---	$142,000	142,000
Railroad	LS	---	241,000	241,000
Site preparation	LS	---	935,700	935,700
Roads	LS	---	1,268,800	1,268,800
Utilities	LS	---	803,800	803,800
Equipment:				$2,208,700
Communications equipment and cable systems	LS	---	2,208,700	2,208,700

	Unit of Measure	Quantity	Unit Cost	Total Cost
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$5,600,000

PROJECT DESCRIPTION:

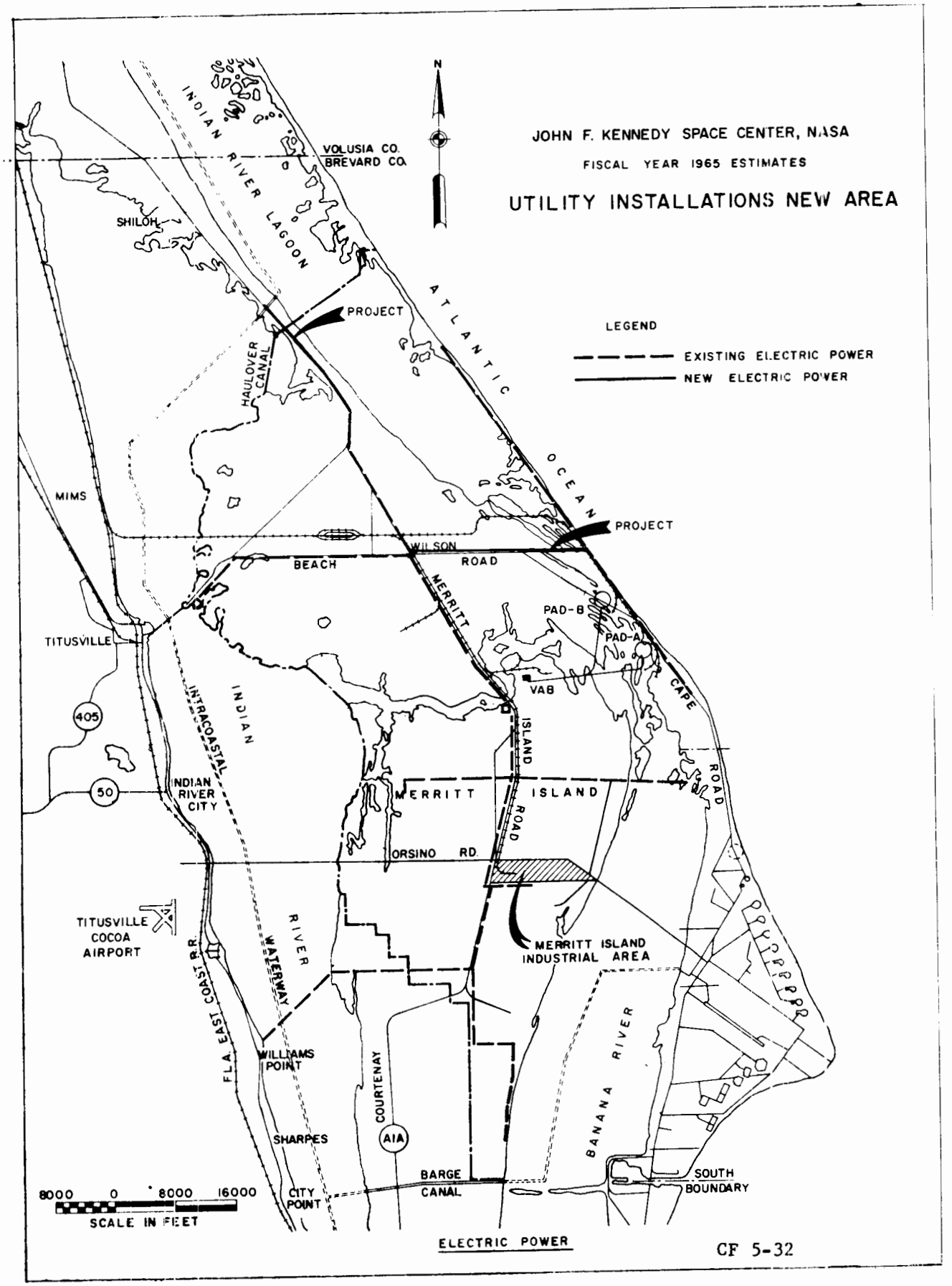
This project provides for the expansion of the existing road, water, electrical distribution and communication systems, and the railroad that will serve the Merritt Island Launch Area. Road construction consists of rebuilding approximately 16.3 miles and constructing approximately 2.2 miles of new roads. Approximately 3.7 miles of 16-inch water main including a pumping station will be constructed. Approximately 36,000 feet of 13.2 KV power line and 6,000 feet of 16-way communication duct is to be constructed. An addition to the existing Central Telephone Office in the Merritt Island Industrial Area will be provided. The 2,000 square foot structure will have concrete frame and concrete block walls. Communications cable, and video and wide band repeaters will be installed throughout the Merritt Island Launch Area. The railroad extension will consist of a 2,000 foot "suspect car" siding, and 8,000 feet of railroad from the existing terminal point at Orsino Road to the Central Supply Complex.

PROJECT JUSTIFICATION:

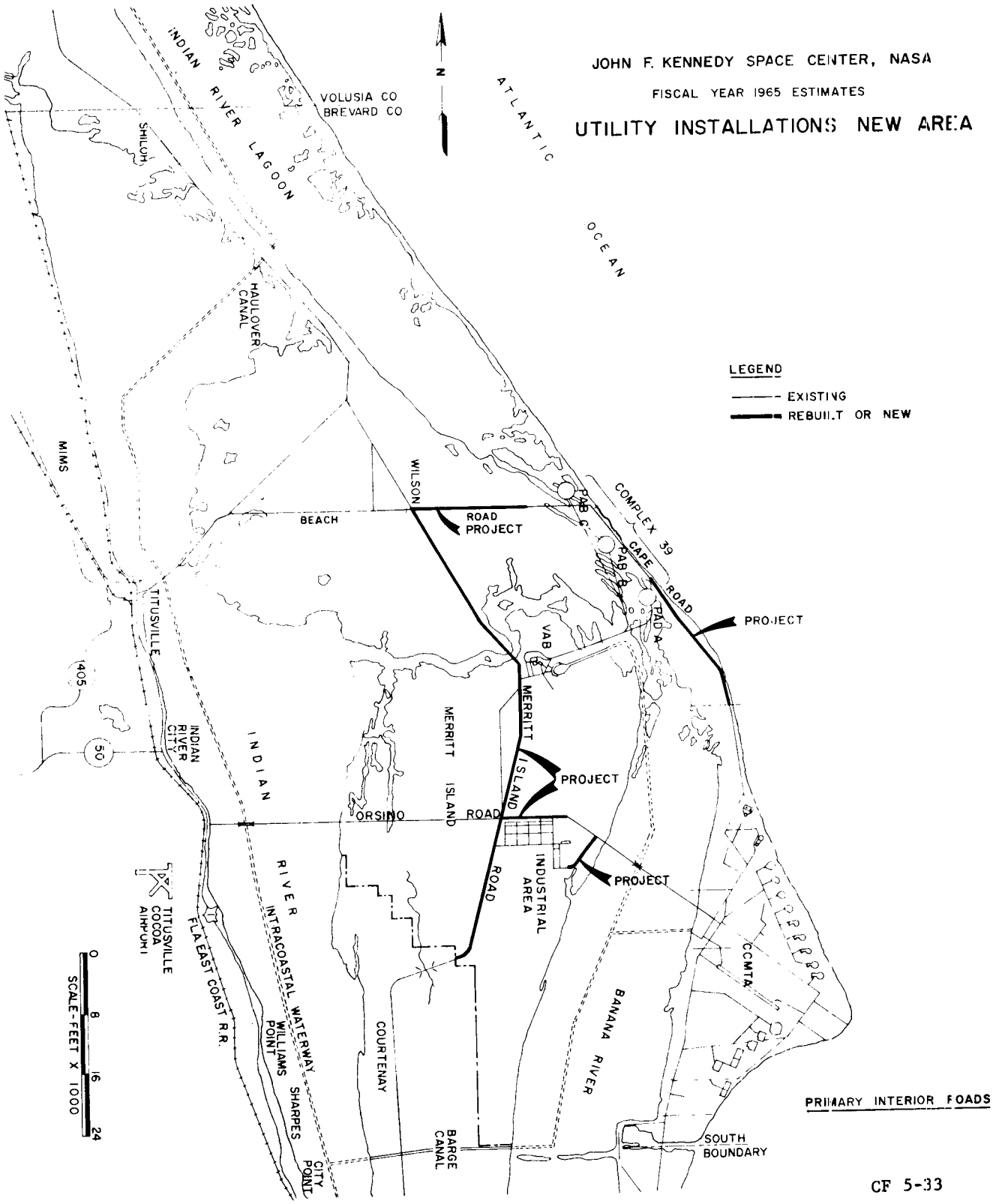
This project is needed to furnish the increased utility capability for supporting the orderly development of the Merritt Island Launch Area in this time frame. Existing roadways not designed for heavy loads must be rebuilt. The addition of two lanes to Orsino Road is required to support the traffic resulting from the buildup of personnel in the industrial area. A road from the Fluid Test Complex to Orsino Road is required to provide an alternate route out of the Fluid Test Complex hazard area. The existing water systems at the Cocoa Beach Missile Test Annex and in the Merritt Island Launch Area are independent of each other and both lack the reserve of an alternate supply line. This main will provide a loop system between the tow areas. A 13.2 KV distribution line along Merritt Island Road is required for the instrumentation sites in that area. The 13.2 KV line along Beach Road will provide a loop system to the universal camera sites along the beach to reduce the possibility of an outage if there is a failure in either of the long supply lines. Additional communication ducts are required to support the Operations and Checkout Building in the checkout of spacecraft. The Central Telephone Office expansion is required to house the video and wideband repeater equipment in support of Launch Complex 39, and will provide a Base Communications Center to furnish teletype and datafax services for the Merritt Island Launch Area. A "suspect car" siding is required in order to remotely locate defective cars carrying

unstable and toxic propellants, such as unsymmetrical di-methyl hydrazine and nitrogen tetroxide. It is essential that these defective cars be removed from close proximity of inhabited areas, buildings, or other rail cars to prevent a possible catastrophe. Tonnages of supplies and materials to be shipped into the Central Supply Complex will average approximately 1,000 tons each month during the time frame. Extension of the railroad will eliminate transfers by truck from the existing railhead, double handling of rail shipped material, and reduction in time required to unload and release rail cars.

ESTIMATED FUTURE YEAR FUNDING: $1,000,000

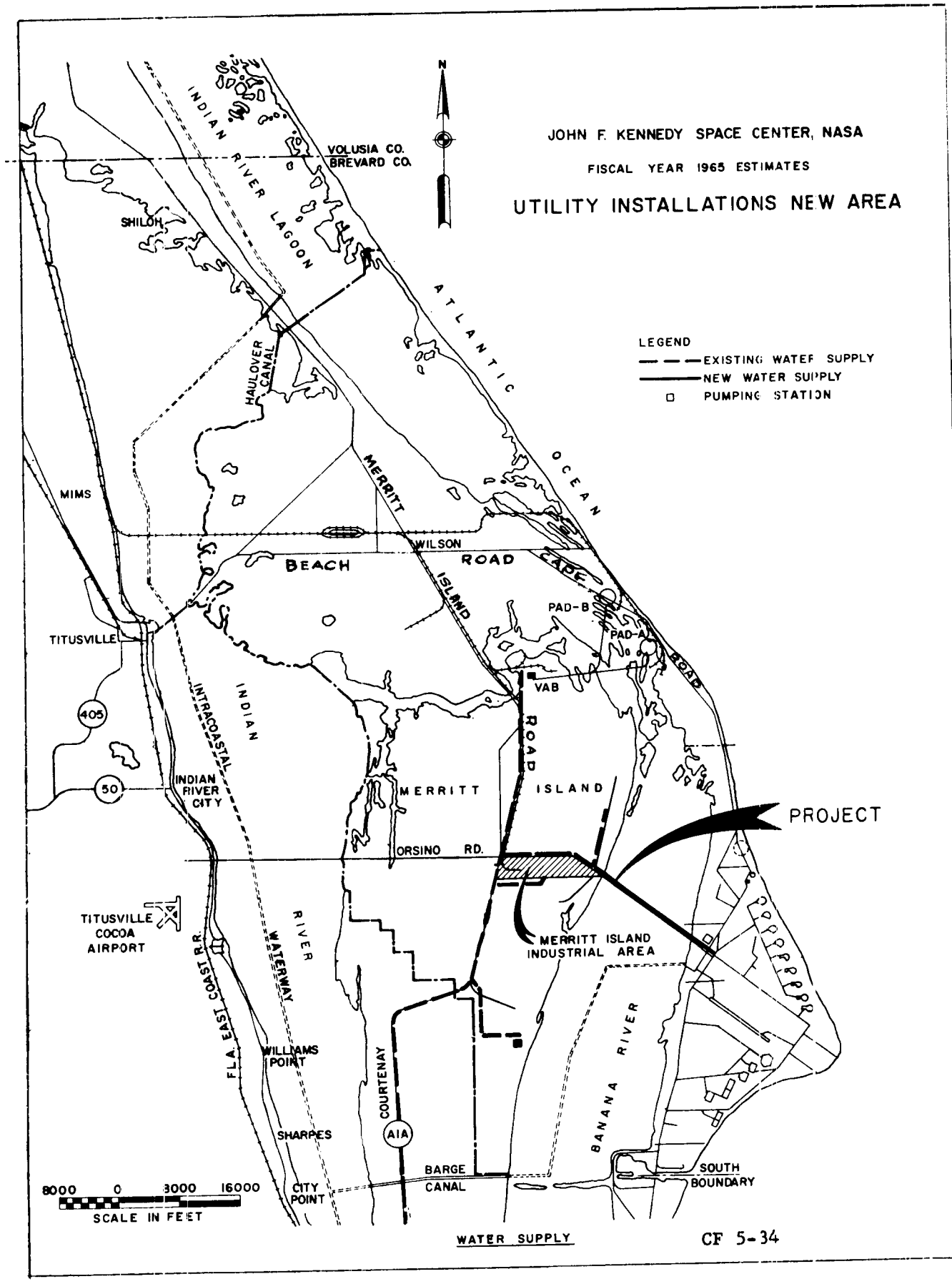

JOHN F. KENNEDY SPACE CENTER, NASA
FISCAL YEAR 1965 ESTIMATES
UTILITY INSTALLATIONS NEW AREA
N
LEGEND
EXISTING ELECTRIC POWER
NEW ELECTRIC POWER
INDIAN RIVER LAGOON
VOLUSIA CO.
BREVARD CO.
SHILOH
PROJECT
HAULOVER CANAL
ATLANTIC OCEAN
MIMS
PROJECT
WILSON
BEACH
ROAD
MERRITT
PAD-B
PAD-A
TITUSVILLE
VAB
CAPE
405
INTRACOASTAL
INDIAN
ISLAND
ROAD
50
INDIAN RIVER CITY
MERRITT ISLAND
ORSINO RD.
TITUSVILLE COCOA AIRPORT
RIVER
WATERWAY
MERRITT ISLAND INDUSTRIAL AREA
FLA. EAST COAST R.R.
WILLIAMS POINT
COURTENAY
BANANA RIVER
SHARPES
AIA
BARGE CANAL
SOUTH BOUNDARY
CITY POINT
8000 0 8000 16000
SCALE IN FEET
ELECTRIC POWER

CF 5-32



CF 5-33

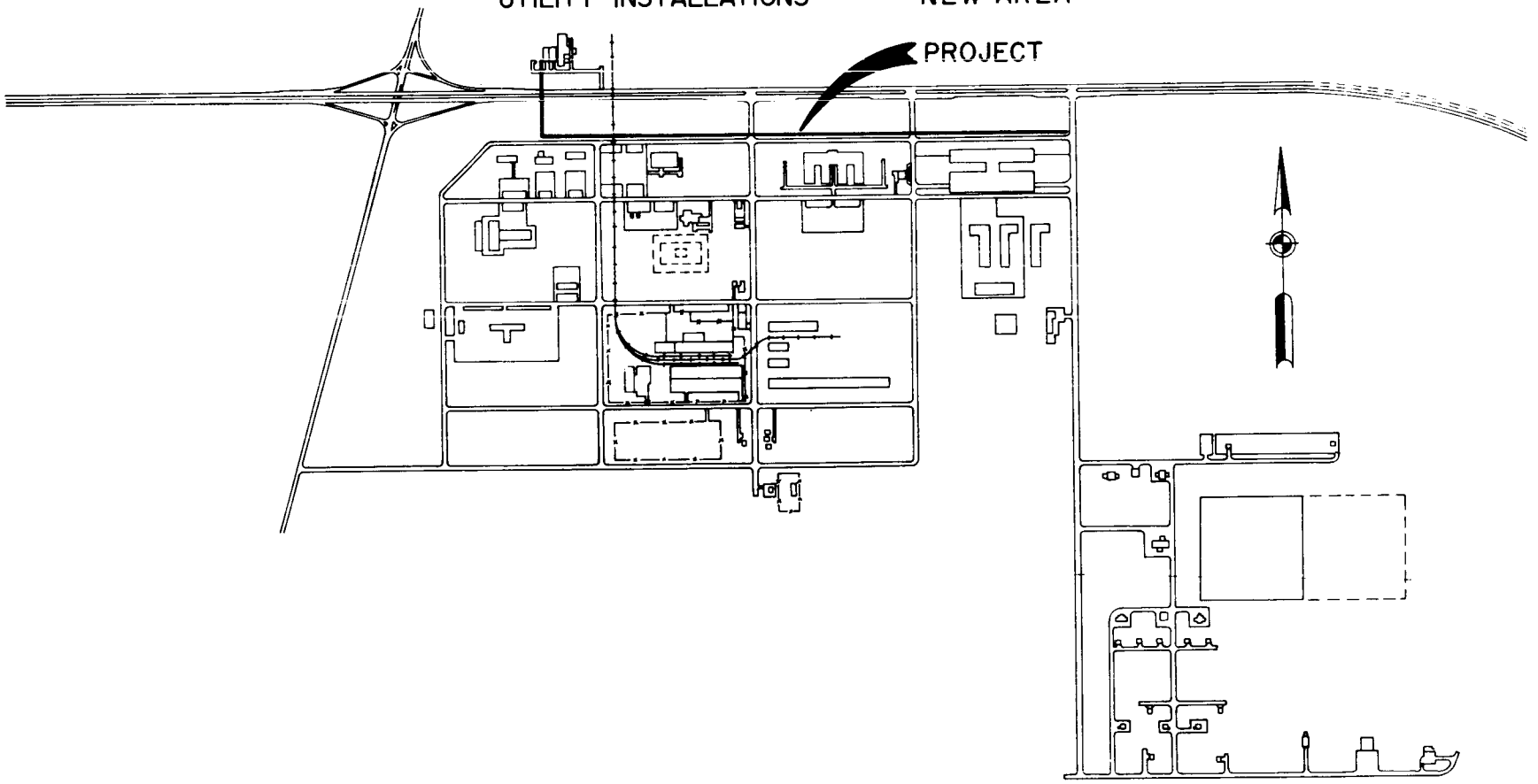
718-879 O - 64 10


JOHN F. KENNEDY SPACE CENTER, NASA
FISCAL YEAR 1965 ESTIMATES
UTILITY INSTALLATIONS NEW AREA
N
LEGEND
EXISTING WATER SUPPLY
NEW WATER SUPPLY
PUMPING STATION
VOLUSIA CO.
BREVARD CO.
INDIAN RIVER LAGOON
SHILOH
HAULOVER CANAL
ATLANTIC OCEAN
MERRITT ISLAND
MIMS
WILSON
BEACH ROAD
CAPE
PAD-B
PAD-A
TITUSVILLE
INTRACOASTAL
INDIAN
VAB
405
ROAD
50
INDIAN RIVER CITY
MERRITT ISLAND
PROJECT
ORSINO RD.
TITUSVILLE COCOA AIRPORT
MERRITT ISLAND INDUSTRIAL AREA
FLA. EAST COAST R.R.
WATERWAY
RIVER
WILLIAMS POINT
COURTENAY
BANANA RIVER
SHARPES
A1A
BARGE CANAL
SOUTH BOUNDARY
CITY POINT
8000 0 3000 16000
SCALE IN FEET
WATER SUPPLY
CF 5-34

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

UTILITY INSTALLATIONS —— NEW AREA



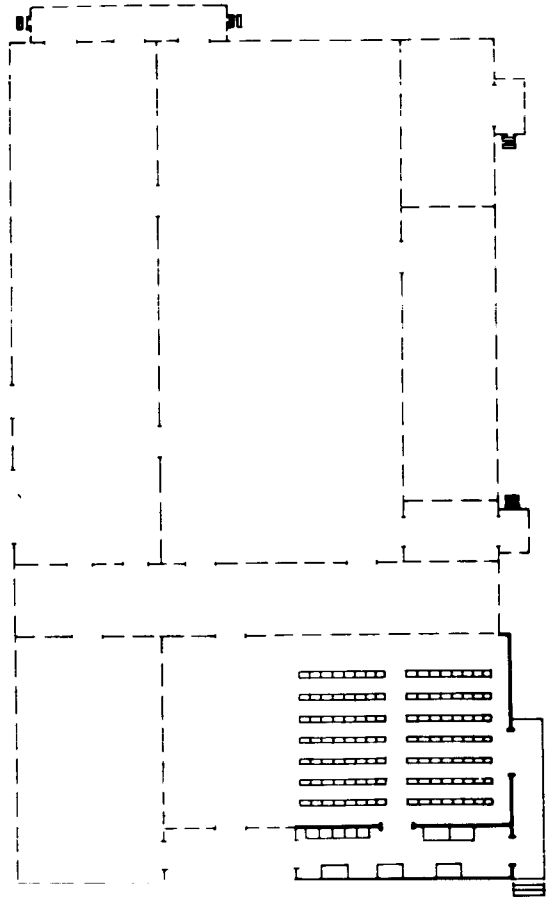
COMMUNICATIONS DUCTS

CF 5-3.3

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

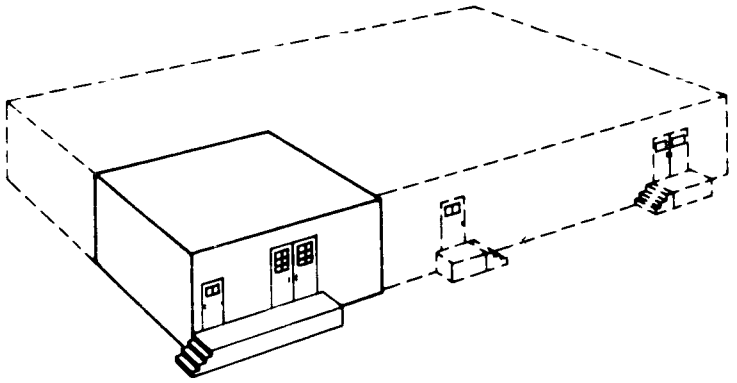
UTILITY INSTALLATIONS NEW AREA



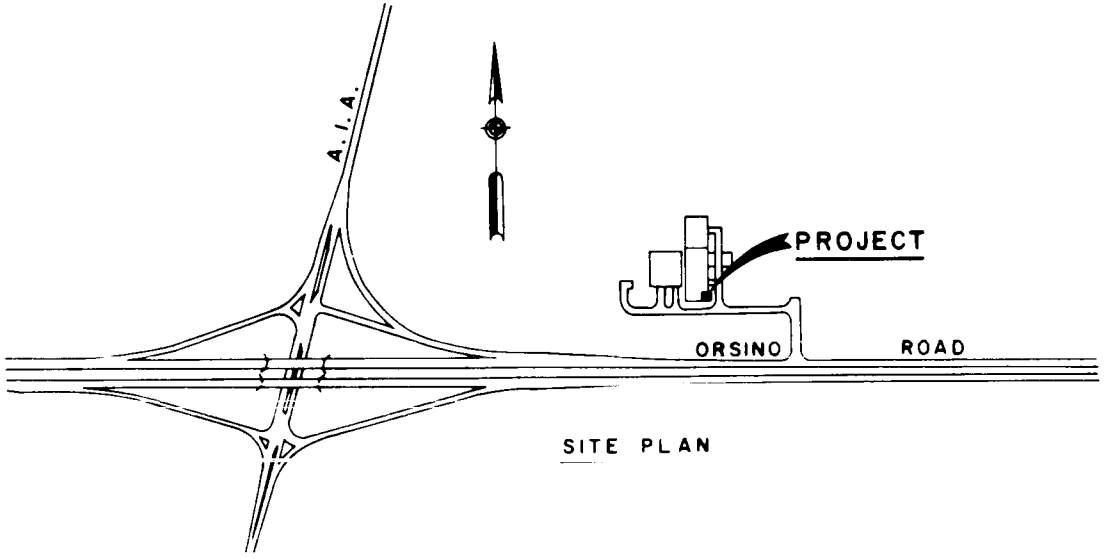
FLOOR PLAN

20 0 20 40

SCALE IN FEET



PERSPECTIVE



SITE PLAN

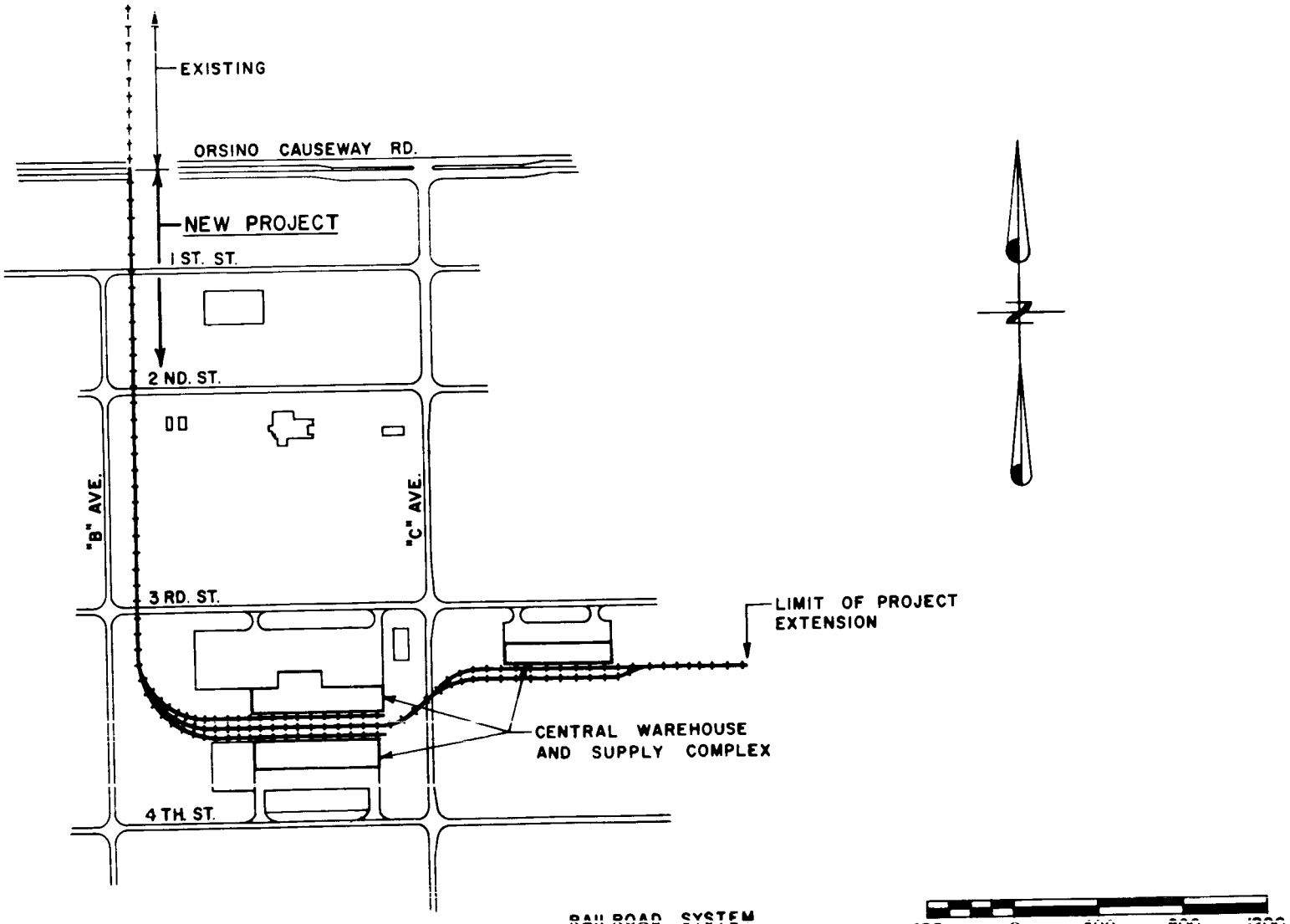
ADDITION TO TELEPHONE CENTRAL OFFICE

CF 5-36

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

UTILITY INSTALLATIONS NEW AREA

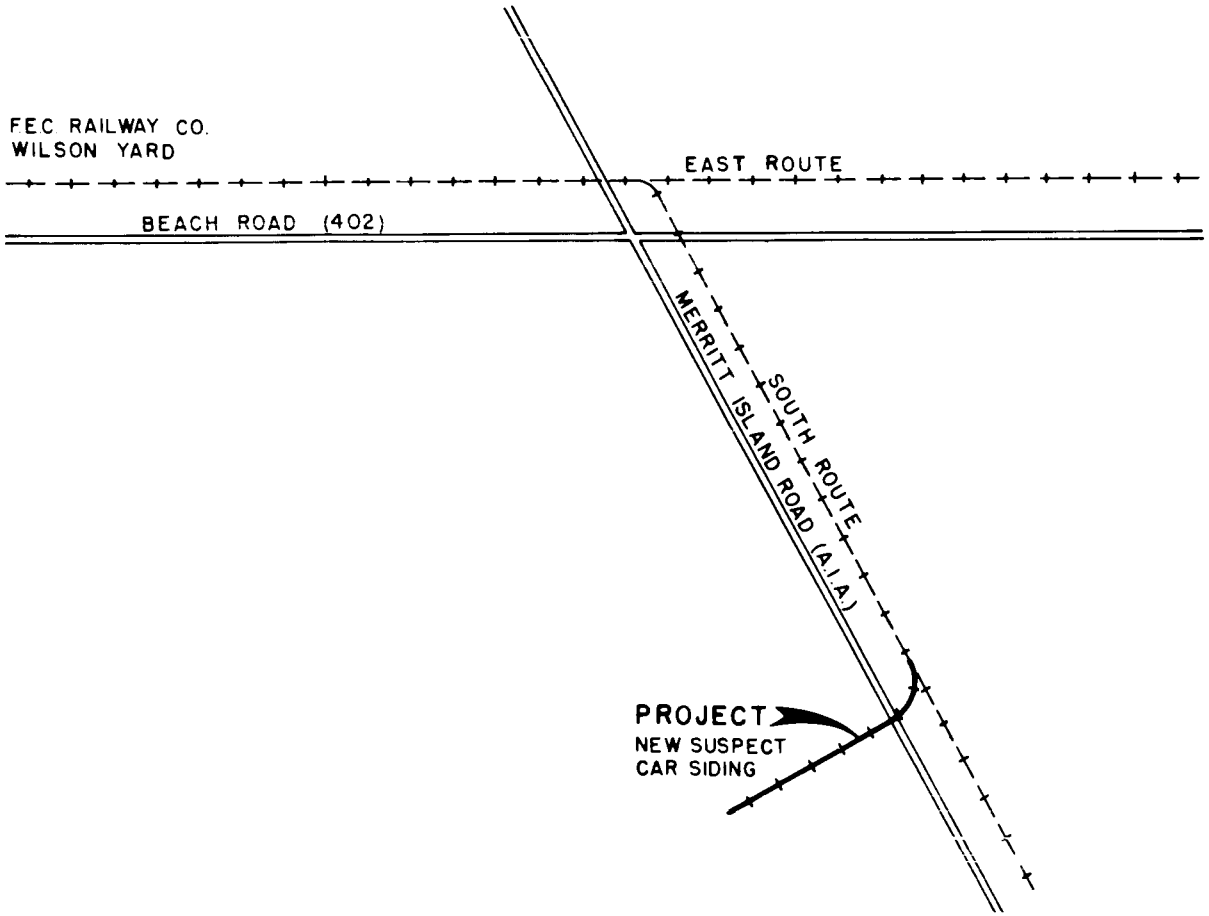


CE 5-37

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1965 ESTIMATES

UTILITY INSTALLATIONS NEW AREA



RAILROAD SYSTEM

SCALE IN FEET

1000 0 1000 2000

1"=1000'

CF 5-38

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

CAFETERIA

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Manned Spacecraft Center

LOCATION OF PROJECT: Clear Lake, Harris County, Texas

COGNIZANT NASA INSTALLATION: Manned Spacecraft Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	$34,200
FY 1964 Estimates	14,000
FY 1965 Estimates	706,000
Total Funding Through FY 1965	$754,200

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$425,200
Building	Sq. Ft.	15,400	$25.05	385,700
Site preparation	LS	---	39,500	39,500
Equipment				$280,800
Cafeteria equipment and furnishings	LS	---	280,800	280,800
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$706,000

PROJECT DESCRIPTION:

This project provides for construction of a 500-seat cafeteria, which will operate as an auxiliary to the cafeteria, presently under construction, authorized in the fiscal year 1962 program. The proposed facility will be a single-story building of standard steel frame construction with a gross area of approximately 15,400 square feet. The dining area is approximately 8,400 square feet with dimensions of 131 feet by 64 feet and the food-handling area and serving area is approximately 7,000 square feet with dimensions of 100 feet by 70 feet. Heating and air-conditioning requirements will be supplied by the Central Heating and Cooling Plant.

PROJECT JUSTIFICATION:

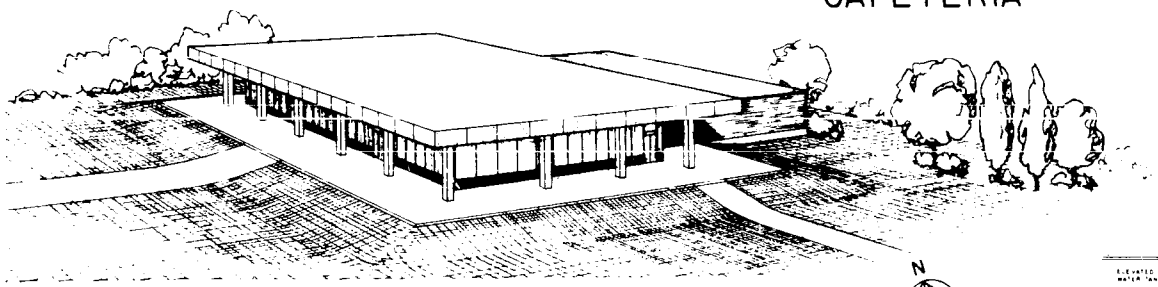
The cafeteria is necessary to provide food-serving facilities for personnel working in the Base Support Area, Thermochemical Test Facility Area, Technical Services Shop, Space Environment Simulation Laboratory, Integrated Mission Control Center and the Project Engineering Facility, where the projected population density will exceed 2,400 personnel. The total NASA and contractor personnel to be located at Clear Lake will be approximately 7,200 by the end of fiscal year 1966. The fiscal year 1962 cafeteria is planned to accommodate approximately 2,500 people in a 2 1/2-hour time period. The facility 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 2 1/2-hour period. Off-site eating facilities are not available to accommodate personnel on a 1/2 hour lunch period.

ESTIMATED FUTURE YEAR FUNDING: None

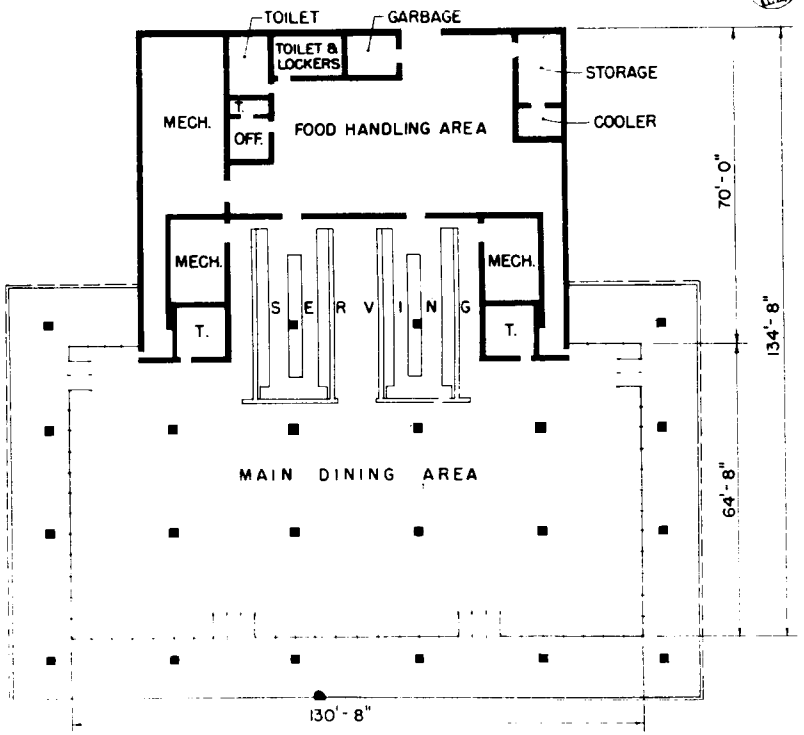
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

CAFETERIA



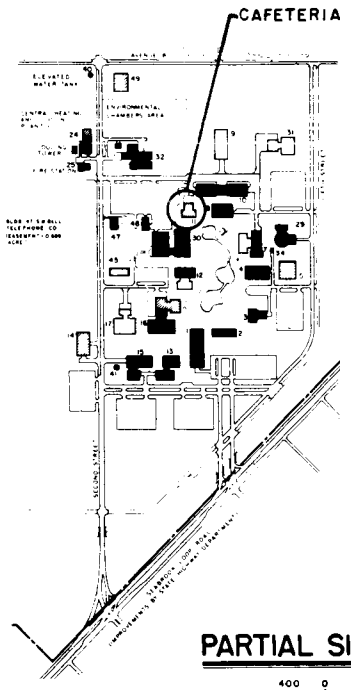
PERSPECTIVE



PLAN

10 0 20 40

SCALE IN FEET



1 AUDITORIUM
2 PROJECT MANAGEMENT
3 CENTRAL CAFETERIA
4 FLIGHT OPERATIONS OFFICE
5 MISSION SIMULATION AND TRAINING FACILITY
7 LIFE SYSTEMS LABORATORY
8 TECHNICAL SERVICES OFFICE
9 TECHNICAL SERVICES FACILITY
10 TECHNICAL SERVICES SHOP
11 BRANCH CAFETERIA
12 CENTRAL DATA OFFICE
13 SYSTEMS EVALUATION LABORATORY
14 ANECHOIC CHAMBER TEST FACILITY
15 INSTRUMENTATION AND ELECTRONIC SYSTEMS LABORATORY
16 SPACECRAFT RESEARCH OFFICE AND LABORATORY
17 SPACECRAFT ELECTRONIC EQUIPMENT EVALUATION FACILITY
24 CENTRAL HEATING AND COOLING PLANT
25 FIRE STATION
29 FLIGHT ACCELERATION FACILITY
30 INTEGRATED MISSION CONTROL CENTER
31 MISSION EXPERIMENTS AND ENVIRONMENTAL TECHNOLOGY FACILITY
32 SPACE ENVIRONMENT SIMULATION LABORATORY
34 FLIGHT ACCELERATION MOTOR-GENERATOR BUILDING
40 ELEVATED WATER TANK
41 GAS STORAGE
45 PROJECT ENGINEERING FACILITY
47 SOUTHWESTERN BELL TELEPHONE BUILDING
48 EMERGENCY POWER BUILDING (IMCC)
49 VIBRATRION AND ACOUSTIC TEST FACILITY

LEGEND

BUILDINGS EXISTING OR UNDER CONTRACT
BUILDINGS FISCAL YEAR 1964
ROADS AND PARKING LOTS EXISTING OR UNDER CONTRACT
BUILDINGS FISCAL YEAR 1965

PARTIAL SITE PLAN

400 0 400 800

SCALE IN FEET

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

CENTRAL DATA FACILITY EXTENSION

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Manned Spacecraft Center

LOCATION OF PROJECT: Clear Lake, Harris County, Texas

COGNIZANT NASA INSTALLATION: Manned Spacecraft Center

TYPE OF CONSTRUCTION PROJECT: Extension

FUNDING:

FY 1963 and Prior Years	$1,498,100
FY 1964 Estimate	70,000
FY 1965 Estimate	2,658,000
Total Funding Through FY 1965	$4,226,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,015,400
Building	Sq. Ft.	31,908	$31.20	995,600
Site preparation	LS	---	19,800	19,800
Equipment				$1,642,600
Data reduction equipment	LS	---	1,460,600	1,460,600
Support equipment	LS	---	182,000	182,000
Design	---	---	---	---

	Unit of Measure	Quantity	Unit Cost	Total Cost
Fallout Shelter	---	---	---	---
		TOTAL		$2,658,000

PROJECT DESCRIPTION:

This project provides for data reduction and analysis operations to support the Gemini and Apollo projects during development tests and following flight missions. This facility will consist of a two-story steel frame, precast concrete integrated office, laboratory, and shop area addition to the existing Central Data Office, Building No. 12. The total area of the addition will be approximately 31,908 square feet; the first floor dimensions will be approximately 74 by 130 feet, and the second floor dimensions will be approximately 84 by 140 feet. A two-story interconnecting corridor, with approximate first story dimensions of 52 feet by 112 feet and approximate second story dimensions of 42 feet by 112 feet will be provided. The building heating and air-conditioning will be supplied by the Central Heating and Cooling Plant.

PROJECT JUSTIFICATION:

A number of new activities in the computation field had to be initiated at the Manned Spacecraft Center to support the flight test phases of the Gemini and Apollo programs. These are: (a) Data reduction, (b) Management computer applications, (c) Engineering documentation and retrieval.

These tasks have approximately doubled the workload of the central data facility included in the fiscal year 1962 Construction of Facilities program. As a rough basis for comparison, it may be noted that the Mercury flights generated approximately 5,000 reels of magnetic tape, whereas it has been determined that 54,000 reels of magnetic tape will be produced by 1968 from the Gemini and Apollo flights. Also the Center's accounting, disbursing, PERT, and administrative data processing tools have increased over twenty percent within the past year and are expected to double with the build-up of the Apollo program. The Apollo and Gemini design effort requires extensive engineering documentation and quick retrieval capability for data concerning parts generation, configuration control, failure reports, and related subjects.

The present computing capacity is inadequate in size and speed to meet the requirements of the Gemini and Apollo programs and related Center support. The existing structure only provides approximately 50% of the equipment area and 55% of the administrative area required to support the total workload. It is essential that adequate facilities be available to provide data reduc-

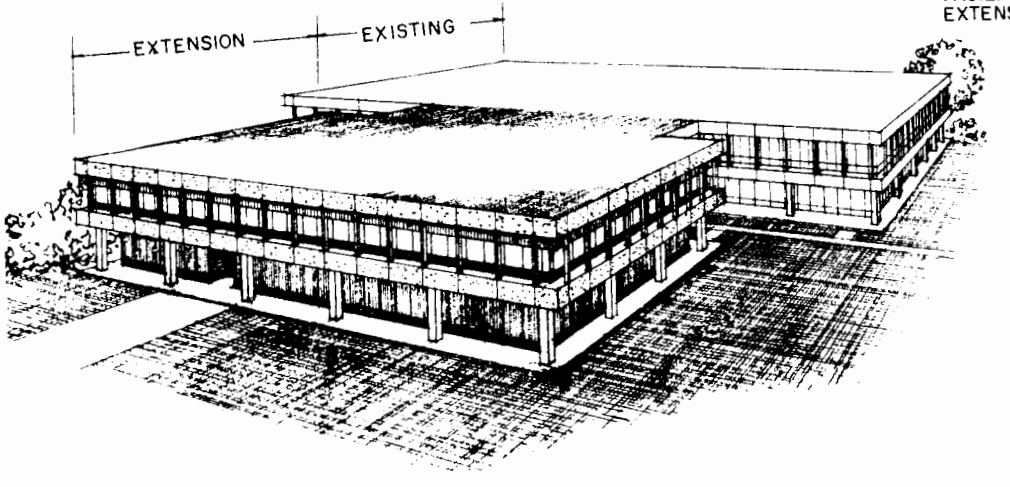
tion services promptly to both technical personnel at the Manned Spacecraft Center and to spacecraft and support systems contractors for timely evaluation of test and flight mission results affecting spacecraft and support systems design and mission planning.

ESTIMATED FUTURE YEAR FUNDING: None

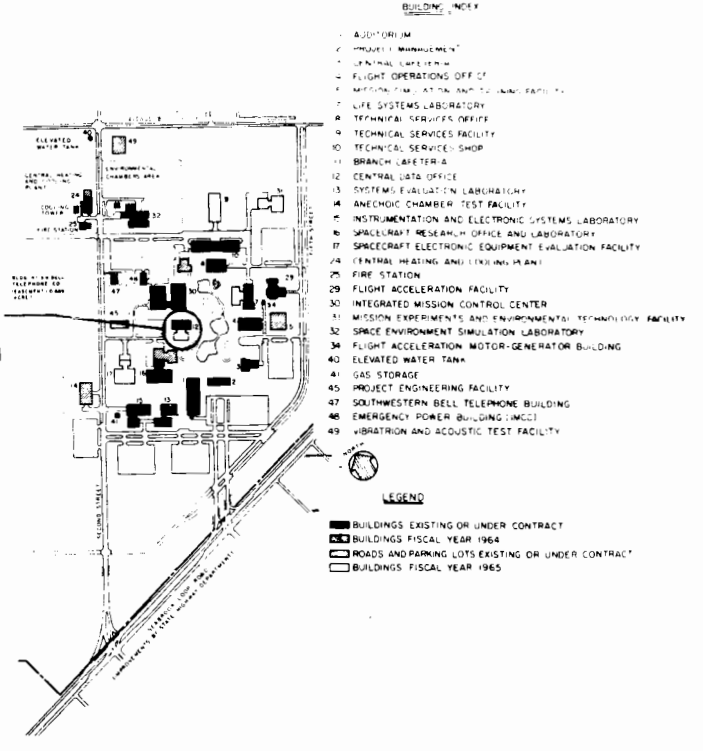
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

CENTRAL DATA FACILITY EXTENSION



PERSPECTIVE



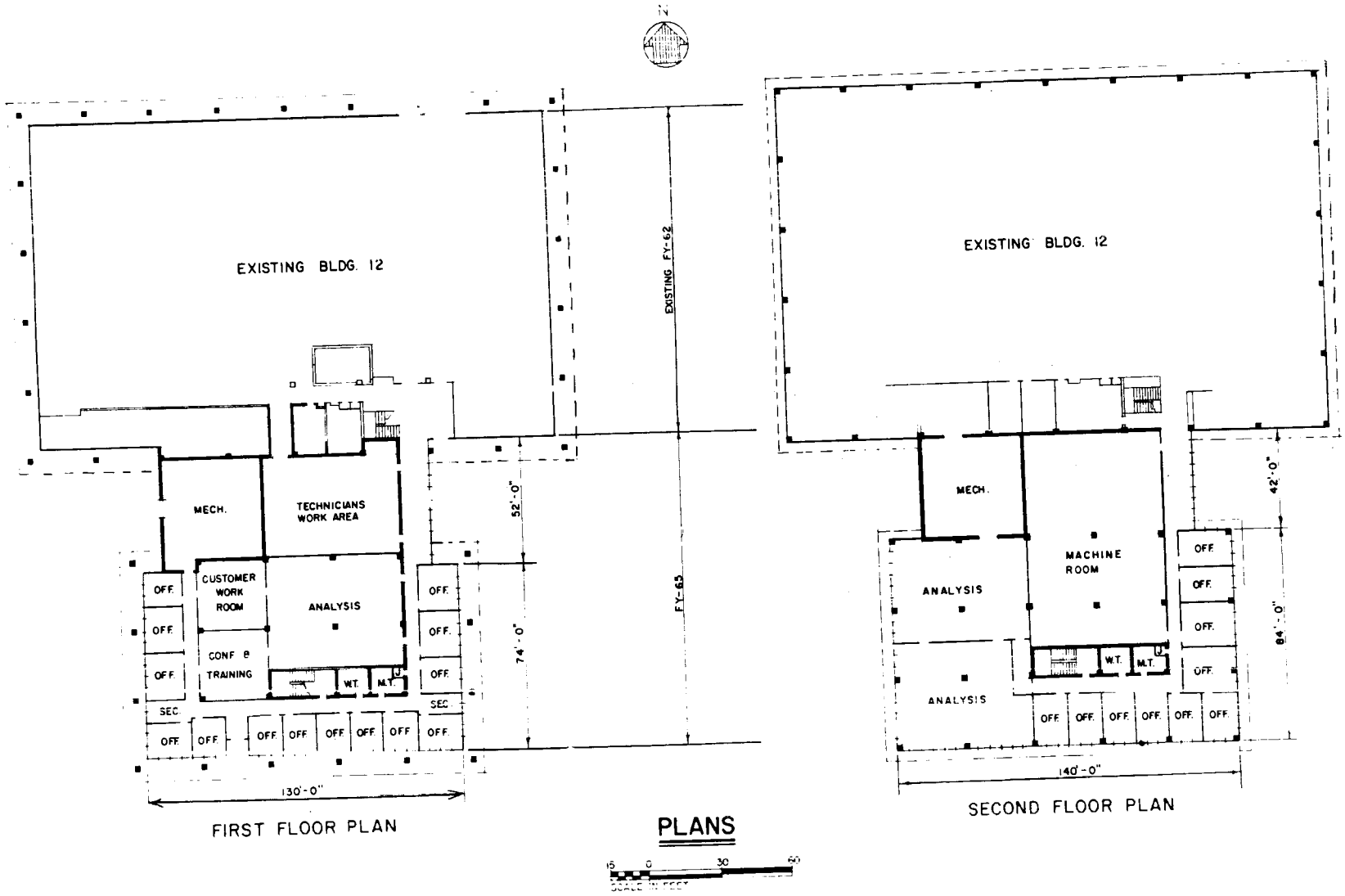
PARTIAL SITE PLAN

400 0 400 800
SCALE IN FEET

MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

CENTRAL DATA FACILITY EXTENSION



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

CENTRAL HEATING AND COOLING PLANT AND WAREHOUSE EXTENSION

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Manned Spacecraft Center

LOCATION OF PROJECT: Clear Lake, Harris County, Texas

COGNIZANT NASA INSTALLATION: Manned Spacecraft Center

TYPE OF CONSTRUCTION PROJECT: Extension

FUNDING:

FY 1963 and Prior Years	$3,563,200
FY 1964 Estimate	2,345,500
FY 1965 Estimate	1,625,000
Total Funding Through FY 1965	$7,533,700

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$566,000
Central heating and cooling plant extension	Sq. Ft.	4,100	$20.34	83,400
Warehouse extension	Sq. Ft.	28,728	13.62	392,000
Utilities	LS	---	32,800	32,800
Site preparation	LS	---	57,800	57,800
Equipment				$1,059,000
Boiler and accessories	LS	---	222,000	222,000
Chilled water equipment	LS	---	340,000	340,000
Support systems	LS	---	497,000	497,000

	Unit of Measure	Quantity	Unit Cost	Total Cost
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$1,625,000

PROJECT DESCRIPTION:

This project will provide the required supporting facilities for the planned Fiscal Year 1965 Construction of Facilities Program at the Clear Lake site.

Central heating and cooling plant extension - This addition encompasses the expansion of the central heating and cooling plant structure and the incorporation of one 60,000 pound per hour steam boiler and one 2,000 ton centrifugal refrigeration unit including all related accessory equipment such as cooling towers, operating and safety controls and piping. Also, the existing central mechanical control system will be expanded. The expansion will provide an additional gross area of approximately 4,100 square feet.

Warehouse facility extension - This facility will provide additional bulk warehousing space required for the central warehousing operations. The addition is to be a single story, high-bay storage area extension to building 420 which is the warehouse building included in the fiscal year 1962 program. The addition will be approximately 28,728 square feet and will match the standard steel frame construction of the existing building.

PROJECT JUSTIFICATION:

Central heating and cooling plant - Evaluation of the central heating and cooling plant indicates that an insufficient capacity exists to provide steam and chilled water to the planned fiscal year 1965 facilities. (The facilities authorized by fiscal year 1962, 1963 and 1964 funds included the installation of four 60,000 pound per hour steam boilers and six 2,000 ton centrifugal refrigeration compressors and chillers.) One additional 60,000 pound per hour steam boiler and one additional 2,000 ton centrifugal refrigeration unit will be required.

Warehouse facility - Warehouse Building 420 included in the fiscal year 1962 Program provided 23,370 square feet of storage space. The fiscal year 1965 addition will furnish 28,728 square feet of storage space for fast-moving electronic, instrumentation, and other types of spare

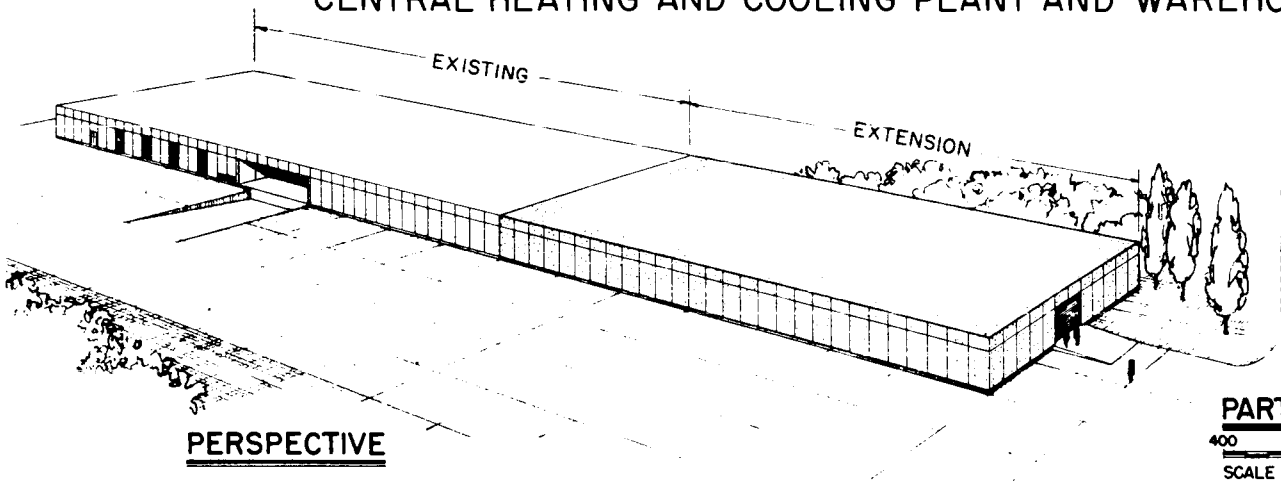
parts required by divisions engaged in development and evaluation programs supporting the Apollo mission.

ESTIMATED FUTURE YEAR FUNDING: None

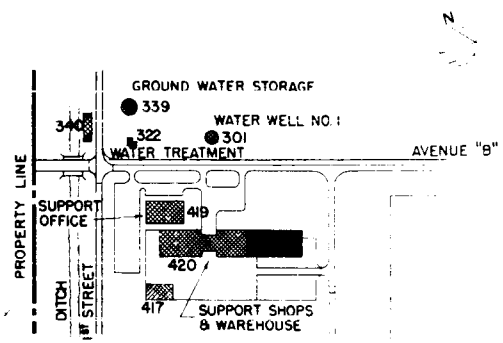
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

CENTRAL HEATING AND COOLING PLANT AND WAREHOUSE EXTENSIONS



PERSPECTIVE



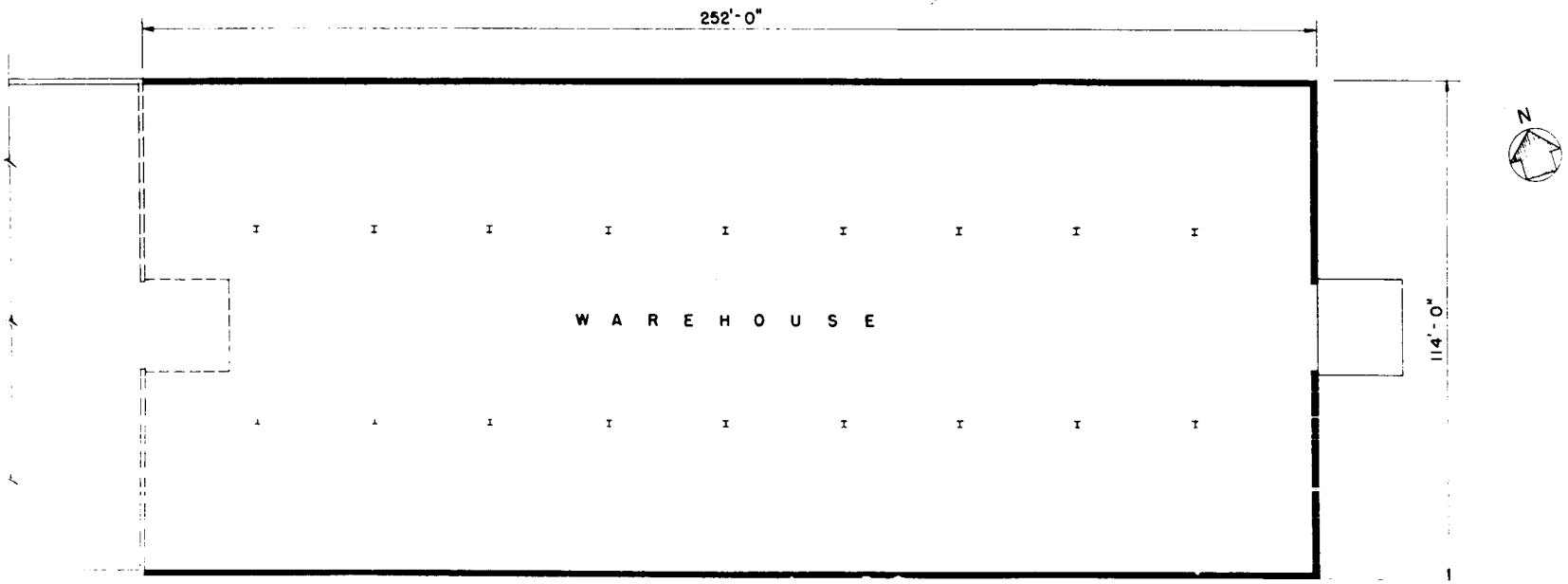
PARTIAL PLOT PLAN

400 0 400 800

SCALE IN FEET

LEGEND

- 1962 PROGRAM
- 1965 PROGRAM



WAREHOUSE EXTENSION PLAN

10 0 20 40

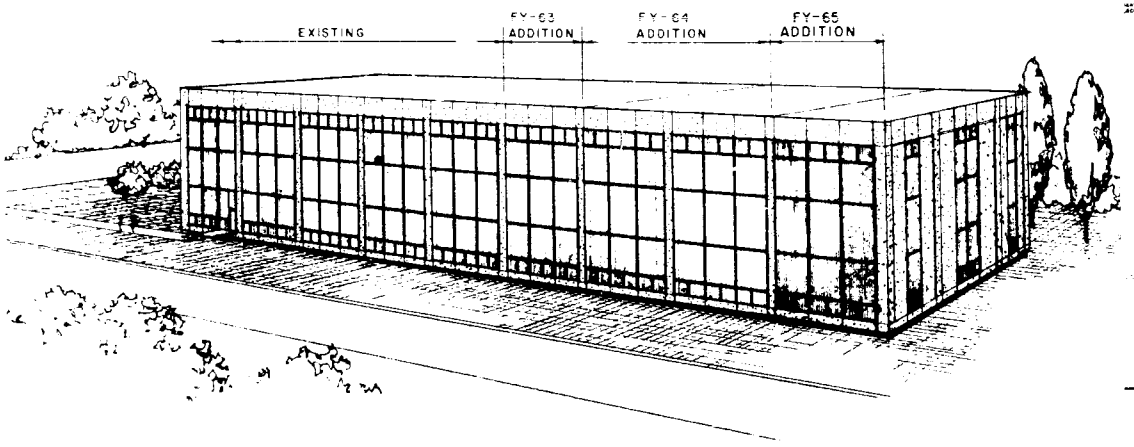
SCALE IN FEET

CE 8-14

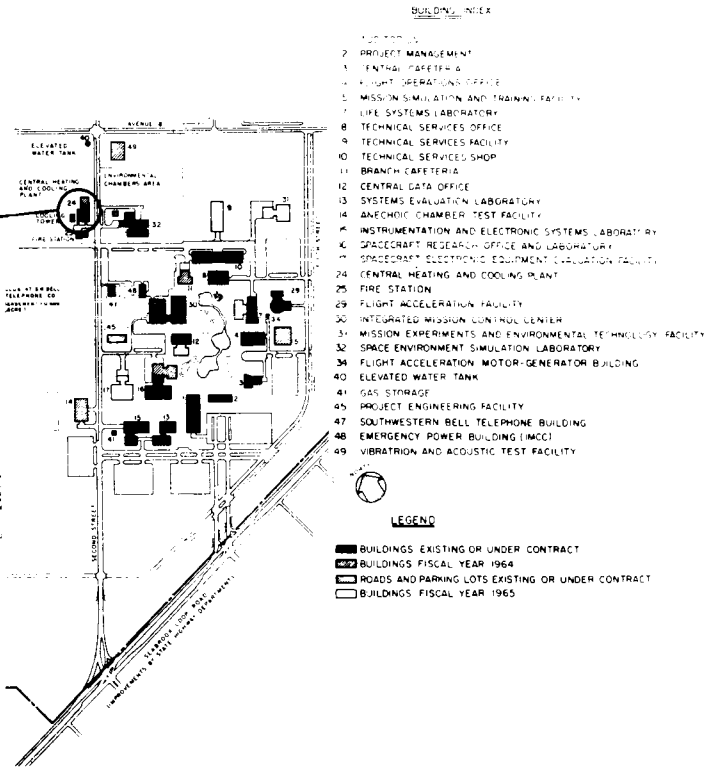
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

CENTRAL HEATING AND COOLING PLANT AND WAREHOUSE EXTENSIONS



PERSPECTIVE



PARTIAL SITE PLAN

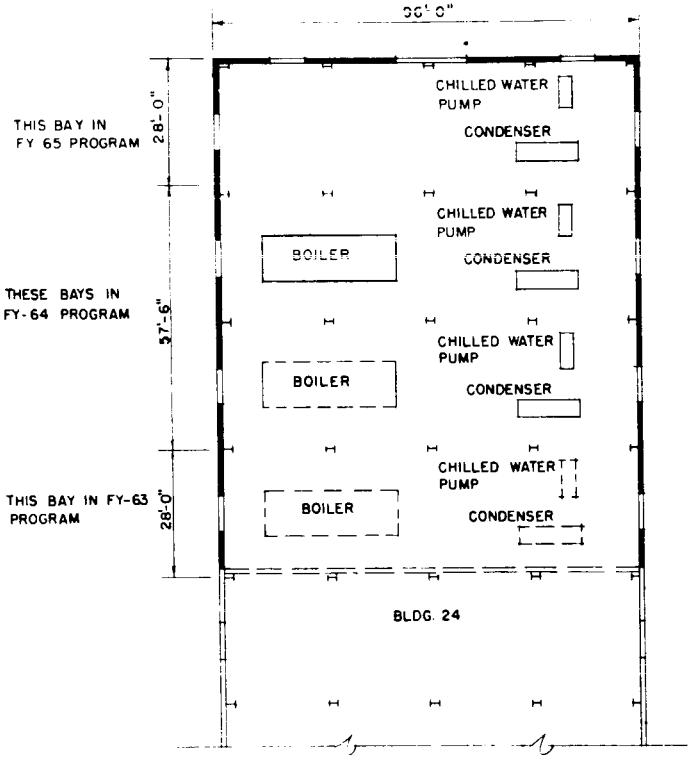
400 0 400 800
SCALE IN FEET

CF 8-15

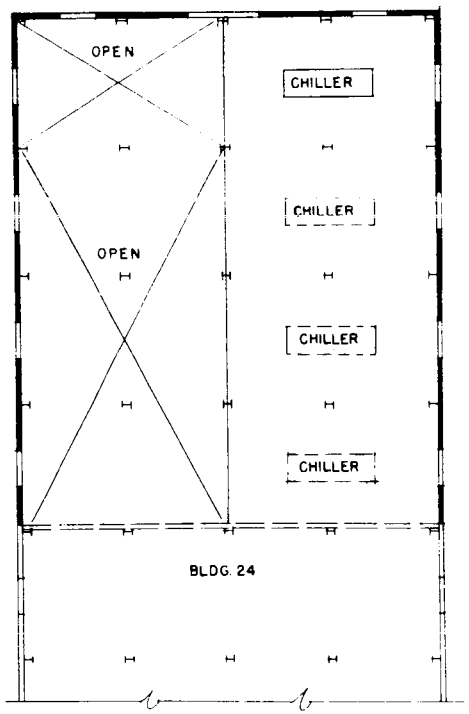
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

CENTRAL HEATING AND COOLING PLANT AND WAREHOUSE EXTENSION



FIRST FLOOR PLAN



SECOND FLOOR PLAN

EXTENSION TO CENTRAL HEATING AND COOLING PLANT – PLANS

10 0 20 40
SCALE IN FEET

CE 8-16

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

FLIGHT CREW OPERATIONS FACILITY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Manned Spacecraft Center

LOCATION OF PROJECT: Clear Lake, Harris County, Texas

COGNIZANT NASA INSTALLATION: Manned Spacecraft Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	---
FY 1964 Estimate	$124,000
FY 1965 Estimate	1,764,000
Total Funding Through FY 1965	$1,888,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,764,000
Building	Sq. Ft.	53,253	$28.49	1,517,800
Utilities	LS	---	227,600	227,600
Site preparation	LS	---	18,600	18,600
Equipment		---	---	---
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$1,764,000

PROJECT DESCRIPTION:

The facility will be a two-story steel frame and precast concrete office-laboratory structure with an area of about 53,253 square feet. The first floor dimensions will be about 133 by 189 feet and the second floor dimensions will be about 142 by 198 feet. The heating and air-conditioning requirements will be supplied by the Central Heating and Cooling Plant. Included in this facility are laboratory areas for systems trainers, visual displays, air pad test stand, optical evaluation, flight evaluation, guidance and navigation demonstration.

PROJECT JUSTIFICATION:

In support of the Gemini and Apollo projects, this facility will be utilized for the performance of the following activities:

a. Direct the program of instruction for flight crews, including intensive courses in space flight technology and scientific disciplines and periodic seminars conducted by outstanding scientists and engineers covering a broad spectrum of space-related subjects.

b. Direct the supervision of flight crew preparations for individual flight missions and recommend individual flight crew personnel for participation.

c. Direct flight planning and mission simulation associated with specific missions, and support checkout activities.

d. Evaluate, operate, modify, and maintain flight crew training equipment and facilities.

e. Furnish instruction on flight crew training equipment, and evaluate the results of simulation exercises involving such equipment. This includes operations briefings and detailed systems familiarization briefings for flight crews.

f. Analyze mission plans and systems operations from the standpoint of flight crew participation and recommend necessary modifications to provide optimum crew/spacecraft integration and safety.

g. Develop in-flight maintenance procedures and training techniques.

h. Conduct operational evaluation of guidance and control modes for Gemini and Apollo. Each mission phase is examined to insure that for every automatic spacecraft mode there is a manual backup control procedure that can be selected at the option of the crew. Mission profiles and trajectories are

evaluated and established so that automatic and manual control modes are operationally compatible.

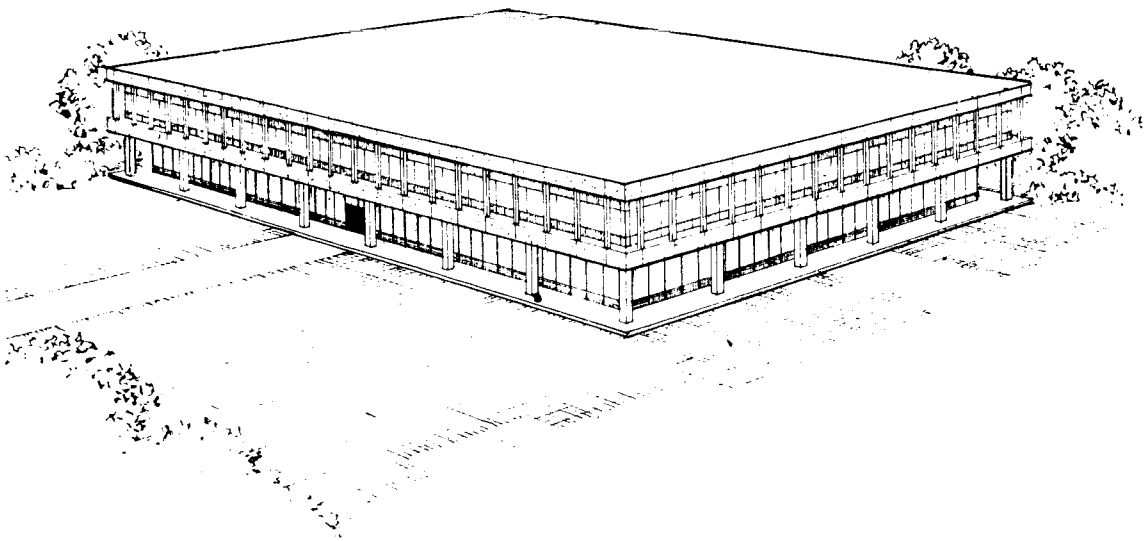
i. Establish requirements and criteria for the selection and training of future flight crews, and assist in screening and recommending candidates for selection as flight crew members on a schedule compatible with future requirements.

ESTIMATED FUTURE YEAR FUNDING: None

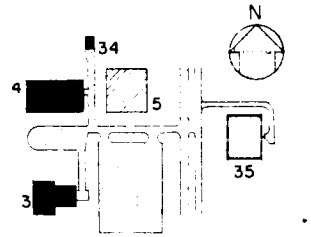
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

FLIGHT CREW OPERATIONS FACILITY



PERSPECTIVE



PARTIAL SITE PLAN

400 0 400 800

SCALE IN FEET

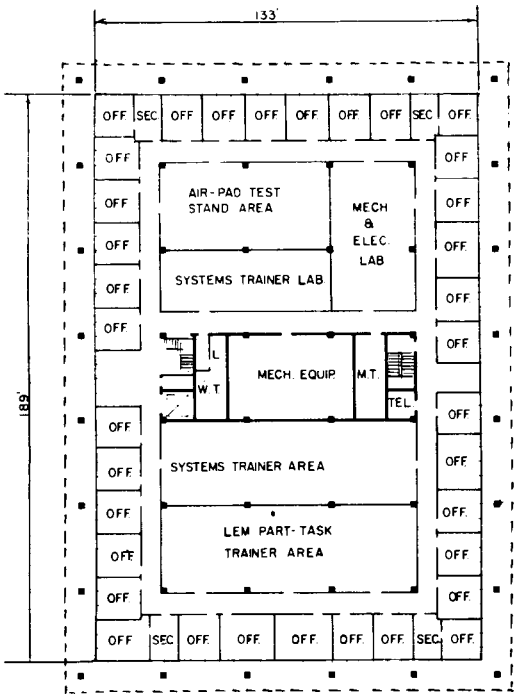
CF 8-20

718-876 O - 64 - 13

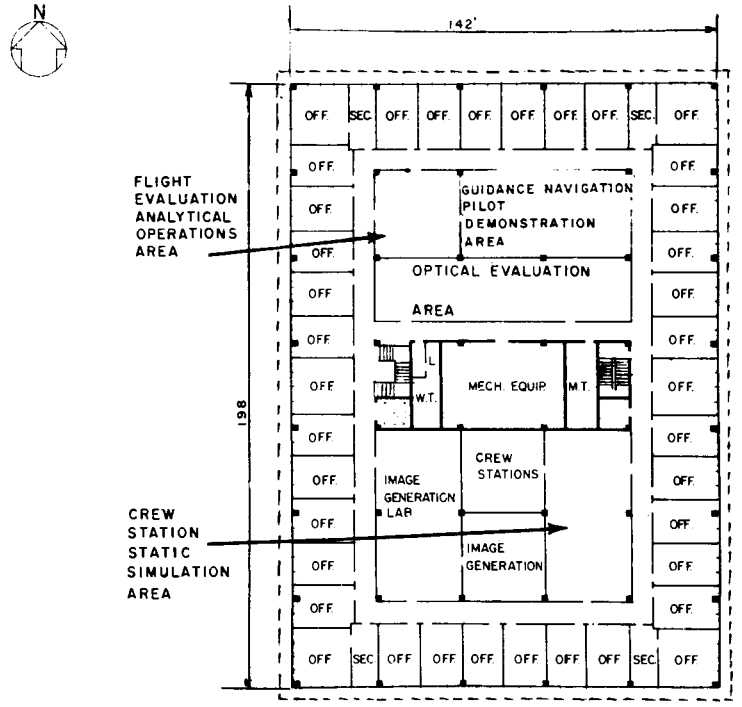
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

FLIGHT CREW OPERATIONS FACILITY



FIRST FLOOR PLAN



SECOND FLOOR PLAN

PLANS

15' 0 30' 60'

SCALE IN FEET

CF 8-21

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

ELECTRONIC SYSTEMS COMPATIBILITY FACILITY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Manned Spacecraft Center

LOCATION OF PROJECT: Clear Lake, Harris County, Texas

COGNIZANT NASA INSTALLATION: Manned Spacecraft Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	$70,000
FY 1964 Estimate	30,000
FY 1965 Estimate	4,110,000
Total Funding Through FY 1965	$4,210,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,694,800
Building	Sq. Ft.	56,545	$27.58	1,559,300
Site preparation	LS	---	135,500	135,500
Equipment				$2,415,200
Transmitting and receiving equipment	LS	---	1,300,200	1,300,200
Data processing and display equipment	LS	---	795,000	795,000
Support equipment	LS	---	320,000	320,000

	Unit of Measure	Quantity	Unit Cost	Total Cost
Design	---	---	---	---
Fallout Shelter	---	---	---	---
			TOTAL	$4,110,000

PROJECT DESCRIPTION:

This project provides a facility for the integrated testing and evaluation of spacecraft and earth-based communication and data acquisition equipment similar to that to be used during lunar operations with the Apollo Command and Lunar Excursion Modules. The building will be a steel frame, precast concrete, integrated office-laboratory and high bay structure with a total area of approximately 56,545 square feet. The office-laboratory wing will have first floor dimensions of approximately 74 by 270 feet and second floor dimensions of approximately 86 by 275 feet. The high bay area will have dimensions of approximately 105 by 123 feet. It will be air-conditioned by a self-contained central unit. The major test areas of this facility will comprise an area for spacecraft systems testing and modification, a Data Recording and Display Console Room for central test control, and a Ground Test Equipment Room which will house the necessary electronic equipment for test support.

PROJECT JUSTIFICATION:

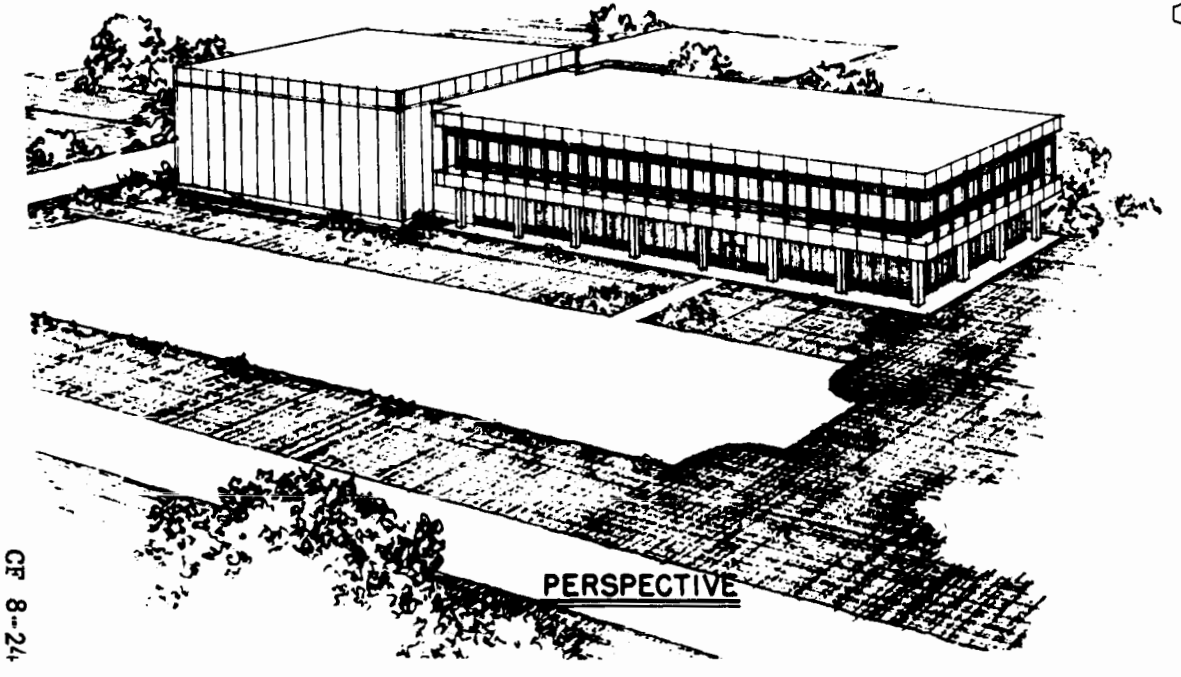
The inherent complexity of the communications and electronic systems to be used in the Gemini and Apollo programs requires that thorough tests be made with spacecraft and ground equipment operating as a complete system. This involves extensive work in a laboratory-type environment which must be undertaken concurrently with the early flight tests that are part of the flight program buildup leading to lunar exploration. Complete system testing is the only practical way to identify and solve many problems which occur in a complex system where various portions of the spacecraft and ground equipment are being supplied by a large number of vendors and manufacturers. It is essential that this work be undertaken and confidence developed in these systems prior to undertaking manned lunar missions. This facility must be operational by the beginning of calendar year 1966 in order to permit adequate testing of the Apollo Command Module, Service Module, and Lunar Excursion Module systems to be used in Apollo/Saturn IB and V flights.

ESTIMATED FUTURE YEAR FUNDING: None

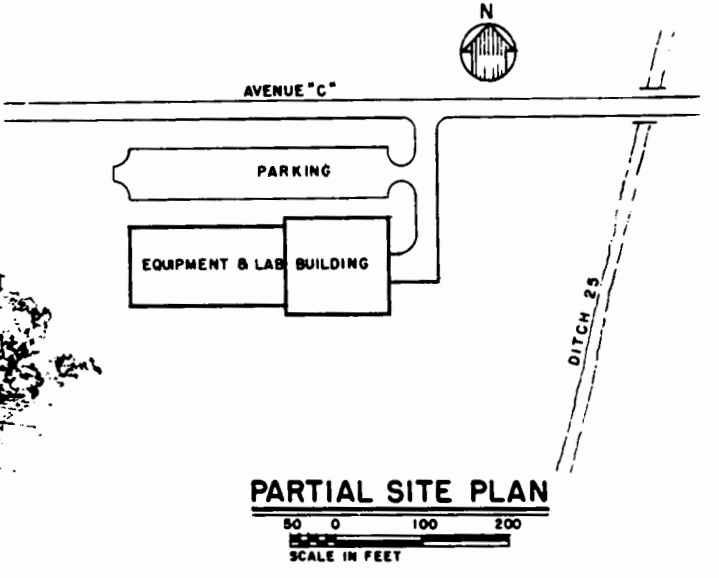
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

ELECTRONIC SYSTEMS COMPATIBILITY FACILITY



PERSPECTIVE



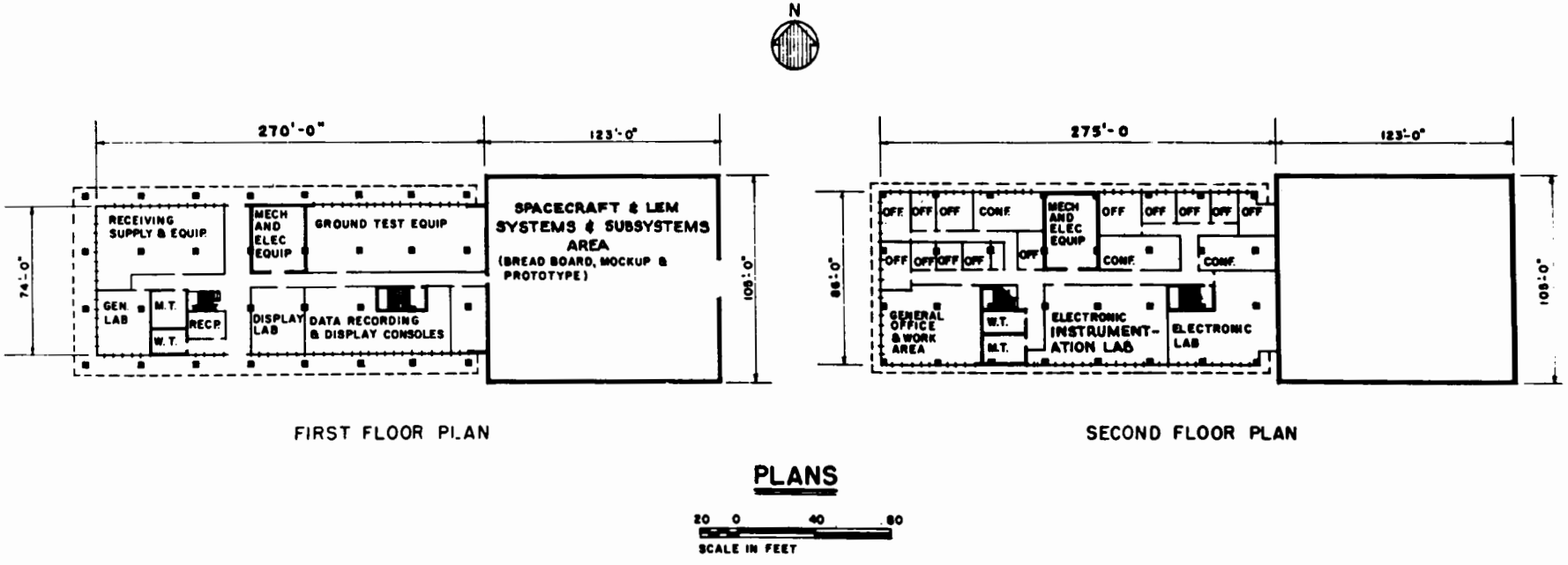
PARTIAL SITE PLAN

CF 8-24

MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

ELECTRONIC SYSTEMS COMPATIBILITY FACILITY



FIRST FLOOR PLAN

SECOND FLOOR PLAN

PLANS

20 0 40 80

SCALE IN FEET

CF 8-25

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

LUNAR MISSION AND SPACE EXPLORATION FACILITY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Manned Spacecraft Center

LOCATION OF PROJECT: Clear Lake, Harris County, Texas

COGNIZANT NASA INSTALLATION: Manned Spacecraft Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	$50,000
FY 1964 Estimate	70,000
FY 1965 Estimate	2,647,000
Total Funding Through FY 1965	$2,767,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,749,300
Building	Sq. Ft.	50,971	$30.16	1,537,100
Utilities	LS	---	185,500	185,500
Site preparation	LS	---	26,700	26,700
Equipment				$897,700
High velocity particle range equipment	LS	---	191,600	191,600
Cartographic and photo-interpretation equipment	LS	---	132,300	132,300
Radiation environment equipment	LS	---	113,600	113,600

	Unit of Measure	Quantity	Unit Cost	Total Cost
Test equipment	LS	---	---	407,400
Impingement and erosion dynamics laboratory	LS	---	52,800	52,800
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$2,647,000

PROJECT DESCRIPTION:

This facility will be a two story standard steel frame, precast concrete structure with an area of approximately 50,971 square feet. It will consist of an office and laboratory wing with first floor dimensions of approximately 107 by 163 feet and second floor dimensions of approximately 111 by 167 feet, a low-bay laboratory wing with dimensions of approximately 115 by 115 feet, and a single story interconnecting corridor. The building heating and air conditioning will be supplied by the central heating and cooling plant. The major laboratories which comprise this facility are: Geochemical Laboratory, Mission Experiments Laboratory, Radiation Environmental Laboratory, High Velocity Particle Range, Impingement and Erosion Dynamics Laboratory, Astronaut Scientific Training Area, Geoscience Laboratory, Cartographic and Photo-Interpretation Laboratory, Applied Physics Laboratory, and Physical Optics Laboratory.

PROJECT JUSTIFICATION:

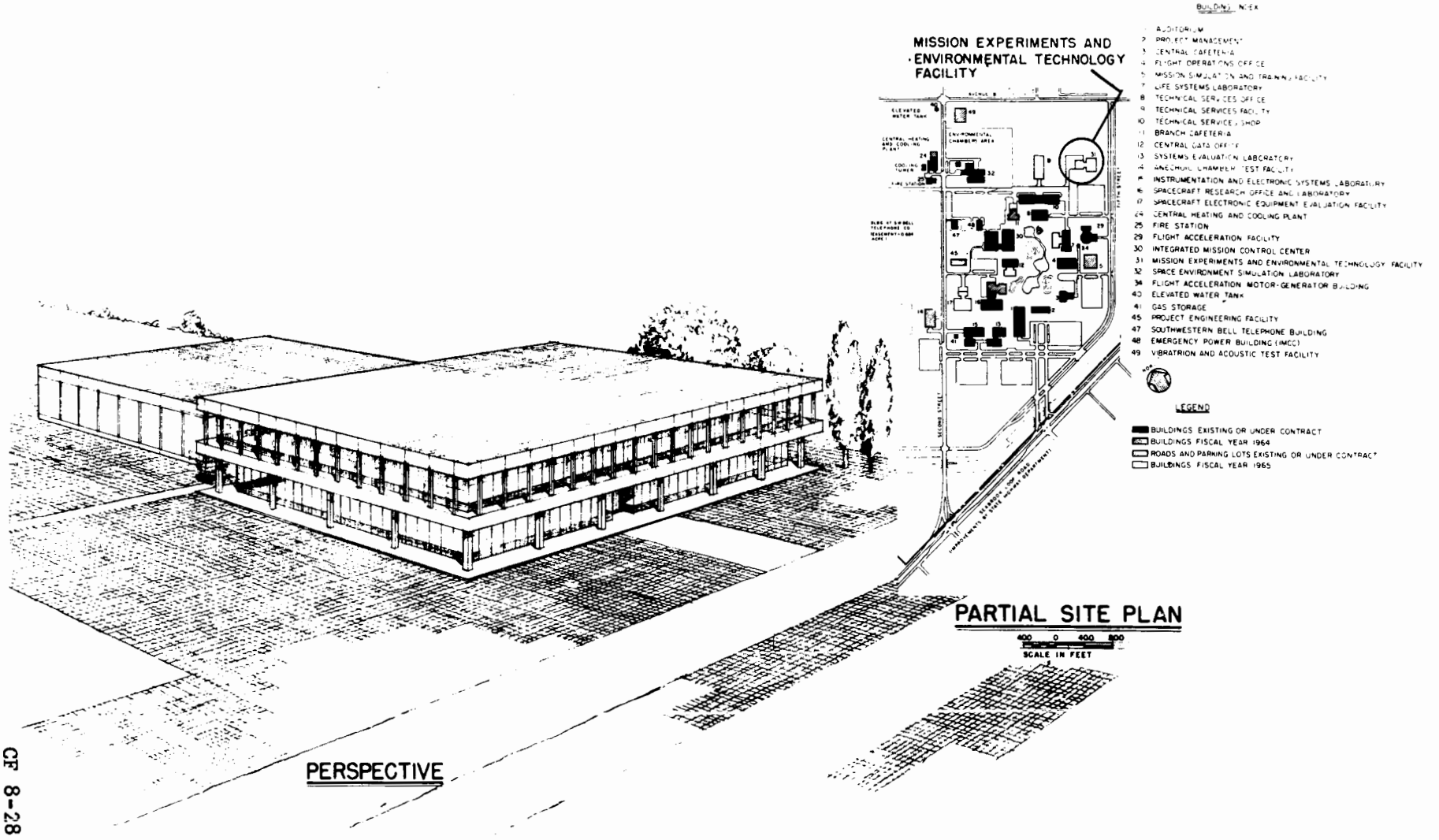
This facility is required to provide the laboratories necessary for the development of the engineering and scientific experiments to be conducted during Apollo missions; for the adaptation of the experiments to the Apollo spacecraft; and for the training of the astronauts in the conduct of the experiments. In addition, the space and lunar surface environment in which the Apollo spacecraft and astronauts will operate will be analyzed in support of both the design of the spacecraft and the conduct of the Apollo missions. The laboratory personnel will maintain close liaison with outside organizations and will conduct theoretical evaluations of their proposals followed by testing in the proposed laboratories. When such experiments are judged desirable and feasible for a particular mission they will then be fitted for installation in the spacecraft and modified as required. The capability to evaluate, adapt, and modify contractor experiments, instruments, and equipment for spacecraft has been found to be a necessity for meeting the imposed safety and reliability requirements.

ESTIMATED FUTURE YEAR FUNDING: None

MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

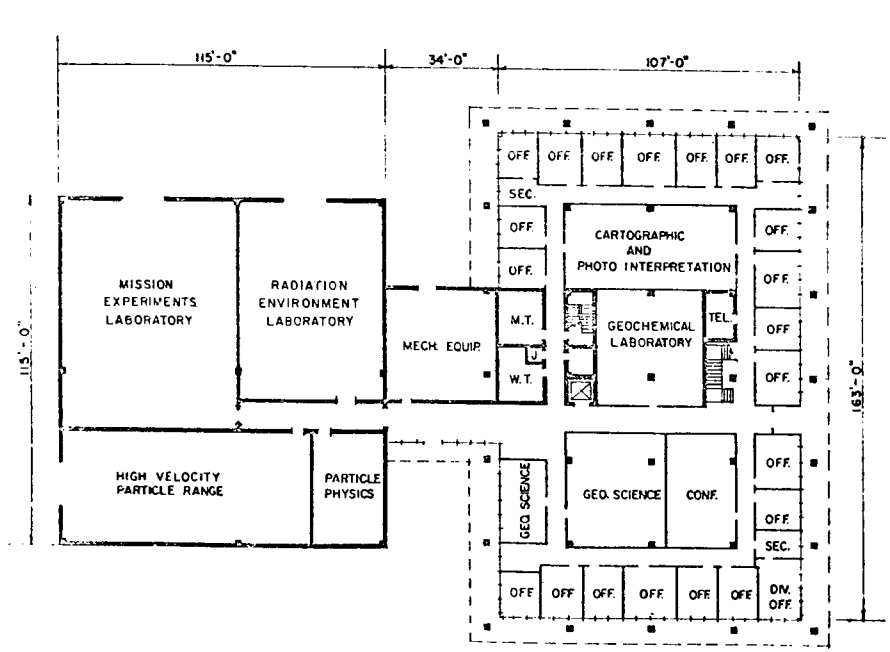
LUNAR MISSION AND SPACE EXPLORATION FACILITY



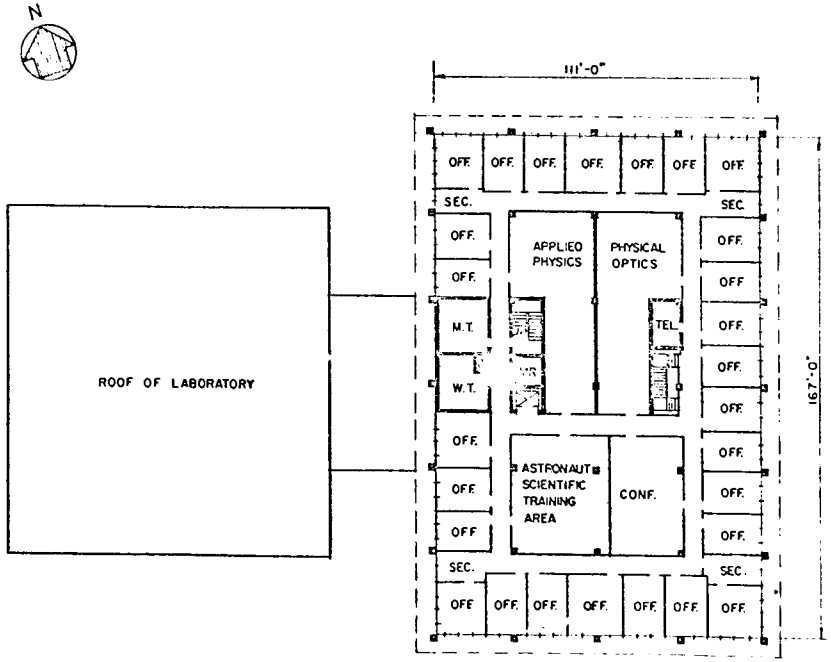
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

LUNAR MISSION AND SPACE EXPLORATION FACILITY



FIRST FLOOR PLAN



SECOND FLOOR PLAN

PLANS

15 0 30 60

SCALE IN FEET

CF 8-29

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

MODIFICATIONS TO THE ENVIRONMENTAL TESTING LABORATORY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Manned Spacecraft Center

LOCATION OF PROJECT: Clear Lake, Harris County, Texas

COGNIZANT NASA INSTALLATION: Manned Spacecraft Center

TYPE OF CONSTRUCTION PROJECT: Alteration

FUNDING:

FY 1963 and Prior Years	$29,882,000
FY 1964 Estimate	400,000
FY 1965 Estimate	9,416,000
Total Funding Through FY 1965	$39,698,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	---
Equipment				$9,416,000
Solar simulation	LS	---	6,939,800	6,939,800
Albedo simulation	LS	---	1,018,200	1,018,200
Gimbal mounts	LS	---	1,458,000	1,458,000
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$9,416,000

PROJECT DESCRIPTION:

This project will provide an expansion in solar simulation capability of the two chambers in the Environmental Testing Laboratory, Building 32. In Chamber "A", the diameter of the are to be irradiated from the top will be increased to 20 feet from the present 13 feet and the side irradiation will be increased from 13 by 32 feet to 20 by 48 feet. Also, an energy source for earth and for lunar albedo simulation and a gimbal mount to permit pitching and yawing of spacecraft modules within Chamber "A" will be installed. In Chamber "B", the diameter of the area to be irradiated from the top will be increased to 20 feet from the present 5.6 feet.

PROJECT JUSTIFICATION:

The proposed modifications to the present laboratory are required to permit testing under environmental conditions not currently attainable.

Increased direct solar simulation capability - The present top "sun" in Chamber "A" will irradiate the Apollo command module and/or service module in a fixed vertical attitude. For more accurate simulation, the test configuration will be pitched or yawed to change the angel of solar radiation. To irradiate the spacecraft after this pitch or yaw movement, the top "sun" must be expanded to twenty feet in diameter.

The extent of the present side "sun" in Chamber "A" is not sufficient to irradiate the entire spacecraft (command and service modules and lunar excursion module) and therefore must be expanded to a width of 20 feet and a height of 48 feet. The present top "sun" in Chamber "B" will irradiate only an astronaut and/or small items of equipment on the chamber floor. To permit heat transfer tests to be made on an Apollo spacecraft module and astronaut working beside the module, the top "sun" of Chamber "B" must be expanded to twenty feet in diameter.

Albedo simulation - During Apollo lunar missions the Apollo spacecraft will, at times, be in a field of direct solar radiation and reflected solar radiation (albedo) from the surface of the earth or the surface of the moon. Tests to be made on the Apollo spacecraft in the Environmental Testing Laboratory must include tests in this environmental condition. The albedo simulator will produce thermal energy largely in the infra-red portion of the spectrum to simulate the effects experienced from this radiant energy.

Space chamber gimbal mounts - Tests in the space chamber, at various attitudes with respect to the simulated sun, will establish those flight positions, relative to the sun, that permit optimum operation of the spacecraft environmental control system. To provide this capability, a large gimbal ring will be used in conjunction with the "lunar plane" in Chamber "A" to produce a two degree of freedom support system. In addition, the space-

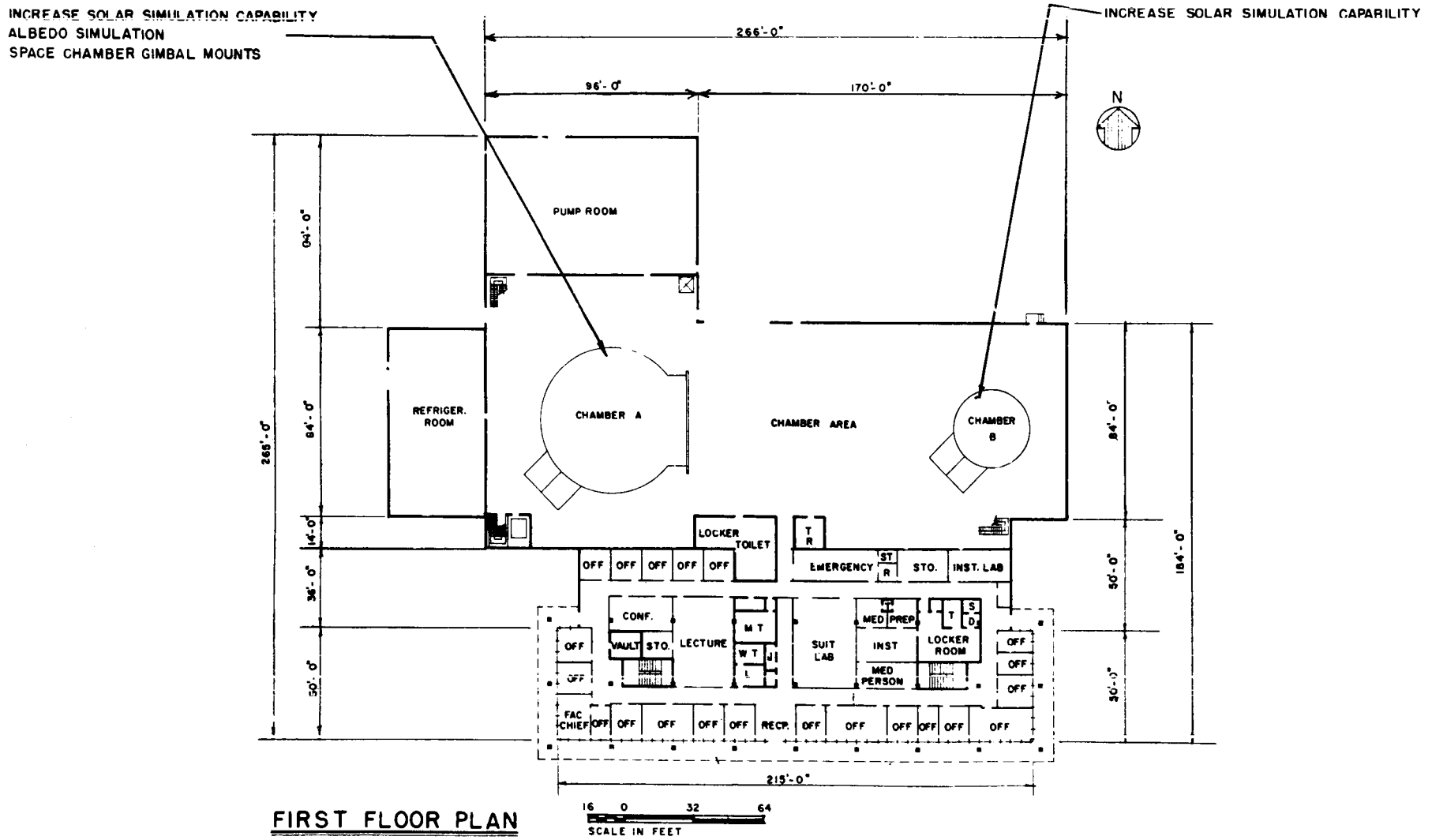
craft can move about its roll axis, permitting full three-degree-of-freedom orientation.

ESTIMATED FUTURE YEAR FUNDING: None

MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

MODIFICATIONS TO THE ENVIRONMENTAL TESTING LABORATORY



FIRST FLOOR PLAN

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

TECHNICAL SERVICES FACILITY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Manned Spacecraft Center

LOCATION OF PROJECT: Clear Lake, Harris County, Texas

COGNIZANT NASA INSTALLATION: Manned Spacecraft Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	---
FY 1964 Estimate	$110,000
FY 1965 Estimate	2,240,000
Total Funding Through FY 1965	$2,350,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,600,400
Building	Sq. Ft.	57,970	$25.40	1,472,300
Utilities	LS	---	114,100	114,100
Site	LS	---	14,000	14,000
Equipment:				$539,000
Model and plastic shop equipment	LS	---	117,600	117,600
Chemical milling and plating equipment	LS	---	139,200	139,200
Electronic calibration and construction equipment	LS	---	110,600	110,600

	Unit of Measure	Quantity	Unit Cost	Total Cost
Optics shop and field test equipment	---	---	$121,600	$121,600
Maintenance shop equipment	---	---	50,000	50,000
Design	---	---	---	---
		Subtotal		$2,139,400
Fallout Shelter				$100,600
		TOTAL		$2,240,000

PROJECT DESCRIPTION:

The purpose of this project is to provide shop facilities to support the Apollo test and evaluation program of the Manned Spacecraft Center. The building will be a high-bay steel frame, precast concrete structure with an area of approximately 57,970 square feet. The dimensions of the first floor will be about 308 feet long and 140 feet wide and the dimensions of the mezzanine will be 308 feet long and 48 feet wide. The heating and air-conditioning will be supplied by the central heating and cooling plant.

PROJECT JUSTIFICATION:

A diversified, well equipped technical shop complex is essential to the conduct of the Manned Spacecraft Center test and evaluation program, The major shops of this proposed facility and their functions are:

Model and plastic shop - Will provide the capability to construct small scale replicas of the Apollo spacecraft required for specific tests and full size mockups of module systems or components needed for the evaluation of the Apollo spacecraft design.

Field test shop - Will provide machine shop space required for the fabrication of equipment such as test rigs and handling equipment necessary for air drops, retrieval of spacecraft after water landings and other special development testing activities.

Pyrotechnics support shop - Will provide a work area for the fabrication of the mechanical, electrical and electronic devices which are required to activate spacecraft pyrotechnic components such as explosive bolts and solid fuel rocket motors.

In addition, a Plating Shop, Optical Shop and an Engineering Division Office will be provided.

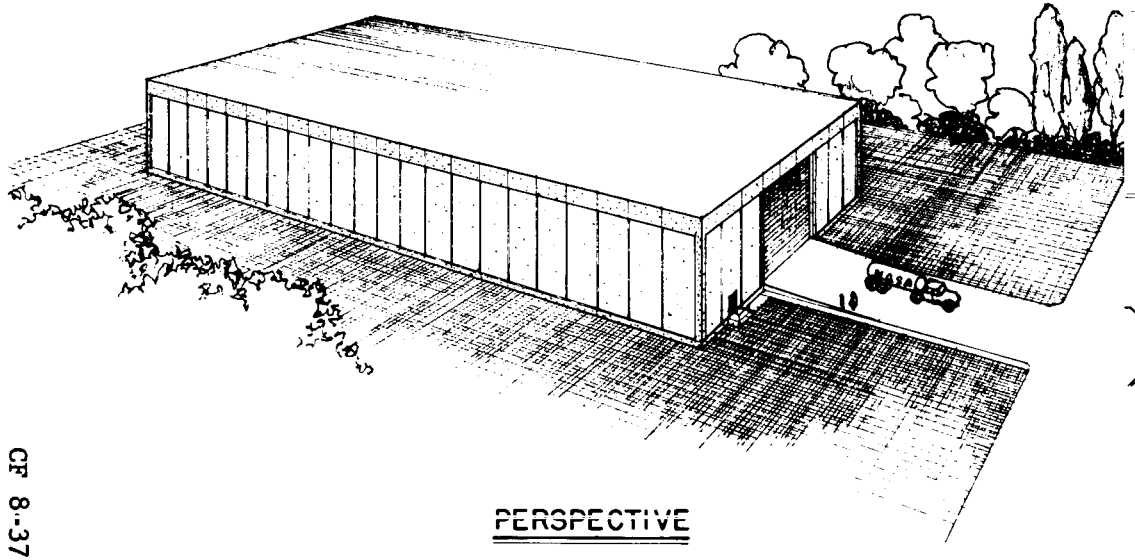
The Manned Spacecraft Center test and evaluation program, essential to assure reliable hardware, requires fabrication of a wide variety of advanced flight and ground support hardware models and mockups. A capability to provide quick reaction time in making and incorporating changes between tests is essential to meeting schedules.

ESTIMATED FUTURE YEAR FUNDING: None

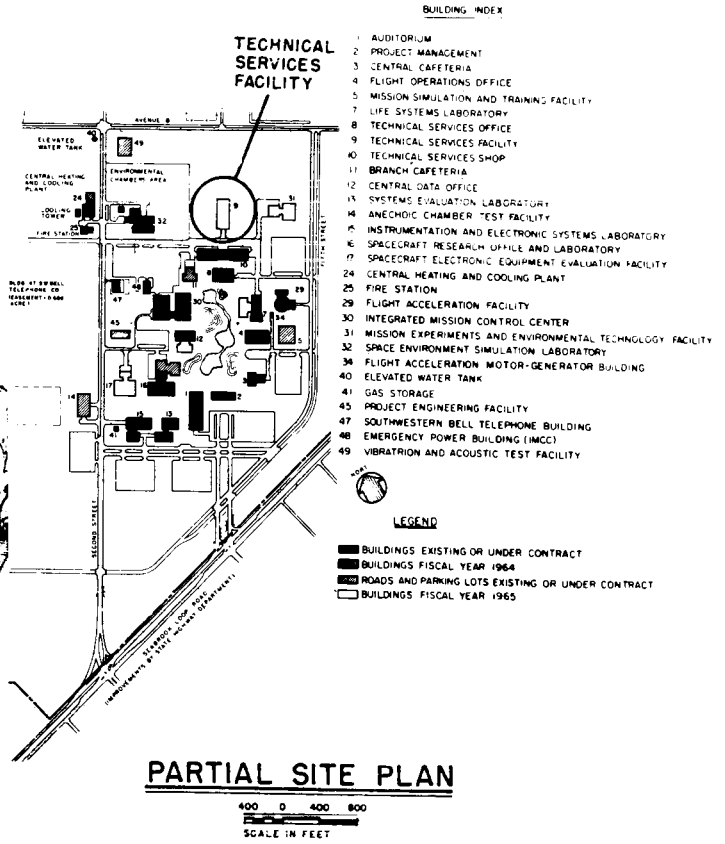
MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

TECHNICAL SERVICES FACILITY



PERSPECTIVE



PARTIAL SITE PLAN

400 0 400 800

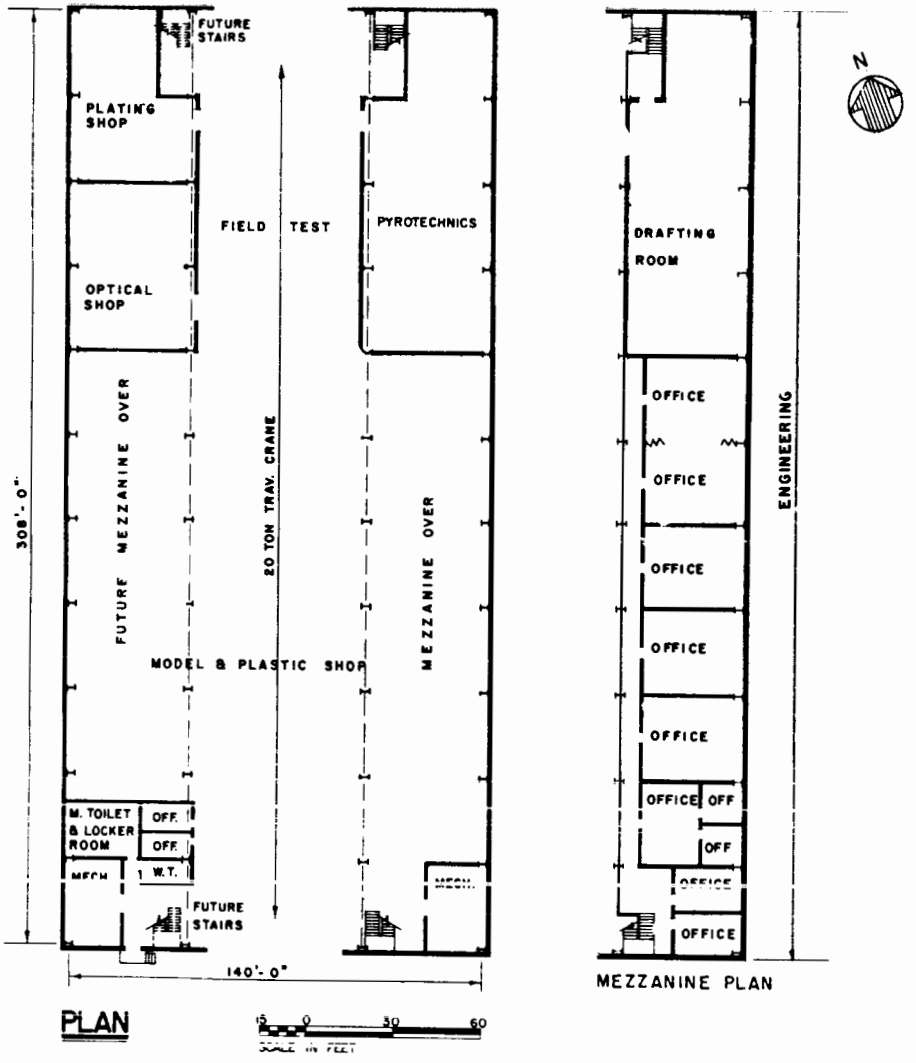
SCALE IN FEET

CF 8-37

MANNED SPACECRAFT CENTER

FISCAL YEAR 1965 ESTIMATES

TECHNICAL SERVICES FACILITY



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

EXTENSIONS TO SATURN V GROUND SUPPORT EQUIPMENT TEST FACILITY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Marshall Space Flight Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: Extensions

FUNDING:

FY 1963 and Prior Years	$5,728,000
FY 1964 Estimate	137,000
FY 1965 Estimate	2,495,000
Total Funding Through FY 1965	$8,360,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$683,400
Support buildings				
Pneumatic test position	Sq. Ft.	7,200	$31.45	226,400
Extension of assembly building	Sq. Ft.	8,080	28.72	232,000
Extension of blockhouse	Sq. Ft.	2,200	31.81	70,000
Site development	LS	---	36,500	36,500
Utilities and paving	LS	---	118,500	118,500
Equipment				$1,809,600

	Unit of Measure	Quantity	Unit Cost	Total Cost
Instrumentation at blockhouse	LS	---	$970,000	$970,000
Instrumentation at HP gaseous nitrogen facility	LS	---	200,000	200,000
Equipment for HP facility	LS	---	639,600	639,600
Design	---	---	---	---
		SUBTOTAL		$2,493,000
Fallout Shelter				$2,000
		TOTAL		$2,495,000

PROJECT DESCRIPTION:

This project provides for extensions to the fiscal year 1963 Saturn V Ground Support Equipment Test Facility as follows:

High pressure pneumatic test facility - This facility will consist of a prefabricated building about 60 feet by 90 feet with an attached reinforced concrete test cell of about 30 feet by 60 feet. The complex will also include two 10,000-gallon vacuum jacketed liquid nitrogen storage tanks with associated piping and converters for converting liquid nitrogen to gas at 15,000 psi.

Additional instrumentation - This item will provide a 100 channel analog to digital recording system, complete with all other appurtenances required to integrate this equipment into the system.

Extension of blockhouse - A two-story addition approximately 20 feet by 55 feet, constructed of reinforced concrete, with air conditioning, and double second floor. This extension will house additional instrumentation.

Extension of assembly building - This item provides for conversion of existing office space on the first floor into a sub-assembly and checkout area. A second floor will be added for engineering offices. A single-story shop extension will also be provided. Approximately 8,080 square feet of floor area will be added.

PROJECT JUSTIFICATION:

The Marshall Space Flight Center is responsible for the test, checkout, and operational reliability of the service swing-arms and holddown arms used to service the Saturn V vehicles during the launch phase. This ground

equipment will be tested and evaluated prior to shipment to the John F. Kennedy Space Center, NASA. This project provides the instrumentation, facilities, and shop space required for the phased increase of testing activities.

High pressure pneumatic test facility - All launch complex equipment is now operating at a maximum pressure of 5,000 pounds per square inch. The ground support systems are being designed for pressure ranges between 8,000 and 10,000 pounds per square inch (psi), and requiring up to 15,000 psi for over-pressure tests. Provision is being made to check equipment for functional suitability and reliability at the higher pressure ranges.

Additional instrumentation - The current facility is equipped with 200 channels of instrumentation. In phase with the development and evaluation schedule and test duration requirements 100 channels of instrumentation will be added in fiscal year 1965.

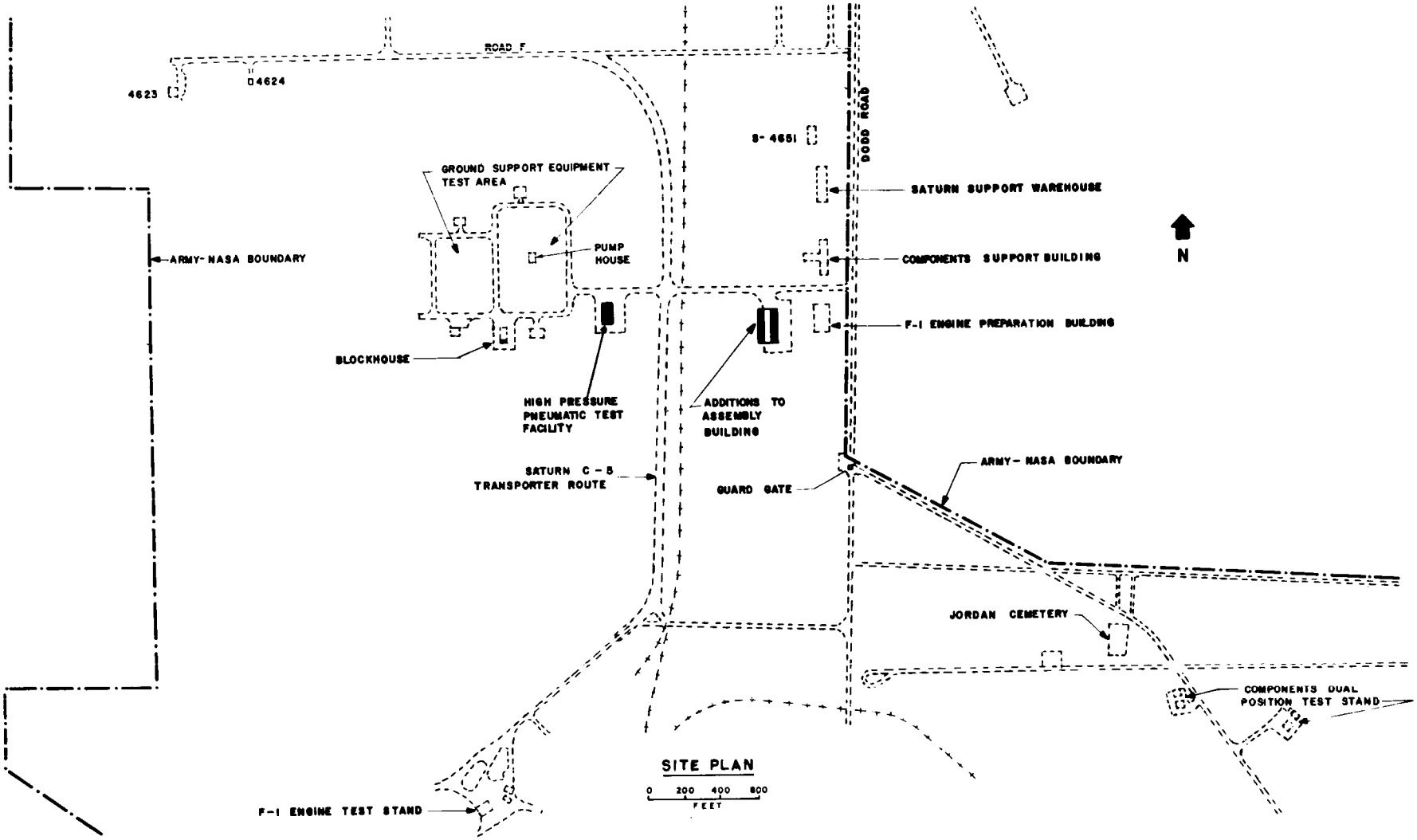
Extension to assembly building - The phased build-up of activities within the assembly building requires an additional 8,080 square feet of shop and subassembly space. This space is required to accommodate the pre-test and post-test activities such as inspection, assembly, checkout, modification, repair, and packaging associated with the receipt of increased quantities of components from contractors.

ESTIMATED FUTURE YEAR FUNDING: None

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

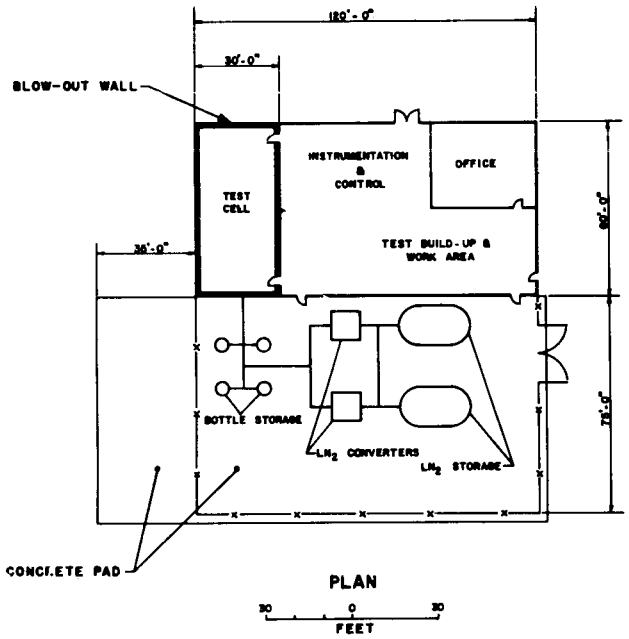
EXTENSIONS TO SATURN V GROUND SUPPORT EQUIPMENT TEST FACILITY



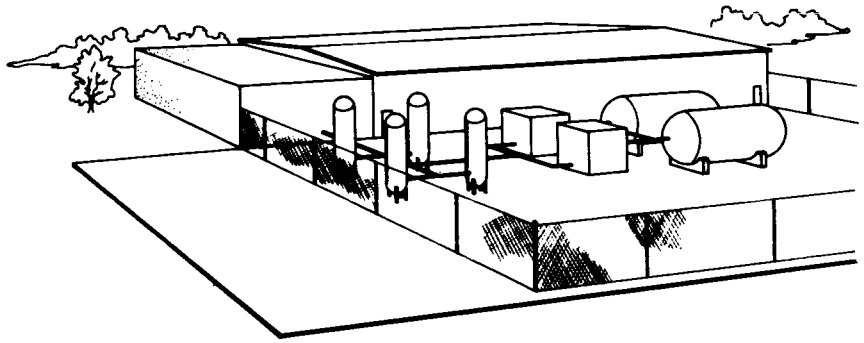
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

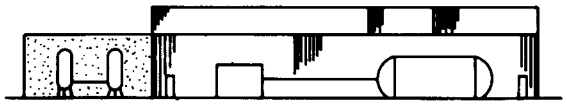
EXTENSIONS TO SATURN V GROUND SUPPORT EQUIPMENT TEST FACILITY



PLAN



PERSPECTIVE



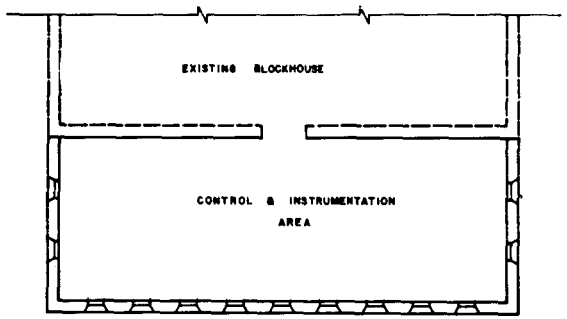
ELEVATION

HIGH PRESSURE PNEUMATIC TEST FACILITY

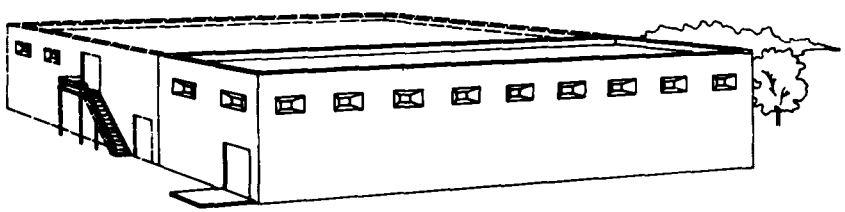
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

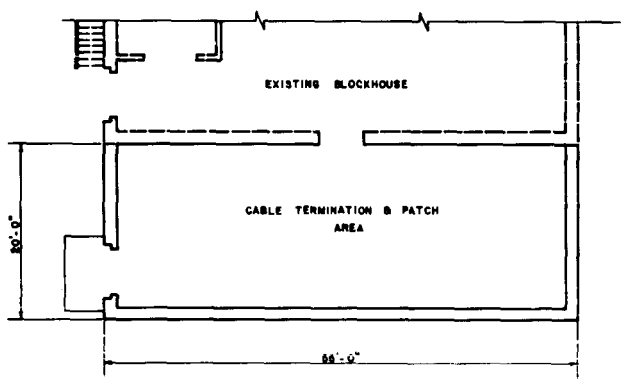
EXTENSIONS TO SATURN V GROUND SUPPORT EQUIPMENT TEST FACILITY



SECOND FLOOR PLAN



PERSPECTIVE



FIRST FLOOR PLAN

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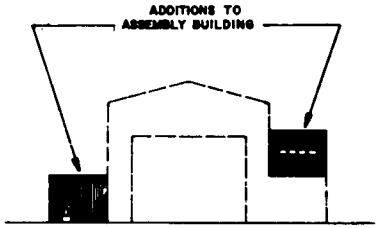
FEET

EXTENSION OF BLOCKHOUSE

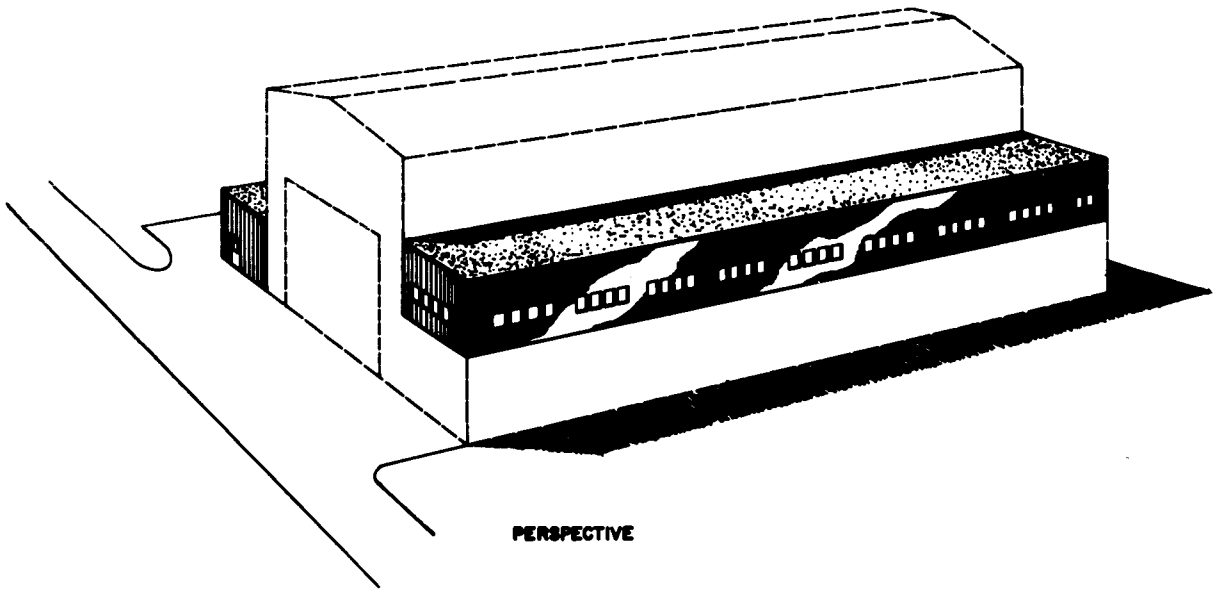
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

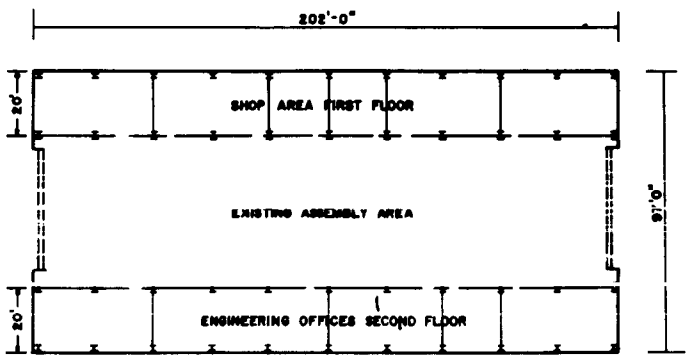
EXTENSIONS TO SATURN V GROUND SUPPORT EQUIPMENT TEST FACILITY



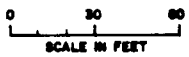
ELEVATION



PERSPECTIVE



FLOOR PLAN



EXTENSION OF ASSEMBLY BUILDING

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

COLD FLOW TEST FACILITY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Marshall Space Flight Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	---
FY 1964 Estimate	$136,000
FY 1965 Estimate	2,368,000
Total Funding Through FY 1965	$2,504,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$906,000
Support building				
Terminal and equipment building	Sq. Ft.	5,000	$34.00	170,000
Test position	LS	---	536,000	536,000
Site development	LS	---	50,000	50,000
Utilities	LS	---	150,000	150,000
Equipment				$1,458,000
Tie-in to existing instrumentation system	LS	---	200,000	200,000

	Unit of Measure	Quantity	Unit Cost	Total Cost
Tie-in to existing control system	LS	---	$100,000	100,000
Propellant systems	LS	---	400,000	400,000
High-pressure gas system	LS	---	200,000	200,000
Prime mover (10,000 H.P. gas turbine)	LS	---	558,000	558,000
Design	---	---	---	---
		SUBTOTAL		$2,364,000
Fallout Shelter				$4,000
		TOTAL		$2,368,000

PROJECT DESCRIPTION:

This project will provide a Saturn V cold calibration test facility. It will be located in the existing cold flow test area and will consist of the following major structures:

Test stand - A structural steel tower approximately 80 feet by 80 feet and 175 feet high on a reinforced concrete foundation will support the vehicle stage tankage and run tankage with associated propellant systems and equipment.

Terminal building - A two-story reinforced concrete structure, approximately 50 feet by 50 feet with 5,000 square feet of floor space will house terminal boards for instrumentation and control systems, cable distribution, patching facilities and a prime mover. The prime mover is a 10,000 horse-power gas turbine with a gas generator and gear box. This equipment will supply propellants to the vehicle pumps in performing studies on both RP1/LOX and LH_2/LOX pumping systems.

PROJECT JUSTIFICATION:

This facility will be used to conduct test programs of a hazardous nature on Saturn V vehicle systems hardware. Specifically, the facility will be used to determine propellant flow characteristics, tank stratification phenomena, propellant pumping techniques and interstage environment investigations through the use of full scale hardware of the Saturn V space vehicle. It will provide the capability for testing of R&D prototype hardware, checkout of vehicle components and verification of vehicle integration design concepts.

Experience has demonstrated that the ground testing program outlined above is essential to the solution of in-flight problems which will assure

the reliability of a man-rated vehicle.

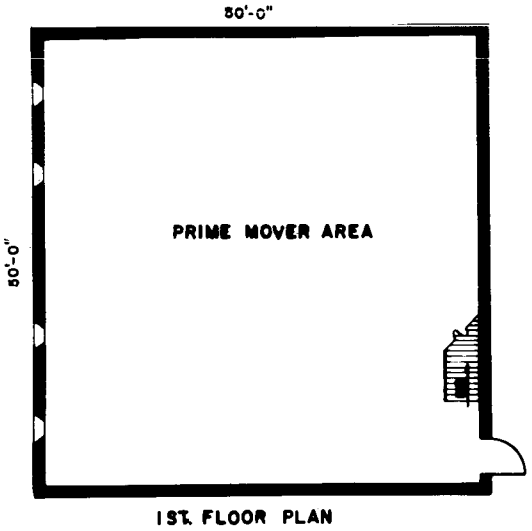
No existing facilities are capable of providing a Cold Flow testing capability for the Saturn V vehicle.

ESTIMATED FUTURE YEAR FUNDING: None

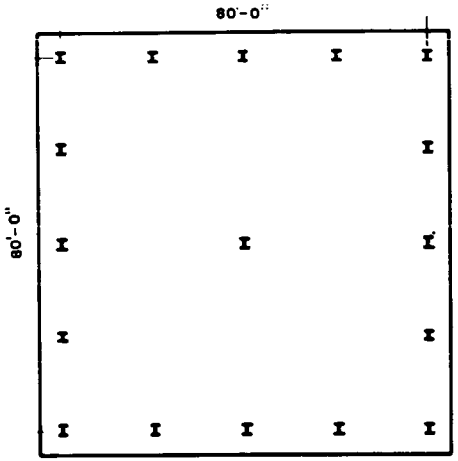
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

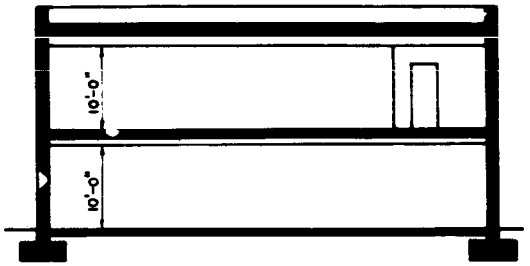
COLD FLOW TEST FACILITY



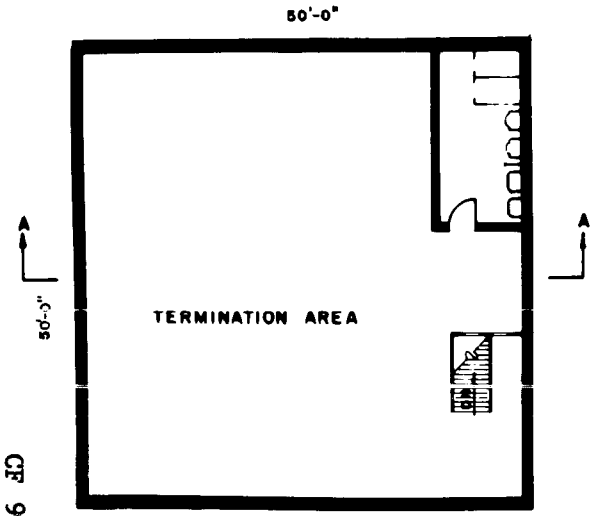
1ST. FLOOR PLAN



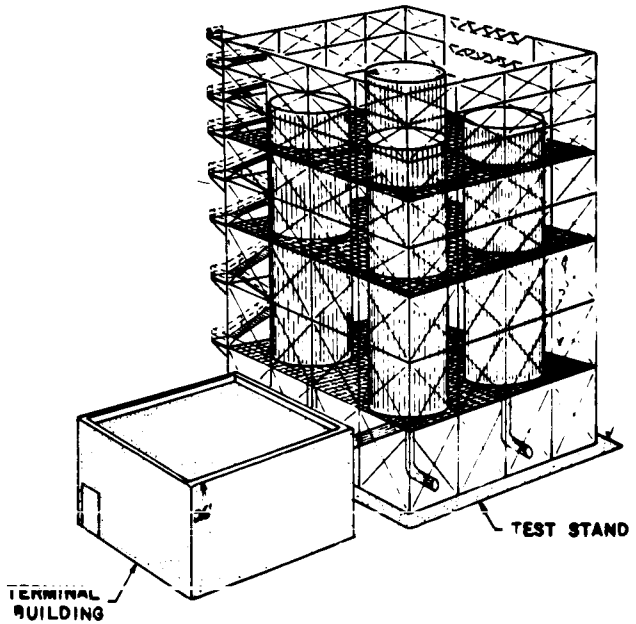
PLAN-TEST STAND



SECTION A-A



2ND FLOOR PLAN



PERSPECTIVE

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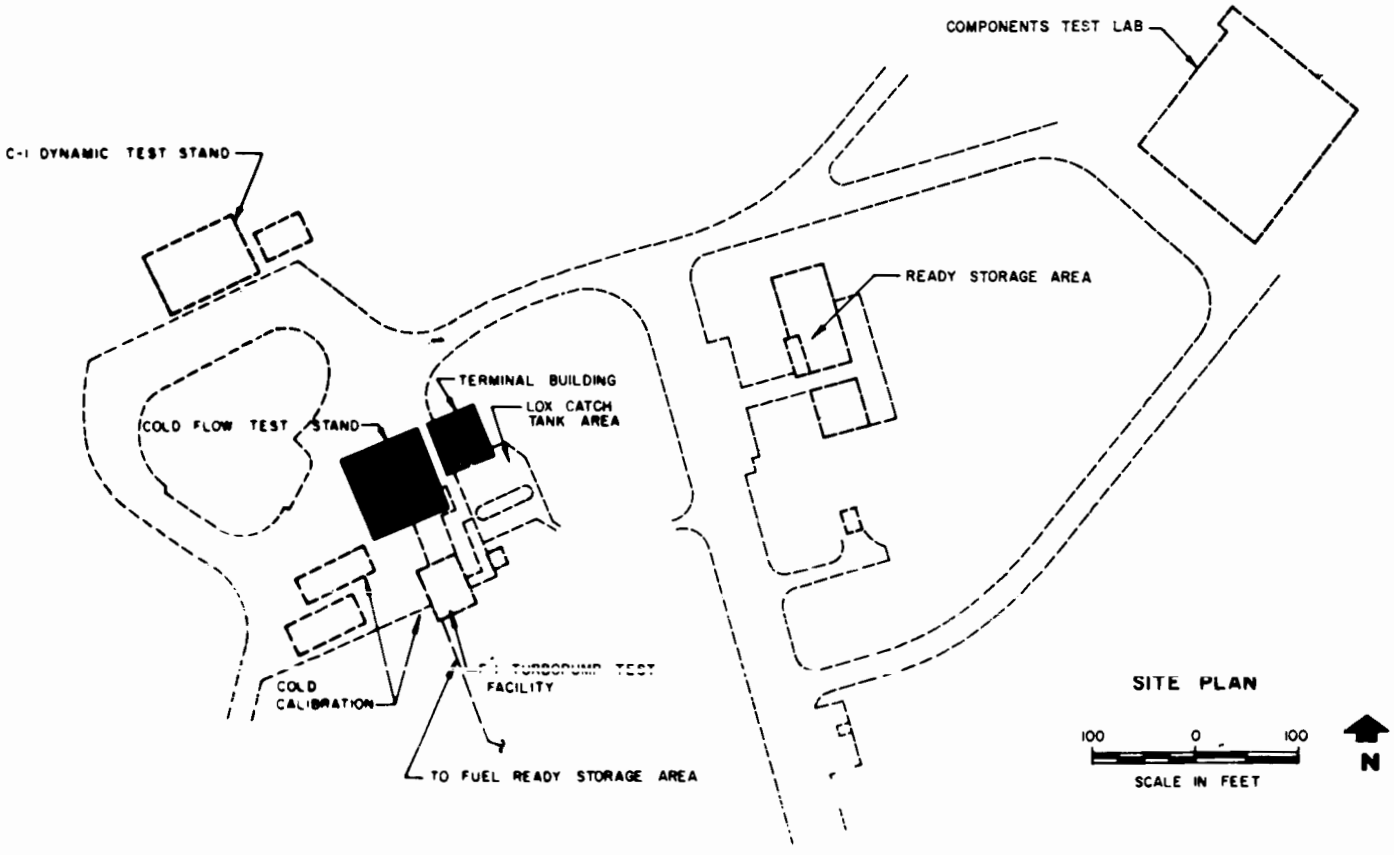
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

COLD FLOW TEST FACILITY



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

EXTENSION OF COMPONENTS TEST FACILITY INSTRUMENTATION

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Marshall Space Flight Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: Extension

FUNDING:

FY 1963 and Prior Years	$7,200,000
FY 1964 Estimate	3,765,000
FY 1965 Estimate	1,814,000
Total Funding Through FY 1965	$12,779,000

PROJECT COST ESTIMATE:

	Unit Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---		---
Construction				$390,000
Building	Sq. Ft.	9,000	$35.56	320,000
Site development	LS	---	10,000	10,000
Utilities and paving	LS	---	60,000	60,000
Equipment				$1,420,000
Recording and signal conditioning	LS	---	1,210,000	1,210,000
Transmission and distribution	LS	---	120,000	120,000
Special instrumentation	LS	---	90,000	90,000
Design	---	---	---	---

	Unit of Measure	Quantity	Unit Cost	Total Cost
		SUBTOTAL		$1,810,000
Fallout Shelter				$4,000
		TOTAL		$1,814,000

PROJECT DESCRIPTION:

This project provides for the construction of an addition to the Instrumentation Center as well as the design, procurement, fabrication, installation and checkout of additional equipment.

This addition to the south side of the existing two-story structure will be approximately 30 feet wide by 150 feet long. Construction features will include blast resistant concrete walls and roof, special regulated AC and DC electrical power circuits, elevated floors, air conditioning and normal utilities.

Additional instrumentation will consist of a 100 channel analog-to-digital system, 30 oscillograph channels, and 24 single channel analog strip chart recorders. Associated equipment will include: wide band DC amplifiers, carrier, flow and positioning circuitry, electronic calibrators, automatic switching equipment and remote data indicators; patch panels and distribution cabling to interconnect the above mentioned equipment with existing equipment will also be included.

PROJECT JUSTIFICATION:

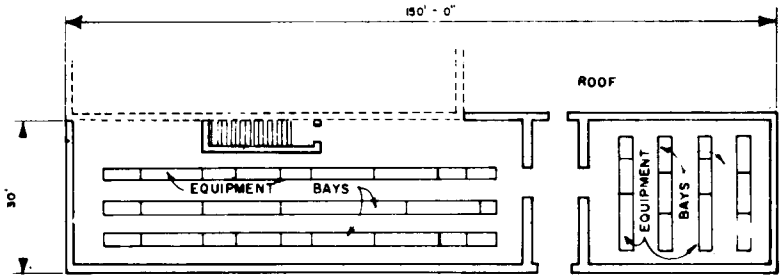
The Saturn V program for testing of subsystems and investigation of interface problems arising from vehicle stage integration will achieve peak proportions in mid-calendar year 1965. This project continues the updating and extension of the instrumentation system in the component test complex in phase with these test requirements. The test programs conducted at this facility are essential in assuring a successful flight test program.

ESTIMATED FUTURE YEAR FUNDING: None

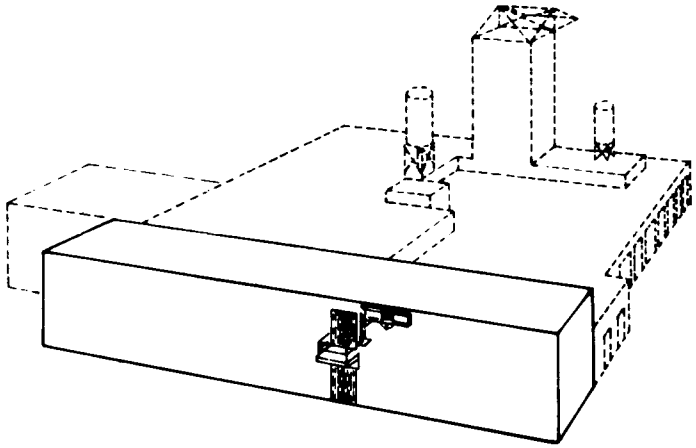
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

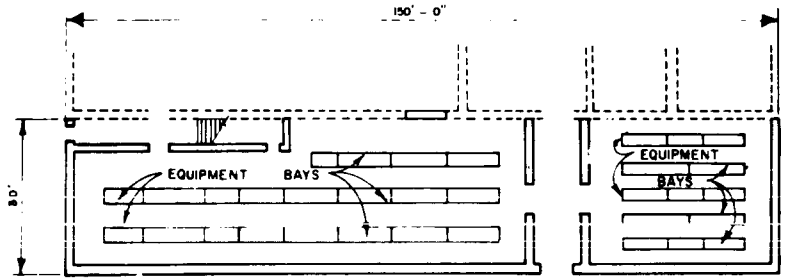
EXTENSION OF COMPONENTS TEST FACILITY INSTRUMENTATION



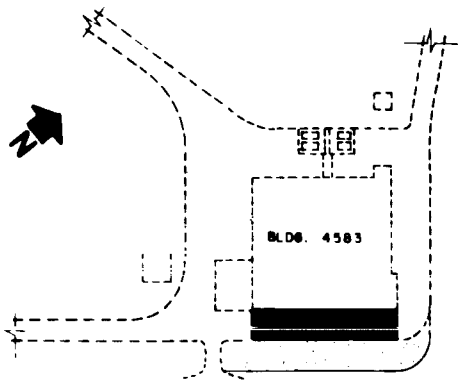
SECOND FLOOR PLAN
NOT TO SCALE



PERSPECTIVE



FIRST FLOOR PLAN
NOT TO SCALE



SITE PLAN
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FEET

CF 9-17

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

EXTENSION TO THE PROPULSION AND VEHICLE ENGINEERING LABORATORY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Marshall Space Flight Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: Extension

FUNDING:

FY 1963 and Prior Years	$1,143,500
FY 1964 Estimate	115,000
FY 1965 Estimate	2,230,000
Total Funding Through FY 1965	$3,488,500

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$2,017,700
Laboratory building and cafeteria	Sq. Ft.	75,600	24.21	1,830,200
Site development	LS	---	37,000	37,000
Utilities paving	LS	---	150,500	150,500
Equipment				174,300
Communication and office equipment	LS	---	97,925	97,925
Cafeteria equipment	LS	---	76,375	76,375

	Unit of Measure	Quantity	Unit Cost	Total Cost
Design	---	---	---	---
		SUBTOTAL		$2,192,000
Fallout Shelter				38,000
		TOTAL		$2,230,000

PROJECT DESCRIPTION:

This project will provide an extension to the existing Propulsion and Vehicle Engineering Laboratory which will be increased by approximately 75,600 square feet of floor area. The main structure will have five stories approximately 70 feet by 180 feet, with 68,600 square feet of floor space, with a partial basement and mechanical room to house building equipment and an elevator room. Adjoining the main structure will be a single story cafeteria, approximately 58 feet by 120 feet with 7,000 square feet of floor space, with a seating capacity for approximately 300 people. The building will be a steel frame structure with metal curtain exterior walls to match the existing laboratory. Normal utilities and air-conditioning are included in this project. The laboratory will provide space for approximately 450 people.

PROJECT JUSTIFICATION:

The activities of the Propulsion and Vehicle Engineering Laboratory have been severely handicapped during the past three years by the dispersion of 630 engineers and support personnel. Over one-third of the P&VE personnel are located 13 miles from the laboratory.

A study of the problem indicates that approximately 1,000 man hours per week are lost in travel time. This split operation assumes greater significance since key personnel make up a large portion of these travelers. Estimated annual cost for the split operation is as follows:

Leased Space	68,600 square feet @ $2.40 per sq. ft.	$164,640
Lost Man hours	1,000 M/H per week @ $8.00 per hr x 52 weeks	$416,000
Commuting Costs	75 round trips per day x $3.40 x 250 days per year	$63,750
Total Annual costs per year		$644,390

On the basis of saving the above costs, the laboratory can be amortized within four years.

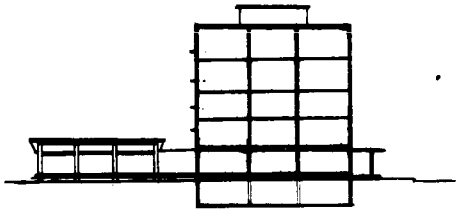
The consolidation of operations will result in improved manpower and facilities utilization and reduced costs to the government.

ESTIMATED FUTURE YEAR FUNDING: None

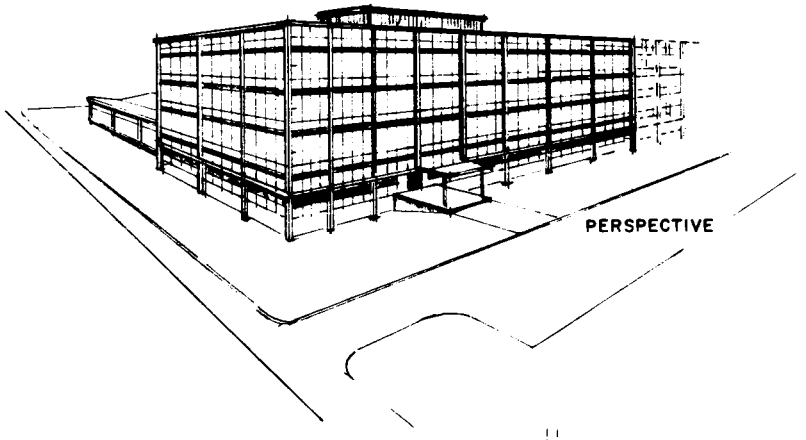
MARSHALL SPACE FLIGHT CENTER

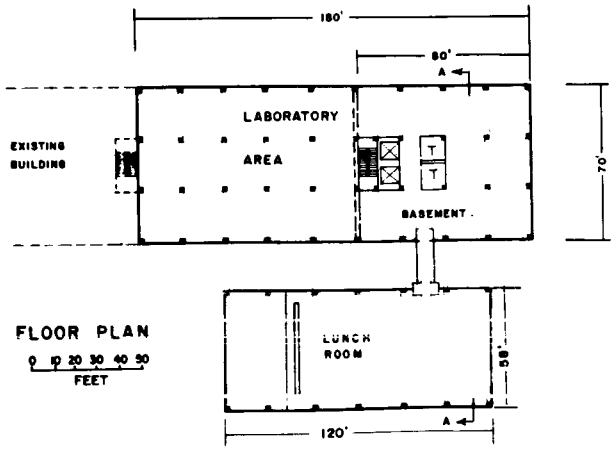
FISCAL YEAR 1965 ESTIMATES

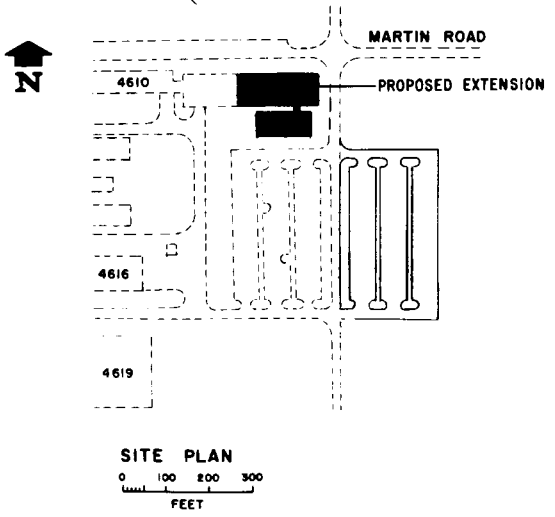
EXTENSION TO THE PROPULSION AND VEHICLE ENGINEERING LABORATORY



SECTION A-A







CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

EXTENSION OF UTILITY SYSTEMS

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Marshall Space Flight Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: Extension

FUNDING:

FY 1963 and Prior Years	---
FY 1964 Estimate	$100,000
FY 1965 Estimate	3,175,000
Total Funding Through FY 1965	$3,275,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$3,175,000
Access road	LS	---	$1,375,000	1,375,000
New roads	Miles	4.2	100,000	420,000
Overpass	LS	---	251,700	251,700
Bridge	LS	---	78,300	78,300
Communication duct and cable	LS	---	770,000	770,000
Utilities	LS	---	280,000	280,000
Equipment	---	---	---	---
Design	---	---	---	---

	Unit of Measure	Quantity	Unit Cost	Total Cost
Fallout Shelter	---	---	---	---
		TOTAL		$3,175,000

PROJECT DESCRIPTION:

This project provides for the following items:

Extension to Rideout access road - This project provides for partial funding of the extension of Rideout Road for the 2.5 mile section from the entrance of Redstone Arsenal to U.S. Highway 72. The road will be a four-lane divided highway with limited access between Alabama Highway 20 and U.S. Highway 72. This project will be undertaken through the Bureau of Public Roads with work accomplished by the Alabama Highway Department.

Center roadnet modifications - Four new segments of a two lane road totaling approximately 4.2 miles. A new overpass on Martin Road and a new bridge on the newly relocated section of Martin Road west of Rideout Road.

Utility lines - Utilities will include the extension of potable and industrial water lines; 4,160 KV electrical distribution lines; steam lines; sewage lines and communication ducts to recently developed areas; replacement and relocation of existing distribution lines. Additional cable will also be required within the existing duct system which will terminate at the Central Communications Facility.

PROJECT JUSTIFICATION:

At present the heavy traffic leaving Redstone Arsenal at Gate 9 on Rideout Road must turn eastward onto Governors Drive or westward on State Road 20 toward Decatur or Athens, Alabama. There is no other road in the vicinity to carry traffic in a northern direction. Traffic continuing eastward to Huntsville congests with other peak hour traffic at Governors Drive, Memorial Parkway and other congested points to reach the northern parts of the city. Traffic destined for Athens, Alabama, or other points northwest of Redstone Arsenal does not have direct access to the existing four-lane U. S. Highway 72.

Recent origin and destination studies indicate that approximately two-thirds of the employees live in Huntsville or other communities north of the arsenal. At present, almost one-third of the peak traffic

(approximately 3,000 vehicles between 6:30 a.m. and 8:00 a.m.) use Gate 9 and Rideout Road as an access to their work. Approximately 34 percent more would be using this route if the full extension were available today. By the time the extension can be completed, it is expected that the traffic entering Gate 9 will increase by 47 percent. The extension of Rideout Road to U. S. Highway 72 will alleviate those traffic conditions.

New roads, an overpass and a bridge will be required to accommodate the peak vehicular traffic within Marshall Space Flight Center. The need is based on extensive traffic surveys recently conducted by the Army Missile Support Command and the Center. In order to control the hazards resulting from increasing traffic congestion, the construction of limited access roads by-passing the main engineering areas, and interchanges with grade separation will be required.

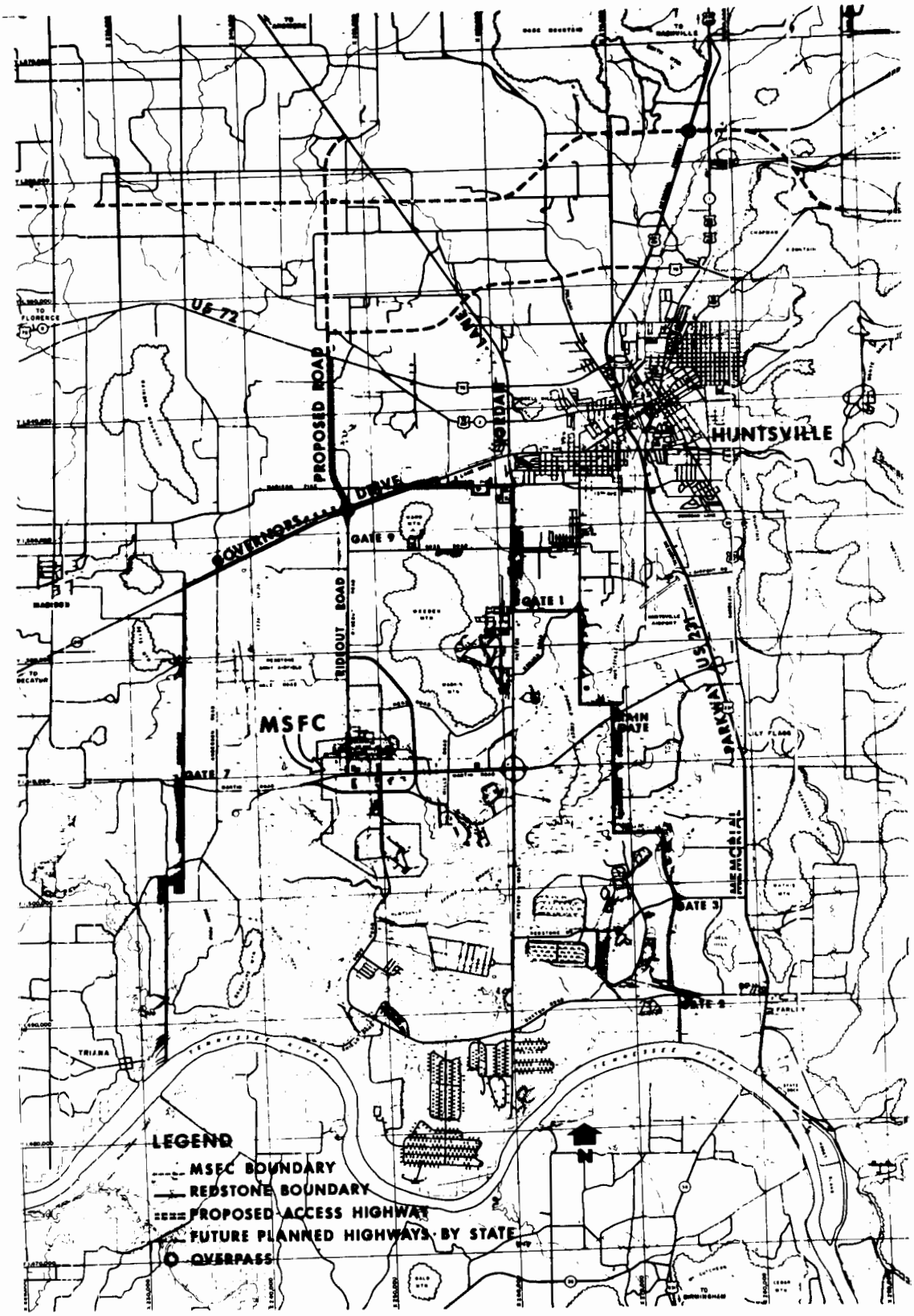
Utility additions include the six basic distribution systems, electric, sewer, communication, steam, potable and industrial water which are required to serve newly developed areas of construction. The communication ducts and cable are expansions of existing systems required to support new facilities which are included in this program. Additional cables, within the existing duct banks, will be required to transmit R&D test data as well as management data from the test area to the Computation Facilities.

ESTIMATED FUTURE YEAR FUNDING: None

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1966 ESTIMATES

EXTENSION OF UTILITY SYSTEM



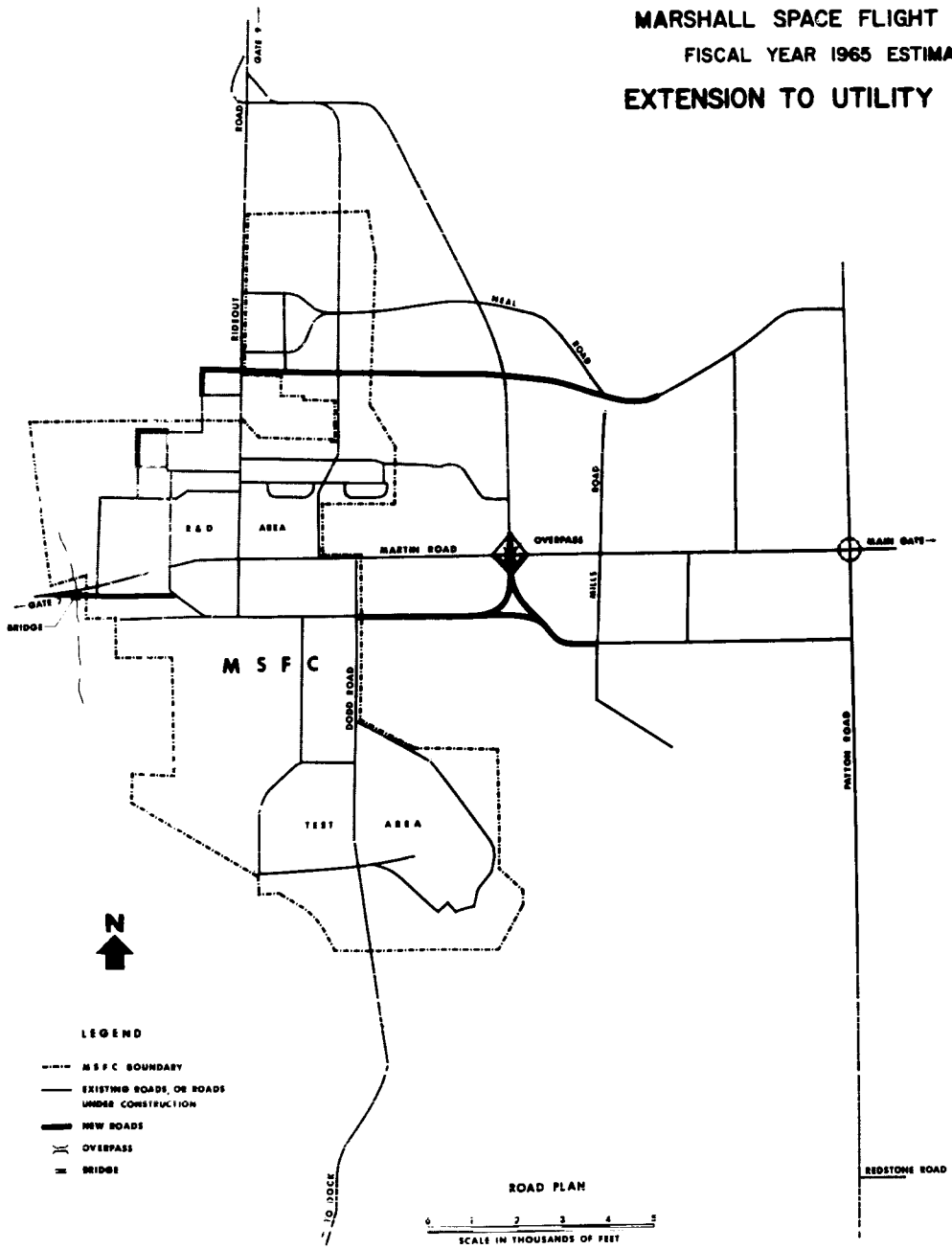
CF 9-25

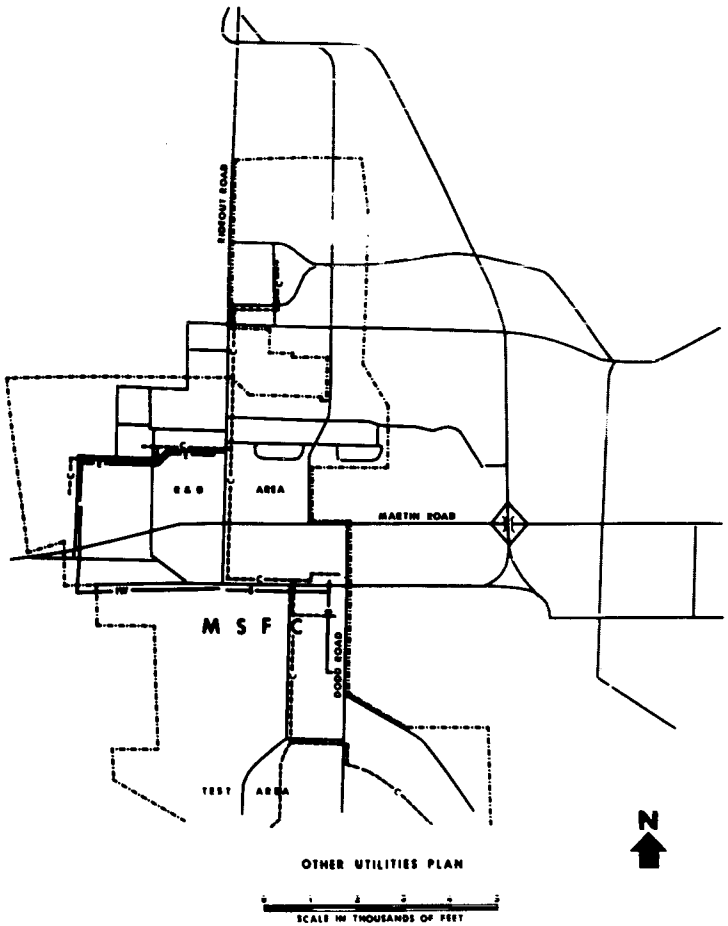
718-879 O - 64 - 18

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

EXTENSION TO UTILITY SYSTEM





CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

SATURN SUPPORT TEST AREA

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Marshall Space Flight Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: Alterations and Extensions

FUNDING:

FY 1963 and Prior Years	$10,947,000
FY 1964 Estimate	148,000
FY 1965 Estimate	3,206,000
Total Funding Through FY 1965	$14,301,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$2,744,000
Support				
Addition to high pressure gas storage 1,250 cubic feet	Each	5	$125,000	625,000
Transportation hangar building	Sq. Ft.	16,000	34.95	559,200
Addition to component support building	Sq. Ft.	11,200	20.71	232,000
Additional propellant & helium storage at East static test tower 1,250 cubic feet gas helium storage vessel	Each	1	160,000	160,000
28,000 gallon LOX tank	Each	1	60,000	60,000

	Unit of Measure	Quantity	Unit Cost	Total Cost
17,000 gallon RP-fuel tank	Each	1	$15,000	15,000
Gaseous hydrogen system 700 cubic foot gaseous hydrogen bottles	Each	3	87,000	261,000
Replacement of deflector pit at power test stand	Each	1	135,000	135,000
Acoustic control & communication center building	Sq. Ft.	4,750	31.16	148,000
Helium gas purification systems building	Sq. Ft.	600	20.00	12,000
Extension of building S-4747 high pressure air system	Sq. Ft.	1,600	25.50	40,800
1,250 cubic foot air bottles	Each	2	134,500	269,000
Site work	LS	---	85,000	85,000
Utilities & paving	LS	---	142,000	142,000
Equipment				$462,000
Hydrogen recharger for additional hydrogen system	LS	---	125,000	125,000
Gas purification equipment for helium gas purification system	LS	---	92,000	92,000
High pressure air system compressors (220 cubic feet @ 3,500 psi)	Each	4	61,250	245,000
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$3,206,000

PROJECT DESCRIPTION:

This project provides for alterations and extensions in the test area required for research and development acceptance testing related to the Saturn program.

Additional high pressure gas storage - Five 1,250 cubic foot (water measure) cylindrical steel pressure vessels for storage of nitrogen or helium gases at pressures up to 5,000 psi. Three of the pressure vessels will be located adjacent to the existing system in the West Test Area and

will be interconnected with the existing distribution system. The remaining two vessels will be located in a special test area where work on special projects will be performed.

Transportation hangar - Prefabricated metal building approximately 200 feet long by 75 feet wide and 70 feet high with attached locker room 40 x 25 x 15 feet high. A twenty-five ton overhead bridge crane, hangar type doors and concrete paving to access roads are included.

Addition to components support building - A T-shaped prefabricated metal structure with approximately 8,000 square feet of working area and 3,200 square feet of storage area for vehicle components. A fifteen ton overhead hoist will be installed in the 22 foot high bay area for handling heavy components.

Additional propellants and helium storage, East static test tower - Storage consisting of one 1,250 cubic foot (water measure) cylindrical steel pressure vessel for helium gas at 5,000 psi interconnected with the existing helium high pressure pipe line at the Liquid Hydrogen Facility; one 28,000 gallon vacuum jacketed cylindrical steel vessel for storage of liquid oxygen; one 17,000 gallon underground steel tank for RP fuel storage.

Gaseous hydrogen system - A 10,000 psi gaseous hydrogen recharger and three 700 cubic foot storage bottles with necessary piping are provided in this project. Two of the storage bottles will serve the components at the dynamic and cold calibration test areas while one bottle will serve the special test area.

Replacement of deflector pit at power plant test stand - The construction of a reinforced concrete pit approximately 150 feet long by 40 feet wide and 10 feet deep to replace the badly eroded existing deflector at the power plant test stand.

Acoustic control and communication center - A reinforced concrete building approximately 64 feet by 74 feet to house controls, instrumentation and communication equipment associated with acoustic measurements during test firing of S-IB and S-IC stages.

Helium gas purification system - A prefabricated metal building addition, approximately 20 feet by 30 feet, to the existing helium compressor building to house equipment used for removal of organic residuals from helium gas.

High pressure air system - An addition to the existing prefabricated metal compressor building which will house four 3,500 psi compressors will be about 40 feet square. Two 1,250 cubic foot bottles will be added to the existing air system storage battery.

PROJECT JUSTIFICATION:

The expansion and modernization of the high pressure gas and propellant system is a continuation of the planned phasing of the program initiated in fiscal year 1964 to accommodate increased requirements in the Saturn program. Quantities of high pressure gases and propellants associated with the Saturn IB and Saturn V are approximately five times those required by the Saturn I and previous projects.

The Transportation Hangar is required to provide an enclosed weather protected area for stage transporter maintenance and to accommodate booster stage modifications.

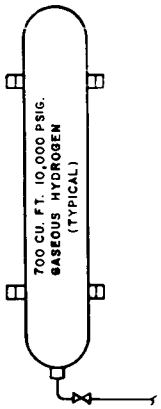
In addition, other support facilities required are an extension to the components support building to handle the larger components of the F-1 engine and S-IC stage; an acoustic control and communications center to provide a central point for rapid assembly and analysis of acoustic and meteorological measurements required for static test firing; and the replacement of an eroded deflector pit.

ESTIMATED FUTURE YEAR FUNDING: None

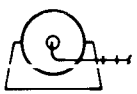
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

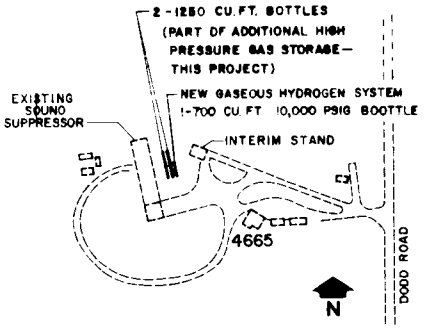
SATURN SUPPORT TEST AREA



PLAN
(SCHEMATIC ONLY)



ELEVATION
(SCHEMATIC ONLY)

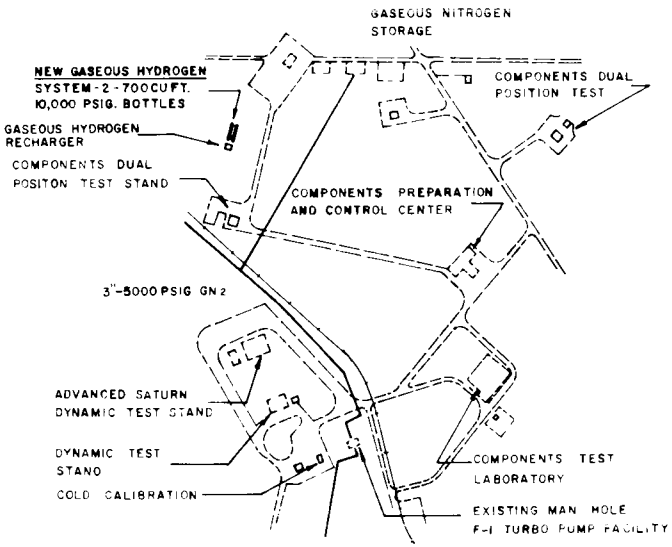


INSET — SPECIAL TEST AREA

SITE PLAN

0 200 400 800

SCALE IN FEET



SITE PLAN

0 200 400 600

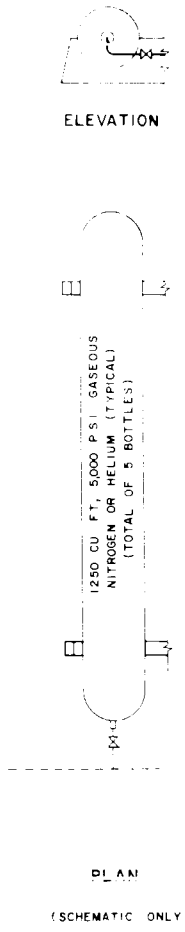
FEET

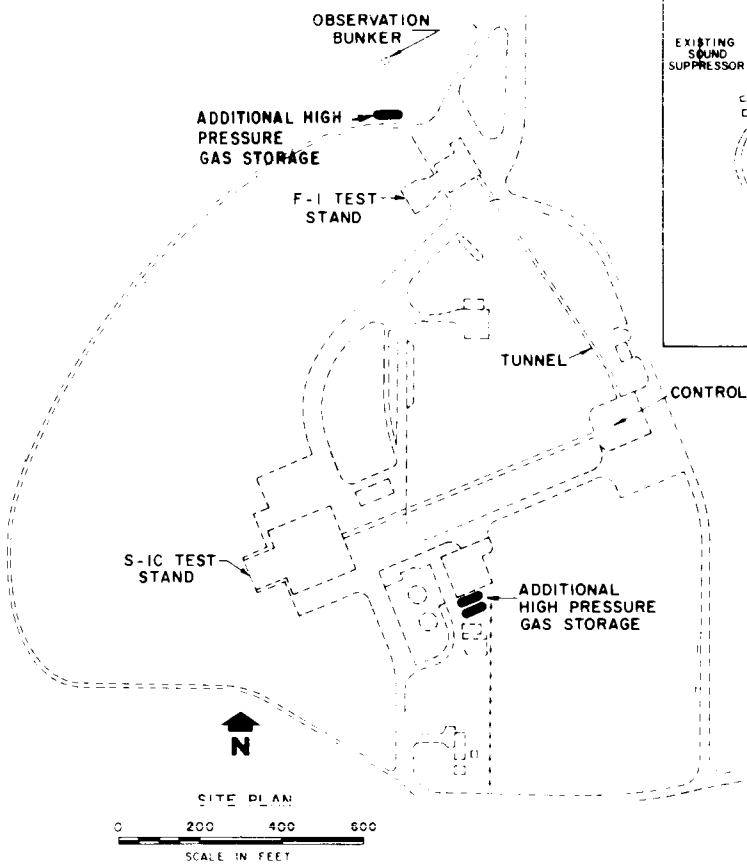
ADDITIONAL HIGH PRESSURE GAS STORAGE

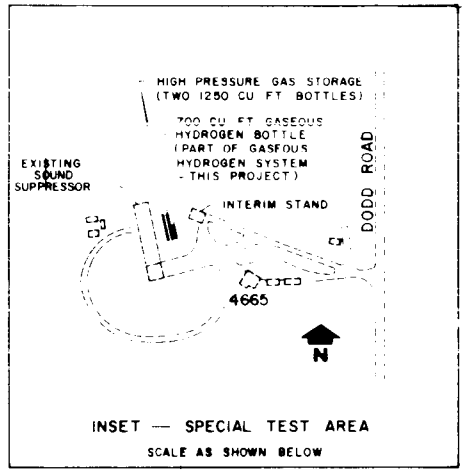
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

SATURN SUPPORT TEST AREA





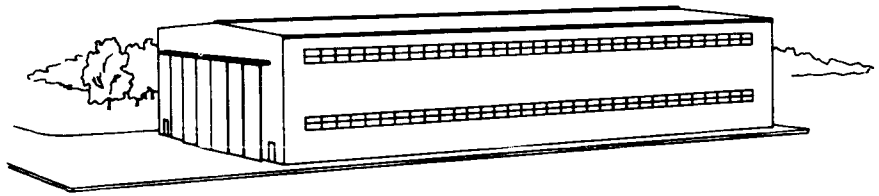


ADDITIONAL HIGH PRESSURE GAS STORAGE

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

SATURN SUPPORT TEST AREA



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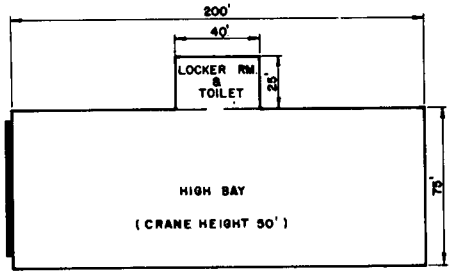
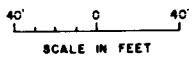
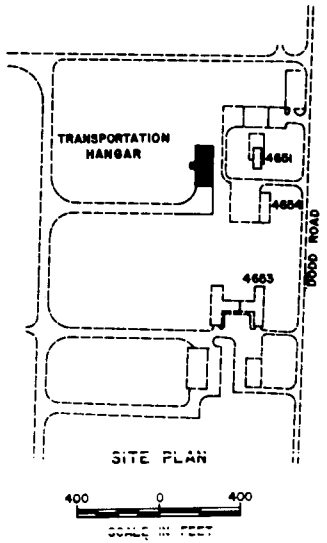


FLOOR PLAN





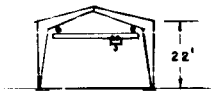
TRANSPORTATION HANGAR

CF 9-33

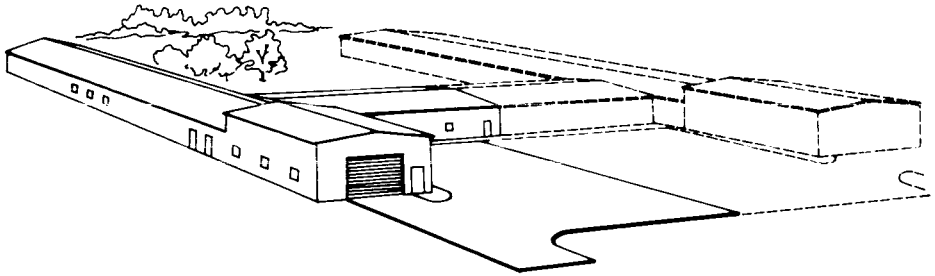
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

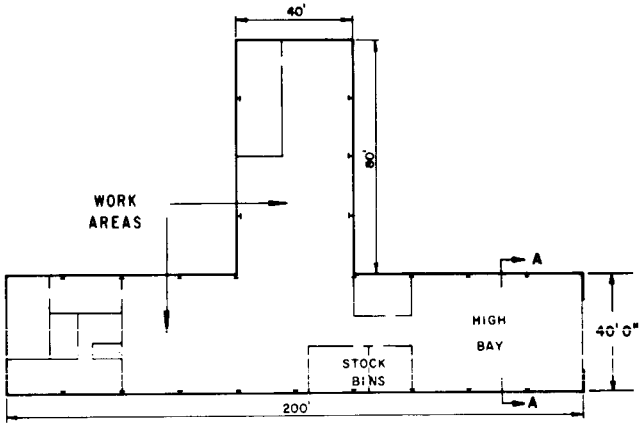
SATURN SUPPORT TEST AREA



SECTION A-A



PERSPECTIVE

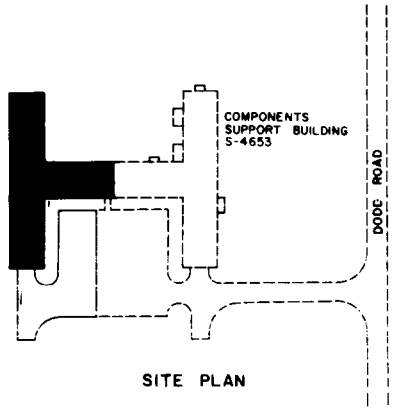


FLOOR PLAN

30' 0 30'

SCALE IN FEET

N



SITE PLAN

100 0 100

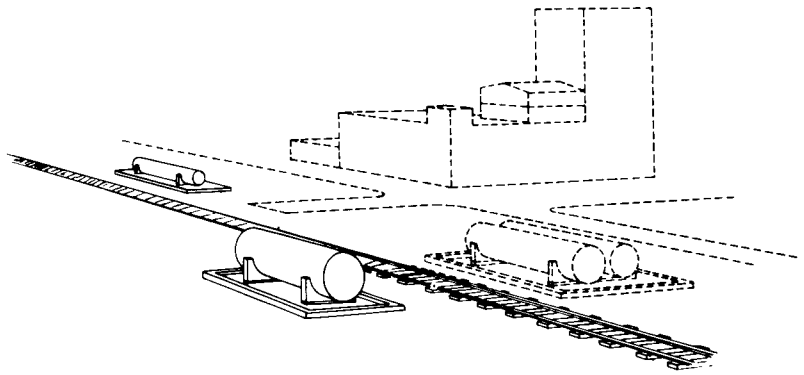
SCALE IN FEET

ADDITION TO COMPONENTS SUPPORT BUILDING

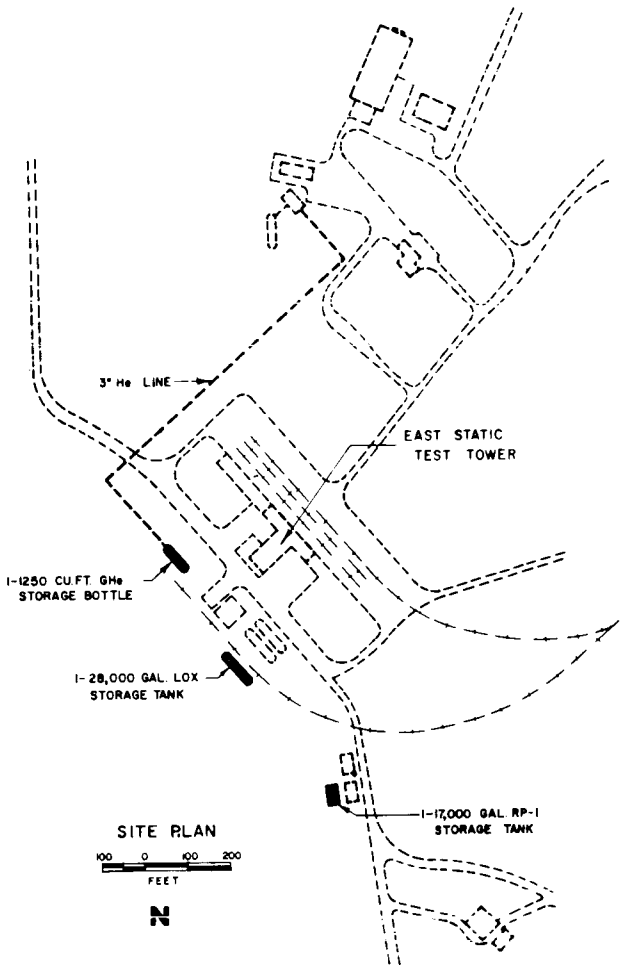
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

SATURN SUPPORT TEST AREA



PERSPECTIVE



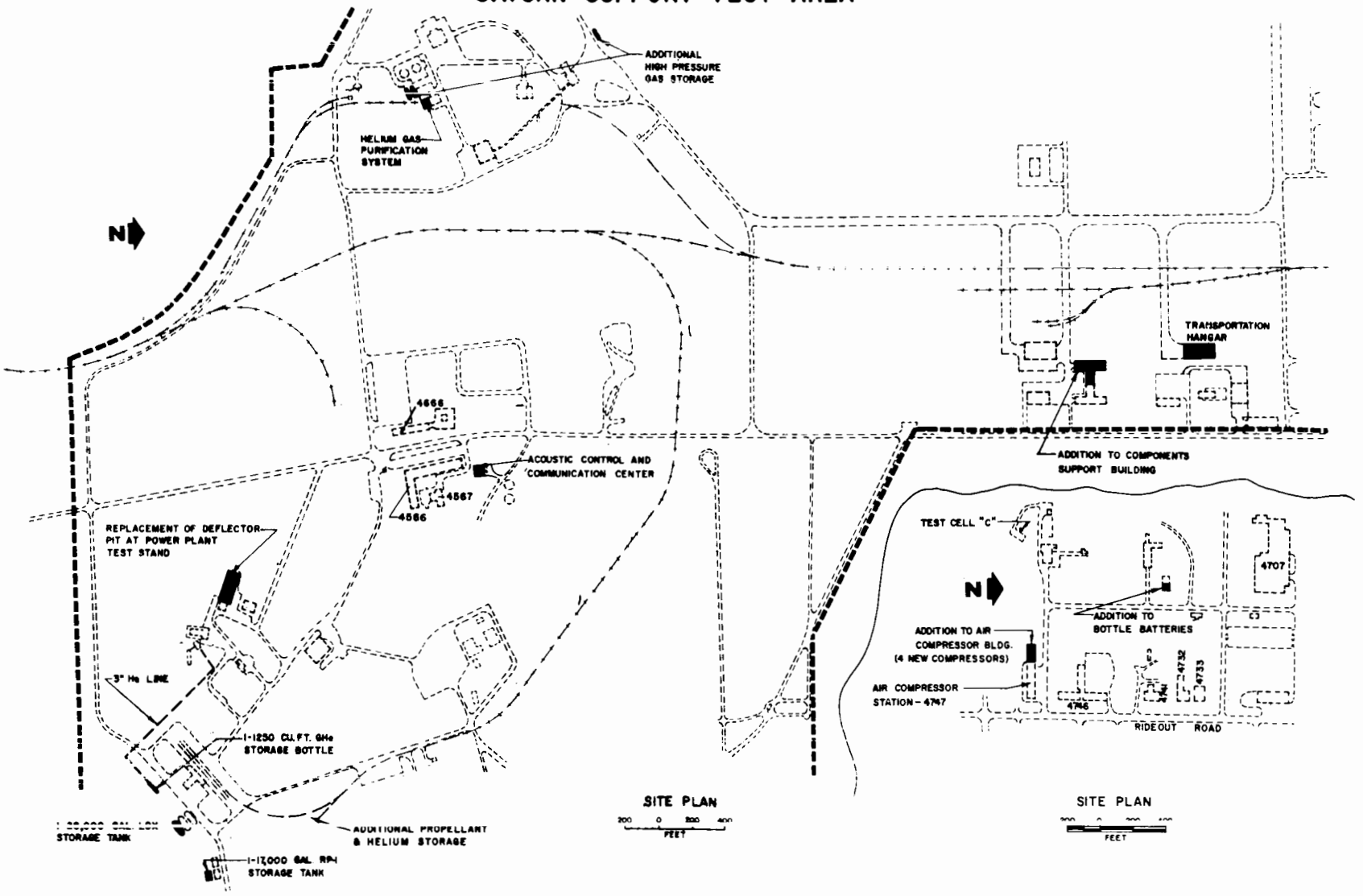
CF 9-35

ADDITIONAL PROPELLANTS & HELIUM STORAGE AT EAST STATIC TEST TOWER

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

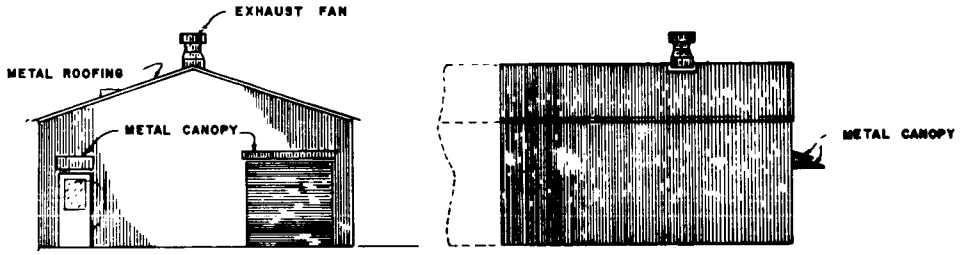
SATURN SUPPORT TEST AREA



MARSHALL SPACE FLIGHT CENTER

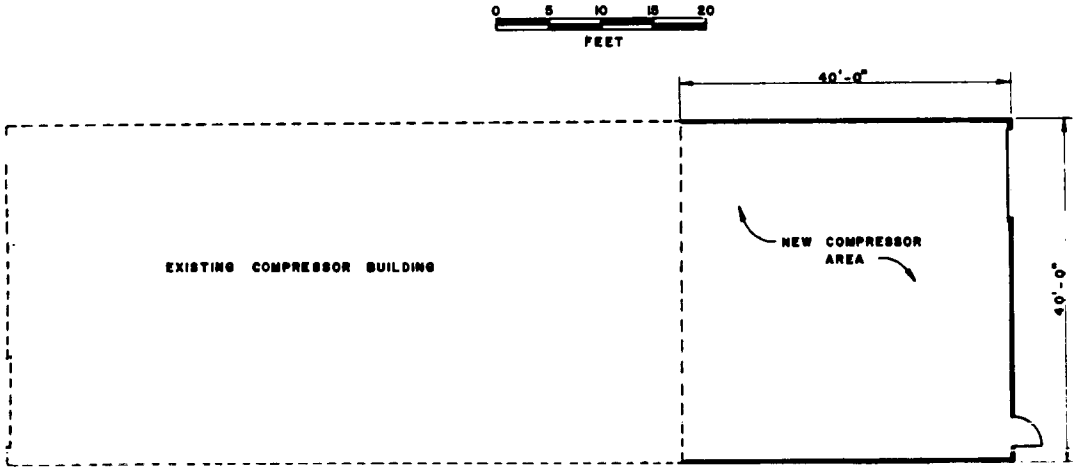
FISCAL YEAR 1965 ESTIMATES

SATURN SUPPORT TEST AREA



WEST ELEVATION

NORTH ELEVATION



PLAN

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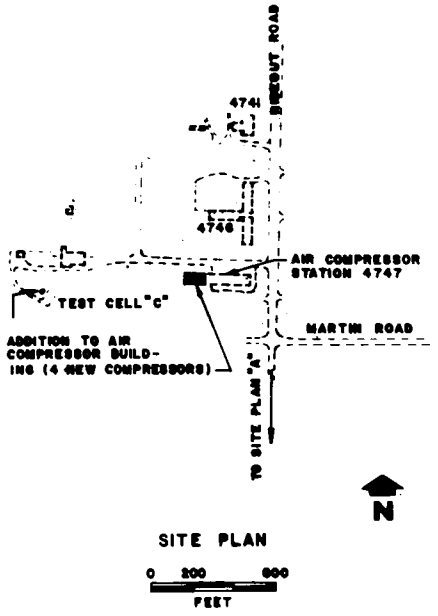
FEET



SITE PLAN

0 200 600
FEET

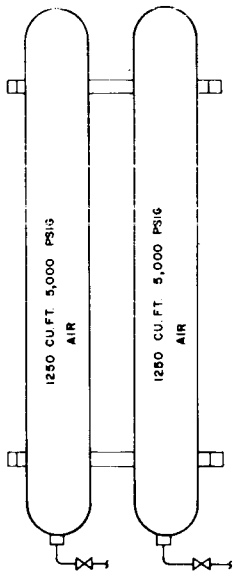
HIGH PRESSURE AIR SYSTEM

CF 9-37

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

SATURN SUPPORT TEST AREA



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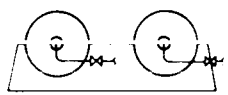

ELEVATION
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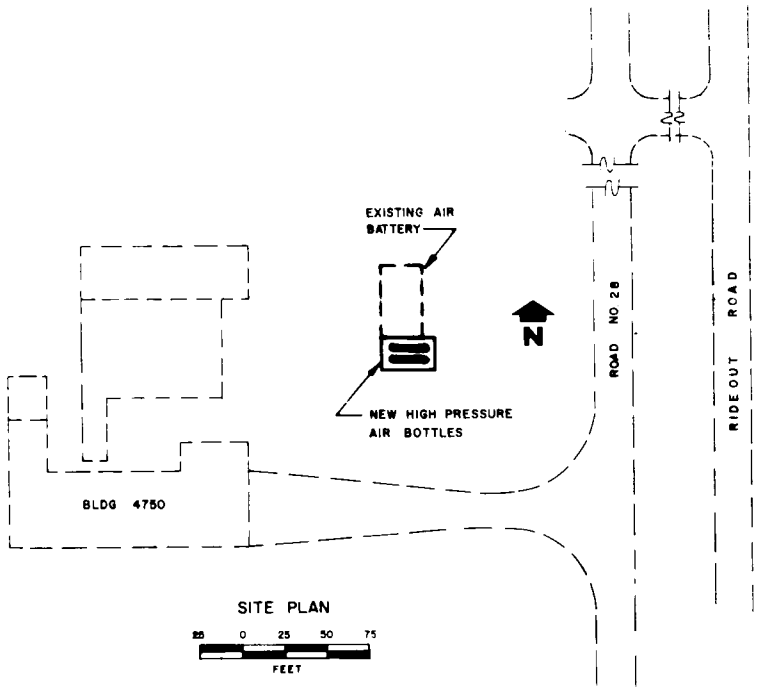


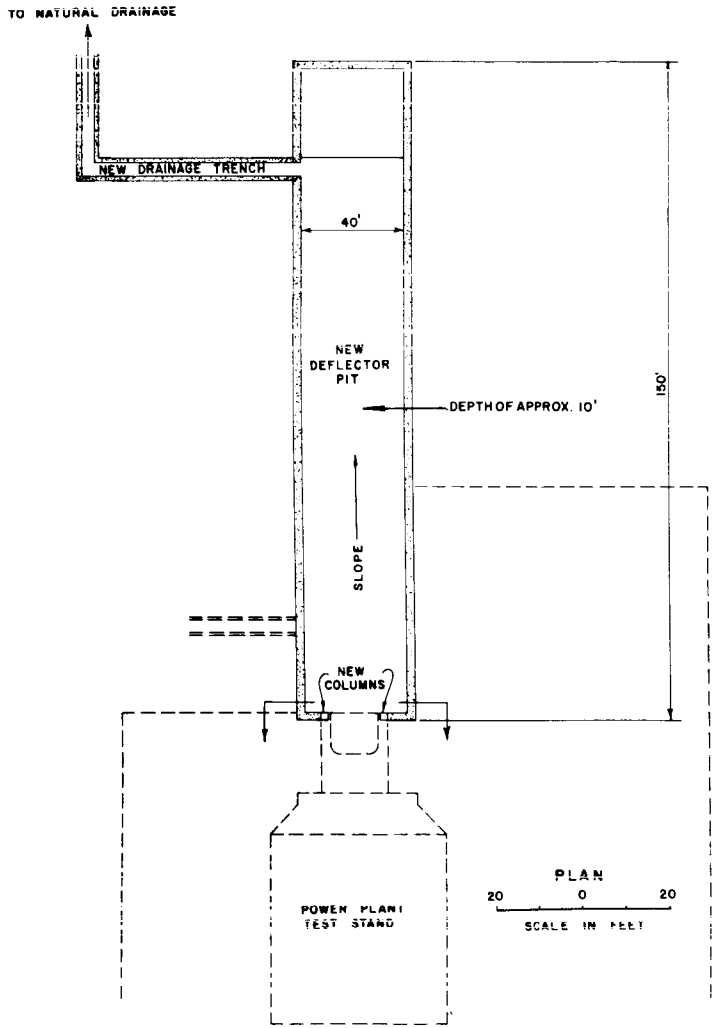
HIGH PRESSURE AIR SYSTEM

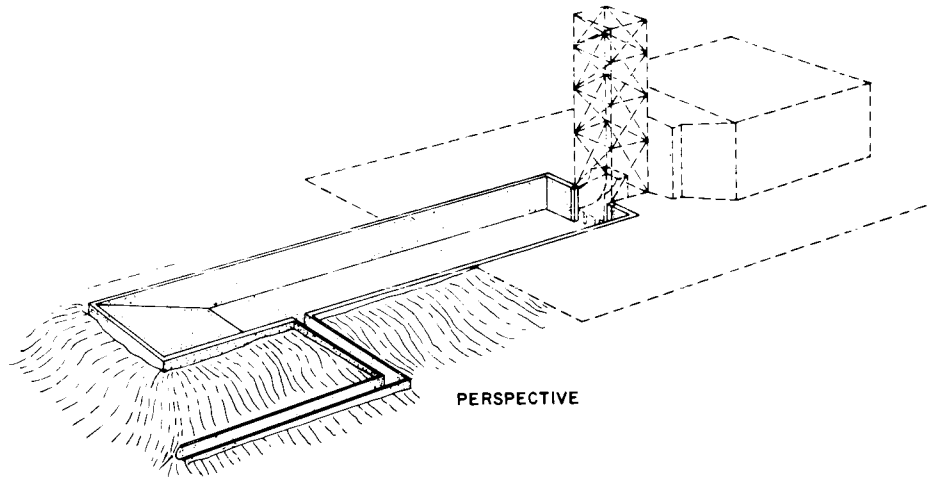
CF 9-38

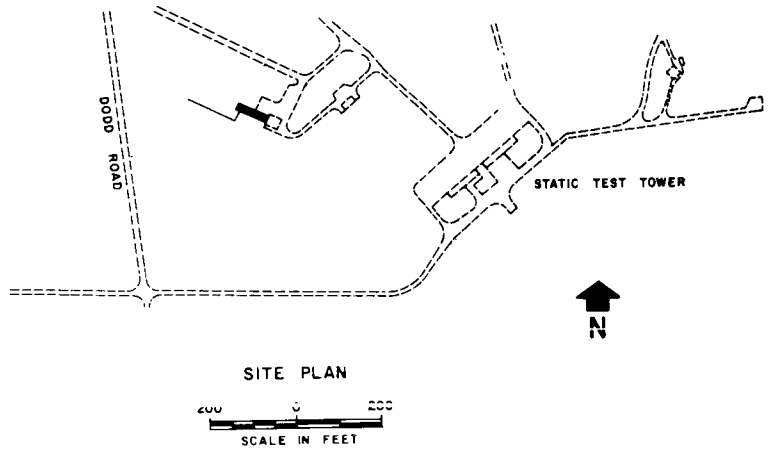
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

SATURN SUPPORT TEST AREA





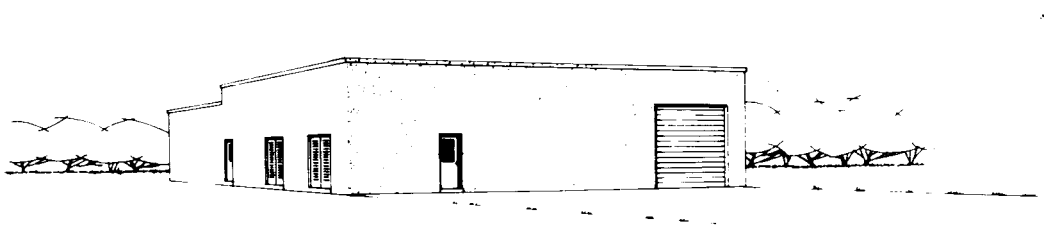


REPLACEMENT OF DEFLECTOR PIT AT POWER PLANT TEST STAND

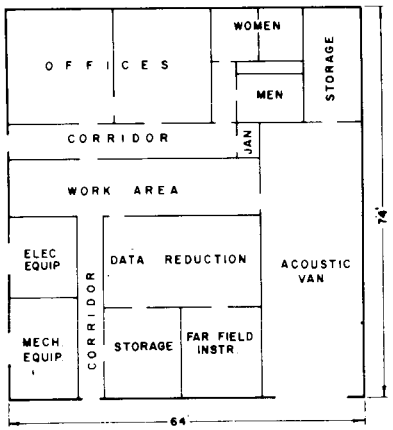
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

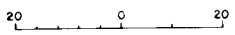
SATURN SUPPORT TEST AREA



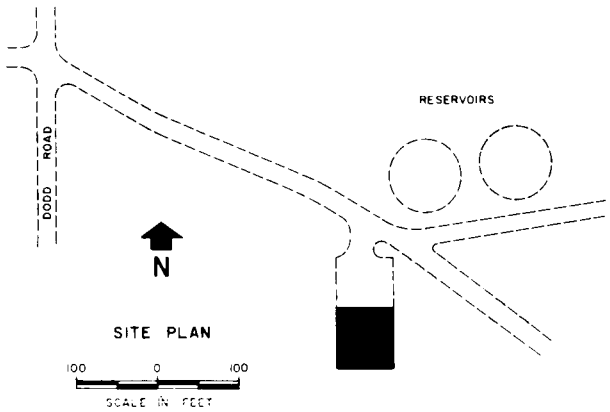
PERSPECTIVE



FLOOR PLAN



SCALE IN FEET



SITE PLAN

SCALE IN FEET

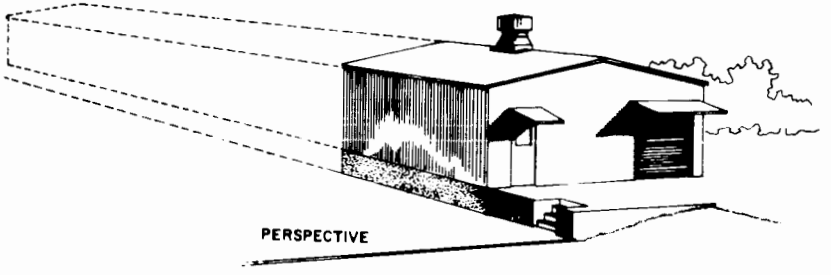
ACOUSTIC CONTROL AND COMMUNICATION CENTER

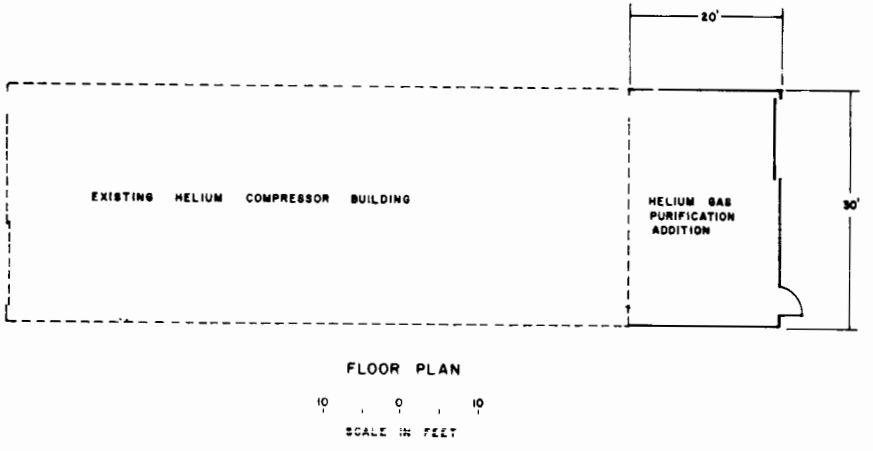
CF 9-40

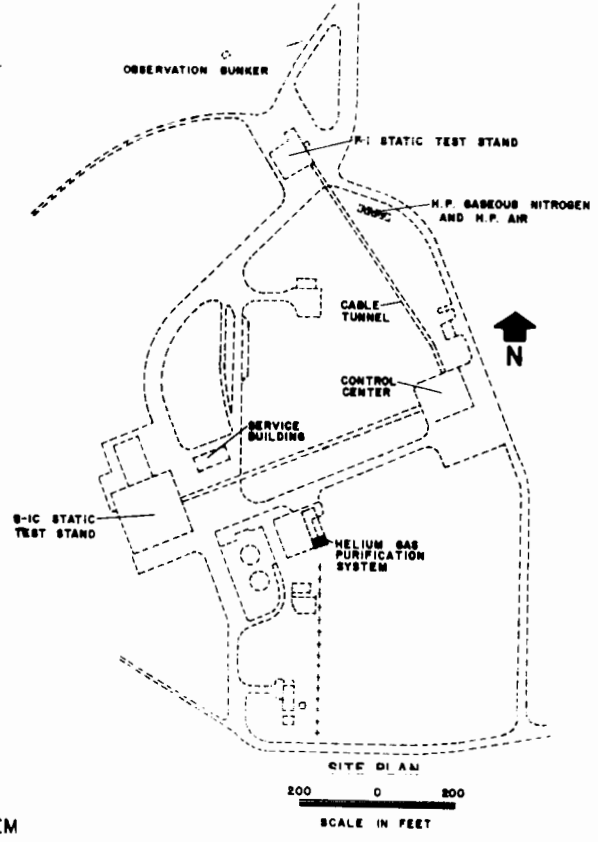
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1965 ESTIMATES

SATURN SUPPORT TEST AREA







HELIUM GAS PURIFICATION SYSTEM

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

FACILITY ADDITIONS, EXTENSIONS AND ALTERATIONS TO SUPPORT S-IB AND S-IC PRODUCTION

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Michoud Plant

LOCATION OF PROJECT: New Orleans, Orleans Parish, Louisiana

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: New, Alteration, Extension

FUNDING:

FY 1963 and Prior Years	---
FY 1964 Estimate	$161,000
FY 1965 Estimate	2,735,000
Total Funding Through FY 1965	$2,896,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$2,666,900
Site preparation, roadways, and paving	LS	---	$584,200	584,200
Contractor services building	Sq. Ft.	74,300	19.43	1,443,500
Extension to saturn marine dock	LS	---	294,300	294,300
Alterations to booster hangar	LS	---	344,900	344,900
Equipment	---	---	---	---
Design	---	---	---	---
		Subtotal		$2,666,900

	Unit of Measure	Quantity	Unit Cost	Total Cost
Fallout Shelter				$68,100
		TOTAL		$2,735,000

PROJECT DESCRIPTION:

This project provides the following items: (1) Construction of an "L" shaped contractor services building of approximately 74,300 square feet, to house firefighting, plant security, communication, medical, photographic, printing reproduction, automotive-maintenance and administrative functions; (2) Extensions to the Saturn marine dock to provide approximately 15,000 additional square feet and a port operations building of approximately 2,400 square feet; (3) Alterations to an existing 70,000 square foot hangar to permit the storage of stages awaiting shipment and/or refurbishment.

PROJECT JUSTIFICATION:

The Contractor services building is needed to combine the Saturn S-IB and S-IC support services into a single centrally located facility. Existing facilities are either too small or obsolete. The existing fire station shed must be replaced because it is now ineffectively located in a highly congested shipping and receiving area which inhibits rapid movement. In addition, the existing facility is too small to accommodate increased equipment assignments, nor does it provide sleeping quarters which in turn leads to a three-shift operation. The existing communication center cannot accommodate equipment needed to support existing buildings and those currently under construction. The infirmary now available was designed to support a maximum of 7,000 personnel, whereas the present staffing plan calls for more than 9,000 to be located at Michoud. A larger facility is therefore required. The reproduction, printing and photographic workload has increased to such a degree that present facilities are totally inadequate. Although major automotive repairs are performed in local commercial shops, first and second echelon maintenance must be performed at the Plant for approximately 600 pieces of vehicular equipment. Existing facilities are capable of supporting only one-half this number.

Extension to Saturn marine dock - Port Michoud is the center of transportation operations for the loading and unloading of boosters manufactured at Michoud and the trans-shipment of all West Coast stages to the Mississippi Test Facility. Port Michoud will also be used as a trans-shipping point for all stages from MTF to the Cape. The Port will service the following type waterborne equipment: two River - Trans/Gulf Barges (48 feet beam, 260 feet length); two MTF shuttle barges (48 feet beam; 260 feet length); one West Coast barge (48 feet beam, 260 feet length); two Point Barrow type ships (72 feet beam, 465 feet

length); one "J" boat (12 feet - 6 inches beam, 45 feet length); and various steel barges (33 feet beam, 20 feet length).

To accommodate the processing of this quantity of cargo, it is necessary to enlarge the existing dock and provide an operations building.

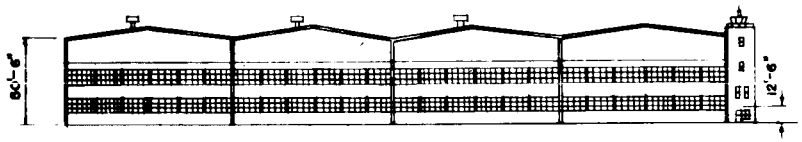
Alterations to existing hangar - Stage boosters must be stored in controlled environments while awaiting shipment or pending refurbishment at Michoud. This can be accomplished in the most economical manner by altering and repairing an existing hangar building and adding the proper environmental control equipment.

ESTIMATED FUTURE YEAR FUNDING: None

MICHOUD OPERATIONS

FISCAL YEAR 1965 ESTIMATES

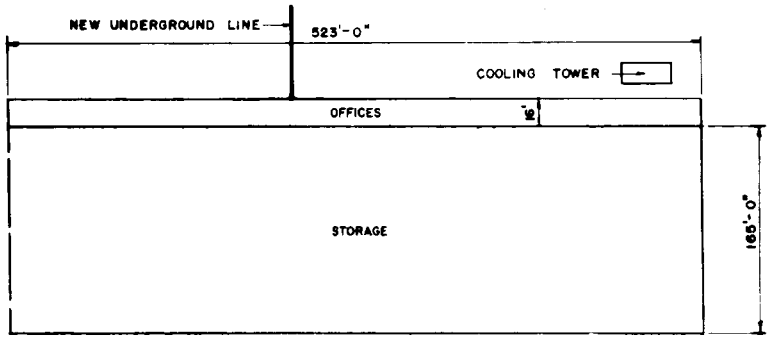
FACILITY ADDITIONS, EXTENSIONS AND ALTERATIONS TO SUPPORT SATURN S-IB & S-IC PRODUCTION



WEST ELEVATION

0 50 100

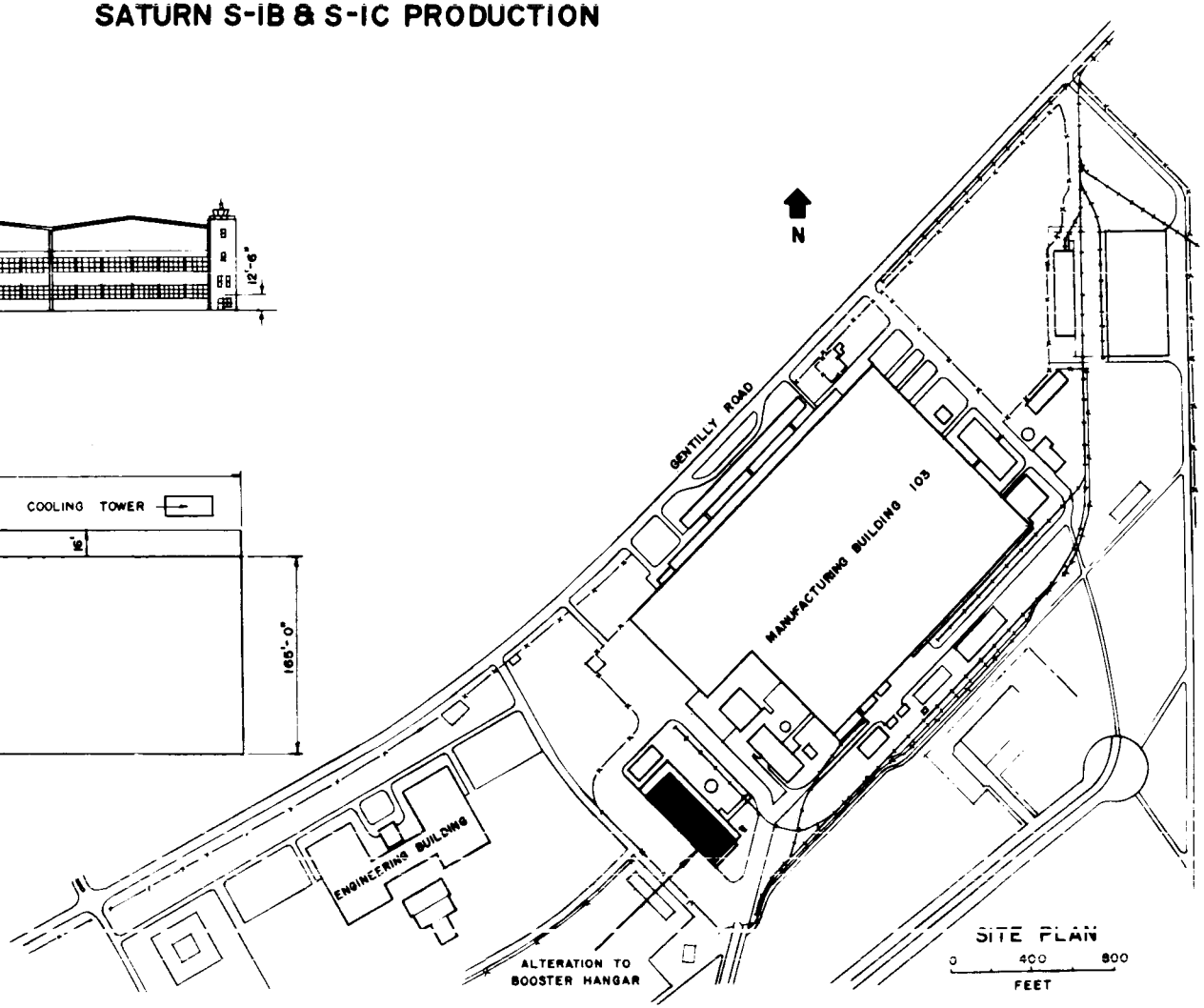
FEET



FLOOR PLAN

0 50 100

FEET



SITE PLAN

0 400 800

FEET

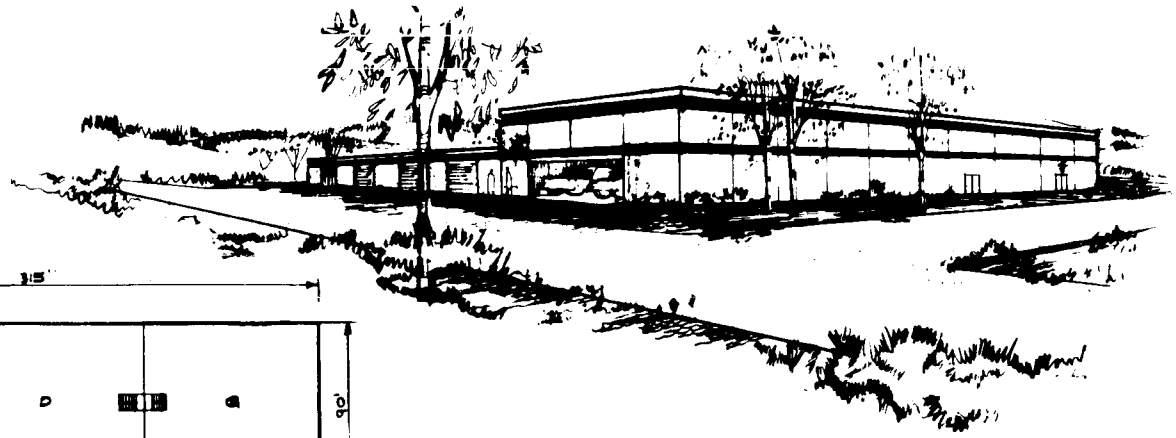
ALTERATION TO BOOSTER HANGAR

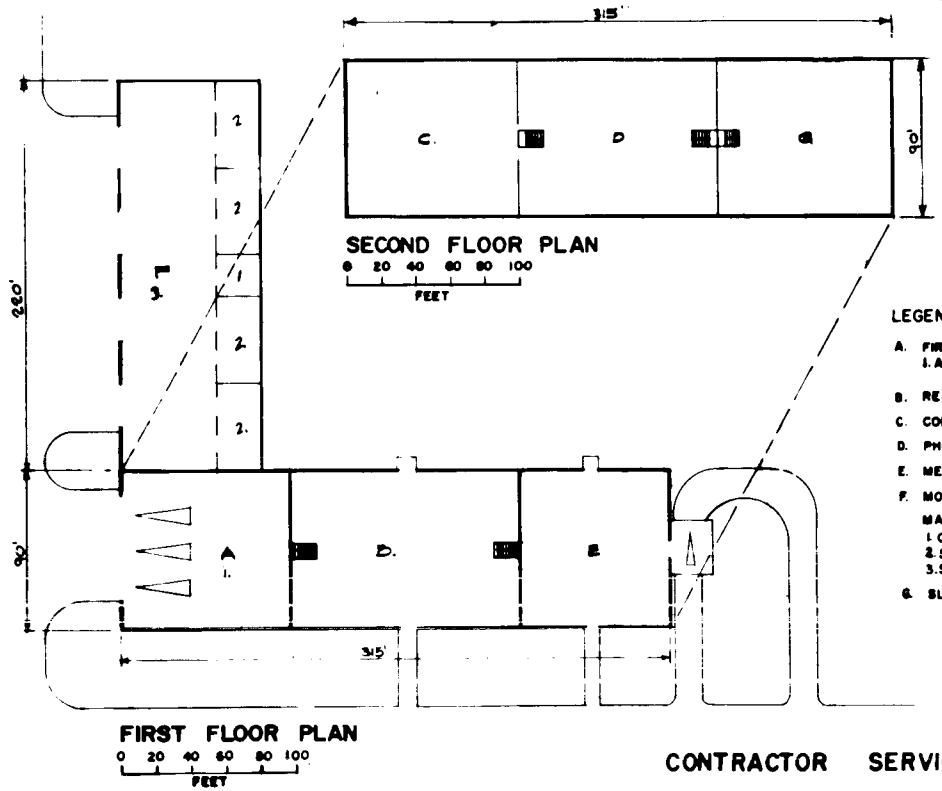
CF 10-6

MICHOUD OPERATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITY ADDITIONS, EXTENSIONS AND ALTERATIONS TO SUPPORT SATURN S-IB & S-IC PRODUCTION





SECOND FLOOR PLAN

0 20 40 60 80 100

FEET

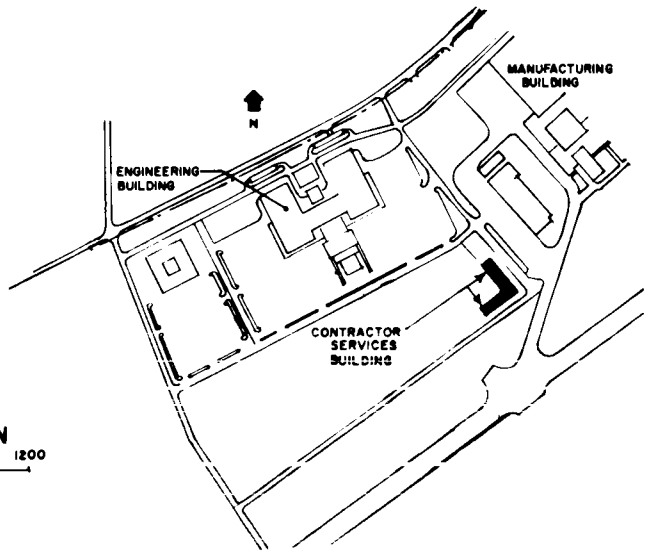
FIRST FLOOR PLAN

0 20 40 60 80 100

FEET

LEGEND

A. FIREHOUSE AND GUARDHOUSE
   1. ADMINISTRATION
B. REPRODUCTION
C. COMMUNICATIONS
D. PHOTOGRAPHY
E. MEDICAL CLINIC
F. MOTOR POOL & AUTOMOTIVE MAINTENANCE
   1. OFFICE
   2. SUPPLIES
   3. SHOP
G. SLEEPING QUARTERS



SITE PLAN

0 600 1200

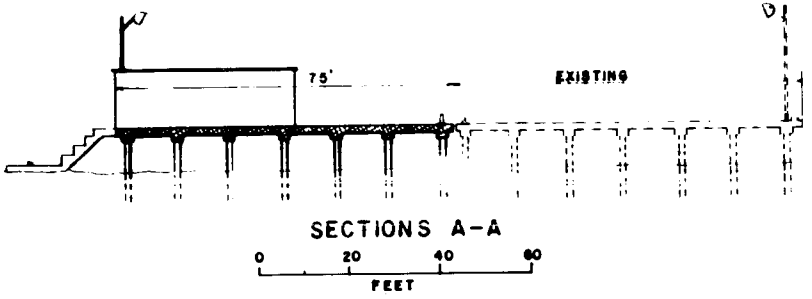
FEET

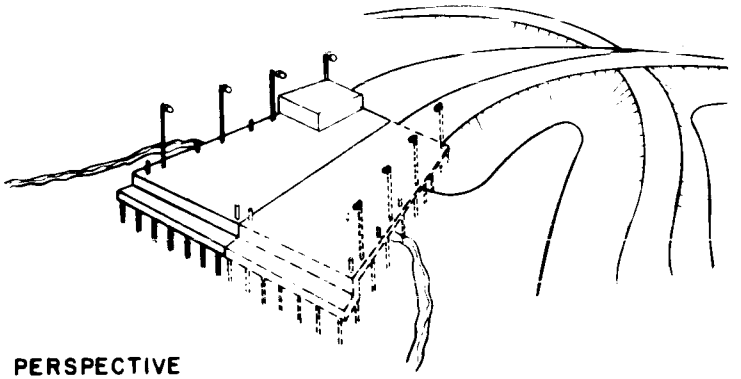
CONTRACTOR SERVICES BUILDING

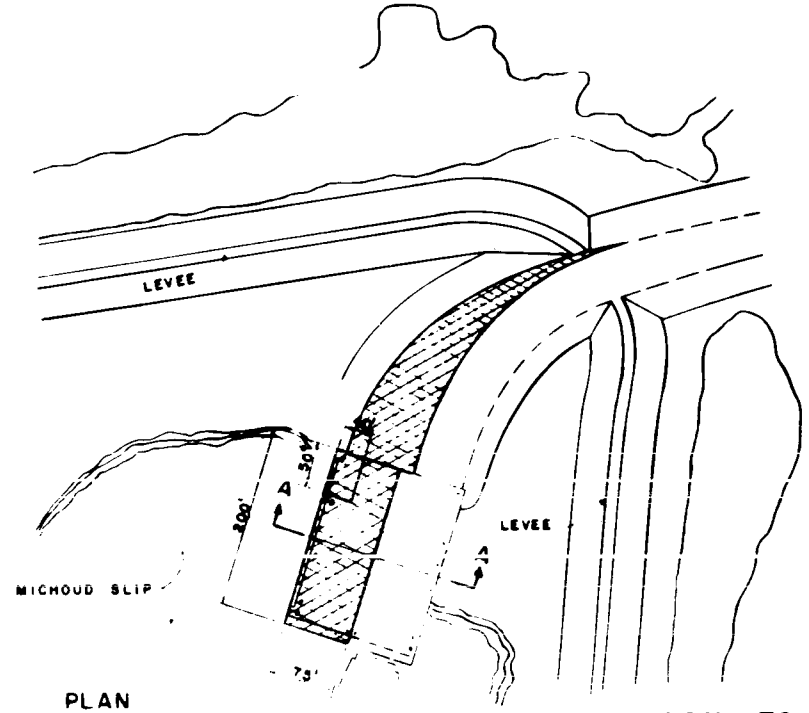
MICHOUD OPERATIONS

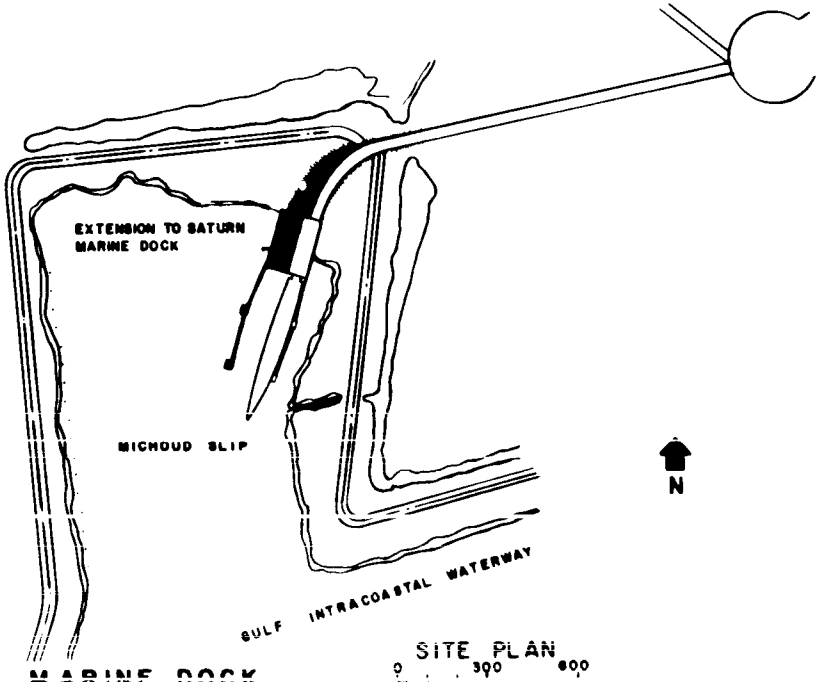
FISCAL YEAR 1965 ESTIMATES

FACILITY ADDITIONS, EXTENSIONS AND ALTERATIONS TO SUPPORT SATURN S-IB & S-IC PRODUCTION




PERSPECTIVE





EXTENSION TO SATURN MARINE DOCK

CF 10-3

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

ALTERATIONS TO SATURN FIRST STAGE PRODUCTION FACILITIES

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Michoud Plant

LOCATION OF PROJECT: New Orleans, Orleans Parish, Louisiana

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: Alteration

FUNDING:

FY 1963 and Prior Years	---
FY 1964 Estimate	$36,000
FY 1965 Estimate	628,000
Total Funding Through FY 1965	$664,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$628,000
S-1C Tank weld position No. 3	LS	---	$282,000	282,000
Tooling foundations	LS	4,900	191,000	191,000
Overhead bridge cranes	LS	---	155,000	155,000
Equipment	---	---	---	---
Design	---	---	---	---

	Unit of Measure	Quantity	Unit Cost	Total Cost
Fallout Shelter	---	---	---	---
		TOTAL		$628,000

PROJECT DESCRIPTION

This project provides for construction of the following items:

Tank weld assembly position No. 3. A third tank assembly position within the existing Vertical Assembly Building. The assembly tower will be approximately 60 feet by 60 feet by 106 feet high, fabricated of structural steel. Three work platforms for the welding areas of the tank will be provided.

Tooling foundations. Special reinforced concrete foundations to support additional weld and assembly fixtures are required in the Minor Assembly Area for production of the S-1C booster.

Overhead bridge cranes. The purchase and installation of: (1) a 15-ton electrically operated bridge crane with five-step variable speeds on bridge trolley and hoist with a sixty-foot span and eighty-foot runway to be located in the Engine Buildup Area and (2) a five-ton crane with 80-foot span and 100-foot runway located in the Production Parts Control Area. (3) Associated building truss modifications and electrical work.

PROJECT JUSTIFICATION:

Tank weld assembly position No. 3. To meet the presently scheduled S-1C delivery rate, a third tank assembly position is needed to fabricate and rework S-1C LOX and Fuel Tanks. This position is required to be available to handle the S-1C-4 in November 1965.

Tooling foundation. Foundations must be individually designed for each specific tool because of the type of subsoil conditions in the area.

Overhead bridge cranes. A bridge crane is required to transfer F-1 engines from the shipping containers to the thrust chamber dolly fixture and thence to the engine installer dolly. The weight, value, and precision-type handling required prohibit the use of portable rigs. The five-ton crane is required to move S-1C stage components into and out of the Production Parts Control area. Transferring these parts by overhead bridge crane will reduce safety hazards, improve space utilization and efficiency and minimize the possibility of damage to components being moved into and out of the area.

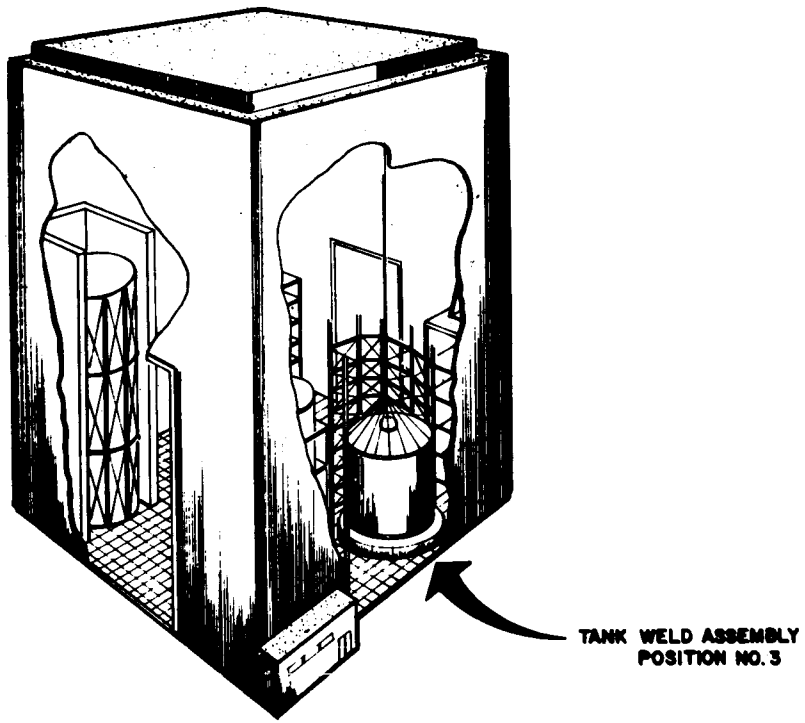
ESTIMATED FUTURE YEAR FUNDING: None

718-879 O - 64 - 21

MICHOUD OPERATIONS

FISCAL YEAR 1965 ESTIMATES

ALTERATIONS TO SATURN FIRST STAGE PRODUCTION FACILITIES



PERSPECTIVE

S-IC TANK WELD ASSEMBLY POSITION NO. 3

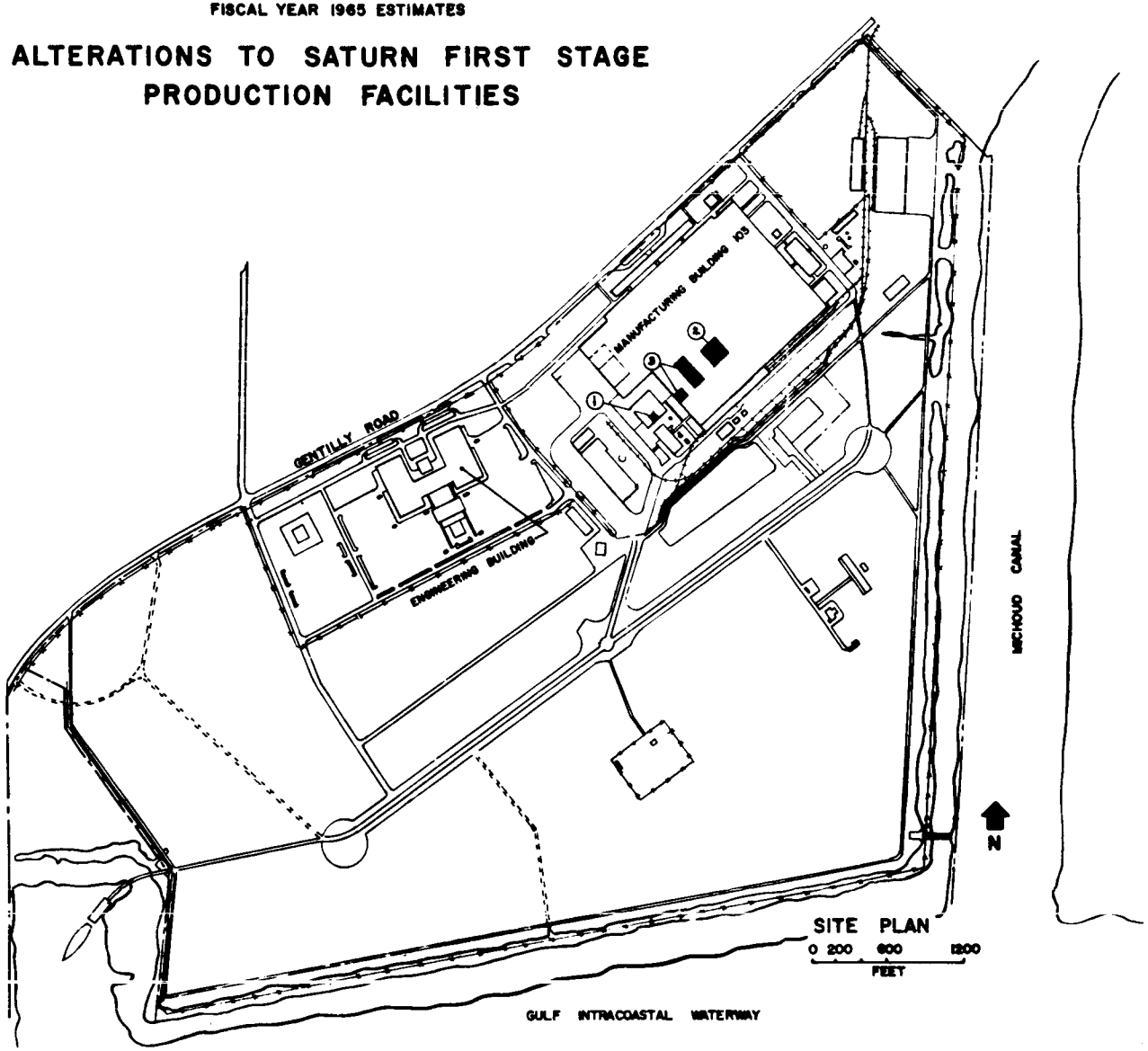
MICHOUD OPERATIONS

FISCAL YEAR 1965 ESTIMATES

ALTERATIONS TO SATURN FIRST STAGE PRODUCTION FACILITIES

LEGEND

1 S-IC TANK WELD ASSEMBLY POSITION NO. 3
2 TOOLING FOUNDATIONS
3 OVERHEAD BRIDGE CRANES



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

CENTRAL COMPUTER FACILITY EXTENSIONS AND ALTERATIONS

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Michoud Plant

LOCATION OF PROJECT: Slidell, St. Tammany Parish, Louisiana

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: Extension and Alteration

FUNDING:

FY 1963 and Prior Years	$390,000
FY 1964 Estimate	85,000
FY 1965 Estimate	1,160,000
Total Funding Through FY 1965	$1,635,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,160,000
Building extensions	Sq. Ft.	33,400	$32.52	1,086,400
Building alterations	Sq. Ft.	6,600	11.15	73,600
Equipment	---	---	---	---
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$1,160,000

PROJECT DESCRIPTION:

This project provides for an extension and alterations to the existing Central Computer Facility which serves NASA Michoud Plant, Mississippi Test Facility (MTF), Chrysler Corporation (S-IB stage contractor), the Boeing Company (S-IC stage contractor), Mason-Rust (support contractor at Michoud), North American Aviation (S-II stage contractor), and General Electric (support contractor at MTF). The extension will provide for approximately 33,400 square feet of additional space which will be divided into a basement, first and second floors. Construction features will include steel and reinforced concrete framework, concrete floor, and prefabricated metal panel curtain walls which will match the existing building. The utility system will be expanded to accommodate the new structure. In addition, alterations will be made within the existing structure to effect maximum utilization of space.

PROJECT JUSTIFICATION:

The Facility is NASA managed with operational functions performed by a computer specialist contractor (Telecomputing Services, Inc.), and computer programs prepared by the various NASA contractors. Space requirements at the Central Computer Facility includes space for the computers and allied equipment; data transmission equipment; NASA supervisory-management personnel; and programming-engineering personnel representatives of each of the contractors: Chrysler Corporation, The Boeing Company, Mason-Rust, General Electric Company and North American Aviation, totalling approximately 320 contractor personnel and ten NASA personnel.

The existing former Federal Aviation Administration building is not adequate to house the equipment and operating personnel needed to support the Saturn computer requirements through fiscal year 1965 at Michoud and Mississippi Test Facility.

The existing areas, plus the new addition, will yield approximately 60,000 net square feet. The space will provide about 32,000 square feet needed for computer areas, and 28,000 square feet needed for general support space.

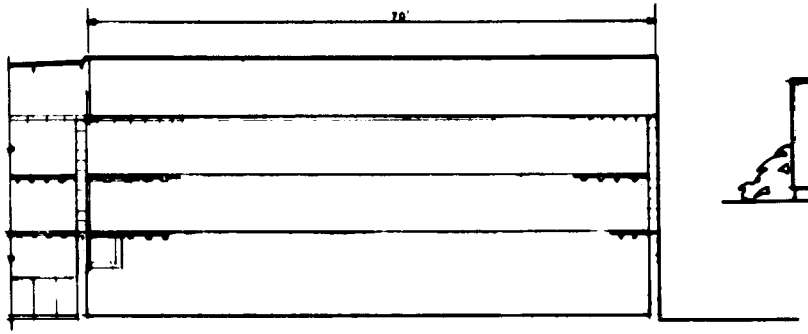
It is essential that additional computer capability become available in the proper time to support the Michoud and Mississippi Test Facility. The proposed extension has been scheduled to keep pace with the static test activity at the Mississippi Test Facility which will achieve major operational status during 1966.

ESTIMATED FUTURE YEAR FUNDING: None

MICHOUD OPERATIONS

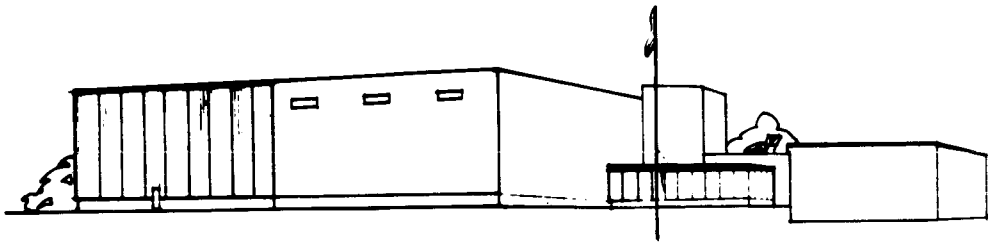
FISCAL YEAR 1965 ESTIMATES

CENTRAL COMPUTER FACILITY EXTENSIONS AND ALTERATIONS

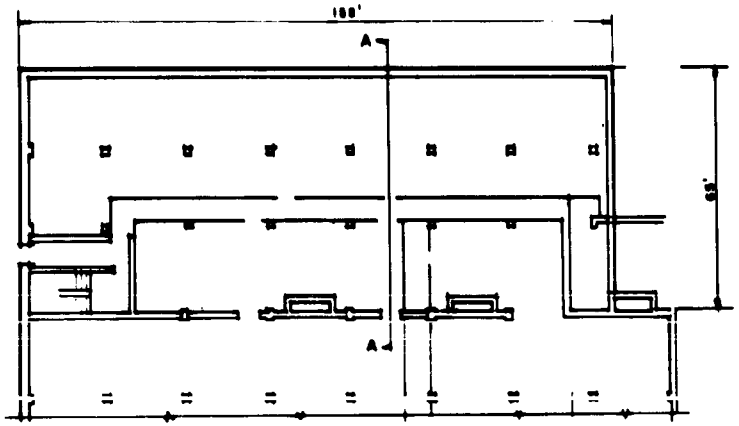


SECTION "A-A"

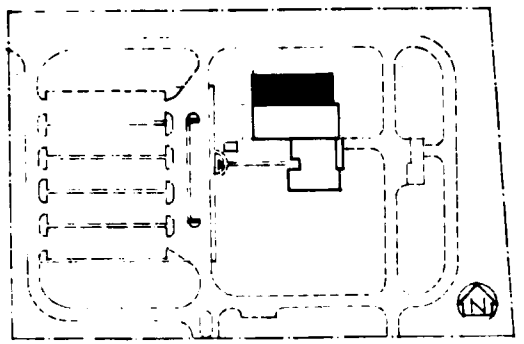
0 10 20
FEET



PERSPECTIVE



FLOOR PLAN
NOT TO SCALE



SITE PLAN

0 100 200
FEET

SLIDELL, LOUISIANA

CF 10-15

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

UTILITY EXTENSION, ALTERATION AND REHABILITATION TO SUPPORT SATURN S-IB AND S-IC PRODUCTION

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Michoud Plant

LOCATION OF PROJECT: New Orleans, Orleans Parish, Louisiana

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: Extension and Alteration

FUNDING:

FY 1963 and Prior Years	---
FY 1964 Estimate	$80,000
FY 1965 Estimate	2,011,000
Total Funding Through FY 1965	$2,091,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$2,011,000
Additional electrical power	LS	---	$526,000	526,000
Plant water distribution system	LS	---	483,000	483,000
Plant air conditioning filters	LS	---	283,000	283,000
Boilers and auxiliary equipment	LS	---	719,000	719,000
Equipment	---	---	---	---
Design	---	---	---	---

	Unit of Measure	Quantity	Unit Cost	Total Cost
Fallout Shelter	---	---	---	---
			TOTAL	$2,011,000

PROJECT DESCRIPTION:

This project provides for the following utility items essential to support approved S-1B and S-1C production schedules:

Additional Electrical Power Facility. This item provides for an addition to the west substation of the Michoud Complex, which includes an underground duct power distribution system to the load areas, and four additional distribution substations. The main substation addition will consist of two 115 KV-13.8 KV, 7,500 KVA transformers, 115 KV oil breakers, steel switch structures, 115 KV switches, and appropriate 13.8 KV switch gear.

Plant Water Distribution Systems. This item provides for an additional twelve-inch water main and the replacement of existing potable water and fire extinguishing distribution systems.

Plant Air Conditioning Filters. This item provides for the replacement of low-efficiency filters with high-efficiency filters in the fifty (50) factory air conditioning penthouses located on the roof of the plant above the S-1C manufacturing area.

Boilers and Auxiliary Equipment. This item provides for the continued rehabilitation and/or replacement of existing boiler units of the central heating and air conditioning system.

ADDITIONAL ELECTRICAL POWER FACILITY

PROJECT JUSTIFICATION:

Additional Electrical Power Facility. The existing electrical power system at Michoud Operations has a capacity of 45,000 KVA and consists of one main substation of 30,000 KVA capacity, 115 KV to 13.8 KV, located at the north corner of the Manufacturing Building, and a second substation of 15,000 KVA capacity, 115 KV to 13.8 KV, located on the western side of the Manufacturing Building. Additions to the production facilities requested in the 1965 budget will increase the total power requirement to 60,000 KVA; therefore, an additional 15,000 KVA is necessary.

Plant Water Distribution Systems. The capacity of the existing twelve-inch main at Michoud is approximately 1,500 gallons per minute. Present estimates have determined that upon attainment of peak booster production in 1965, potable water requirements will total approximately 2,900 gallons per minute. To provide this capacity, an additional twelve-inch water main must be installed. In addition, existing pumps, and potable water and fire distribution systems, which are over twenty years old and badly deteriorated, must be replaced.

Plant Air Conditioning Filters. Airborne contamination in the vicinity of the Michoud Complex is excessive, especially during periods of stagnant low pressure conditions when fog, smoke, and smog from burning of refuse dumps, are prevelant. High efficiency type filters are essential to avoid contamination of Stage Components by oily films and foreign particles.

Boilers and Auxiliary Equipment. Existing boilers, which are twenty years old and have been idle for long periods of time, are either in need of extensive repairs or must be replaced. Also, production facility additions and new buildings have increased the demand for these services requiring the capacity of the existing system to be increased.

ESTIMATED FUTURE YEAR FUNDING: None

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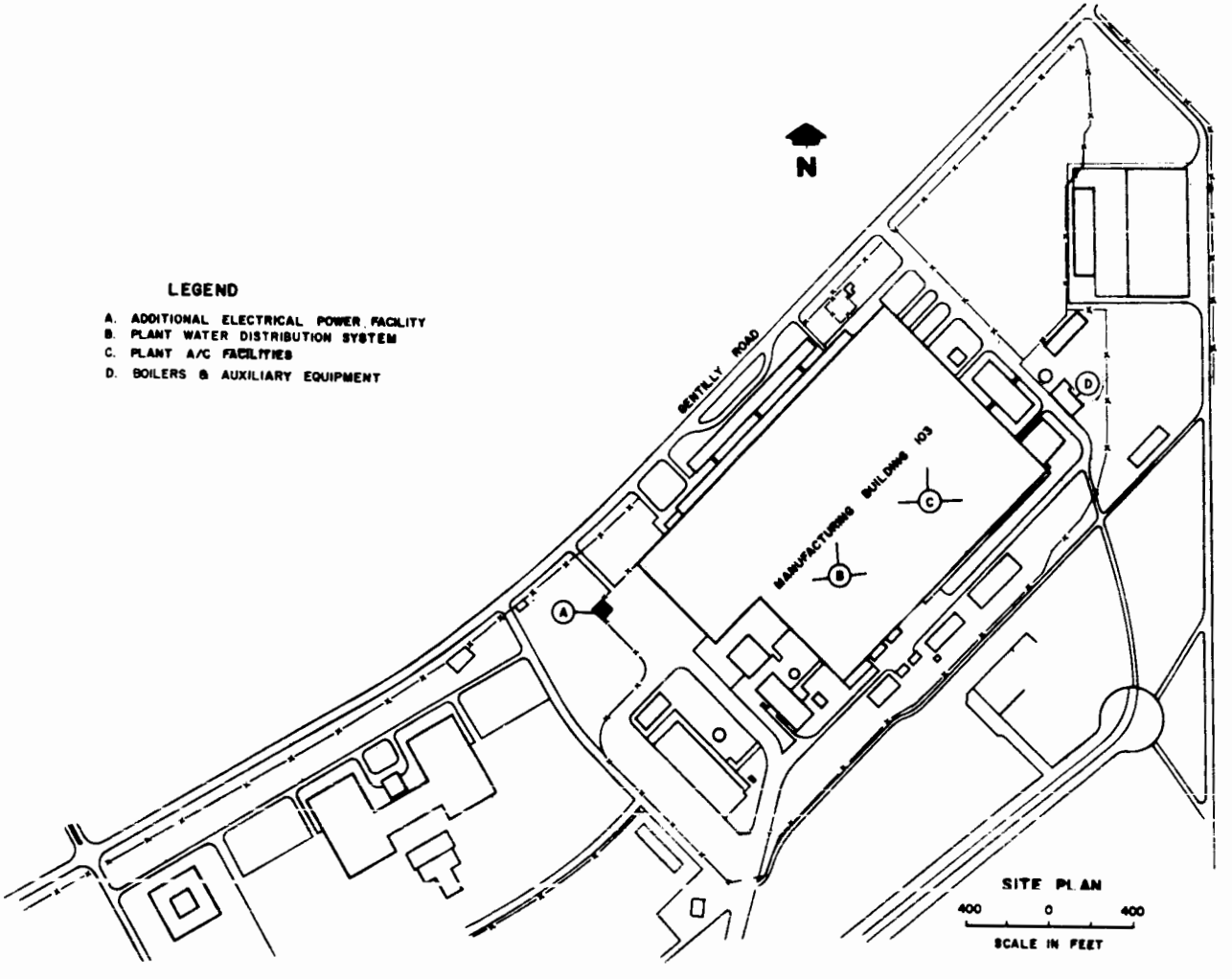
MICHOUD OPERATIONS

FISCAL YEAR 1965 ESTIMATES

UTILITY EXTENSION, ALTERATION AND REHABILITATION TO SUPPORT SATURN S-IB AND S-IC PRODUCTION



ADDITIONAL ELECTRICAL POWER FACILITY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

ADDITIONAL UTILITY INSTALLATIONS AND SUPPORT FACILITIES

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Mississippi Test Facility

LOCATION OF PROJECT: Pearl River, Hancock County, Mississippi

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	$4,615,900
FY 1964 Estimate	9,431,800
FY 1965 Estimate	9,533,000
Total Funding Through FY 1965	$23,580,700

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$7,150,200
Site preparation	LS	---	$275,000	275,000
Access roads (to fee area)	LS	---	1,075,400	1,075,400
Area roads and parking facilities	LS	---	2,908,600	2,908,600
Utilities	LS	---	584,000	584,000
North security control center	Sq. Ft.	3,800	22.60	85,900
South security control center	Sq. Ft.	6,200	22.60	140,200
Warehouse addition	Sq. Ft.	108,200	11.71	1,265,000
Salvage material storage building	Sq. Ft.	4,000	9.23	36,900

	Unit of Measure	Quantity	Unit Cost	Total Cost
Mobile equipment operation building	Sq. Ft.	35,000	$20.18	706,400
Cryogenic barge service building	Sq. Ft.	3,000	24.27	72,800
Equipment				$2,382,800
Mobile equipment operation building equipment	LS	---	103,200	103,200
Cryogenic barge service equipment	LS	---	237,200	237,200
Test maintenance shop equipment	LS	---	1,479,700	1,479,700
Control and communication systems	LS	---	474,400	474,400
Packaging and coating equipment	LS	---	88,300	88,300
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$9,533,000

PROJECT DESCRIPTION:

This project will provide the utilities and support facilities needed to support presently planned test programs at the Mississippi Test Facility. It will include off-site access roads connecting the North and South entrances with existing State Highways (located in the buffer zone not entirely owned in fee by the U.S. Government), the major road network at the site in the fee area, consisting of (1) a four-lane North-South road approximately 4.5 miles long; (2) two-lane access roads comprising a total of approximately 5 miles; and (3) 12-mile, one-lane patrol road around the northern and eastern boundaries of the fee area; a North and South security control center; an additional 108,200 square feet of warehouse and storage area; a cryogenic barge service building of about 3,000 square feet; a mobile equipment operation building of about 35,000 square feet as central point for the operation and maintenance and minor repair of about 600 mobile vehicles; test maintenance equipment; and a control and communications system providing area-wide oral, aural and visual warning and communications.

PROJECT JUSTIFICATION:

This project provides for the completion of all support facilities and utilities required to activate the Mississippi Test Facility. Earlier phases of this construction have been accomplished with prior year funds.

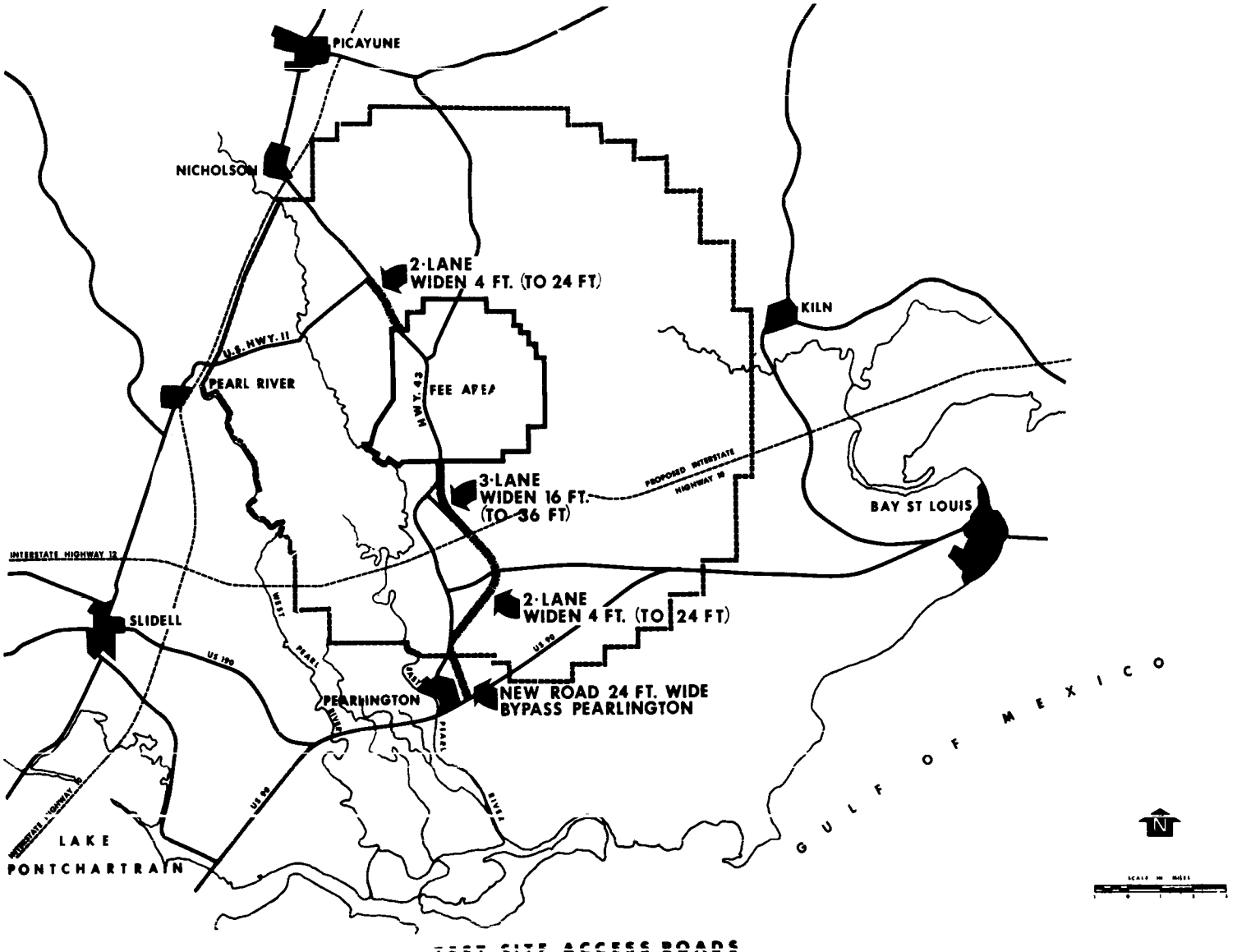
This year's funding increment includes provisions for the necessary access road system required to handle peak hour traffic loads exceeding 1,200 vehicles per hour at the South gate and 800 vehicles per hour at the North gate, a one-lane patrol road for security surveillance, and the North and South security control centers. The project also provides for completion of the maintenance and storage facilities necessary for the scheduled test activity as well as the cryogenic service building required to maintain and service the highly specialized and complex cryogenic equipment carried by the cryogenic propellant barges.

ESTIMATED FUTURE YEAR FUNDING: None

MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

ADDITIONAL UTILITY INSTALLATIONS AND SUPPORT FACILITIES



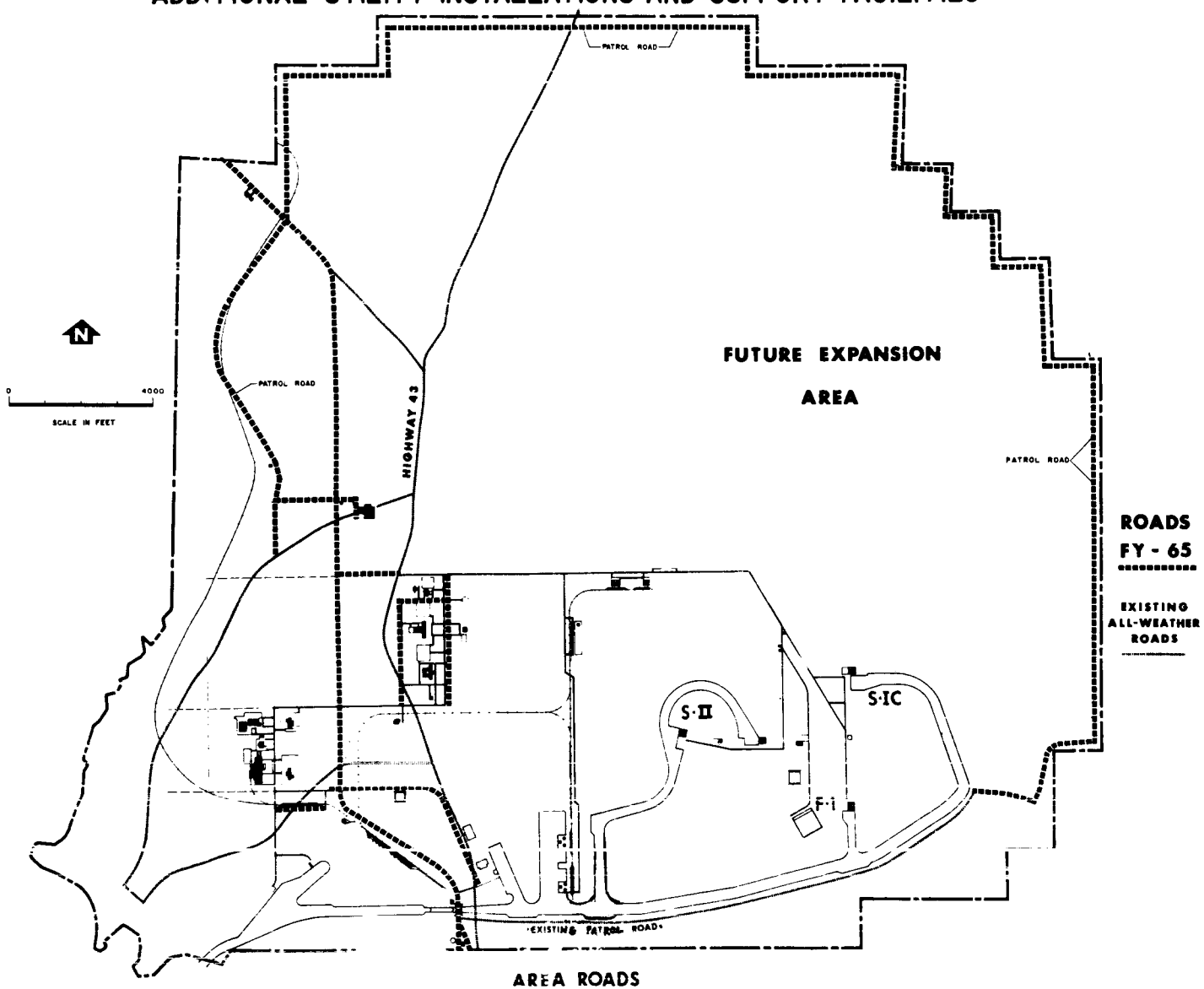
TEST SITE ACCESS ROADS

CF 11-6

MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

ADDITIONAL UTILITY INSTALLATIONS AND SUPPORT FACILITIES



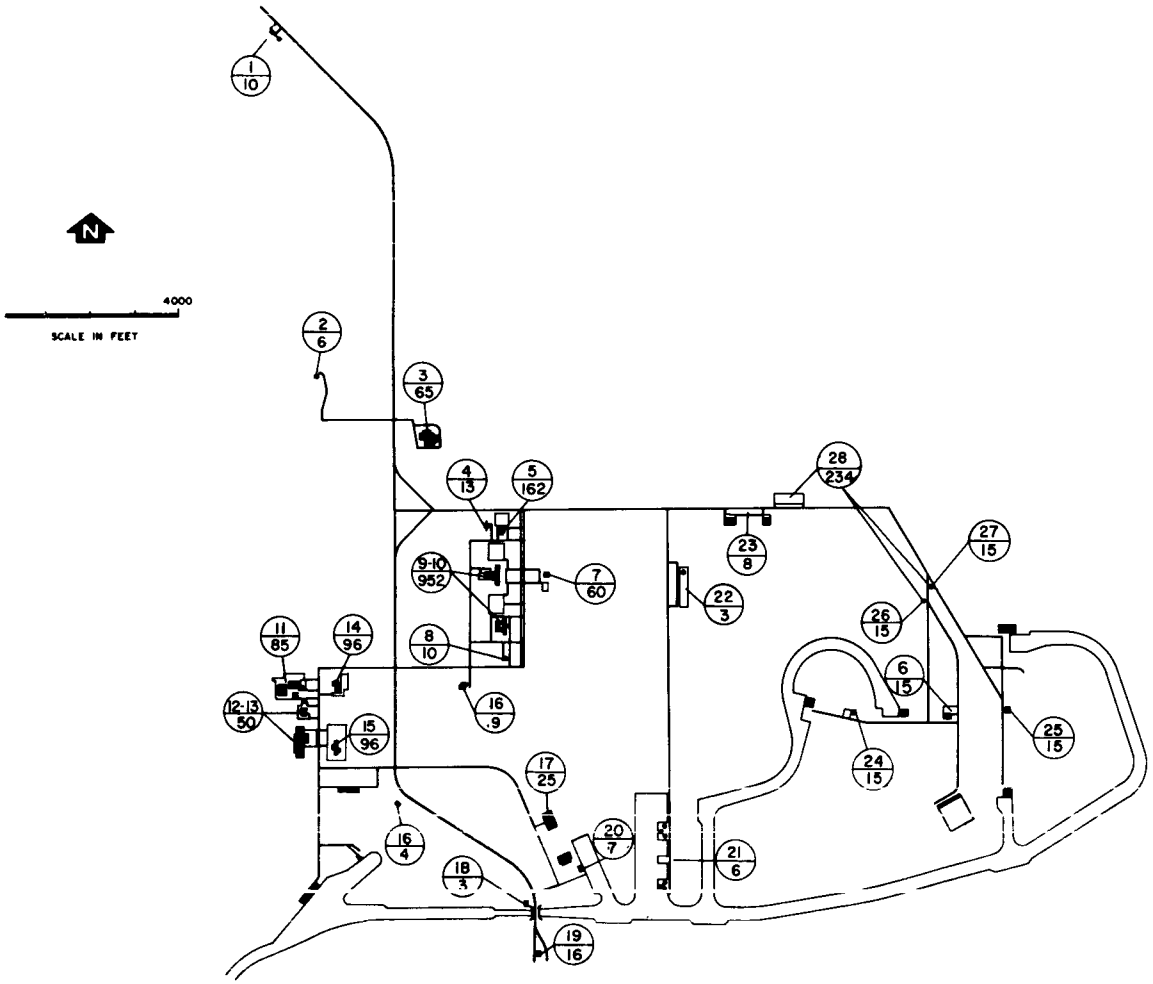
AREA ROADS

CF 11-7

MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

ADDITIONAL UTILITY INSTALLATIONS AND SUPPORT FACILITIES



LEGEND

		FY 1964	FY 1965	TOTAL
1.	NORTH SECURITY CENTER		10	10
2.	METEOROLOGICAL BUILDING		6	6
3.	COMPONENT SERVICE FACILITY		65	65
4.	COMMUNICATION BUILDING	13		13
5.	TEST AREA CONTROL CENTER	12	150	162
6.	DATA ACQUISITION FACILITY	15		15
7.	DATA HANDLING FACILITY	60		60
8.	ACOUSTICS LAB	10		10
9	ELECTRONICS, INSTRUM. & MTLS. LAB			
10.	OFFICE AND ADMINISTRATION BUILDING	421	531	952
11	MAINTENANCE BUILDINGS	35	50	85
12.	STORAGE AREAS			
13.	WAREHOUSE		50	50
14.	EMERGENCY SERVICE BUILDING	30	66	96
15.	MOBILE EQUIPMENT OPERATIONS BUILDING		96	96
16:	HEATING PLANT	9		9
17.	S-II SERVICE AND STORAGE BUILDING		25	25
18.	BRIDGE AND LOCKS CONTROL		3	3
19.	SOUTH SECURITY CENTER		16	16
20.	CRYOGENIC BARGE SERVICE BUILDING		7	7
21.	CRYOGENICS STORAGE	6		6
22.	RP-1 STORAGE	3		3
23.	COMPRESSOR BUILDINGS	8		8
24.	S-II TEST CONTROL CENTER	15		15
25.	S-IC TEST CONTROL CENTER	15		15
26.	S-II COMPLEX GATE	15		15
27.	S-IC COMPLEX GATE	15		15
28.	SATURN V PARKING	74	160	234
	TOTALS	756	1235	1991

0 — NUMBER OF BUILDING OR FACILITY
00 — NUMBER OF SPACES ALLOCATED

VEHICLE PARKING SPACES

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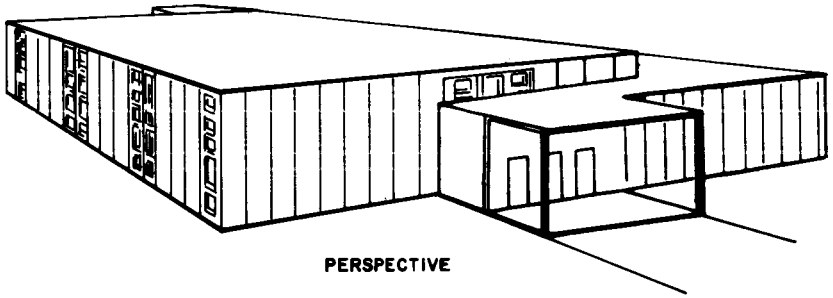
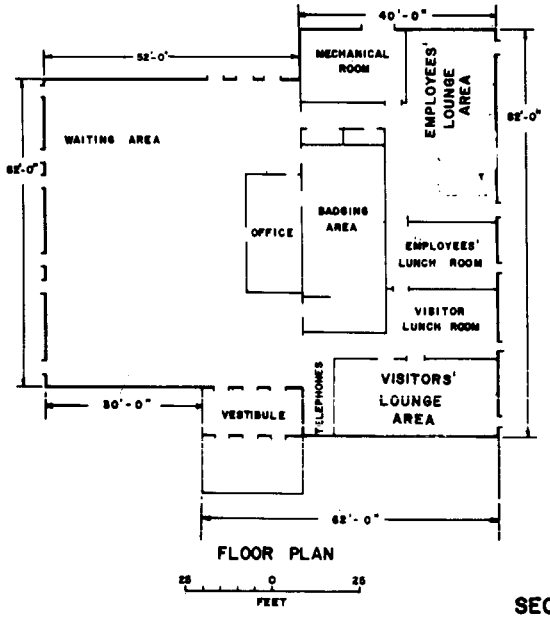
MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

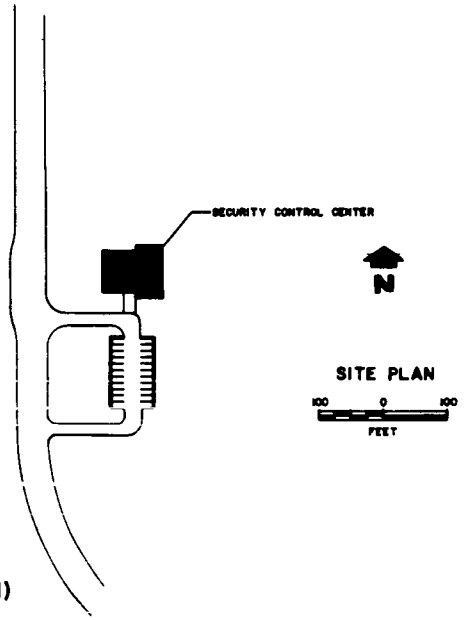
ADDITIONAL UTILITY INSTALLATIONS AND SUPPORT FACILITIES



PERSPECTIVE



FLOOR PLAN



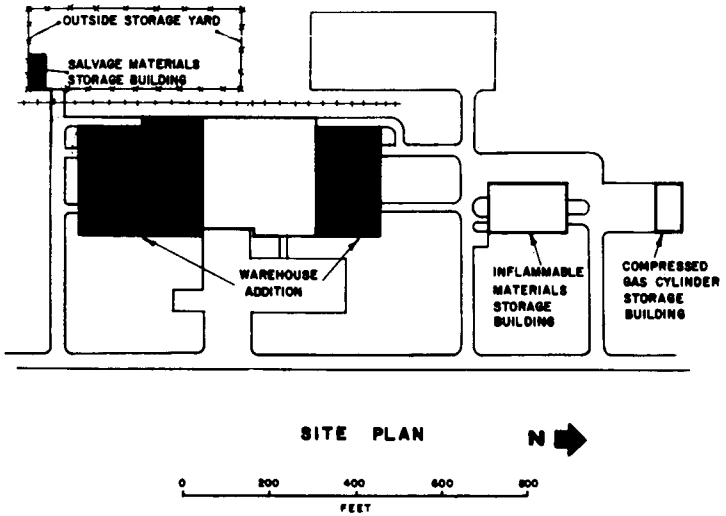
SECURITY CONTROL CENTER (SOUTH)

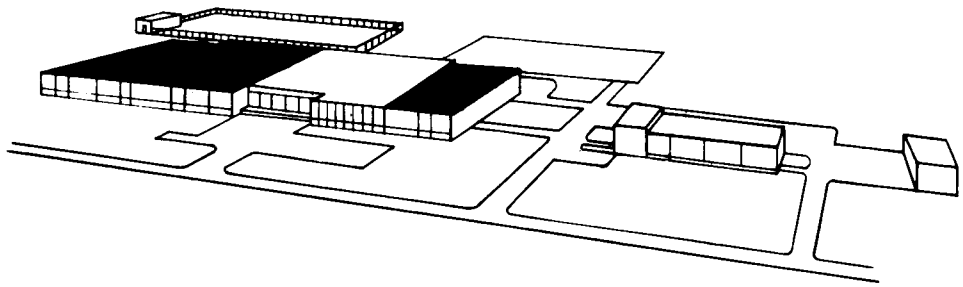
CF 11-9

MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

ADDITIONAL UTILITY INSTALLATIONS AND SUPPORT FACILITIES





PERSPECTIVE

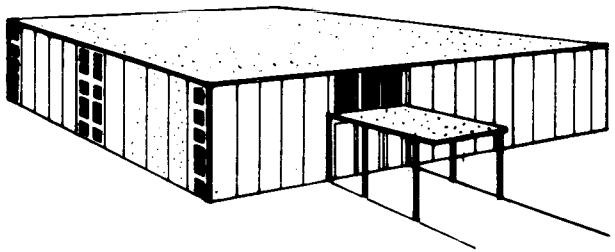
CF 11-10

WAREHOUSE ADDITION AND STORAGE FACILITIES

MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

ADDITIONAL UTILITY INSTALLATIONS AND SUPPORT FACILITIES



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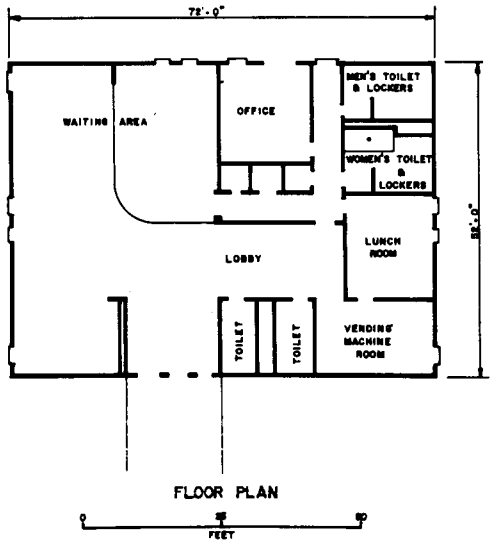
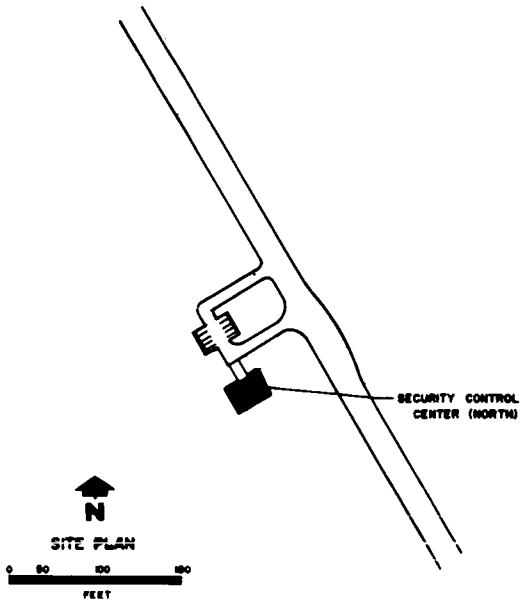


FLOOR PLAN



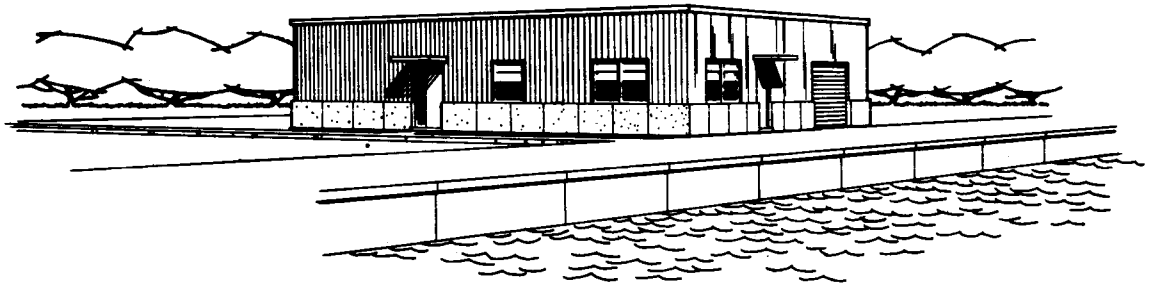
SITE PLAN

SECURITY CONTROL CENTER (NORTH)

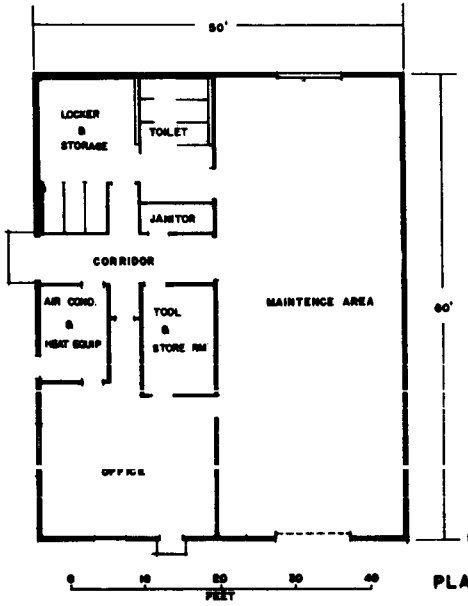
MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

ADDITIONAL UTILITY INSTALLATIONS AND SUPPORT FACILITIES

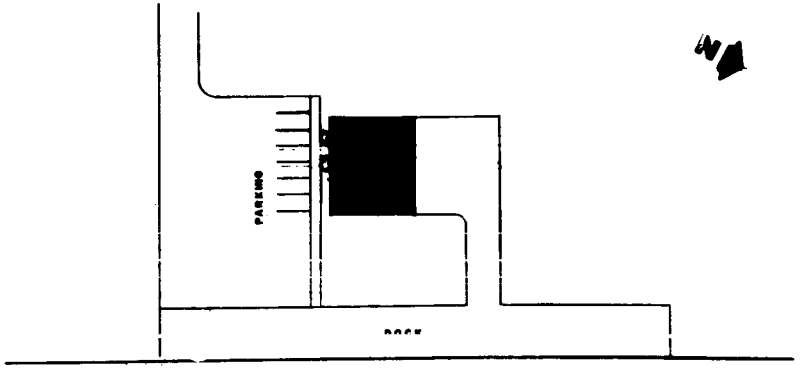


PERSPECTIVE



PLAN

CRYOGENIC BARGE SERVICE BUILDING



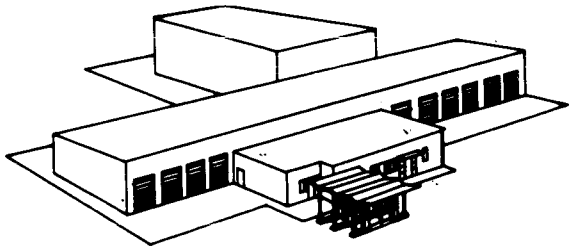
SITE PLAN

CF 11-12

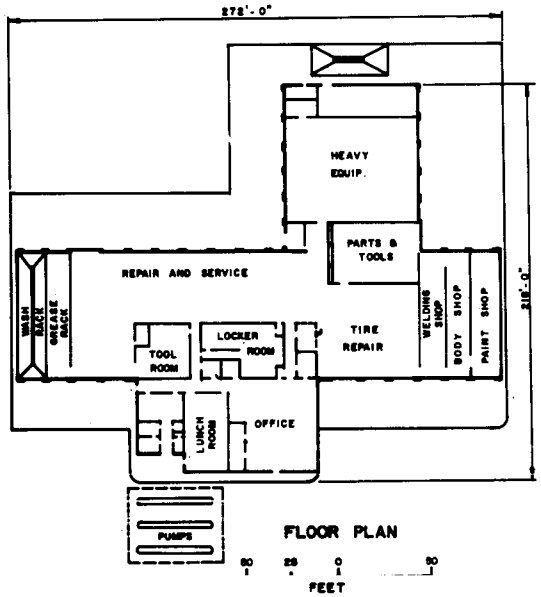
MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1968 ESTIMATES

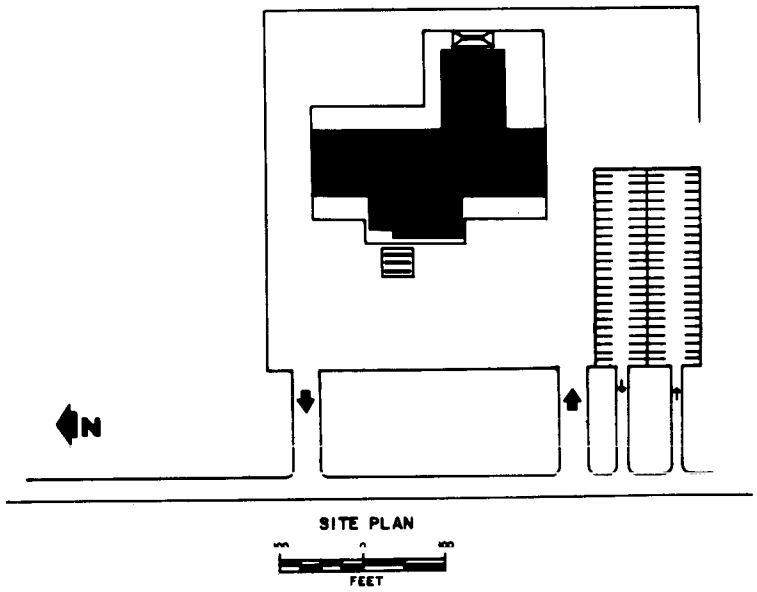
ADDITIONAL UTILITY INSTALLATIONS AND SUPPORT FACILITIES



PERSPECTIVE



FLOOR PLAN



SITE PLAN

MOBILE EQUIPMENT OPERATIONS BUILDING

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

COMPONENT SERVICE FACILITIES

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Mississippi Test Facility

LOCATION OF PROJECT: Pearl River, Hancock County, Mississippi

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	$130,000
FY 1964 Estimate	150,000
FY 1965 Estimate	5,499,000
Total Funding Through FY 1965	$5,779,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$2,278,000
Site development	LS	---	$193,000	193,000
Utilities	LS	---	246,300	246,300
Components service Building	Sq. Ft.	67,500	27.24	1,838,700
Equipment				$3,221,000
Instrumentation	LS	---	928,000	928,000
Special service equipment	LS	---	472,000	472,000
Special test equipment	LS	---	1,086,300	1,086,300
High pressure air	LS	---	210,000	210,000
High pressure nitrogen gas	LS	---	210,000	210,000
High pressure helium gas	LS	---	104,700	104,700
Control and communication system	LS	---	210,000	210,000

	Unit of Measure	Quantity	Unit Cost	Total Cost
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$5,499,000

PROJECT DESCRIPTION:

This project provides for the construction of facilities for servicing of stage, engine and test facility components in support of the Saturn V program.

The facilities include a component service building and all utilities, equipment and systems required for an operational facility. The building is a one-and-a-half story structure with an approximate gross area of 67,500 square feet. The structure will consist of a steel frame, insulated metal panel walls, and a built-up roof. The building will include clean rooms with dust and humidity control, pressure and environmental test cells, measuring and control systems, built-in test and calibration systems and the related engineering space.

PROJECT JUSTIFICATION:

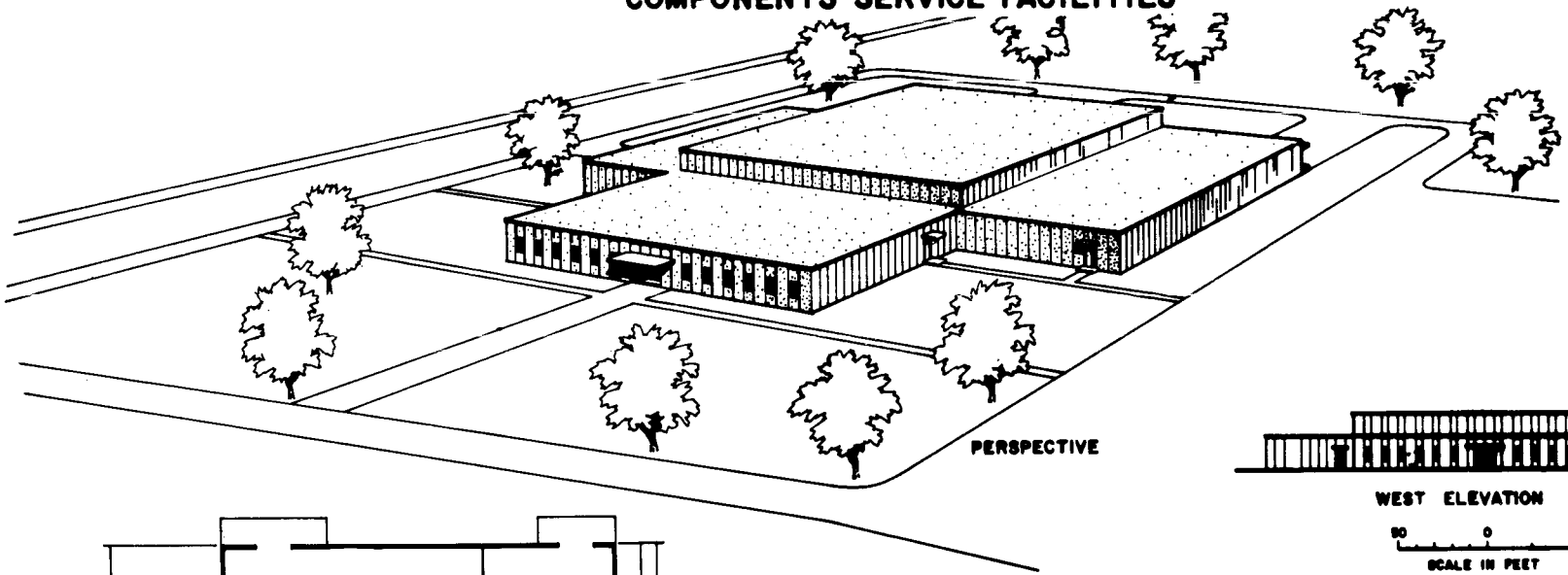
This project provides the necessary facilities for servicing, checking, testing, and calibrating the components of vehicle stages and test stand technical systems. This analysis and investigation function is an essential element of the total test program. The components which make up engine, stage, propellant systems, high pressure gas systems and fire protection systems must meet the highest standards of reliability and quality for a successful flight mission. The required assurance can be attained only by a thorough analysis of each component failure or malfunction which occurs during a static test. Facilities are required in which components can be dissassembled, cleaned, installed and operated in a special test cell until the cause of a problem can be determined. Such analysis establishes the basis for corrective action in the design, manufacture and qualify control of the component in question. It is essential that this facility be operational by the middle of calendar year 1966 to support the static tests of the SII-I and the first S-IC stages arriving at the Mississippi Test Facility.

ESTIMATED FUTURE YEAR FUNDING: None

MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

COMPONENTS SERVICE FACILITIES

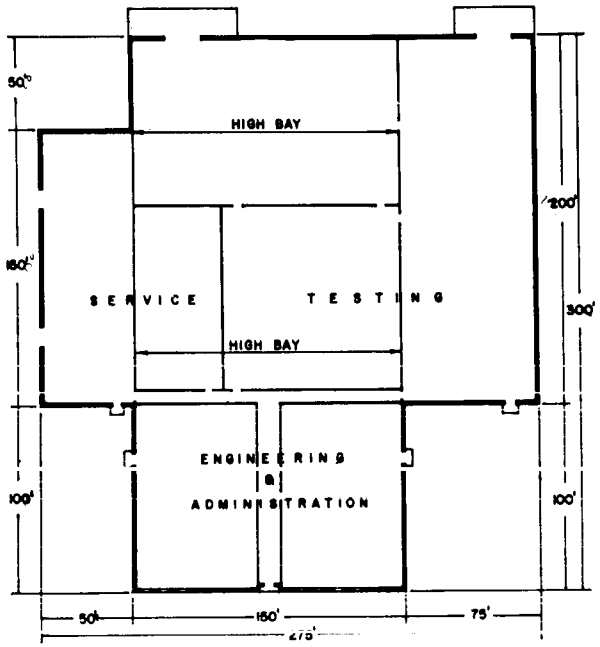


PERSPECTIVE

WEST ELEVATION

50 0 50

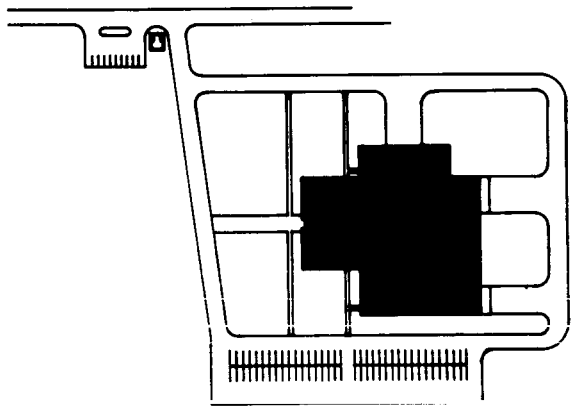
SCALE IN FEET



FLOOR PLAN

50 0 50

SCALE IN FEET



N

SITE PLAN

150 0 150

SCALE IN FEET

CF 11-16

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

SATURN V FIRST STAGE (S-IC) STATIC TEST FACILITY

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Mississippi Test Facility

LOCATION OF PROJECT: Pearl River, Hancock County, Mississippi

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	$13,216,000
FY 1964 Estimate	38,473,800
FY 1965 Estimate	26,384,000
Total Funding Through FY 1965	$78,073,800

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$18,012,800
Test stand structure (completion)	LS	---	$9,197,500	9,197,500
Sound suppressor	each	2	4,378,500	8,757,000
Observation bunker	each	1	---	58,300
Equipment				8,371,200
Adaptation hardware	LS	---	572,500	572,500
Instrumentation system	LS	---	2,779,000	2,779,000
Control & communication systems	LS	---	2,339,000	2,339,000

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	Unit of Measure	Quantity	Unit Cost	Total Cost
High pressure water system	LS	---	$1,255,500	$1,255,500
High pressure GAS distribution system	LS	---	891,400	891,400
Propellant transfer system	LS	---	533,800	533,800
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$26,384,000

PROJECT DESCRIPTION:

This project provides for the completion of the second position of the dual position Saturn V first stage (S-IC) test stand. Included are the second position steel superstructure, instrumentation systems, control and communication systems, propellant transfer systems, high pressure gas and high pressure water systems, adaptation hardware, and an observation bunker to bring the dual-test stand to operational readiness. Also provided will be a sound suppressor for each test position. The suppressor will consist of two basic elements. The first element is a mixing chamber approximately 100 feet high and 60 feet wide. It will allow the mixing of water with engine exhaust gases in an aspirator type chamber. This mixture of water and gas will pass through ducts where the energy in the exhaust gases will be significantly dissipated by accelerating a large mass of water. The second element consists of two circular condensers which will provide for the separation of the water from the exhaust gases and the recirculation of the separated water.

PROJECT JUSTIFICATION:

This project is required to complete the dual position Saturn V first stage (S-IC) test stand complex which was authorized and received initial funding in fiscal year 1963. The first position will be completed in December, 1965. Following facility checkout using the S-IC T stage the S-IC-3 and S-IC-4 flight stages will undergo acceptance testing using this position. The stand utilization plan and Saturn V flight schedule require construction completion of the second position in August, 1966 for subsequent testing of the S-IC-5 flight stage. Construction leadtimes require funds to be available in October, 1964, in order to meet this schedule. Both positions are required to meet the scheduled delivery rates.

The sound propagation problem from firing very large rocket engines is two fold. In the immediate area, the sound energy can seriously affect and

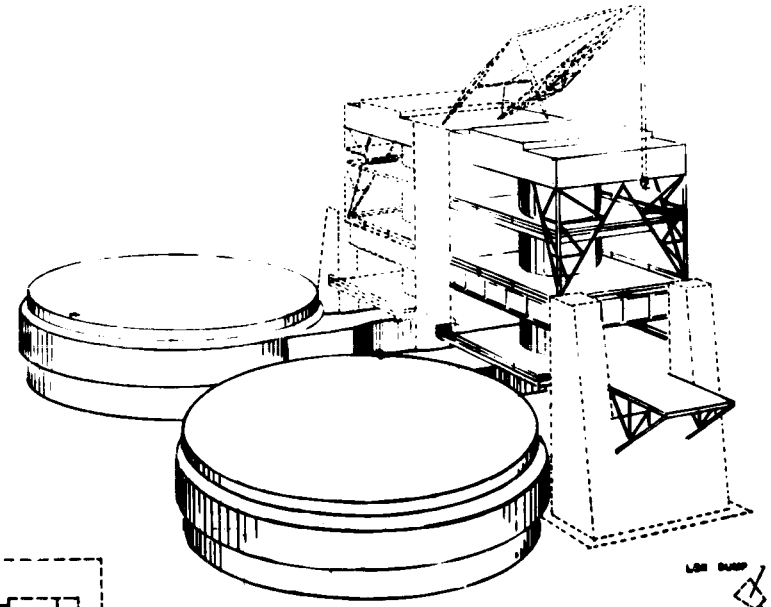
damage structures and buildings as well as people. The Mississippi Test Facility and acoustic easement area was designed to handle this hazard. The second problem is that of high intensity sound focusing at great distances from the source caused by the reflection of sound by air layers of different temperatures. Since it would not be feasible to acquire the necessary land to overcome this hazard, sound suppressors are required for this test stand.

ESTIMATED FUTURE YEAR FUNDING: None

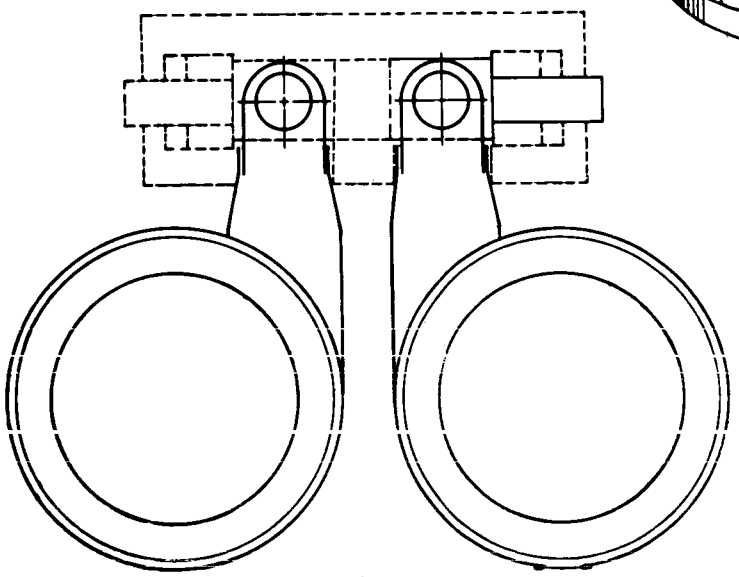
MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

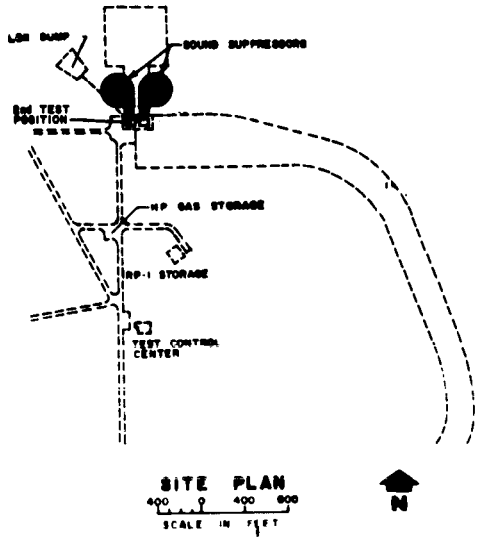
SATURN V FIRST STAGE (S-IC) STATIC TEST FACILITY



PERSPECTIVE



PLAN



DUAL TEST STAND

SECOND TEST POSITION

SOUND SUPPRESSORS FOR FIRST & SECOND TEST POSITIONS

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

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

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Mississippi Test Facility

LOCATION OF PROJECT: Pearl River, Hancock County, Mississippi

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: New

FUNDING:

FY 1963 and Prior Years	$20,353,000
FY 1964 Estimate	16,301,900
FY 1965 Estimate	20,575,000
Total Funding Through FY 1965	$57,229,900

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$8,494,500
Test stand	LS	---	$3,861,900	3,861,900
Stage checkout building	Sq. Ft.	62,000	44.95	2,786,700
Utilities	LS	---	337,200	337,200
Support facilities	LS	---	737,400	737,400
Deflector	LS	---	771,300	771,300
Equipment				$12,080,500
Instrumentation systems	LS	---	2,105,000	2,105,000
Control and communications systems	LS	---	1,515,600	1,515,600
Adaptation hardware	LS	---	525,000	525,000

	Unit of Measure	Quantity	Unit Cost	Total Cost
High pressure water system	LS	---	$1,823,800	1,823,800
High pressure gas system	LS	---	1,993,400	1,993,400
Propellant transfer system	LS	---	1,710,700	1,710,700
Helium cold gas system	LS	---	527,000	527,000
Stage checkout and storage equipment	LS	---	1,880,000	1,880,000
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$20,575,000

PROJECT DESCRIPTION:

This project provides for completion of the second test stand for the Saturn V vehicle second stage (S-II), including all necessary instrumentation, equipment and systems required for an operational facility. Included is the stand superstructure, an underground instrumentation tunnel connecting the test stand with the Test Control Center, a flame deflector, adaptation hardware to attach the stage to the load frame, a high pressure gas system, a high pressure water system, instrumentation systems, control and communication systems, a stage checkout and storage building which includes an area for pre-static and post-static stage checkout.

PROJECT JUSTIFICATION:

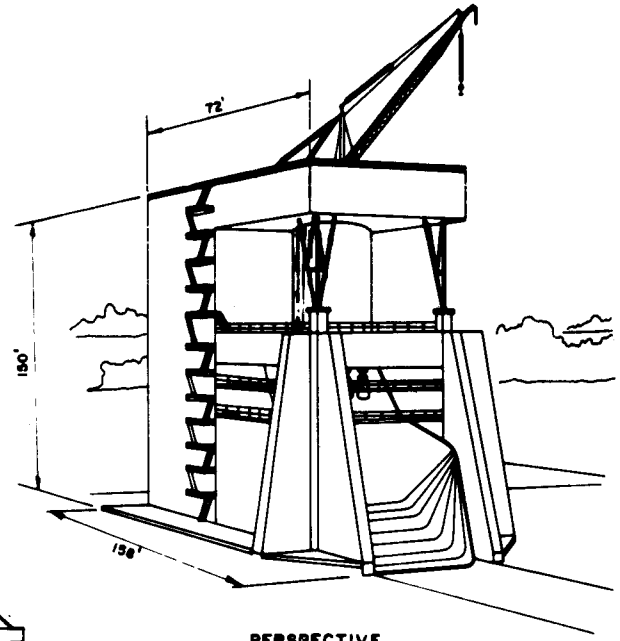
This project provides for the continuation and completion of the Saturn V second stage (S-II) test complex initiated in prior years. The S-II stands at the Mississippi Test Operations facility will be used for full duration all-systems tests and acceptance testing of all flight stages. The first stand which was funded in fiscal years 1963 and 1964 will be completed in August 1965. After facility checkout using the S-II-F checkouts stage, the first test stand will be initially used for all systems testing, and for acceptance testing of S-II-1 and S-II-2. The S-II-2 will be on the stand when the S-II-3 is received for acceptance testing. The second stand is required and must be funded in fiscal year 1965 if it is to be available in time for S-II-3 stage acceptance testing in October 1966. From this time on two stands are required to meet the scheduled delivery rates.

ESTIMATED FUTURE YEAR FUNDING: None.

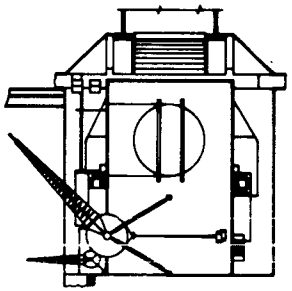
MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

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



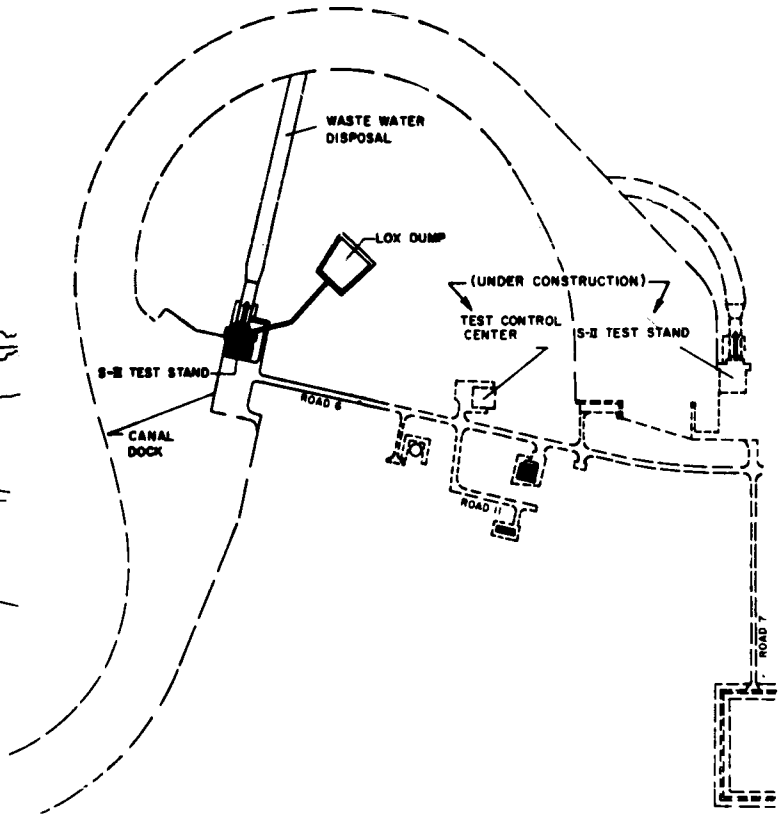
PERSPECTIVE



PLAN

80 0 80

FEET



SITE PLAN

200 0 200 400

FEET

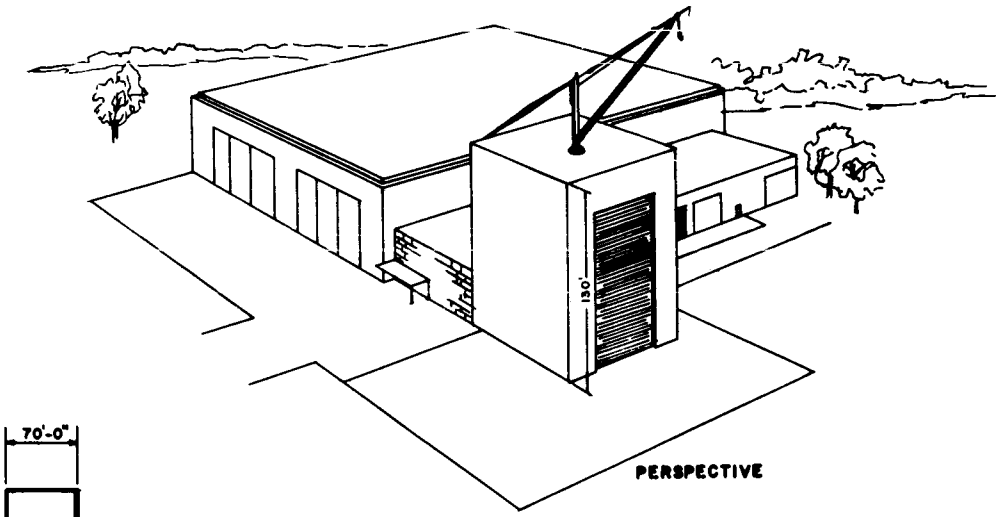
N

TEST STAND

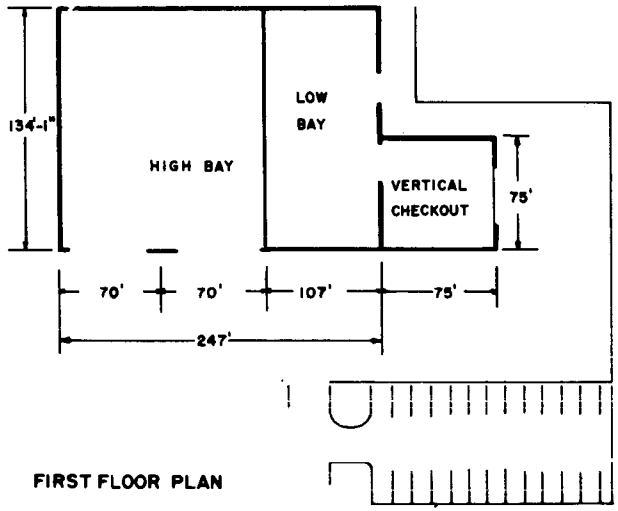
MISSISSIPPI TEST OPERATIONS

FISCAL YEAR 1965 ESTIMATES

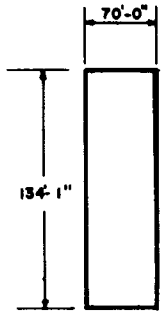
SATURN V SECOND STAGE (S-II) STATIC TEST FACILITIES



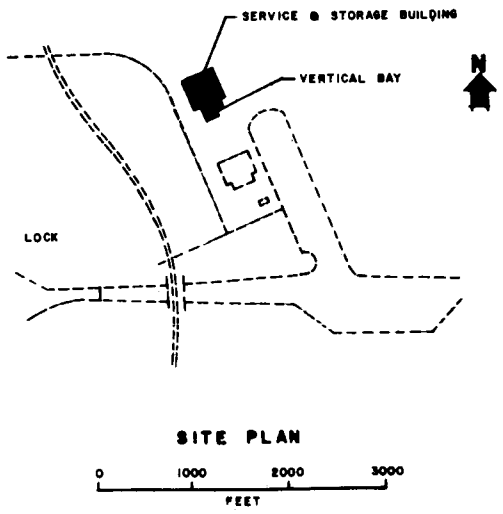
PERSPECTIVE



FIRST FLOOR PLAN



SECOND FLOOR PLAN
(LOW BAY AREA)



SITE PLAN

0 1000 2000 3000
FEET

STAGE CHECKOUT AND STORAGE BUILDING

CF 11-24

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR F-1 ENGINE PROGRAM

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Various Locations

LOCATION OF PROJECT: Canoga Park, Santa Susana, and Edwards, California

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: New, Repair

FUNDING:

FY 1963 and Prior Years	$44,868,000
FY 1964 Estimate	14,335,000
FY 1965 Estimate	2,707,000
Total Funding Through FY 1965	$61,910,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$2,707,000
Engine checkout cell	Each	1	$99,000	99,000
Liquid oxygen "run" tank	Each	1	129,000	129,000
Gaseous nitrogen storage bottle	Each	1	101,000	101,000
Fuel "run" tank	Each	1	151,000	151,000
LOX storage tank	Each	4	310,000	1,240,000
Fuel storage tank	Each	2	29,500	59,000
Fuel supply system	Each	1	480,000	480,000
Flame channel (repair)	LS	---	149,000	149,000
Reclamation dam (modifications)	LS	---	245,000	245,000
Site development	LS	---	54,000	54,000

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	Unit of Measure	Quantity	Unit Cost	Total Cost
Equipment	---	---	---	---
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$2,707,000

PROJECT DESCRIPTION:

This project provides the additional facilities required to support the F-1 engine program. At Canoga Park, California, a 1,053 square foot reinforced concrete engine checkout cell will be constructed to permit safe full pressure testing of the F-1 engine. At Santa Susana, construction in support of component testing consists of an additional 3,000 pound per square inch, 2,500 gallon liquid oxygen "run" tank; a 5,000 pound per square inch, 470 cubic foot gaseous nitrogen storage bottle, and a 3,000 pound per square inch, 3,000 gallon fuel "run" storage tank. At Edwards, the installation of four additional 1,000 ton bulk liquid oxygen storage tanks and two additional 100,000 gallon fuel storage tanks. The addition of a fuel supply system, flame channel repairs and reclamation dam modifications are also to be provided.

PROJECT JUSTIFICATION:

Additional facilities are required at Canoga Park, Santa Susana, and Edwards to meet the F-1 engine delivery rates necessary to support the Saturn V launch schedule. This delivery schedule requiring five F-1 engines per vehicle, plus spares, reaches its peak rate in early 1966. The peak rate of component and acceptance testing of engines for flight vehicles is attained while the engine development testing continues.

The engine checkout cell is required at Canoga Park to permit full pressure testing of the F-1 engine prior to shipment to Edwards for hot firing tests. Existing facility capacity is restricted to low pressure testing. Without the full pressure testing capability engine leaks are often found for the first time after installation on the stands at Edwards. This procedure requires the return of the engine to the factory and causes a significant loss of time in the test program.

Additional test facilities are required at Santa Susana to maintain component quality and delivery rates. The liquid oxygen "run" tank is required for use in F-1 turbo-pump seal test since the existing 360 gallon tank does not have the capacity to establish the "steady-state" conditions

in the test system which are necessary for proper testing. The gaseous nitrogen storage bottle is required to increase the F-1 engine turbo-pump testing rate capability from two to four tests per shift. A minimum of four tests per shift is required to meet delivery rates. The fuel "run" tank will provide the necessary capability for full duration testing of the F-1 gas generators.

Acceptance testing of F-1 engines at Edwards begins in 1964. This increase in acceptance testing builds up concurrently with the continued development testing and reaches a peak in early 1966 with 36 flight engines being delivered in that year. The present capacity for bulk liquid oxygen and fuel storage must be increased to keep pace with the testing schedule. The current bulk LOX storage capacity of 3,000 tons must be increased by an additional 4,000 tons. The fuel storage (RJ-1) capacity of 360,000 gallons must be increased by an additional 200,000 gallons.

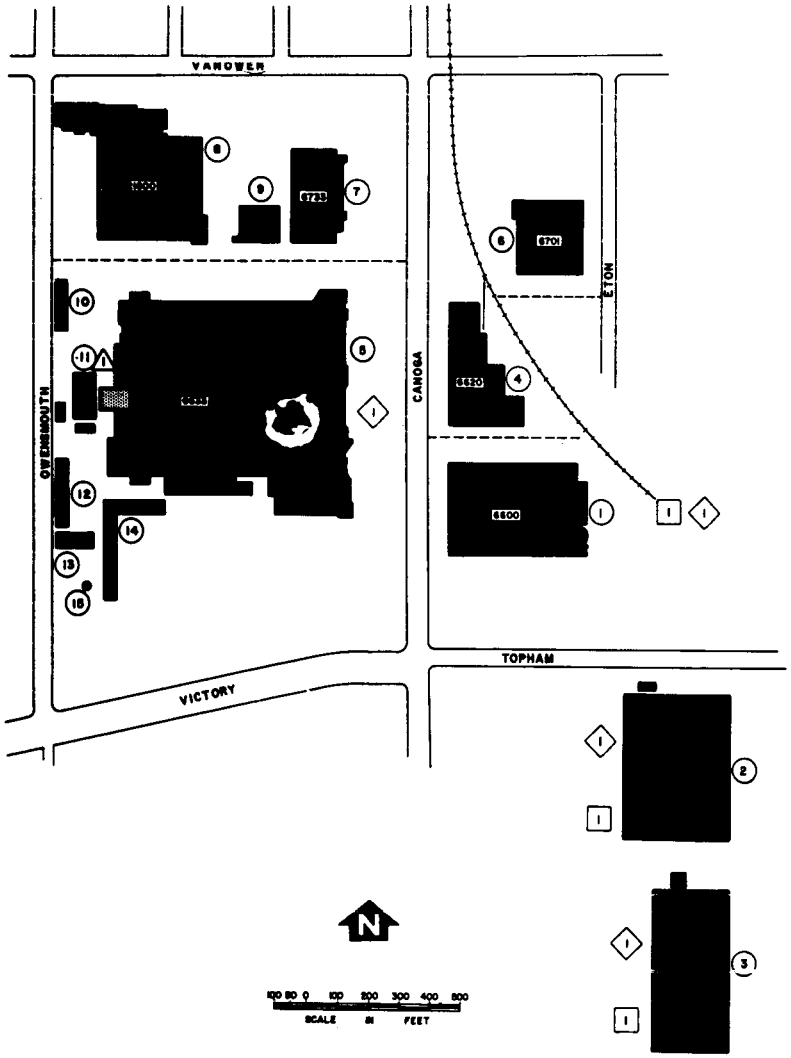
In addition, protection of the test stand structures and the need to minimize loss of deflector coolant water requires the repair of flame channels and modification of reclamation dams.

ESTIMATED FUTURE YEAR FUNDING: None

VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR F-I 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 1963 PROJECT

[1] EXPANSION OF R & D PRODUCTION MANUFACTURING EQUIPMENT

FISCAL YEAR 1964 PROJECT

◇1 EXPANSION OF R & D PRODUCTION MANUFACTURING EQUIPMENT

PROPOSED FISCAL YEAR 1965 PROJECT

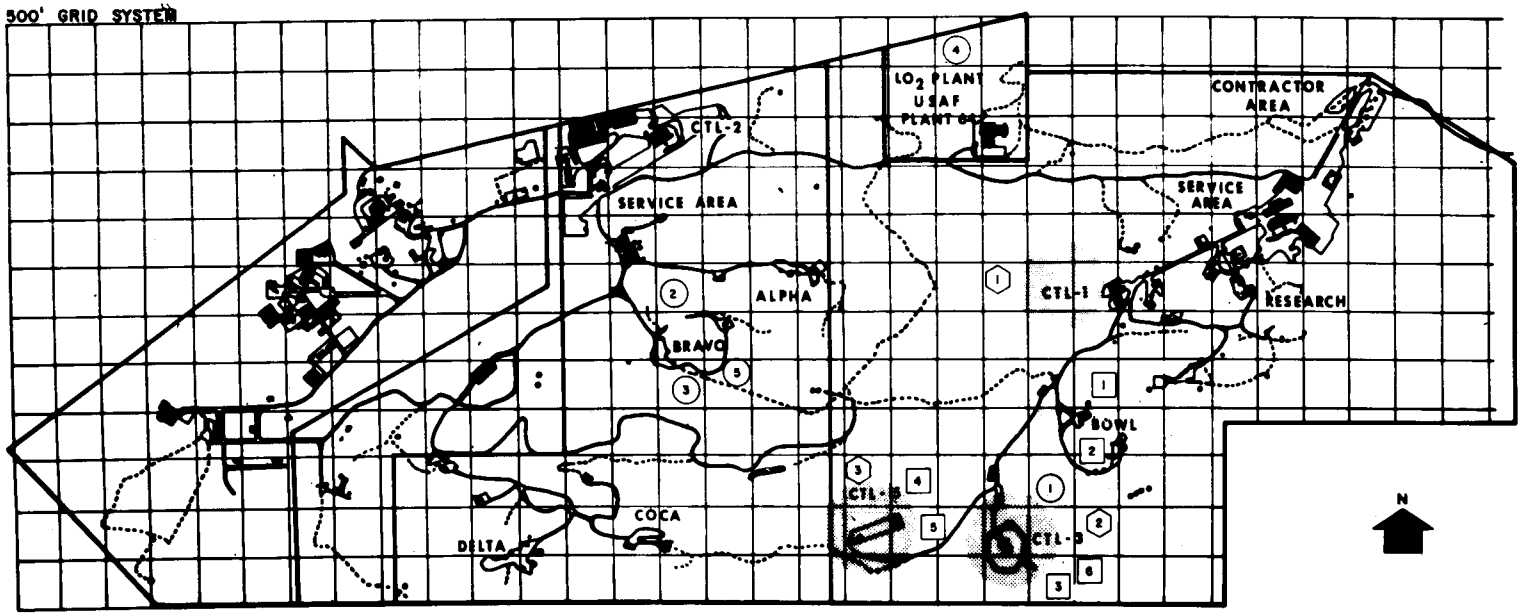
△1 ENGINE CHECKOUT CELL

CF 12-5

VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR F-1 ENGINE PROGRAM



SANTA SUSANA, CALIFORNIA

LEGEND

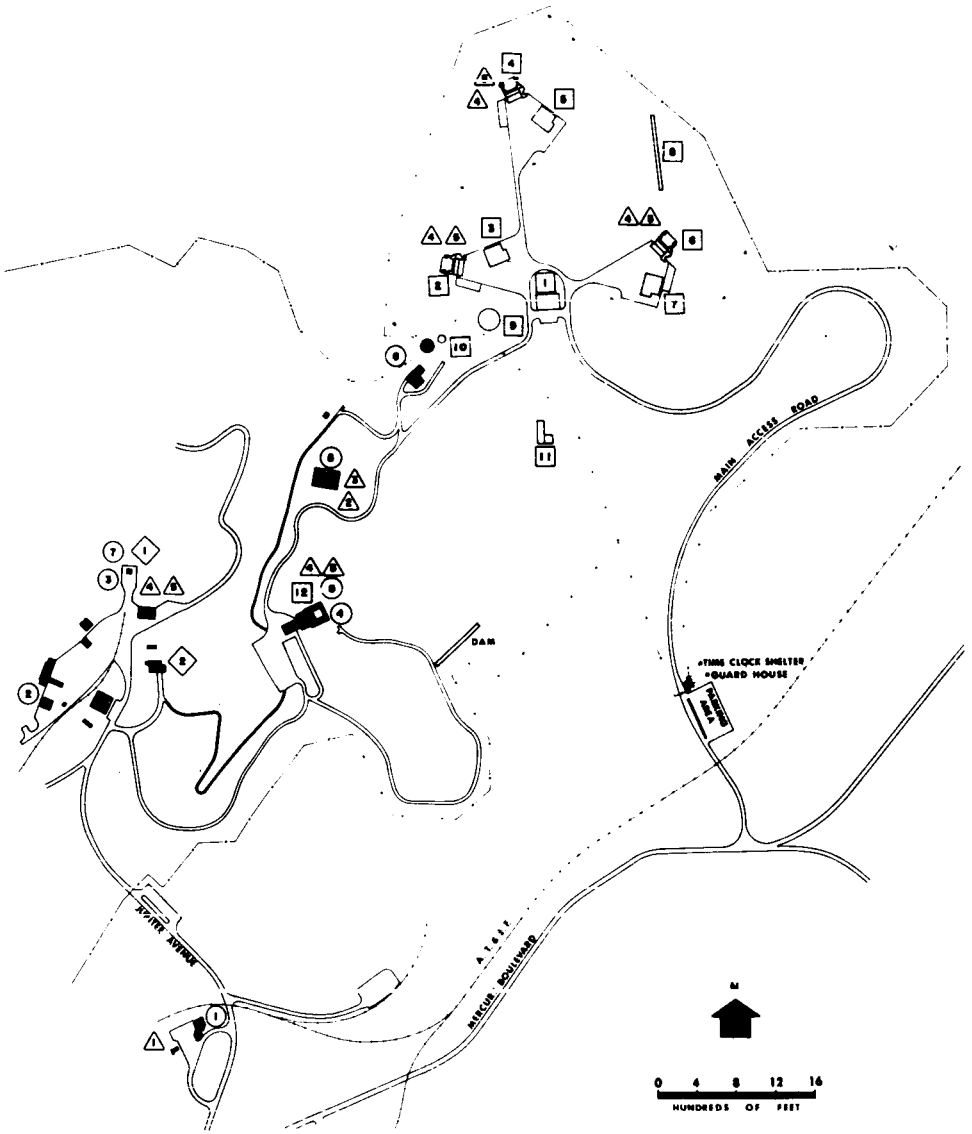
EXISTING FACILITIES	FACILITIES AUTHORIZED & UNDER CONSTRUCTION	PROPOSED FISCAL YEAR 1965 PROJECTS
(1) CTL-3	[1] ADDITIONAL INSTRUMENTATION CENTRAL RECORDING	⬡1 LOX RUN TANK
(2) BRAVO 1	[2] BOWL AREA	⬡2 FUEL RUN TANK
(3) BRAVO 2	[3] ADDITIONAL STORAGE TANKS CTL-3	⬡3 GN_2 BOTTLE
(4) LN_2 LOX BUFFER STORAGE	[4] ADDITIONAL STORAGE BOTTLES CTL-5	
(5) MODIFICATION TO BRAVO AREA	[5] MISC ITEMS FOR CTL-3 & CTL-5	
	[6] ADDITIONAL INSTRUMENTATION	

CF 12-6

VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR F-1 ENGINE PROGRAM



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
7. MODIFICATION TO TEST STAND 1-A
8. MODIFICATION TO TEST STAND 1-B
9. DESIGN LONGLEAD PROCUREMENT & EARTHWORK

FACILITIES AUTHORIZED & UNDER CONSTRUCTION

FISCAL YEAR 1963 PROJECT

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. 1,000,000 GAL. DEFLECTOR WATER TANK
10. 400,000 GAL. FIRE TANK
11. PUMP HOUSE AREA
12. MODIFICATION OF TEST STAND 1-B

FISCAL YEAR 1964 PROJECT

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

PROPOSED FISCAL YEAR 1965 PROJECT

1. ADDITIONAL LOX STORAGE
2. ADDITIONAL FUEL STORAGE
3. FUEL SUPPLY SYSTEM
4. RECLAMATION DAMS
5. FLAME CHANNEL MODIFICATIONS (FOR ALL EXISTING STANDS)

EDWARDS AIR FORCE BASE, CALIFORNIA

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Various Locations

LOCATION OF PROJECT: Santa Susana and Canoga Park, California

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: New and Alterations

FUNDING:

FY 1963 and Prior Years	$11,250,000
FY 1964 Estimate	7,113,000
FY 1965 Estimate	10,971,000
Total Funding Through FY 1965	$29,334,000

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$6,685,926
Production test facilities	LS	---	$3,915,000	3,915,000
Site development	LS	---	518,000	518,000
Component test area facilities	LS	---	1,090,000	1,090,000
Delta 3 test stand alteration	LS	---	715,000	715,000
Bowl test area facilities	LS	---	447,926	447,926
Equipment				$4,285,074
Production test facility equipment	LS	---	3,815,000	3,815,000
Development support equipment	LS	---	470,074	470,074
Design	---	---	---	---

	Unit of Measure	Quantity	Unit Cost	Total Cost
Fallout Shelter	---	---	---	---
		TOTAL		$10,971,000

PROJECT DESCRIPTION:

This project provides for the following items of construction at Santa Susana:

Site development, utilities, equipment and construction of an electric drive pump test facility. This facility will consist of a 30,000 horsepower drive system, a building and support system which includes a cooling tower, an oil supply system, a load center, a bridge crane, a liquid oxygen flow system, a simulated fuel flow system, a liquid hydrogen flow system, a nitrogen pressurization system and a hydrogen pressurization system.

In the component test areas, a hydrogen storage system, a centralized hydrogen burn-off system, a hydrogen recovery system, a seal and bearing test flow system and an off-loading, liquid hydrogen storage vessel.

In the Delta area, the Delta 3 test stand will be completed. Construction of this stand was initiated in the fiscal year 1964 program. This project completes construction with the addition of liquid oxygen and liquid hydrogen "run" vessels, platform modifications, stand support systems and stand instrumentation. Area support including a hydrogen gas recovery system and additional liquid hydrogen and liquid oxygen storage vessels are also to be provided.

In the Bowl area, construction includes an additional helium storage system, a gaseous hydrogen storage system and improvements to the liquid oxygen propellant handling system.

This project also provides for the procurement and installation of additional production test and development support equipment such as a vibration test system, dynamic test system, environmental equipment, recorders, grinders, leak detectors, welders, lathes, etc., at Santa Susana and Canoga Park to support the continued manufacture of development and production engines.

PROJECT JUSTIFICATION:

At the Santa Susana Test Site additional facilities are required to meet the J-2 engine delivery schedule in support of the Saturn IB and Saturn V programs. This delivery schedule, requiring five J-2 engines for each S-II stage and one J-2 engine for the S-IVB stages in both the Saturn V and Saturn IB vehicles, reaches its peak in late 1965. Engine deliveries run concurrently with the engine development program.

A major requirement at this location is a new Turbopump Drive Facility. It is essential that this facility become operational in January 1966 in order to meet the established test schedule. The existing facility has exceeded its useful life and is constantly down for repairs and/or maintenance. In addition, it does not have the capability of meeting full power requirements of the components to be tested. The new facility will permit the required frequency of testing with increased reliability and simplified operating procedures.

Another significant item at Santa Susana is completion of the Delta 3 Test Stand. Construction of this facility was initiated with fiscal year 1964 funds. This year's funding will allow for completion in 1965 and provide the necessary capability for reaching and maintaining the required engine delivery rates. Additional hydrogen storage capacity is required to keep pace with the testing schedule.

This project also provides a hydrogen burn-off system necessary to eliminate safety hazards, additional helium storage capacity to permit simulation of flight conditions for testing of the engine start sequence, and the procurement and installation of production test and development support equipment required to maintain scheduled delivery rates.

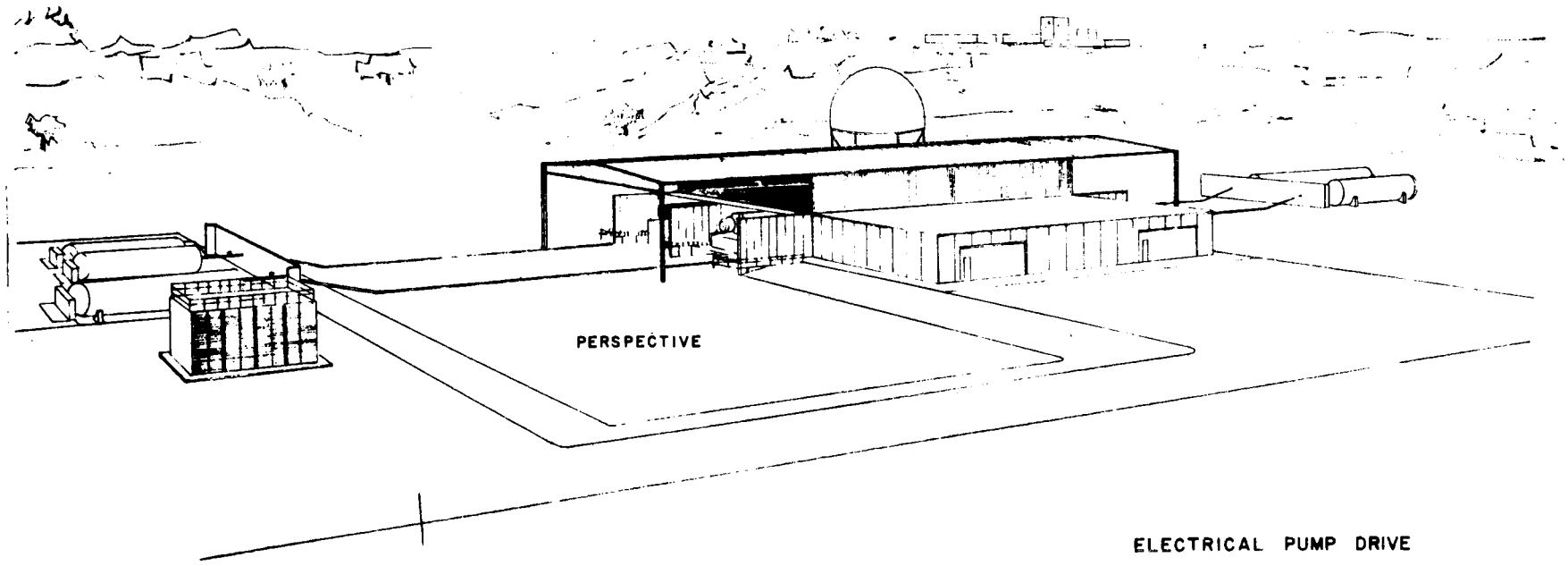
ESTIMATED FUTURE YEAR FUNDING: None

718-879 O - 64 - 26

VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM



ELECTRICAL PUMP DRIVE

ALFA AREA

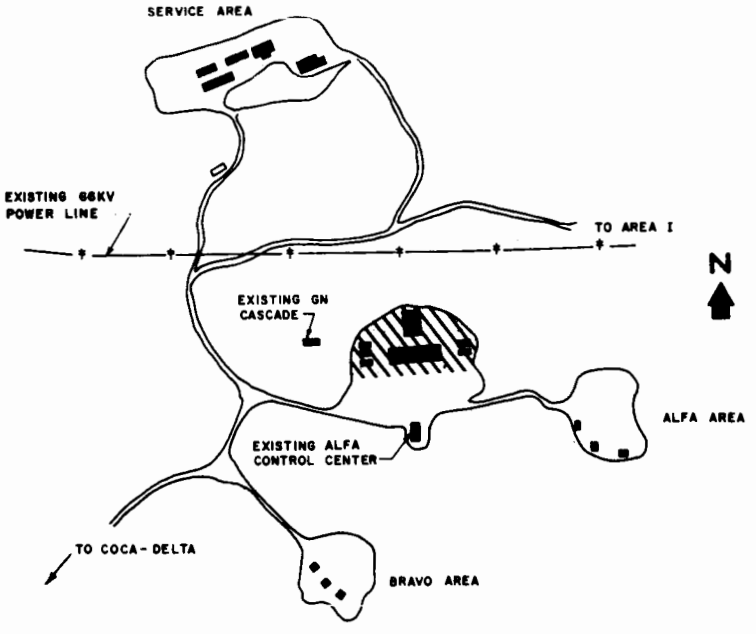
SANTA SUSANA, CALIF.

CF 12-11

VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM



SITE PLAN

ELECTRIC PUMP DRIVE

ALFA AREA

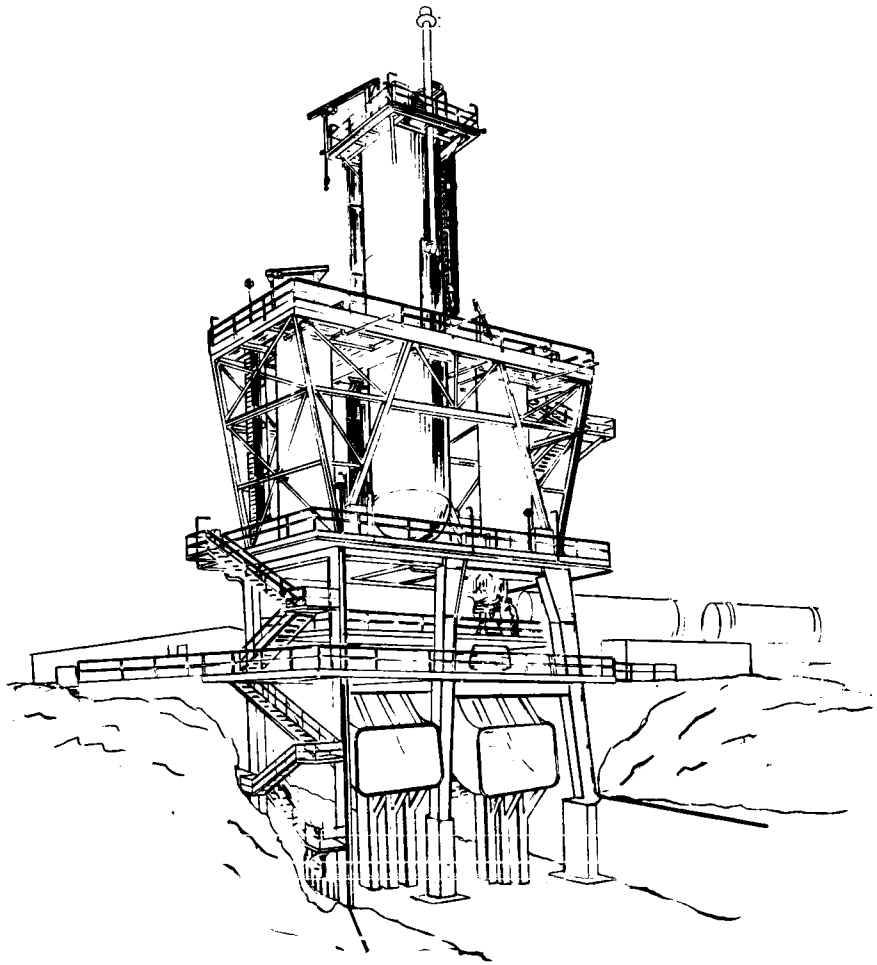
SANTA SUSANA, CALIFORNIA

CF 12-12

VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM

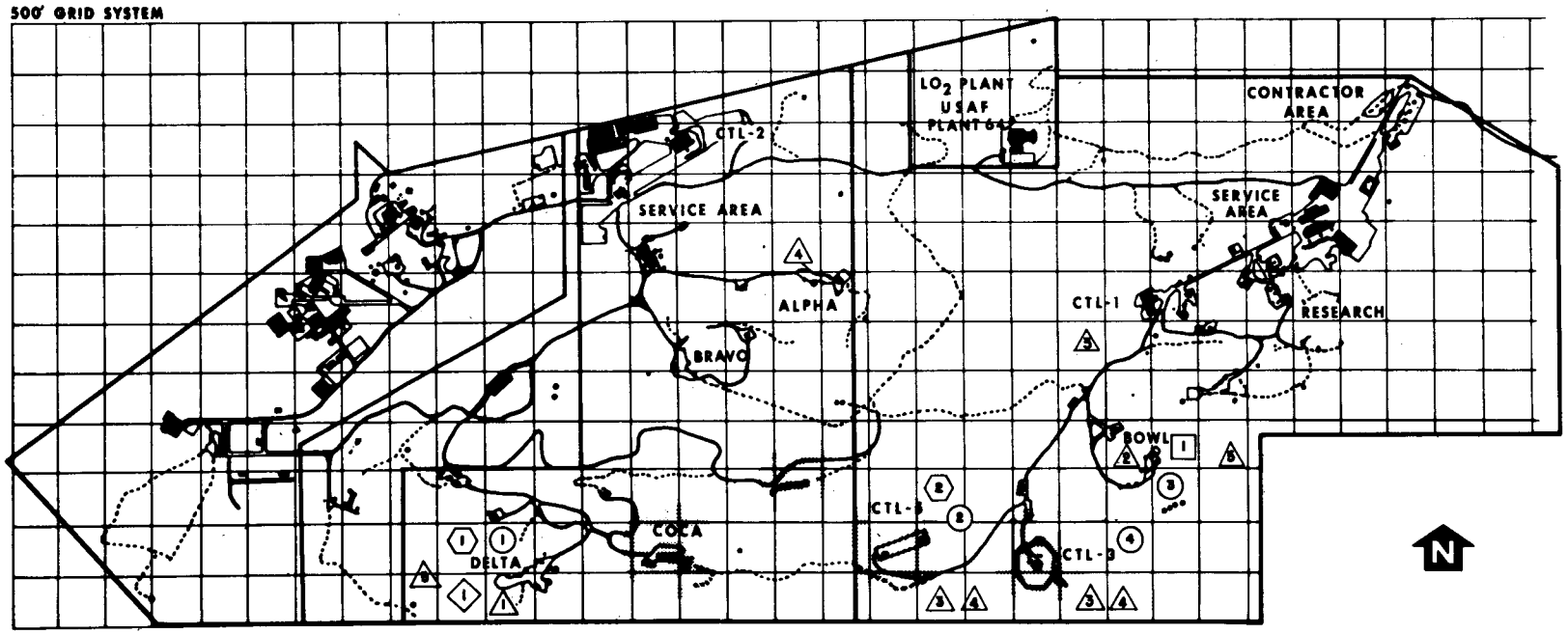


DELTA 3 TEST STAND

VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM



SANTA SUSANA, CALIFORNIA

LEGEND

EXISTING FACILITIES

1. DELTA
2. CTL-5
3. BOWL
4. CTL-3

FACILITIES AUTHORIZED & UNDER CONSTRUCTION

FISCAL YEAR 1962

1. DELTA 5-2 TEST STANDS
2. CTL-3 MODIFICATION

FISCAL YEAR 1963

1. VTS-3 MODIFICATION

FISCAL YEAR 1964

1. DELTA-3 MODIFICATION

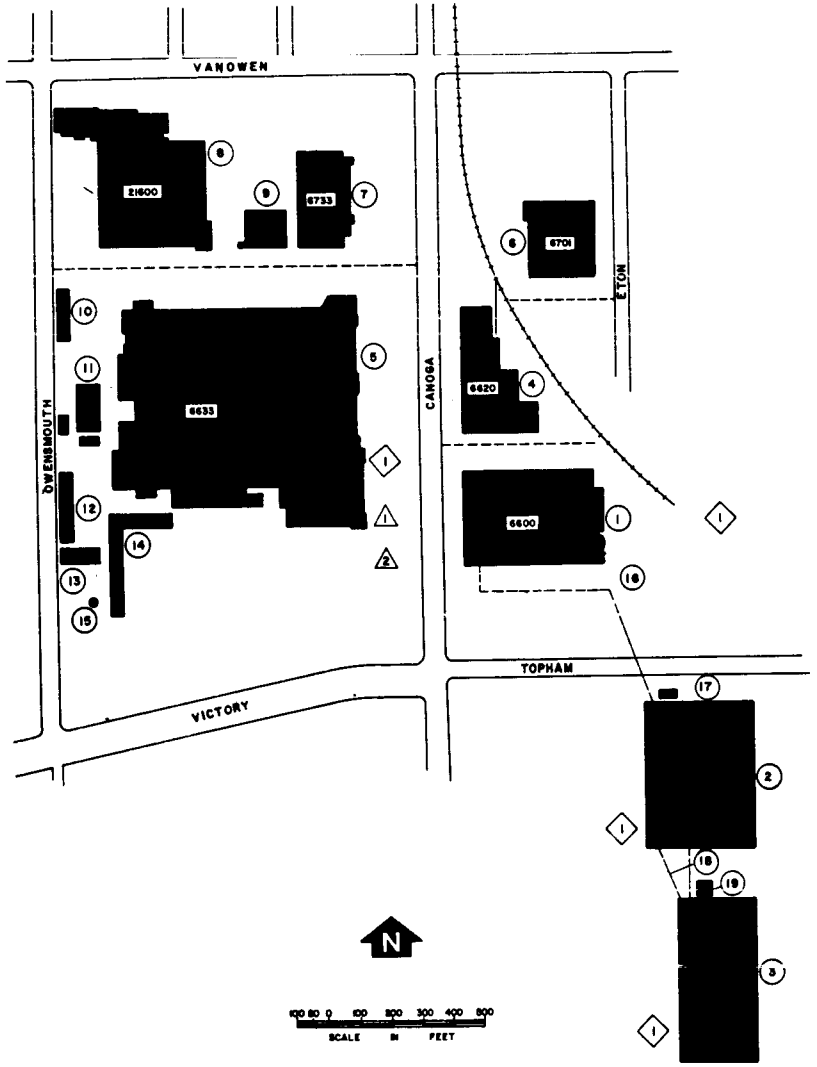
PROPOSED FISCAL YEAR 1965 PROJECT

1. DELTA-3 MODIFICATION
2. BOWL
3. CTL
4. PRODUCTION TEST FACILITIES
5. DEVELOPMENT SUPPORT EQUIPMENT

VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR J-2 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
16. 1.5 INCH DIAMETER NITROGEN LINE
17. NITROGEN GAS CYLINDER & COMPRESSOR
18. 1 INCH DIAMETER HELIUM LINE
19. HELIUM K BOTTLE BANK

FACILITIES AUTHORIZED & UNDER CONSTRUCTION

◇1 EXPANSION OF R&D PRODUCTION MANUFACTURING EQUIPMENT

PROPOSED FISCAL YEAR 1965 PROJECTS

△1 PRODUCTION TEST FACILITIES

△2 DEVELOPMENT SUPPORT EQUIPMENT

CF 12-1.5

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR S-II STAGE PROGRAM

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Various Locations

LOCATION OF PROJECT: Santa Susana, California and Seal Beach, California

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: New, Alteration

FUNDING:

FY 1963 and Prior Years	$536,500
FY 1964 Estimate	---
FY 1965 Estimate	2,024,000
Total Funding Through FY 1965	$2,560,500

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,302,800
Santa Susana, Calif.				
High pressure gas system	LS	---	$364,600	364,600
Thermal control system	LS	---	52,700	52,700
Seal Beach, Calif.				
Vertical checkout bldg.	LS	---	1,385,500	1,385,500
Equipment				$221,200
Seal Beach-special electrical tower	LS	---	221,200	221,200

	Unit of Measure	Quantity	Unit Cost	Total Cost
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$2,024,000

PROJECT DESCRIPTION:

This project provides for construction of additional facilities required for the development of the S-II Stage at: (a) Santa Susana and (b) Seal Beach, California.

Santa Susana. Facilities will include (1) a high-pressure gas storage system, and (2) a thermal control system including a high-pressure pump, nitrogen vaporizers and associated piping and controls.

Seal Beach. A vertical checkout building is required. The facilities will consist of two vertical integrated systems checkout stations, approximately 130 feet wide, by 56 feet deep, by 120 feet high, with a two-story lean-to on the south side of the building to house the mechanical equipment and checkout control room. The building will have a structural steel frame with metal siding and will contain a 20-ton and an 80-ton bridge crane with associated support structures. Blast protection is required for protection from the hazards of pneumatic testing. Mechanical and electrical equipment will consist of heating, air-conditioning, utilities, high-pressure gas, special electrical power and a 1000-KVA substation.

PROJECT JUSTIFICATION:

Santa Susana Facilities:

(1) Present high-pressure gas storage will meet only the S-II stage pressurization requirements for a normal countdown. No reserve capacity is now available to provide for extended holds. This project provides the additional gas storage required to maintain pressurization and thus prevent a costly (in time and dollars) test abort.

(2) There are presently six 1500 standard cubic feet per minute cascade units at Santa Susana providing gaseous nitrogen during vehicle countdown. One additional 1500 SCFM unit with pump, vaporizer and piping is needed to provide thermal control of electrical components within the engine compartment.

Seal Beach - Vertical Checkout Building

The S-II manufacturing plan through all phases involves a series of sequential station operations. Assembly and checkout of the five non-flight stages is being carried out using the stations in the existing Vertical Assembly Building. During this period it is possible to recycle the stages where more than one operation is conducted at a single station. However, as the pipeline begins to fill with flight stages, beginning with the S-II-1 in late 1964, it will not be possible to recycle, and two additional test and checkout stations are required. These stations are required by December 1965 when the S-II-2, 3, 4, and 5 are simultaneously in process. Construction of the additional checkout stations is scheduled to start in October 1964.

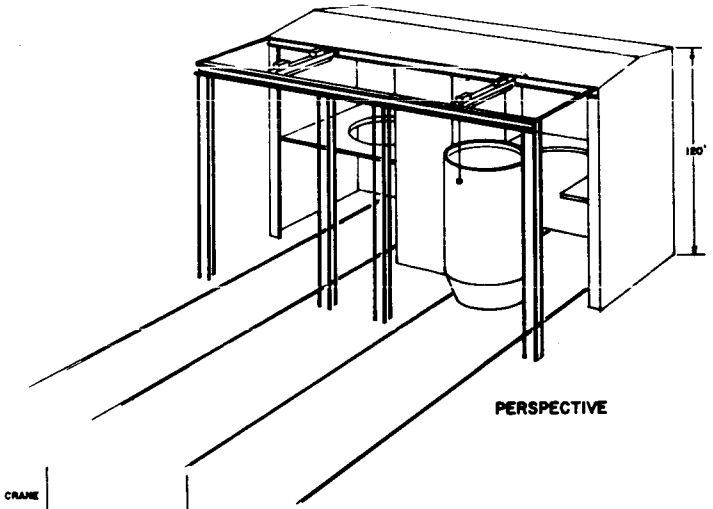
ESTIMATED FUTURE YEAR FUNDING: None

718-870 O - 64 - 27

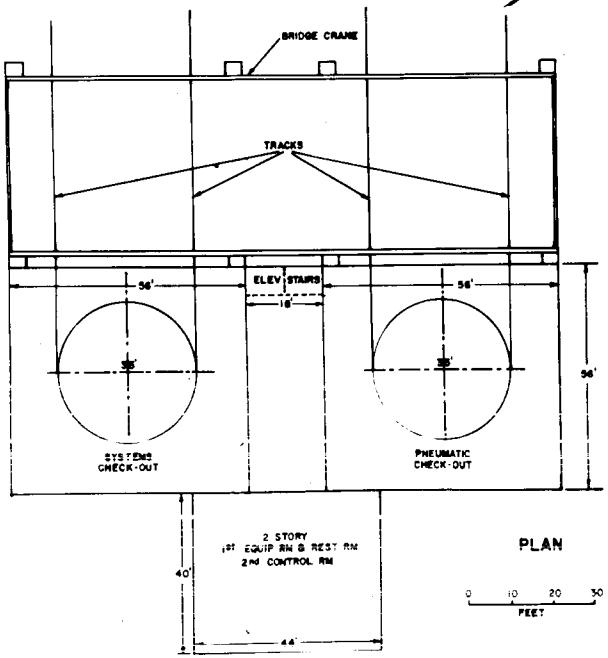
VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

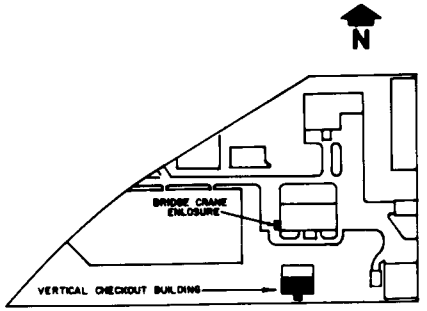
FACILITIES FOR S-II STAGE PROGRAM



PERSPECTIVE



PLAN



SITE PLAN

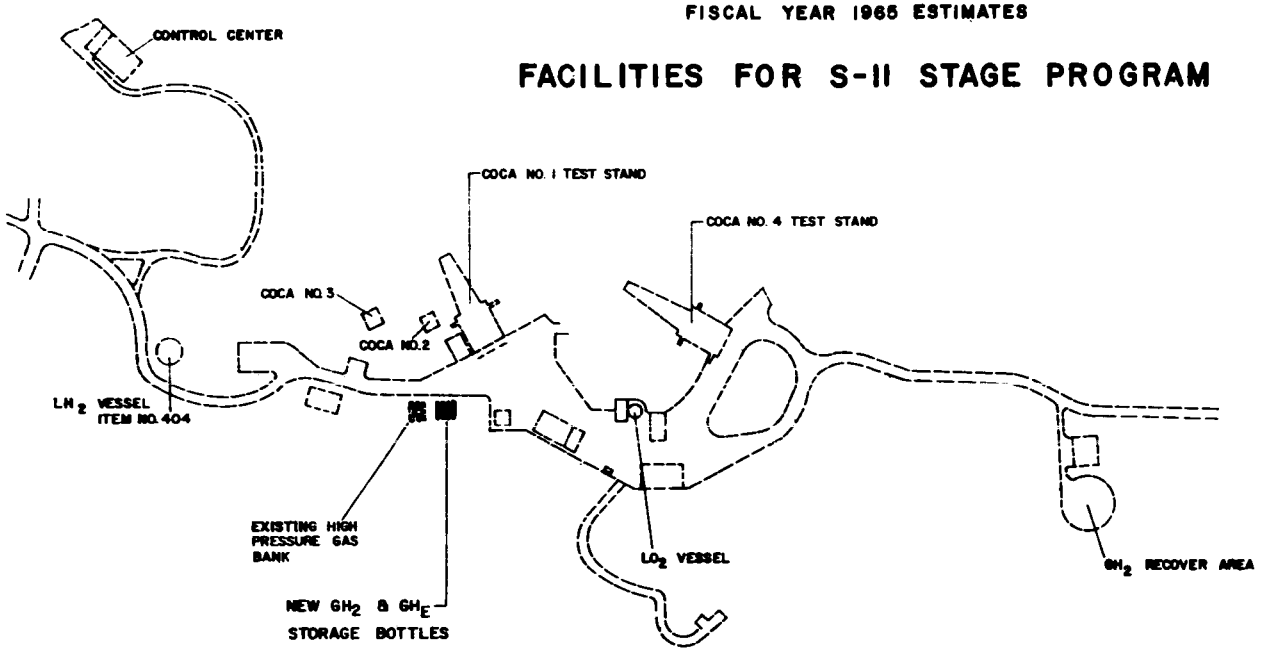
VERTICAL CHECKOUT BUILDING

SEAL BEACH, CALIFORNIA

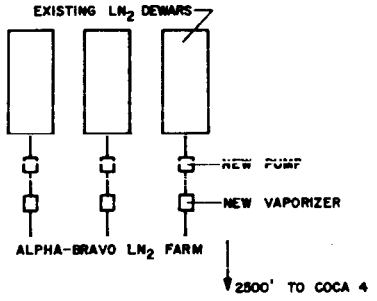
VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

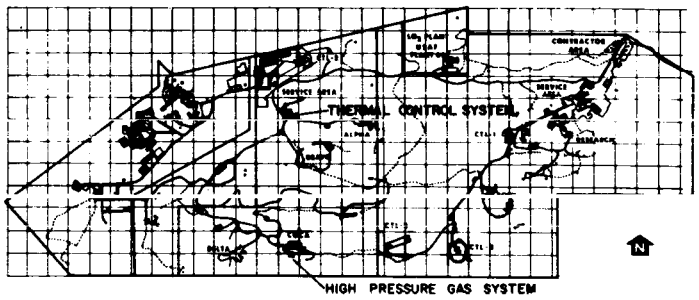
FACILITIES FOR S-II STAGE PROGRAM



HIGH PRESSURE GAS SYSTEM



THERMAL CONTROL SYSTEM



SANTA SUSANA (AIR FORCE PLANT 57), CALIF.

CF 12-20

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR S-IVB STAGE PROGRAM

PROGRAM OFFICE FOR THE INSTALLATION: Office of Manned Space Flight

PROGRAM OFFICE FOR THE PROJECT: Office of Manned Space Flight

AUTHORIZATION LINE ITEM: Various Locations

LOCATION OF PROJECT: Sacramento Field Station, Sacramento, California

COGNIZANT NASA INSTALLATION: Marshall Space Flight Center

TYPE OF CONSTRUCTION PROJECT: Extension; Alteration

FUNDING:

FY 1963 and Prior Years	$375,000
FY 1964 Estimate	5,553,500
FY 1965 Estimate	10,709,000
Total Funding Through FY 1965	$16,637,500

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$6,731,000
Utilities and paving	LS	---	$374,000	374,000
Test stand & auxiliary structures	LS	---	3,787,000	3,787,000
Propellant system	LS	---	1,551,000	1,551,000
Alteration to existing test stand	LS	---	1,019,000	1,019,000
Equipment				$3,978,000
Electric/electronic systems and data processing equipment	LS	---	3,634,000	3,634,000

	Unit of Measure	Quantity	Unit Cost	Total Cost
Shop, laboratory and cryogenic weighing equipment	LS	---	$344,000	$344,000
Design	---	---	---	---
Fallout Shelter	---	---	---	---
		TOTAL		$10,709,000

PROJECT DESCRIPTION:

This project provides for construction of additional facilities for the S-IVB Stage Program at Douglas Aircraft Company's Sacramento Field Station, Sacramento, California. The facilities to be constructed will include a Static Test Stand with auxiliary structures and systems required for acceptance testing of a complete S-IVB Stage and the required alteration of an existing Battleship Test Stand for acceptance testing of a complete S-IVB Stage. In addition to the stands, included are such items as propellant storage and transfer system, instrumentation cable tunnel, ground instrumentation, cryogenic weight system, and modifications and additions to the high-pressure gas storage and transfer system.

PROJECT JUSTIFICATION:

The S-IVB will be the third stage of the Saturn V and the second stage of the Saturn IB vehicle. A two test-stand complex is currently under construction and scheduled for completion during 1964. One of the stands will be used solely for all systems testing and will continue to be used in this capacity throughout the life of the program. The other stand will be used initially for the battleship test program; this year's project provides for the necessary alterations of that stand to permit acceptance testing of an S-IVB stage. This stand conversion which takes approximately 6 months will begin in December 1964 and be available for acceptance testing of the first S-IVB stage for the Saturn IB (SA201). This stand is adequate for the acceptance testing rate of the stages for the Saturn IB program, but as the stages for the Saturn V phase-in during early 1966 a second stand must be available. To meet this requirement construction of this stand must begin in October 1964.

ESTIMATED FUTURE YEAR FUNDING: None

VARIOUS LOCATIONS

FISCAL YEAR 1965 ESTIMATES

FACILITIES FOR S-IVB STAGE PROGRAM