

*National Aeronautics
and Space Administration*

BUDGET ESTIMATES



FISCAL YEAR 1964
Volume III

CONSTRUCTION OF FACILITIES
PART 1

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

SUMMARY OF NEW OBLIGATIONAL AUTHORITY

	<u>Fiscal Year 1962</u>	<u>Fiscal Year 1963</u>	<u>Fiscal Year 1964</u>
SALARIES AND EXPENSES.....	\$(206,750,000)	-	-
RESEARCH AND DEVELOPMENT..	(1,302,500,000)	-	-
RESEARCH, DEVELOPMENT, AND OPERATION.....	1,509,250,000	\$2,897,878,000	\$4,912,000,000
CONSTRUCTION OF FACILITIES	<u>316,000,000</u>	<u>776,237,000</u>	<u>800,000,000</u>
TOTAL APPROPRIATIONS....	<u>\$1,825,250,000^{a/}</u>	<u>\$3,674,115,000</u>	<u>\$5,712,000,000</u>

a/Includes Supplemental Appropriation as follows:
 \$82,500,000 Research, Development, and Operation
 \$71,000,000 Construction of Facilities

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

APPROPRIATION SUMMARY

	<u>Salaries and Expenses</u>	<u>Research and Development</u>	<u>Research, Development, and Operation</u>	<u>Construction of Facilities</u>	<u>Total</u>
<u>FISCAL YEAR 1962</u>					
Independent Offices Appropriation Act, 1962 (75 Stat. 355).	(\$206,750,000)	(\$1,220,000,000)	\$1,426,750,000	\$245,000,000	\$1,671,750,000
Supplemental Appropriation Act, 1962 (75 Stat. 742).....	(<u>a/+9,340,000</u>)	(<u>a/ -9,340,000</u>)	-	-	-
Second Supplemental Appropriation Act, 1962 (76 Stat. 212).	(<u> -</u>)	(<u> 82,500,000</u>)	<u> 82,500,000</u>	<u> 71,000,000</u>	<u> 153,500,000</u>
Total appropriations.....	(\$216,090,000)	(\$1,293,160,000)	\$1,509,250,000	\$316,000,000	\$1,825,250,000
NASA Appropriation Transfers (75 Stat. 355).....	(-2,000,000)	(-7,752,000)	-9,752,000	+9,752,000	-
Transfer to General Services Administration (75 Stat. 353).....	(<u> -319,845</u>)	(<u> -</u>)	<u> -319,845</u>	<u> -</u>	<u> -319,845</u>
Appropriation (adjusted).....	<u>(\$213,770,155)</u>	<u>(\$1,285,408,000)</u>	<u>\$1,499,178,155</u>	<u>\$325,752,000</u>	<u>\$1,824,930,155</u>

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

APPROPRIATION SUMMARY

	<u>Salaries and Expenses</u>	<u>Research and Development</u>	<u>Research, Development, and Operation</u>	<u>Construction of Facilities</u>	<u>Total</u>
<u>FISCAL YEAR 1963</u>					
Independent Offices Appropriation Act, 1963 (76 Stat. 730-1).....	-	-	\$2,897,878,000	\$776,237,000	\$3,674,115,000
NASA Appropriation Transfers (76 Stat. 730-1).....	-	-	+38,812,000	-38,812,000	-
Transfer to General Services Administration (76 Stat. 728).....	-	-	-801,615	-	-801,615
Appropriation (adjusted).....	<u>-</u>	<u>-</u>	<u>\$2,935,888,385</u>	<u>\$737,425,000</u>	<u>\$3,673,313,385</u>
<u>FISCAL YEAR 1964</u>					
Appropriation request	<u>-</u>	<u>-</u>	<u>\$4,912,000,000</u>	<u>\$800,000,000</u>	<u>\$5,712,000,000</u>

a/Transfer not to exceed \$10 million from "Research and development" to "Salaries and expenses", authorized under this Act.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

SUMMARY OF CONSTRUCTION OF FACILITIES PROGRAM
BY BUDGET ACTIVITY

<u>Budget Activity</u>	<u>Fiscal Year</u> <u>1962</u>	<u>Fiscal Year</u> <u>1963</u>	<u>Fiscal Year</u> <u>1964</u>
1. Manned Space Flight.....	\$245,418,700	\$535,090,600	\$564,538,000
2. Space Applications.....	-	-	4,103,000
3. Unmanned Investigations in Space.....	39,828,800	55,817,450	25,509,000
4. Space Research and Technology.	37,814,500	95,436,000	74,979,000
5. Aircraft Technology.....	110,000	6,697,000	3,271,000
6. Supporting Operations.....	35,018,000	36,287,750	127,600,000
Reserved for Allocation Under Reprogramming Authority.....	-	8,096,200	-
Total Plan.....	<u>\$358,190,000</u>	<u>\$737,425,000</u>	<u>\$800,000,000</u>

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

SUMMARY OF CONSTRUCTION OF FACILITIES PROGRAM BY LOCATION

<u>Location</u>	<u>Fiscal Year 1962</u>	<u>Fiscal Year 1963</u>	<u>Fiscal Year 1964</u>
Ames Research Center.....	\$6,564,000	\$14,200,000	\$13,076,000
Flight Research Center.....	110,000	1,697,000	4,081,000
Goddard Space Flight Center.....	12,170,000	17,556,250	20,932,000
Jet Propulsion Laboratory.....	4,063,800	10,003,200	7,000,000
Langley Research Center.....	6,942,500	8,861,000	9,768,000
Launch Operations Center.....	116,291,400	326,974,400	312,855,000
Lewis Research Center.....	1,835,000	43,485,000	25,835,000
Manned Spacecraft Center.....	66,688,600	45,282,700	37,736,000
Marshall Space Flight Center.....	30,318,000	43,559,500	38,496,000
Michoud Plant.....	10,723,000	18,294,000	10,003,000
Mississippi Test Facility.....	18,990,000	73,200,000	111,690,000
Nuclear Rocket Development Station.	22,930,000	17,470,000	20,490,000
Pacific Launch Operations Office...	975,000	-	-
Various Locations ^{1/}	47,874,000	99,721,000	176,038,000
Wallops Station.....	11,714,000	4,160,750	2,000,000
Facility Planning and Design ^{2/}	700	4,864,000	10,000,000
Reserved For Allocation Under Reprogramming Authority.....	-	8,096,200	-
Total Plan.....	<u>\$358,190,000</u>	<u>\$737,425,000</u>	<u>\$800,000,000</u>

^{1/}Excludes amounts appropriated for facilities at Various Locations in fiscal years 1962 and 1963 which are now identified as part of specific NASA installations.

^{2/}Amounts appropriated in fiscal years 1962 and 1963 are reflected by location on the basis of current allocations.

RECONCILIATION OF FINANCING TO PLAN

"Construction of facilities" appropriation.....	\$316,000,000	\$776,237,000	\$800,000,000
Transferred from:			
"Salaries and expenses".....	2,000,000	-	-
"Research, development, and operation".....	7,752,000	-	-
Transferred to "Research, development, and operation".....	-	-38,812,000	-
Appropriation (adjusted).....	<u>325,752,000</u>	<u>737,425,000</u>	<u>800,000,000</u>
Unobligated balance brought forward available to finance new budget plan.....	1,490,000	-	-
Unobligated balance transferred from:			
"Research, development, and operation".....	<u>30,948,000</u>	-	-
Total Financing.....	<u>\$358,190,000</u>	<u>\$737,425,000</u>	<u>\$800,000,000</u>

SUM 5

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

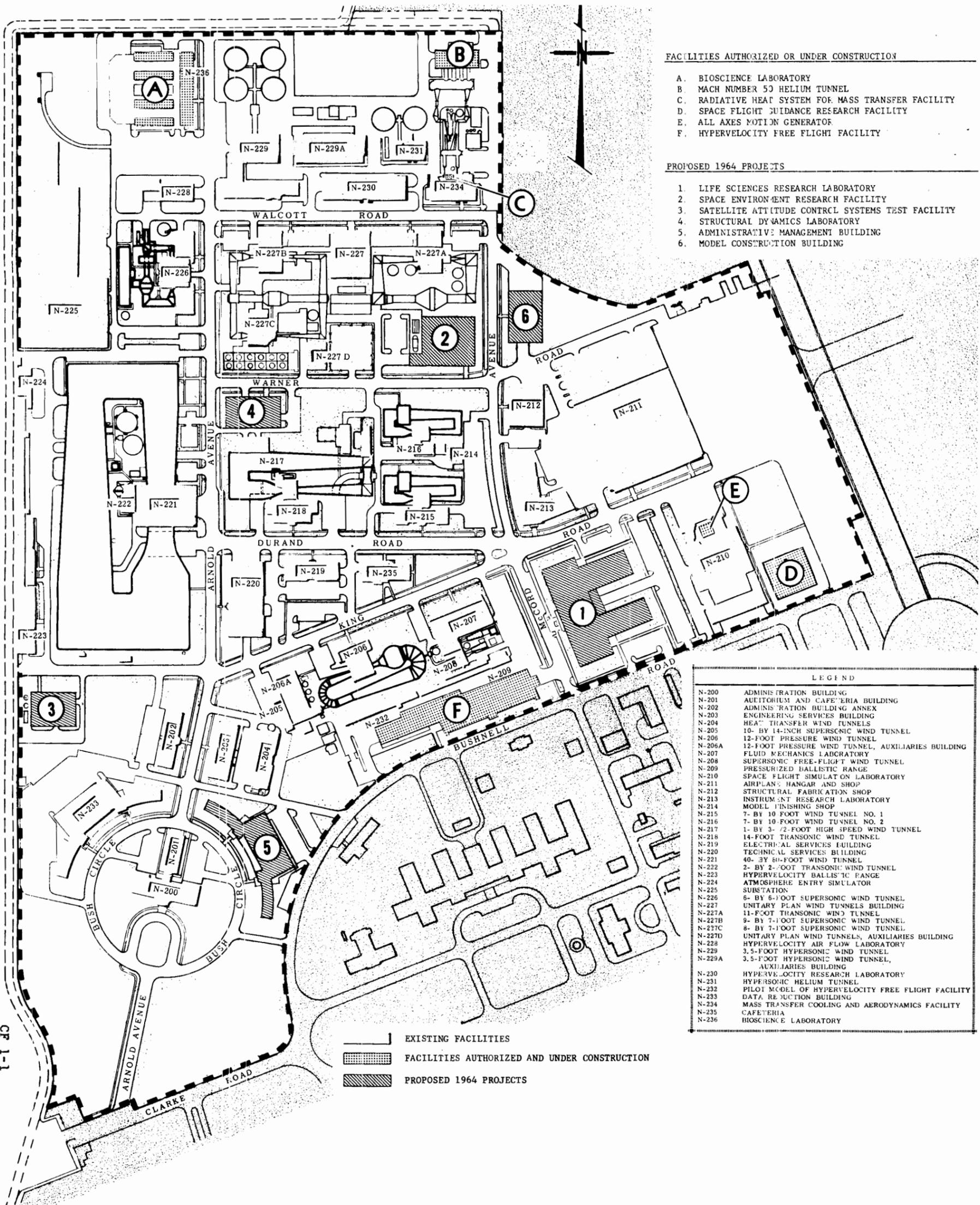
CONSTRUCTION OF FACILITIES - 1964 PROGRAM

AMES RESEARCH CENTER

		<u>Page No.</u>
Location plan.....		CF 1-1
Administrative management building.....	\$ 1,375,000	CF 1-2
Life sciences research laboratory.....	4,880,000	CF 1-5
Model construction building.....	347,000	CF 1-12
Satellite attitude control systems test facility.....	1,230,000	CF 1-15
Space environment research facility.....	3,600,000	CF 1-20
Structural dynamics laboratory.....	<u>1,644,000</u>	CF 1-25
Total.....	<u>\$13,076,000</u>	

AMES RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN



FACILITIES AUTHORIZED OR UNDER CONSTRUCTION

- A. BIOSCIENCE LABORATORY
- B. MACH NUMBER 50 HELIUM TUNNEL
- C. RADIATIVE HEAT SYSTEM FOR MASS TRANSFER FACILITY
- D. SPACE FLIGHT GUIDANCE RESEARCH FACILITY
- E. ALL AXES MOTION GENERATOR
- F. HYPERVELOCITY FREE FLIGHT FACILITY

PROPOSED 1964 PROJECTS

- 1. LIFE SCIENCES RESEARCH LABORATORY
- 2. SPACE ENVIRONMENT RESEARCH FACILITY
- 3. SATELLITE ATTITUDE CONTROL SYSTEMS TEST FACILITY
- 4. STRUCTURAL DYNAMICS LABORATORY
- 5. ADMINISTRATIVE MANAGEMENT BUILDING
- 6. MODEL CONSTRUCTION BUILDING

LEGEND

N-200	ADMINISTRATION BUILDING
N-201	AUDITORIUM AND CAFETERIA BUILDING
N-202	ADMINISTRATION BUILDING ANNEX
N-203	ENGINEERING SERVICES BUILDING
N-204	HEAT TRANSFER WIND TUNNELS
N-205	10- BY 14-INCH SUPERSONIC WIND TUNNEL
N-206	12-FOOT PRESSURE WIND TUNNEL
N-206A	12-FOOT PRESSURE WIND TUNNEL, AUXILIARIES BUILDING
N-207	FLUID MECHANICS LABORATORY
N-208	SUPERSONIC FREE-FLIGHT WIND TUNNEL
N-209	PRESSURIZED BALLISTIC RANGE
N-210	SPACE FLIGHT SIMULATION LABORATORY
N-211	AIRCRAFT HANGAR AND SHOP
N-212	STRUCTURAL FABRICATION SHOP
N-213	INSTRUMENT RESEARCH LABORATORY
N-214	MODEL FINISHING SHOP
N-215	7- BY 10 FOOT WIND TUNNEL NO. 1
N-216	7- BY 10 FOOT WIND TUNNEL NO. 2
N-217	1- BY 3- 7/2-FOOT HIGH SPEED WIND TUNNEL
N-218	14-FOOT TRANSONIC WIND TUNNEL
N-219	ELECTRICAL SERVICES BUILDING
N-220	TECHNICAL SERVICES BUILDING
N-221	40- BY 60-FOOT WIND TUNNEL
N-222	2- BY 2-FOOT TRANSONIC WIND TUNNEL
N-223	HYPERVELOCITY BALLISTIC RANGE
N-224	ATMOSPHERE ENTRY SIMULATOR
N-225	SUBSTATION
N-226	6- BY 6-FOOT SUPERSONIC WIND TUNNEL
N-227	UNITARY PLAN WIND TUNNELS BUILDING
N-227A	11-FOOT TRANSONIC WIND TUNNEL
N-227B	9- BY 7-FOOT SUPERSONIC WIND TUNNEL
N-227C	8- BY 7-FOOT SUPERSONIC WIND TUNNEL
N-227D	UNITARY PLAN WIND TUNNELS, AUXILIARIES BUILDING
N-228	HYPERVELOCITY AIR FLOW LABORATORY
N-229	3.5-FOOT HYPERSONIC WIND TUNNEL
N-229A	3.5-FOOT HYPERSONIC WIND TUNNEL, AUXILIARIES BUILDING
N-230	HYPERVELOCITY RESEARCH LABORATORY
N-231	HYPERSONIC HELIUM TUNNEL
N-232	PILOT MODEL OF HYPERVELOCITY FREE FLIGHT FACILITY
N-233	DATA REDUCTION BUILDING
N-234	MASS TRANSFER COOLING AND AERODYNAMICS FACILITY
N-235	CAFETERIA
N-236	BIOSCIENCE LABORATORY

- EXISTING FACILITIES
- ▨ FACILITIES AUTHORIZED AND UNDER CONSTRUCTION
- ▩ PROPOSED 1964 PROJECTS

CP 1-1

AMES RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

ADMINISTRATIVE MANAGEMENT BUILDING

DESCRIPTION:

This project proposes construction of an administrative management office facility consisting of one two-story center section approximately 170 feet long by 100 feet wide and two single-story wing sections each approximately 100 feet long by 40 feet wide to be located on the northeast side of Bush Circle as shown on the drawing on the following page. The building will provide approximately 65,000 square feet of space. It will be designed to provide adequate space for essentially all administrative support personnel, except fiscal personnel, who will remain in the present administration building annex and certain property and supply personnel who will remain in the enclosed area under the 40- by 80-foot wind tunnel.

The proposed structure will be constructed of reinforced concrete with an exterior architectural treatment compatible with existing buildings on Bush Circle. Standard heating and air-conditioning equipment will be included. A partial basement is proposed for necessary utilities and records storage. New centralized telephone equipment will be included, with a four-position switchboard. The building will be designed to provide working space for approximately 325 persons.

JUSTIFICATION:

An overall increase of approximately 17 per cent in the Ames complement for fiscal year 1962 plus approximately 23 per cent for the fiscal year 1963, without a corresponding increase in office space for the administrative staff, have created inefficient and uneconomic operating conditions. Relief in part from the crowded conditions has been obtained by leasing space, and using, on an emergency basis, technical area space which should be returned to research activity use. These undesirable solutions have been adopted reluctantly and are proposed to be discontinued upon completion of this project. Meanwhile, planned increases in complement of about 15 per cent for the fiscal year 1964 will continue to put pressure on available office space, and cause further deterioration in efficient operating conditions unless the proposed new building is provided.

The administrative management facility will provide housing within one building for support personnel in administration services, personnel, management analysis, legal counsel, patent law, procurement contract negotiations, price analysis, and procurement review. The space thus made available in the existing administration building will be utilized for additional technical staff in such areas as program development and management, reliability and quality assurance and applications. In addition, the vacated space will house the new office of the Assistant Director for Life Sciences near the Center

AMES RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

ADMINISTRATIVE MANAGEMENT BUILDING

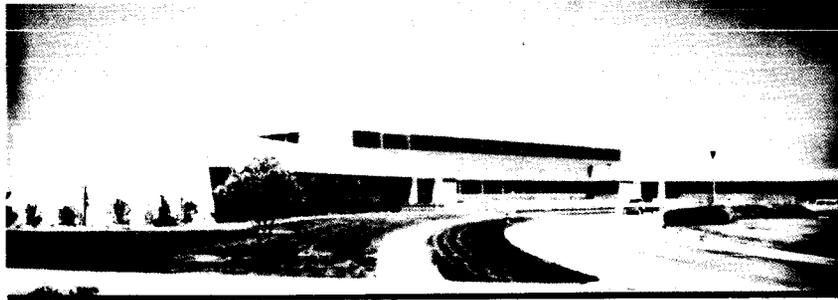
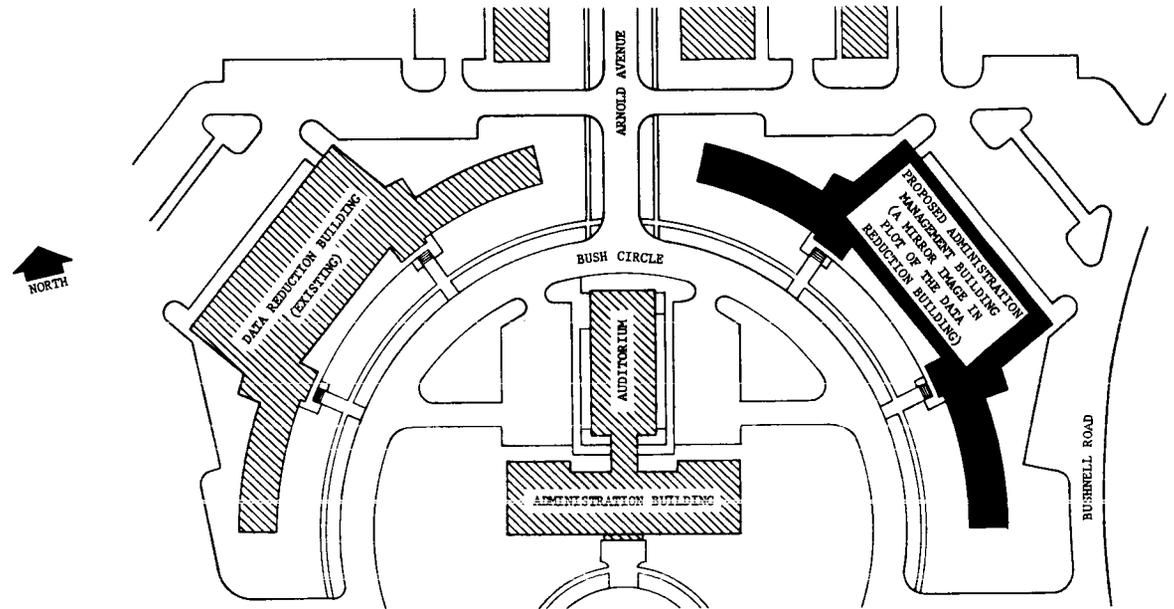


PHOTO OF DATA REDUCTION BUILDING
PROPOSED ADMINISTRATIVE MANAGEMENT
BUILDING TO BE SIMILAR IN APPEARANCE



GENERAL ARRANGEMENT

Director and other assistant directors for better program planning and program coordination. The space vacated in the existing administration annex will house expanded fiscal activities and the expanded technical library.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$121,000
Site improvement.....	\$13,000	
Roads, walks, and parking areas.....	68,000	
Utility connections.....	8,000	
Electrical distribution.....	32,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,182,000
Office area (47,100 square feet at \$19.50 per square foot).....	918,000	
Basement area (17,600 square feet at \$15.00 per square foot).....	264,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		---
E. DESIGN AND ENGINEERING SERVICES.....		<u>72,000</u>
Total estimated cost.....		<u>\$1,375,000</u>

AMES RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

LIFE SCIENCES RESEARCH LABORATORY

DESCRIPTION:

The construction of a life sciences research laboratory is proposed to provide facilities to conduct research and development in the fields of biotechnology, biomedical research and support, and exobiology. Laboratory space, offices, and requisite support functions and systems are included in the request to permit research in these fields and the required systemic, subsystemic, and cellular subdivisions thereof.

As shown on the sketch on the following page, the laboratory will consist of three major elements to house the life sciences research divisions and the supporting facilities peculiar to their needs. Each of these three elements will be two stories high with a full basement. The two smaller units will provide about 21,000 square feet of floor space each. The third unit will add approximately 64,000 square feet of additional floor space including about 6,000 square feet of office space and other areas common to all divisions. The total floor area provided will be 106,000 square feet.

The site has been chosen to provide maximum integration with existing and associated instrumentation research, aerospace flight motion simulator research, and guidance and control research groups at the Ames Center.

Pending construction of this facility, the life sciences staff is being housed in temporary laboratories, in rented buildings, and in space needed by other activities. The temporary laboratories are being equipped as necessary to conduct the approved program. This equipment will be moved from these temporary locations to the proposed facility. Accordingly, the cost estimate does not request funding for portable equipment.

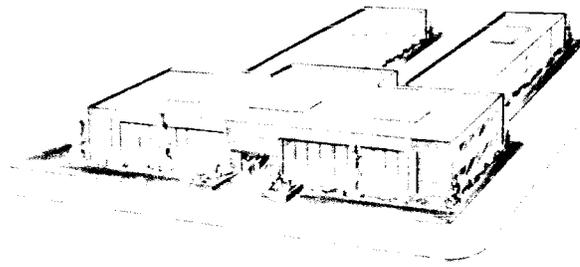
JUSTIFICATION:

Man's ability to survive and function in space travel will depend upon learning and surmounting the hazards of lengthy journeys in a foreign and hostile environment within confined quarters possessing severely limited facilities. To assess these hazards and man's capabilities, it is essential that basic research be pursued in at least three major areas of life sciences - biotechnology, biomedical research and support, and exobiology.

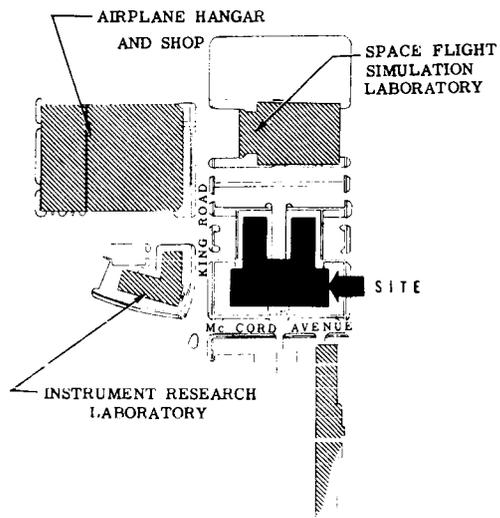
The major competence within the NASA for research and development pertaining to life sciences is being systematically developed at the Ames Research Center. Scientific personnel are being obtained for the Center and extensive programs pertaining to life sciences problems have been initiated. Research will be conducted by three divisions, with associated special services. A discussion of the three major areas follows:

AMES RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

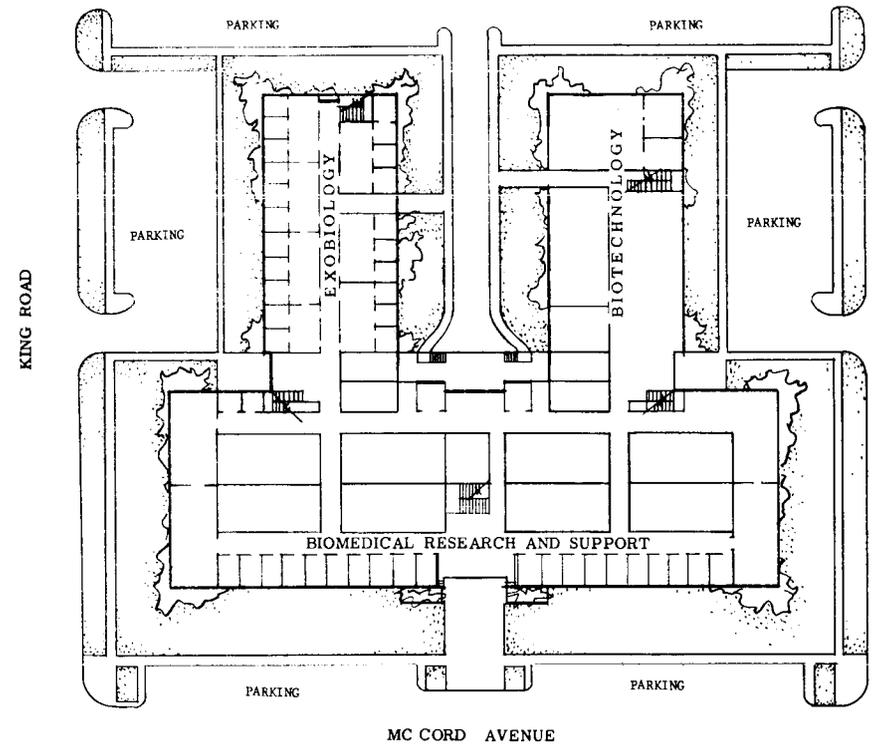
LIFE SCIENCES RESEARCH LABORATORY



PERSPECTIVE



PLOT PLAN



GENERAL ARRANGEMENT



NOTE:

BUILDING IS TWO STORY WITH FULL BASEMENT UNDER EACH WING.

CP 1-6

Biotechnology research: This area of research is concerned with all aspects of the relationship between manned space flight and in the support of man during lunar and planetary exploration, as well as for the manning of permanent lunar and planetary bases.

The extension of time spent in space away from terrestrial environments to more than 30 days requires new concepts for man-machine integration, vehicle control and display systems, life support, and radiation protection. Studies for the provision of metabolic requirements and waste disposal must parallel this work, as must the development of equipment and instrumentation for optimum physiological and performance data monitoring systems. This monitoring must be selective and of such a processing nature as to permit read-out and decision-making for land-based observers and the astronauts alike.

There is a requirement to develop specialized monitoring systems that are effective for animal land-based experiments as well as for required animal flight projects. New and improved physical sensors are required to improve both physiological and physical sensing device systems.

New methods must provide the capability for man to explore and exploit space by the use of remote control of vehicle and sampling devices. This must necessarily include the creation and use of newer methods to provide information in a form readily accessible to the human brain and the improvement of effectiveness of both directly controlled and remotely controlled vehicle systems.

Reliable sources of habitable atmospheres must be devised to sustain man for periods of a year and longer where no sensible atmosphere exists. Closed ecological support systems that re-use all waste materials to reconstitute the habitable atmosphere and supply food and water to the astronaut must be devised. Improved positional and restraint systems and new techniques for astronaut performance in free space must parallel development of individual portable life support systems and personal space transport devices. Survival and rescue equipment and techniques are necessary to assure astronaut recovery from space emergencies and disasters.

Research in the basic physiologic functions of man associated with the development of new and improved pressure suits for both intra- and extra-vehicular use will be given a high priority. Newer methods for the development of a biological power source using human waste materials are being pursued, and tapping the body of its bioelectrical potential to power micro-miniaturized monitoring circuitry is proving feasible to researchers at the Center.

In order to fully study environmental effects on the physiological, psychological, and performance capabilities of man and experimental animals in land-based laboratories, limited simulation facilities unique to biotechnical requirements must be devised and utilized.

Biomedical research and support: Experiments are being undertaken to obtain information concerning the effects of outer space and planetary environments on living systems and processes. Basic human research is directed toward gathering information about metabolic, physiologic, and psychologic processes of man and animals as related to space flights. As manned space flights extend beyond 30 days into months and years, there is need for fundamental information of basic medical and behavioral problems.

Physical measurements of the radiation in space have defined the requirements for more precise evaluation of the effects of long-term, relatively low dosages of ionizing radiation and the finding of means for protection therefrom in addition to conventional shielding techniques. Altered metabolic reactions achieved through temporary lowering of body temperatures or pharmacologic means hold promise of affording varying degrees of protection from radiation or effects which may result from exposure to other sources of energy in the electromagnetic spectrum as occur in space flight.

Radiation hazards in projected manned space flight missions to the moon and planets make radiology a primary area of effort. In addition to the ambient radiation in space, the proposed use of nuclear energy for auxiliary power and for propulsion lend more emphasis to this field. Metabolic requirements of animals and men in terms of energy exchange, heat transfer, and nutrition under the limitations imposed by confinement in an artificial space capsule environment pose problems of a fundamental nature which require further study.

Acceleration forces and weightlessness produce a redistribution of blood flow to the heart, lungs, brain, and kidneys. The chronic effects of these physical stresses on vital organs and adaptation thereto, as well as the long-term cardiovascular effects of restricted mobility are subjects for detailed scientific consideration as they relate to space exploration. Long-term living in an artificial atmosphere which can be expected to deviate from optimal conditions on occasion necessitates further study of the process of diffusion of gases including toxic substances from the lungs to blood and from blood to body tissues as well as further consideration of the chemical alterations incident to pulmonary ventilation.

More detailed knowledge of nervous system sensors; visual and auditory perception; the physiologic substrata of orientation,

thought, and emotion; the neural control of respiration, cardiovascular function, temperature, and metabolism; and the neuro-physiological aspects of environmental adaption and fatigue as well as psychological reactions involved in motivation, vigilance, and social adjustment, reflect a series of important areas of concern in regard to man's performance under conditions imposed in flight.

Further research is required for the improvement in astronaut selection criteria. Physical examinations and psychological testing in the process of selection must be more precise and the many laboratory procedures available to the medical selection team must be evaluated and supplemented in order that criteria established will result in identifying the right man for the specific mission. Investigation into the effects of space travel on the normal circadian rhythm of man and for the best work-rest cycle is needed.

Exobiology: It is proposed to undertake basic research related to the prediction, detection, and study of extraterrestrial life. Experiments utilizing the basic approach have been initiated to obtain information concerning the origin and evolution of organic molecules and subsequent life synthesis in various extraterrestrial environments. Equipment is being developed whereby both in-flight and ground-based experiments may be undertaken to identify and study terrestrial and extraterrestrial life.

This project proposes the construction of a facility suitable for the conduct of research by the three groups whose work is described above. Staffing for these life sciences groups is proposed as follows:

Biomedical research and support division..	50	research professionals
Exobiology division.....	40	research professionals
Biotechnology division.....	65	research professionals
Supervision and special projects.....	<u>10</u>	research professionals
Total.....	<u>165</u>	research professionals
Supporting personnel.....	<u>450</u>	
Total staffing.....	<u>615</u>	

Of this total, approximately 15 of the research professionals will conduct their research elsewhere, primarily in the existing flight operations laboratory. However, approximately 150 research professionals will require the facilities being requested in this project. These 150 research professionals must have technical, mechanical, and clerical support working directly with them. With approximately 150 support personnel, a total of 300 people will occupy the laboratory. The remainder of the necessary support personnel will be distributed throughout the various shops and

supporting facilities already in existence at the Ames Center. The proposed structure has, therefore, been designed to provide the laboratory space, the built-in laboratory equipment, and the office space necessary for a research staff of 300 people.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$ 300,000
Site preparation and landscaping.....	\$15,000	
Roads, walks, and parking areas.....	58,000	
Utility connections.....	27,000	
Substation breakers, transformers, and switchgear.....	34,000	
Emergency generator.....	40,000	
Electrical distribution.....	126,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		2,940,000
Building (106,000 square feet at \$22.90 per square foot).....	2,425,000	
Special ventilation and fans.....	140,000	
Special laboratory plumbing.....	260,000	
Special air-conditioning for isolated laboratories.....	50,000	
Special electrical systems.....	65,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,400,000
Specialized built-in equipment:		
Radioactive material handling, storage, disposal, and protec- tion equipment.....	270,000	
Radioactive source shielding.....	25,000	
Decontamination equipment.....	10,000	
Radioisotope receiving storage and disper- sing equipment.....	75,000	
Electron microscope equipment.....	40,000	
Shielding and equip- ment for radiation work.....	120,000	

Electromagnetic protection
 equipment.....\$110,000
 Electromagnetically
 shielded room equip-
 ment and shielding... \$70,000
 High voltage x-ray
 shielded source..... 40,000
 Environmental control and simula-
 tion equipment..... 630,000
 Environmental chamber.. 350,000
 Anechoic chamber..... 180,000
 Constant-temperature
 room equipment..... 60,000
 Incubation rooms equip-
 ment..... 40,000
 Surgical rooms and laboratory
 equipment..... 390,000
 Surgical waste crema-
 torium..... 85,000
 Photographic and auto-
 radiography equipment 45,000
 Surgical room equipment 100,000
 Distilled water units.. 18,000
 Deionized water units.. 16,000
 Glass washing equipment 26,000
 Centralized stock room
 and safety equipment. 35,000
 Animal holding area
 equipment..... 20,000
 Glass blowing equip-
 ment..... 45,000

E. DESIGN AND ENGINEERING SERVICES..... \$240,000
 Total estimated cost..... \$4,880,000

AMES RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

MODEL CONSTRUCTION BUILDING

DESCRIPTION:

The proposed building will be single story, of reinforced concrete construction, 102 feet wide by 154 feet long and will contain a large main shop area plus a plastics fabrication room, boiler room, office, tool crib, locker room, and lavatory. A mezzanine floor over the boiler room and offices will permit complete utilization of the covered area for working space. An incinerator will be provided outside the building for sawdust disposal.

A five-ton bridge crane will serve the main shop and a two-ton bridge crane will serve the plastics fabrication room. The main shop area will have a concrete floor and the mezzanine will have a wooden deck. Heating will be radiant floor type. Machinery and equipment from the existing model fabrication shop will be relocated in the new building.

The building will be similar in appearance and design to existing buildings at the Ames Center. The proposed location, floor plan and a typical cross section are shown in the drawings on the following page.

JUSTIFICATION:

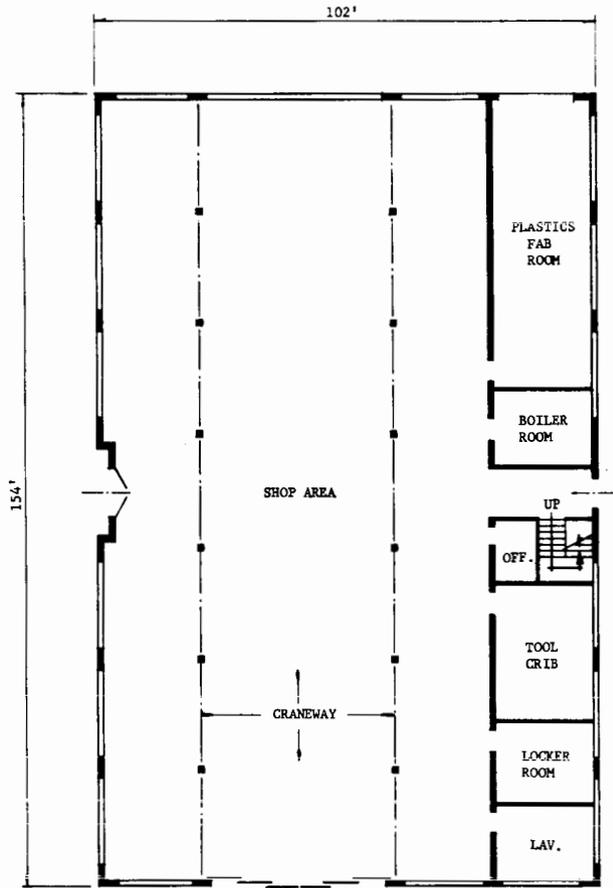
The several new research facilities which have been provided at Ames Center in the 22 years since the existing model shop was constructed have imposed increasing demands and requirements for model construction. The point has now been reached where new and improved quarters and facilities are needed to provide:

- (a) Increased working room to accommodate equipment for new and improved model-making techniques employing plastics, ceramics, and precision metal castings.
- (b) Space to consolidate all activities at one location which at present are performed at scattered locations throughout the Center due to overcrowding of the shop.
- (c) Elimination of the existing safety hazards resulting from the necessity of raising heavy loads into and out of the shop by means of the machine shop bridge crane.

Relocation of the model construction activities to the proposed building will make available space urgently required for precision machining activities and particularly for the establishment of "clean room" facilities for work that must be performed under controlled atmospheric conditions.

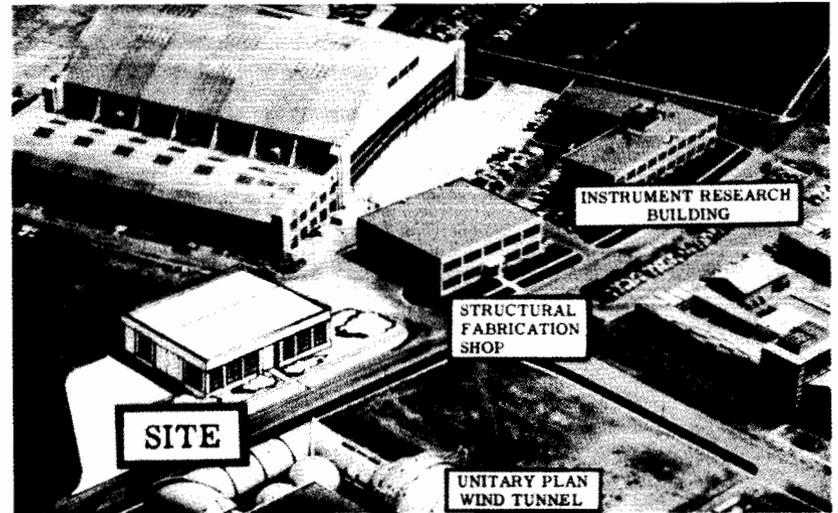
AMES RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

MODEL CONSTRUCTION BUILDING

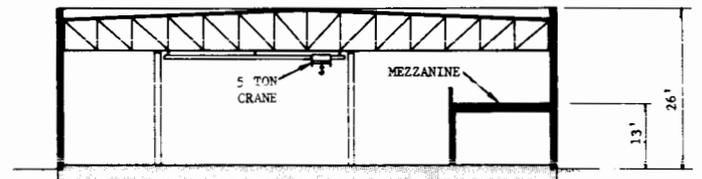


FLOOR PLAN

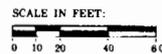
CF 1-13



PERSPECTIVE



SECTION



COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$42,000
Site improvements.....	\$2,000	
Roads, sidewalks, and parking area.....	16,000	
Utility connections.....	4,000	
Electrical distribution.....	20,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		235,000
Building (15,700 square feet at \$15 per square foot).....	235,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		51,000
Cranes, fume blowers and control equipment..	25,000	
Model shop incinerator.....	26,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>19,000</u>
Total estimated cost.....		<u>\$347,000</u>

AMES RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

SATELLITE ATTITUDE CONTROL SYSTEMS TEST FACILITY

DESCRIPTION:

A test facility is required for use in evaluating the performance of systems for attitude control of space vehicles. The essential features of the required system are low to negligible friction, minimum uncontrollable external torques, rotational freedom about three axes, and simulation of attitude references such as the sun, earth, and stars. The system will consist of a platform, supported by a gas bearing, upon which the control system can be mounted. The platform and its support will be housed in a vacuum chamber to minimize the torques due to the presence of an atmosphere.

The platform will be supported by a spherical gas bearing about 1.0 inches in diameter. The bearing capacity will be about 3000 lbs. when the flow of gas through the bearing is of the order of 0.4 lbs/minute. Removal of this gas from the vacuum chamber presents a nearly insurmountable problem if it is allowed to expand to the vacuum chamber pressure. A separate pumping system will therefore be required. This system will remove the gas from regions between the bearing and seals nearly in contact with the sphere. In this way, two pumps of reasonable displacement can be used to remove nearly all of the bearing gas from the system. Gas bearings which have been constructed to date have an inherent uncontrollable torque which is believed to be caused by gas flow across small surface imperfections on the bearing. This torque which has been termed "turbine torque" is less than 100 dynecentimeters for bearings of the type under consideration.

The platform will be shaped to permit free rotation about the vertical axis and $\pm 30^\circ$ about any horizontal axis. The use of a gas bearing support and the limited access imposed by the vacuum chamber dictate that the platform have its own control system so that it can be given any desired initial position and angular rate. A telemetry system will be necessary for command of the platform systems and to transmit performance data. The platform must have a remotely operable system to achieve static balance. This cannot be accomplished prior to evacuation of the chamber since buoyancy moments will exist at atmospheric pressure which will vanish in vacuo unless the centers of mass and volume coincide. The platform must contain its own power supply.

This platform will be about 90 inches in diameter. By placing weights around the periphery, a moment of inertia of about 1000 slug ft² about any axis should be attainable without exceeding the capacity of the gas bearing. A minimum moment of inertia of less than 50 slug ft² should also be attainable. The platform will be constructed so that the gas bearing and the systems described above form one structural unit, and the housing for the control system to be tested forms another. Several of the control system housings will be constructed so that systems can be set up and checked out outside of the vacuum chamber.

The vacuum chamber will be approximately spherical with an internal diameter of approximately 140 inches. A mechanical fore-fump and a one stage diffusion pump will be provided with sufficient capacity to maintain the pressure at less than 1 micron (1/760,000 atmospheres) while the gas bearing is operating. At this pressure the "turbine torques" from the gas bearing should be by far the major source of external disturbance to the platform.

Radiation sources to simulate the earth, sun, and stars, will be placed near the walls of the upper half of the vacuum chamber. The walls of the upper half of the chamber will be covered with a light absorbent material such as blackened aluminum honeycomb. Provision will be made to cool the honeycomb with liquid nitrogen if necessary. This may be required for adequate simulation for some scanning-type sensors such as infra-red earth seekers which detect the temperature discontinuity between the earth and space. An alternative approach would be to modify such sensors to detect a discontinuity in the visible wave lengths so that a simple discontinuity in color would suffice. The lower half of the vacuum chamber will be fixed and contain all pumping ports. The upper half, containing the light absorbent walls and radiation sources, will be lifted vertically to provide access.

The equipment will be located in a building which will have a crane capable of handling the upper half of the vacuum chamber. Air conditioning will be provided to remove dust, oils, and other contaminants to vacuum systems. Sufficient area is included for shops for maintenance of the equipment and for set up and check out of the test control systems. A floor area of about 2000 square feet is proposed.

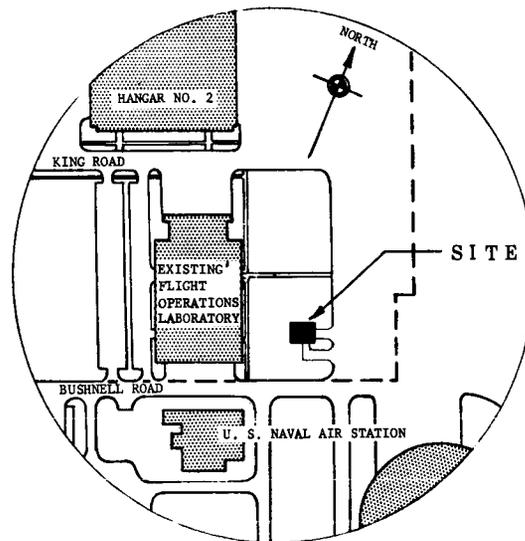
Sketches of the facility are shown on the following two pages.

JUSTIFICATION:

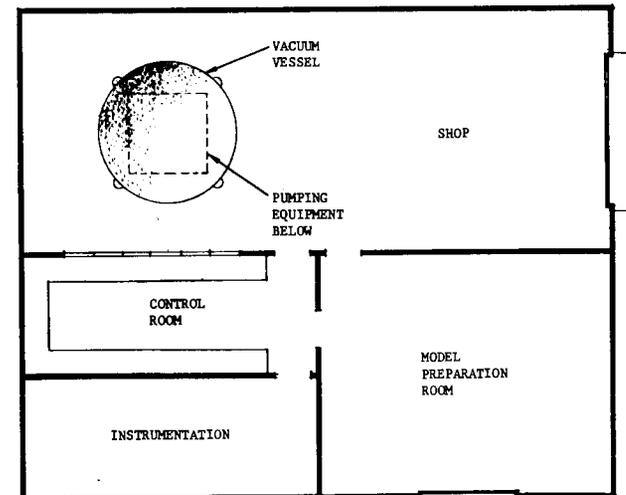
Proper evaluation of solutions of space vehicle attitude control problems often requires that a control system be built and tested. Such hardware simulation provides, for example, the only practical means for assessing the importance of coupling between the various channels of a complex system. Moreover, it permits study of the behavior of systems whose dynamic range of operation is too large to be simulated in any other way. The quality of the hardware simulation of control components and systems previously performed at Ames on air bearing platforms has been limited by a lack of realistic environment. Methods of vehicle actuation, for example, can be evaluated properly only when the simulation is disturbed as little as possible by its environment. Furthermore only an appropriate environment permits realistic appraisal of signal quality and of the dynamic problems associated with horizon sensors, star-trackers, and other components. The proposed facility will provide the equipment and environment needed to verify and complete analytic and computer studies of space vehicle control system behavior.

AMES RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

SATELLITE ATTITUDE CONTROL SYSTEMS TEST FACILITY



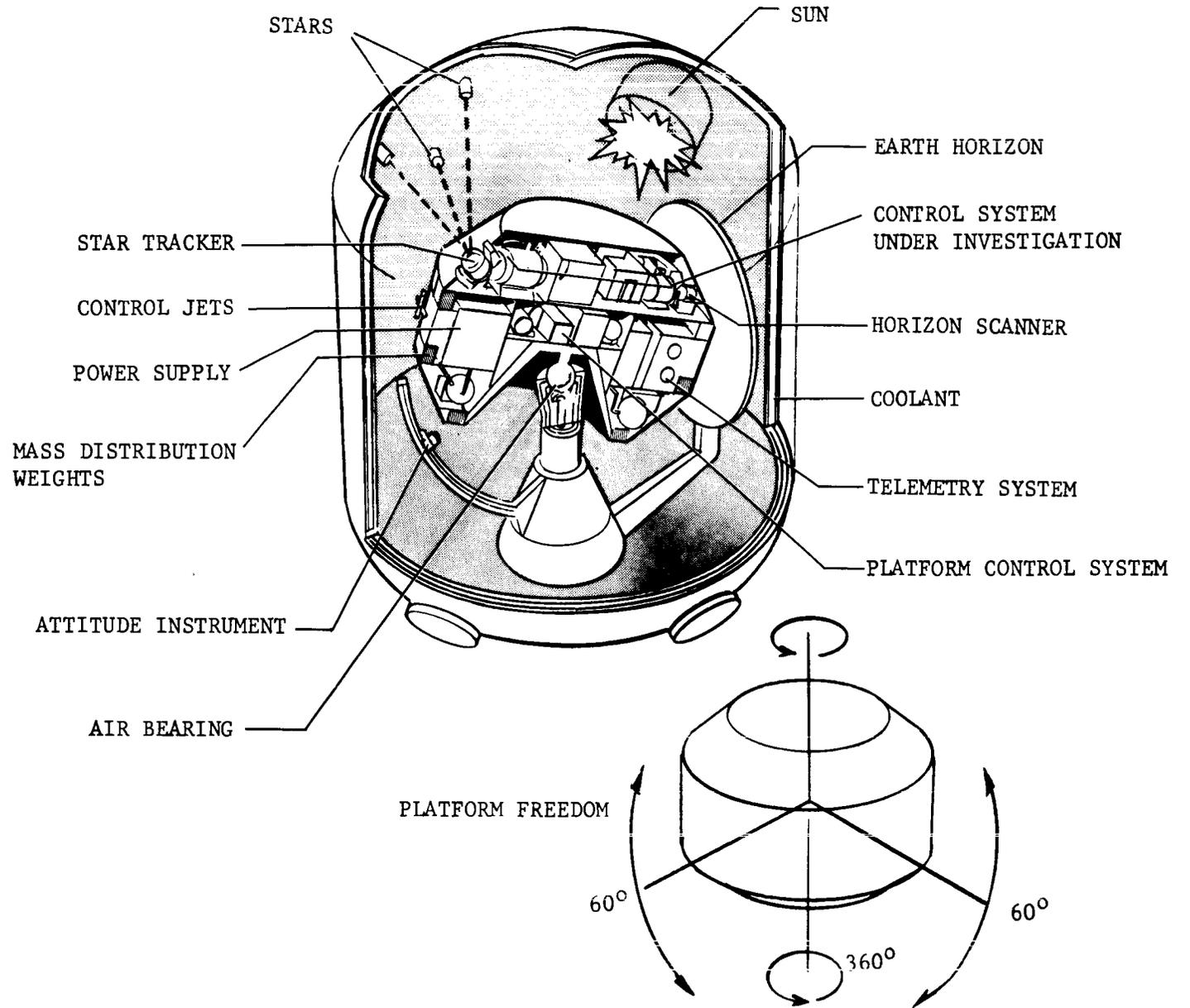
PLOT PLAN



FLOOR PLAN



SATELLITE ATTITUDE CONTROL SYSTEMS TEST FACILITY



COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$50,000
Utilities, connections, parking and landscaping.....	\$30,000	
Electrical distribution.....	20,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		520,000
Building...(2,000 square feet at \$20.00 per square foot).....	40,000	
Simulator foundation.....	5,000	
Vacuum chamber.....	100,000	
Pumping equipment.....	375,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		585,000
Air bearing table and pumps.....	150,000	
Cold wall and liquid nitrogen pumps and storage.....	200,000	
Sun and earth simulating device.....	150,000	
Telemetry.....	50,000	
Instrumentation and controls.....	35,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>75,000</u>
Total estimated cost.....		<u>\$1,230,000</u>

AMES RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

SPACE ENVIRONMENT RESEARCH FACILITY

DESCRIPTION:

It is proposed to construct a materials laboratory that will provide the facilities necessary for research on the interrelated effects of the spatial environment on materials which would be used for spacecraft. For this research, the environmental constituents to be simulated will include high-vacuum, electromagnetic and particle radiation, heat sink of outer space, and impact by micrometeoroids.

The major equipment required for the laboratory will include vacuum chambers, liquid-nitrogen storage and liquid-helium refrigeration systems for chamber cold-walls, high-vacuum pumping systems, radiation sources, micrometeoroid particle launcher, and mechanical, physical, and chemical research instrumentation and equipment. The vacuum chambers will include one 5-foot diameter chamber for pressures to 10^{-10} mm of Hg., and one 16-inch bell jar for pressures to 10^{-15} mm of Hg. Each will be equipped with cold-wall panels which can be cooled with liquid nitrogen (-320°F) and/or liquid helium (-452°F). The pumping systems will include mechanical vacuum pumps, mechanical vacuum blowers, oil diffusion pumps, gettering-type pumps, and cryogenic baffles. The electromagnetic (solar) radiation simulators will consist of suitably arranged and filtered sources which produce solar energy fluxes up to approximately 13,000 watts per square foot. The particle radiation simulator will consist of ion accelerators which operate in the range from 1 kev to 3 mev. In the micrometeoroid particle launcher, particles of submicron size will be accelerated to velocities greater than 30,000 feet per second with an electrostatic accelerator. The research instrumentation and equipment will include mechanical test equipment, vacuum furnaces, metallurgical and X-ray diffraction equipment, polymer syntheses and characterization equipment, mass spectrometer, photochemical and thermochemical equipment, and data recording instrumentation. A building for housing this equipment as well as existing related equipment is also included.

The proposed location and arrangement of the laboratory are shown in the sketch on the following page.

JUSTIFICATION:

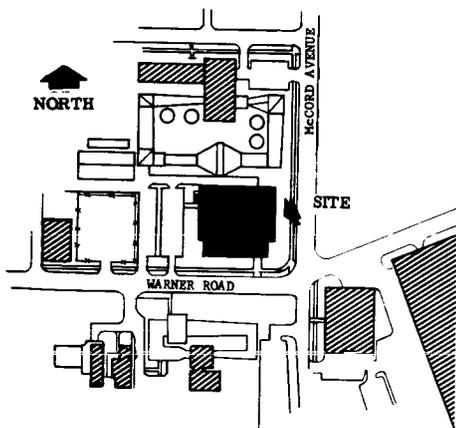
The feasibility of spacecraft for certain types of space missions has already been established. For example, studies have shown that spacecraft for manned landings on the moon are feasible and the earliest possible achievement of this mission has been established as a national goal in the form of Project Apollo. Feasibility studies such as those made for the Project Apollo spacecraft and for a solar probe point up areas where knowledge is either severely limited or nonexistent. One area of particular

AMES RESEARCH CENTER
 FISCAL YEAR 1964 ESTIMATES
 SPACE ENVIRONMENT RESEARCH FACILITY

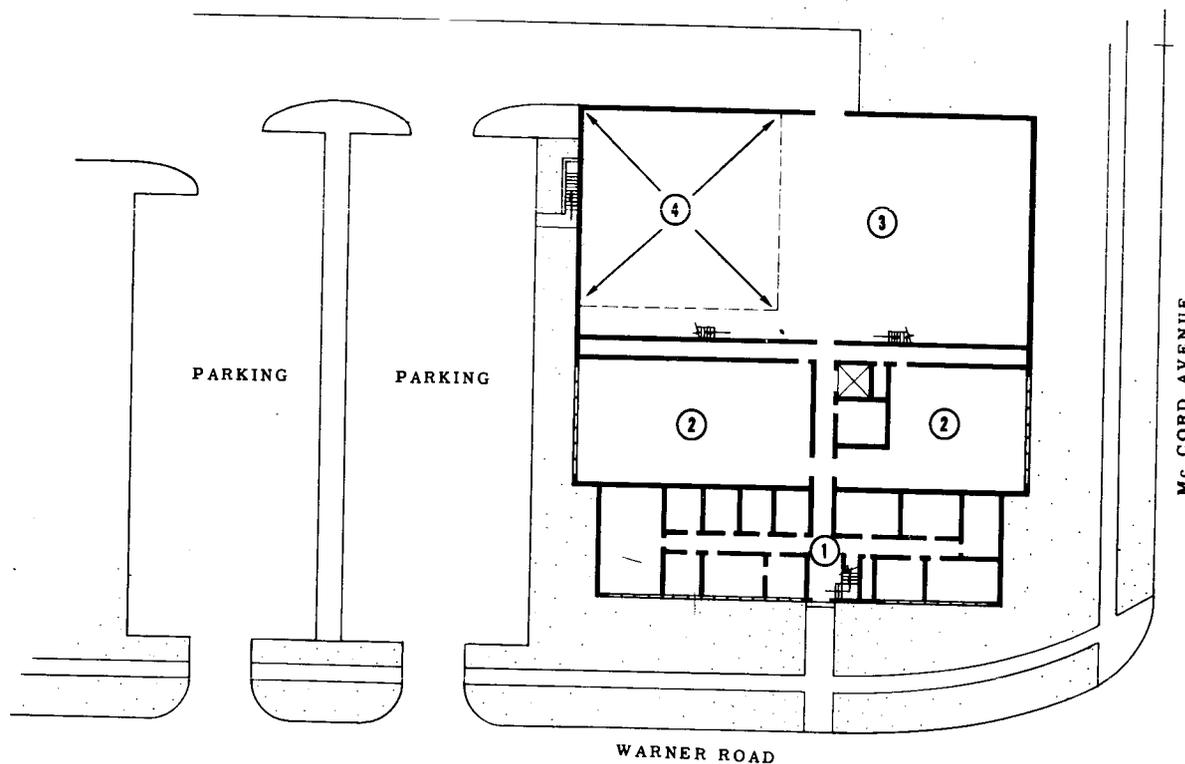
LEGEND

1. OFFICES
FIRST AND SECOND FLOOR
2. LABORATORY ROOMS
FIRST AND SECOND FLOOR
3. LABORATORY
FIRST FLOOR - OPEN TO
CEILING - SECOND FLOOR
4. BASEMENT AREA

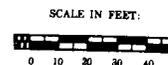
CF 1-21



PLOT PLAN



GENERAL ARRANGEMENT



concern is that associated with the effect of the spatial environment on materials which might be suitable for all components of a spacecraft. Because of the present lack of knowledge in this area, the designer must build into each spacecraft extra factors of safety and reliability which can result in a great deal of redundancy. This redundancy may severely compromise the intended mission due to the associated weight penalty. It is imperative, then, that studies be undertaken to obtain the knowledge required for the practical and efficient design of all types of space vehicles. The purpose of the proposed space **environment** research facility is to provide the equipment necessary to study in detail the effects of the spatial environment on materials. It should be emphasized that this facility has two unique features. First, materials can be simultaneously subjected to the various components of the spatial environment. Second, material properties can be evaluated while the material is in the environment.

One important phenomenon encountered in space is the extremely high vacuum. In high vacuum, the vapor pressure and the rate of weight loss of a material can become significant properties. At present, these material properties can only be predicted with certainty for elements and for some inorganic compounds. For most organic materials, little is known of these properties either theoretically or experimentally. For all materials, the rate of weight loss increases with increase in temperature. Thus, for any material, there is a temperature at which the rate of material loss can become significant. For example, polymeric compounds suitable for such applications as ablation heat shields or insulators can have rates of material loss which would be significant at temperatures as low as 100° Fahrenheit. For efficient operation of thermoelectric and thermionic energy conversion devices, materials must operate at their highest practical temperatures. In this case, the best of materials can have significant weight losses. Other effects of high vacuum are associated with the lack of oxygen and other gases at the surface of a material. There are, for instance, indications that the absence of oxygen and other gases can substantially modify some of the mechanical properties of materials. For example, crack propagation in metals has been found to be influenced by oxidation and by absorbed gases. Moreover, the normal oxide film formed on a metal while in the atmosphere can be removed in space by evaporation and/or by erosion due to particle bombardment. The loss of this film can also substantially change the optical properties of the surface, and, most important, it can change the strength of the metal. For example, nickel alloys are known to have lower stress-rupture and creep strengths when their oxide films are removed. The removal of water from a material also influences its characteristics. Many polymers, for example, are hygroscopic and can have greatly altered properties when the absorbed water is removed. Another example is graphite which normally is an excellent lubricant but which becomes an abrasive when the entrapped water is removed. The vacuum chambers, with associated test equipment proposed in this project, can achieve pressures sufficiently low to permit the study of such problems for materials in space.

Electromagnetic and particle radiation can also significantly alter the characteristics of materials which might be useful for spacecraft. At the longer wave lengths (infrared), electromagnetic radiation contributes primarily to the temperature of the material being irradiated. One effect on materials of such heating is that of dependence of mechanical properties on temperature. Another effect is that of temperature on rate of material loss as previously noted. At the shorter wave lengths (ultraviolet to X-ray), electromagnetic radiation will have various effects on materials. At present none of these effects is believed critical for metals. For organic materials (polymers), however, such radiation can have diverse effects depending on the material. Both chain scission and cross-linking can occur - one or the other usually predominates depending on the type of polymer. Chain scission increases the tendency for the material to lose weight and may cause it to lose strength. Cross-linking will tend to reduce the compliance of the material. Such radiation can also affect the optical properties of polymers. Many inorganic materials are also susceptible to electromagnetic radiation. Again, the primary effects are changes in mechanical and optical properties. Particle radiation can have similar effects on materials. However, because the energies are higher than for solar radiation, a greater variety of materials could be affected. With the equipment proposed herein, studies can be made of such effects due to both electromagnetic and particle radiation.

Particle bombardment, both by molecular species and by micrometeoroids, can also have significant effects on materials used for spacecraft. Both types of particles can cause surface erosion and the larger micrometeoroids can puncture the vehicle skin. Surface erosion will, first of all, affect the optical properties of the surfaces of materials. For example, tests on the effect of ion bombardment of several metallic surfaces have indicated changes of up to 60 percent in the total hemispherical emittance. Secondly, as previously mentioned, the removal of surface films such as oxide films can change the strength of the material. The ion and micrometeoroid accelerators and associated equipment proposed for this laboratory can provide the equipment required for the study of the effects of surface erosion on materials. The mechanism of impact of the larger micrometeoroids on materials has been the subject of extensive study at Ames. There is a need for research on the effects of this impact on the structural properties of a material. For example, in the region of the impact, there can be localized changes in the mechanical properties of the material in combination with stress concentrations. The existing impact facilities will be utilized for these studies.

It should again be emphasized that the interrelated effects of these environmental factors must also be studied. For example, it is most probable that the rate of material loss from a surface under combined high vacuum, radiation, and particle bombardment will be different than for this combination of factors evaluated separately. To provide for such studies, the proposed equipment is designed for tests which include all these factors simultaneously.

With the proposed laboratory, then, studies can be made of the effects of the space environment on materials. Since many of the NASA missions for the near future will be dependent on the knowledge gained by these studies, it is essential that the proposed laboratory be approved at an early date.

COST ESTIMATE:

A.	LAND ACQUISITION.....	---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$375,000
	Utility connections, roads, and	
	landscaping.....	\$75,000
	Electrical distribution.....	300,000
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....	669,000
	Laboratory building:	
	Basement (in laboratory bay; 3,800	
	square feet at \$15 per square foot)....	57,000
	Laboratory bay (12,000 square feet at	
	\$18.50 per square foot).....	222,000
	Laboratory rooms (10,300 square feet	
	at \$19 per square foot).....	196,000
	Offices (7,800 square feet at \$19.75	
	per square foot).....	154,000
	Radiation shielding.....	40,000
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	2,486,000
	Equipment crane.....	25,000
	Auxiliary test equipment.....	400,000
	Instrumentation.....	461,000
	Space chamber.....	250,000
	Solar radiation simulator.....	150,000
	Particle radiation source.....	150,000
	Micrometeoroid bombardment apparatus.....	450,000
	Cryogenic system.....	500,000
	Fume disposal and dust removal system.....	100,000
E.	DESIGN AND ENGINEERING SERVICES.....	<u>70,000</u>
	Total estimated cost.....	<u><u>\$3,600,000</u></u>

AMES RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

STRUCTURAL DYNAMICS LABORATORY

DESCRIPTION:

The construction of a structural dynamics laboratory is proposed to provide a central location for structural dynamics research and for the pre-test calibration and check out of models involved in dynamic tests in the numerous research facilities.

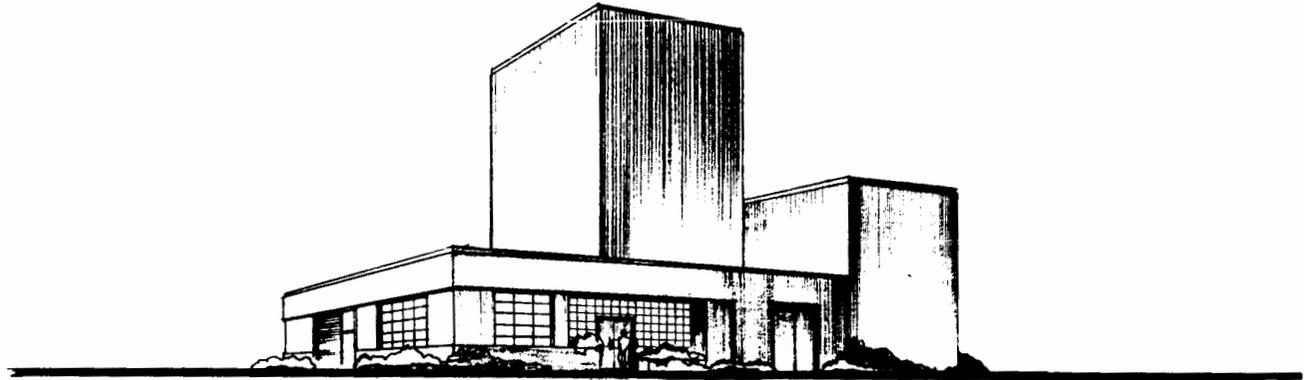
The building, as shown in the sketch on the following page, will consist of a concrete enclosed floor area 100 by 130 feet with a ceiling height of 30 feet over 10,500 square feet of the floor area, and a ceiling height of 100 feet over 2,500 square feet of the floor area, together with office space and on-line computing equipment space totaling an additional 6,000 square feet. The building foundation and walls will be constructed to provide a suitable mounting for models, vibration shakers, and heat sources so that combined heat and vibration environments may be simulated.

JUSTIFICATION:

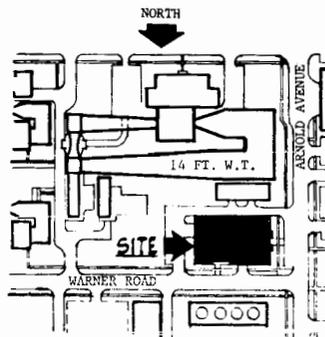
Considerations of structural dynamics are an important factor in the design of space vehicles and research in this area has been severely limited in scope by lack of adequate space and modern test equipment. In order to extend the scope of the significant work being done in transonic buffeting of launch vehicles, dynamics of liquid and solid fuels, moon landing, etc., the proposed facility and equipment are urgently needed. With these facilities, overall dynamic systems with complex interactions, interfaces, and environments will be studied so that complete space vehicles may be evaluated.

The Ames Research Center is engaged in a continuing program involving the dynamic testing of models. This work includes studies of the dynamic stability of entry and launch configurations, launch vehicle dynamics such as ground wind research and transonic buffeting, panel flutter, and the flutter and vibration of lifting surfaces. At the present time, models are pre-test checked in various areas about the field, a procedure which requires transportation and the repeated set up of significant amounts of equipment. Scattered areas in several buildings are available part time for this work, including small areas on each of three floors in the 14-foot transonic wind tunnel; parts of the first floor of the 12-foot wind tunnel, the 6 x 6-foot wind tunnel and the physics laboratory; and the basement of the instrumentation building. The region used is shifted according to availability and adaptability to the needs of the research. A significant increase in efficiency can be obtained by the construction of a facility to provide a central and coordinated effort for this type of work.

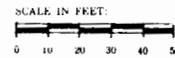
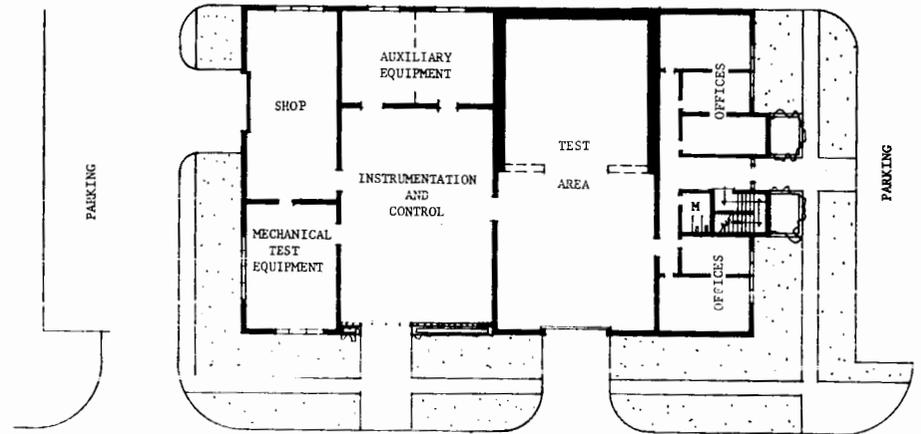
AMES RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES
STRUCTURAL DYNAMICS LABORATORY



PERSPECTIVE



PLOT PLAN



FLOOR PLAN

CF 1-26

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$40,000
Utility, connections, parking areas and landscaping.....	\$30,000
Electrical distribution.....	10,000
C. FACILITY CONSTRUCTION.....	700,000
Main test area (10,500 square feet at \$29.50 per square foot).....	310,000
High test bay area (2,500 square feet at \$72.00 per square foot).....	180,000
Equipment area (6,000 square feet at \$15.80 per square foot).....	95,000
Special foundations.....	115,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	830,000
Electromagnetic shakers and control consoles.....	150,000
Hydraulic pumping unit.....	30,000
Heat source (4,000°F surface temperature).....	400,000
Analog computing equipment.....	250,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>74,000</u>
Total estimated cost.....	<u>\$1,644,000</u>

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

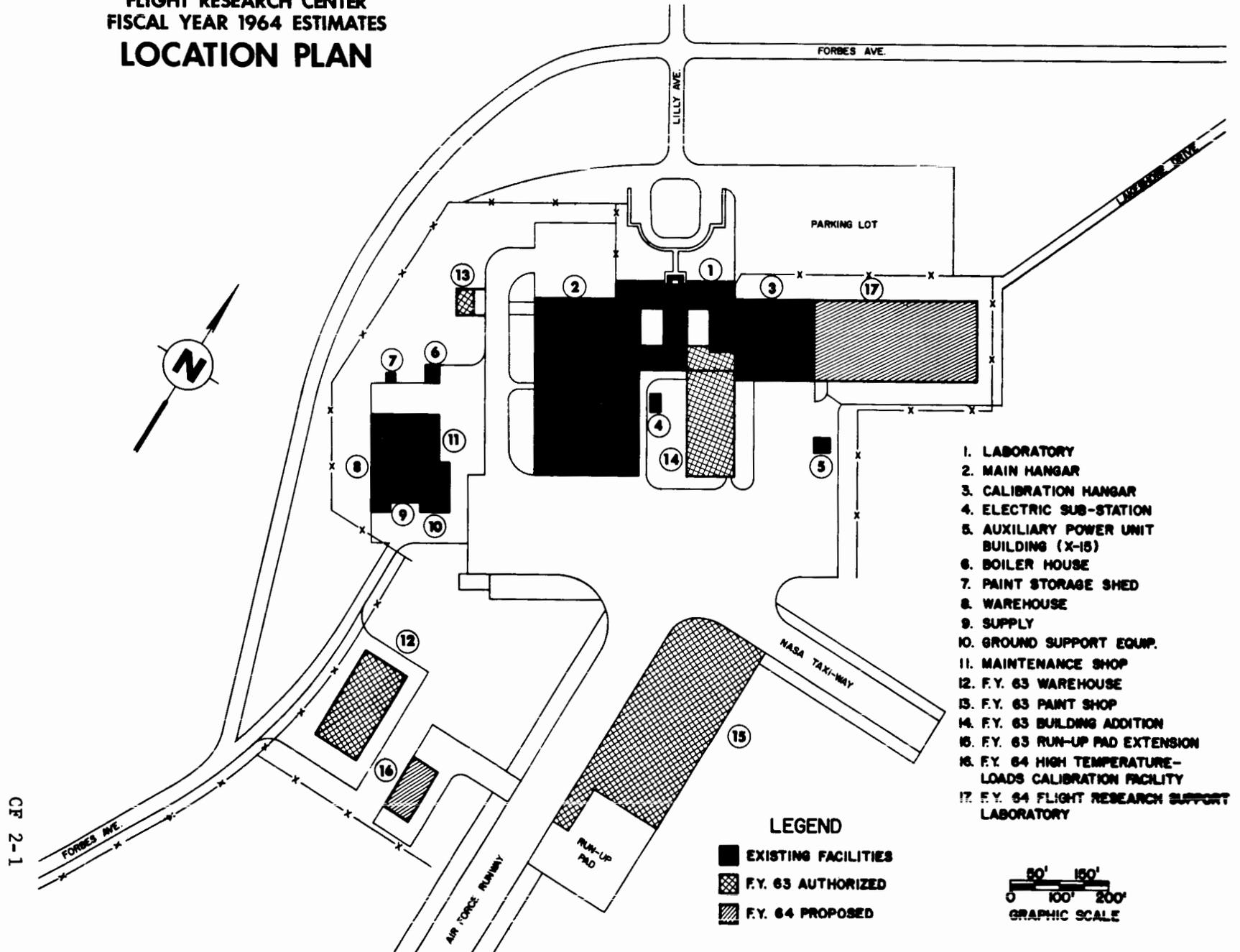
FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

FLIGHT RESEARCH CENTER

		<u>Page No.</u>
Location plan.....		CF 2-1
Flight research support laboratory.....	\$2,924,000	CF 2-2
High temperature loads calibration facility.....	<u>1,157,000</u>	CF 2-5
Total.....	<u>\$4,081,000</u>	

**FLIGHT RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES
LOCATION PLAN**



FLIGHT RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

FLIGHT RESEARCH SUPPORT LABORATORY

DESCRIPTION:

It is proposed that a flight research support laboratory be constructed to house all of the simulation equipment including its analog and power supply equipment. The laboratory will be constructed adjacent to the loads calibration laboratory where provisions are available for bringing a research aircraft in close proximity to the laboratory in order to utilize the actual aircraft systems with the various simulators and analog equipment. The offices and work shops required to service and operate the simulation equipment will also be included in the one-story building. A drawing of the proposed laboratory is shown on the following page.

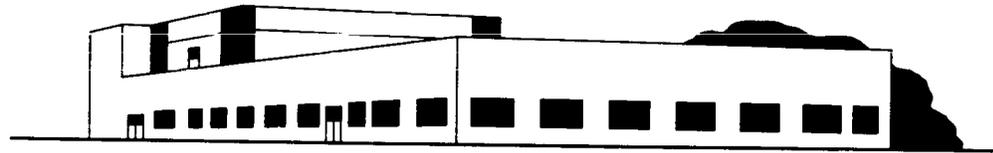
JUSTIFICATION:

There has been a considerable increase in the space required for simulation equipment at the Flight Research Center as a result of the increased number and complexity of flight projects and because of the increased use of simulation to complement, guide, and extend flight research. The simulators are presently housed in the loads calibration laboratory which is unsuitable for this purpose. The loads calibration laboratory is a large hangar-type building that does not permit the proper environmental control required by simulation equipment. The analog equipment used with the simulators is remotely located to the detriment of efficient operation. In addition, the simulation equipment is encroaching severely upon the space available for the performance of loads calibration and aircraft modification work. The proposed laboratory will permit both the simulation work and the loads calibration and aircraft modification work to be carried out in an effective and efficient manner.

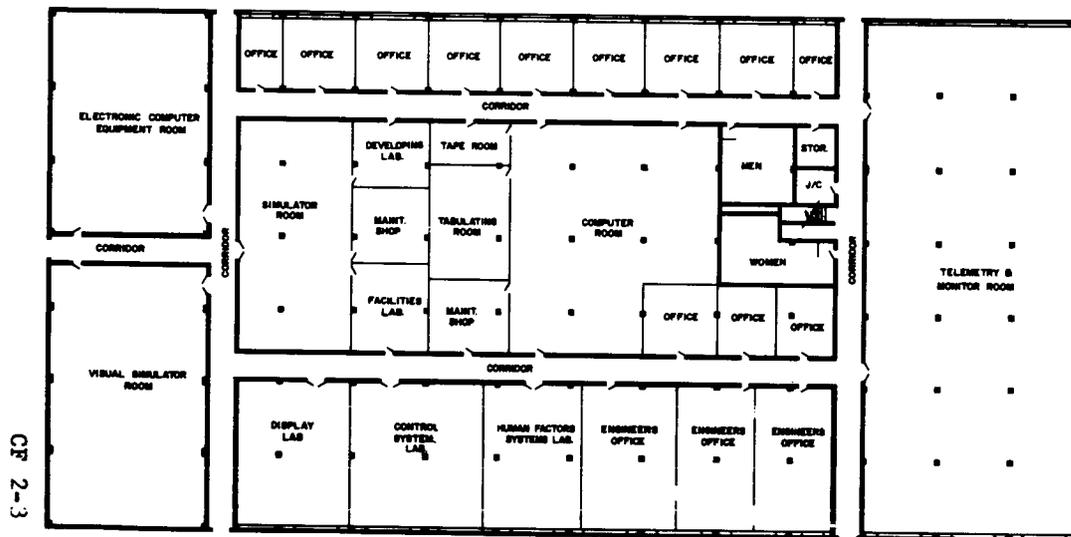
COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$257,000
Excavation and fill.....	\$14,000
Extension of parking area.....	20,000
Access paving.....	16,000
Relocation of fire control system.....	8,000
Extension of fire pipe line.....	28,000
Extension of 12.5 KV power line and substation.....	116,000
500 KV generator and switching gear.....	55,000

FLIGHT RESEARCH CENTER
 FISCAL YEAR 1964 ESTIMATES
**FLIGHT RESEARCH
 SUPPORT LABORATORY**

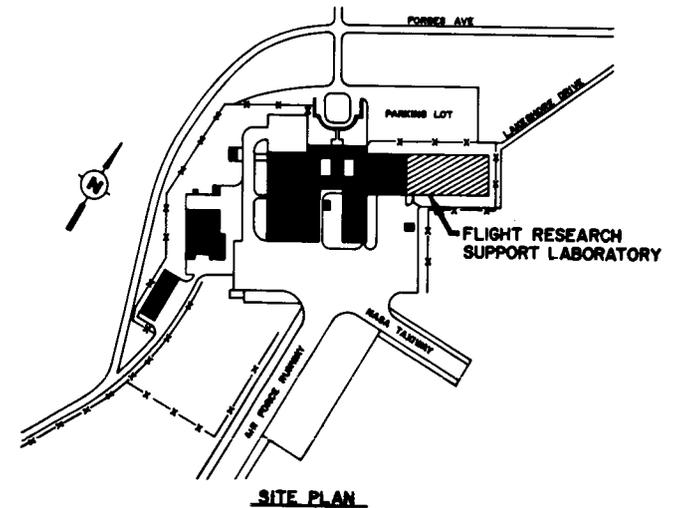
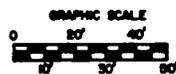


PERSPECTIVE



CF 2-3

FLOOR PLAN



SITE PLAN

C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		\$1,392,000
Building..(54,780 square feet at \$25 per square foot).....	\$1,392,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,080,000
Carbon dioxide fire control equipment.....	30,000	
Office and shop equipment.....	25,000	
Modernization of existing computing equipment	200,000	
New computing equipment.....	220,000	
Biotechnology laboratory equipment.....	170,000	
Display laboratory equipment.....	20,000	
Control system laboratory equipment.....	65,000	
Air-conditioning equipment for electronic equipment.....	275,000	
Control center and data acquisition equipment	75,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>195,000</u>
Total estimated cost.....		<u>\$2,924,000</u>

FLIGHT RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

HIGH-TEMPERATURE LOADS CALIBRATION FACILITY

DESCRIPTION:

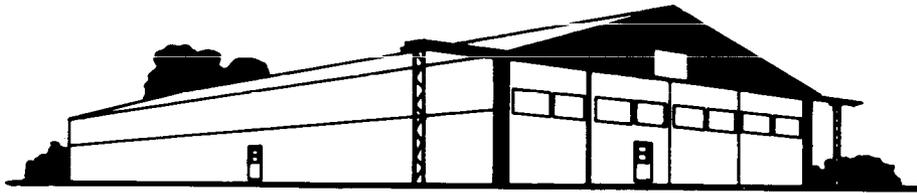
This project provides for the construction of a facility designed to supply the temperature and loads environment for the calibration of high performance aircraft and reentry vehicles for flight measurements. The facility will provide the capability for calibration under simulated flight conditions and for predicting the behavior of structural components under the combined effects of loads and temperatures expected in flight. A drawing of the proposed facility is shown on the following page. The project includes the following items:

- (a) Modernization of the loads facilities of the Flight Research Center including the addition of hydraulic loading units, hydraulic pumps, load control units, deflection measuring instruments, and programming units.
- (b) A high-temperature radiant-heat source with 30-channel ignition control, temperature program units, heat lamps and reflectors.
- (c) A data recording system capable of digital readout at a rate of at least 100 samples per second and a tape transport system for data recording.
- (d) Hangar construction for containing the test equipment and calibration area together with a suitable control room to provide for stable atmospheric environment for recorders and control systems and to provide for safety and protection of personnel.
- (e) The necessary electrical cables, hydraulic hoses, storage units, load frames and lamp supports for the operation and protection of the equipment.

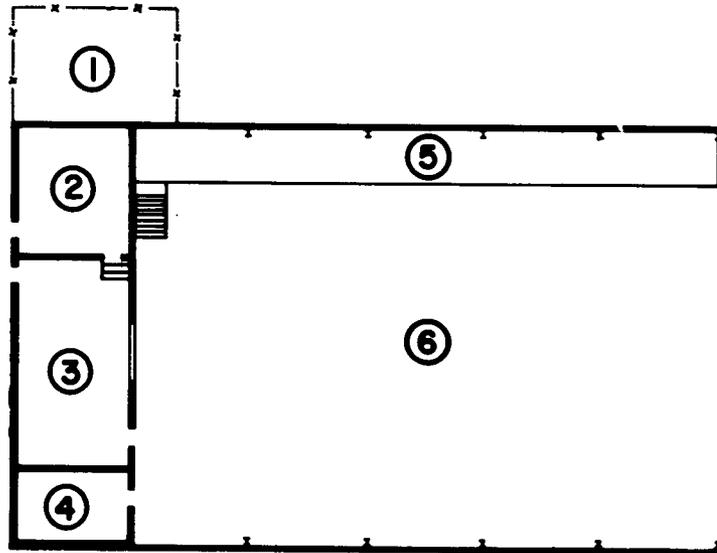
JUSTIFICATION:

The flight test program for manned hypersonic and reentry vehicles is greatly hampered by the lack of adequate facilities for ground testing and calibration under combined effects of loads, temperatures and thermal gradients expected in flight. Room temperature calibrations are hopelessly inadequate for determining the flight response of vehicle structures since the response of measuring instruments to temperatures and to thermal stress cannot be included in the low temperature calibrations nor can they be adequately accounted for by other means. As future vehicles reach higher

FLIGHT RESEARCH CENTER
 FISCAL YEAR 1964 ESTIMATES
**HIGH-TEMPERATURE
 LOADS CALIBRATION FACILITY**

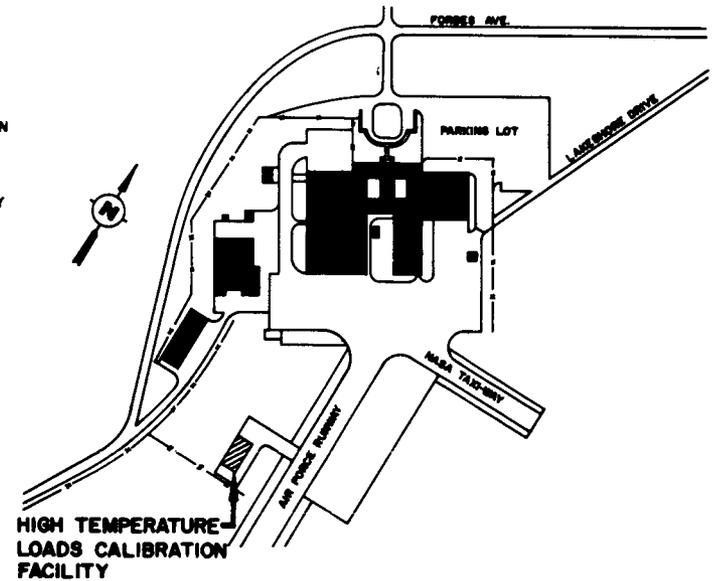


PERSPECTIVE



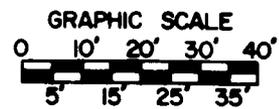
FLOOR PLAN

- ROOM SCHEDULE
- 1. ELECTRIC SUB-STATION
 - 2. OFFICE
 - 3. CONTROL ROOM
 - 4. TOILET
 - 5. CONTROLLER BALCONY
 - 6. TEST AREA



HIGH TEMPERATURE-
LOADS CALIBRATION
FACILITY

SITE PLAN



CI' 2-6

temperatures the reliability of present methods of predicting the structural response will decrease and new and different structural configurations and materials will present more difficult problems of loads, stress, and deflection determination during high-temperature flights.

Possible loss or malfunction of flight vehicles could be avoided and more fruitful areas of the flight regime could be explored by appropriate tests and calibration under conditions which closely approximate areas of the combined environment which the vehicle will experience. The X-15 is presently engaged in exploring the hypersonic flight regime. The proposed facility will be invaluable for extending the research capability of the X-15 beyond the design area and for the development of techniques required to obtain the utmost research information from flight test programs of advanced vehicles. The facility proposed in this project is designed primarily to provide sufficient environments of temperature and loads to calibrate vehicles for flight measurements and to insure the integrity demanded and the reliability required for the safe and efficient operation of the vehicles.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$270,000
Site development.....	\$10,000	
Transmission lines, substation, and switching gear.....	190,000	
Water and sewer line extensions.....	25,000	
Taxiway and ramp.....	45,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		165,000
Building (6,000 square feet at \$19.00 per square foot).....	114,000	
Special loading unit foundations.....	21,000	
Automatic fire control.....	30,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		655,000
Power controllers and programming computers.....	125,000	
Heat lamps and connections.....	115,000	
Hydraulic power and loading equipment.....	115,000	
Loading jigs and lamp supports.....	50,000	
Personnel protection screens.....	10,000	
Transducers.....	20,000	
High-temperature wiring.....	40,000	
Specialized data recording system.....	150,000	
Data tape transport.....	30,000	

E. DESIGN AND ENGINEERING SERVICES..... \$67,000

Total estimated cost..... \$1,157,000

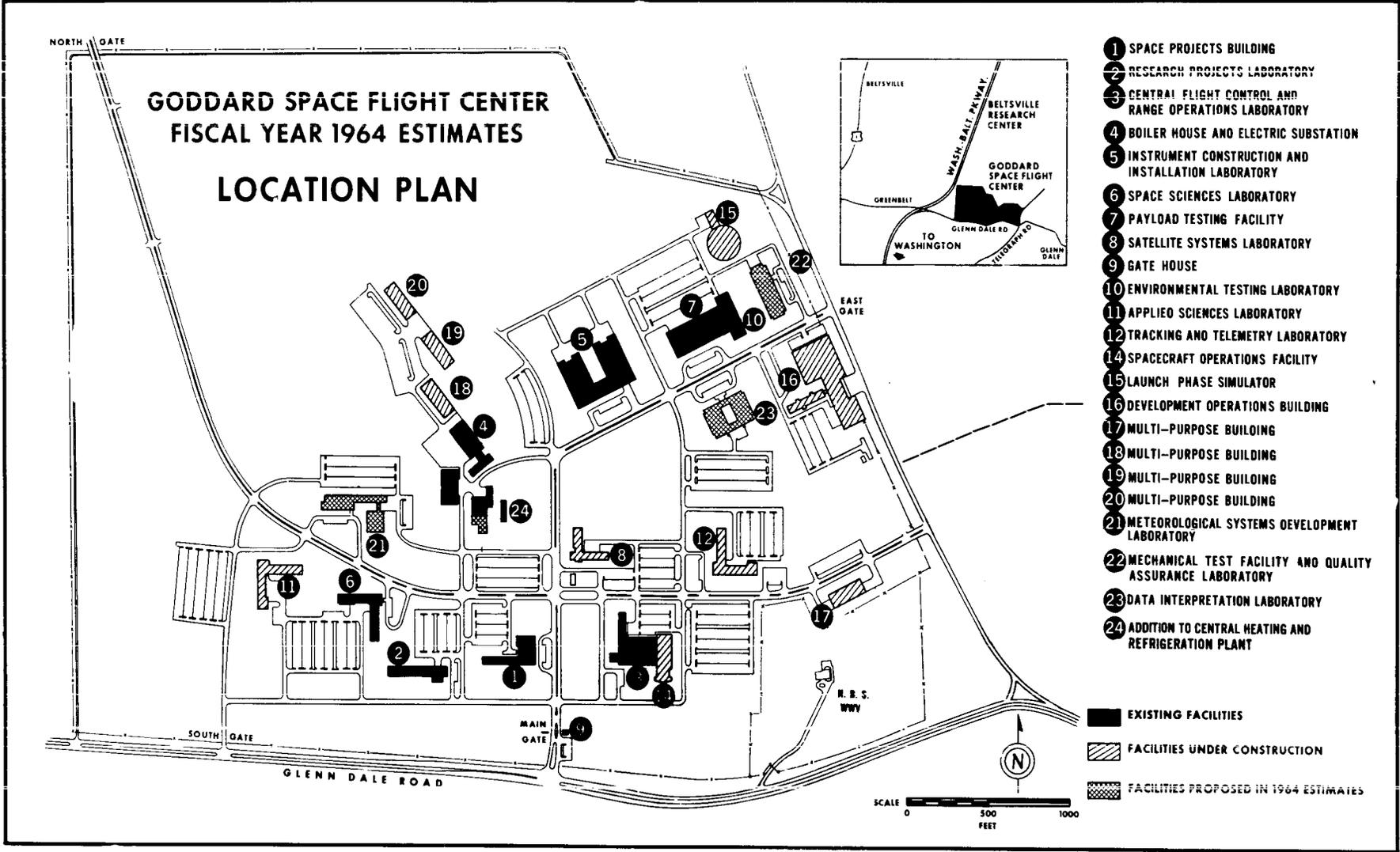
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

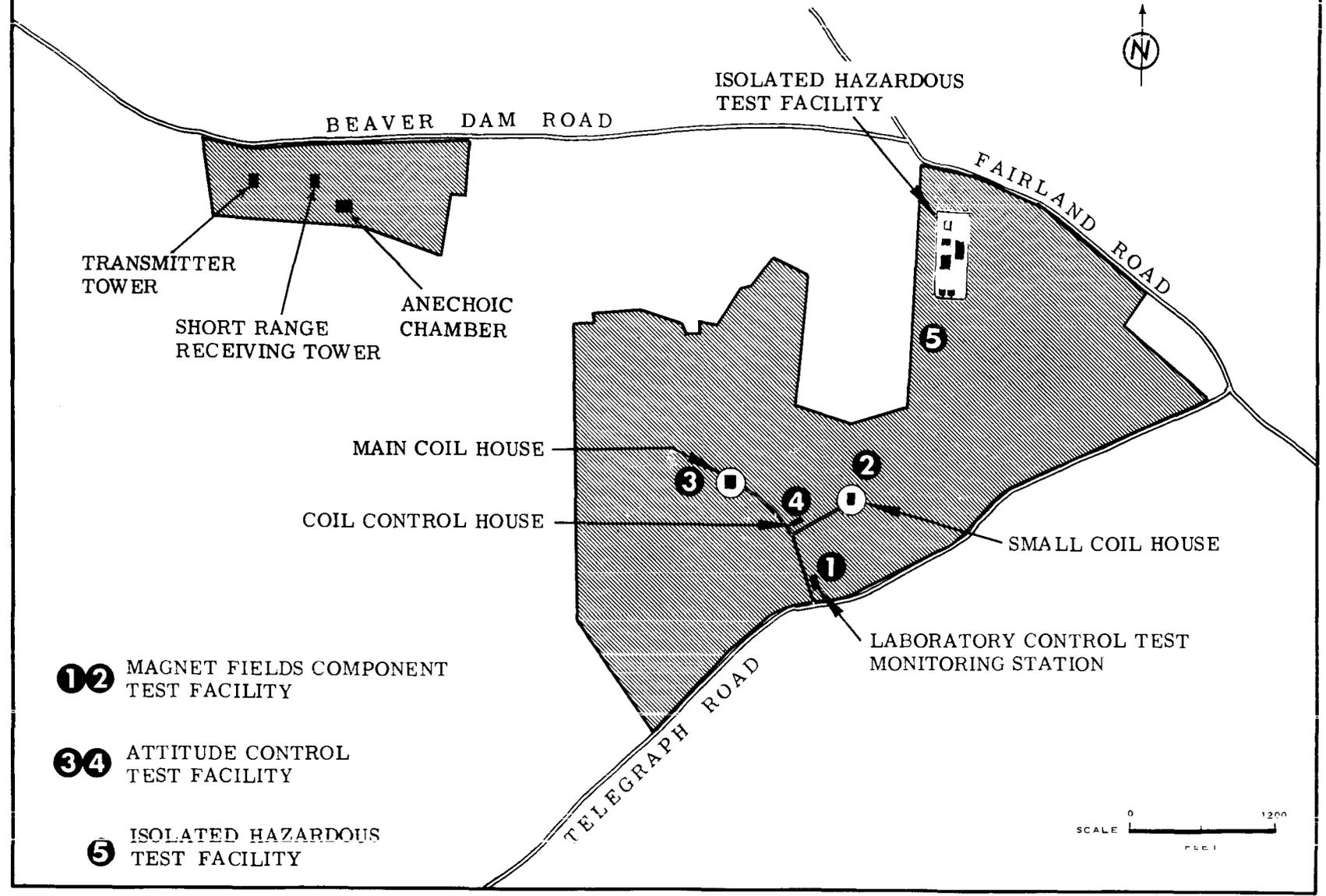
GODDARD SPACE FLIGHT CENTER

		<u>Page No.</u>
Location plan.....		CF 3-1
Data interpretation laboratory.....	\$ 5,390,000	CF 3-3
Isolated hazardous test facility.....	800,000	CF 3-8
Mechanical test facility and quality assurance laboratory.....	5,700,000	CF 3-12
Meteorological systems development laboratory.....	4,103,000	CF 3-17
Modernization of payload test facility.....	2,500,000	CF 3-21
Utility installations.....	<u>2,439,000</u>	CF 3-23
Total.....	<u>\$20,932,000</u>	



GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

REMOTE SITE AREAS



TRANSMITTER
TOWER

SHORT RANGE
RECEIVING TOWER

ANECHOIC
CHAMBER

MAIN COIL HOUSE

COIL CONTROL HOUSE

SMALL COIL HOUSE

LABORATORY CONTROL TEST
MONITORING STATION

1 2 MAGNET FIELDS COMPONENT
TEST FACILITY

3 4 ATTITUDE CONTROL
TEST FACILITY

5 ISOLATED HAZARDOUS
TEST FACILITY

CF 3-2

SCALE 0 1200
FEET

GODDARD SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

DATA INTERPRETATION LABORATORY

DESCRIPTION:

It is proposed to construct a laboratory of approximately 135,000 square feet of floor area in a ground floor and two additional floors. The building will be of concrete and steel construction with heavy masonry walls and masonry and steel partitions. Offices, laboratories and parking areas will be provided to accommodate 400 people. By extending the existing utility system to the building, all necessary electrical, air-conditioning, ventilation and plumbing systems will be provided to adequately support the proposed facility. The central power plant steam generator and chilled water capacity will be expanded as required under a separate project. Drawings of the proposed building are shown on the following two pages.

JUSTIFICATION:

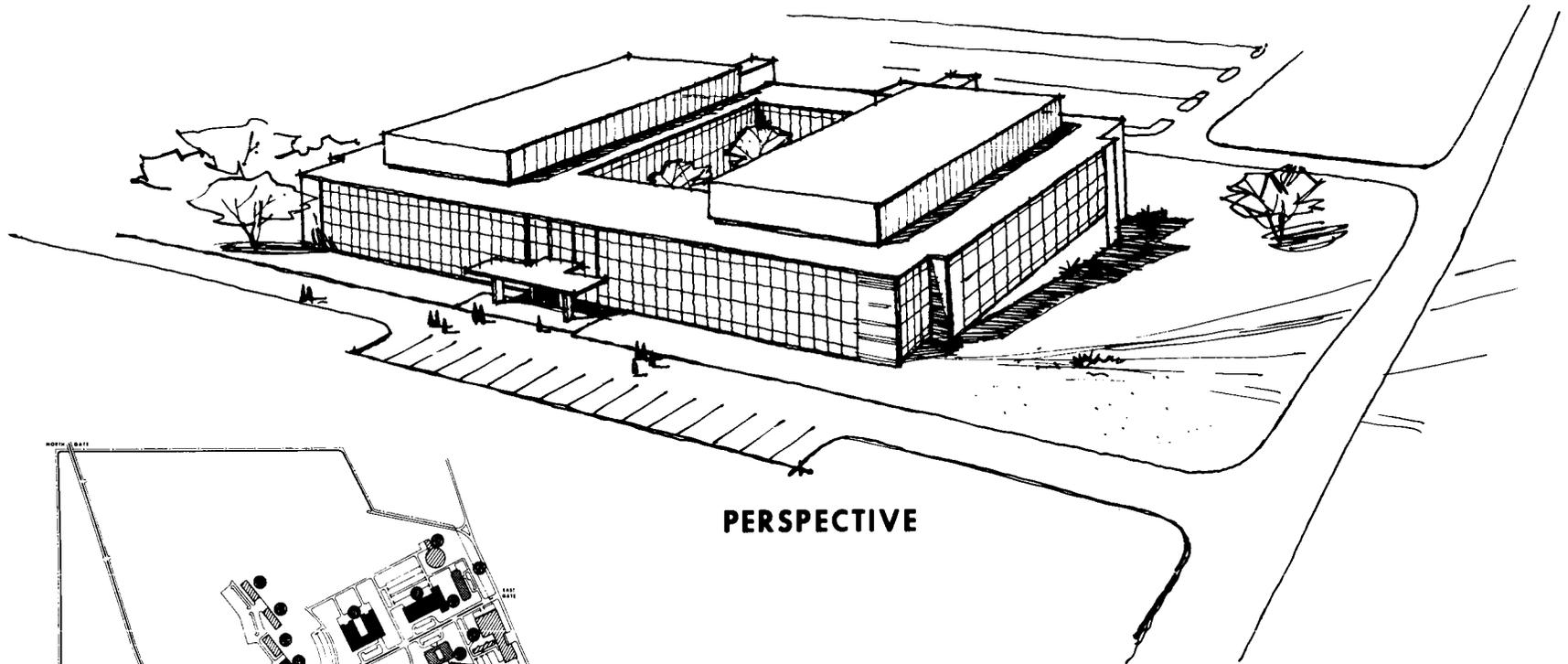
The data interpretation laboratory is required to provide an integrated data laboratory for operational data analysis and processing, development of advanced data processing systems, and the coordinated development and analysis of future aerospace telemetry and control data systems. By having all of these functions in one building, it will be possible to tie together efficiently the developments and operations of the entire satellite-ground data systems.

In the development of a spacecraft telemetry and control data system, the first step is the formulation of the design concepts for the entire data system. This starts with the requirements for a particular satellite mission and the analysis of these requirements for the generation of a data system plan. Almost simultaneously, the requirements are interpreted for the planning of the satellite command system for data control. In formulating these plans, an operational concept is generated which leads to requirements for the development of the real-time data handling and processing for control of the satellite. Similarly, the concepts for the final scientific data processing are also formulated. Thus, all the data systems designs (from the spacecraft through the data processing systems) must be planned simultaneously as one large system. The development of the electronics for the entire system is initiated, based on the overall plan. The several groups which contributed to the overall data system planning are also responsible for the development of these different data subsystems.

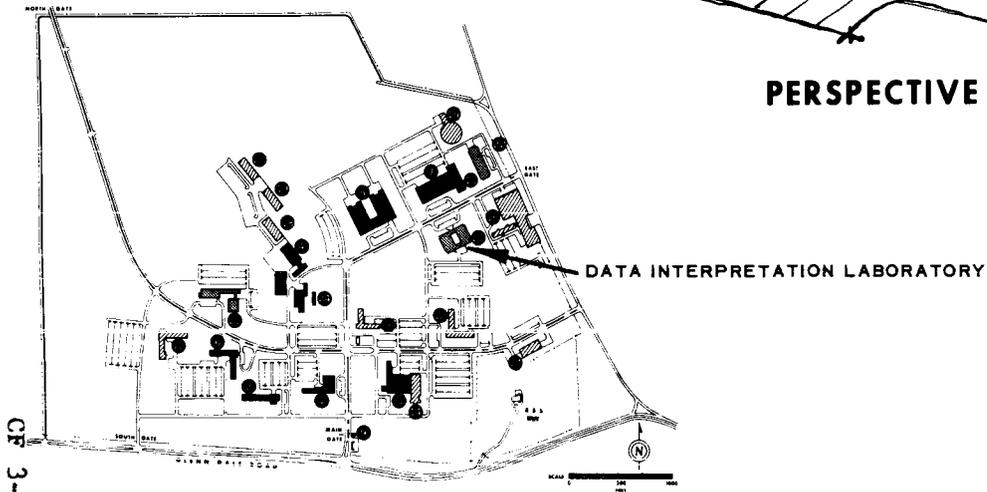
During the development, a very close cooperative effort is required between these different groups in order to handle the interface problems and the various system design changes which occur in different subsystems and have effects on the operations of other parts of the data system. Overall systems tests are required to check out satisfactorily and evaluate

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

DATA INTERPRETATION LABORATORY



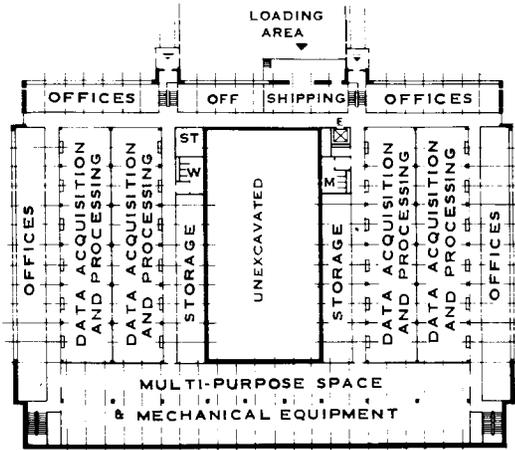
PERSPECTIVE



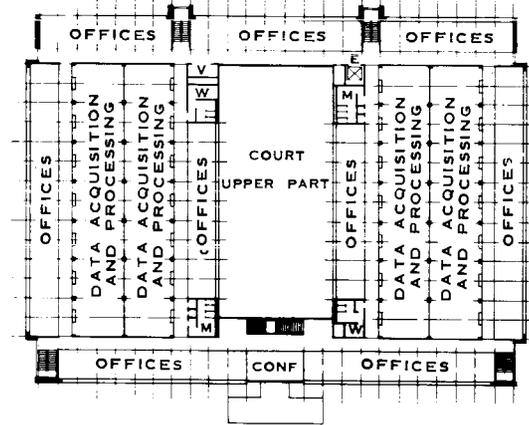
LOCATION PLAN

GODDARD SPACE FLIGHT CENTER
 FISCAL YEAR 1964 ESTIMATES

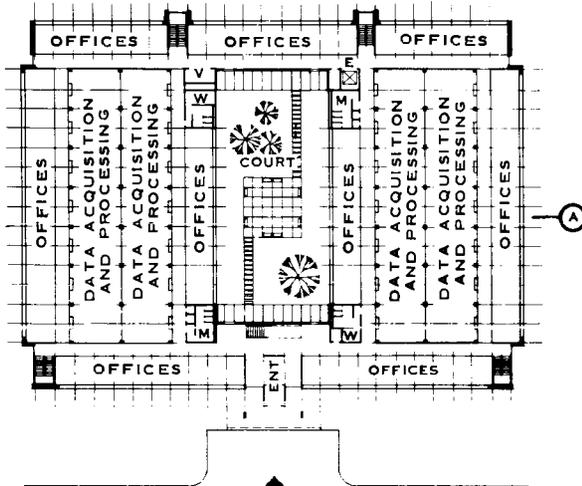
DATA INTERPRETATION LABORATORY



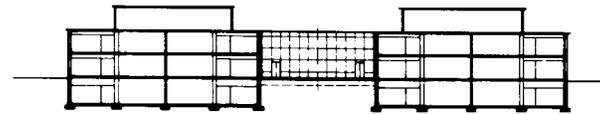
GROUND FLOOR PLAN



SECOND FLOOR PLAN



FIRST FLOOR PLAN



SECTION AA

CF 3-5



the complete data system. It is now the policy of the Goddard Center to test the entire data system completely from the spacecraft through data acquisition stations, the real-time data processing, the command control, the processing of the scientific data, and the analysis of the results. The most efficient way to accomplish this function is to have the data system development organizations co-located with the data processing and analysis facility. Also, this co-location of developmental and operational groups has the additional advantage that the developmental personnel can more easily learn of the operational problems and can work more closely with the operational personnel in finding solutions to these problems.

At the present time, the several groups working on aerospace data systems are located in rented buildings away from the Center and in several buildings at different locations at the Center. The new buildings to be constructed in the fiscal year 1963 will not be sufficient to handle the expanding requirements in the tracking and data acquisition area. Therefore, it will be necessary to start construction of this building in the fiscal year 1964. By the time the building is completed, the available floor space for data processing operations and analysis in the spacecraft operations facility will be much too small to house the required facility. It will be necessary to relocate the data processing facility at that time in the proposed data interpretation laboratory. The balance of the floor space will be devoted to the developmental units working on aerospace data systems.

Since this laboratory will house existing organizational units which have been operating for some time, it will not be necessary to procure a large amount of electronic data facility equipment for this building. Most of the large data processing systems will be in existence prior to the completion of the building. However, there are several small supporting systems and facilities which will be required. The data processing facility will require additional data display equipment such as printers, plotters, and other display systems in order to handle the more sophisticated satellites such as the Advanced Orbiting Solar Observatory. Similarly the data processing facility will require the addition of several small-scale computer systems for performing quality control on the systems operations, automatized tape evaluation, and handling the increased volume of data logging operations. A closed-circuit monitoring system will be required for tying together the many operational units in the data processing facility plus the real-time checkout stations and the prototype facilities to be evaluated. In the development areas, several of the groups will require screened rooms for assuring a noise-free environment during critical tests of the spacecraft data systems. The real-time telemetry station to be utilized by both the developmental units and the data processing facility for system checkout and compatibility evaluations will require the addition of new electronic systems such as advanced telemetry receivers, signal conditioning consoles, and command consoles. These electronic components are presently under development for the satellite instrumentation network and they must be included in this real-time telemetry station in order to be compatible with the network stations.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$240,000
City water lines.....	\$15,000
Chilled water lines.....	18,000
Steam lines.....	20,000
Sanitary and storm sewers.....	12,000
Electric power and communications systems.....	60,000
Roads and parking areas.....	115,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	3,575,000
Building (135,000 square feet at \$25.00 per square foot).....	3,375,000
Special raised flooring for electronic data processing equipment (40,000 square feet at \$5.00 per square foot).....	200,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	1,305,000
Special electrical system for laboratory use.....	75,000
Special air-conditioning for high-heat loss electrical equipment.....	75,000
Data display equipment.....	500,000
Small-scale computer systems.....	400,000
Closed-circuit monitoring system.....	30,000
Screened rooms.....	20,000
Telemetry station electronics.....	205,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>270,000</u>
Total estimated cost.....	<u><u>\$5,390,000</u></u>

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES
ISOLATED HAZARDOUS TEST FACILITY

DESCRIPTION:

The proposed facility will be located south of Beaver Dam Road and Fairland Road on a remote site near the Goddard Center on land occupied under a use permit from the Department of Agriculture. The facility will be composed of two hazardous laboratory-type buildings and a concrete test pad separated by earth bunkers, a central control building, two storage bunker buildings, parking areas, roads, utilities, and a security fence. All the buildings will be of a single story ground floor with no basement. The laboratories will be constructed of reinforced concrete with special blow-out and safety features; the storage bunker buildings will be constructed of reinforced concrete; the control building will be constructed of standard concrete and masonry; the test pad will consist of a reinforced concrete slab.

All the necessary electrical, air-conditioning, ventilation, and plumbing systems will be provided to adequately support the proposed research and development activities. Drawings of the proposed facility are shown on the following two pages.

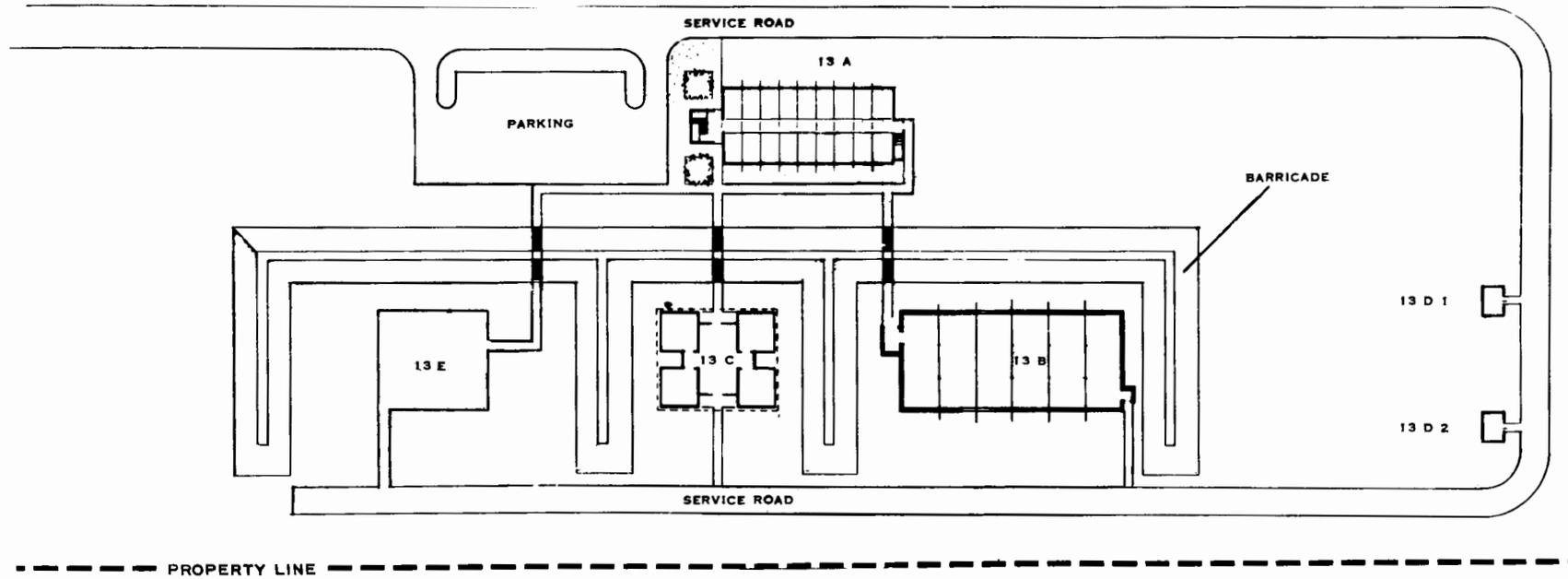
JUSTIFICATION:

At present, there are no adequate facilities located at the Goddard Center to safely perform tests, experiments, and developments on hazardous types of materials, components, and assemblies in support of spacecraft systems. This proposal will provide the Center with such a complex by the construction of the following facilities:

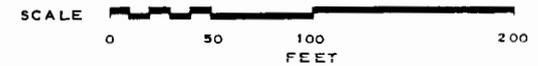
1. Explosives devices building: This building will be used for tests on explosive mechanisms such as explosive bolts, squibs primer chord, pyrotechnics, and shaped charges.
2. High-energy laboratory building: This building will be used to conduct various experiments on spacecraft systems and subsystems; to isolate such hazards as radioactive and electro-magnetic radiation, tests will be conducted under hazardous conditons involving the charging and discharging of high-pressure fluid and vapor systems, and the proof testing of high-pressure piping and valving arrangements.
3. Concrete test pad: The pad will be used to conduct open type field tests and burning where shelter is not required.
4. Central control building: This facility is required for remote control, observation, and recording of activities performed in the hazardous buildings. The building will house the mechanical and electrical equipment required to service the entire facility.

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

ISOLATED HAZARDOUS TEST FACILITY



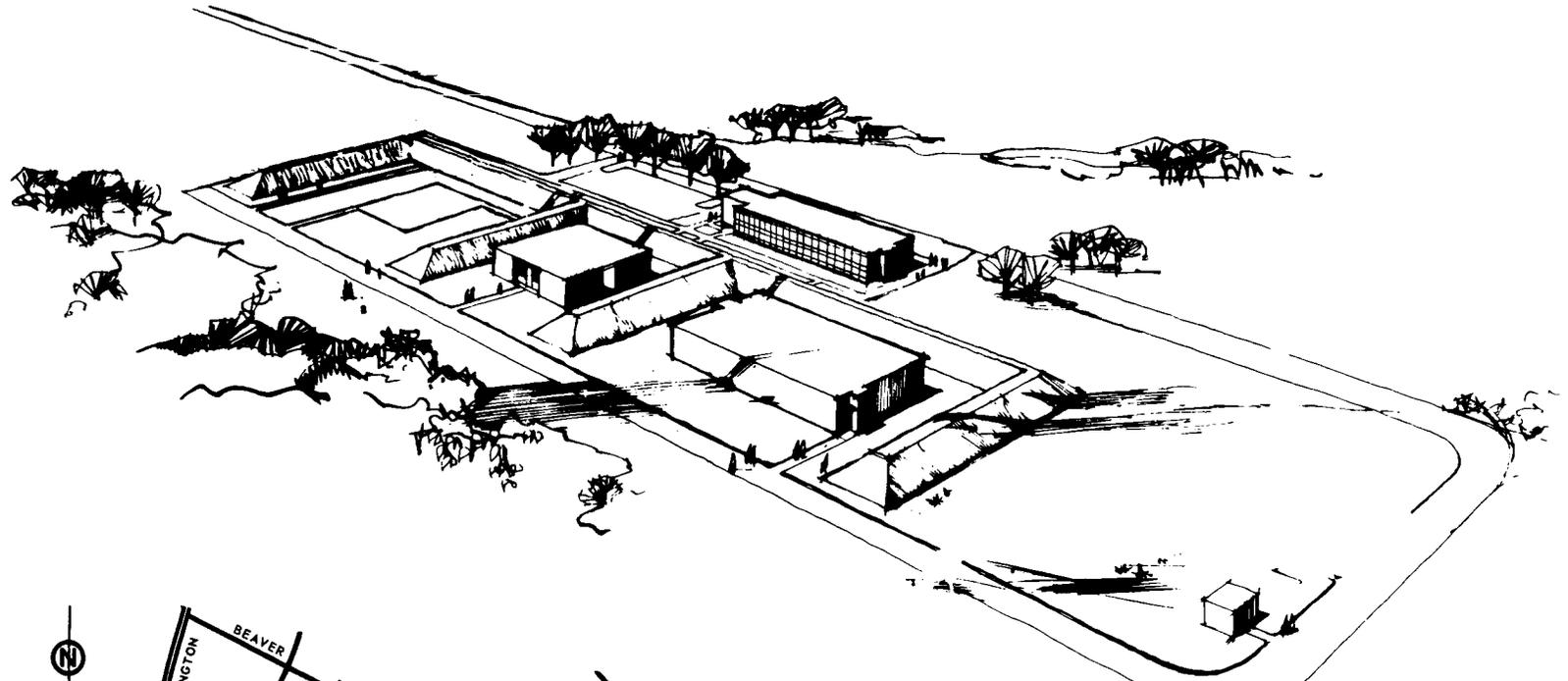
- 13A CENTRAL CONTROL BUILDING
- 13B HIGH ENERGY LABORATORY BUILDING
- 13C EXPLOSIVE DEVICES BUILDING
- 13D1 STORAGE BUNKER BUILDING
- 13D2 STORAGE BUNKER BUILDING
- 13E CONCRETE TEST PAD



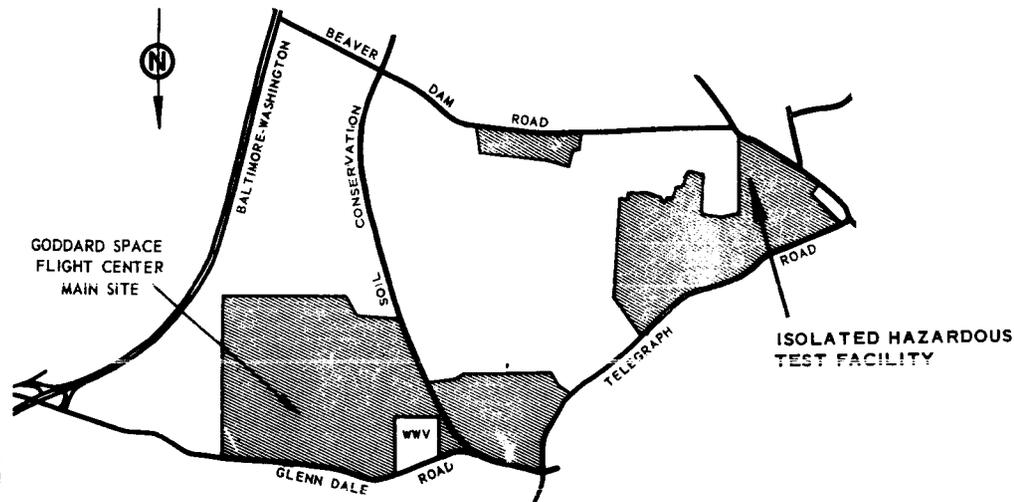
CP 3-9

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

ISOLATED HAZARDOUS TEST FACILITY



PERSPECTIVE



LOCATION PLAN

CF 3-10

Also included is work space, a storage area and first aid and toilet facilities.

5. Storage bunkers: Two bunkers are required to store small quantities of explosive and radioactive materials.

The construction of this facility will provide a safe means of conducting investigations on the damage resulting from radiation or other high energy fields and will provide a safe means for the containment of blast and fragmentation damage caused by scheduled and unscheduled detonation of high energy materials.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$126,000
Well, storage tank, and distribution lines...	\$5,000	
Septic system and sanitary lines.....	7,000	
Electrical distribution system.....	25,000	
Bunkers.....	54,000	
Roads and parking areas.....	35,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		404,000
Central control building (3,600 square feet at \$29.00 per square foot).....	105,000	
High-energy laboratory (6,000 square feet at \$34.00 per square foot).....	204,000	
Explosive devices building (2,210 square feet at \$34.00 per square foot).....	75,000	
Storage bunkers (250 square feet at \$60.00 per square foot).....	15,000	
Concrete test pad (3,600 square feet at \$1.40 per square foot).....	5,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		225,000
Test item instrumentation.....	160,000	
Radiation sources.....	65,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>45,000</u>
Total estimated cost.....		<u>\$800,000</u>

GODDARD SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

MECHANICAL TEST FACILITY AND QUALITY ASSURANCE LABORATORY

DESCRIPTION:

It is proposed to construct a laboratory consisting of approximately 60,000 square feet of floor area. The structure will include a high bay area for a mechanical test chamber which increases the unit cost higher than usual due to the high volume to area ratio. The balance of the structure will consist of a ground floor and two additional floors housing electrical and mechanical equipment, control and monitor rooms, failure analysis, calibrations and standards laboratories, and office and parking space for 120 personnel. All service lines will be extended to adequately support the requirements for the building occupancy. The central power plant steam generator and chilled water capacity will be expanded as required under a separate project.

The mechanical test facility will provide capabilities for evaluating dynamic mechanical functions of spacecraft and spacecraft systems. The facility will house a test chamber, its support equipment, and its operating control station.

The test chamber will be a structural steel vacuum vessel enclosing a clear cylindrical volume 40 feet in diameter and 30 feet high. A hemispherical head will provide an additional 20 feet of interior height. The size of the vessel is dictated by the free area required for rotation of spacecraft with paddles, booms, de-spin masses and other outboard structures fully deployed. The height must be adequate for rigging of nose cone and spacecraft separation tests and for activities such as erection of paddles in vacuum during free fall.

Operating vacuum levels to one micron will be provided. The high performance pumping system will be capable of maintaining the operating vacuum under gas loads imposed by operation of guidance and control thrust jets during functional tests of spacecraft and spacecraft subsystems.

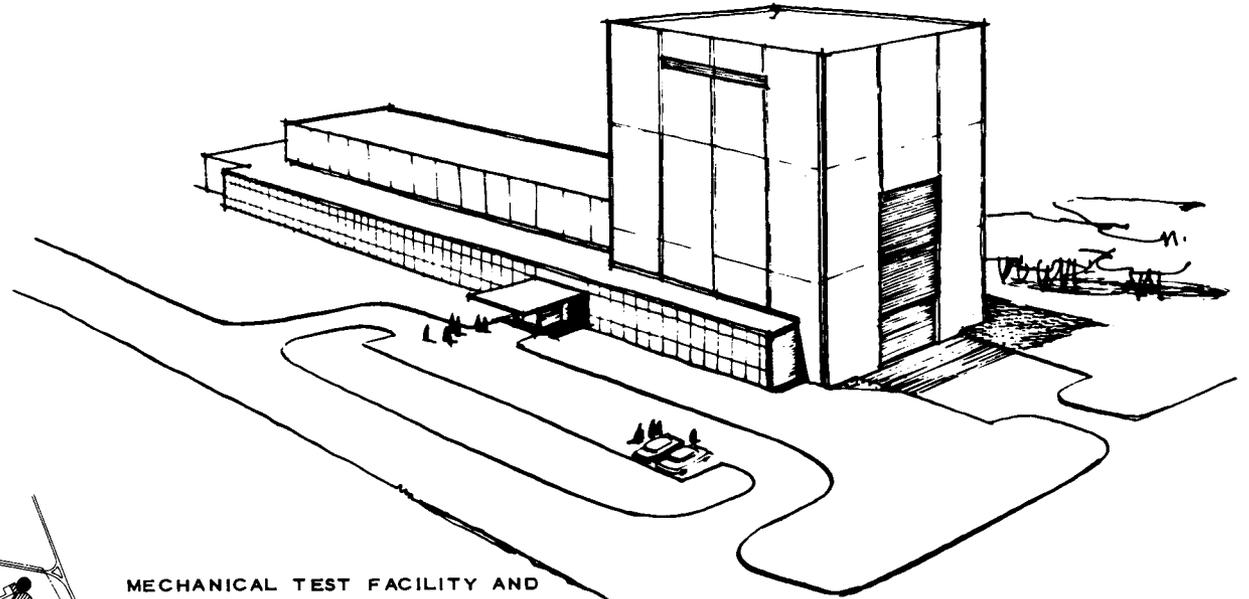
Included in the project is the equipment required for the failure analysis and calibration laboratories, and for functional testing in the mechanical test chamber. Sketches of the proposed laboratory are shown on the following two pages.

JUSTIFICATION:

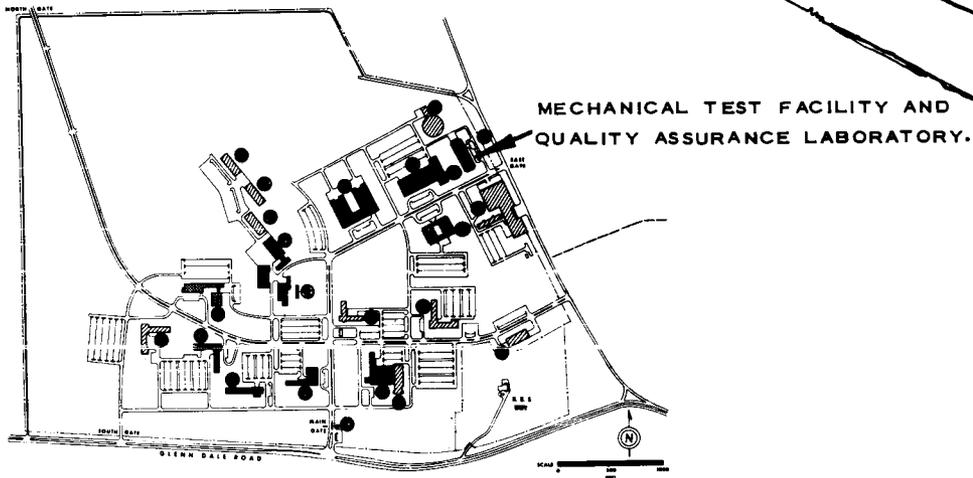
Reliability is the key to successful spacecraft development programs. It is best achieved by assurance of the highest standards in all components, materials and systems used in the spacecraft and by use of redundancy of critical items. However, the scope of unmanned scientific space missions is limited by available payload capacity of the appropriate vehicles, so that

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

MECHANICAL TEST FACILITY AND QUALITY ASSURANCE LABORATORY



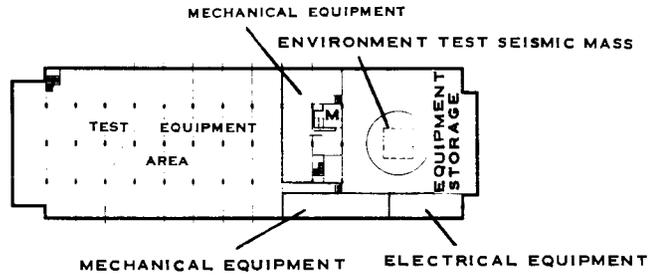
PERSPECTIVE



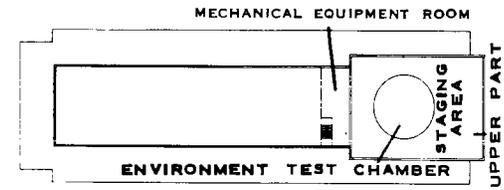
LOCATION PLAN

CF 3-13

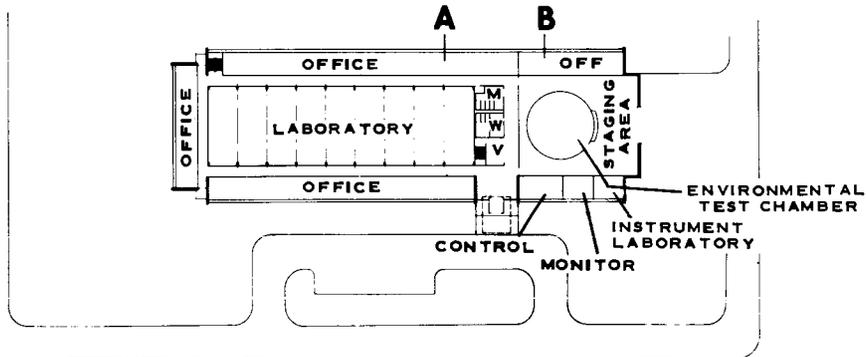
MECHANICAL TEST FACILITY AND QUALITY ASSURANCE LABORATORY



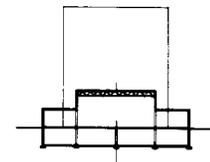
BASEMENT PLAN



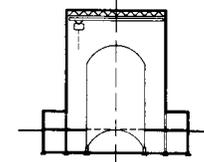
ROOF PLAN



FIRST FLOOR PLAN



SECTION A A



SECTION B B

achievement of reliability by redundancy is not afforded. Therefore, failure of any single component, structure, or system can cause total failure of the mission.

The quality assurance needed by the Goddard Center includes (1) quality engineering--the systematic, informed selection of components and materials of known performance and integrity for use in the design; (2) process control--the exclusive use of materials of acceptable quality and strict adherence to established standards of workmanship in fabrication; and (3) failure analysis--determination of cause of failure and course of corrective action.

Existing commercial and military specifications establish minimum reliability levels that are not generally adequate for space applications. Many new materials and components developed for space applications are not controlled by any specifications. Therefore, at best, existing qualified products lists can serve only as a guide to preliminary selection of spacecraft components. Therefore, the need exists for a facility to perform comparative tests of many samples of competitive items proposed for use in spacecraft. Such tests may involve not only survival and life appraisal analysis but also conditioning by accelerated aging or prolonged exposure to space environments.

Failure analysis and process control are needed to supplement the test and evaluation programs. Naturally, isolated chance failures will not be entirely eliminated, but each failure should be carefully analyzed to establish that it occurred as a result of chance causes rather than from a systematic type of error such as improper identification of a lot of material, failure to relieve stresses after a fabrication operation or unrealistic testing. Repeated failures cause lost motion and slippage of schedule which need not occur if they are promptly and thoroughly analyzed.

The subject laboratory will provide capabilities for the required quality assurance functions in support of the Goddard Center's in-house and contracted design-development-fabrication activities.

The mechanical test facility will provide continuing capabilities at the Goddard Center for mechanical testing in vacuum and for "dirty" tests after the conversion of the dynamic test chamber to a space simulator an authorized project to be completed during 1964. The expected volume of such tests, the workloads scheduled for the space simulator, and the requirements for maintaining an ultra-clean environment in the space simulator make it impractical to use a single vessel alternately for "dirty" tests and high-vacuum space simulation.

The mechanical test facility will permit tests of mechanical actions that are normally executed in the vacuum of space and which would be improperly simulated if tests were carried out at atmospheric pressure. For example at pressures above 1mm of mercury, drag forces may be destructive and may preclude spin and dynamic balancing of spacecraft with solar paddles and other structures deployed; turbulence can cause data to be erratic and unrepeatable; and damping can so retard the motion of erecting outboard struc-

tures that neither functional nor structural integrity of the mechanism can be evaluated. One or several of these mechanical actions are critical to the functional reliability of most spacecraft. Construction of this facility will eliminate expense and delay incurred in the current practice of using make-shift and marginally adequate facilities at establishments remote from the Goddard Center. The Government will benefit from the increased capability for better testing by improved reliability of spacecraft and accelerated development of advanced hardware for future spacecraft.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$124,000
City water lines.....	\$6,000	
Chilled water lines.....	24,000	
Steam lines.....	16,000	
Sanitary and storm sewers.....	12,000	
Electric power and communication systems.....	24,000	
Roads and parking areas.....	42,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,826,000
Building (60,000 square feet at \$30.50 per square foot).....	1,826,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		3,620,000
40-foot diameter test chamber.....	350,000	
Vacuum pumping system.....	420,000	
Instruments and control.....	225,000	
Data handling system.....	200,000	
Spacecraft orientation and mounting equipment	125,000	
Driven gimbal system.....	400,000	
Analog computer.....	500,000	
Earth horizon simulator.....	200,000	
Dynamic environment test equipment.....	320,000	
Stress analysis instrumentation.....	85,000	
Automatic testing and inspection equipment...	355,000	
Thermal and vacuum equipment for life testing	120,000	
Special optical and electrical test and inspection equipment.....	120,000	
Calibration and standards--mechanical and electrical.....	200,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>130,000</u>
Total estimated cost.....		<u><u>\$5,700,000</u></u>

GODDARD SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

METEOROLOGICAL SYSTEMS DEVELOPMENT LABORATORY

DESCRIPTION:

It is proposed to construct a laboratory of approximately 130,000 square feet of floor area in a ground floor and two additional floors to be located in the vicinity of the space sciences laboratory. The building will be of concrete and steel construction having masonry walls, and masonry and steel partitions. Offices, laboratories and parking areas will be provided to accommodate approximately 325 people in related areas of work. It will also include a cafeteria to serve the surrounding buildings which are becoming more remote due to expansion of the Center. By extending existing utilities systems to the building all necessary electrical, air-conditioning, ventilation, and plumbing systems will be provided to adequately support the proposed research and development activities. The central power plant steam generator and chilled water capacity will be expanded as required under a separate project. Drawings of the proposed building are shown on the following two pages.

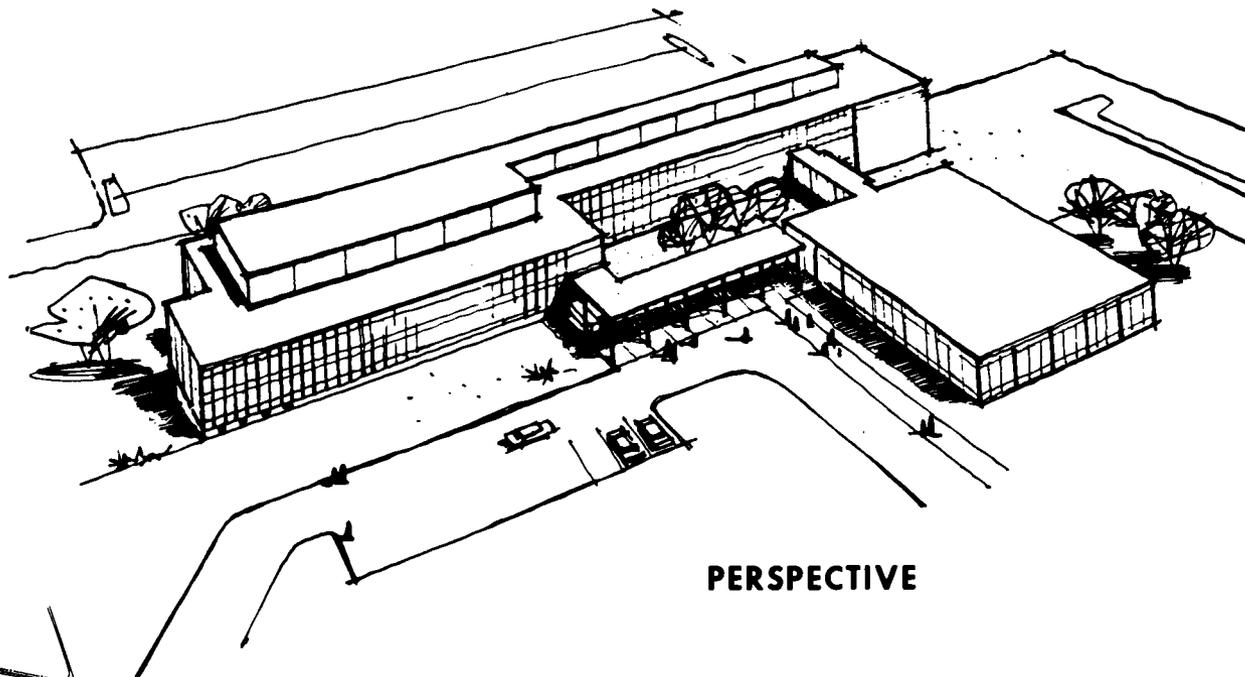
JUSTIFICATION:

The proposed laboratory building will bring together related and mutually dependent meteorological systems efforts now widely scattered in separate locations. The personnel performing this work are located in three buildings, two of which are leased buildings unsuited to the particular laboratory requirements. The third location is on the Goddard Center in the research projects laboratory. The two rented locations are 5 and 10 miles respectively from the Center and 10 miles apart. This situation causes much lost time in travel between buildings and creates many difficulties in coordinating the research effort.

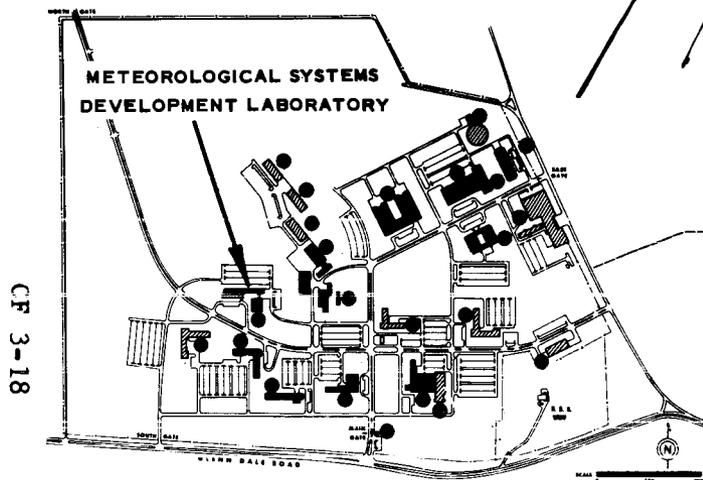
The work to be accomplished in this building will include research in structure, composition, motion and dynamics of planetary atmospheres; experiments in the physics of atmospheric gases; and the reduction and interpretation of data in light of known properties of the atmosphere, including investigation of data handling as applied to global phenomena. This building also will house developmental work on design and calibration of unique mechanical and electrical instruments necessary for the exploration of the physics of planetary atmospheres. Special devices and electro-mechanical subsystems will be developed to conduct physical experimentation in sounding rocket probes and satellites. Spacecraft-borne electronic systems for handling unique data problems will also be designed and developed. In addition, design, development, and systems integration will be conducted for use in the physical exploration of planetary atmospheres by means of probes and satellites.

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

METEOROLOGICAL SYSTEMS DEVELOPMENT LABORATORY



PERSPECTIVE

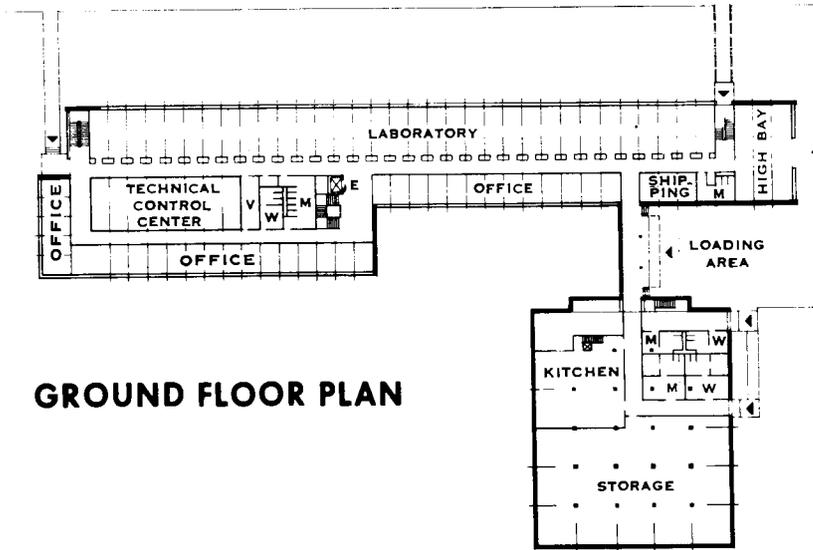


CF 3-18

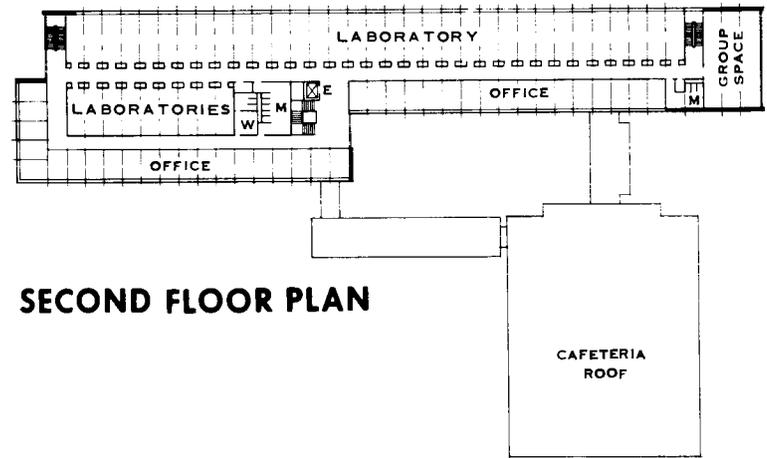
LOCATION PLAN

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1964 ESTIMATES

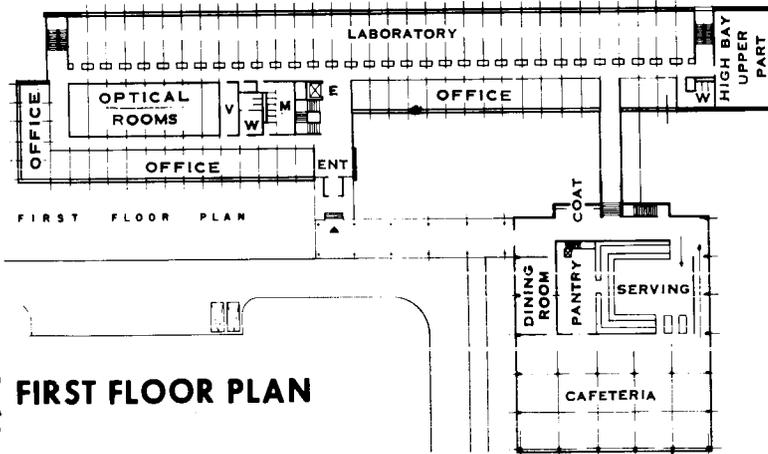
METEOROLOGICAL SYSTEMS DEVELOPMENT LABORATORY



GROUND FLOOR PLAN



SECOND FLOOR PLAN



FIRST FLOOR PLAN

CP 3-19



ELEVATION



SECTION AA

SCALE 0 50 100
FEET

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$403,000
City water lines.....	\$15,000	
Chilled water lines.....	90,000	
Steam lines.....	25,000	
Sanitary and storm sewers.....	20,000	
Electric power and communications systems	138,000	
Roads and parking areas.....	115,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		3,250,000
Building (130,000 square feet at \$25.00 per square foot).....	3,250,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		250,000
Special electrical system for laboratory use.....	75,000	
Special air-conditioning for high-heat loss electrical equipment.....	75,000	
Cafeteria equipment.....	100,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>200,000</u>
Total estimated cost.....		<u>\$4,103,000</u>

GODDARD SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

MODERNIZATION OF PAYLOAD TEST FACILITY

DESCRIPTION:

This project provides for modernization and expansion of the test and evaluation facilities which presently exist in the payload test facility.

The centralized data collection and analysis system installed in the building will be expanded to provide additional high-speed and low-speed channels. Provisions will be made so that more scientific experimenters may control and monitor their experiments while they are undergoing environmental tests. Additional real time output stations will be provided to keep the operating personnel informed of the operations of their facility. A system will be provided for calibration of the entire data central complex.

A solar simulator will be designed and constructed for the existing 12 x 15-foot thermal-vacuum chamber. This simulator will be of advanced design and will provide a better spectro-match and a more uniform distribution than the solar simulator which is now under construction for the space environment simulator.

New equipment for use in the mechanical test laboratory of the payload test facility will be designed to extend its present limit for testing 1000-pound spacecraft to a capability for handling 4000-pound spacecraft. Some equipment which was obtained from surplus at the beginning of the space program will be replaced with more modern equipment. Additional instrumentation for the collection and analysis of tests being conducted in the vibration area will be provided.

Many environmental tests on satellites are required to run uninterrupted for a week or more and a program will be initiated for improving the electrical control systems. A comprehensive re-examination of various pieces of research equipment now on hand will be conducted to identify sub-standard components. In order to increase the reliability of the test equipment, these items will be replaced as required.

JUSTIFICATION:

Facilities and techniques used in the new field of space environment simulation have, of necessity, used equipment and experience developed for testing aircraft, ordnance, and weapons systems. A high rate of obsolescence of equipment and techniques develops as facilities become operational and as experience grows. In the infancy of this new science, rapid advances in technology are needed for adequate testing of the larger and more complex spacecraft now being flown and being developed for future missions. Such rapid advances are the rewards and the justification for efforts to date in the space program.

Implementation of a program to maintain a modern state-of-the-art testing facility must emphasize improved simulation of the space environment and expanded capability to test spacecraft of all sizes. Improvements in simulation will provide improved accuracy of the environment producing equipment, advanced levels for intensity of the environment, production of new environments and combined environments. Capability will be expanded by improving the accuracy of the instrumentation, by adding equipment of increased size, and by incorporating techniques and equipment to extend and accelerate data acquisition and interpretation. As an example, the first random motion vibration test console, obtained as surplus equipment, requires manual equalization and is limited in the required precision by the state-of-the-art at the time of its development in 1958. Even to exploit the equipment within its limits requires a half day of effort by two highly skilled technicians. The new automatic system permits one man to establish a more accurate equalization profile in one-half hour. The urgent need for expanded capability in instrumentation is illustrated by the fact that early spacecraft included two to six experiments and could be fully instrumented by twenty-four channels. Spacecraft now under development will carry forty to fifty experiments and will require up to two hundred channels of instrumentation.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	\$1,250,000
Solar simulator.....	\$1,250,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	1,250,000
Vibration equipment and instrumentation.....	575,000
Multiple head vibration system.....	\$175,000
Replacement of manual vibration system..	180,000
Vibration data acquisition	
instrumentation.....	220,000
Expansion of central data acquisition systems.....	350,000
Operation monitoring equipment.....	100,000
Additional channel of hi-speed data.....	250,000
Expansion of display equipment.....	200,000
Electrical control improvement program.....	125,000
E. DESIGN AND ENGINEERING SERVICES.....	---
Total estimated cost.....	\$2,500,000

GODDARD SPACE FLIGHT CENTER

FISCAL YEAR 1964 ESTIMATES

UTILITY INSTALLATIONS

DESCRIPTION:

It is proposed to expand the utility installations to include an addition to the central heating and refrigeration plant; the installation of 4,000 tons of refrigeration; the installation of a 33,000-pound per hour steam generating boiler in the new addition; the installation of site-chilled water mains; and the installation of site gas mains. The addition to the building will house the proposed steam generating boiler and refrigeration equipment. The new steam generating boiler will be similar to existing boilers and will be installed for parallel operation. The refrigeration equipment will consist of multiple chiller units and will be installed for parallel operation with the existing chiller units.

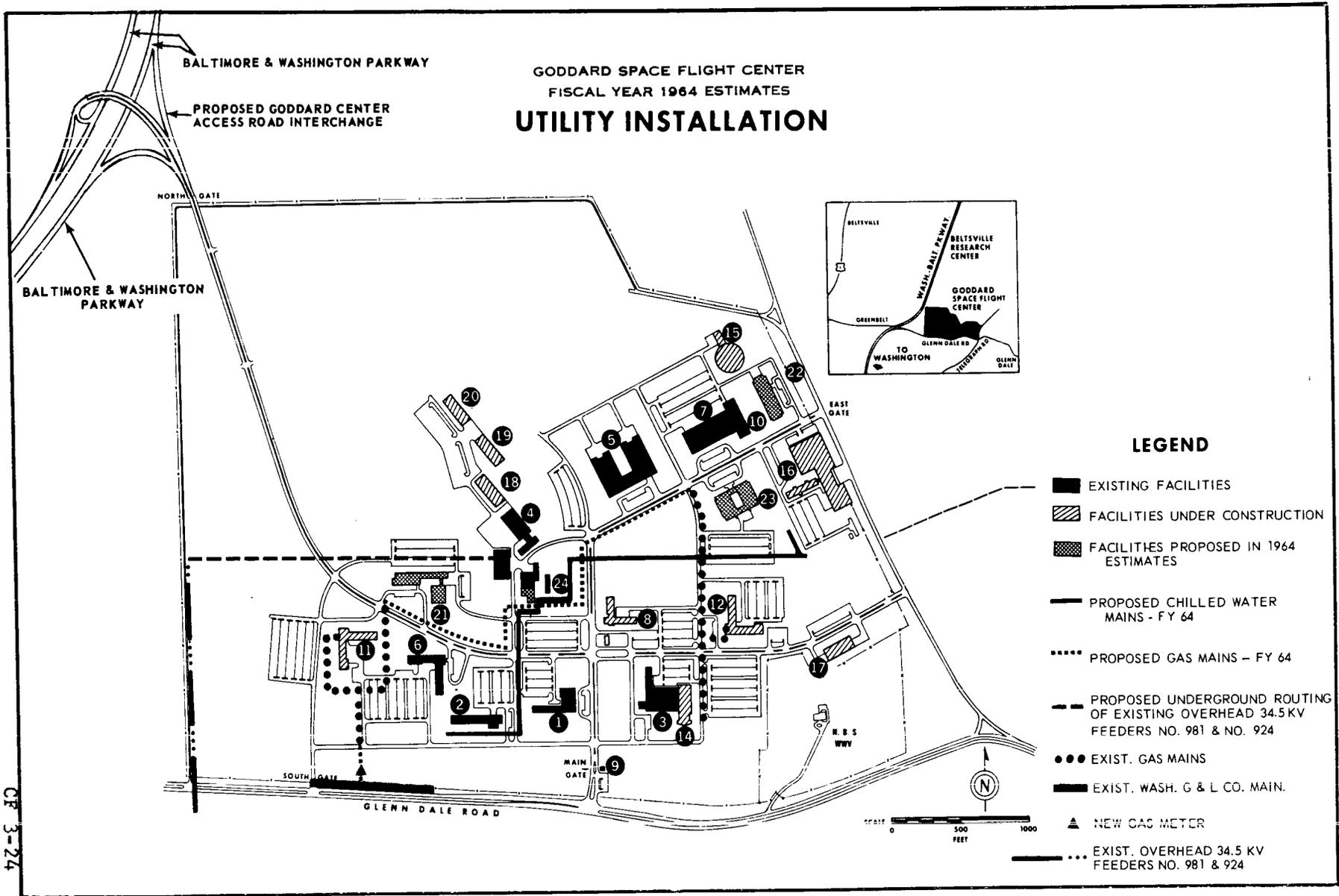
In addition to the above, it is proposed to run the present 33 KV power line underground from the present main substation westward to the perimeter fence. This duct system will in general follow the route of the present overhead feeders avoiding future building sites and at depths conforming to future grades in this area. Manholes complete with necessary racks and pulling irons will be located on approximately 400 foot spacings. Cables in the proposed duct system will be supplied and installed by the electric power company servicing the Center.

Also included is the requirement for an interchange with the Baltimore-Washington Parkway which results from studies with the Bureau of Public Roads regarding the improvement of Glenn Dale Road. The studies have led to the recommendation that the Goddard Center develop its own interchange with the Baltimore-Washington Parkway off the northwest corner of the main site which abutts parkway property.

Sketches of the work encompassed by this project are presented on the following two pages.

JUSTIFICATION:

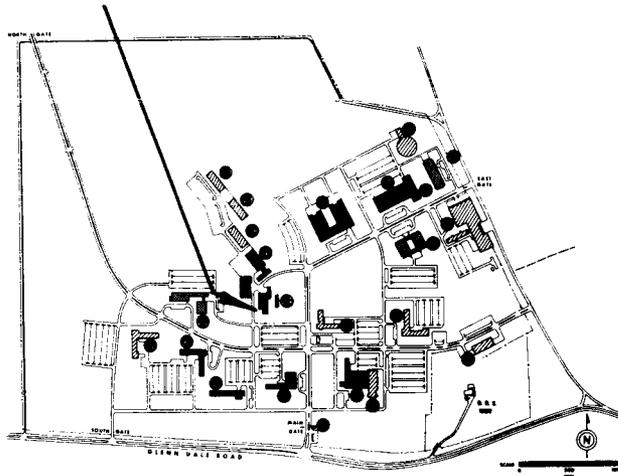
It is estimated that cooling capacity through the fiscal year 1964 building program will require a 4,000-ton increase at the central heating and refrigeration plant. With this increase in cooling capacity, the total plant capacity will be 7,200-tons. Using an 85 per cent diversity on the 8,400-ton building demand, the 7,200-ton capacity will be satisfactory for authorized projects as well as those proposed in this budget. The chilled water main system must be expanded to handle the increased refrigeration capacity and to serve the new buildings proposed in this budget. It is also proposed to connect several existing buildings to the



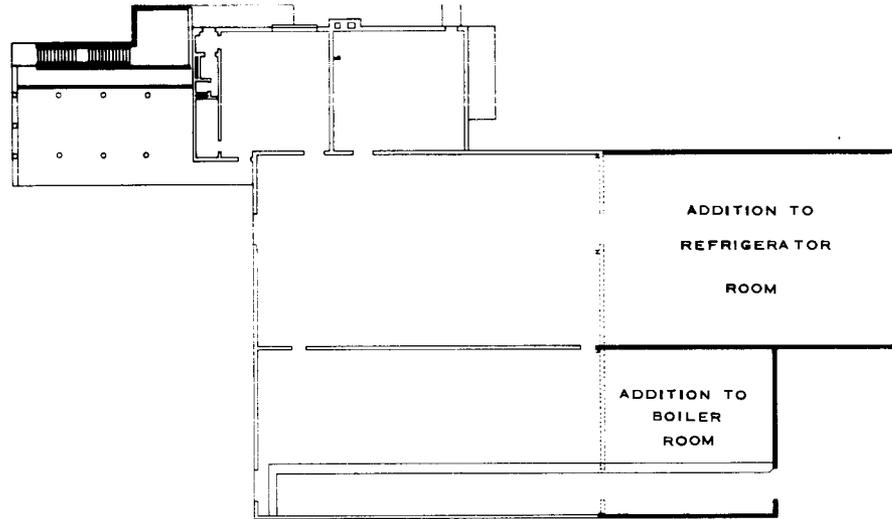
LOCATION PLAN

ADDITION TO CENTRAL HEATING AND REFRIGERATION PLANT

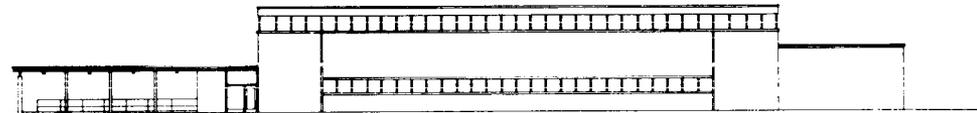
ADDITION TO CENTRAL HEATING
AND REFRIGERATION PLANT



LOCATION PLAN



FIRST FLOOR PLAN



WEST ELEVATION



CF 3-25

central chilled water system. These buildings heretofore have utilized their individual systems for air-conditioning. Increased economy can be realized by placing these smaller air-conditioning plants in standby and by using the central system. In standby, the individual plants can be available for emergencies and for augmentation of the total system capacity as may be needed.

Natural gas mains will be extended to serve additional laboratory buildings where gas is required for research purposes and to the central heating and refrigeration plant where gas will be used as a standby fuel supply.

The proposed electrical duct system is required to effectively use and develop existing and future facility sites in the areas traversed by the existing overhead primary feeder system. The proposed underground installation will also increase the reliability of the Center's main feeder system by eliminating the hazards associated with an overhead system.

The need for the proposed interchange is largely the result of the serious crowding of the Greenbelt interchange for the Baltimore-Washington Parkway. The location of the new circumferential Capital Beltway interchange requires left hand turns for traffic coming onto Glenn Dale Road from the south and for traffic entering the parkway from the west and headed north. Marginal acceleration and deceleration lanes, due to the close proximity of the interchanges, also contributes to the hazard in this area during the peak traffic periods. The project includes an off-ramp, an on-ramp, a connecting road in the center, a bridge over the parkway, and access in both directions to and from the Center.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$1,274,000
Chilled water mains	\$254,000
Gas piping.....	20,000
Electric power lines.....	250,000
Road interchange.....	750,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	150,000
Addition to central power plant (6,500 square feet at \$25.00 per square foot).....	150,000

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	\$890,000
4,000 tons of refrigeration at	
\$200 per ton.....	\$800,000
One 33,000-pound per hour boiler and	
auxiliaries.....	90,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>125,000</u>
Total estimated cost.....	<u>\$2,439,000</u>

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

JET PROPULSION LABORATORY

		<u>Page No.</u>
Location plan.....		CF 4-1
Addition to the space flight operations facility.....	\$1,000,000	CF 4-2
Development engineering building.....	3,900,000	CF 4-7
Materiel services building.....	1,633,000	CF 4-11
Utility installations.....	<u>467,000</u>	CF 4-16
Total.....	<u><u>\$7,000,000</u></u>	

JET PROPULSION LABORATORY

FISCAL YEAR 1964 ESTIMATES

ADDITION TO THE SPACE FLIGHT OPERATIONS FACILITY

DESCRIPTION:

The project proposes the construction of an addition to the space flight operations facility from which operations associated with the unmanned lunar and planetary programs of the NASA are conducted. The facility, with this addition, will be capable of servicing the space flight operations associated with the multiple missions concurrently planned by the NASA.

The addition to the facility will consist of approximately 7,200 square feet to the west side of each of the two floors and basement of the existing facility, adding a total of approximately 21,600 square feet. The additional area will be used to house new analog and digital data processing equipment, communication systems, and a spacecraft video processing facility. Operational space for the technical personnel required to conduct the space flight operations will also be provided.

The basement of the addition will provide space for the mechanical and electrical systems required to support the facility as well as the operational communications system and the technical repair and maintenance laboratories for the data processing and spacecraft video systems housed on upper floors. The additional area on the first and second floors of the facility will be used to provide for data, video, and display systems required to conduct extensive space flight operations.

Sketches of the proposed addition are shown on the following two pages.

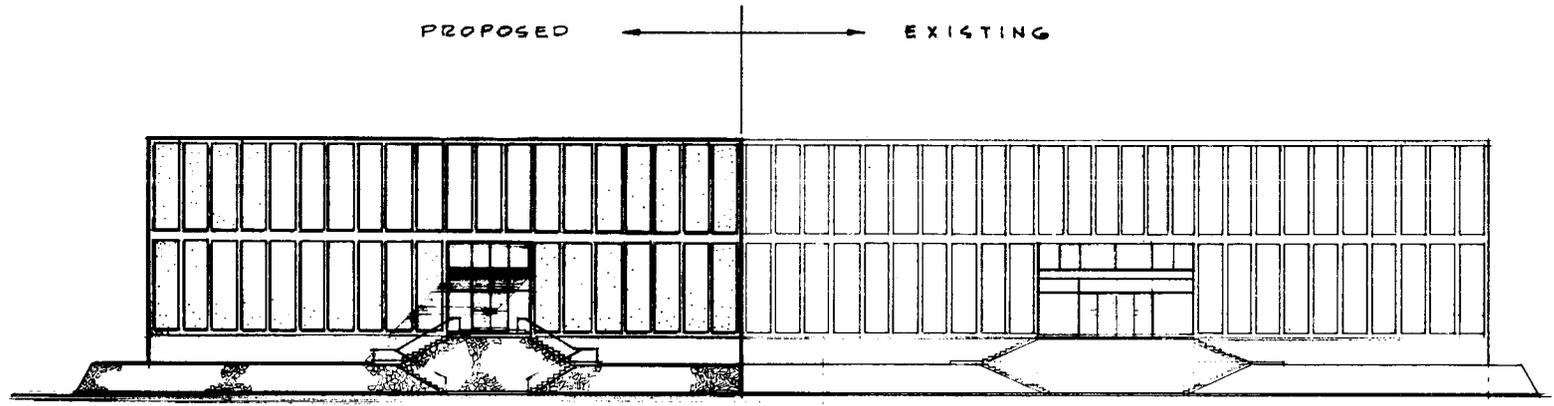
JUSTIFICATION:

The primary justification for this addition is the requirement to conduct space flight operations simultaneously for multiple missions.

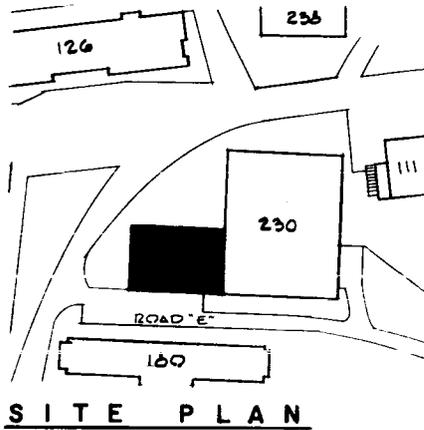
The currently established program of unmanned lunar and planetary exploration being conducted for the NASA by JPL consists of several projects. The Ranger and Surveyor projects are directed at lunar exploration; the Mariner series at planetary and interplanetary exploration. The space flight operations associated with these projects are defined as the operations necessary to obtain and process spacecraft information and dispatch commands during flight from launch to the accomplishment of the mission.

The current flight schedule for the Ranger project requires the launching of five spacecraft during the calendar year 1964. The flight schedule for the Surveyor project requires two flights during 1964, six during 1965, seven during 1966, and eight during 1967. With the exception of two or

JET PROPULSION LABORATORY
FISCAL YEAR 1964 ESTIMATES
ADDITION TO THE SPACE FLIGHT OPERATIONS FACILITY

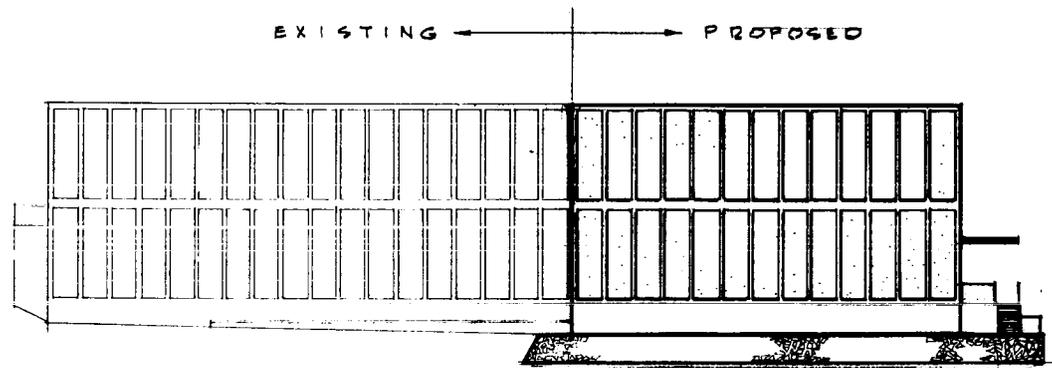


SOUTH ELEVATION



SITE PLAN

SCALE IN FEET
0 50 100 200

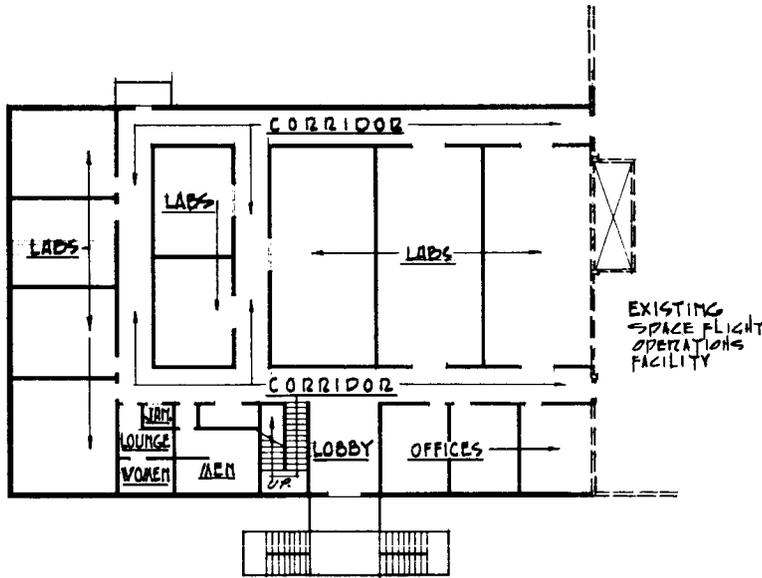


WEST ELEVATION

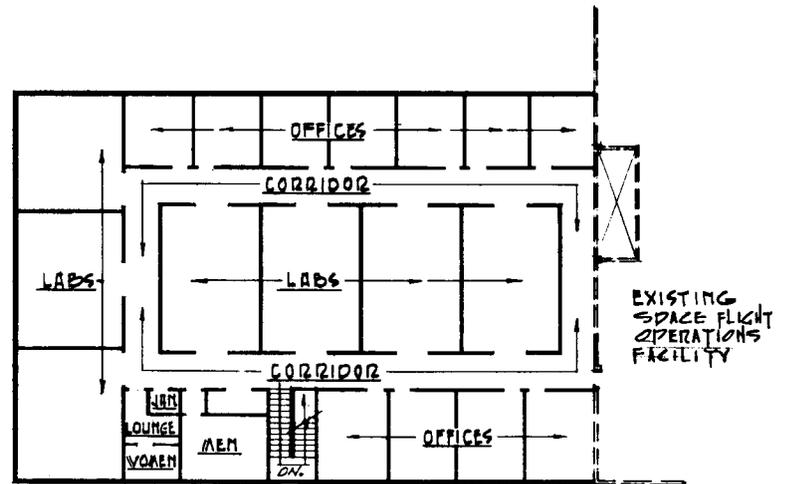
JET PROPULSION LABORATORY

FISCAL YEAR 1964 ESTIMATES

ADDITION TO THE SPACE FLIGHT OPERATIONS FACILITY



FIRST FLOOR PLAN



SECOND FLOOR PLAN

OF 4-4



SCALE IN FEET
0 4 8 16 32

three test flights, the planetary flight schedule is constrained by the availability of the planets Mars and Venus; dual launches are planned at each opportunity. Two important distinguishing and contrasting characteristics of the lunar and planetary missions are shown below.

<u>Characteristics</u>	<u>Lunar</u>	<u>Planetary</u>
Mission life	3 to 60 days	5 months to 3 years
Transit time	3 days	5 months to 2 years
Gross scientific objectives	Lunar photography	Interplanetary space measurements
	Detailed surface exploration	Planet characteristics measured by radar

The more or less competing nature of the lunar and planetary projects with respect to lifetime, transit time, and objectives are apparent from the above table. The flight schedules of these projects coupled with the protracted lifetimes of the planetary projects establish clearly the requirement to service more than one mission simultaneously. The basic facility possesses the capability of serving not more than two missions simultaneously, and then only marginally.

A secondary requirement for the proposed building mission is the requirement established primarily by the lunar projects to process spacecraft video data in real and **nonreal time**.

In summary, a facility capable of accomplishing the space flight operations associated with concurrent lunar and planetary projects does not currently exist. The addition to the facility is required primarily to establish this capability. Additionally, the modified facility will provide the space to house the video processing system required by these projects.

COST ESTIMATE:

A. LAND ACQUISITION	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS	\$63,000
Clearing and grading	\$20,000
Roads and sidewalks	2,200
Landscaping	6,500
Transformer bank	30,000
Utility connections	4,300

C. FACILITY CONSTRUCTION AND MODIFICATIONS	\$735,000
Building addition (21,600 square feet at \$34 per square foot).....	\$735,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS	122,000
Video processing equipment	122,000
E. DESIGN AND ENGINEERING SERVICES	<u>80,000</u>
Total estimated cost.....	<u><u>\$1,000,000</u></u>

JET PROPULSION LABORATORY

FISCAL YEAR 1964 ESTIMATES

DEVELOPMENT ENGINEERING BUILDING

DESCRIPTION:

This project proposes the construction of a building consisting of an office wing and a laboratory wing which will include a total of 96,000 square feet. The office wing will consist of 58,000 square feet, including a division office complex, ten section chief offices, engineering offices, design and drafting rooms, and six conference rooms. The laboratory wing will consist of 38,000 square feet, including eleven technical laboratories, a machine shop, a stock room storage area, and a high bay developmental laboratory. In the office wing, utility feeds will be located in floor conduits on 5- or 10-foot centers to allow for maximum flexibility. Interior partitions will, wherever possible, be of the 7-foot high movable type. By using movable partitions, future changes can be made without creating air-conditioning and lighting problems, costs of making changes will be lower, less disturbance will occur during changes, and changes can be accomplished faster. Floor-to-ceiling walls will be used in the conference room, restrooms, and executive offices where privacy is essential.

The laboratory wing will be of rigid frame construction and will have two floors of laboratory space on either side of a high bay area in the center. The high bay area will have a hook height of approximately 35 feet to handle spacecraft, components, mock-ups, ground handling and test equipment, shrouds, and interface components associated with spacecraft and launch vehicles. The pyrotechnics, temperature control coatings, instrumentation, circuitry, electro-mechanics, cabling, potting, and spectro-photometry. A semi-clean room, a machine shop, a stock room, a storage area, and a small number of offices will be provided.

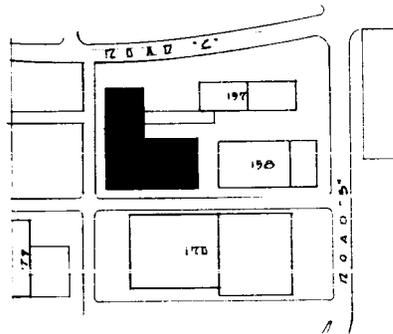
Sketches of the proposed building are shown on the following two pages.

JUSTIFICATION:

As the unmanned space exploration program advances from the use of the Atlas-Agena launch vehicle to the Centaur and Saturn vehicles, the size and complexity of spacecraft increases accordingly. Additionally, through extended development of the smaller-class spacecraft for application to special scientific missions, the number of separate spacecraft concurrently under development also increases. This growth of development engineering workload has already seriously strained facilities, forced the use of ten different buildings and twelve trailers on the JPL premises and one leased facility off the JPL premises to house the Engineering Mechanics Division. It is considered essential for the efficient and effective development of future spacecraft to bring the personnel of this division together into a single building and to eliminate the use of trailers and off-site leases.

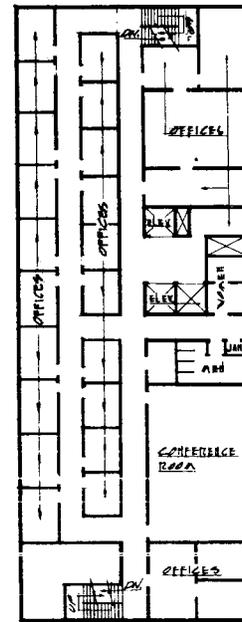
JET PROPULSION LABORATORY
FISCAL YEAR 1964 ESTIMATES

DEVELOPMENT ENGINEERING BUILDING



SITE PLAN

SCALE IN FEET
0 90 180 270

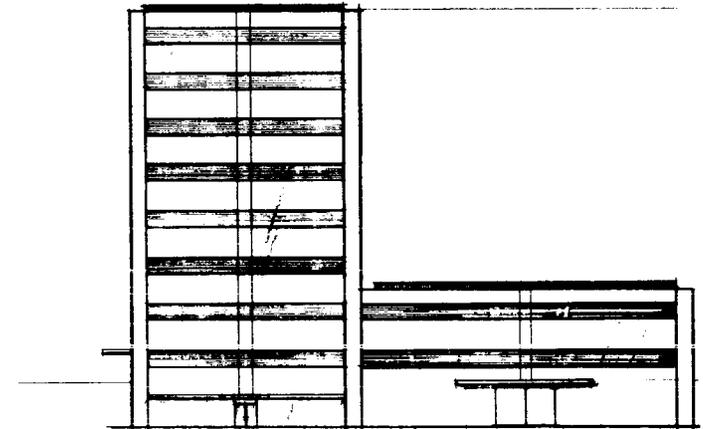


THIRD THRU EIGHTH FLOORS

SCALE IN FEET
0 40 80 120 160 200



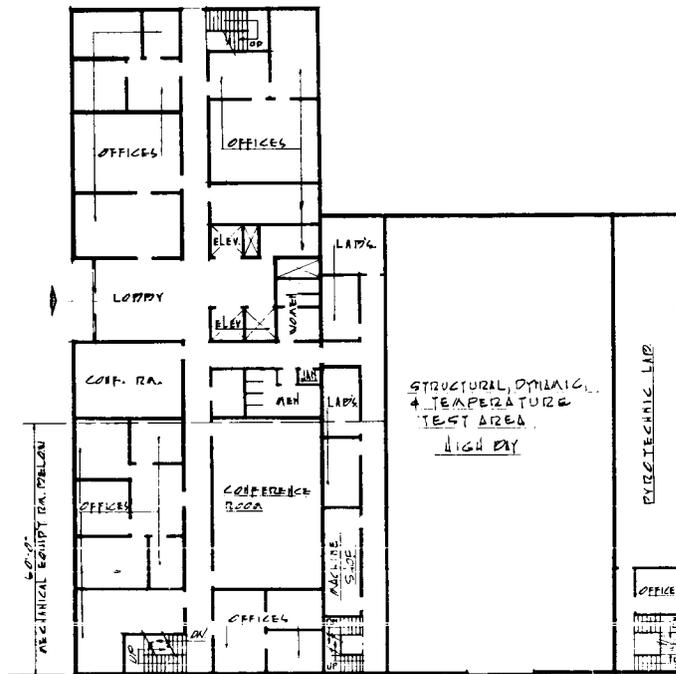
WEST ELEVATION



SOUTH ELEVATION

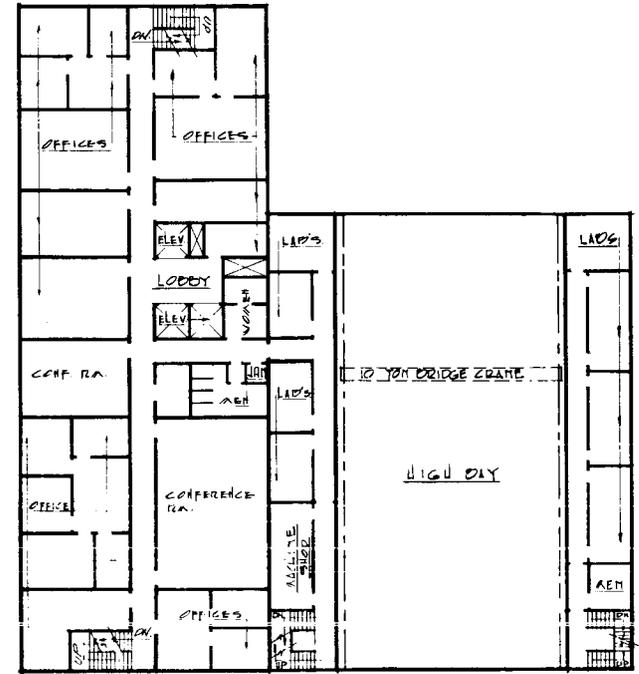
JET PROPULSION LABORATORY
FISCAL YEAR 1964 ESTIMATES

DEVELOPMENT ENGINEERING BUILDING



FIRST FLOOR PLAN

SCALE IN FEET
0 5 10 20



SECOND FLOOR PLAN

CP 4-9

At present, the Engineering Mechanics Division totals approximately 350 employees. In addition, approximately 80 contractor representatives assist in the design and application of spacecraft components and subsystems on a day-to-day basis. In the interests of efficient communication and coordination, it is highly desirable to provide closely integrated facilities for contractor as well as JPL personnel.

The present decentralization of Engineering Mechanics Division activities has separated the engineers from the developmental laboratories and shops in which much of their work is carried on. This separation, both of personnel and activities, is a serious handicap to efficient and technically effective work. Moreover, in many instances, the present facilities are overcrowded and are generally inadequate to fully exploit the staff capabilities.

Completion of this proposed facility will eliminate the need for the twelve trailers now occupied by Engineering Mechanics Division personnel, as well as 29,000-square feet of leased off-site space resulting in a monthly saving of approximately \$12,000.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$66,000
Clearing and grading.....	\$10,000	
Roads and sidewalks.....	3,000	
Landscaping.....	6,000	
Transformer bank.....	40,000	
Utility connections.....	7,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		3,244,000
Building (96,000 square feet at \$33.75 per square foot).....	3,244,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		255,000
Machine tools.....	15,000	
Materials handling equipment.....	30,000	
Data handling equipment.....	50,000	
Laboratory equipment.....	50,000	
Structural and dynamic test equipment.....	50,000	
Cryogenic equipment.....	20,000	
High-temperature equipment.....	10,000	
Collimated light system.....	30,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>335,000</u>
Total estimated cost.....		<u><u>\$3,900,000</u></u>

JET PROPULSION LABORATORY

FISCAL YEAR 1964 ESTIMATES

MATERIEL SERVICES BUILDING

DESCRIPTION:

This project provides for the construction of a four-story materiel services facility of approximately 53,000 square feet which will house all of the functions and activities of the Material Services Division except the convenience of stockrooms which are strategically located in other laboratory buildings for the support of the technical divisions. The building will be of permanent-type construction and partially air-conditioned.

The facility will be utilized as follows:

Mail service: There will be a fully-equipped mailroom for the dispatch and distribution of mail and parcel post, with capabilities for handling classified material; an addressograph room to house addressing equipment, plate files, and facilities to prepare Lab-wide mailings; and an adequate parking area and loading zone to accommodate mail vehicles and service trucks.

Inventory control: Office facilities will be provided for ordering all material issued by the stockrooms and for maintaining proper inventories in the stores warehouse.

Central stores warehousing: A warehouse area will be provided in which inventories of all types of material are maintained for stocking the laboratory stockrooms.

Stores: An office area will be provided for supervisory and administrative personnel who operate the stockrooms.

Receiving and shipping: An area will be provided for handling all material arriving at or leaving the Laboratory; marking plant equipment; assembling shipments; and an office for personnel engaged in the preparation and filing of required documents and records.

Receiving inspection: Facilities must be provided to permit classified and other material to be inspected on arrival and before release.

Property accounting: Space is included for supervisory and administrative property personnel engaged in the accounting and maintenance of all Government property records.

Material services division offices: An office will be provided to house the division administrative personnel and staff.

JUSTIFICATION:

The steady growth in size and scope of operations at the Laboratory has imposed a considerable increase in the demands on the service and support functions provided by the Material Services Division. Centering the location of the activities of this division within a confined area, readily accessible but away from the focal point of technical activities, has been a prime goal of the JPL master planning board. The proposed building provides the solution to these problems by partially consolidating the activities of the division and maintaining them near an outer perimeter of the Laboratory. The proposed location will confine the majority of vendor truck traffic to the lower southeast area of the Laboratory.

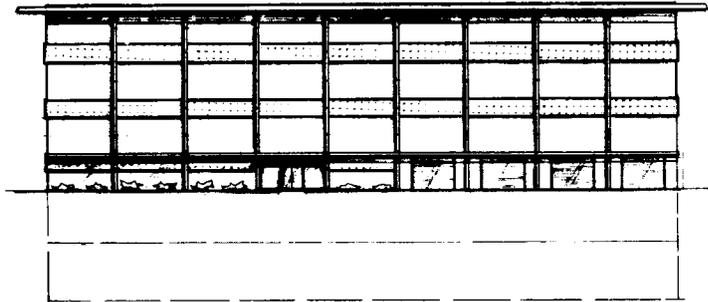
Sketches of the proposed building are shown on the following two pages.

The proposed building, in addition to consolidating the various departments of the Material Services Division, will release the space formerly occupied in the administrative services building to the Fabrication and Facilities Procurement Section, the Industry Evaluation and Assistance Section, and the Supply Procurement Division; the Accounting Section, Financial Planning Section, and Business Services Section, of the Financial Management Division; and the NASA-WOO Residency offices. The Procurement Division and the NASA-WOO offices are now housed in eight trailers and one leased off-site facility of 3,100 square feet. After the above-mentioned moves, the trailers will be eliminated and the off-site facility will be released. Elimination of the off-site space will result in a savings of approximately \$3,000 monthly.

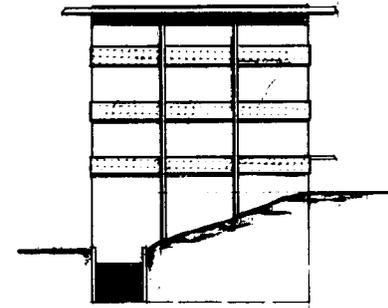
COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$60,000
Clearing and grading.....	\$25,000
Roads and sidewalks.....	5,800

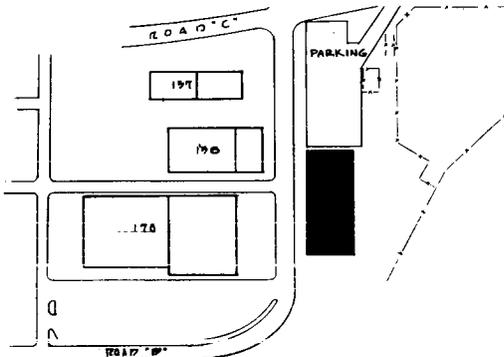
JET PROPULSION LABORATORY
 FISCAL YEAR 1964 ESTIMATES
MATERIEL SERVICES BUILDING



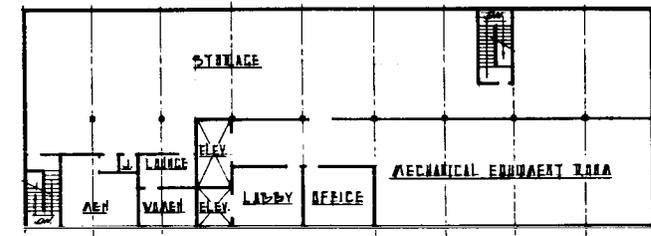
WEST ELEVATION



NORTH ELEVATION



SITE PLAN
 SCALE IN FEET
 0 50 100 150



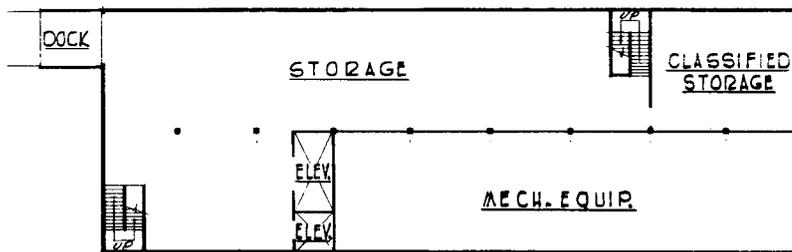
THIRD FLOOR PLAN
 SCALE IN FEET
 0 4 8 16 20

CP 4-13

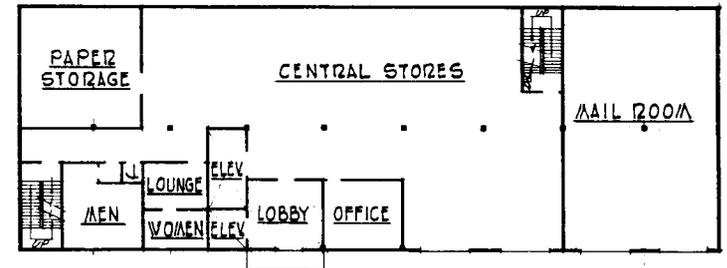
JET PROPULSION LABORATORY

FISCAL YEAR 1964 ESTIMATES

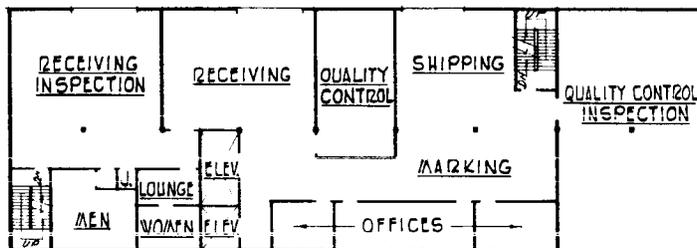
MATERIEL SERVICES BUILDING



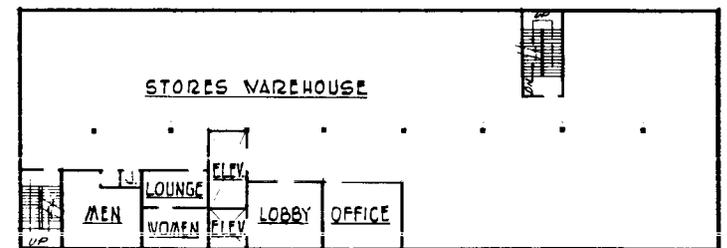
BASEMENT PLAN



FIRST FLOOR PLAN



GROUND FLOOR PLAN



SECOND FLOOR PLAN

CF 4-14



Landscaping.....	\$1,000	
Transformer bank.....	25,000	
Utility connections.....	3,200	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		\$1,424,000
Building (53,000 square feet at \$26.80 per square foot).....	1,424,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS...		---
E. DESIGN AND ENGINEERING SERVICES.....		<u>149,000</u>
Total estimated cost.....		<u><u>\$1,633,000</u></u>

JET PROPULSION LABORATORY

FISCAL YEAR 1964 ESTIMATES

UTILITY INSTALLATIONS

This project proposes the accomplishment of a series of site development and utility improvements. The scope of the work is identified on the Jet Propulsion Laboratory site plan presented at the beginning of this section. The required items are more specifically described as follows:

Road north of the telecommunications building: A service road on the north side of the telecommunications building will be reworked by grading, paving, installing sidewalks, street lighting and the necessary utilities under the road.

Bailey bridge: the project includes the installation of a bailey bridge parallel to the present bridge across the Arroyo Seco. The bridge will be obtained from Government surplus and the work will consist of installing foundations and piers, and erecting the bridge. This bridge will be used for one-way traffic in conjunction with the present bridge.

Water system: The rehabilitation of the present water system at the Laboratory is required. The work will consist of installing a new water tank adjoining the present tank, reworking the present pumping station and equipment, and rehabilitating the inlet line which crosses the Arroyo Seco from the City of Pasadena main on the east bank.

Demolition of buildings: The demolition of thirteen obsolete buildings is included in this project.

Parking areas: The project includes the necessary grading and paving to construct lots north of the materiel services building, in the east area of the Laboratory, in the northwest area of the Laboratory, and north of Edison substation. Space will be provided for approximately 375 cars.

Storm drain: A 36-inch reinforced concrete storm drain will be installed in the canyon at the east end of the Laboratory.

Landscaping: Landscaping is required for areas adjacent to the new buildings and along roads in accordance with the master landscaping plan, and including the center mall.

Center mall: The project includes the necessary grading and paving to construct a center pedestrian mall which will extend from Road "B" to Road "C" between the fabrication shop and the vehicle assembly building.

Improvements to the sewer system: Changes will be made to the present sewer system and lift station to accommodate the increased load created by the new facilities.

Erosion control: Earthwork and planting will be placed on existing bare and steep slopes to prevent erosion and resulting damage to buildings and outdoor equipment.

JUSTIFICATION:

Road north of telecommunications building: It is necessary to construct this road as an access road to service the new buildings in this area being constructed under the fiscal year 1963 program.

Bailey bridge: With the widening of the east Arroyo access road this year, a large increase in traffic from the east is anticipated which can be brought directly into the Laboratory. To handle this traffic, however, it is mandatory that two lanes be provided. The present Bailey Bridge is only wide enough for one-way traffic and can only be used for emergency egress. With the acquisition of a second bridge, and in the event of an emergency, two lanes of cars could be dispatched from the Laboratory.

Water system: The present water tank was constructed by the Corps of Engineers in 1957 when the Laboratory had a population of approximately 2,000. Since that time the population has increased to approximately 3,800. The existing tank is inadequate from a fire prevention standpoint to take care of the present population and the proposed construction program. The new tank will be equal to the present one in capacity. The existing supply line from the City of Pasadena and pump were also constructed by the Corps of Engineers in 1957 and both the pump and the line are inadequate to meet the demands of the increased population and new buildings.

Demolition of buildings: Several obsolete buildings must be demolished to provide building sites for the facilities in this budget and to conform to the long-range master site plan.

Parking areas: Additional parking areas are required to partially replace parking areas which have been lost because of new construction.

Storm drain - East Area: This project is necessary to carry off seasonal storm waters from the mesa in the east portion of the Laboratory.

Landscaping: There are a number of areas throughout the Laboratory which require regrading and it is necessary to landscape these areas to prevent soil erosion.

Center mall: The master site and landscape plans provide for a pedestrian mall to provide access between the upper and lower areas of the Laboratory.

Improvements to the sewer system: The present sewer system was designed in 1955 by the Corps of Engineers and was based on a maximum population of approximately 2,500 people. At the present time, there are approximately 3,800 people at the laboratory. It is necessary to rework most of the system, including some of the lines and most of the lift stations to provide adequate capacity for the present and immediate future demands.

Erosion control: At the present time there are numerous banks which have been created by previous cuts and fills. To prevent further erosion of these banks with resulting water damage to existing property, it is necessary that proper control methods be applied.

COST ESTIMATE:

A. LAND ACQUISITION	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$424,000
Road north of telecommunications building..	\$ 14,000
Bailey bridge.....	41,000
Water system	130,000
Demolition of buildings.....	10,000
Parking lots.....	79,000
Storm drain - East Area	30,000
Landscaping.....	20,000
Center mall.....	30,000
Improvements to the sewer system.....	50,000
Erosion control.....	20,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

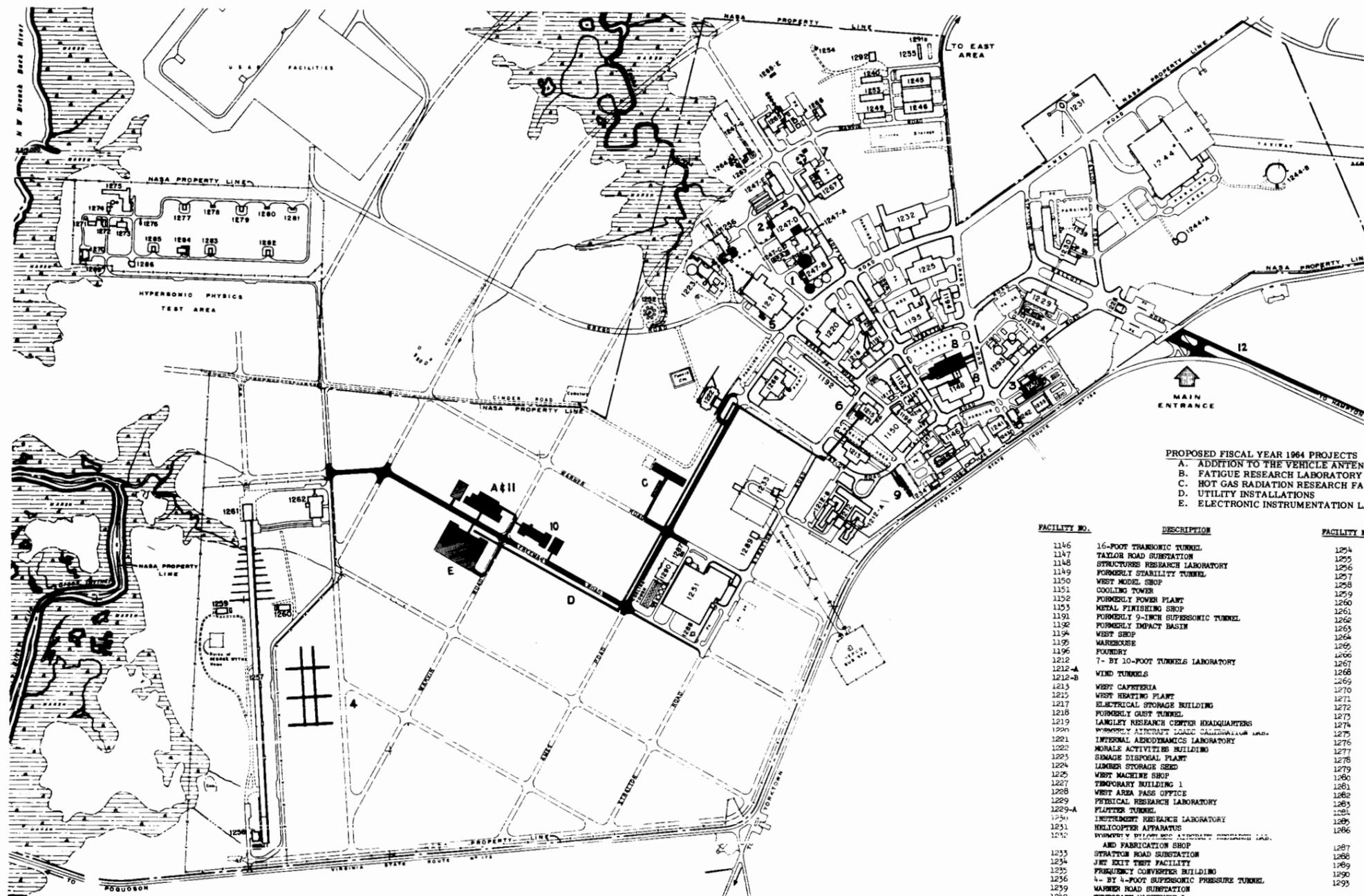
CONSTRUCTION OF FACILITIES - 1964 PROGRAM

LANGLEY RESEARCH CENTER

		<u>Page No.</u>
Location plan.....		CF 5-1
Addition to the vehicle antenna test facility.....	\$1,758,000	CF 5-3
Electronic instrumentation laboratory.....	2,850,000	CF 5-7
Fatigue research laboratory.....	1,291,000	CF 5-11
Hot gas radiation research facility.....	2,620,000	CF 5-15
Utility installations.....	<u>1,249,000</u>	CF 5-20
Total.....	<u>\$9,768,000</u>	

LANGLEY RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN



PROPOSED FISCAL YEAR 1964 PROJECTS
 A. ADDITION TO THE VEHICLE ANTENNA TEST FACILITY
 B. FATIGUE RESEARCH LABORATORY
 C. HOT GAS RADIATION RESEARCH FACILITY
 D. UTILITY INSTALLATIONS
 E. ELECTRONIC INSTRUMENTATION LABORATORY

FACILITY NO.	DESCRIPTION	FACILITY NO.	DESCRIPTION
1146	16-FOOT TRANSONIC TUNNEL	1254	AMMUNITION STORAGE 1
1147	TAYLOR ROAD SUBSTATION	1255	TEMPORARY WAREHOUSE 6
1148	STRUCTURES RESEARCH LABORATORY	1256	9- BY 6-FOOT THERMAL STRUCTURES TUNNEL
1149	FORMERLY STABILITY TUNNEL	1257	LANDING LOADS TRACK
1150	WEST MODEL SHOP	1258	LANDING LOADS TRACK COMPRESSOR BUILDING
1151	COOLING TOWER	1259	NORTH ARRESTING GEAR HOUSING
1152	FORMERLY POWER PLANT	1260	SOUTH ARRESTING GEAR HOUSING
1153	METAL FINISHING SHOP	1261	LANDING LOADS TRACK SHOP
1191	FORMERLY 9-INCH SUPERSONIC TUNNEL	1262	HIGH-SPEED HYDRODYNAMICS OFFICE AND SHOP
1192	FORMERLY IMPACT BASIN	1263	CERAMIC-HEATED JET (PILOT MODEL)
1194	WEST SHOP	1264	HIGH-TEMPERATURE MACH 7 JET (PILOT MODEL)
1195	WAREHOUSE	1265	6-FOOT HIGH-TEMPERATURE STRUCTURES TUNNEL
1196	FOUNDRY	1266	HOFFERT ROAD SUBSTATION
1212	7- BY 10-FOOT TUNNELS LABORATORY	1267	HIGH-TEMPERATURE MATERIALS LABORATORY
1212-A	WIND TUNNELS	1268	DATA REDUCTION BUILDING
1212-B	WEST CAPTHERIA	1269	GATE HOUSE (HYPERSONIC PHYSICS TEST AREA)
1213	WEST HEATING PLANT	1270	ROCKET PROPELLANT TEST UNIT, HPTA
1215	ELECTRICAL STORAGE BUILDING	1271	OFFICE BUILD, HPTA
1216	FORMERLY GUST TUNNEL	1272	HEATING PLANT, HPTA
1219	LANGLEY RESEARCH CENTER HEADQUARTERS	1273	OPERATIONS CENTER, HPTA
1220	FORMERLY AIRCRAFT LOGIC CALIBRATION LAB	1274	CERAMIC-HEATED MACH 15 JET, HPTA
1221	INTERNAL AERODYNAMICS LABORATORY	1275	IMPACT AND PROJECTILE TEST UNIT, HPTA
1222	MORALE ACTIVITIES BUILDING	1276	TOXITE ASSEMBLY BUILDING, HPTA
1223	SHRIMP DISPOSAL PLANT	1277	STORAGE A
1224	LINKER STORAGE SHED	1278	STORAGE B
1225	WEST MACHINE SHOP	1279	STORAGE C
1227	TEMPORARY BUILDING 1	1280	STORAGE D
1228	WEST AREA PASS OFFICE	1281	STORAGE E
1229	PETROCHEMICAL RESEARCH LABORATORY	1282	STORAGE F
1229-A	FLATBED TUNNEL	1283	STORAGE G
1230	INSTRUMENT RESEARCH LABORATORY	1284	ROCKET PROPELLANT PROCESSING BUILDING, HPTA
1231	HELICOPTER APPARATUS	1285	STORAGE H
1232	FORMERLY BIOMEDICAL AIRCRAFT RESEARCH LAB. AND FABRICATION SHOP	1286	ROCKET ASSEMBLY AND SHROUDED ALTERNATOR BUILDING
1233	STRATTON ROAD SUBSTATION	1287	TEMPORARY SHED
1234	JET EXIT TEST FACILITY	1288	SOLAR ENERGY COLLECTOR
1235	FREQUENCY CONVERTER BUILDING	1289	TEMPORARY STORAGE
1236	4- BY 4-FOOT SUPERSONIC PRESSURE TUNNEL	1290	SUBSTATION
1239	WALKER ROAD SUBSTATION	1293	DYNAMICS RESEARCH LABORATORY
1240	TEMPORARY WAREHOUSE 3		
1241	DRIVE CONTROL BUILDING		
1242	PROPELLER STATIC TEST STAKE		
1243	YUKTOWNE ROAD SUBSTATION		
1244	FORMERLY FLIGHT RESEARCH LABORATORY		
1244-A	WATER TANK NO. 2		
1244-B	CONTROL LINE FACILITY		
1245	TEMPORARY WAREHOUSE 1		
1246	TEMPORARY WAREHOUSE 2		
1247-A	FORMERLY GAS DYNAMICS LABORATORY CENTER		
1247-B	WEST WING		
1247-C	COOLING TOWER		
1247-D	EAST WING		
1247-E	COMPRESSOR BUILDING		
1247-F	ANKS ROAD SUBSTATION		
1247-G	HIGH-PRESSURE SHOCK TUBE		
1249	TEMPORARY WAREHOUSE 4		
1251	UNITARY PLAN WIND TUNNEL		
1252	WATER TANK NO. 1		
1253	TEMPORARY WAREHOUSE 5		

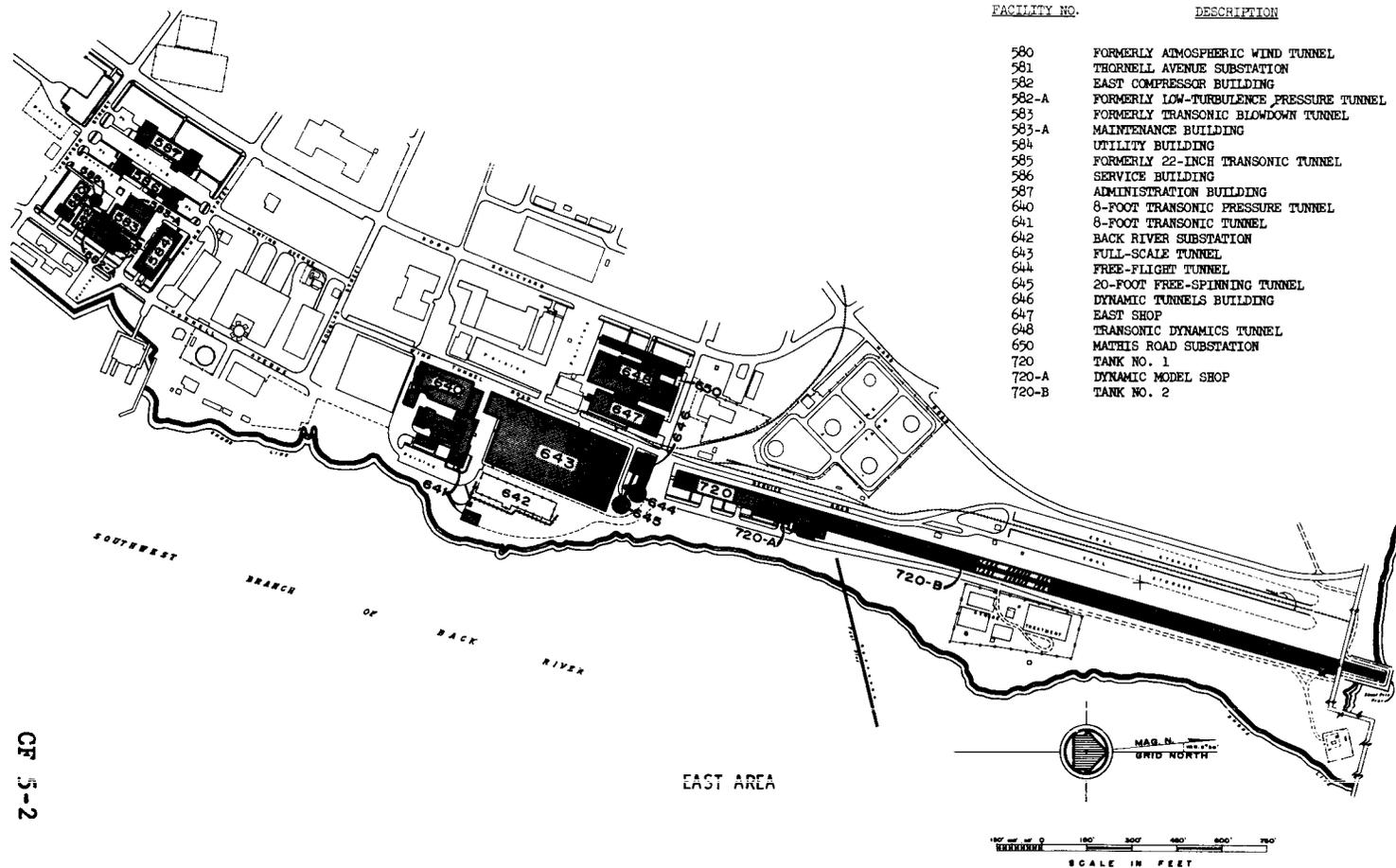
- FACILITIES AUTHORIZED AND UNDER CONSTRUCTION
1. HYPERSONIC AEROTHERMAL DYNAMICS FACILITY
 2. EQUIPMENT FOR MACROFLAMMODYNAMICS RESEARCH
 3. HIGH VACUUM SPACE STRUCTURES FACILITY
 4. LUNAR LANDING RESEARCH FACILITY
 5. LOW-FREQUENCY ENVIRONMENTAL NOISE FACILITY
 6. ADDITION TO HEATING PLANT
 7. ADD. POWER SUPPLY AND IMPROVED ARC CHAMBER FOR 10-MEGAWATT ARC TUNNEL
 8. ENVIRONMENTAL RESEARCH FACILITIES FOR SPACECRAFT COMPONENTS AND MATERIALS
 9. PARTICLE ACCELERATOR FOR SIMULATION OF MICRO-METEOROID IMPACT
 10. STABILIZATION AND CONTROL EQUIPMENT LABORATORY
 11. VEHICLE ANTENNA TEST FACILITY
 12. WEST AREA APPROACH ROAD

WEST AREA



LANGLEY RESEARCH CENTER FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN



CF 5-2

LANGLEY RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

ADDITION TO THE VEHICLE ANTENNA TEST FACILITY

DESCRIPTION:

This project proposes construction of an addition to the vehicle antenna test facility approved in the fiscal year 1963 construction program and soon to be placed under construction. The addition will provide facilities for research and development work on transmitting and receiving equipment in the microwave and millimeter wavelength regions, radiating systems for use in highly ionized flow fields, single element and arrayed spacecraft antennas to obtain required gain beamwidth characteristics, feed systems for increased efficiency, low noise amplification techniques, and related electronic systems.

The facilities will include: electro-optics rooms with controlled ambient radiation over the ultraviolet to infrared spectrum, and physical optics instrumentation and equipment for the investigation of techniques for the generation, modulation, and detection of coherent radiation at light frequencies; radio-frequency shielded rooms and microwave instrumentation for development of spacecraft transmission systems with improved efficiencies; a laboratory equipped with instrumentation for accurate frequency and power level measurements; cryogenic facilities such as helium liquefiers, high field electromagnets, low-temperature measurement equipment, and other devices for research on low noise amplification techniques; and laboratory space and instrumentation for research on advanced data acquisition and transmission concepts for spacecraft and ground systems.

Detailed arrangements of the addition are shown in the drawing on the next page.

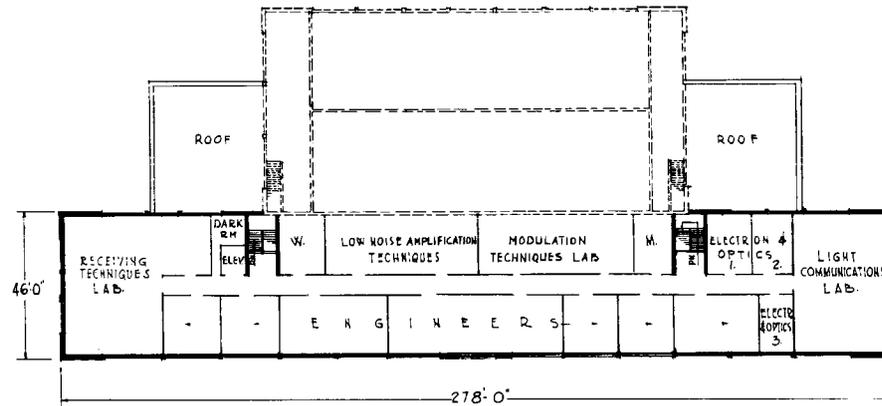
JUSTIFICATION:

The vehicle antenna test facility is urgently needed for the developmental testing of flight systems for immediate projects. During the year since the formulation of the 1963 construction program, a study of proposed space research missions was made and telecommunication requirements were compared with existing capabilities. This study revealed that a significant expansion of research programs is required to provide the basic information necessary to design spacecraft and ground telecommunication systems for these missions. The proposed addition to the vehicle antenna test facility is one of the steps necessary to provide the facilities needed for expanded research effort in this field.

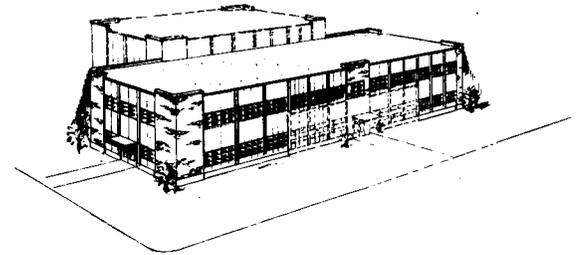
The proposed facilities will provide equipment and instrumentation for research on techniques for increasing the information capacity and for

LANGLEY RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

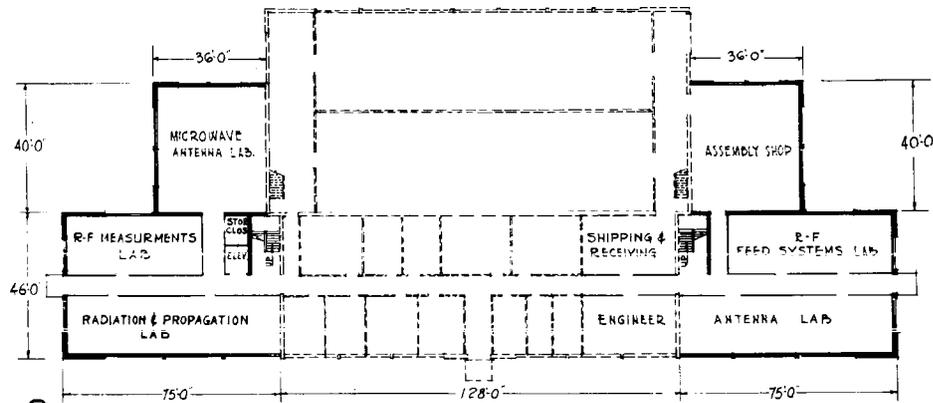
ADDITION TO THE VEHICLE ANTENNA TEST FACILITY



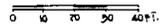
SECOND FLOOR PLAN



PERSPECTIVE VIEW



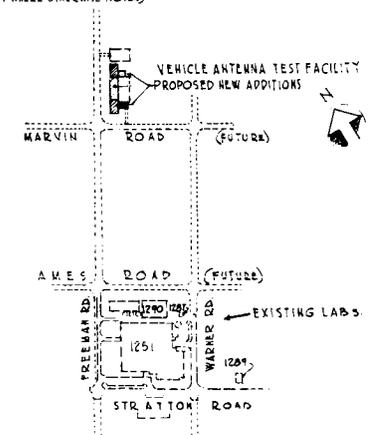
FIRST FLOOR PLAN



CR 5-4

LEGEND

- PROPOSED NEW ADDITIONS
- - - FISCAL - 1963 (EXCEPT WHERE OTHERWISE NOTED)



LOCATION PLAN



extending the range of telecommunication systems. Because of variations in mission requirements, spacecraft size, and other considerations, an improvement in a single technique, such as increasing the size of the spacecraft antenna, will not provide the required telecommunication capability. Rather, orders of magnitude improvements in antenna gain, transmission power, and receiver sensitivity (effective systems temperature) for both spacecraft and ground-based systems are required.

Research on high gain erectable antennas for spacecraft, which has been initiated at the Langley Center, will be expanded when the vehicle antenna test facility is completed. However, parallel research efforts are required on antenna feed systems, transmitters, and receiving techniques needed for use with these antennas. Additional laboratory space and equipment are required for this work and will be provided by this addition. Work on techniques for increasing the gain, and thus the range, of large ground antenna will require facilities for work on masers, cooled parametric amplifiers, signal acquisition and detection techniques, and antenna feed systems. Research on techniques of improving the over-all efficiency and increasing the power output of spacecraft transmission systems requires additional microwave equipment, measurement standards, and test facilities. Studies with coherent radiation at light frequencies have indicated the potential of improving information capacity and extending the range of communication systems. Investigations in this area will require careful control of ambient conditions over a broad frequency spectrum and will require the special equipment provided by this project for the generation and control of coherent radiation at light frequencies.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$26,500
Utility connections.....	\$20,500
Grading and paving.....	6,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	832,000
Light control chambers and shielded rooms.....	180,000
Laboratory additions..(26,080 square feet at \$25.00 per square foot).....	652,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	822,500
Laboratory standards and calibration equipment....	150,000
Laboratory test and shop equipment.....	87,500
Light frequency equipment and instrumentation....	250,000
Cryogenic equipment.....	155,000
Telemeter receiving and check-out equipment.....	180,000

E. DESIGN AND ENGINEERING SERVICES.....	<u>\$77,000</u>
Total estimated cost.....	<u><u>\$1,758,000</u></u>

LANGLEY RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

ELECTRONIC INSTRUMENTATION LABORATORY

DESCRIPTION:

This project proposes the construction of an electronic instrumentation laboratory to provide facilities for research on microelectronics, development of thin film electronic components, and advanced research and development of measurement devices and techniques that are basically vital to progress in space technology.

The facility will include laboratories equipped with small thermal environmental test chambers and instrumentation for development and testing of telemetry components; dust controlled rooms, pressurized chambers, electron beam evaporators, high-vacuum deposition systems, and other equipment for research in microelectronics; electro-optics rooms with controlled ambient radiation over the ultraviolet to infrared spectrum, physical optics instrumentation, and equipment for the investigation of photoelectric and electro-optical techniques applicable, for example, to hypervelocity flow diagnostic instrumentation; equipment for reliability testing of electronic equipment; and laboratory standards necessary for the development of high accuracy electronics instrumentation.

General purpose laboratory space will be provided for use in technical fields such as the application of information theory to modulation techniques, advanced telemetry systems, onboard electronic data processing techniques, and the associated transducers and electronic measurement techniques.

Detailed arrangements of the facility are shown in the drawing on the following page.

JUSTIFICATION:

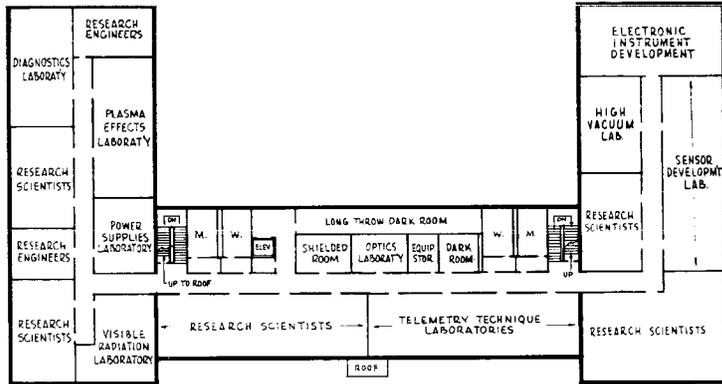
An important objective of current research is to gain detailed knowledge of the space environment with a view toward effective utilization by man. The first phase of this research effort is directed at the development of the concepts, designs, equipment, and techniques to accomplish the task of accumulating necessary scientific data. Because important data must be returned to earth over great distances, electronic techniques must be employed to properly condition and convert physical measurements into proportional electrical quantities for transmission.

Successful accomplishment of future missions is contingent upon the development of techniques and equipment to reduce the weight, space, and power requirements of the electronic equipment to be used. The degree of sophistication required in the data gathering and processing portions of space probes, coupled with the limited payload capabilities of launch vehicle

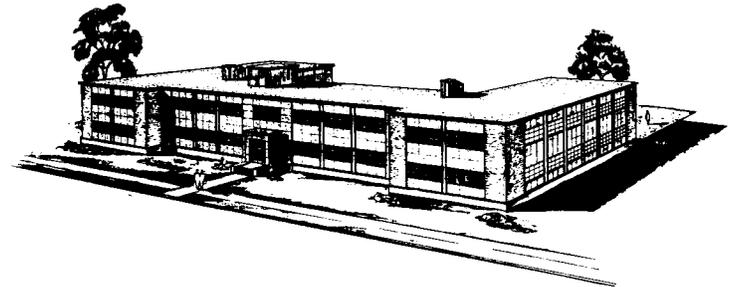
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LANGLEY RESEARCH CENTER FISCAL YEAR 1964 ESTIMATES

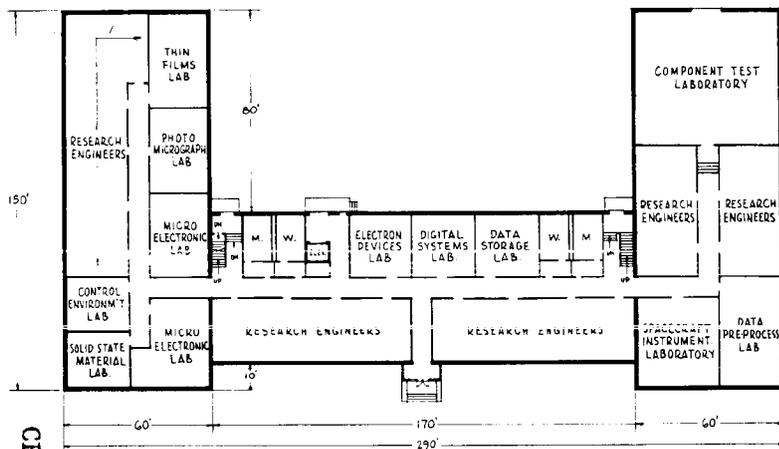
ELECTRONIC INSTRUMENTATION LABORATORY



SECOND FLOOR PLAN

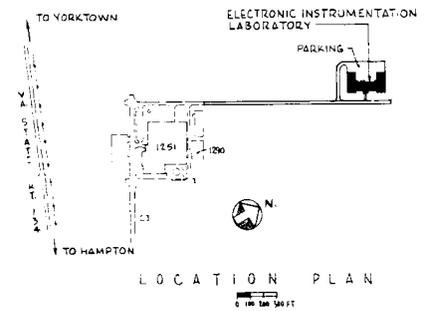


PERSPECTIVE



FIRST FLOOR PLAN

CF 5-8



LOCATION PLAN

systems, make improvements in electronic equipment and techniques necessary. In addition, the typical long duration of space missions, and the absence of onboard repair capability, requires that the reliability of these systems and components be materially improved. Two techniques which promise to alleviate these problems are the use of microelectronics and thin films. Research into methods of obtaining flight-qualified components, utilizing these techniques which have predetermined characteristics, is urgently needed.

The development of new techniques of processing the information gathered in space for transmission back to earth can also result in appreciable savings in space, weight, and power requirements. Adaptive processing techniques, for example, may be developed which would permit maximum utilization of the available transmission bandwidth during all phases of the space mission. Present techniques do not afford sufficient flexibility to transmit data with the required accuracy, recognizing that accuracy requirements for any particular measurement will vary with the different phases of flight.

A third area requiring research is the development of advanced measurement techniques. The conquest of space will require the development of new measurement instrumentation designed specifically for the totally different space environment. The fact that the terms pressure, temperature, and radiation levels each carries a physically new concept in space requires that new techniques be developed in order that these parameters can be measured accurately and reliably.

The requested electronic instrumentation laboratory has been designed to significantly bolster this important area of space payload instrumentation and measurement techniques research. The selection of instrumentation technologies and facilities that should be provided is based on a study of NASA's future needs in the area of electronic instrumentation. This study clearly shows that major advances in this field are required to accomplish NASA's planned missions.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$312,770
Grading and paving.....	\$50,200	
Outside mechanical utilities.....	55,055	
Outside electrical utilities.....	207,515	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,618,800
Laboratory building.....	1,438,800	
(First and second floors 56,400 square feet at \$25.00 per square foot = \$1,410,000)		

	(Partial basement 3,600 square feet at \$8.00 per square foot = \$28,800)	
	Special environmental controls.....	180,000
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	803,430
	Laboratory standards.....	190,000
	Environmental test equipment.....	200,000
	Electronic test and shop equipment.....	363,430
	Equipment installation.....	50,000
E.	DESIGN AND ENGINEERING SERVICES.....	<u>115,000</u>
	Total estimated cost.....	<u>\$2,850,000</u>

LANGLEY RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

FATIGUE RESEARCH LABORATORY

DESCRIPTION:

This project proposes the construction of a fatigue research laboratory to house equipment utilizing high-capacity hydraulic apparatus. The facility will provide a floor area of approximately 24,500 square feet, including area for utilities equipment, and will be divided into the following general areas:

Hot structure test area: This area will contain approximately 5,000 square feet of floor space with a heavy-duty floor. The area will be provided with T-slot tie-downs at 2-foot spacings to support large structural components during tests under cyclic heating and loading. A 5-ton overhead traveling crane will be installed for handling large structural components.

General fatigue test laboratory: This area will contain approximately 15,500 square feet of air-conditioned space and will house existing fatigue test machines and associated equipment. Most of the area will have a 20-foot clear height with a 7-1/2 ton traveling crane to facilitate installation of heavy accessories and maintenance of equipment. Special cells, some of them heavily soundproofed, will be provided to protect personnel from very high intensity noise associated with high-performance hydraulic test apparatus. A sight-controlled room for photo-elastic stress analysis and special environmental control for tests in simulated space environments will be provided. The special cells will have individually controlled air-conditioning or ventilation as required for equipment to be housed. A central closed circulating water system with cooling tower will be provided for cooling portions of testing machines having high-heat sources.

General work space: Approximately 4,000 square feet of space will be provided for working areas for scientific and supporting personnel connected with the fatigue research laboratory.

The new laboratory will be located adjacent to the structures research laboratory and will utilize the 10-megawatt power supply located in that building for fatigue tests at elevated temperatures.

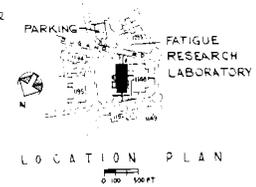
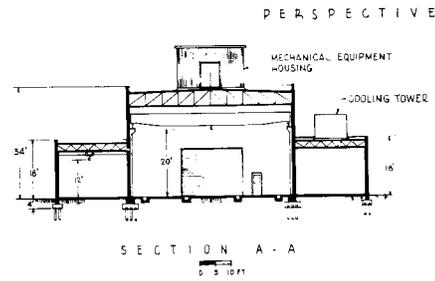
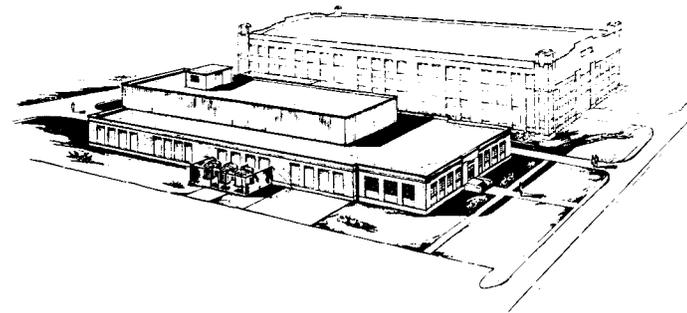
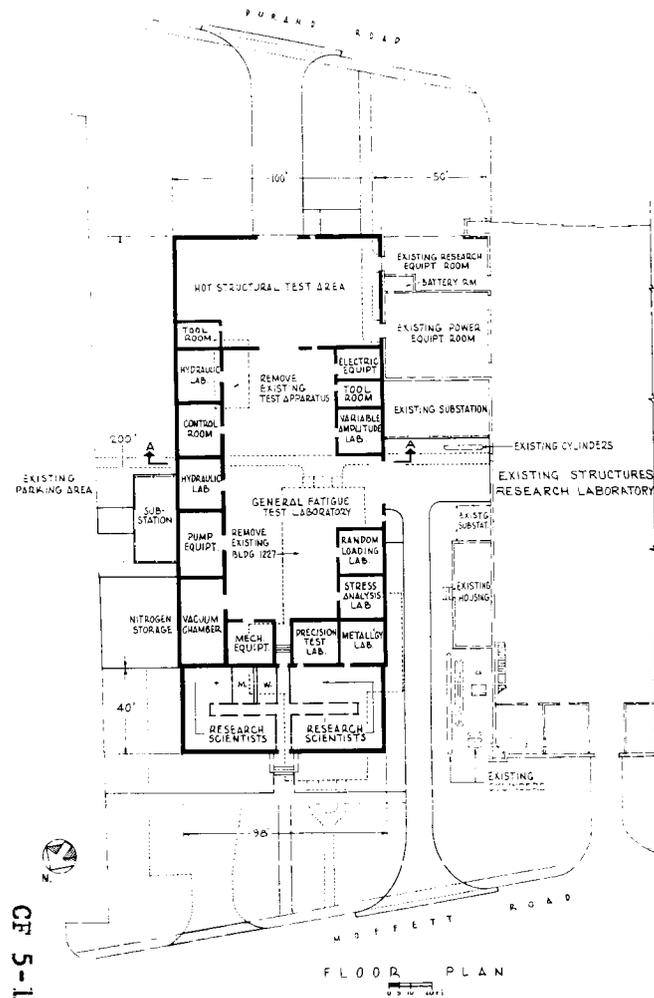
Detailed arrangements of the facility are shown in the drawing on the following page.

JUSTIFICATION:

The prevention of failure by fatigue continues to be one of the most

LANGLEY RESEARCH CENTER FISCAL YEAR 1964 ESTIMATES

FATIGUE RESEARCH LABORATORY



- LEGEND**
- NEW CONSTRUCTION
 - EXISTING CONSTRUCTION
 - EXISTING TO BE REMOVED

CF 5-12

important considerations in the design of aircraft and space structures. Although research on the problems has been conducted for some years, fatigue design has not been systematized as much as it must be to assure adequate safety and life without costly proof tests. The situation is aggravated by the introduction of environmental parameters such as heat, vacuum, and intense noise fields. These parameters not only affect the phenomenon itself but require that new materials and advanced structural configurations be developed and evaluated. An expansion of research effort is needed to provide urgently needed design criteria and to develop improved structural configurations.

The conduct of fatigue research involves a large number of tests in a variety of fatigue testing machines. Most of these machines have strain-gaged components which function most reliably if fluctuations in ambient temperatures are minimized. Also, programming devices which are used on many of the machines require good humidity and dust control for maximum reliability in operation. The materials under test are themselves sensitive to the environment in which they are tested to the extent that test results can be seriously affected.

Fatigue research at the Langley Center is now being conducted in a large hangar-type building originally constructed for the calibration of aircraft for flight tests. The building is shared with other groups requiring frequent access through large hangar doors. The opening and closing of these doors cause rather large changes in temperature and humidity at irregular intervals. The resulting effect on machine reliability and instrument calibrations has hampered progress to a very significant extent.

The proposed facility will provide a more nearly ideal environment in which to conduct fatigue research without the undesirable influences which have been present in the past. It will also provide well-designed space for expansion of the effort so that tests under simulated environments and on structural specimens can be conducted.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$224,000
Site preparation and relocation of utilities.....	\$1,700
Drives, walks, and parking areas.....	14,800
Demolition of temporary building.....	4,500
Primary underground cable and ducts.....	23,000
Secondary unit substation.....	79,000
Secondary power duct for heater load.....	79,000
Communication connections.....	10,000
Mechanical utility connections.....	12,000

C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		\$656,000
Building (24,500 square feet at \$20 per square foot).....	\$490,000	
Special humidity control and air-con- ditioning.....	80,000	
Special pilings.....	43,000	
Special foundations, structural fixtures, and sound insulation.....	43,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		336,000
Cranes.....	43,000	
Fatigue research equipment.....	112,000	
Instrumentation.....	171,000	
Laboratory equipment.....	10,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>75,000</u>
	Total estimated cost.....	<u>\$1,291,000</u>

LANGLEY RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

HOT GAS RADIATION RESEARCH FACILITY

DESCRIPTION:

This project proposes the construction of a hot gas radiation research facility consisting of a 6-inch-diameter electrically driven shock tube, a 12-inch-diameter electrically driven expansion tube, and a 10-million-joule capacitor bank.

The shock tube driven section will consist of 6-inch-diameter stainless steel tubes totaling 45 feet in length. Two test sections will be constructed, one for use between driven tube sections and one for use at the downstream end of the tube. The shock tube driver will be a 2-foot-long steel pressure vessel capable of withstanding a pressure of 45,000 pounds per square inch. The driver and driven sections will be joined together by a diaphragm section and the entire shock tube will be supported in a heavy structural steel frame. Auxiliary equipment will include a collector coupling, collector support, collector cables, and concrete thrust anchor. The shock tube will be driven by helium, heated electrically by up to 5-million joules from the 10-million-joule capacitor bank.

The 12-inch-diameter expansion tube will consist of an 8-foot-long driver, an 8-foot-long stainless-steel intermediate chamber, and a 150-foot-long stainless-steel acceleration chamber terminating in a test section. Auxiliary equipment will include diaphragm sections, a collector assembly, and a concrete thrust anchor. The expansion tube will be driven by helium, heated electrically, utilizing the full power of the 10-million-joule capacitor bank.

Use of a 10-million-joule capacitor bank to drive the two facilities will require the purchase of capacitors totaling 7-1/2-million joules to add to an available 2-1/2-million-joule bank. The additional energy storage system will be of the same type and quality as the existing system. The necessary capacitor racks, cables, and charging equipment will be purchased.

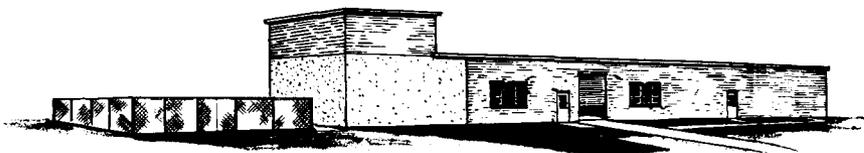
The shock tube and expansion tube will be housed in a masonry shelter approximately 235 feet long, 40 feet wide, and 15 feet high. Lighting, ventilation, heating, air conditioning, and an electrical supply system will be provided. The capacitor racks will be installed adjacent to this shelter.

Detailed arrangements of this facility are shown in the drawing on the following page.

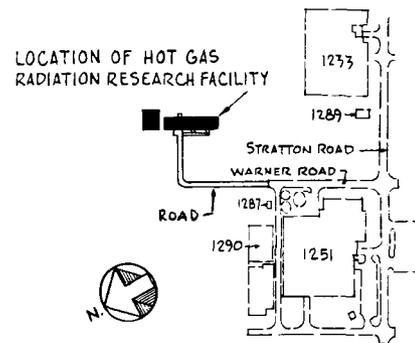
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LANGLEY RESEARCH CENTER FISCAL YEAR 1964 ESTIMATES

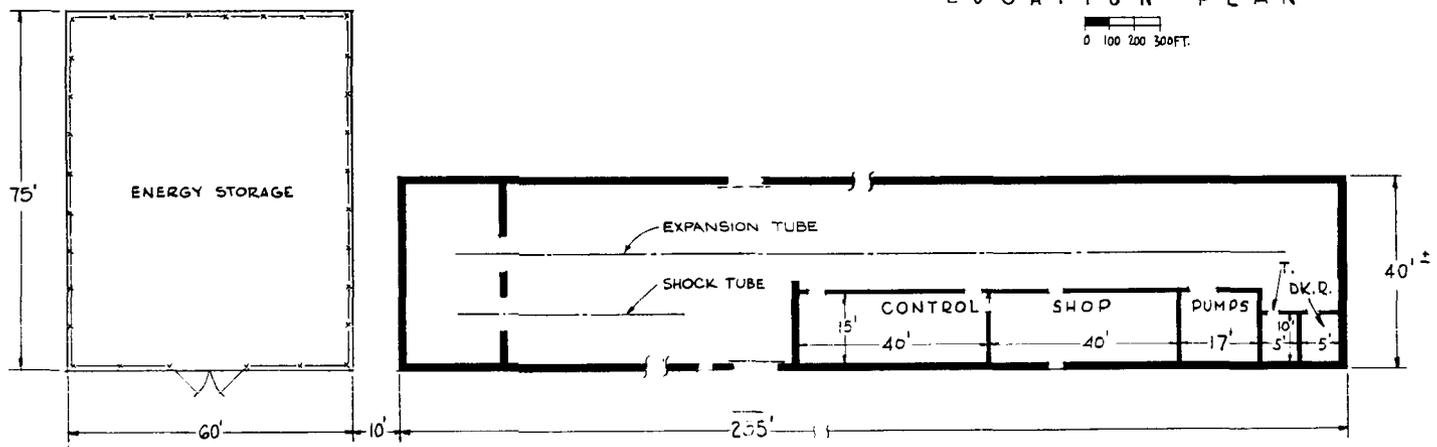
HOT GAS RADIATION RESEARCH FACILITY



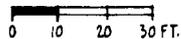
PERSPECTIVE



LOCATION PLAN



PLAN



LEGEND
--- EXISTING CONSTRUCTION
--- NEW CONSTRUCTION

CF 5-16

JUSTIFICATION:

For reentry vehicles entering the earth's atmosphere at speeds greater than satellite speed, thermal radiation from the hot gas cap must be considered in designing the vehicle heat protection system. Compared to convective heating, radiative heating is important for Apollo reentries but not dominant, whereas it is predominant for entry from interplanetary missions. The nature of this dominant radiative heating in both earth and planetary atmospheres must be determined now in order to avoid the future penalties of crash programs, overruns in development projects, and/or excessive heat shield weight with resultant sacrifice in payload.

The problem of computing the radiant heat flux to a reentry vehicle may be conveniently divided into two problem areas: first, the basic radiative properties of the gas in question at a given chemical and thermodynamic state (e.g., intensity of radiation, spectral distribution, self-absorption), and second, the definition of the flow field and radiation distribution to the vehicle.

In recent years, much experimental research has been carried out to determine the basic radiative properties of high-temperature air; the bulk of this research has been conducted in shock tubes. Data have been obtained for temperatures up to those typical of Apollo reentries, but existing shock tubes do not have the capability of attaining higher temperatures.

The proposed 6-inch-diameter shock tube, driven by 5-million joules from the capacitor bank, will be capable of investigating both equilibrium and nonequilibrium radiation from air at temperatures characteristic of entry velocities much higher than Apollo velocities. Radiation studies behind incident shock waves (which duplicate the normal bow shock for the flight vehicle) will be carried out up to shock velocities of 50,000 feet per second. Equilibrium radiation behind the reflected shock can be investigated at gas conditions characteristic of entries at velocities in excess of 60,000 feet per second. It should be pointed out that, although the proposed shock tube will be utilized chiefly for the investigation of radiative heat transfer in air, other useful research programs, such as radiation studies in planetary atmospheres, studies of chemical reaction rates, and convective heat-transfer research will be carried out in this facility.

Whereas the aforementioned experimental work on basic radiation data will be carried out in conjunction with theoretical studies, experiments must carry the major burden of defining the radiative heat-transfer distribution about reentry vehicles because of the difficulty of computing real gas flow fields. The shock tube, although a highly useful tool for basic radiation research, is not capable of providing radiation distribution data because the flow fields are not simulated when models are inserted in the high-temperature (low Mach number) shock tube flow.

The only ground facility previously known to be capable of duplication of flight velocity and free-stream conditions at altitudes of interest is the ballistic shock tunnel. In this facility, small models (up to about 1/2 inch in diameter) are fired into the flow generated by a conventional shock tunnel. The small model size prohibits the use of onboard instruments and thus measurements must be made by sensors fixed in the tunnel walls. As a result, testing times are extremely short (about 1 microsecond) and distribution of the radiation energy flux to various regions of the model cannot be obtained. Further, models in ballistic shock tunnels are normally symmetrical models restricted to flight at zero angle of attack; tests of lifting configurations are extremely difficult to carry out.

Consequently, it is clear that existing facilities will not yield sufficient flow field and radiation heat-transfer distribution data for the efficient design of heat protection systems for lunar and interplanetary reentry vehicles.

The proposed 12-inch-diameter expansion tube will be capable of providing a short duration (tens of microseconds) flow of air at full-scale velocities over 45,000 feet per second with complete duplication of the free-stream properties. Fixed models of up to about 4 inches in diameter will be tested with onboard instrumentation installed to measure the spatial distribution of radiation energy flux to the vehicle surface. In addition, high-speed motion pictures, shadowgraphs, and spectrographic data will be obtained from equipment mounted outside the tunnel in a conventional manner. A range of model sizes will be used, making possible the isolation of both equilibrium and nonequilibrium radiation over a range of altitude. Because the models will be fixed to the expansion tube, asymmetric shapes at arbitrary angles of attack will be utilized to make available data on lifting configurations not otherwise obtainable except in expensive large-scale flight tests.

It has been demonstrated by previous shock tube work that the use of a high-energy capacitor discharge into the shock tube driver yields performance far exceeding that obtainable by any other practical drive methods. To obtain the performance and testing time desired of the proposed expansion tube, a capacitor bank of 10-million joules of energy storage is required of which 2-1/2-million joules are available from capacitors already purchased.

The hot gas radiation research facility, consisting of the 6-inch-diameter shock tube, the 12-inch-diameter expansion tube, and the 10-million-joule capacitor bank will contribute major inputs to designers of reentry vehicle heat protection systems.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$1,567,000
Electrical utility connections.....	\$98,000
Site preparation, roads, and mechanical utility connections.....	140,700
Capacitor banks, cable, and controls.....	1,328,300
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	847,000
Enclosure for shock tube (9,400 square feet at \$14.36 per square foot).....	135,000
Tubes, test sections, drives, and supports.....	654,200
Handling equipment.....	50,000
Energy storage sun shade.....	7,800
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	80,000
General instrumentation.....	80,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>126,000</u>
Total estimated cost.....	<u>\$2,620,000</u>

LANGLEY RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

UTILITY INSTALLATIONS

DESCRIPTION:

This project covers the extension of utilities at the Langley Research Center to support existing facilities, facilities under construction, and future facilities to be constructed. The scope of the project includes:

Road construction: The extension of Ames Road consisting of the construction of approximately 3,500 feet of 30-foot wide paved road including all necessary ground preparation such as clearing, grubbing, excavation, fill, grading, and seeding. The proposed construction will extend Ames Road from the morale activities building to the Unitary Plan wind tunnel and from the Unitary Plan wind tunnel to the high-speed hydrodynamics office and shops.

Utilities tunnel extension: The construction of approximately 3,800 linear feet of tunnel extending the existing walk-through tunnel from the West Area heating plant to the area in which new facilities are being located. The proposed tunnel extension will be approximately 7 feet wide by 7 feet high and will provide central utility services to existing and future facilities in the general area of the Unitary Plan wind tunnel.

The location of the proposed road and utilities tunnel is shown in the drawing on the following page.

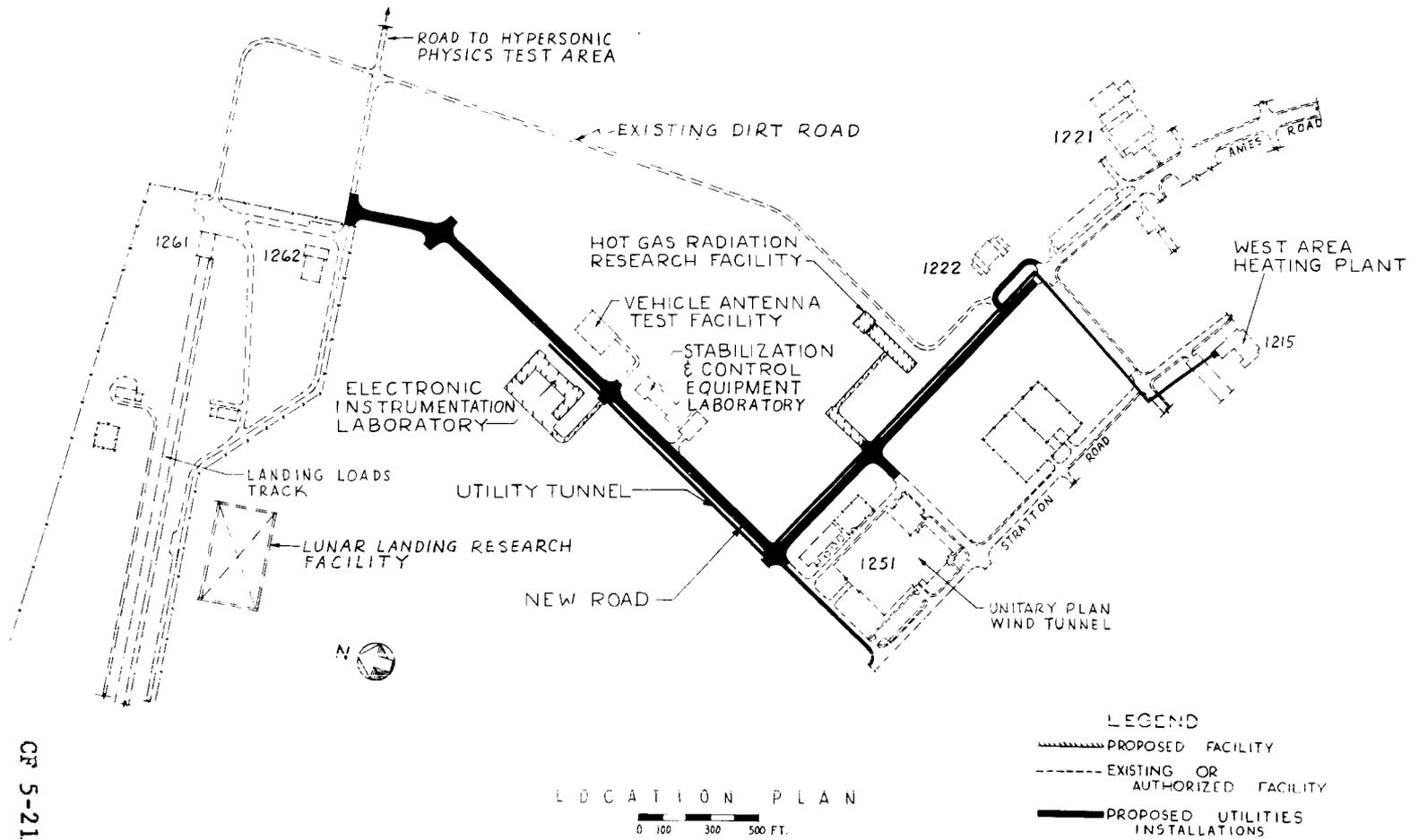
JUSTIFICATION:

The more effective utilization of the newly developed portion of the Langley Research Center West Area requires the extension of essential utility services to that area where facilities have just been completed, where facilities are now under construction, and where future facilities will be built. The following factors justify each portion of the subject project:

Road construction: The principal access to the hypersonic physics test area, to the landing loads track and to the lunar landing research facility now being constructed is a temporary unsurfaced road. This temporary road becomes almost impassible during extended inclement weather. In addition, it will be unable effectively to carry the anticipated traffic load to the existing facilities, to the facilities being constructed, and to the new facilities authorized for construction in the fiscal year 1963 construction program. The proposed new paving will extend the existing road system to these new facilities.

LANGLEY RESEARCH CENTER FISCAL YEAR 1964 ESTIMATES

UTILITY INSTALLATIONS



CP 5-21

Utilities tunnel extension: The underground utility tunnel system protects the utility service lines from the weather and from ground water protection which is not possible with overhead lines or with buried lines. With an underground tunnel, maintenance is required less often, and when it is necessary it can be carried on without excavation, pole climbing, or regard to weather conditions. The extension of the tunnel system will permit coordinating common utilities between the facilities in the newly developed area, and between the facilities in that area and the established West Area facilities.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$1,178,000
Road construction (approximately 3,500 feet of pavement, 30 feet wide).....	\$325,000	
Street lighting.....	24,000	
Concrete tunnel (3,800 feet; 7 by 7 feet; underground).....	564,000	
High-pressure steam and water piping.....	241,000	
Electrical installations.....	24,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		---
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		---
E. DESIGN AND ENGINEERING SERVICES.....		<u>71,000</u>
Total estimated cost.....		<u>\$1,249,000</u>

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

LAUNCH OPERATIONS CENTER

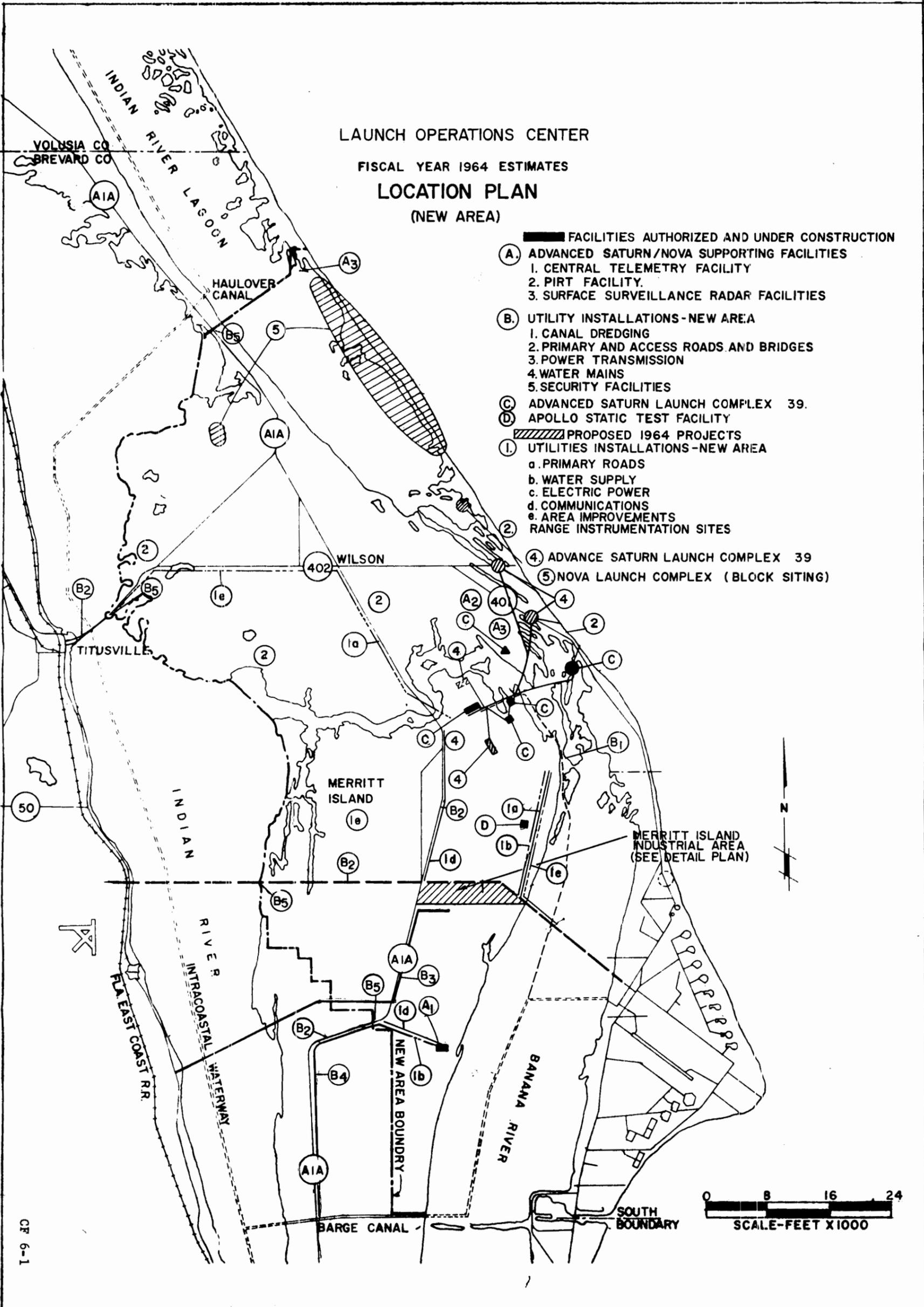
		<u>Page No.</u>
Location plan.....		CF 6-1
Advanced Saturn launch complex No. 39.....	\$217,219,000	CF 6-5
Advanced Saturn supporting facilities.....	9,309,000	CF 6-31
Barge lock and channel.....	1,000,000	CF 6-42
Careteria.....	899,000	CF 6-45
Calibrations and standards laboratory.....	2,867,000	CF 6-48
Central instrumentation facility.....	31,508,000	CF 6-51
Deep space network launch station.....	4,000,000	CF 6-59
Launch equipment shop.....	1,517,000	CF 6-61
Manned spacecraft facilities.....	6,512,000	CF 6-64
Modifications to Saturn launch complex No. 34	1,310,000	CF 6-76
Modifications to Saturn launch complex No. 37	3,435,000	CF 6-81
Optical and electronic component servicing facility.....	855,000	CF 6-86
Range engineering and administration building	605,000	CF 6-89
Range instrumentation sites.....	4,823,000	CF 6-92
Unmanned satellite operations facility.....	1,680,000	CF 6-99
Utility installations - New Area.....	23,755,000	CF 6-102
Vehicle maintenance and service facilities..	<u>1,561,000</u>	CF 6-114
Total.....	<u><u>\$312,855,000</u></u>	

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN

(NEW AREA)



- FACILITIES AUTHORIZED AND UNDER CONSTRUCTION
- (A) ADVANCED SATURN/NOVA SUPPORTING FACILITIES
 - 1. CENTRAL TELEMETRY FACILITY
 - 2. PIRT FACILITY
 - 3. SURFACE SURVEILLANCE RADAR FACILITIES
- (B) UTILITY INSTALLATIONS - NEW AREA
 - 1. CANAL DREDGING
 - 2. PRIMARY AND ACCESS ROADS AND BRIDGES
 - 3. POWER TRANSMISSION
 - 4. WATER MAINS
 - 5. SECURITY FACILITIES
- (C) ADVANCED SATURN LAUNCH COMPLEX 39
- (D) APOLLO STATIC TEST FACILITY
- ▨ PROPOSED 1964 PROJECTS
 - (1) UTILITIES INSTALLATIONS - NEW AREA
 - a. PRIMARY ROADS
 - b. WATER SUPPLY
 - c. ELECTRIC POWER
 - d. COMMUNICATIONS
 - e. AREA IMPROVEMENTS
 - (2) RANGE INSTRUMENTATION SITES
 - (4) ADVANCE SATURN LAUNCH COMPLEX 39
 - (5) NOVA LAUNCH COMPLEX (BLOCK SITING)

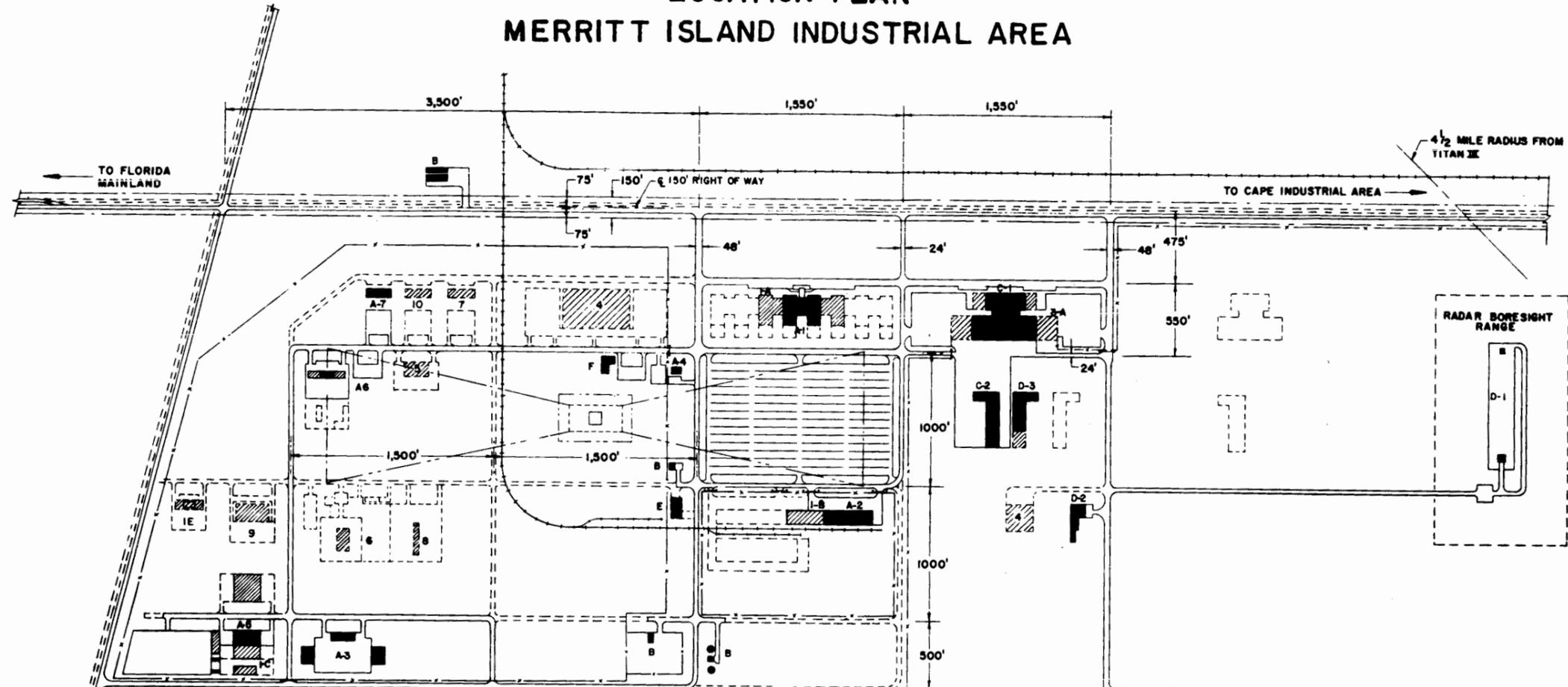


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LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

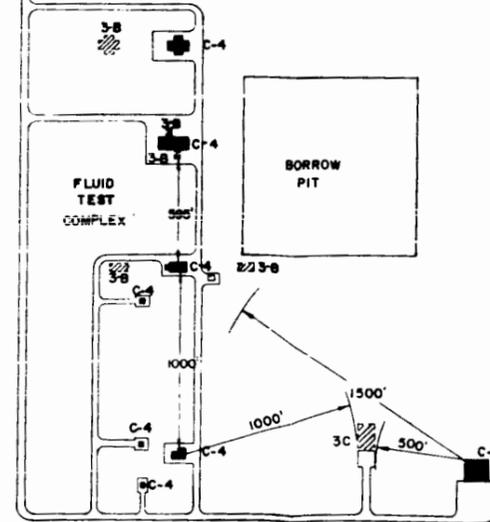
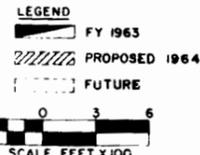
LOCATION PLAN MERRITT ISLAND INDUSTRIAL AREA



NASA MERRITT ISLAND INDUSTRIAL AREA

- FACILITIES AUTHORIZED AND UNDER CONSTRUCTION**
- A. ADVANCED SATURN/NOVA SUPPORTING FACILITIES
 - 1. LAUNCH OPERATIONS CENTER HEADQUARTERS
 - 2. CENTRAL SUPPLY FACILITY
 - 3. CABLE STORAGE AND MAINTENANCE FACILITY
 - 4. DISPENSARY
 - 5. WAREHOUSE
 - 6. MAINTENANCE FACILITY
 - 7. CORPS OF ENGINEERS BUILDING
 - B. UTILITY INSTALLATIONS-NEW AREA
 - 1. ALL ROADS & UTILITIES AS INDICATED
 - 2. COMMUNICATIONS FACILITIES
 - C. APOLLO MISSION SUPPORT FACILITIES
 - 1. OPERATIONS AND CHECKOUT BUILDING
 - 2. SUPPLY, SHIPPING & RECEIVING WAREHOUSE
 - 3. WEIGHT AND BALANCE BUILDING
 - 4. FLUID TEST COMPLEX
 - D. MANNED SPACECRAFT FACILITIES
 - 1. RADAR BORESIGHT RANGE
 - 2. PARACHUTE AND PARAGLIDER BUILDING
 - 3. SUPPLY AND GSE SERVICE BUILDING
 - E. FIRE STATION
 - F. MAIN CAFETERIA

- PROPOSED 1964 PROJECTS**
- 1. ADVANCED SATURN/NOVA SUPPORTING FACILITIES
 - A. ADDITION TO LAUNCH OPERATIONS CENTER HEADQUARTERS
 - B. ADDITION TO CENTRAL SUPPLY
 - C. ADDITION TO WAREHOUSE FACILITY
 - D. ADDITION TO PLANT MAINTENANCE FACILITY
 - E. SECURITY HEADQUARTERS
 - 2. UTILITY INSTALLATIONS-NEW AREA
 - A. ADDITION TO ROAD AND UTILITY
 - 3. MANNED SPACECRAFT FACILITIES
 - A. ADDITION TO OPERATIONS CHECKOUT BUILDING
 - B. ADDITION TO FLUID TEST COMPLEX
 - C. ORDNANCE FIELD TEST LABORATORY
 - 4. CENTRAL INSTRUMENTATION FACILITY
 - 5. LAUNCH EQUIPMENT SHOP
 - 6. VEHICLE MAINTENANCE FACILITY
 - 7. RANGE ENGINEERING AND ADMINISTRATIVE BUILDING
 - 8. VEHICLE SERVICE FACILITY
 - 9. OPTICAL AND ELECTRONIC COMPONENT SERVICING FACILITY
 - 10. STANDARDS AND CALIBRATION LABORATORY



LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES

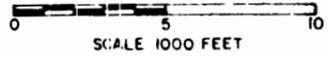
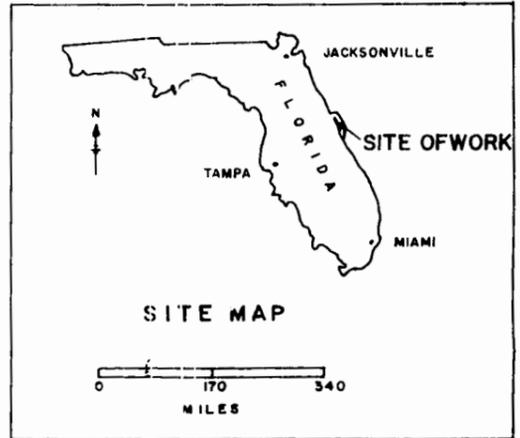
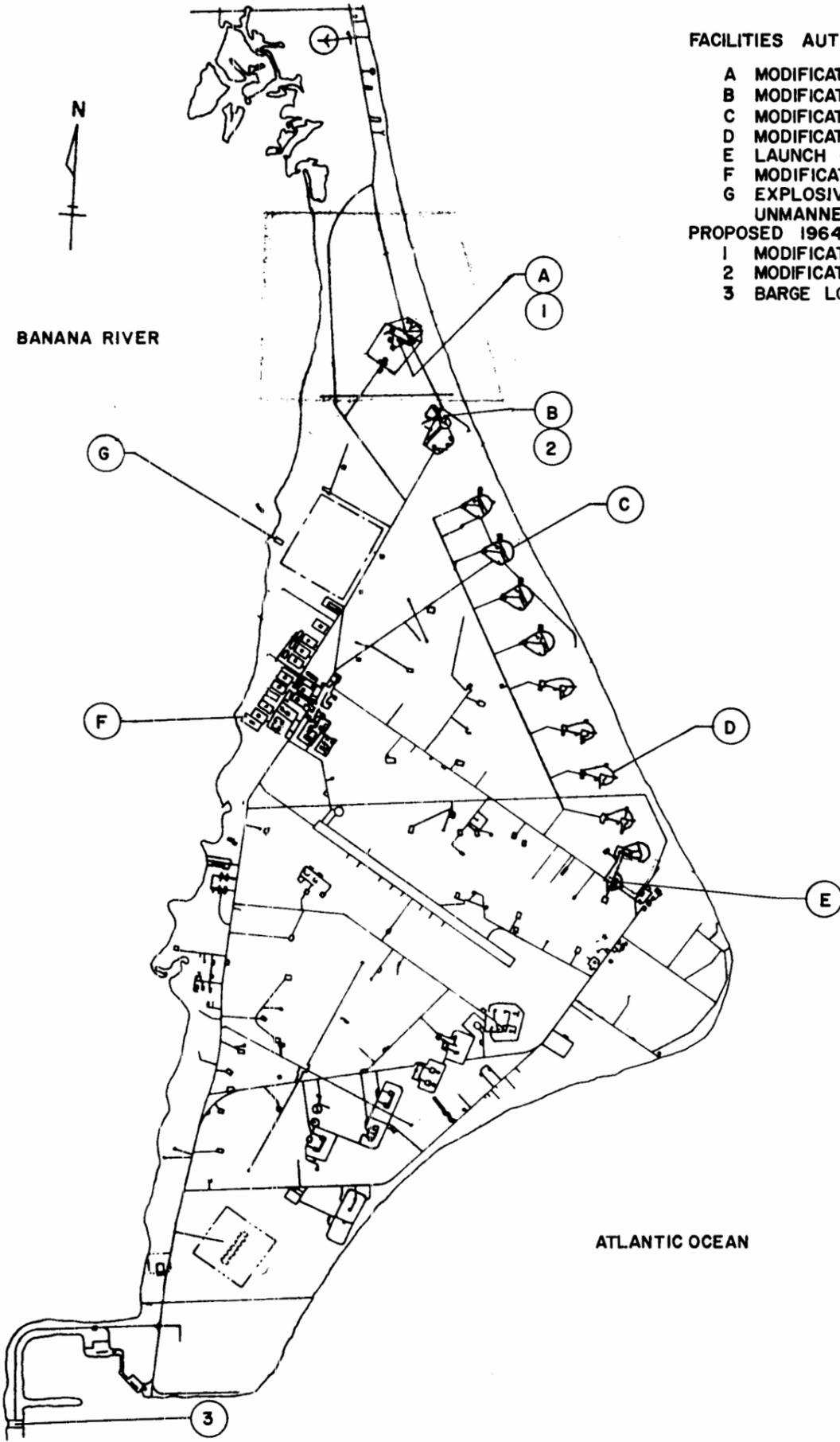
LOCATION PLAN
CCMTA

FACILITIES AUTHORIZED AND UNDER CONSTRUCTION

- A MODIFICATIONS TO LAUNCH COMPLEX 37
- B MODIFICATIONS TO LAUNCH COMPLEX 34
- C MODIFICATIONS TO LAUNCH COMPLEX 19
- D MODIFICATIONS TO LAUNCH COMPLEX 12
- E LAUNCH COMPLEX 36B
- F MODIFICATIONS TO MAB "AF"
- G EXPLOSIVE SAFE ASSEMBLY FACILITY FOR UNMANNED SPACECRAFT

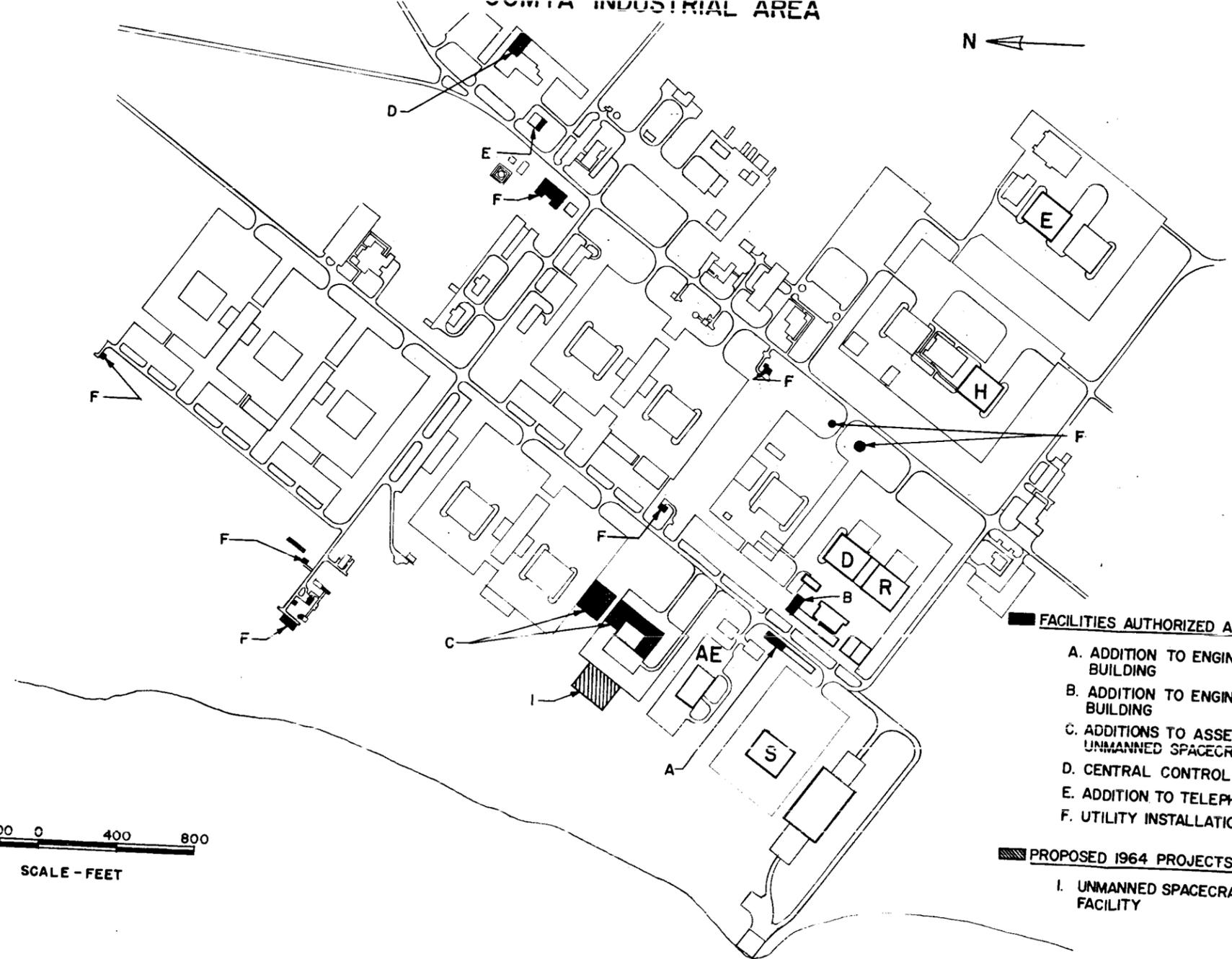
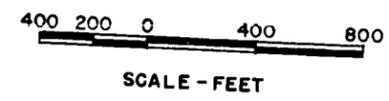
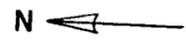
PROPOSED 1964 PROJECTS

- 1 MODIFICATIONS AND ADDITIONS TO L.C 37
- 2 MODIFICATIONS AND ADDITIONS TO L.C 34
- 3 BARGE LOCK AND CHANNEL



LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES

CCMTA INDUSTRIAL AREA



- FACILITIES AUTHORIZED AND UNDER CONSTRUCTION
- A. ADDITION TO ENGINEERING & OPERATIONS BUILDING
- B. ADDITION TO ENGINEERING & LABORATORY BUILDING
- C. ADDITIONS TO ASSEMBLY FACILITY FOR UNMANNED SPACECRAFT
- D. CENTRAL CONTROL FACILITY
- E. ADDITION TO TELEPHONE EXCHANGE (CCMTA)
- F. UTILITY INSTALLATION-EXISTING AREA
- ▨ PROPOSED 1964 PROJECTS
- I. UNMANNED SPACECRAFT OPERATIONS FACILITY

45-1115 2405

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN LAUNCH COMPLEX NO. 39

DESCRIPTION:

This project provides the third increment of funds for the design and construction of facilities required for the assembly, checkout, and launch of the Advanced Saturn vehicle and other advanced vehicle configurations. The funds requested herein will cover approximately 50 percent of the estimated total complex cost. The fiscal year 1963 program funded approximately 40 percent of the total complex cost and provided for the design and construction of four high bays and the associated low bays of the vertical assembly building, one launch pad, the crawler roadway system from the assembly building to the launch pad, two crawler transporters, two launcher-umbilical towers and the procurement of steel for a third, three terminal repeater buildings, and a portion of the site preparation, roads within the complex, and associated utility connections. The fiscal year 1963 funds also provided for the study, design, and initial procurement of checkout and control equipment, flame deflectors, firing accessories, instrumentation and connecting cabling, general support equipment and the design of the ordnance arming tower. Additional funds will be required in subsequent fiscal years to complete the project and maintain its operational readiness to service future launch vehicle programs. The principle elements of the complex are shown in the location plans and sketches on the following ten pages. The scope of work encompassed by the fiscal year 1964 project includes the following items:

Site development and utility installations: This work will consist of site preparation for one additional launch pad and advanced site preparation for a third pad, final grading, and installation of utility lines and connections throughout the area. The project also includes hydraulic fill and other site preparation for the barge terminal facilities in the assembly building area, and the installation of cable raceways. The materials unloading area, funded in the fiscal year 1963, will be adapted to provide fender piling, wharf, storage, and vehicle handling facilities for terminal unloading. Roadways to outlying sites on the pad and to various facilities located in the intermediate area between the pads and the vertical assembly building will be surfaced with asphaltic concrete for heavy-duty operations.

Vertical assembly building: The basic structure was funded in the fiscal year 1963. Funds are now requested to provide for partitioning, flooring, lighting and equipping the following areas within the vertical assembly building and includes the necessary structural features related thereto:

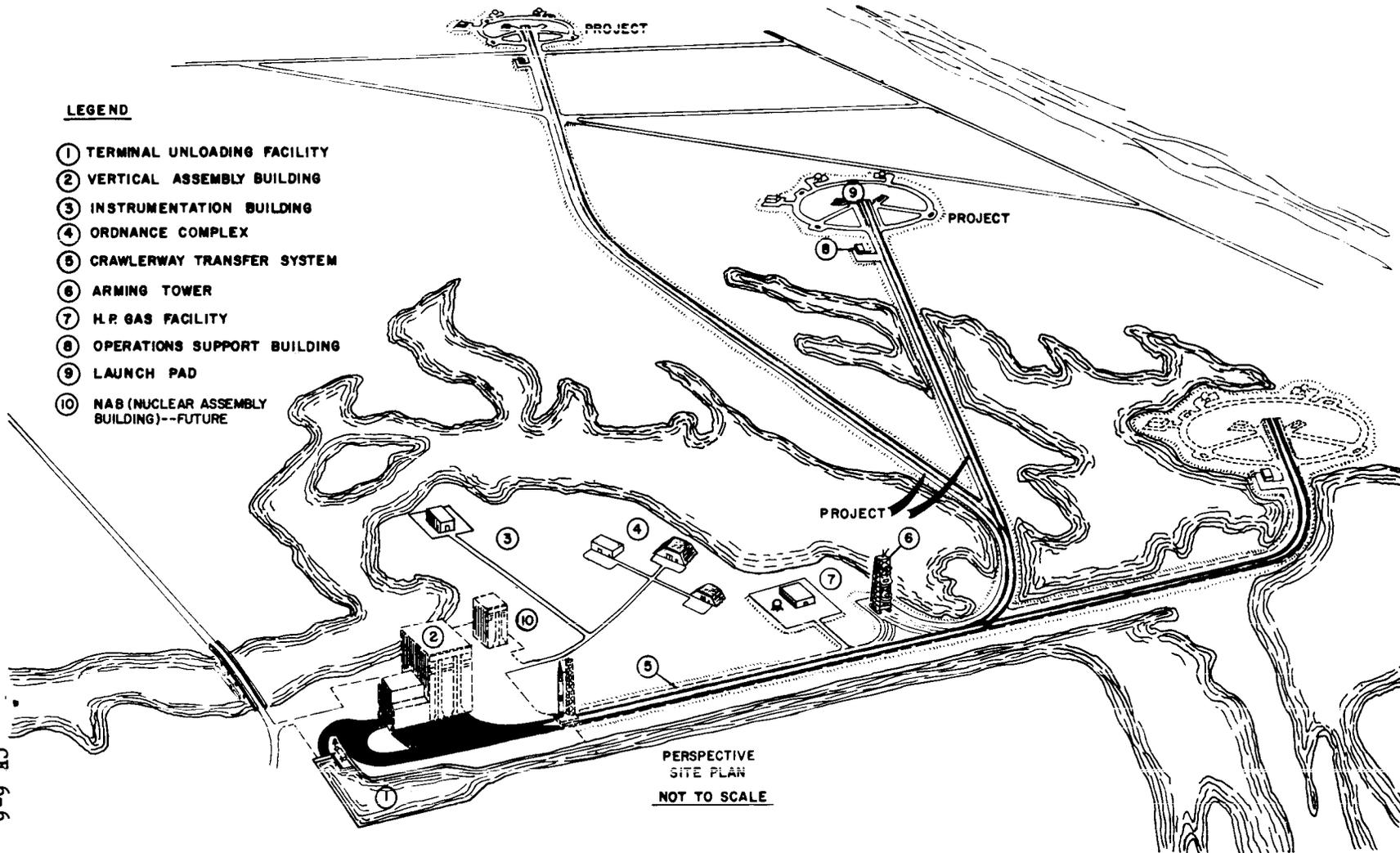
LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN LAUNCH COMPLEX NO. 39

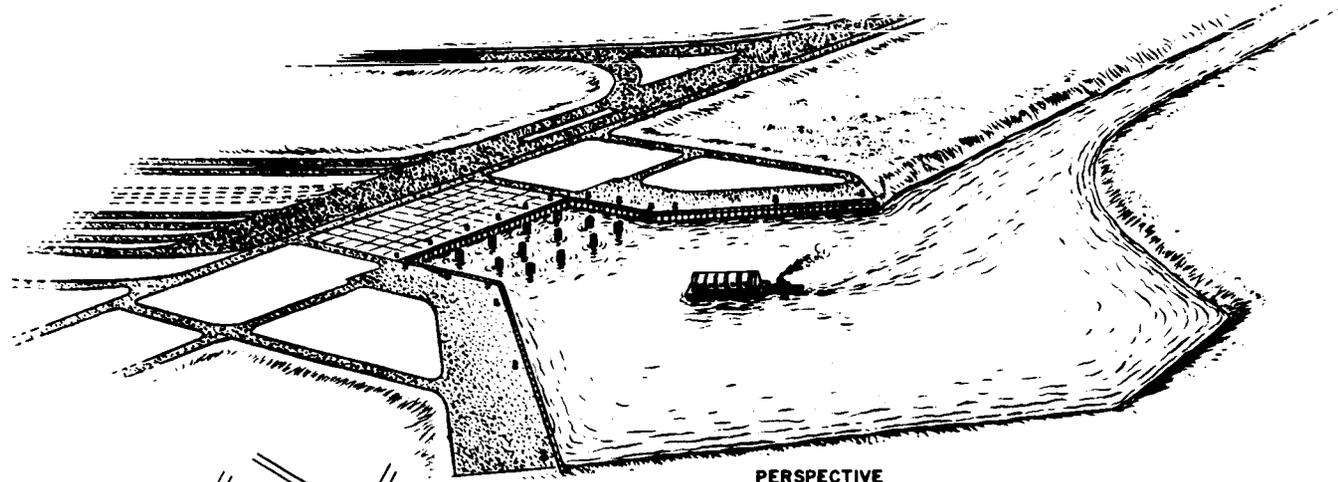
LEGEND

- ① TERMINAL UNLOADING FACILITY
- ② VERTICAL ASSEMBLY BUILDING
- ③ INSTRUMENTATION BUILDING
- ④ ORDNANCE COMPLEX
- ⑤ CRAWLERWAY TRANSFER SYSTEM
- ⑥ ARMING TOWER
- ⑦ H.P. GAS FACILITY
- ⑧ OPERATIONS SUPPORT BUILDING
- ⑨ LAUNCH PAD
- ⑩ NAB (NUCLEAR ASSEMBLY BUILDING)--FUTURE

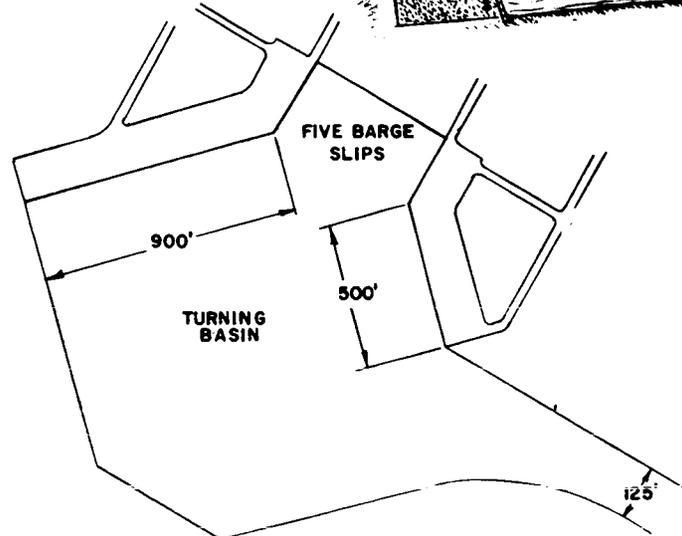


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LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
ADVANCED SATURN LAUNCH COMPLEX NO. 39



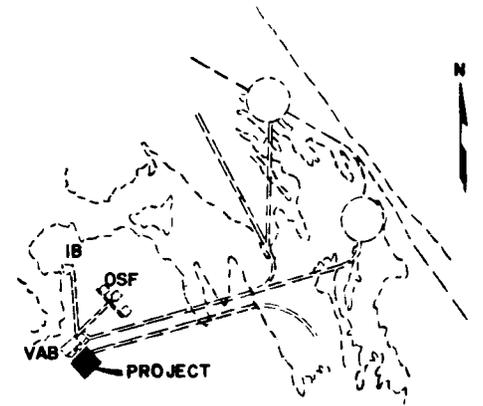
PERSPECTIVE



PLAN



TERMINAL UNLOADING FACILITIES



SITE PLAN

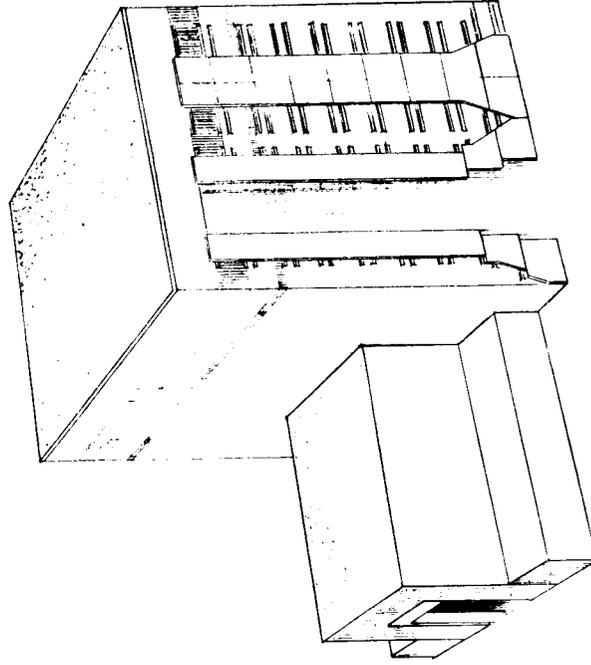


CF 6-7

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

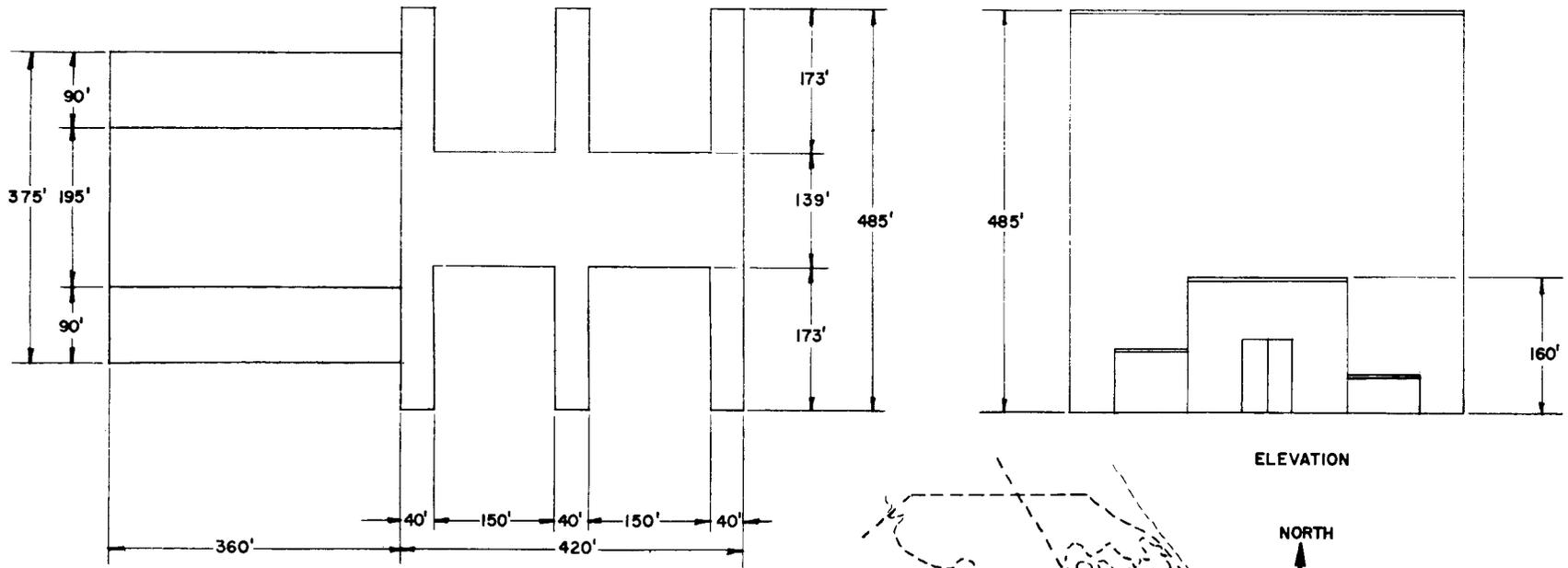
ADVANCED SATURN LAUNCH COMPLEX NO. 39



PERSPECTIVE

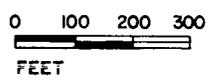
VERTICAL ASSEMBLY BUILDING

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
ADVANCED SATURN LAUNCH COMPLEX NO. 39

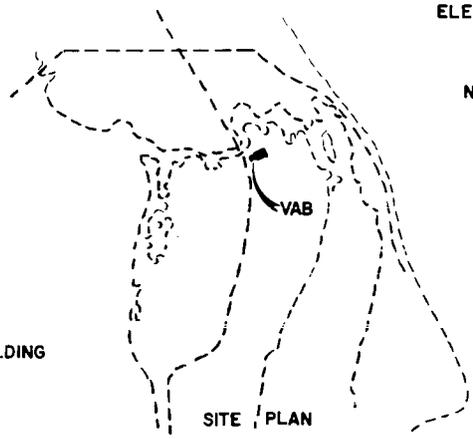


PLAN VIEW

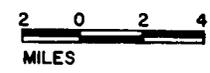
ELEVATION



VERTICAL ASSEMBLY BUILDING

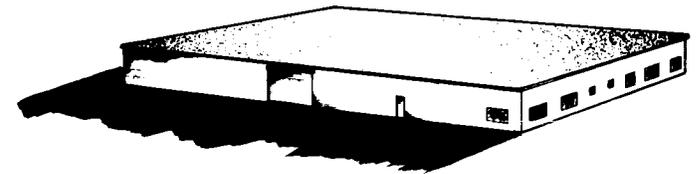
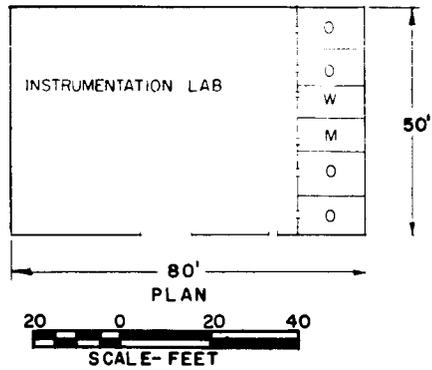


SITE PLAN

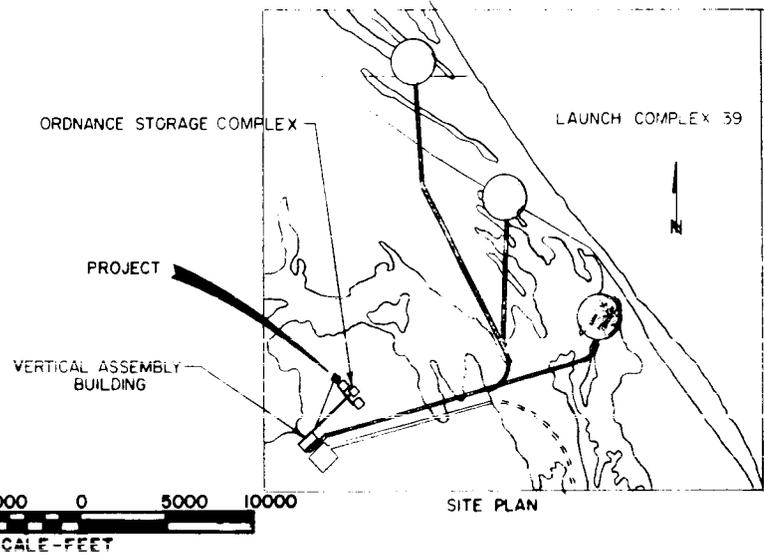


6-9 ID

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
ADVANCED SATURN LAUNCH COMPLEX NO. 39



PERSPECTIVE



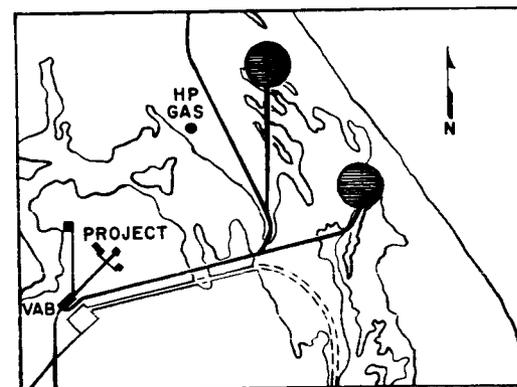
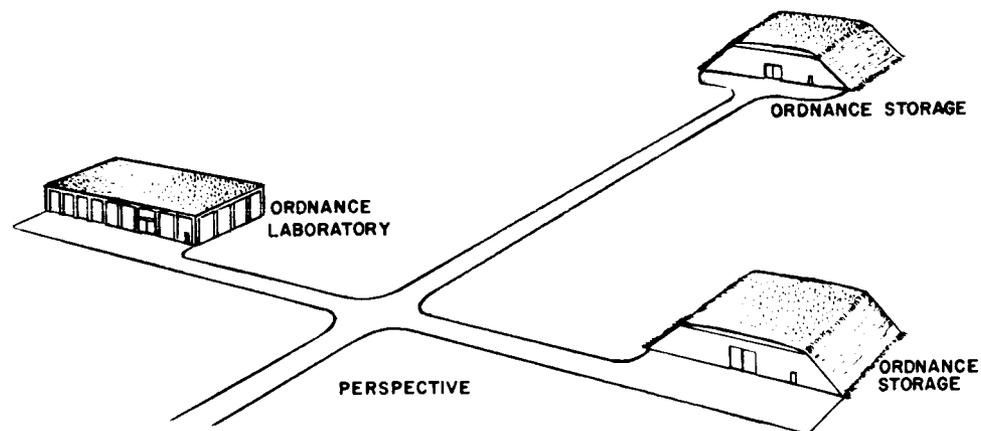
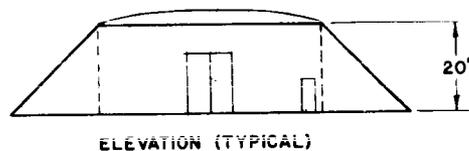
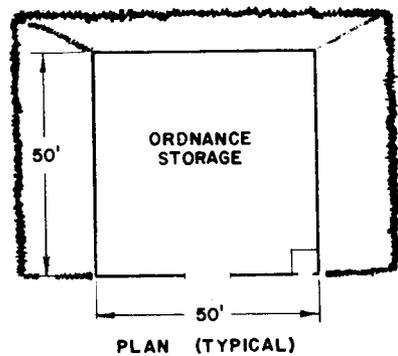
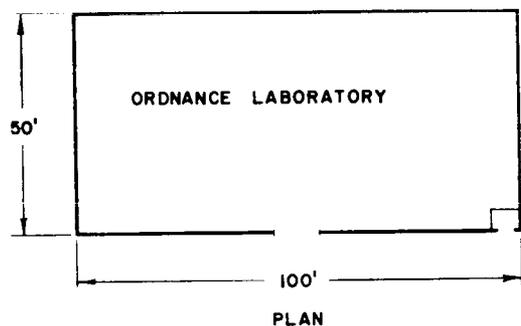
INSTRUMENTATION FACILITY

CF 6-10

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN LAUNCH COMPLEX NO. 39



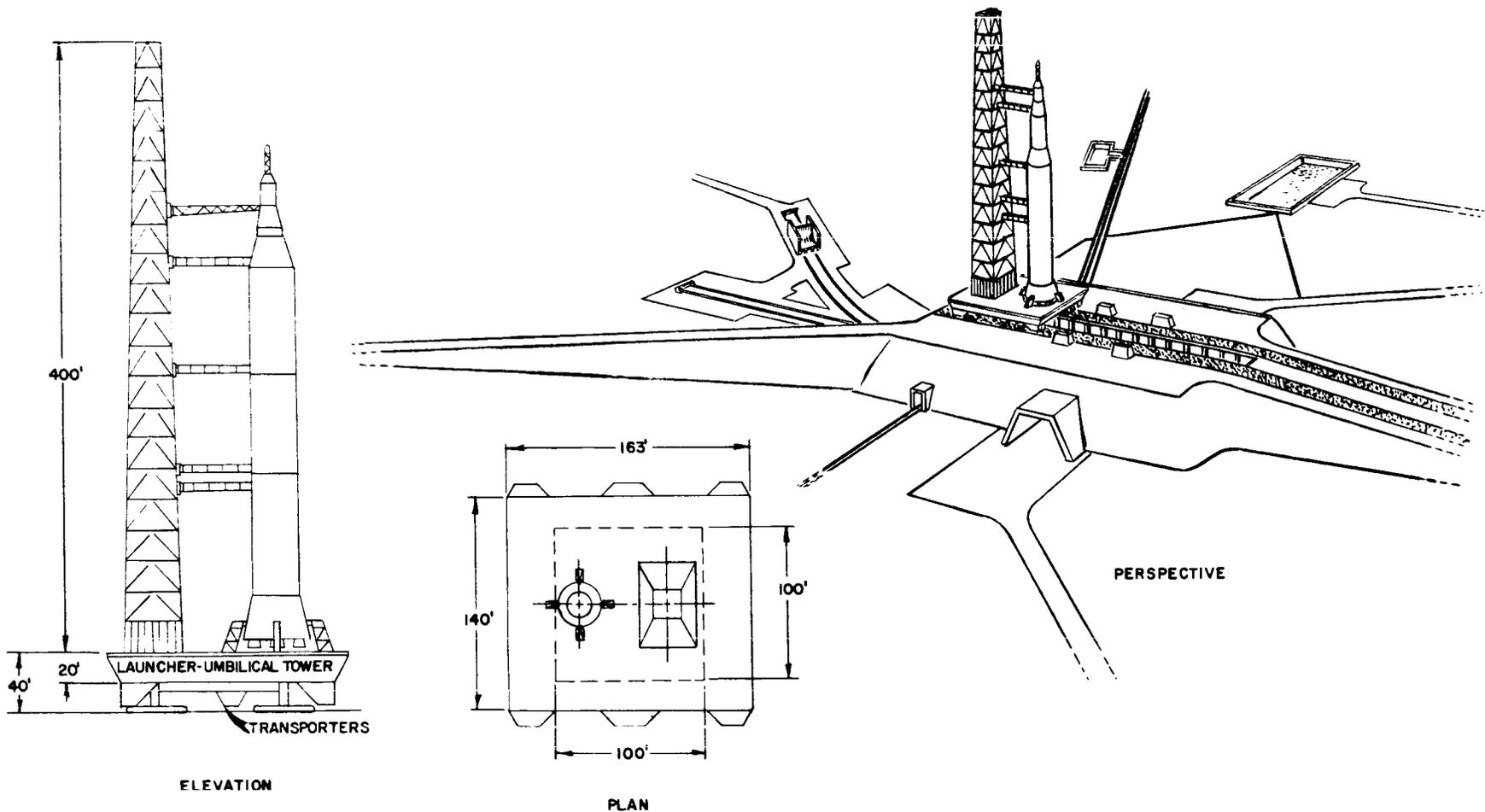
ORDNANCE STORAGE FACILITY

CF 6-11

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN LAUNCH COMPLEX NO. 39



CF 6-12

ELEVATION

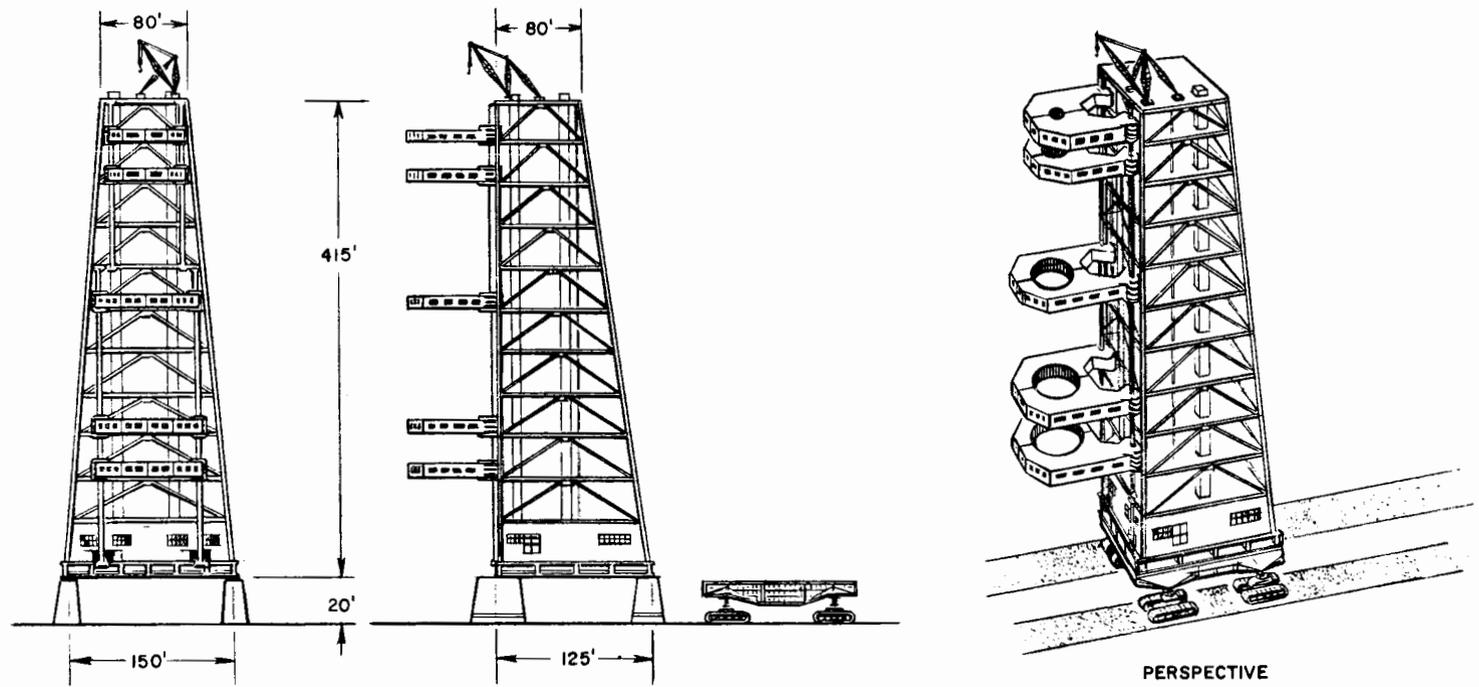
PLAN

PERSPECTIVE

TRANSPORTER AND LAUNCHER UMBILICAL TOWER

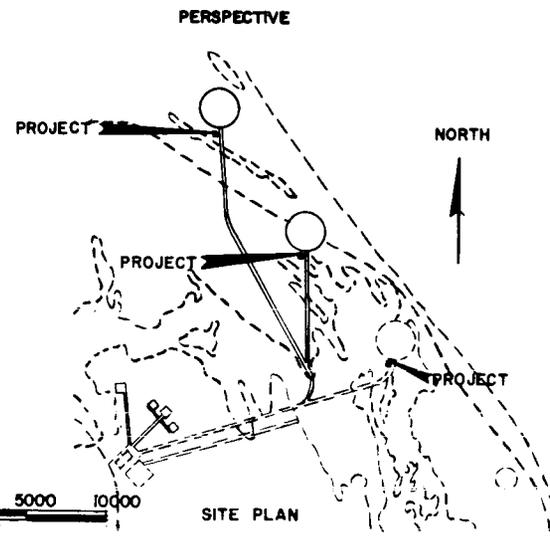
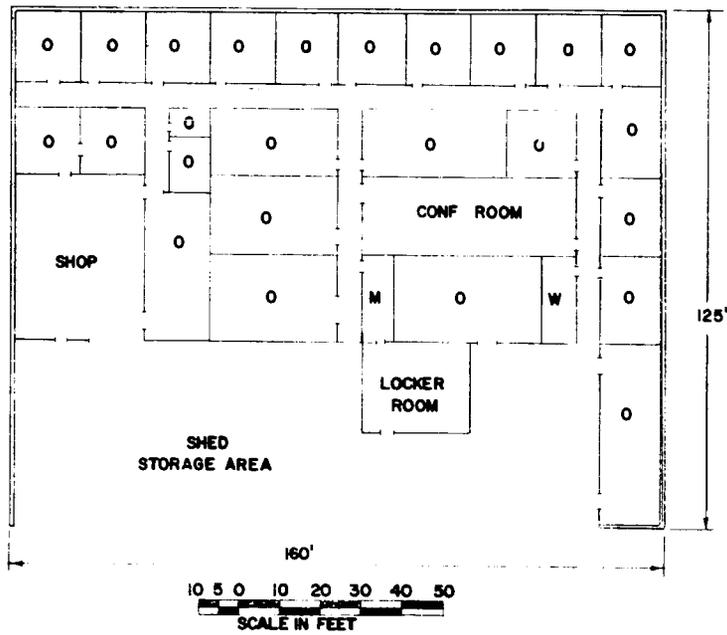


LAUNCH OPERATIONS CENTER
FISCAL YEAR 1963 ESTIMATES
ADVANCED SATURN LAUNCH COMPLEX NO. 39



MOBILE ARMING TOWER
NOT TO SCALE

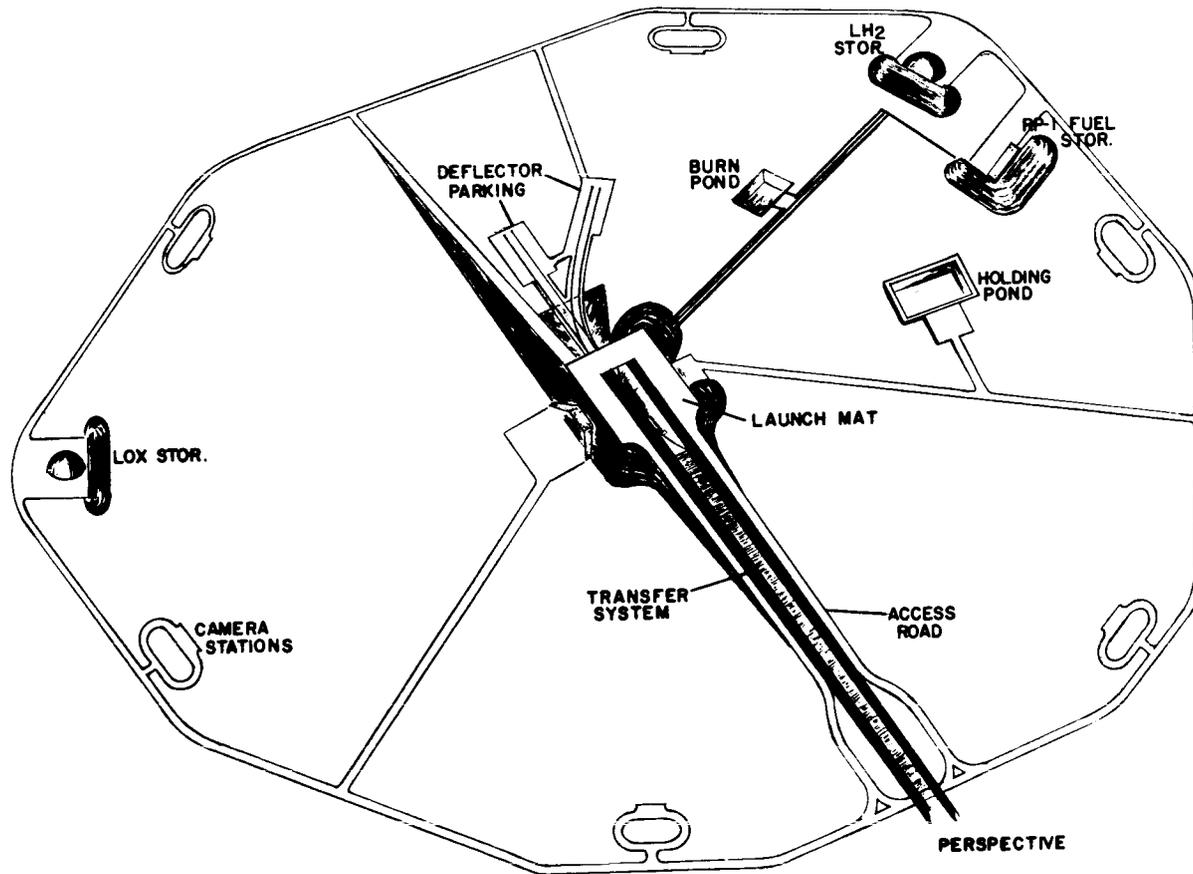
LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
ADVANCED SATURN LAUNCH COMPLEX NO. 39



OPERATIONS SUPPORT BUILDING

CF 6-14

LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES
ADVANCED SATURN LAUNCH COMPLEX NO. 39



LAUNCH PAD
NOT TO SCALE

Flight crew quarters: Four flight crews will be involved in the complex checkout process. Quarters totaling approximately 3,000 square feet will be required. The quarters will be air-conditioned, soundproofed, and contain sleeping areas, lavatory facilities, lounge area, suit storage area, exercise room, briefing room, kitchen, examination room, and shower room.

Spacecraft support personnel quarters: These quarters, comprising approximately 4,000 square feet, will contain air-conditioned sleeping areas, lavatory facilities, and a lounge area for spacecraft support personnel.

Medical dispensary area: A 4,000 square foot area will provide for normal industrial medical care, for emergency medical treatment of flight crew personnel, and for emergency treatment of launch site personnel in the event of a disaster on the pad. The dispensary will be in the vertical assembly building at ground level and will contain a ward area, two surgical rooms, an equipment storage area, and a medical supply area.

Launch control center: Approximately 90,000 square feet of floor area in the vertical assembly building will be outfitted to receive all vehicle checkout and launch equipment for pre-launch and launch operations. Display and monitoring equipment, control equipment, and computer systems for automated and manual vehicle systems tests will be installed in this area.

Spacecraft operations control room: A 20-by 30-foot room will be located in the immediate vicinity of the launch control center. This area will provide control for spacecraft operations and for display and monitoring of spacecraft systems during pre-flight preparations and launch.

Engineering shop and storage: This area, totaling approximately 400,000 square feet, will contain engineering space, shop, and storage space for NASA and contractor personnel working on upper stage preparation.

Instrumentation facilities: A total of approximately 71,700 square feet of floor space will be required

for instrumentation facilities. Approximately 3,000 square feet will be situated in the low bay area of the vertical assembly building, 9,400 square feet in the high bay area, 9,050 square feet in the launch control center, and 50,250 square feet in the area immediately adjacent to the launch control center.

Cafeteria: This area will consist of approximately 7,000 square feet of floor space in the low bay area. Hot meals will be truck transported to the cafeteria and then dispensed to workers in the vertical assembly building and launch complex areas. It is estimated that 2,000 persons will be employed in the launch complex No. 39 area during normal operations.

Launch pad: Funding is requested for the construction of one complete launch pad. These additional facilities are identical to pad No. 1 which was funded in the fiscal year 1963 program.

Crawler transfer system: Approximately 5 miles of the crawler roadway is required to the two additional pads. This extension will connect with the approximately three miles of roadway to pad No. 1 funded in the 1963 program.

Arming tower: The arming tower has two basic functions. The first is that of providing access required for the installation of major ordnance and equipment on the assembled launch vehicle. The second is the provision of access to the assembled vehicle for service as may be necessary while the vehicle is on the pad. The tower will be a rigid-frame steel structure approximately 415 feet high, 150 feet by 125 feet at the base, and 80 feet square at the top, and weighing approximately 7,300,000 pounds. It will be equipped with a stiff-leg derrick, capable of lifting approximately 75 tons, an elevator system, enclosed work platforms, and the necessary equipment for performing its functions. The tower will be mobile and will be moved by the crawler transporter from its parked position to serve the launch vehicles on the pads.

Ordnance facilities: These facilities will provide two storage areas for retro-rockets, ullage rockets, separation devices, emergency escape rockets, and an area to store and test the electro-explosive devices that will initiate or detonate ordnance items. These facilities will be of approved design and consist of vertical wall, overburdened, reinforced concrete and block structures containing approximately 10,000 square feet of environmentally-controlled space.

Operations support buildings: A prefabricated type building, one story, of approximately 20,000 square feet, will be provided at each of the three pads. The buildings will provide engineering space, launch operation support services space, and facilities for mechanical, structural and propulsion activities. They will also provide space for the storage of spare parts associated with pad operations.

Instrumentation facility: This structure will be a one-story building, 4,000 square feet in area, constructed of reinforced concrete and concrete block, and environmentally controlled. It will be located in the vicinity of the vertical assembly building and will serve to house additional instrumentation allied with equipment in the assembly building but which must be remotely located to eliminate radio frequency interference.

Data link terminal and repeater buildings: This system will be comprised of a total of twelve buildings, housing equipment to terminate and amplify closed-circuit TV, intercom, and data cabling. Three of these buildings are being constructed with fiscal year 1963 funds. Of the remaining nine buildings requested in this budget, one will be a terminal building located at the transfer system intersection and eight will be repeater buildings located at regular intervals between the intersection and the new pads. The terminal building will contain approximately 400 square feet and the repeater buildings approximately 300 square feet each.

Propellant services:

High-pressure gas systems: A high-pressure gas converter facility will be centrally located in the intermediate area at a safe distance from the launch pads. One facility will provide all gaseous nitrogen and helium required at the various launch sites and vehicle checkout areas. Liquid nitrogen and liquid helium will be stored at this facility for conversion into gases as required. The gases will be transferred from the facility to the launch sites and checkout areas. Vaporized gases will be distributed from the gas converter facility to high-pressure gas batteries at the launch sites as they are required for checkout and launch purposes.

Liquid oxygen system: Liquid oxygen will be stored in Dewar tanks with the necessary transfer equipment located at each launch pad. The transfer equipment will be used to transfer liquid oxygen from the storage tanks to fill and replenish the vehicle tanks. Liquid oxygen replenishing tanks, insulated but not

vacuum-jacketed, are to be installed at each launch site. The propellant will be used to replenish liquid oxygen boiloff after the vehicle has been loaded.

Fuel system: The RP-1 fuel facility will be located within the launch pad area. Tanks are to be cross-connected so that they can be filled or drained either separately or concurrently. A fuel unloading station will be provided that is capable of simultaneously handling four 6,000-gallon RP-1 fuel transport semi-trailers. A transfer pump with a total pumping capacity of 2,000-gallons per minute will be used to load the stage through a transfer line. The transfer system will automatically fill, replenish, and adjust the fuel in the vehicle and evacuate the transfer line. It will also drain the vehicle and transfer line in case of an emergency.

Liquid hydrogen system: This equipment will be used to fill and replenish liquid hydrogen from the ground storage tanks to the S-II and S-IVB stages. It will also supply liquid hydrogen to the stages for replenishing during standby. The transfer system will be completely automated and designed to be remotely controlled from panels located in the launch control center of the vertical assembly building. Liquid hydrogen replenishing tanks will be installed at each launch site. The propellant will be used to replenish liquid hydrogen boiloff after the stage has been loaded. Hydrogen boiloff is disposed of by burning it in air after it has bubbled up through the water in the burn pond. A gas pilot burns continuously to provide a constant ignition source. Water will be supplied to the pond from an artesian well.

Launcher-umbilical towers: The launcher-umbilical tower is primarily a transportable launcher which carries the connected umbilical tower and the vertically assembled Advanced Saturn vehicles. Three additional units (less the cost of steel for one which was purchased with fiscal year 1963 funds), for a total of five, are to be provided under this project.

Communications and TV systems: Visual monitoring (closed-circuit TV) and voice communication systems interconnecting the operating areas of the complex will be provided. The various components of these systems will be located in the racks, consoles, and cabinets in the vertical assembly building and throughout the launch complex area as required.

Firing accessories: Firing accessories consist of items essential to the functioning, checkout, reliability, or safety of the launch vehicle system during pre-launch liftoff, or abort phases of the launch operations. Included will be all of those items (of ground support equipment) necessary for system interfaces in the area of propellant loading, propellant replenishing, umbilical swing arms and controls, short cable masts, launcher arms, and water quenching system.

Instrumentation: This item covers instrumentation equipment in, and adjacent to, the launch complex which will be operated in conjunction with other instrumentation located in the Industrial Area. The equipment consists of:

Computer equipment: This is peripheral equipment for use in conjunction with the general-use scientific and real-time instrumentation computers which are located in the Industrial Area. It includes printers, card readers, and punchers, short-term data storage, and equipment for checking the validity of digital data.

Data handling, processing, and presentation equipment: Equipment will be provided for the local processing of a limited number of quick-look records, presentation of the results of onboard and ground measurements during pre-flight tests and during early flight, the local playback and presentation of records made during pre-flight tests, and the conversion of data to a form suitable for transmission to the real-time instrumentation computers.

Tracking equipment: Equipment of this type is used for the checkout of the on-board beacons and other tracking aids, for compatibility tests involving on-board and ground-based tracking equipment used for flight safety purposes, and for gathering trajectory information.

Flight TV ground equipment: This equipment is used to check out the on-board TV equipment and to establish compatibility between the on-board equipment and flight TV ground station. It is also used to receive television information relayed to the vertical assembly building from the flight TV ground station.

Acoustics: Included under this heading is the necessary instrumentation for measuring the local acoustical environment during launches from the complex and for measuring the sound pressure levels to which personnel and equipment on the complex are subjected when missiles and space vehicles are launched from nearby complexes.

Instrumentation engineering support equipment: Equipment is required to measure the effects of the launch environment on facilities and equipment on the complex during launch and to determine the local environment prior and subsequent to the flight. Also included are equipment and prepared space to provide some general services required in the launch complex such as instrument calibration, laboratory workshop, instrument storage, and electronic supplies.

Communications and data transmission equipment: This item includes voice communications and signaling equipment required for communications and data transmission between the various instrumentation areas within the complex. It is used to transmit instrumentation data (both in real-time and after the fact) to computers and to data presentation equipment located elsewhere in the launch area, and to receive data from instrumentation systems and computation equipment elsewhere in the launch area.

Telemetry equipment: This item contains the equipment required in the launch complex to check out the on-board telemetry equipment and the on-board command receiver equipment during closed-loop operation, and to condition closed-loop telemetry information for transmission to the telemetry station when the on-board telemetry cannot radiate during the pre-launch tests.

Measuring equipment: This item includes the equipment required to check out the on-board instruments. It also includes the equipment used to monitor the output of some of these instruments during those pre-launch tests which do not include the telemetry package.

Cabling: Control, intercommunication, closed-circuit TV, data transmission and countdown clock cabling is requested herein. This cabling will be terminated in distributors located in each bay of the vertical assembly building, the launch control center, and each pad as required. The cable, where practicable, will follow the route and utilize available cableway facilities

provided for the launch pad.

General support equipment: Specialized tools, fixtures, and items of equipment are required in support of pre-launch preparations and launch operations, which are not provided as a component part of operating facilities. Included are such items as mobile service platforms; engine service and exchange work dollies; stage handling and erection equipment; trucks for transporting stages during checkout; portable hoists; portable service equipment such as air compressors, pumps, hydraulic power units and electrical auxiliary power units; work scaffolding; shop tools; shop furniture and equipment; office furniture and equipment; medical equipment; and cafeteria equipment.

Deflectors: The two deflectors will be constructed of structural steel beams and trusses supporting a thick steel skin. The deflector will be transportable by attached truck-wheel combination. It will be secured in place on the pad, underneath the launch-umbilical tower by lowering shear plates into slots provided in the concrete.

Checkout and control equipment: A special power supply and electrical distribution system will be provided for the checkout and control instrumentation, which will be very accurately controlled in frequency and voltage and which will be so distributed with isolation devices that there will be a minimum of transient false signal feedback or interaction between equipments and a minimum of voltage fluctuation resulting from instantaneous line loads.

JUSTIFICATION:

In the fiscal year 1963 program, funds were requested to implement the long-lead-time items for the launch complex and to carry out the initial phases of the construction of the complex. This project requests funds for completion of the launch complex increment necessary to meet the initial phases of the Advanced Saturn launch schedule. Also included are funds for increasing the initial launch capability by the addition of one launch pad and supporting facilities for two pads. Specifically, individual items are required as follows.

Site development and utility installations: This work is required prior to beginning facility construction. Launch pad areas require surcharge for foundation consolidation and fill for elevation build-up. Underground utility lines, roads, and terminal unloading facilities serving areas of the complex must be installed.

Vertical assembly building. The following facilities will be included in the low bay area of the vertical assembly

building:

Flight crew quarters: Experience with spacecraft checkout has indicated that the flight crews must be continuously available due to their involvement in pre-launch operations. Living quarters must, therefore, be provided in the complex area to maintain the proximity to checkout operations and simultaneously to provide areas for rest and study which are essential to fulfillment of the mission.

Spacecraft support personnel: Sleeping and living quarters are needed for approximately 20 personnel whose services are required throughout the final phases of spacecraft checkout and in support of the flight crews.

Medical dispensary area: A study of the requirements for medical support of the manned launches and hazards inherent therein, and of normal industrial medical support and possible disaster conditions, indicates that medical facilities should be provided within the complex area. The best site for this facility is within the vertical assembly building.

Launch control center: This facility houses final checkout and launch control equipment, and it is from this command point that pre-launch and launch operations are directed. It is, therefore, essential for the operation of the complex and is contiguous to that operation.

Spacecraft operations control room: This space is required for occupation by the Spacecraft Operations Director for the proper coordination of the launch operations with the mission control center at the Manned Spacecraft Center, and with the tracking network support functions.

Engineering, shop and storage: Engineering, shop, and storage space is required in the vertical assembly building to directly support the checkout and assembly of the vehicles.

Instrumentation facilities: The 71,700 square feet planned for these facilities are required to house instrumentation and personnel essential to operation of the launch complex.

Cafeteria: The number of personnel in the area and the distance to the nearest existing cafeteria justify the requirement for an eating establishment in the vertical assembly building.

Launch pad: The additional launch pad is required to provide sufficient launch capability to support the launch rates of the Advanced Saturn vehicles as planned for the Manned Lunar Landing program. The pads in the complex are widely spaced, self-contained entities, and will provide a sufficient degree of safety and reliability to accommodate a high launch rate and provide a reasonable backup capability.

Crawler transfer system: This system is required to provide means for transporting the assembled launch vehicle, the launcher-umbilical tower and the arming tower to the new launch pad.

Arming tower: The arming tower is required to install major ordnance, and to provide proper access to the vehicle on the launch pad. All major ordnance and sensitive-type ordnance which could constitute an unacceptable hazard must be installed away from the stage and vehicle test assembly areas. Because of the large size of the escape, ullage, and retro-rockets of the vehicle, an ordnance tower must be used to provide access and handling capability for ordnance installations. Because of severe design limitations imposed upon the spacecraft, it is necessary that 360° access be provided for the spacecraft while pre-launch operations are in process at the pad. The availability of the crawler transporter as a prime mover with the necessary capacity, and the fact that the functions would be needed at each pad of complex No. 39, suggested the mobile arming tower concept. The concept is considered to be sound from an engineering standpoint and offers the best overall solution to the problem. It is considered to offer the best utility and safety characteristics from an operational standpoint.

Ordnance facilities: These structures are required for the local storage and test of ordnance items in accordance with established safety codes and practices. No other facilities are available within the area to satisfactorily serve the purpose. The operation and quarters involved are such as to prohibit use of facilities at the Cape Canaveral Missile Test Annex.

Operations support building: Buildings are required to provide technical support and shop space for personnel stationed at the pads during pre-launch operations. They will also provide for the storage of spare parts such as high-pressure gas

system components which must be readily accessible during launch preparations. To realize maximum efficiency for pad operations, it is necessary that space be provided at a location convenient to the pad.

Instrumentation facility: The 4,000-square-foot building will be near the vertical assembly building but sufficiently distant to eliminate various radiation hazards and line of sight problems.

Data link terminal and repeater buildings: These buildings are required to terminate and reconnect cabling. The buildings will contain panelboards and equipment to amplify electrical impulses being carried by the cables. It is necessary that this equipment be housed in a properly conditioned building to provide proper and correct signal strength. Since operational data will be transmitted along cables connecting these buildings, it is extremely important that signal level be maintained which is compatible with terminal equipment and that there be no signal distortion.

Propellant services: The propellant services including the high-pressure gas systems, the liquid oxygen systems, the fuel systems, and the liquid hydrogen systems are required to provide the desired quantities of gases and propellants necessary to support pre-launch and launch operations. Because of the large quantities of gases and propellants required, it is impractical to deliver directly to the pad without compromising operational time, gas and propellant losses, or taxing the logistic capabilities for provisioning of these items in the short time frame required.

Launcher-umbilical towers: The launcher-umbilical tower is the key to the mobile concept of operation. Its function is to allow the vehicle to be assembled and then checked out in the vertical assembly building and to transport the launch-ready system to the launch site. The tower also serves as a launch platform at the launch site.

Communications and TV systems: These systems will provide operating personnel with the capability for communications with, and visual inspection of, the various complex areas during pre-launch and launch operations. It would be very difficult to operate this enormous complex, spread over the large area involved, without an adequate closed-circuit TV system to view all operations in critical areas of the complex. Communications to all areas are essential to continuity of operations and safety standards.

Firing accessories: These items are essential to operation of the complex as they perform the vital functions of connecting the facilities of the complex to the launch vehicle.

Instrumentation:

Computer equipment: Peripheral equipment is required in the vertical assembly building area to permit the instrumentation computers in the industrial area to function as a part of this complex during checkout of the on-board instrumentation, and to receive data from the instrumentation computers when they are being used to monitor telemetry data received at the telemetry stations during vehicle pre-launch tests and during early flight.

Data handling, processing, and presentation equipment: This equipment is required in the vertical assembly building area to condition data for real-time transmission, to prepare nonreal-time data for shipment to the user or for local quick-look evaluation, and to display telemetry and tracking information during pre-launch tests and during early flight.

Tracking equipment: This equipment is required in the launch complex to check out the on-board tracking beacons and to provide trajectory measurements during the first seconds of flight, before the vehicle is high enough to be accurately tracked by equipment which serves more than one complex.

Flight TV ground equipment. Two functions are served by this equipment: first, it is required in the launch complex to check out the on-board television system, and second, it will be used to show a flight TV presentation in the Launch Operations Center area.

Acoustics: Instrumentation is required to determine the nature of the acoustical environment produced by the vehicle. This data is necessary to assist in the evaluation of test data so that design and criteria for future launch complexes and launch area equipment can be established.

Instrumentation engineering support equipment: The instrumentation systems included in this item are required to measure the effects of the launch environment on structures and equipment in the launch

complex. This data is necessary to establish the cause of malfunctions and to provide design criteria for future equipment. The test equipment and instrumentation standards are required in the launch complex in order to minimize holds in the countdown.

Communications and data transmission equipment: The considerable instrumentation located in the vertical assembly building area must be connected, both by voice communication and by data link, with other instrumentation in the area or with instrumentation, recording, or computer equipment located in other areas and serving more than one complex. This equipment is necessary to accomplish such connection functions, so that maximum efficiency and continuity of operations are maintained.

Telemetry equipment: On-board telemetry and command equipment is frequently checked out through closed-loop procedures. This requires telemetry checkout equipment and command equipment in close proximity to the vehicle and also necessitates the ability to forward this information to the main telemetry station.

Measuring equipment: This equipment is required to check out and calibrate the on-board measurements used to gather data during flight. It is also required to monitor the output of some of these measurements during vehicle tests which do not require operation of the telemetry system.

Cabling: Instrumentation and communications cabling is essential to the operations of the complex by providing the means of transmitting vital data and information from the pad areas and the vehicles to the launch control center and by linking all operating areas of the complex.

General support equipment: This equipment is required to properly equip the shops, offices, and specialized support areas of the complex to carry out the missions of the complex.

Deflectors: The flame deflector is required to divert the products of combustion of the vehicle exhaust gases and to protect the boattail section of the vehicle and the launch pad from temperatures and pressures generated by the exhaust flame during the first phase of the launch between engine ignition and lift-off.

Checkout and control equipment: Checkout and control equipment which is made up of various types of measurement instruments, and computational and display devices, requires closely controlled electrical power free of transient noise and false signal feedback to prevent errors in the checkout results.

<u>COST ESTIMATE:</u>	<u>Fiscal Year 1963</u>	<u>Fiscal Year 1964</u>
A. LAND ACQUISITION.....	---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$4,780,000	\$6,660,000
Site preparation and roads.....	\$1,580,000	\$2,560,000
Utility installations.	3,200,000	4,100,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	93,019,000	66,333,000
Vertical assembly building.....	70,539,000	28,663,000
Launch pads.....	15,930,000	15,930,000
Transfer system.....	5,560,000	7,080,000
Arming tower.....	---	13,000,000
Ordnance (10,000 square feet at \$70 per square foot)	---	700,000
Operations support building (three; 20,000 square feet at \$12.50 per square foot).....	---	750,000
Instrumentation facil- ity (4,000 square feet at \$30 per square foot).....	---	120,000
Data link terminal and repeater buildings (2,800 square feet at \$32.15 per square foot).....	60,000	90,000
High-pressure gas fa- cility.....	930,000	---
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	53,551,000	125,046,000
Propellant services:		
High-pressure gas system.....	834,000	6,400,000
Liquid oxygen system	1,053,000	8,900,000
Fuel system.....	196,000	2,200,000
Liquid hydrogen system.....	717,000	5,000,000

	<u>Fiscal Year</u> 1963	<u>Fiscal Year</u> 1964
Launch-umbilical towers (three).....	\$22,400,000	\$34,100,000
Communications and TV systems for:		
Pads.....	---	1,450,000
Vertical assembly building/launch control center...	---	2,200,000
Crawler way.....	---	437,000
Firing accessories:		
Umbilical swing arms.....	1,000,000	3,405,000
Platforms and handling gear.....	250,000	2,570,000
High-pressure gas regulation, control system, component tests and manuals.....	500,000	6,550,000
Launcher arms.....	1,600,000	2,150,000
Stage ground support equipment...	250,000	1,900,000
Liquid oxygen, fuel, short cable masts, and water quench systems.....	1,400,000	6,220,000
Instrumentation and Equipment:		
Computer equipment.	---	500,000
Data handling, processing, and presentation equipment.....	---	1,115,000
Tracking equipment.	600,000	2,209,000
Flight TV ground equipment.....	---	60,000
Acoustic equipment.	---	200,000
Instrumentation, engineering support equipment...	---	780,000
Communications and data transmission equipment.....	---	500,000
Telemetry equipment	700,000	5,000,000
Measuring equipment	700,000	4,500,000
Cabling for:		
Pads.....	250,000	1,000,000

	<u>Fiscal Year</u> 1963	<u>Fiscal Year</u> 1964
Vertical assembly building/ launch control center.....	\$250,000	\$1,000,000
Crawler way.....	2,400,000	10,000,000
General support equipment:		
Furniture and office equipment....	---	600,000
Safety and medical equipment....	---	400,000
Shop equipment....	---	1,200,000
Special handling equipment.....	700,000	1,325,000
Mechanical equipment	---	1,475,000
Deflectors (two).....	2,000,000	1,800,000
Checkout and control equipment:		
Vertical assembly building special power supply.....	1,300,000	7,900,000
Launch control center equipment....	1,400,000	---
Equipment for launcher- umbilical towers and arming tower, and auxiliary electrical equipment.....	2,051,000	---
Transporters.....	11,000,000	---
E. DESIGN AND ENGINEERING SERVICES....	<u>\$16,500,000</u>	<u>19,180,000</u>
Total estimated cost.....	<u>\$167,850,000</u>	<u>\$217,219,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN SUPPORTING FACILITIES

DESCRIPTION:

This project proposes the construction of additions to the general support facilities in the Merritt Island Area, which must be expanded in the fiscal year 1964 to meet growing operational requirements. All of the facilities involved in this project are located in the Merritt Island Industrial Area. The project includes personnel parking, roads, equipment, and utilities to connect with primary lines to make each facility completely useable. Sketches of the facilities are shown on the following six pages; more detailed descriptions of the work covered in this project follow:

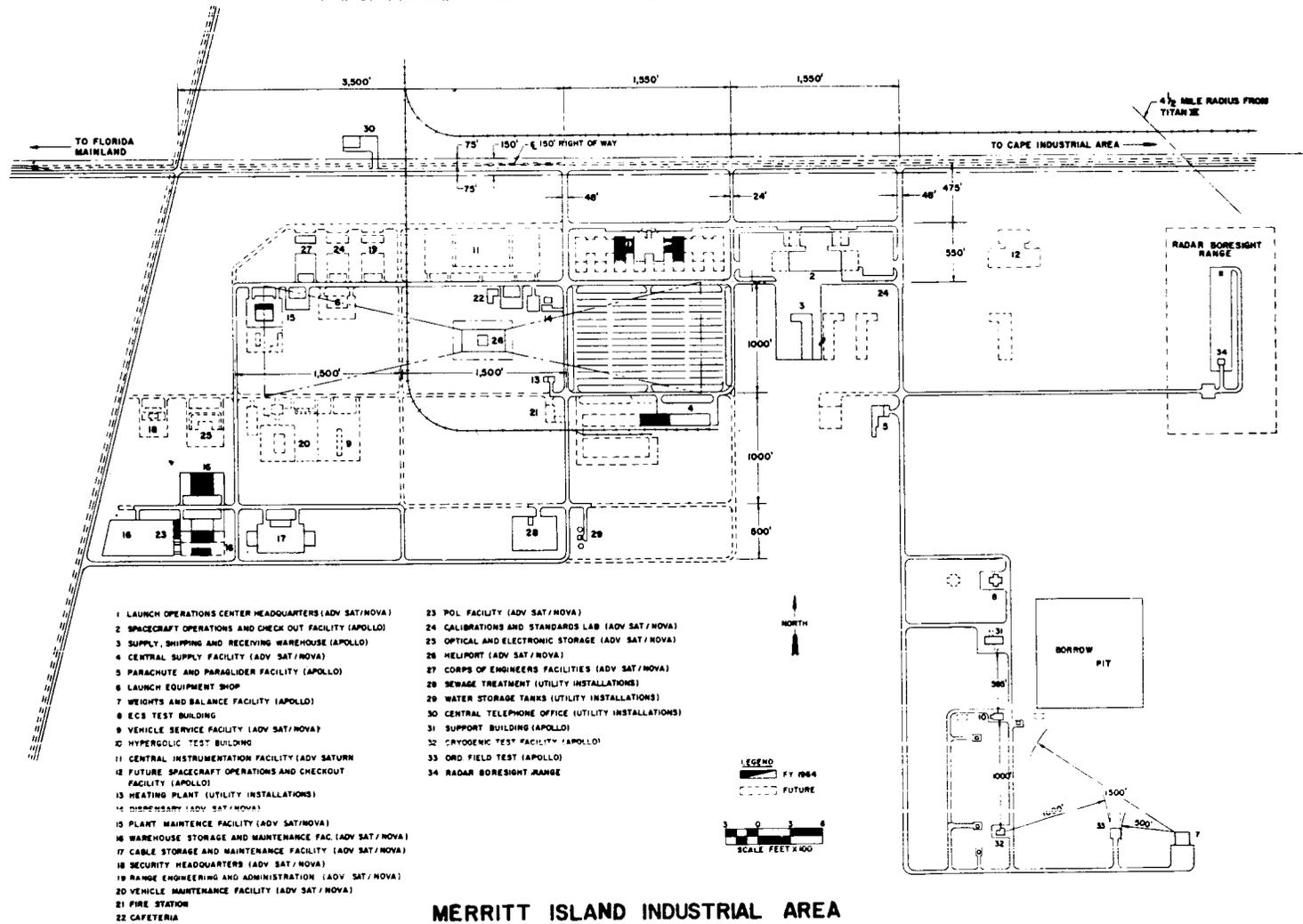
Addition to the Launch Operations Center headquarters: This portion of the project provides for the construction of a two-wing addition to the existing Launch Operations Center headquarters, formerly called the engineering and operations building. The three-story addition will consist of approximately 197,000 square feet, with overall dimensions of each wing being approximately 190 feet by 220 feet. The addition will be constructed of masonry on steel frame and will harmonize with the existing structure. Its interior will be finished for office and laboratory use. The building will house a population of approximately 2,030 people.

Addition to central supply building: The construction of a one-story addition to the central supply building with dimensions of approximately 136 feet by 294 feet will add an area of approximately 40,000 square feet. The building will be constructed of steel frame with metal siding on a concrete slab similar to the existing construction. The office area will be air-conditioned and 4,000 square feet of the storage area will be humidity-controlled. The storage space will provide for the requirements of the NASA and its supporting contractors. Approximately 6,500 persons (3,261 NASA employees and 3,239 contractor or other agency employees) were considered in arriving at the supply and storage space requirements. The total supply requirement, through the fiscal year 1966 of 109,600 square feet is satisfied with the programmed construction and the continued use of approximately 36,000 square feet of storage in the Cape Canaveral existing Industrial Area.

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

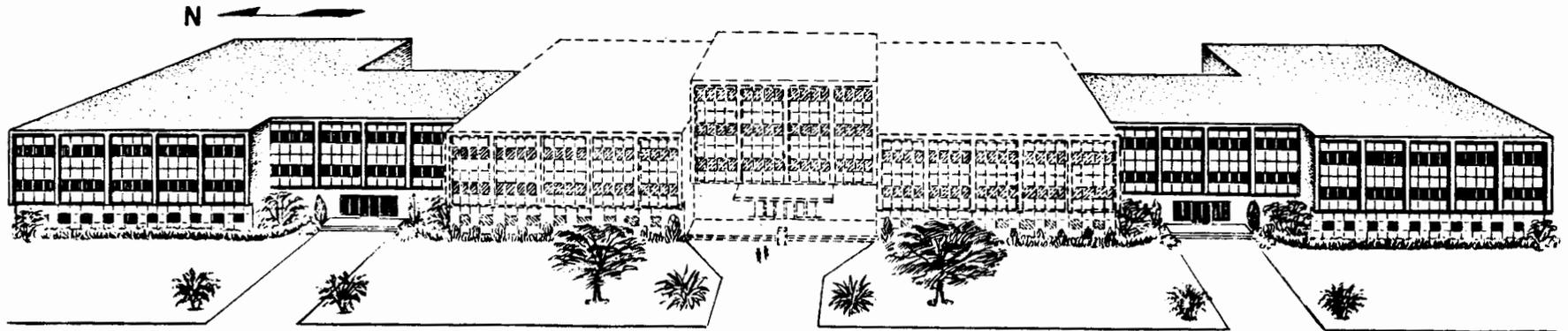
ADVANCED SATURN SUPPORTING FACILITIES



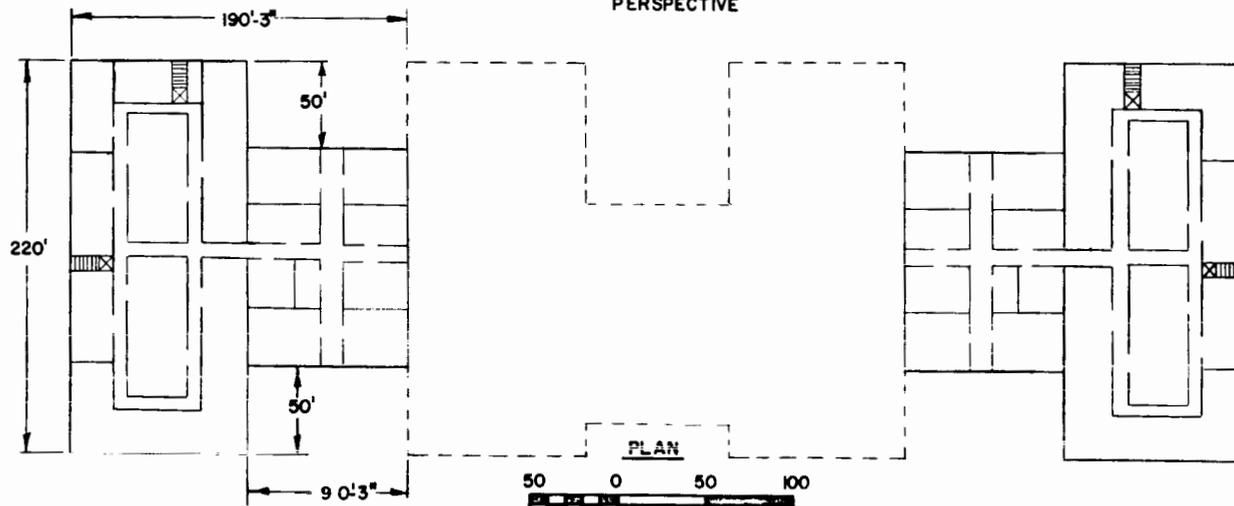
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|--|---|
| 1 LAUNCH OPERATIONS CENTER HEADQUARTERS (ADV SAT/NOVA) | 23 POL FACILITY (ADV SAT/NOVA) |
| 2 SPACECRAFT OPERATIONS AND CHECK OUT FACILITY (APOLLO) | 24 CALIBRATIONS AND STANDARDS LAB (ADV SAT/NOVA) |
| 3 SUPPLY, SHIPPING AND RECEIVING WAREHOUSE (APOLLO) | 25 OPTICAL AND ELECTRONIC STORAGE (ADV SAT/NOVA) |
| 4 CENTRAL SUPPLY FACILITY (ADV SAT/NOVA) | 26 HELIPORT (ADV SAT/NOVA) |
| 5 PARACHUTE AND PARAGLIDER FACILITY (APOLLO) | 27 CORPS OF ENGINEERS FACILITIES (ADV SAT/NOVA) |
| 6 LAUNCH EQUIPMENT SHOP | 28 SEWAGE TREATMENT (UTILITY INSTALLATIONS) |
| 7 WEIGHTS AND BALANCE FACILITY (APOLLO) | 29 WATER STORAGE TANKS (UTILITY INSTALLATIONS) |
| 8 ECS TEST BUILDING | 30 CENTRAL TELEPHONE OFFICE (UTILITY INSTALLATIONS) |
| 9 VEHICLE SERVICE FACILITY (ADV SAT/NOVA) | 31 SUPPORT BUILDING (APOLLO) |
| 10 HYPERGOLIC TEST BUILDING | 32 CRYOGENIC TEST FACILITY (APOLLO) |
| 11 CENTRAL INSTRUMENTATION FACILITY (ADV SATURN FACILITY (APOLLO)) | 33 ORD FIELD TEST (APOLLO) |
| 12 FUTURE SPACECRAFT OPERATIONS AND CHECKOUT FACILITY (APOLLO) | 34 RADAR BORESIGHT RANGE |
| 13 HEATING PLANT (UTILITY INSTALLATIONS) | |
| 14 DISPENSARY (ADV SAT/NOVA) | |
| 15 PLANT MAINTENANCE FACILITY (ADV SAT/NOVA) | |
| 16 WAREHOUSE STORAGE AND MAINTENANCE FAC (ADV SAT/NOVA) | |
| 17 CABLE STORAGE AND MAINTENANCE FACILITY (ADV SAT/NOVA) | |
| 18 SECURITY HEADQUARTERS (ADV SAT/NOVA) | |
| 19 RANGE ENGINEERING AND ADMINISTRATION (ADV SAT/NOVA) | |
| 20 VEHICLE MAINTENANCE FACILITY (ADV SAT/NOVA) | |
| 21 FIRE STATION | |
| 22 CAFETERIA | |

MERRITT ISLAND INDUSTRIAL AREA

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
 ADVANCED SATURN SUPPORTING FACILITIES



PERSPECTIVE

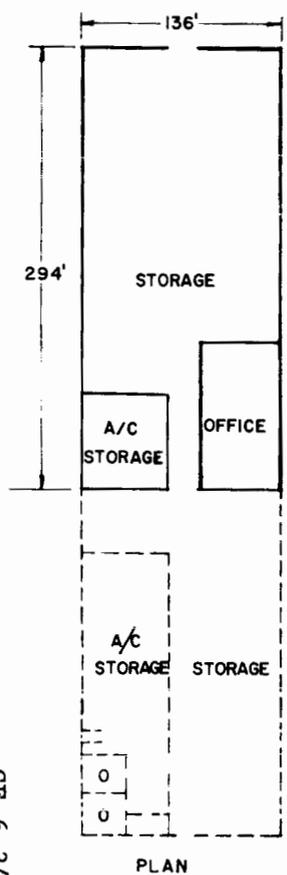


TYPICAL THREE FLOORS - BOTH WINGS

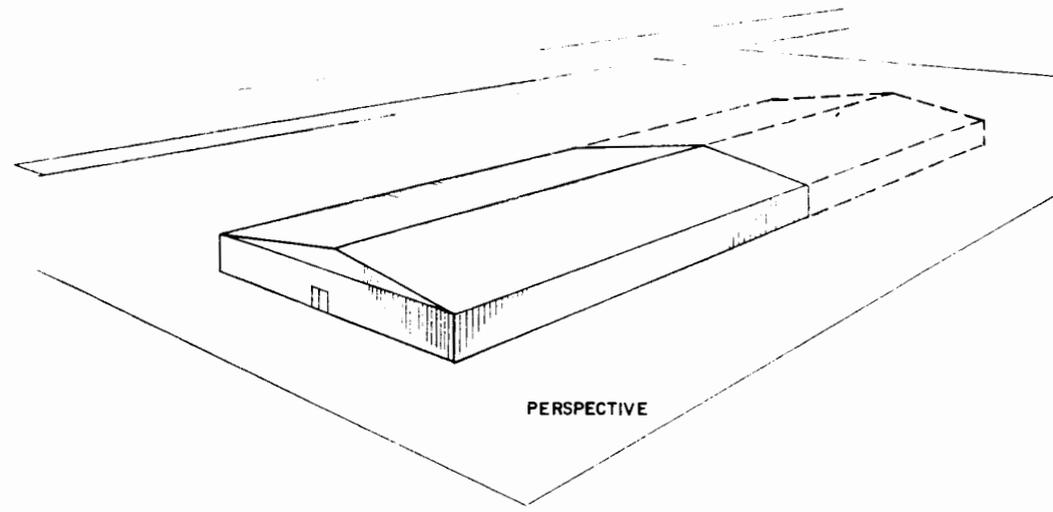
ADDITION TO LAUNCH OPERATIONS CENTER HEADQUARTERS

CF 6-33

LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES
ADVANCED SATURN SUPPORTING FACILITIES



CF 6-34

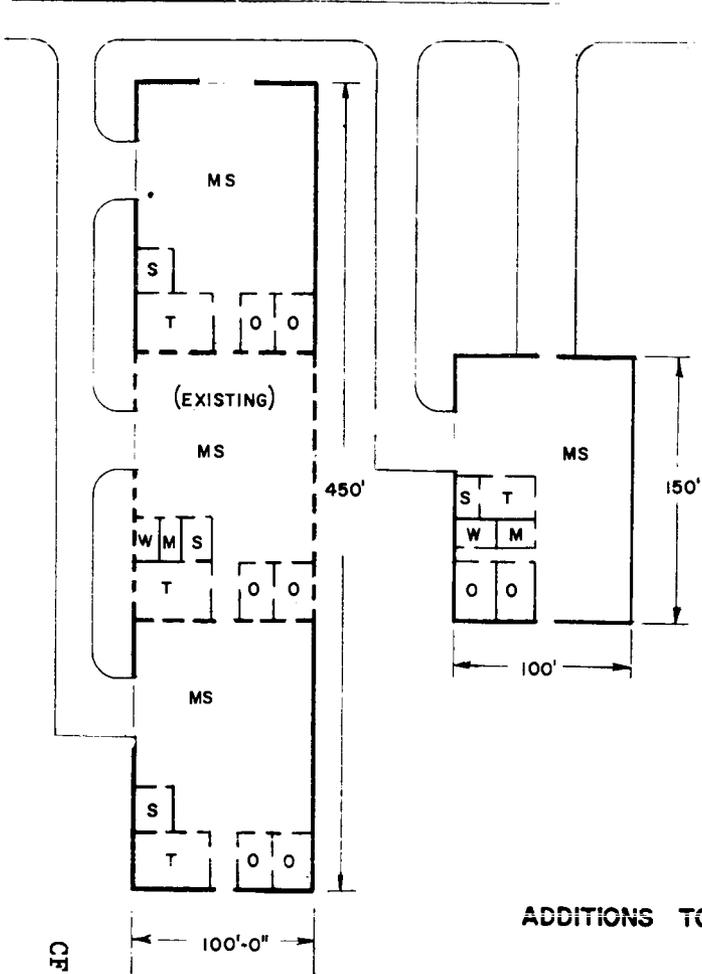


ADDITION TO THE CENTRAL SUPPLY BUILDING

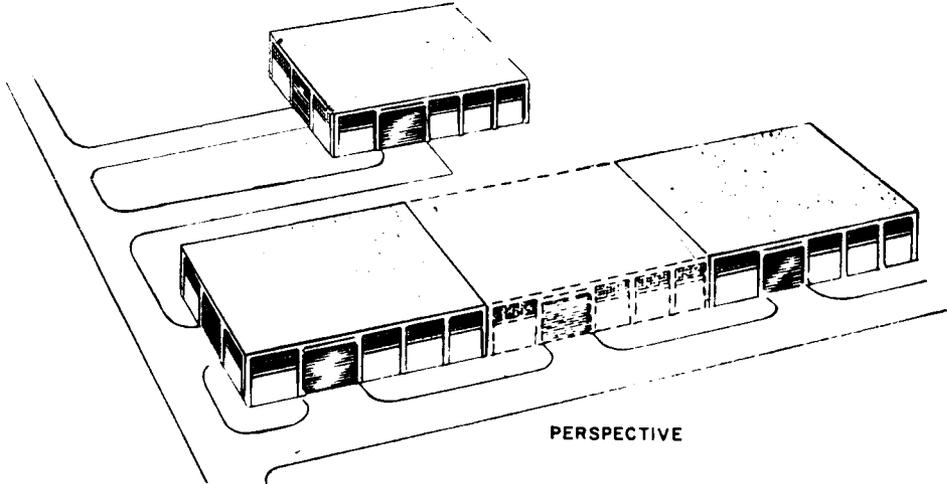
LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

ADVANCED SATURN SUPPORTING FACILITIES



PLAN



- LEGEND**
- MS MAINTENANCE SHOP
 - O OFFICE
 - T TOOL CRIB
 - S STORAGE

ADDITIONS TO PLANT MAINTENANCE FACILITIES

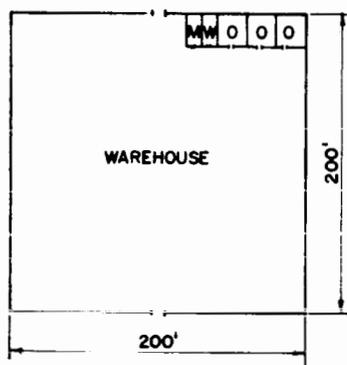
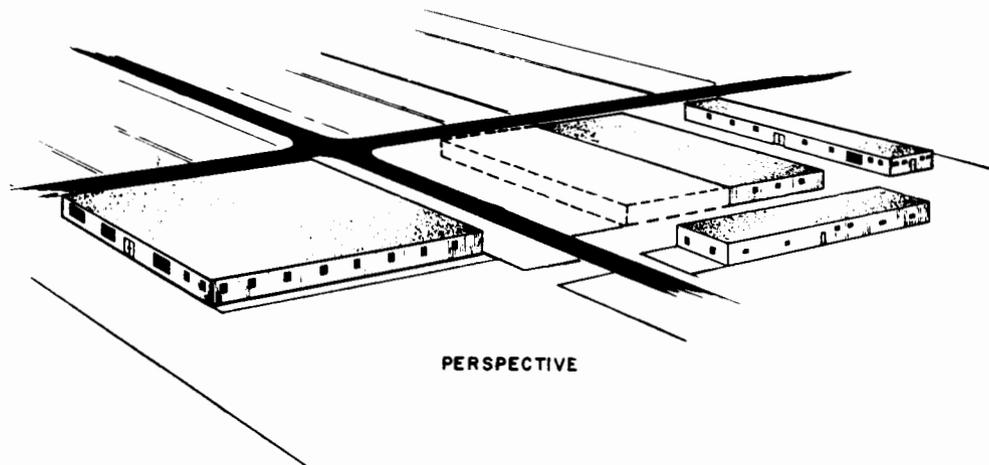
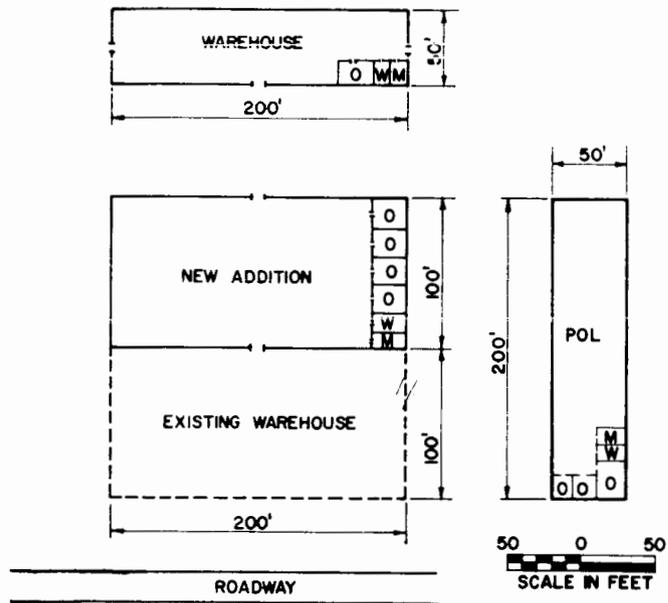


CF 6-35

L LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

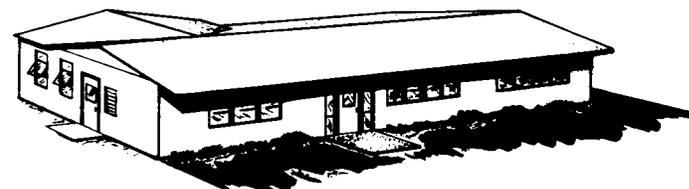
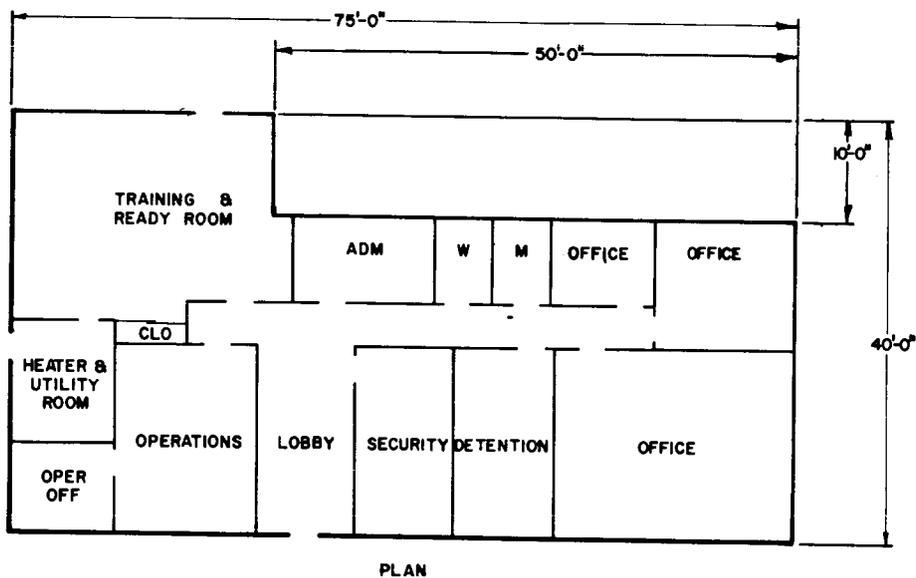
ADVANCED SATURN SUPPORTING FACILITIES



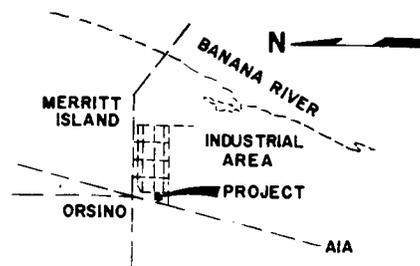
WAREHOUSE FACILITIES

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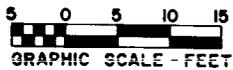
LAUNCH OPERATIONS CENTER FISCAL YEAR 1964 ESTIMATES ADVANCED SATURN SUPPORTING FACILITIES



PERSPECTIVE



SITE PLAN



SECURITY HEADQUARTERS



CF 6-37

Storage requirements for the period subsequent to the fiscal year 1966 cannot be adequately determined at this time.

Additions to plant maintenance facilities: Additions to the existing plant maintenance facility will consist of a one-story extension to both ends of the existing building and the construction of a separate building. Plant maintenance includes the maintenance and repair of all buildings and grounds, roads, utilities, canals, and facilities. The two extensions and the separate building will each have an area of approximately 15,000 square feet, for a total area of approximately 45,000 square feet in the fiscal year 1964 project. Utilities required to make the facility completely operable will be provided. Outside storage will be available for road working equipment, trucks, and other vehicular equipment used in maintenance work. Related work such as interior shop work will be grouped into one building and work generally involving the outside activities will be grouped in another building. The buildings will be of masonry construction similar to and compatible with the existing construction.

Additions to warehouse facilities: This portion of the project provides for the construction of a total of approximately 80,000 square feet of enclosed warehouse space and approximately 6,700 square yards of outside storage. The work consists of (a) an addition to the existing facility for hardware and small non-electrical items, of approximately 20,000 square feet, (b) a paint-oil-lubricant storage building, with an area of approximately 10,000 square feet, (c) a building for storage of lumber, doors, windows, and bulky construction materials, with an area of approximately 10,000 square feet, and (d) a humidity-controlled building for storage of electrical supplies with an area of approximately 40,000 square feet. Utilities will be provided as required to make the facilities completely operable. The buildings will be properly isolated for fire and explosion damage control, yet will be close enough for economical loading, unloading, and management. This facility will provide storage for all range support items except cable, electronic, and optical items. The structures will be of masonry construction and will harmonize with the existing construction.

Security headquarters: The construction of a security building is required for a police force headquarters. The single-story, masonry structure will have a gross area of approximately 2,500 square feet. The building will be air-conditioned and a fire alarm system will be included. Heat will be supplied by the central heating plant in the area. Roads, parking, site development, and utilities will be provided as required to make the facility completely operable. The facility will serve as an administrative center for police matters and as a dispatching point for security police assigned to the new area. The building

will also serve as the weapons depository, interrogation point for minor police matters, temporary detention point, and police radio base station.

JUSTIFICATION:

The continuing build-up of personnel for the Manned Lunar Landing program and the progress on the associated facilities and programs require increases in mission and range support facilities. The additional personnel must be provided working space, transportation, supply, and all other services necessary for proper work performance. The present mission and range support facilities are inadequate for the work programmed in the fiscal years 1965 and 1966.

Addition to the Launch Operations Center headquarters: The forecast number of related research, engineering, and administrative personnel who should be housed together in this facility through the period covered by construction in the fiscal year 1964 is 2,031. The authorized building will accommodate 1,110 persons. These personnel are concerned with the Saturn and Advanced Saturn vehicles; and with fiscal matters, procurement, and overall management and administration. Housing these groups under one roof will greatly simplify transportation, travel time, and meeting problems; will improve overall program management, and will create an atmosphere of unity of purpose. The most logical location for the required additional space is an addition to the Launch Operations Center headquarters.

Addition to the central supply building: The activities and the personnel in the new area will be increasing steadily during the next few years. Larger amounts of supplies and equipment will, therefore, have to be handled and stocked in support of this build-up. The return and salvage cycle will be in full operation. More dispensing and recording operations will be involved. Since the order-receiving-issuing cycle involves, in many cases, a protracted period, it is necessary to have adequate storage to prevent damage to merchandise and delays in issuing. The requested space will provide the necessary facilities from which efficient supply functions can be maintained.

Addition to plant maintenance facilities: As new facilities begin to be completed toward the end of 1963, there will be a definite need for increased plant maintenance functions. In the fiscal year 1964, there will be a sharp increase in plant maintenance and repair requirements as large increments of building space and utilities are completed and go into full operation. Preventive maintenance and minor repair begin as soon as a facility is completed. In a semi-tropical climate, the deterioration of paint, wood, paving, and metal is rapid. The intensive use of facilities also results in the rapid break-

down of support systems and utilities. Maintenance and repair facilities must be available on a continuing basis as soon as a facility becomes operable.

Addition to warehouse facilities: The authorized facility provides only the initial or token increment of the storage requirements for range support materials. As the program moves into 1964, the new construction in the Industrial Area will be going into operation. Warehouse capacity must be available to accommodate the supplies and materials which will be arriving in ever-increasing volume to support the program. Lack of these local storage facilities would move the logistic support area back to the Cape Canaveral Missile Test Annex and to Patrick Air Force Base. The result would be a most inefficient and uneconomical operation. In addition, adequate storage area is not actually available at either of the alternate sites mentioned.

Security headquarters: Guards are needed to protect the Government property from theft and sabotage and to provide vehicular traffic control. There will be upward of 6,000 persons employed in the new area which contains approximately 87,000 acres. Approximately 115 persons will be engaged in security matters associated with the new area. The administration of the operations of that force requires a headquarters for records filing, for guard supervision, and for a reporting station for the guards going on duty.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$865,000
Clearing and grading.....	\$158,000
Roads, parking areas, and outdoor storage areas	457,000
Water, sewer, electrical, heating, and	
communication connections.....	250,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	6,399,000
Addition to the Launch Operations Center	
headquarters (197,000 square feet at \$22	
per square foot).....	4,334,000
Addition to the central supply facility	
(40,000 square feet at \$9 per square foot)...	360,000
Additions to the plant maintenance facility	
(45,000 square feet at \$19 per square foot)..	855,000
Additions to the warehouse (80,000 square feet	
at \$10 per square foot).....	800,000

Security headquarters (2,500 square feet at \$20 per square foot).....	\$50,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		\$1,010,000
Inter-communication equipment.....	300,000	
Laboratory and shop equipment.....	650,000	
Furniture.....	60,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>1,035,000</u>
Total estimated cost.....		<u>\$9,309,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

BARGE LOCK AND CHANNEL

DESCRIPTION:

This project provides for NASA's share of the cost of constructing a waterway connection between Port Canaveral Harbor on the Atlantic Ocean and the existing barge channel in the Banana River. The overall scope of the work consists of a ship lock with dimensions of approximately 90 feet in width, 400 feet in length, and 14 feet in depth over sills; a four lane moveable bridge with a clear span of approximately 90 feet; approximately 12,000 linear feet of channel, with approximate dimensions of 125 feet in width and 12 feet in depth, extending from the lock to the existing Saturn barge channel in the Banana River. The project also includes the deepening of the existing barge channel from approximately 10 feet to approximately 12 feet, between the connecting point and the Advanced Saturn launch complex No. 39. A 2,400 square foot operations building, with dimensions of approximately 40 feet by 60 feet, will be provided at the lock to house the operating equipment and operations crew. All site preparation and utilities required to provide a completely operable facility will be included with the building. One person will be on duty at all times, and a minimum crew of three will be required to operate the lock.

The portion of the work to be funded by NASA is as follows:

- (a) The additional cost of providing lock width of approximately 34 feet more than the 56 feet which the U. S. Army Corps of Engineers would normally provide.
- (b) The lock operations building.
- (c) The deepening of the existing channel from 10 feet to 12 feet.

The basic lock and the channel dredging in the lock area will be included in the Corps of Engineers budget for the fiscal year 1964. The bridge will be provided by the State of Florida.

JUSTIFICATION:

The present barge channel from the intra-coastal waterway to the Advanced Saturn launch complex No. 39 area is 125 feet wide by 10 feet deep. However, bridge clearances on the intra-coastal waterway limit barge width to 55 feet. Advanced launch vehicles to be transported in the near future will require a minimum barge width of 87 feet and these launch vehicles could not be barged over the intra-coastal waterways without major revisions to several existing bridges.

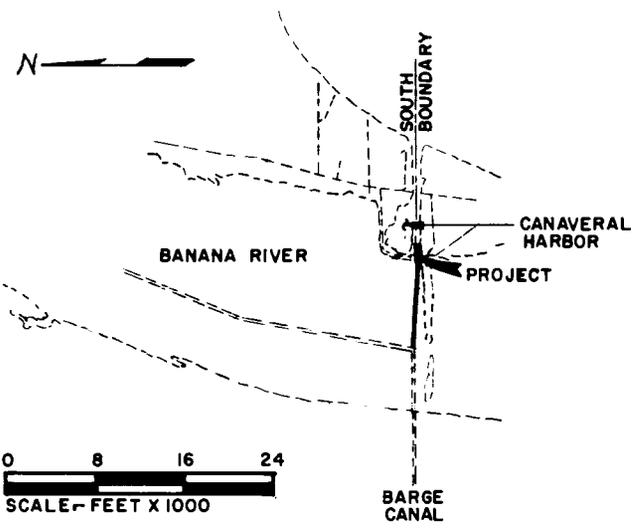
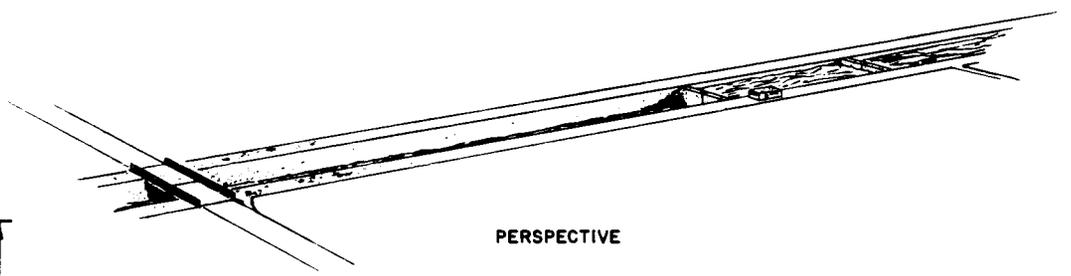
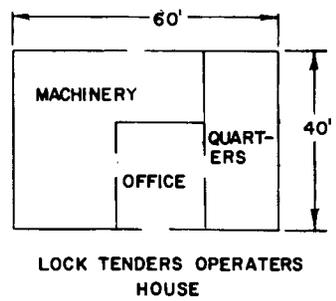
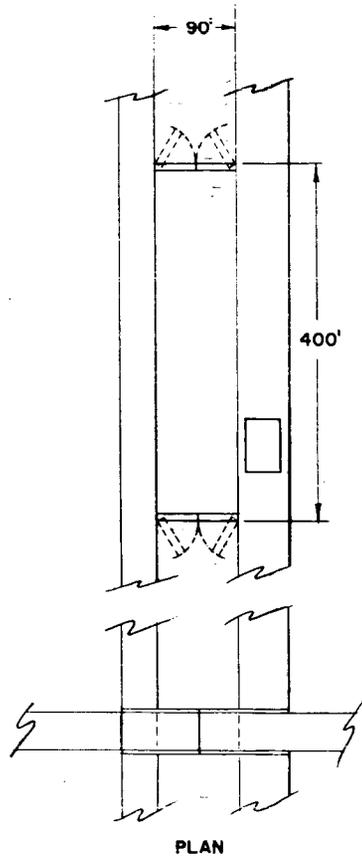
Altering the structure of existing bridges would be expensive, time-consuming, and would seriously disrupt vehicular traffic over a wide area. This is not considered feasible. Construction of the lock and channel is the only practical means of accommodating the larger barges. The right-of-way land is owned by the Port Authority of Brevard County, Florida so that no costs for land will be involved. The location of the lock at the Port Canaveral Harbor will utilize existing port facilities to the greatest extent possible.

Without the proposed lock and channel, the direct delivery of fully-assembled advanced launch vehicles to the barge unloading facility will not be possible in the Advanced Saturn launch complex No. 39 area. The vehicles would have to be shipped in smaller sections for extensive local assembly or be transshipped at Port Canaveral. This multiple handling would be expensive, time-consuming, and hazardous.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$925,000
Site preparation and utility connections.....	\$25,000	
Lock.....	700,000	
Channel dredging.....	200,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		48,000
Operations building (2,400 square feet at \$20 per square foot).....	48,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		12,000
Lock operation equipment.....	11,000	
Furniture.....	1,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>15,000</u>
Total estimated cost.....		<u>\$1,000,000</u>

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
BARGE LOCK AND CHANNEL



CF 6-44

LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES

CAFETERIA

DESCRIPTION:

This project proposes the construction of a 400-seat main cafeteria and central kitchen to be located in the Merritt Island **Industrial Area**. The cafeteria building will have a gross area of approximately 15,000 square feet, with over-all dimensions of approximately 135 feet by 158 feet. The construction will be of reinforced concrete with masonry curtain walls and will be of standard design. The project includes the necessary utilities, roads, parking, equipment, and furnishings to make this a complete and operable facility. Also included in the project are the equipment and furnishings for outlying serving areas. A sketch of the facility is shown on the following page.

JUSTIFICATION:

Recent food service plans prepared independently by the Launch Operations Center and the range contractor have resulted in the conclusion that a requirement exists for a centralized kitchen cafeteria with auxiliary food service lines located in several additional areas throughout the NASA activities on Merritt Island. These plans reflect a savings in cost to be realized from grouping of personnel and cooking facilities in one locale. A 400 man cafeteria will be located adjacent to the main kitchen to serve range operation personnel in the immediate vicinity.

The food prepared in the central facility will be transferred by van to the various outlying servicing facilities. It is estimated that by January 1, 1965, there will be approximately 6,000 people working in the Merritt Island area, of which approximately 3,000 will require the services of this cafeteria.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$150,000
Clearing, grub'ing, and grading.....	\$50,000
Water, sewer, electric, telephone and fire alarm services.....	30,000
Service road and parking area.....	70,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	370,000
Building..(15,000 square feet at \$24.70 per square foot).....	370,000

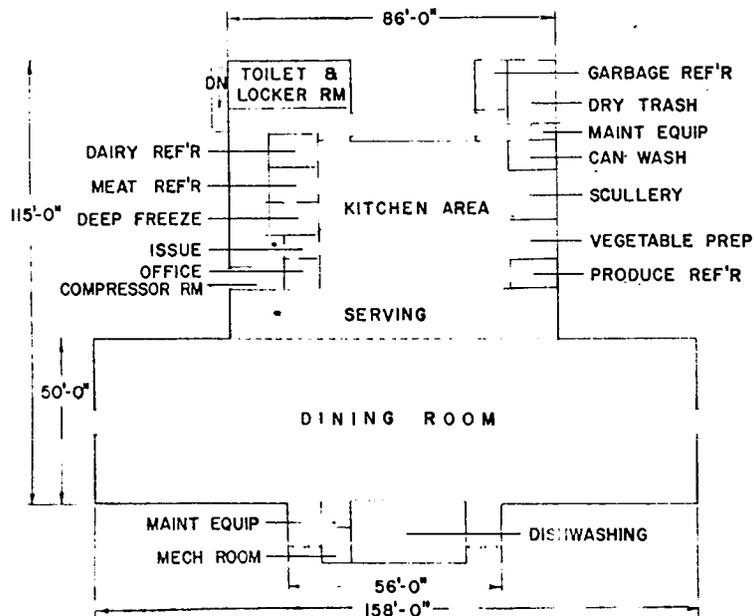
LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

MAIN CAFETERIA



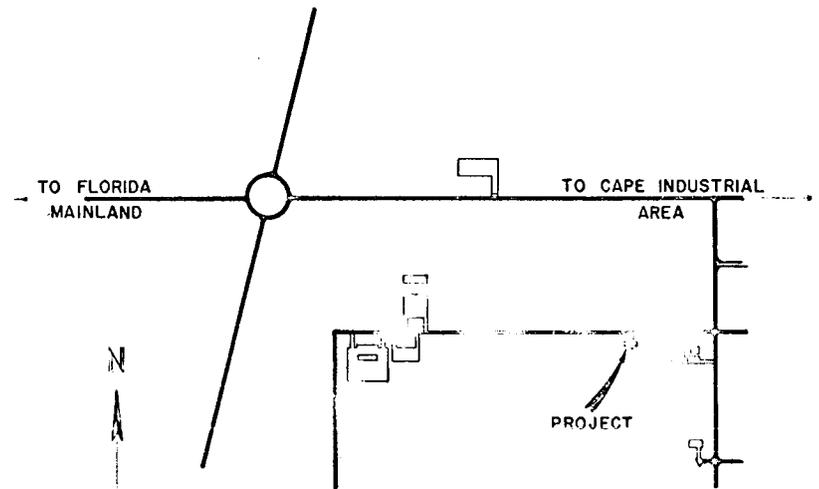
PERSPECTIVE



PLAN

CF 6-46

0 5 10 15 20 40
GRAPHIC SCALE



SITE PLAN

3 0 3 6
SCALE - FEET X 100

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		\$306,000
Main kitchen and cafeteria equipment.....	\$157,500	
Main cafeteria furniture.....	9,500	
Serving line equipment at the operations and checkout building.....	59,000	
Serving line equipment at the engineering and operations building.....	80,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>73,000</u>
Total estimated cost.....		<u>\$899,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

CALIBRATIONS AND STANDARDS LABORATORY

DESCRIPTION:

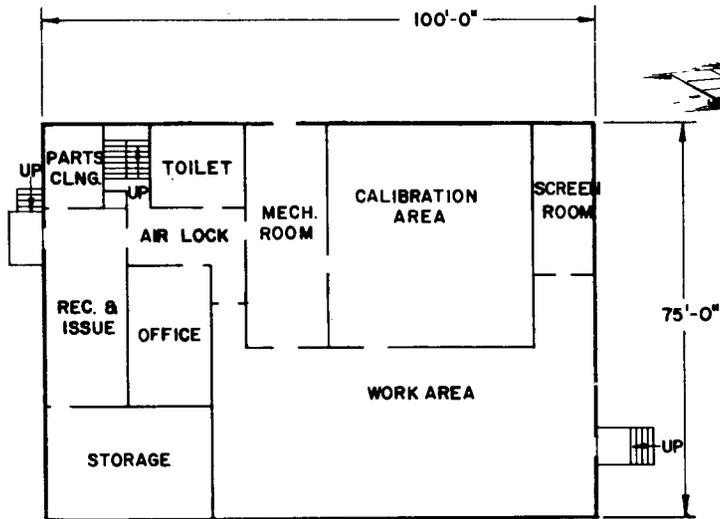
This project provides for the construction of a laboratory of approximately 15,000 square feet for calibrating and standardizing electronic and mechanical equipment. As indicated in the drawing on the following page, the laboratory will be a two-story masonry structure located in the Merritt Island Industrial Area, with dimensions of approximately 75 feet by 100 feet. Heat will be supplied by the central heating plant in the area. This facility will be provided with a very high order of air-conditioning and humidity control. Other special environmental controls for light and dust will be needed in some specialized areas. A fire alarm system will be provided within the structure. The equipment foundations will be designed to eliminate vibrations produced by vehicle firings and flight. Site development, parking, access roads, and utilities, such as water, sewer, special electric power, and communications, will be provided as required to make the facility completely operable.

The facility will provide the capacity to adjust, to a uniform standard, gages, meters, and equipment used to read or measure physical quantities or qualities including wave shape, frequency, and amplitude; electrical resistance, capacitance, and potential; pressure, temperature, light, velocity, acceleration, thickness, hardness, length, weight, and time.

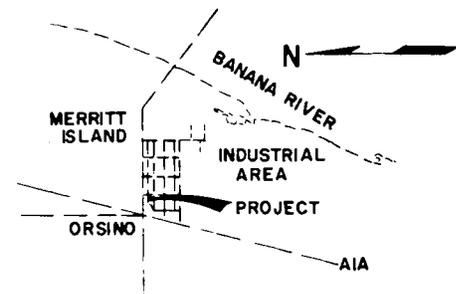
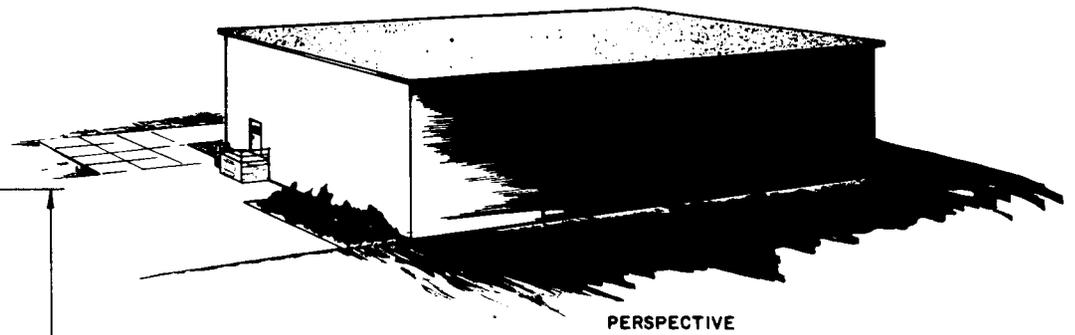
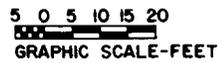
JUSTIFICATION:

The equipment used to launch vehicles and to obtain data from launches is extensive and, in part, delicate and complicated. The equipment must be accurate and operable. To insure the accuracy of readings and the reliability of performance, all items must be checked and tested. The gages, meters, tools, and equipment used for checking must all be accurate to fixed standards. To provide and maintain that degree of accuracy, they are returned to a standards and calibration laboratory for periodic examination and setting. The actual launch equipment itself, if portable, can, when desired, be sent to the laboratory for recalibration by the master equipment. The existing facilities at Cape Canaveral and at the Patrick Air Force Base are operating on two shifts to keep up with the current workload. A new test shop and standards laboratory is programmed for the Patrick Air Force Base in the fiscal year 1965 to meet the present workload. The present workload is estimated at calibrating over 15,000 items on an average of twice a year. The additional workload which will be generated by the expanded facilities of the Launch Operations Center cannot

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
 CALIBRATIONS AND STANDARDS LABORATORY



PLAN
 TYPICAL - 2 STORIES



CF 6-49

be accommodated by any existing or planned facility. The distances from the new Merritt Island Industrial Area via the completed road net are 7 miles to the Cape Canaveral standards laboratory and 25 miles to the Patrick Air Force Base laboratory. A saving of 2 hours of travel time plus mileage costs would be realized by the elimination of each trip to the Patrick Air Force Base and 24 per cent of that saving by eliminating each trip to the existing area from the new area. In addition, there would be an increased possibility of shock damage to the adjustments when transporting equipment the longer distances to the present ships. The economical location of the required additional capacity is on Merritt Island. The unit cost of this facility is above normal due to the requirement for foundations capable of damping out shocks and vibrations, and due to unusual environmental requirements required in this type of structure.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$60,000
Clearing, grubbing and grading.....	\$20,000	
Access roads and parking area.....	20,000	
Utilities extensions.....	20,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		700,000
Building (15,000 square feet at \$46.65 per square foot).....	700,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		2,000,000
Electronic test equipment and standards.....	1,000,000	
Mechanical-hydraulic test equipment and standards.....	750,000	
Physical standards.....	250,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>107,000</u>
Total estimated cost.....		<u>\$2,867,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

CENTRAL INSTRUMENTATION FACILITY

DESCRIPTION:

This project covers the design and construction of an instrumentation facility consisting of two separate masonry buildings. The two-story primary structure, with dimensions of approximately 200 feet by 235 feet, and a gross area of approximately 94,000 square feet, will be centrally located in the Merritt Island Industrial Area. The one-story auxiliary structure, with dimensions of approximately 50 feet by 156 feet and a gross area of approximately 7,800 square feet, will be located approximately one mile north of the primary structure to avoid radio frequency interference from equipment operating in that structure. Both buildings will have dropped acoustic ceilings, composition tiled floors (elevated in laboratory and other special use areas requiring extensive cabling), and a high order of humidity control and air-conditioning. Sketches of the two buildings are shown on the following page.

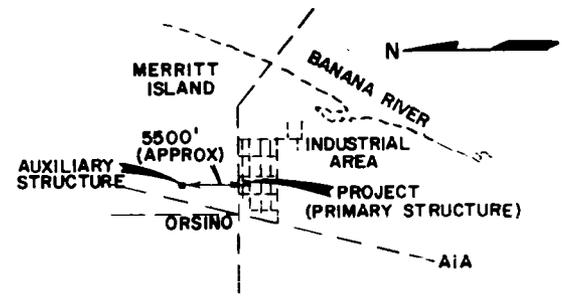
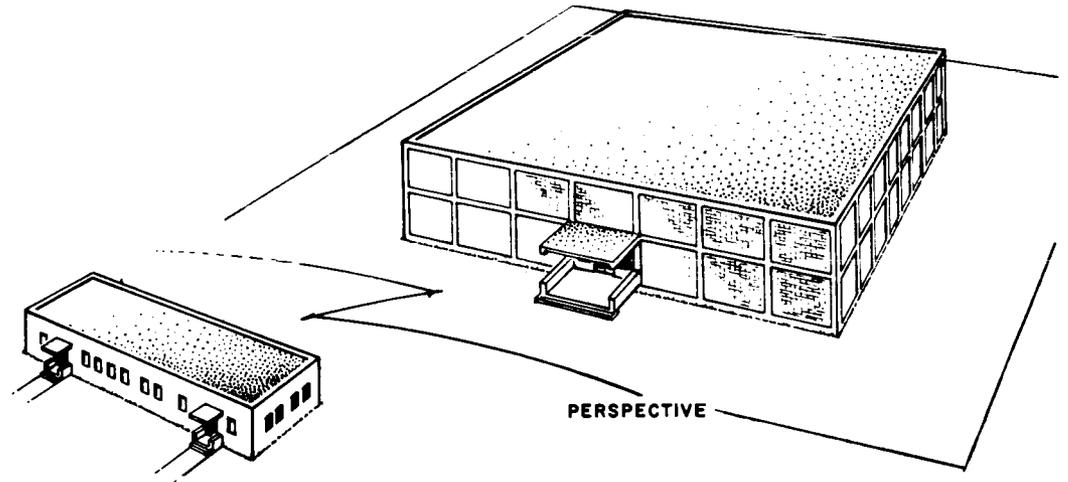
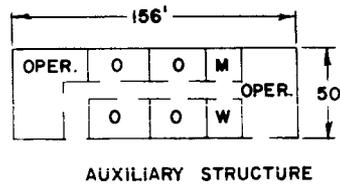
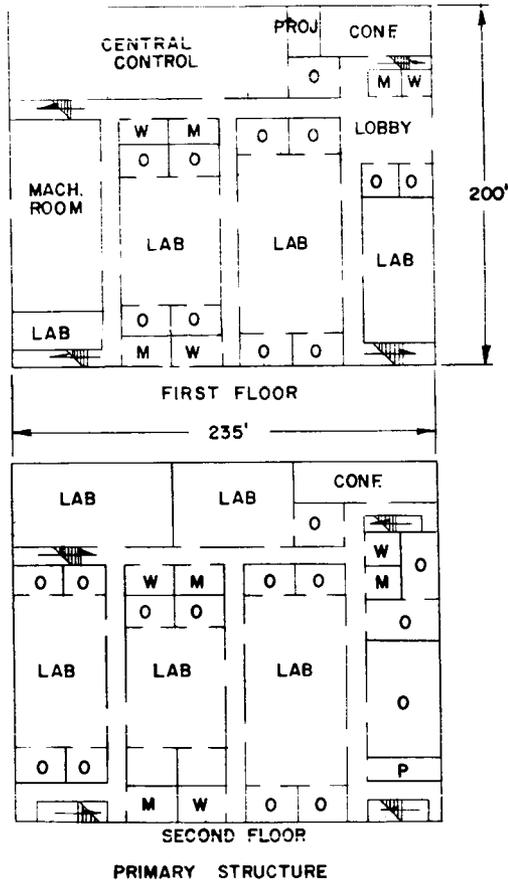
This facility will serve all NASA launch complexes. It will include electronic and other equipment suitable for operation from a central facility in support of more than one launch complex, to accomplish: (1) environmental measurement at the launch site before and during flight; (2) pre-launch checkout of on-board measuring, telemetry, tracking, command, and television equipment; (3) flight readiness monitoring before and during flight; (4) receiving and recording telemetry, television, and tracking data during lift-off and early flight; (5) real-time presentation of tracking, telemetry, and television data including limited real-time data reduction and analysis; (6) preliminary post-flight reduction and evaluation of tracking and telemetry data; and (7) scientific computations related to launch preparation.

The required equipment consists of:

Computer equipment: Computer equipment is required for scientific calculations related to launch preparations; real-time computer equipment is required for analyzing telemetry and tracking data during pre-launch vehicle tests and powered flight. The main bulk of the computer equipment will be centrally located to serve more than one complex. The nature of the computer task demands close coordination with, and proximity to, other elements in the area of data input (especially telemetry data), data output, and display.

Data handling, processing and presentation equipment:
This equipment will be used for checking the validity of

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
CENTRAL INSTRUMENTATION FACILITY



SITE PLAN



raw and reduced data, making tape and card copies and hard-copy records; and preparing digital and analog records for shipment to the user for local quick-look evaluation, presentation, or reduction. It includes card handling and data conversion equipment, printers, photo processing equipment for analog records, digital and analog display equipment, short-time data storage equipment, and the buffers necessary to operate this equipment in conjunction with the computers mentioned above.

Tracking equipment: The project includes a central recording station and associated equipment for tracking systems operated by NASA in the launch area. The equipment is used for coordination in checking out on-board beacons and other tracking aids, for compatibility tests between the on-board beacons and ground-based tracking equipment used for flight safety purposes, and for recording trajectory data for later reduction. This will be the centralized station for several large and complex tracking systems such as the ultra-high and very-high frequency doppler trajectory instrumentation systems now operated elsewhere on the Florida coast by NASA.

Flight TV ground equipment: Equipment is required which will be used to receive and record television information from the vehicle during the check-out and powered flight, and to display the information in real-time or during playbacks after a preflight or flight test.

Acoustic measuring equipment: The necessary instrumentation will be provided for measuring the area-wide acoustical environment during a launch and to serve as the central acoustical laboratory where calibrations and system tests will be run, and where acoustical data reduction and evaluation will be performed.

Instrumentation engineering support equipment: This equipment is used in support of firings for more than one launch complex, and is required to measure the effects of the launch environment on structures and equipment in the launch area. It also is used to provide general instrumentation services, such as instrument calibration, laboratory workshop, preventive maintenance, and short-lead-time modifications of instrumentation systems.

Communication and data transmission equipment: Voice communication and signaling equipment is required between the various instrumentation sites which can be more conveniently combined with data transmission than with general purpose communications. Included is equipment required for

transmitting and receiving digital and analog information between various instrumentation sites in the launch area and for receiving data (both in real time and after the fact) for computer input, data presentation, and data processing.

Telemetry equipment: A substantial quantity of general-use equipment will be operated in support of vehicle checkouts and launches from more than one complex. This equipment includes antennas, preamplifiers, multiplexers, receivers, discriminators, decommutators, and recording equipment for pulse amplitude modulated, pulse duration modulated, pulse coded modulated, and single sideband telemetry at both ultra-high-frequency and very-high-frequency; and the conditioning equipment required to supply telemetered data to computers, data presentation equipment, and data links. This equipment will also be capable of performing playbacks of telemetry tapes to provide computer and data inputs as hard-copy digital and analog records required for quick-look evaluation of pre-launch and flight tests. With this equipment it will be possible to record simultaneously 26 telemetry links all of which can be standard very high frequency links or some can be ultra high frequency or single-sideband links. It will also be possible to decommutate 26 links simultaneously, either in real-time or during tape playbacks to provide inputs to other equipment.

JUSTIFICATION:

A central instrumentation facility is essential for providing, in an appropriate central location in the new Industrial Area, the increased NASA instrumentation capability that will be necessary after the fiscal year 1964 effectively to support the constantly expanding NASA launch operation activities, particularly those related to the Manned Lunar Landing program.

The relatively high unit construction cost (\$50.00 per square foot) estimated for this facility is predicated on heavy air-conditioning and humidity control loads, hung acoustic tile ceilings, elevated floors, and similar requirements which are typical of instrumentation facilities. The concentration of this instrumentation in a centrally located facility represents a savings over the choice of several widely-separated, smaller facilities, each of which would require separate environmental control systems and their associated utility services.

Detailed justifications for the equipment, instrumentation, and support systems that will provide the increased capability essential to the NASA missions follow:

Computer equipment: There are two different basic require-

ments for instrumentation computer utilization in connection with the Manned Lunar Landing program:

- (1) A requirement for the technical analysis of systems, statistical studies, creation of error propagation models, and predictions of systems behavior. This requirement is not tied to any specific launch vehicle.
- (2) A requirement for the digital real-time handling of data received by means of the vehicle telemetry links for the purpose of checking and analyzing the entire telemetry loop. This function of the computing system is enlarged during vehicle flight by the adding of real-time data received from tracking systems, whereby flight performance analysis may be performed.

Computing equipment meeting the above requirements will be grouped into two systems to achieve a minimum of operational interfaces. One group will consist of a medium-size computer system. For the other, and necessarily much larger system, there are two basic approaches. One is to employ one, or probably two, large size computer systems. The other is to devise a system of several (six to eight) identical medium size computer systems (modules) for parallel operation. Detail hardware studies will be made to establish the best method of approach. Neither the cost nor the space requirements of either method will vary materially.

Data handling, processing, and presentation equipment: This equipment is required to condition telemetry and tracking data for computer input, to check the validity of raw data, to make tape and card copies and hard-copy records, and to prepare digital and analog records for shipment or for local evaluation. It is also needed to present critical trajectory and telemetry data in this facility for human evaluation of situations not covered by computer programs.

Tracking equipment: Tracking instrumentation in the facility will consist of ground receiving equipment, data link receivers, and communications, digitizing, and recording equipment. The equipment is required to make optimum real-time use of the tracking information available from existing tracking stations on the Florida coast, as well as to record the information for future data reduction.

This equipment will replace an existing similar station now located in the present Cape Canaveral Industrial Area. However, the new facility will include an increased real-time

capability, whereas the present station is intended primarily for recording data for later reduction. Useable existing tracking equipment will be transferred to the new facility and this factor has been considered in preparing the cost estimate. The present facility will be used by NASA contractors engaged in the Saturn program.

Flight TV ground equipment: This equipment will be used primarily to record, for later evaluation, all video information received from the vehicle, either in flight or during ground check-outs. It will also be necessary to relay this information to such points in the area as may require it in real-time and during playbacks, and to make copies of the flight TV records for shipment to the data users.

Acoustic measuring equipment: The reduction of acoustical data recorded at the launch complex, at other inhabited sites in the launch area, and in the surrounding towns is required to develop criteria for the design of future equipment and facilities, to establish acoustical danger areas for future firings, to investigate the probability of acoustical focusing which might cause damage to civilian populations, to provide data to evaluate methods of predicting focusing problems, and to investigate claims of acoustical damages in neighboring towns.

Instrumentation engineering support equipment: This equipment is required to furnish engineering support to instrumentation systems in the launch area and to design, fabricate, and install instrumentation required to evaluate the performance of ground equipment during the launch preparations and early flight.

Communication and data transmission equipment: Equipment of this type is required to tie together parts of instrumentation systems which are necessarily separated and to make it possible for computers and other equipment of a general-use category to serve more than one complex from a central facility. The equipment will consist of data transmission and communication equipment which is an internal part of an instrumentation system.

Telemetry equipment: Telemetry equipment must operate in conjunction with the computers and data presentations and must be located in close proximity to that equipment. It is required to receive, record, and process data from the vehicle, either in flight or during checkout. It will also supply telemetered information from the vehicle to instrumentation computers, which will evaluate the data during pre-launch tests to determine flight readiness and,

during the powered flight of the booster, to detect and evaluate malfunctions in real-time.

COST ESTIMATE :

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$110,000
Site clearing and grading.....	\$20,000	
Roads and parking areas.....	60,000	
Utility connections.....	30,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		5,090,000
Primary building..(94,000 square feet at \$50 per square foot).....	4,700,000	
Auxiliary building..(7,800 square feet at \$50 per square foot).....	390,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		24,715,000
General purpose digital computers.....	4,000,000	
Buffer system.....	1,500,000	
Input - output conditioning system.....	1,700,000	
Peripheral off-line equipment.....	1,600,000	
Data handling, processing, and presentation equipment.....	1,900,000	
Antennae and associated hardware.....	1,550,000	
Low noise pre-amplifiers and tracking signal recovery equipment.....	1,320,000	
Remote tracking, receiving and signal trans- mission equipment.....	645,000	
Tracking signal recording and quality determining equipment.....	849,000	
Tracking interrogators and reference equipment	586,000	
Flight TV ground equipment.....	1,500,000	
Acoustic measuring equipment.....	65,000	
Instrumentation engineering support equipment.	850,000	
Signal modulators and transmitters.....	900,000	
Signal receivers and demodulators.....	450,000	
Wide-band transmission system.....	350,000	
Input - output buffering equipment.....	800,000	
Radio frequency receiving and combining equip- ment.....	450,000	
Signal recording equipment.....	690,000	
Data digitizing equipment.....	800,000	
Frequency modulated video processing equipment	700,000	
Pulse coded modulated processing equipment....	500,000	
Signal patching equipment.....	700,000	

Strip chart recording equipment.....	\$310,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>\$1,593,000</u>
Total estimated cost.....		<u>\$31,508,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

DEEP SPACE NETWORK LAUNCH STATION

DESCRIPTION:

A deep space network launch station is required at the Launch Operations Center, Cape Canaveral, Florida. The station will provide a prelaunch check-out communication link between the spacecraft and the spacecraft data users during all scheduled tests involving a radio frequency link; it will serve as a real-time launch countdown telemetry link between the spacecraft and the data user and will advise the control center at the Jet Propulsion Laboratory on the condition of the telemetry and communication systems; and it will track the spacecraft from launch to the horizon to provide spacecraft data during the critical launch portion of the trajectory. The major equipment items which comprise the facility are a 25-foot diameter S-band transmitting and receiving antenna; an S-band radio frequency receiving system; an S-band transmitter; and such support equipment as recorders, test instrumentation, and data transfer equipment. Approximately 25 percent of the existing launch station data handling equipment will be integrated into the new facility. The remaining useable equipment will be returned to the Jet Propulsion Laboratory. Structures required to support the facility include the antenna mount and foundation, an operations and engineering building, and a collimation tower. The project includes the necessary utility connections and access roads.

JUSTIFICATION:

The deep space network presently consists of five stations and a control center. Two of the stations, the temporary launch station at Cape Canaveral and the mobile tracking station at Johannesburg, South Africa, are designed for the tracking of the spacecraft during the early phases of its flight. The other stations located at Goldstone, California; Woomera, Australia; and Johannesburg, South Africa, are larger permanent stations equipped with an 85-foot diameter paraboloidal antenna reflector and the necessary equipment to allow the station to track and communicate with the spacecraft at lunar and interplanetary distances. The control center is located at Pasadena, California.

The facility requested in this project will replace the temporary launch station, now in trailers at Cape Canaveral, with a permanent facility capable of handling the workload of the expanding lunar and planetary spacecraft programs.

It is imperative that the equipment at the Launch Operations Center be compatible with the equipment at the other stations in the deep space network. Due to an increasing need for more and broader band space communications, it has become necessary to shift space communications from L-band to the less congested S-band frequency range. Consequently, the conversion of the launch

station from a temporary to a permanent station will also provide the necessary modification from L-band to S-band concurrent with the frequency shift at the other network stations.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$100,000
Clearing, grading, and erosion control.....	\$25,000	
Access and site roads.....	40,000	
Utility connections.....	35,000	
FACILITY CONSTRUCTION AND MODIFICATIONS.....		305,000
Operations and laboratory building (3,000 square feet at \$35.00 per square foot).....	105,000	
Antenna installation and erection.....	60,000	
Collimation tower and housing.....	65,000	
Antenna foundation.....	75,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		3,545,000
Precision doppler and ranging system.....	600,000	
Multi-channel receiving system with frequency synthesizer control.....	1,100,000	
200-watt S-band transmitter.....	200,000	
Antenna and feed system.....	200,000	
Support equipment.....	650,000	
Data handling and processing equipment.....	750,000	
Air conditioning for high-heat loss electronic equipment.....	45,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>50,000</u>
Total estimated cost.....		<u>\$4,000,000</u>

LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES

LAUNCH EQUIPMENT SHOP

DESCRIPTION:

It is proposed to construct a one-story building to serve as the base technical support shop for the fabrication and repair of launch equipment, such as umbilical tower swing arm attachments, communication and electrical cable switching and jack points, and television camera mounts. As indicated in the drawing on the following page, the structure, with dimensions of approximately 129 feet by 202 feet and containing approximately 20,750 square feet, will be located in the Merritt Island Industrial Area. Space within the facility will be functionally allocated approximately as follows:

	<u>Square Feet</u>
Sheet metal and welding shops.....	5,040
Machine shop, grinding shop, and tool room..	4,170
Electrical and communications shop.....	2,000
Woodworking and plastics shops.....	1,350
Painting and plating shops.....	1,290
Materials storage enclosure.....	1,400
Nonfunctional shop area, including aisles....	2,060
Offices, lavatories, and locker, shower, janitors' and equipment rooms.....	<u>3,440</u>
Total.....	20,750

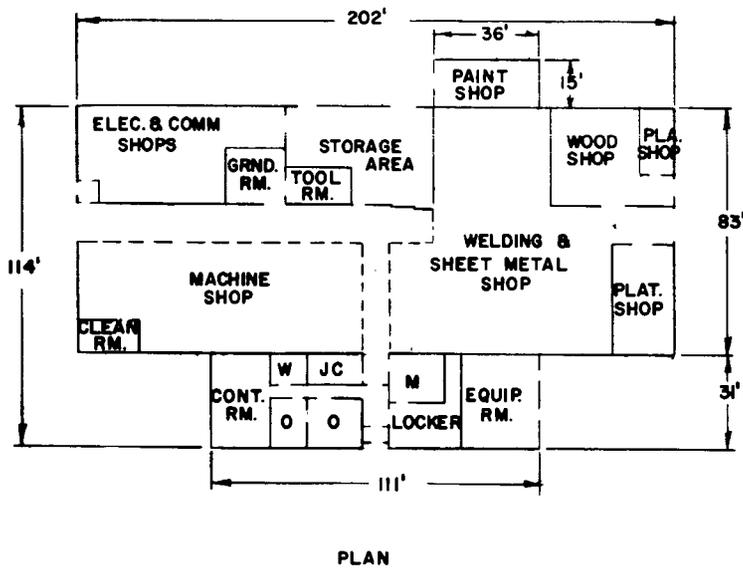
High-precision machine shop areas, and other areas as required, will be air-conditioned or humidity-controlled to protect both men and machinery, and to assure work of the necessary quality. Heat will be supplied by the central heating plant within the area. A fire alarm system will be provided within the building. Site development, parking, and utilities, such as water, sewer, electric power, and communications, will be provided as required to make the facility completely operable.

This facility will have the capability for milling, grinding, shaping, pressing, rolling, riveting, heat treatment, woodworking, plastics working and the emergency repair of electrical equipment. Centrally located in the new Merritt Island Industrial Area, it will serve as the main shop for all NASA-operated launch complexes.

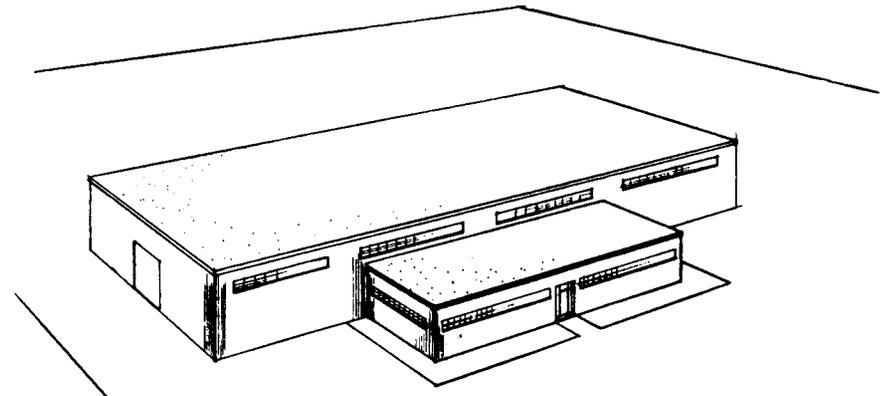
JUSTIFICATION:

This facility is required to provide the level and quality of quick-response launch equipment fabrication and repair service that will be required by the NASA and its stage contractors after the fiscal year 1964.

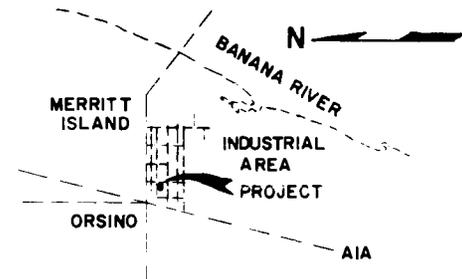
LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
LAUNCH EQUIPMENT SHOP



PLAN



PERSPECTIVE



SITE PLAN



CF 6-62

Operations at Saturn launch complex No. 34, from which three successful Saturn launches have been made, have shown that technical support shop service for the immediate fabrication and repair of launch equipment is vital. During launching operations, when a missile is on the pad, contracting for emergency work without costly and prohibitive delay is an impossibility.

A detailed study of the Launch Operations Center technical support shops shows that existing shop capacity is insufficient and that greater and more diverse shop capability is necessary if existing and planned complexes are to receive adequate support. The parameters for the proposed facility were determined by projecting past requirements placed on the Launch Operations Center shops, Patrick Air Force Base shops, Pan American shops, and other contractors and NASA activities. The proposed location, in the new Merritt Island Industrial Area, is based on the distances from this site to the complexes which will be served and on the workloads predicted.

This facility will be an adjunct to and control center for the present shops now located in the Cape Canaveral Industrial Area. These existing shops will be maintained and utilized as "advance" shops in support of NASA-launch complexes in that vicinity.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$60,000
Clearing, grubbing, and grading.....	\$18,000
Access roads and parking area.....	30,000
Utility extensions.....	12,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	394,000
Shop building (20,750 square feet at \$19.00 per square foot).....	394,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	1,000,000
Milling machines.....	315,900
Lathes.....	168,750
Drill presses.....	100,100
Grinders.....	100,000
Jig-borer.....	76,950
Wood-working machines.....	8,300
Electrical service equipment.....	80,000
General shop equipment.....	140,000
Furniture, fixtures, and office equipment.....	10,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>63,000</u>
Total estimated cost.....	<u>\$1,517,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

MANNED SPACECRAFT FACILITIES

DESCRIPTION:

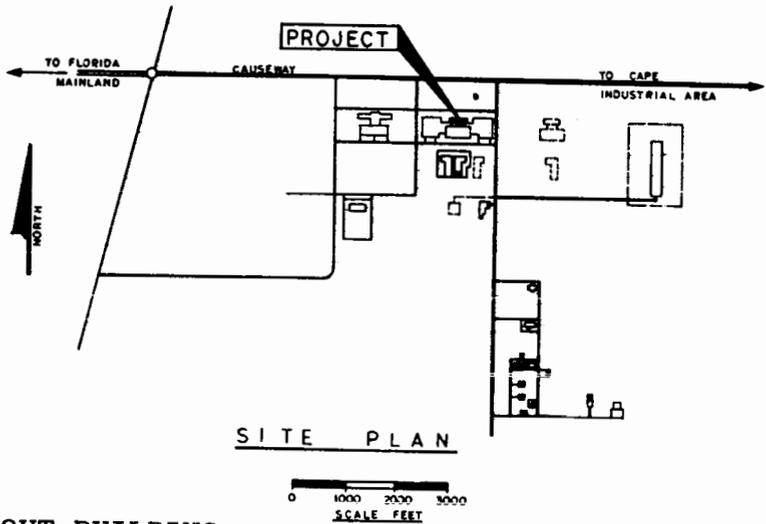
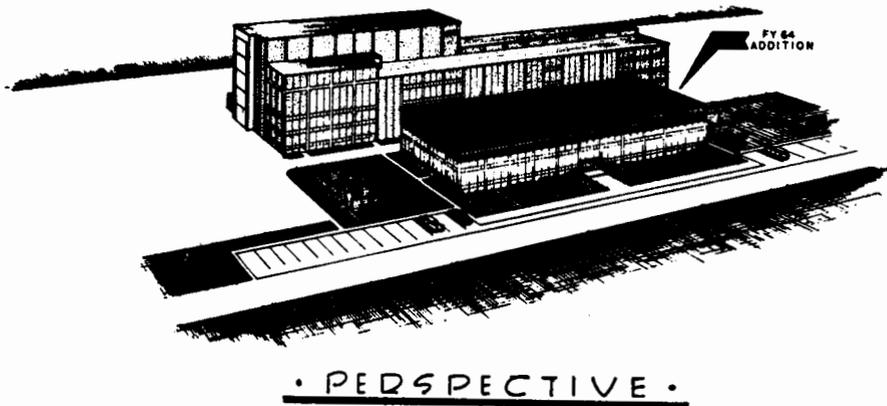
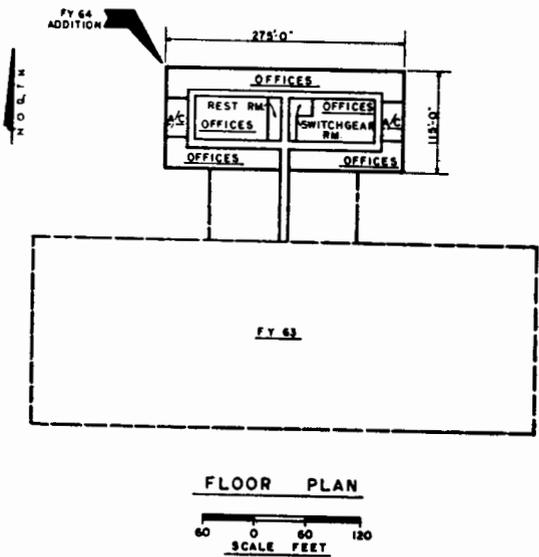
The impact of operational schedules of the Gemini and Apollo programs necessitates several additions to the Apollo mission support facilities and field test laboratory. These facilities will hereinafter be known as the manned spacecraft facilities. The additions are necessary to process the increased number and types of manned spacecraft. Due to hazardous conditions, such as toxic fumes, the fluid test complex and the ordnance field test laboratory have been sited differently from that which was shown in the fiscal year 1963 Apollo mission support facilities project. These facilities are in the same general area on Merritt Island, but they have been relocated farther away from the other manned spacecraft facilities in the interest of safety. Sketches of the facilities included in this project are presented on the following six pages. Detailed descriptions follow below:

Additions to the operations and checkout building: This project provides for the construction of a third floor addition to the administration and engineering area of the spacecraft operations and checkout building. This addition will contain approximately 31,625 square feet, with dimensions of approximately 115 feet by 275 feet. It will provide an air-conditioned working space for approximately 290 people. The addition will match the architectural design and features of the original building and will include an elevator to serve the administrative and office area of the building.

Additions to the fluid test complex: These additions are required to provide an expanded facility for remote and safe checkout of the spacecraft hypergolic systems. The units to be added to the complex are described in the following paragraphs:

Additional hypergolic test spacecraft building: To provide expanded facilities for the checkout of spacecraft hypergolic systems, a test building will be constructed consisting of two test cells with control rooms. The building will also include an equipment room, locker rooms, and a machine room. Each test cell will have an area of approximately 1,600 square feet with dimensions of approximately 40 by 40 feet. The building will be of irregular shape with a two-story central core. The

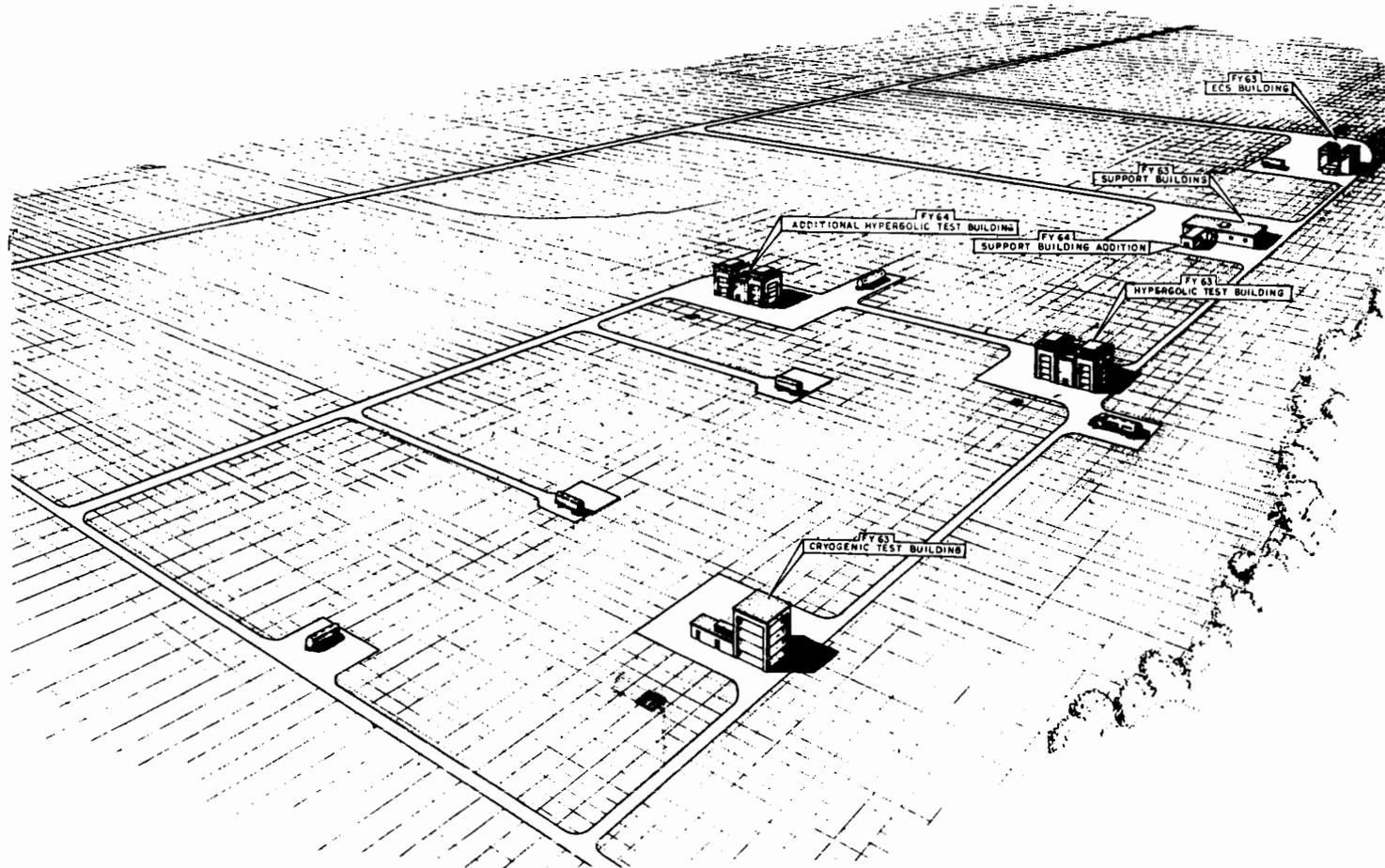
LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
 MANNED SPACECRAFT FACILITIES



CP 6-65

ADDITIONS TO THE OPERATIONS AND CHECKOUT BUILDING

LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES
MANNED SPACECRAFT FACILITIES

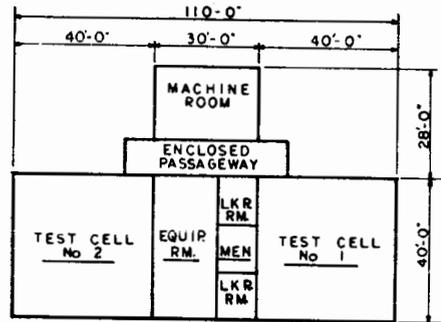


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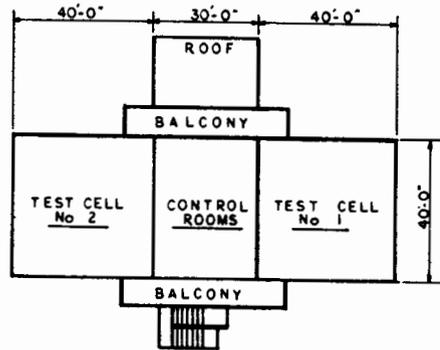
◦ PERSPECTIVE ◦

ADDITIONS TO THE FLUID TEST COMPLEX

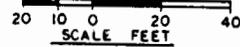
LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
MANNED SPACECRAFT FACILITIES



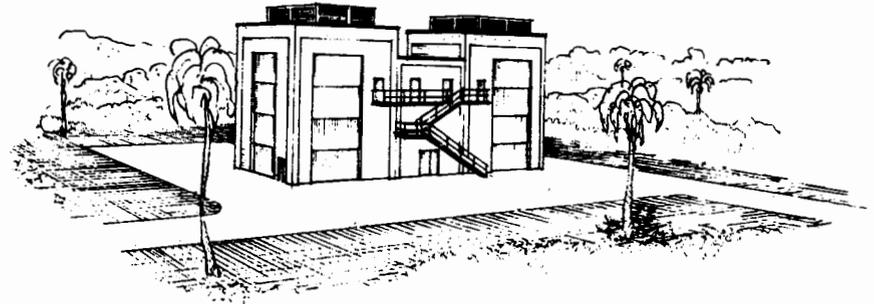
FIRST FLOOR PLAN



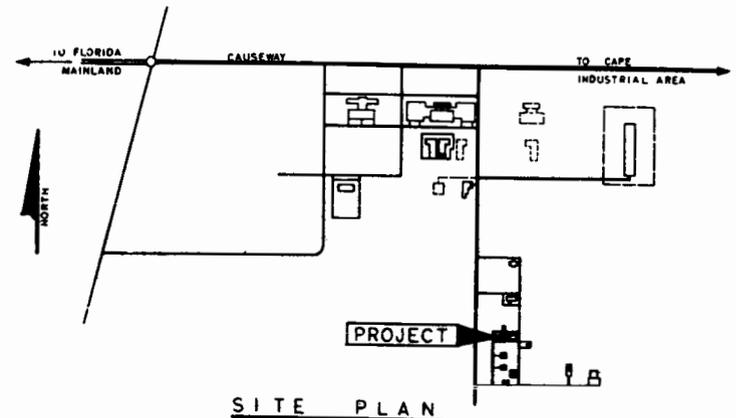
SECOND FLOOR PLAN



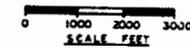
ADDITIONAL HYPERGOLIC TEST BUILDING



PERSPECTIVE



SITE PLAN



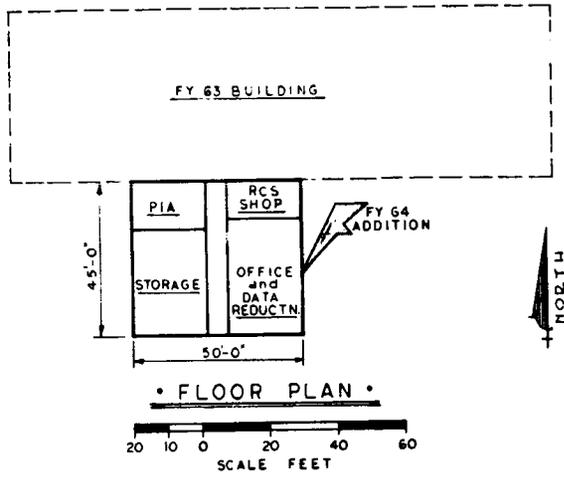
ADDITIONS TO THE FLUID TEST COMPLEX

CF 6-67

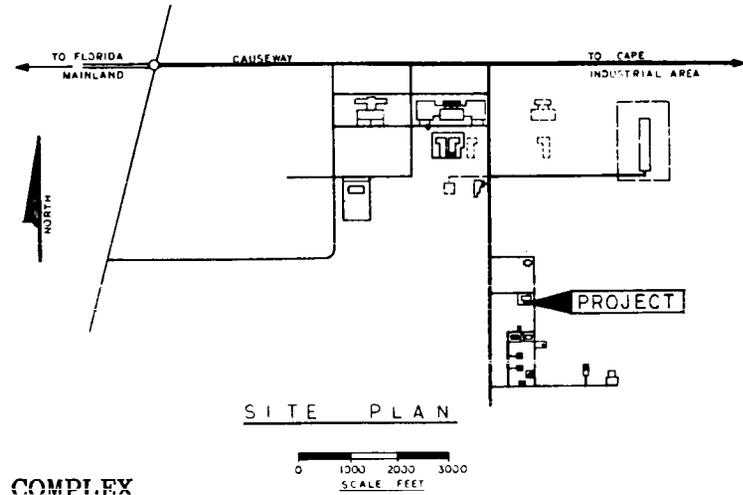
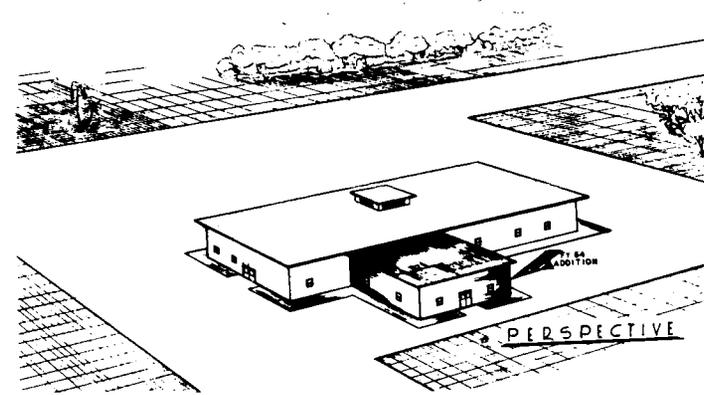
LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

MANNED SPACECRAFT FACILITIES



ADDITION TO SUPPORT BUILDING

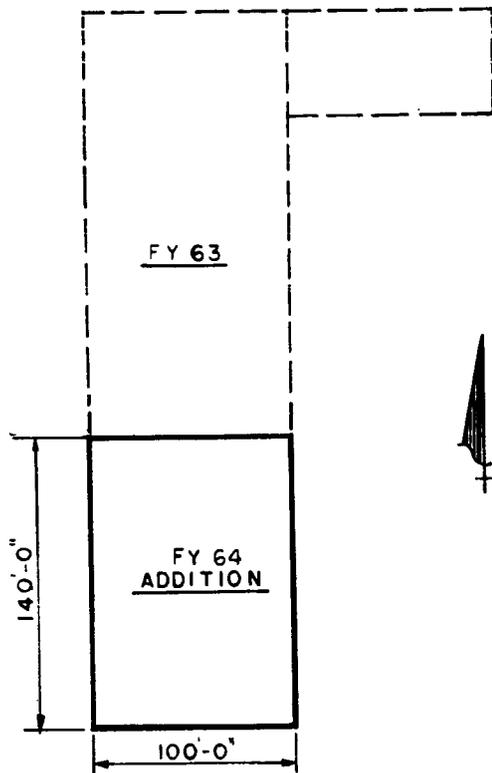


ADDITIONS TO THE FLUID TEST COMPLEX

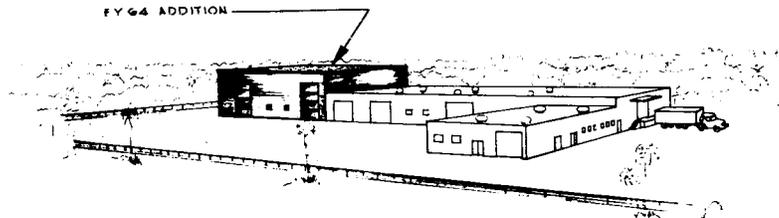
CF 6-68

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
 MANNED SPACECRAFT FACILITIES

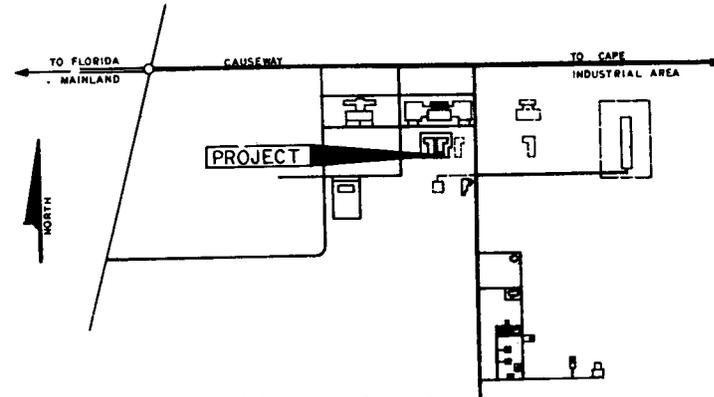
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• FLOOR PLAN •
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 SCALE FEET



PERSPECTIVE



SITE PLAN
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 SCALE FEET

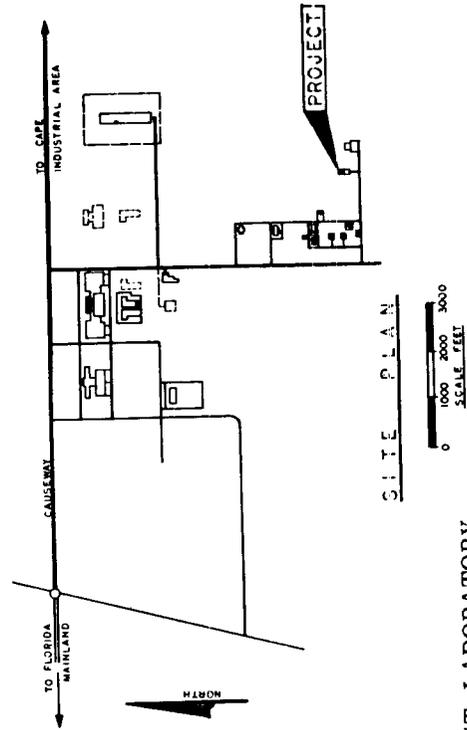
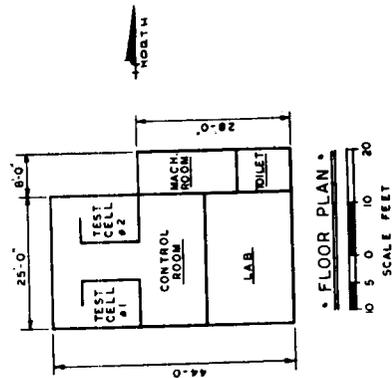
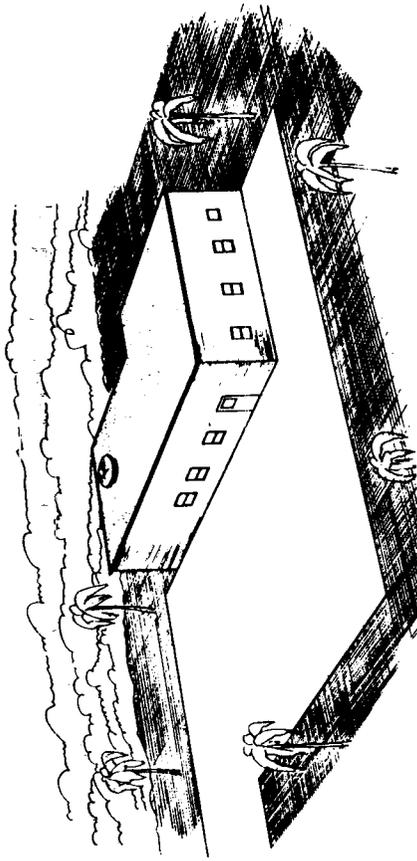
ADDITION TO THE SUPPLY AND GROUND SUPPORT
 EQUIPMENT SERVICE BUILDING

CP 6-69

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

MANNED SPACECRAFT FACILITIES



ORDNANCE FIELD TEST LABORATORY

CF 6-70

overall dimensions of the building will be approximately 110 feet by 68 feet with an approximate area of 7,100 square feet. Each test cell will have a crane with hook height of approximately 45 feet. The building will be air-conditioned and will have several special features to provide for the safe handling of the hazardous fuels and oxidizers. The control rooms will be so constructed as to provide the operators optimum protection from possible explosions or fumes. The test cells will be provided with large capacity exhaust systems, and the cells will have a floor system which will collect and dilute hypergolic spills.

Addition to the support building: This addition will consist of an air-conditioned wing added to provide additional space for laboratories, shops and offices for the personnel operating the expanded complex. The single-story structure will be of reinforced concrete frame with masonry exterior walls to match the architectural design and functional plan of the original building.

Additional service facilities: Additional facilities will be provided to furnish attendant services to the other facilities described. These will consist of stations for transferring fluids from mobile vehicles to the test cells and a dilution system and sump for disposing of spilled fuels and oxidizers.

Addition to the supply and ground support equipment building: The addition to this building will provide additional space and facilities to maintain, modify, and shelter ground service and handling equipment for the manned spacecraft programs. The addition will be a permanent, one-story steel or reinforced concrete frame structure of 14,000 square feet with masonry walls matching the architectural and functional design of the original building.

Ordnance field test laboratory: This project will provide a safe, isolated facility and special equipment for disassembling, checking, and testing small pyrotechnic devices. The overall dimensions of this irregular-shaped building will be approximately 33 by 44 feet, and it will have a total area of approximately 1,324 square feet. It will consist of two test cells, a control room, a laboratory, a washroom, and a machine room. The building will be air-conditioned and will have fans to remove combustion gases from

the test cells. The control room will be constructed with blast-resistant walls to protect the operators from explosive hazards. The building will be a one-story masonry and reinforced concrete structure.

JUSTIFICATION:

Fiscal year 1963 funds were provided to construct the necessary Manned Spacecraft Center facilities at the Launch Operations Center to meet initial Gemini and Apollo objectives. As the two flight programs progress, these facilities must be augmented to accommodate increased quantities, types, and complexity of spacecraft.

The additions required in the fiscal year 1964 include special fixtures, equipment, and test areas necessary to support, control, and test manned spacecraft. Since each of the spacecraft projects involves a separate contractor and each will be working simultaneously on different schedules and types of spacecraft, the facilities described are the minimum essential requirements which will permit timely accomplishment of the objectives of the two programs.

Additions to the operations and checkout building: The planned addition to the office portion of the building is required to supplement the existing administration and engineering area. Many advantages are evident in conducting similar nonhazardous testing of all manned spacecraft in a central integrated facility. Such consolidation of checkout and test operations, together with a proper selection of multi-purpose and versatile equipment, will effect savings in facility, equipment and manpower expenditures. Additional space is required to provide engineering and administrative office space for contractor personnel who will be associated with the Gemini program.

This project also includes funds for the space simulation and other testing equipment. The major items include two altitude chambers which are required for the simulation of conditions at various altitudes in space and on the moon to adequately test the Gemini, Apollo, and lunar excursion module spacecrafts both with and without the astronaut in the spacecrafts.

Additions to the fluid test complex: An expansion is necessary to the fluid test complex to provide pre-flight firing checkout capability for the increased number of spacecraft modules requiring checkout. Additional hypergolic capabilities are required. To meet anticipated schedules, the combination of these facilities with the original hazardous area complex will provide flexibi-

lity in conducting tests of such systems. Exposure to these hazardous conditions by all nonoperational personnel will be reduced by conducting tests of hypergolic spacecraft systems in a controlled access area.

Addition to the supply and ground support equipment building:

It is necessary that additional space of the required height be provided for contractor-performed maintenance operations on ground support equipment, including transport trailers, spacecraft dollies, module dollies, various test and service trailers, workstands, and other specialized equipment. Protection from the corrosive weather conditions is required for this experiment. Expansion of the original structure is needed to accommodate additional equipment furnished to meet the increased number of spacecraft to be processed at Merritt Island.

Ordnance field test laboratory: The Launch Operations Center has no facility for testing pyrotechnic devices other than to measure bridgewire resistances. Several occasions arose in Project Mercury when other testing of pyrotechnic devices was necessary and the testing had to be performed under a relatively unsafe temporary set up, which furnished only partial results due to the unsatisfactory testing environment and facilities.

Based on this experience, a facility is required to provide replies to questions which must be answered quickly in order not to stop the spacecraft testing. If a defective item is found in the spacecraft, this facility will provide testing requirements without the necessity for shipping the item back to the vendor and causing possible further damage during shipment. It is sometimes necessary to disassemble pyrotechnic devices to get data for a post-flight analysis. Since time is usually critical, this facility will provide a safe, clean area to do this work.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$222,800
Clearing.....	\$35,500
Filling.....	32,700
Roads.....	33,000
Parking area.....	42,400
Utility lines and connections.....	79,200

C. FACILITY CONSTRUCTION AND MODIFICATIONS..... \$1,681,500

Addition to the spacecraft operations and checkout building (31,625 square feet at \$30 per square foot).....	\$948,000	
Fluid test complex.....	273,000	
Additional hypergolic test building (7,100 square feet at \$26 per square foot).....	\$184,600	
Addition to the support building (2,250 square feet at \$20.60 per square foot).....	46,400	
Additional service facilities.	42,000	
Fuel station installation.....	\$9,000	
Dilution system....	27,000	
Disposal sump.....	6,000	
Addition to the supply and ground support equipment building (14,000 square feet high-bay at \$30 per square foot).....	420,700	
Ordnance field test laboratory (1,324 square feet at \$30 per square foot).....	39,800	

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS..... 3,734,000

Addition to the spacecraft operations and checkout building.....	3,395,000	
Control system air-conditioning	40,000	
Heating and cooling system.....	75,000	
Elevators.....	35,000	
Test and laboratory equipment..	345,000	
Altitude chambers (2 at \$1,420,000 each; 31 feet in diameter; 42 feet high; vacuum capacity, 10 ⁻⁴ torr).....	2,840,000	
Office equipment.....	60,000	
Fluid test complex.....	216,300	
Lab and office equipment.....	39,000	
Shop equipment.....	4,000	
Test equipment.....	20,800	
Vapor detection warning system.	2,500	
Cranes (2-20 ton at \$50,000 each).....	100,000	
Liquid piping and purging systems.....	50,000	
Supply and ground service equipment building.....	72,000	

Material handling equipment....	\$60,000	
Store room equipment.....	12,000	
Ordnance field test laboratory equipment..		\$50,700
E. DESIGN AND ENGINEERING SERVICES.....		<u>\$873,700</u>
Total estimated costs.....		<u><u>\$6,512,000</u></u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

MODIFICATIONS TO SATURN LAUNCH COMPLEX NO. 34

DESCRIPTION:

This project provides for the following necessary modifications and additions to Saturn launch complex No. 34 to support the Saturn B vehicle and the Apollo spacecraft programs:

- (a) Additions and modifications to service structure: The service structure will be modified to add a retractable platform, modify inserts on two existing platforms, install retro-rocket handling rigs, construct a checkout enclosure (white room) for the Apollo spacecraft, and modify work platforms to accommodate new umbilical connections.
- (b) Modification to blockhouse: An additional checkout and control computer necessary for automated checkout will be installed in the blockhouse. Additional cabling will be installed between the blockhouse and the launch pad.
- (c) Additions and modifications to propellant service facilities: Existing RP-1 fuel, liquid hydrogen, and liquid oxygen facilities will be modified and additional facilities constructed for the installation of additional propellant equipment. This work will consist of concrete propellant equipment foundations, concrete and earth revetments, concrete propellant line supports, instrumentation control ducts, and power cableways. Modifications and additions to propellant servicing equipment will be required in the fiscal year 1965; however, funding for supporting facilities are requested now to phase construction scheduling to meet the research and development schedule of the Saturn program.
- (d) Extension of communications system: The existing system will be modified and extended to provide communications to the additional platform, white room, computer room, and fueling facilities requested herein. This work will consist of procurement and installation of additional cameras, controls, monitors, short-length interconnecting cables, microphones, headsets, telephones, operation intercommunications system, timing system, visual countdown clock system and supporting appurtenances to the added facilities.

A sketch of the Saturn launch complex No. 34 is shown on the following page.

JUSTIFICATION:

The Saturn B will be used to qualify the S-IVB stage and the Apollo spacecraft for the Manned Lunar Landing program. The larger propellant capacity (approximately twice that of the Saturn, S-IV stage) and automated checkout requirements of the S-IVB stage and the Apollo spacecraft make changes to the complex necessary. The program will be concurrent with early developmental launching of the Advanced Saturn first and second stages, thereby greatly accelerating the Advanced Saturn program. The Advanced Saturn will be used in the initial manned lunar exploration. The time saved through utilization of the Saturn B for qualification of the S-IVB stage and the Apollo spacecraft will produce an earlier operational date for the basic Advanced Saturn vehicle.

Launch complex No. 34 was originally designed to launch the Saturn Block I vehicle (first stage with dummy upper stages and payload). The construction of this complex was accomplished during the fiscal years 1959, 1960, and 1961, concurrent with the development of the Saturn vehicle first stage. Between launches of the Saturn Block I vehicles in the fiscal years 1962 and 1963, additional facilities were scheduled to serve the Block II vehicles (S-I and S-IV stages and payloads).

The current facilities of launch complex No. 34 are not suitable for the Saturn B program. The larger propellant capacity, and consequently larger dimensions, of the S-IVB stage plus the automated checkout requirements of the S-IVB and the Apollo spacecraft, make changes to the complex necessary to support the Saturn B program.

The following specific additions and modifications to launch complex No. 34 are necessary to service the Apollo spacecraft and the Saturn B:

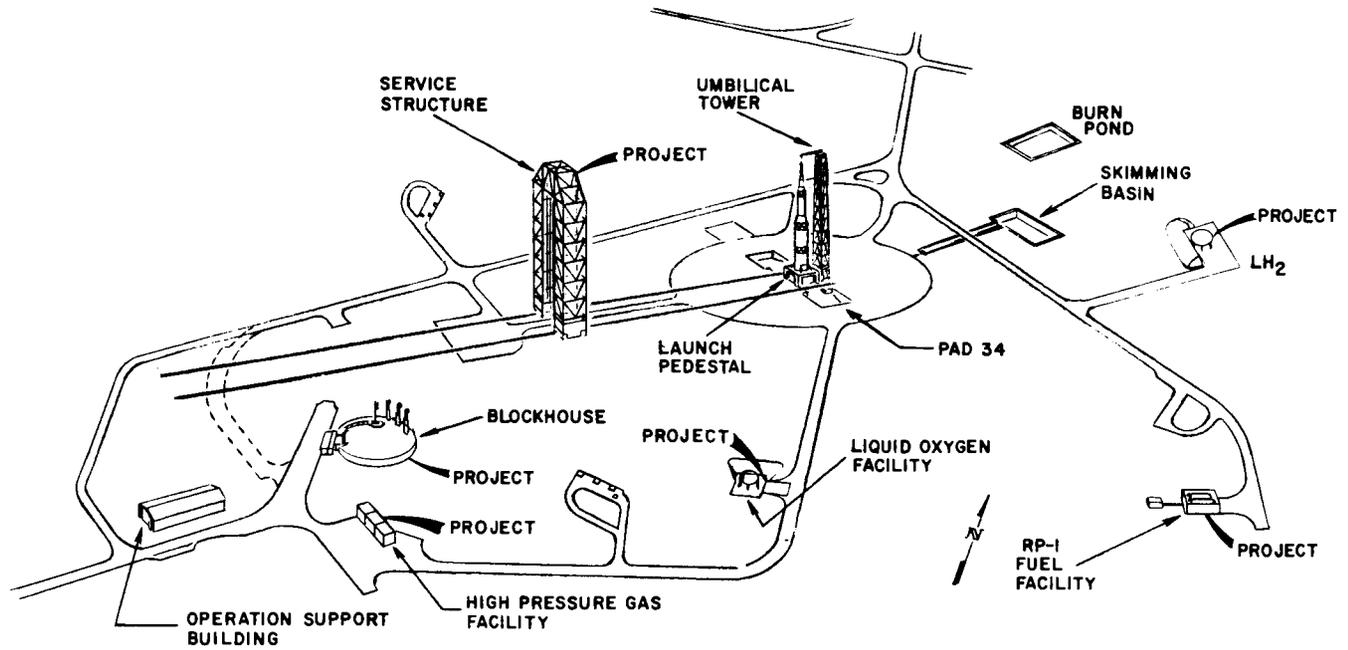
(a) Additions and modifications to service structure:

- (1) An additional work platform on the service structure is required for the pre-launch checkout of Apollo spacecraft.
- (2) Two of the existing work platforms must be modified to fit the enlarged diameter of the S-IVB stage.
- (3) Retro-rocket handling rigs will be required for installation of auxiliary solid rockets which are added to the vehicle late in the pre-launch checkout. These rockets function to separate the vehicle stages during flight.

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

MODIFICATIONS TO SATUN LAUNCH COMPLEX NO.34



PERSPECTIVE
NOT TO SCALE

- (4) The Apollo spacecraft, during pre-launch checkout, must be enclosed by a work area that has stringent requirements for cleanliness and a controlled environment. This enclosure, commonly known as a "white room," will be added to the service structure.
- (5) Work platforms on the service structure will have to be modified to accommodate changes in the locations of the umbilical swing arms.
- (b) Modifications to blockhouse: Rearrangements must be made to the blockhouse interior to provide space for the additional checkout equipment used for the S-IVB stage launch, including the automatic checkout equipment.
- (c) Additions and modifications to propellant service facilities: Funding for additional propellant supporting facilities is needed in the fiscal year 1964, so that propellant servicing equipment can be installed in the fiscal year 1965 to meet the launch schedule of the Saturn B vehicle; approximately \$2,000,000 will be required for this purpose in the fiscal year 1965. The Saturn B vehicle has an S-IVB upper stage with approximately twice the propellant capacity of the S-IV stage.
- (d) Extension of communications system: Cabling will be necessary for connections between the blockhouse and the additional facilities installed to provide a complete system for automatic checkout and control. The communications system must be enlarged to provide communications to the new additions.

A project for similar type of modifications to Saturn launch complex No. 37 is also included in the fiscal year 1964 construction program. These complexes are required in mutual support of each other for two reasons: (1) as back-up in the event of an explosion, malfunction or mishap to the other complex; and (2) to accommodate the workload imposed by the frequency of scheduled launchings for the Saturn B and Apollo programs.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	\$330,000
Retractable work platform.....	\$250,000
Modification of inserts on two platforms.....	14,000
Retro handling rigs.....	18,000

White room	\$65,000	
Work platform modifications.....	20,000	
Blockhouse additions.....	68,000	
Propellant concrete foundation, supports, propellant line supports, ducts and power cableways.....	345,000	
Cabling.....	50,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		\$338,000
Installation of checkout equipment.....	150,000	
Communication system extension.....	188,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>142,000</u>
Total estimated cost.....		<u>\$1,310,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

MODIFICATIONS TO SATURN LAUNCH COMPLEX NO. 37

DESCRIPTION:

This project provides for the necessary modifications and additions to Saturn launch complex No. 37 to support the Saturn B vehicle and the Apollo spacecraft programs. Launch complex No. 37 has two launch pads designated as "A" and "B". Use of pad "B" for the Saturn program will be continued until this program is phased out and therefore will not be affected by this project. At such time as the Saturn is phased out, pad "B" will be adapted for other advanced programs. Under this project the development of pad "A" will be extended and other complex No. 37 facilities will be adapted for launching the Saturn B and to advance the development of the Apollo program, as follows:

- (a) Modifications to service structure: The service structure will be modified by altering inserts on three existing platforms, installing retro-rocket handling rigs, constructing a white room and modifying silo gates to accommodate new umbilical connections.
- (b) Modification to blockhouse: The blockhouse interior will be modified to house an additional checkout and control computer necessary for automated checkout of the S-IVB stage. Additional cabling will be required from the blockhouse to pad and fueling areas.
- (c) Modifications to propellant service facilities: Existing RP-1 fuel, liquid hydrogen, and liquid oxygen facilities will be modified, and new facilities provided for additional propellant equipment. This will include concrete propellant equipment foundations, concrete and earth revetments, concrete propellant line supports, and instrumentation control ducts and power cableways, for the increased propellant requirements of the Saturn B vehicles.
- (d) Communications systems: The existing systems will be modified and extended to provide communications to the service platforms, the white room, the computer room, and the fueling facilities requested herein.
- (e) Additional propellant services: The existing propellant system will be modified and expanded to incorporate additional tanks, pumps, control consoles, and transmission lines for hydrogen, oxygen, RP-1 fuel, and high-pressure gas systems.

A sketch of the Saturn launch complex No. 37 is shown on the following page.

JUSTIFICATION:

The Saturn B will be used to qualify the S-IVB third stage and the Apollo spacecraft before their use on the Advanced Saturn vehicle. The program will be concurrent with the early developmental launches of the Advanced Saturn first and second stages, thereby greatly accelerating the Advanced Saturn program. The Advanced Saturn will be utilized in the first manned lunar explorations. The use of the Saturn B for qualification of the S-IVB and the Apollo capsule is an essential step in the development of the basic Advanced Saturn program.

Launch complex No. 37 was originally designed to launch the Saturn vehicle; Block II (S-I and S-IV stages and payload). The complex was constructed in orderly steps during the fiscal years 1961, 1962 and 1963, concurrent with the development of the Saturn vehicle.

The second stage of the Saturn B (S-IVB) is presently planned to be twice the physical size and therefore carries approximately twice the volume of propellants carried by the Saturn (S-IV) second stage. The S-IVB stage also requires additional checkout and control equipment. Consequently, additions and modifications to launch complex No. 37 are necessary to receive the larger and more complex Saturn B vehicle and the Apollo spacecraft.

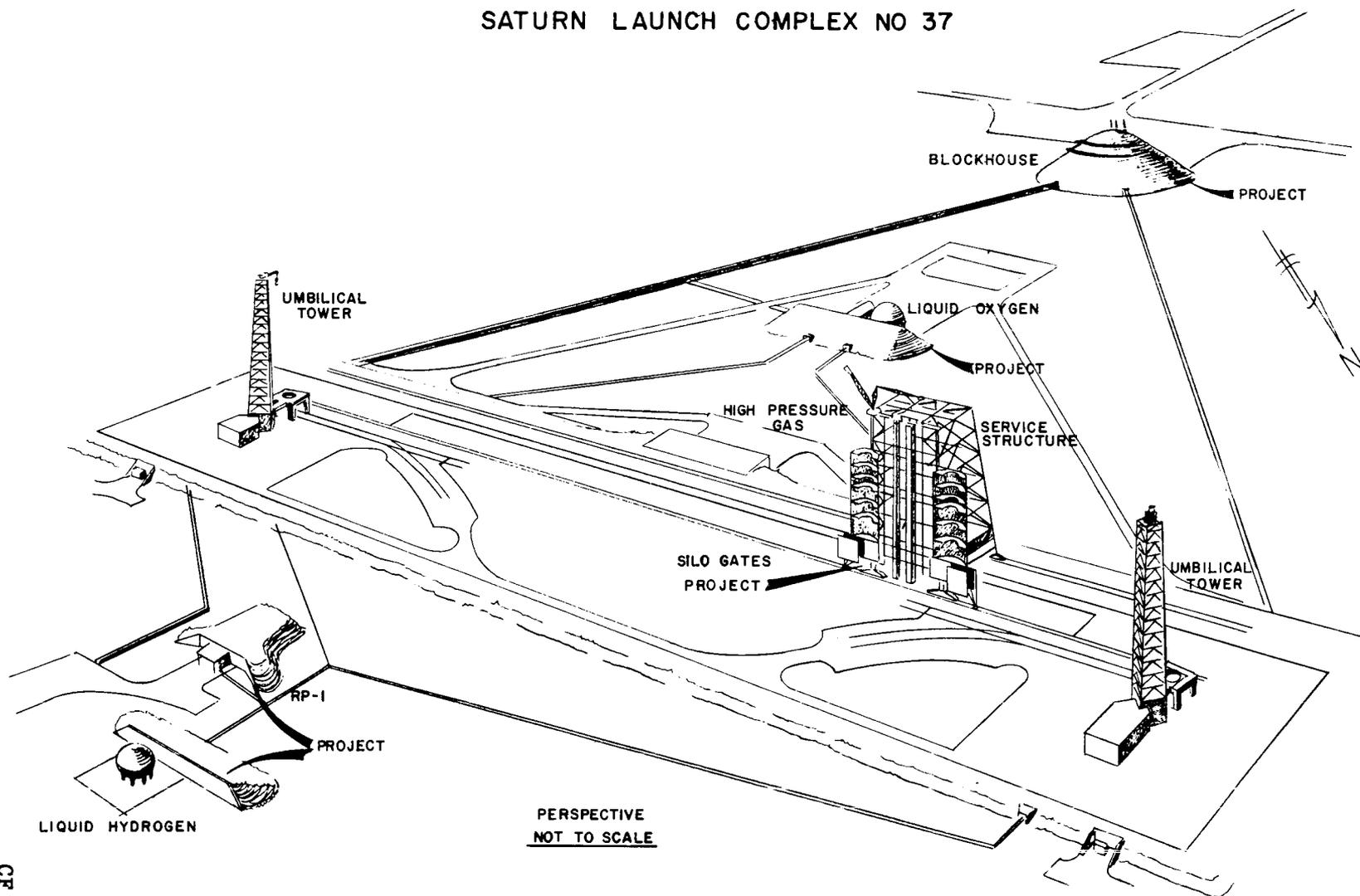
More detailed justifications of the specific items that comprise this project follow:

(a) Modification to service structure:

- (1) Three of the existing work platforms on the service structure must be modified to fit and serve the enlarged diameter of the S-IVB stage.
- (2) Retro-rocket handling rigs must be added to the service structure for installing auxiliary solid propellant rockets late in the pre-launch checkout. These rockets separate the vehicle stages in flight.
- (3) A white room must be added to the service structure to enclose the Apollo spacecraft during prelaunch checkout. This room must meet stringent cleanliness and environmental control specifications.
- (4) The silo gates on the service structure require modification to accommodate changes in the location of umbilical swing arms.

(b) Modification to blockhouse:

LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES
SATURN LAUNCH COMPLEX NO 37



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Modifications are required in the blockhouse interior to provide space for the additional checkout equipment used for the S-IVB stage. Cabling will be necessary for connections between the blockhouse, pad, and fueling areas to accommodate the additional checkout and control computer required for automated checkout of the S-IVB stage.

(c) Propellant services:

Additional propellant structural facilities and equipment and supporting systems are required to service the larger S-IVB stage with approximately twice the propellant capacity of the S-IV stage. These items will provide an operational system necessary to meet initial launch schedules of the Saturn B vehicle.

(d) Communications systems:

The communications systems must be modified and expanded to provide service to facilities requested herein.

A project for similar type of modifications to Saturn launch complex No. 34 is also included in the fiscal year 1964 construction program. These complexes are required in mutual support of each other for two reasons: (1) as back-up in the event of an explosion, malfunction, or mishap to the other complex; and (2) to accommodate the workload imposed by the frequency of scheduled launchings for the Saturn B and Apollo programs.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		\$866,000
Modification of inserts on three plat-		
forms.....	\$21,000	
Retro handling rigs.....	18,000	
White room.....	65,000	
Silo gate modifications.....	75,000	
Blockhouse modification.....	42,000	
Propellant concrete foundations, supports,		
propellant line supports, ducts and		
power cableways.....	345,000	
Cabling.....	300,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		2,304,000

Installation of checkout equipment.....	\$150,000	
Communications systems.....	354,000	
Propellant tank system.....	500,000	
Propellant control network.....	350,000	
Propellant piping, valves and storage con- necting lines.....	950,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>\$265,000</u>
Total estimated cost.....		<u>\$3,435,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

OPTICAL AND ELECTRONIC COMPONENT SERVICING FACILITY

DESCRIPTION:

This project proposes the construction of a reinforced concrete frame and masonry structure of approximately 25,000 square feet. The one-story structure, with dimensions of approximately 125 feet by 200 feet, will be located in the Merritt Island Industrial Area. A sketch of the facility is shown on the following page. It will be used for the maintenance, repair, and storage of optical and electronic tracking instrumentation, including approximately 100 TV, movie, and still cameras, two high resolution tracking radars, one meteorological radar, one air route surveillance radar, one command control radar, and some 200 frequency control and analysis (FCA) and weather data acquisition devices, required to support launch complexes in the Merritt Island launch area. The facility will be air-conditioned and humidity-controlled to protect the equipment and components and to assure workmanship of the necessary quality. Heat will be supplied by the central heating plant in the area, and a fire alarm system will be provided within the building. Site development, parking, and utilities, such as water, sewer, electric power, and communications, will be provided as required to make the facility completely operable. In addition to the usual shop apparatus, the repair and maintenance equipment used in the building will consist of signal generators, oscilloscopes, meters, special test gear and secondary calibration standards.

JUSTIFICATION:

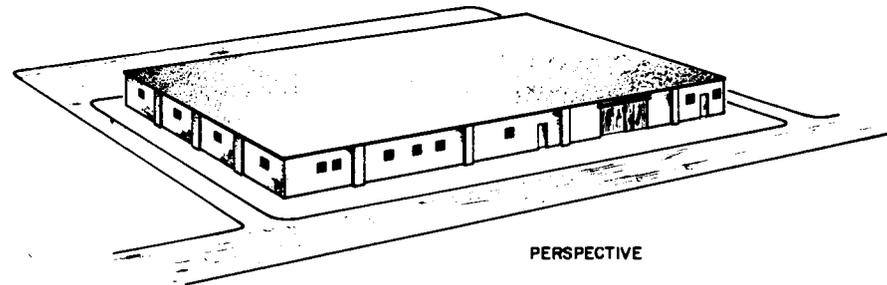
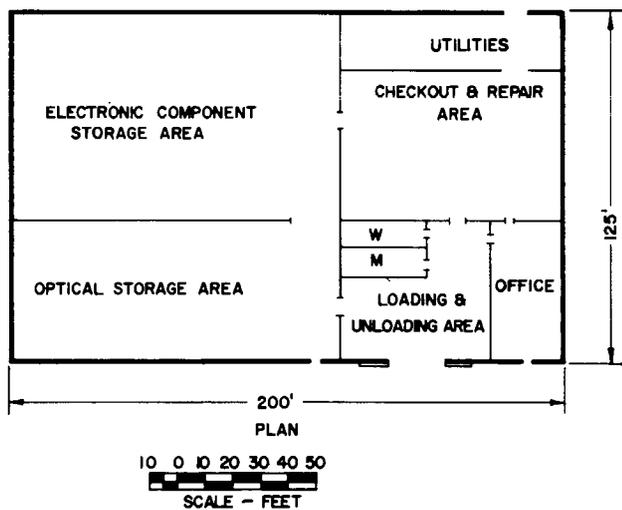
A servicing facility is required to provide the capability for maintaining, repairing, and storing both tracking radar and cameras used to acquire early launch metric and engineering sequential data. Electronic and optical equipment of this kind contains numerous delicate mechanisms which normally require frequent adjustment and continuous protection from corrosion. Remotely controlled television cameras which provide engine-start and lift-off data must be located close to the launch pad and, consequently, require extensive overhaul after each launch. To avoid degeneration from unnecessary exposure to moisture and weather, such equipment must be placed in air-conditioned, humidity-controlled storage between missions.

Services similar to those to be provided in the proposed facility are presently being performed at the technical laboratory, Patrick Air Force Base. This laboratory is inadequate, spacewise, to handle the additional workload that will be imposed on it by the launch complexes in the Merritt Island launch area. The existing laboratory is also too far removed for efficient servicing of equipment in the new area.

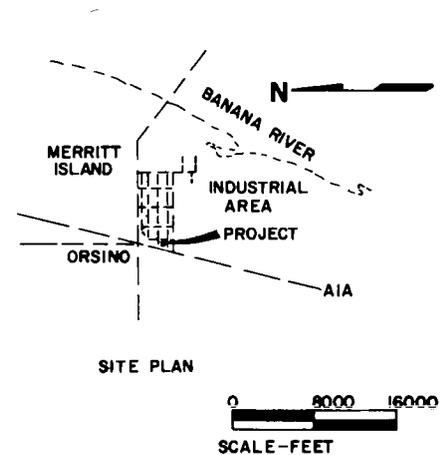
LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

OPTICAL AND ELECTRONIC COMPONENT SERVICING FACILITY



PERSPECTIVE



CF 6-87

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$90,000
Clearing, grubbing, and grading.....	\$13,000
Access roads and parking area.....	55,000
Utility extensions.....	22,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	625,000
Building..(25,000 square feet at \$25.00 per square foot).....	625,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	40,000
Shop equipment.....	20,000
Furniture and fixtures.....	20,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>100,000</u>
Total estimated cost.....	<u>\$855,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

RANGE ENGINEERING AND ADMINISTRATION BUILDING

DESCRIPTION:

This project provides for the construction of a building of approximately 20,000 square feet, consisting of engineering and administration space for the Range support facilities and the Range contractors in the Merritt Island area. It will be a two-story irregularly shaped masonry building, with overall dimensions of approximately 68 feet by 160 feet. The building will be air-conditioned, and heat will be supplied by the central heating plant in the area. A fire alarm system within the building will be provided. Site development, parking, access roads, and utilities, such as water, sewer, electric power, and communications, are included to make the facility operable. The building will include space for about 150 of the 900 contractor personnel programmed for fiscal year 1964. These 150 personnel will perform operations, maintenance, administrative, and technical management functions for the support of all facilities and operations at the Merritt Island area of Launch Operations Center. The building will be constructed in the Merritt Island Industrial Area as indicated in the sketch on the next page.

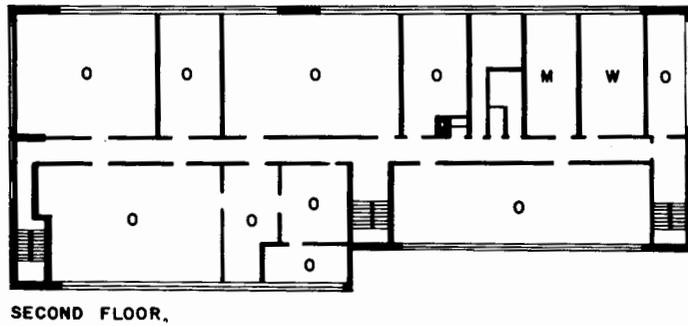
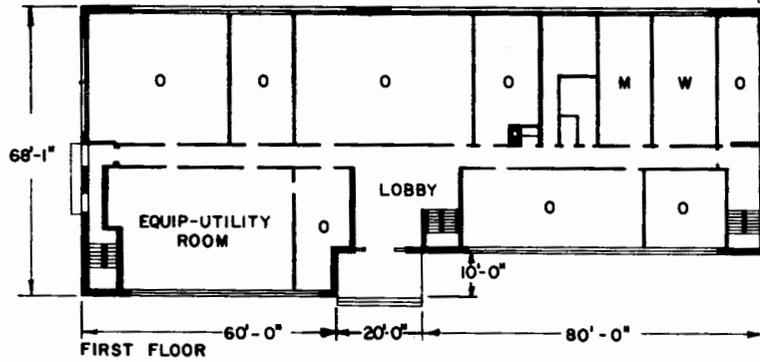
JUSTIFICATION:

Range operations and maintenance functions are furnished by contracts negotiated and supervised by the Air Force. By the end of the fiscal year 1964, approximately 900 persons will be involved in range support operations in the new area, and more will be added as the program progresses. The present Range Headquarters at the Patrick Air Force Base and the Range administrative facilities at Cape Canaveral are overcrowded and can support only the continuing work load of the existing area. Since there is no facility available which can accommodate the required number of personnel and the work load created by the new area, additional contractor personnel and space are required to handle this load.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$65,000
Clearing, grubbing, and grading.....	\$15,000
Access roads and parking area.....	35,000
Utility extensions.....	15,000

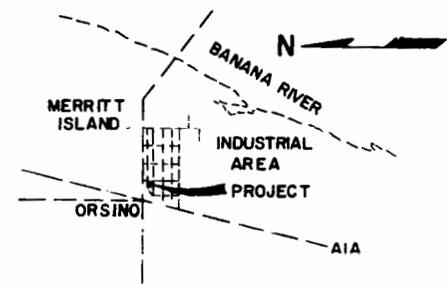
LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
 RANGE ENGINEERING AND ADMINISTRATION BUILDING



PLAN



C/F 6-90



C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	\$440,000
Building..(20,000 square feet at \$22.00 per square foot).....	\$440,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	30,000
Office equipment and furniture.....	30,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>70,000</u>
Total estimated cost.....	<u>\$605,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

RANGE INSTRUMENTATION SITES

DESCRIPTION:

This project proposes the construction of instrumentation sites essential to the launch of advanced space vehicles. The project includes the required roads, and utilities to the instrumentation sites and roads and utilities to other sites to be constructed by the Department of Defense. The instrumentation sites will obtain vital metric data for the early launch phase, for launch area safety, and for post-flight analysis and documentation. NASA-funded sites include universal camera pads, an air route surveillance radar, a high-resolution tracking radar, and meteorological towers. U. S. Air Force-funded sites in the new area will include a command control pad, ballistic camera sites, and a frequency control and analysis facility.

Universal camera pads: Eighteen raised concrete positions are proposed in the Merritt Island Industrial Area to accommodate mobile optical instrumentation. The project includes the construction of six such sites and roads, utilities, and communications for all eighteen. Twelve of the sites will be constructed with U.S. Air Force funds. The project does not include the mobile equipment which will use these sites. Since most optical instrumentation either is remotely controlled or is connected to the central computer for near-real time readout and recording, each site will have multiple-conductor cabling and connections to the communications network, as well as a power supply. The sites will be selected for clear lines of sight to launch pads in the coverage area, and access roads will be built to each site so that mobile equipment can be moved into and out of each site.

Air route surveillance radar: A permanent two-story building, will be constructed with dimensions of approximately 25 feet by 75 feet and gross area of approximately 3,650 square feet, to house an S-band radar for control of air space around the new launch area. The structure, which will be located on Merritt Island, will have a reinforced concrete frame with concrete block curtain walls, and a separate foundation antenna mount and radome. The radar will have a track-while-scanning capability and will be used to identify aircraft and control launch support and instrumentation checkout aircraft operating in the new launch area airspace. The building will be air-conditioned, and heat will be furnished from within the building. A fire alarm system will be installed.

The radar, antenna foundation, and all roads, utilities, and communications required to make the facility completely operable are included.

High resolution tracking radar pads and supporting facilities:

The project includes the construction of two boresight tower foundations and two mobile van-mounted radar pads, with roads, utilities, and communications required to make the facilities completely operable. One of the pads will be located behind the Advanced Saturn launch area, and the other behind the Nova area. The sites selected will permit line-of-sight coverage by both radars of launches from either the Advanced Saturn or Nova complexes. The radars will be modified Nike-Ajax systems with infra-red and television added. Mounted on vans, they will be moved from their sites to the Industrial Area for storage, checkout, and maintenance. In operation, they will supply real-time-tracking information for range safety in the early launch period.

Meteorological towers: Two 500-foot high meteorological towers, including foundations and meteorological equipment, will be provided. This equipment will be used to collect launch-point micro-meteorological data for launch area safety, including temperature-differential, humidity, and wind data for protection against accidental release of toxic or radioactive material. One of the towers will be located in the Advanced Saturn launch area, and the other in the Nova launch area. The project includes preparation of the sites, roads, and utilities as required to make the facilities completely operable.

Besides these 500-foot towers, an array of 54-foot masts will be distributed through the new area to define the horizontal distribution of temperature and wind fields in the launch area as related to diffusion. Utilities and roads for these masts are included in this project.

Communications, roads, and utilities: NASA has agreed with the Department of Defense to furnish access roads and utilities to all sites in the new area regardless of whether funded by NASA or the Department of Defense. The Department of Defense sites for which such services are included in this project are the command control pad, the mobile synchronous ballistic camera system sites, the frequency control and analysis facilities, and weather data acquisition sites.

Location plans of the facilities and installations covered by this project and a sketch of the air surveillance radar building are presented on the following three pages.

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

RANGE INSTRUMENTATION FACILITIES

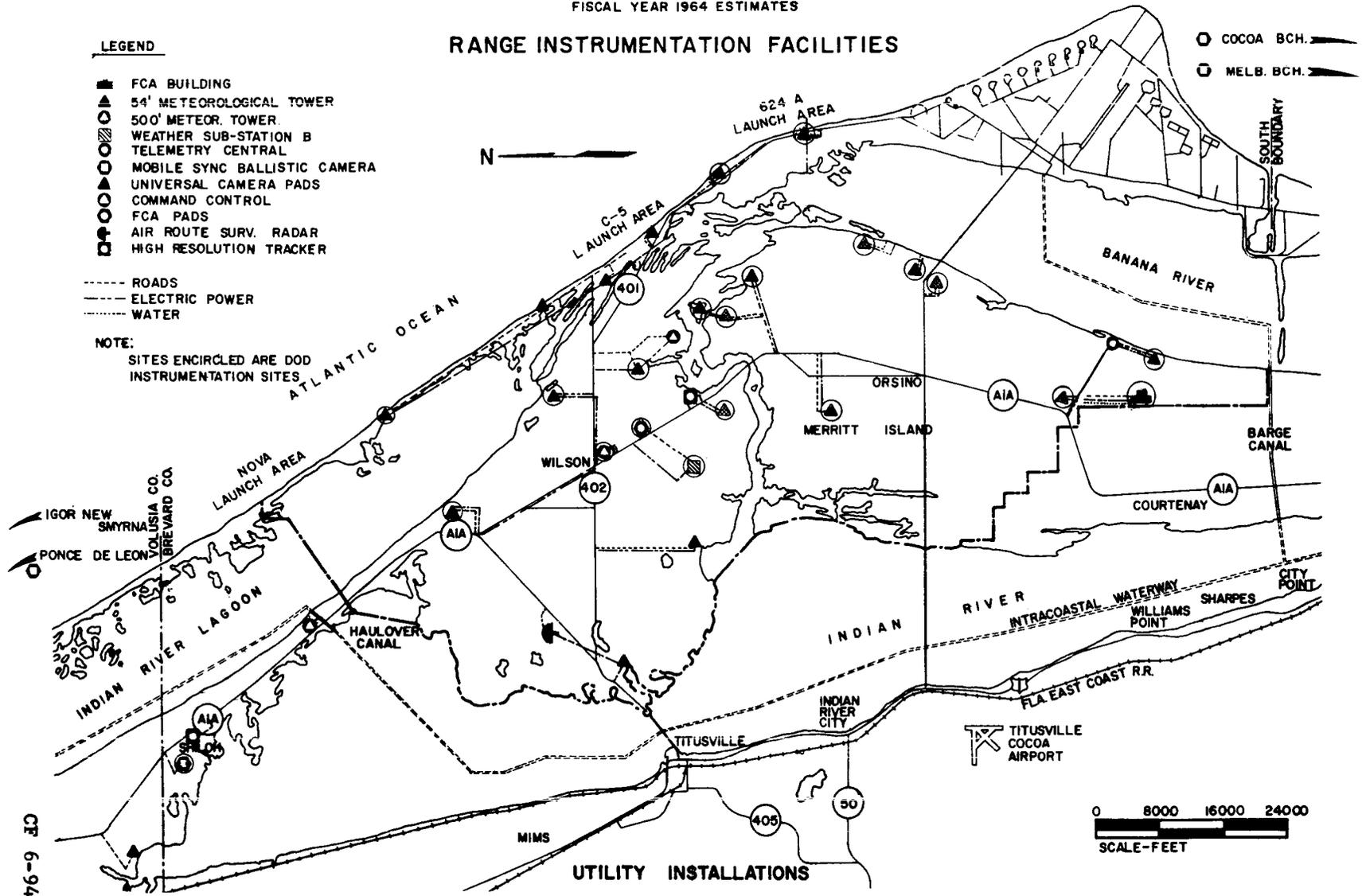
TELEMETRY SITE - GBH
& VERO BCH.

LEGEND

- FCA BUILDING
- ▲ 54' METEOROLOGICAL TOWER
- 500' METEOR. TOWER
- ◐ WEATHER SUB-STATION B
- TELEMETRY CENTRAL
- ◐ MOBILE SYNC BALLISTIC CAMERA
- UNIVERSAL CAMERA PADS
- COMMAND CONTROL
- FCA PADS
- AIR ROUTE SURV. RADAR
- HIGH RESOLUTION TRACKER

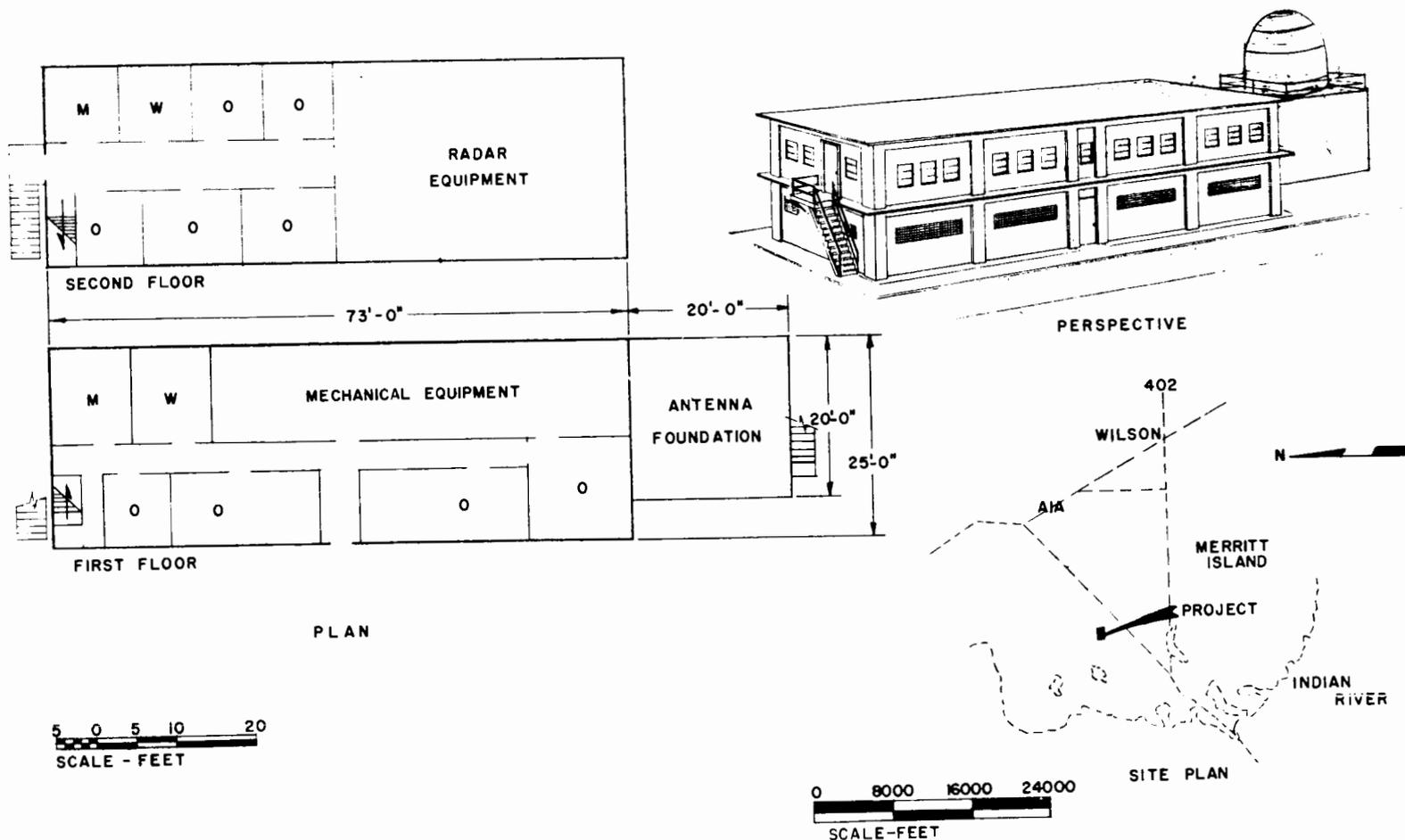
- - - - ROADS
- - - - ELECTRIC POWER
- - - - WATER

NOTE:
SITES ENCIRCLED ARE DOD
INSTRUMENTATION SITES



CF 6-94

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
 RANGE INSTRUMENTATION SITES



AIR ROUTE SURVEILLANCE RADAR

CF 6-95

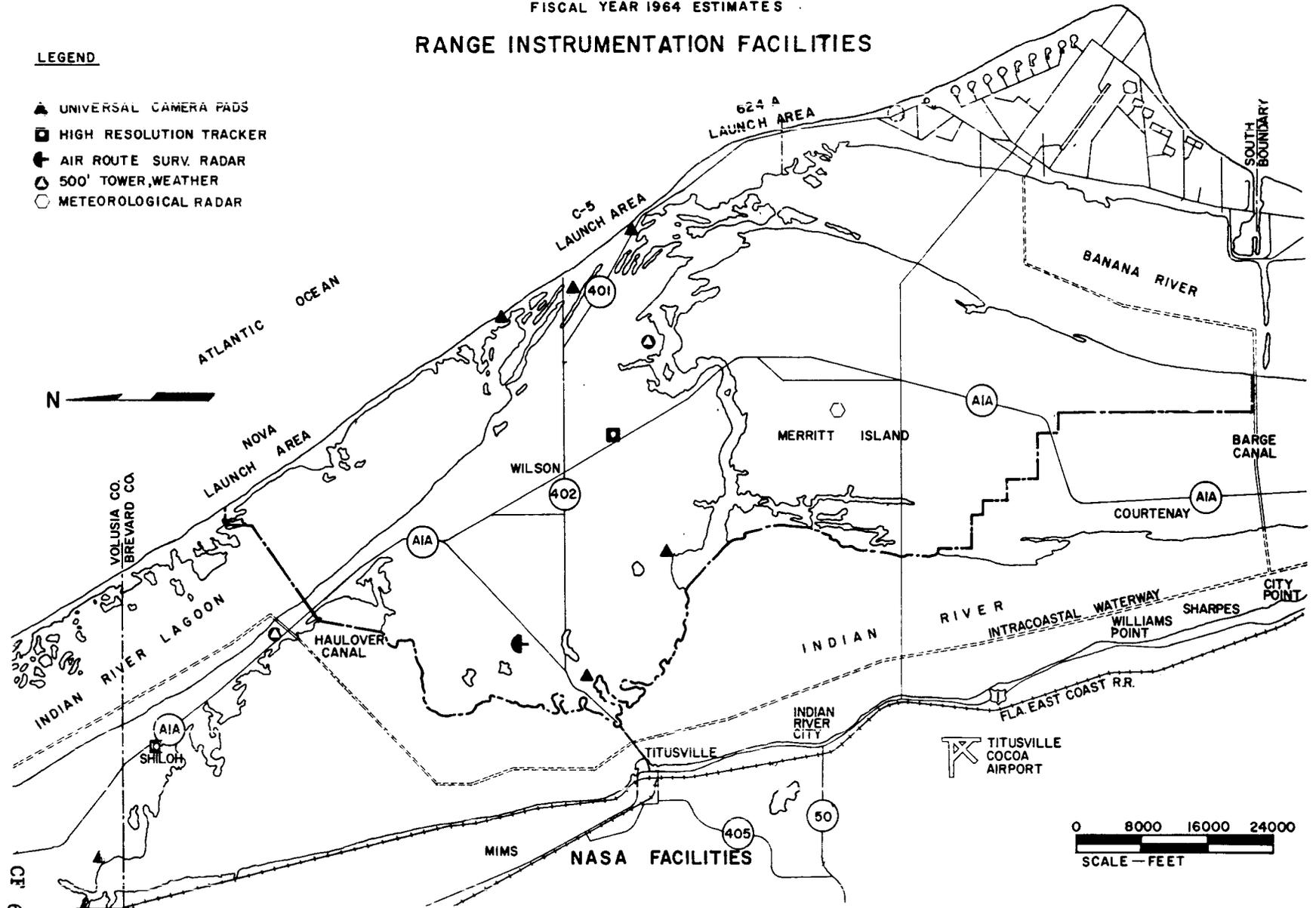
LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

RANGE INSTRUMENTATION FACILITIES

LEGEND

- ▲ UNIVERSAL CAMERA PADS
- HIGH RESOLUTION TRACKER
- ⊖ AIR ROUTE SURV. RADAR
- ⊙ 500' TOWER, WEATHER
- METEOROLOGICAL RADAR



CF 6-96



JUSTIFICATION:

The proposed instrumentation sites are needed because of the expansion of the launch area with the advent of the Advanced Saturn and Titan III programs. Present instrumentation cannot adequately cover launches from these new complexes. More detailed justifications of the individual items follow.

Universal camera pads: Present positions available for mobile optical instrumentation are oriented to cover existing launch complexes. Line-of-sight, range-limitations, and other difficulties arise when present sites are considered for covering new complexes in the NASA Merritt Island launch area. New sites are needed for proper coverage of these complexes. The existing pads will continue to be used for camera support of launches from complexes located in the present Cape Canaveral area.

Air route surveillance radar: The existing air surveillance radar, is of limited range, and is located near the south end of the present Cape area. This radar cannot furnish adequate control of air space about the new launch area which extends northward from the present Cape. Therefore, a new surveillance radar site is required in the new launch area to provide proper coverage of the air space. Without this radar site, a serious gap in the air surveillance net in the launch area could result which could imperil either the launch or the lives of occupants of intruding aircraft.

High-resolution tracking radar pads and supporting utilities: These radars are needed to supply precision real-time data to the Range Safety Officer during the early launch period (from liftoff to 20,000 feet). Other radars do not supply reliable tracking data in this altitude range because of multipath and antenna lobing. The high-resolution trackers, using combined radar and infra-red tracking from liftoff to a point where automatic radar tracking can take over, will provide the precise position information necessary. This may avoid otherwise unnecessary destruction of the launch vehicle due to faulty data displayed from instrumentation which is unreliable at low altitudes. The proper sites for this critical instrumentation are necessary to prevent the premature destruction of a costly vehicle and the attendant loss of property.

Meteorological towers: Large launch vehicles such as the Saturns require that meteorological data vital for safety in the launch area be obtained. Temperature, humidity, and wind patterns near the surface must be known accurately at all times during pre-launch and launch operations.

Present meteorological facilities are not adequate nor accurate enough to fulfill these requirements. Without improved facilities costly over-design of large vehicles could result which could lead to costly delays and uncertainties in launching vehicles using toxic or nuclear fuels.

Utilities and roads: NASA funding of these items has been agreed upon with the Department of Defense to avoid costly duplication of effort. It will be cheaper and more efficient to build the system of roads and utilities for all new instrumentation sites as a single project with subsequent site construction by the agency concerned. The Department of Defense will fund for all comparable work in the existing Cape Canaveral area.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$2,862,000
Clearing and grubbing.....	\$45,000	
Fill and compaction.....	340,000	
Grading and erosion control.....	194,000	
Paved areas for mobile equipment.....	96,000	
Roads (26 miles at \$65,000 per mile).....	1,694,000	
Water and electric power connections.....	493,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		431,000
Air surveillance radar building (3,650 square feet at \$37 per square foot).....	135,000	
Air surveillance antenna foundation.....	15,000	
Boresight tower foundations (2 each at \$40,000).....	80,000	
500-foot meteorological towers (2 each at \$100,500).....	201,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT.....		1,070,000
Air surveillance radar.....	650,000	
Meteorological equipment for two 500-foot towers.....	420,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>460,000</u>
Total estimated cost.....		<u>\$4,823,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

UNMANNED SATELLITE OPERATIONS FACILITY

DESCRIPTION:

This project will consist of the design and construction of an engineering and laboratory building 155 feet by 178 feet. The building will consist of an 8,900 square foot high bay area, 8,900 square feet of shop space, and a two-story wing of laboratory and engineering office space containing 18,380 square feet. The total gross floor area will be 37,380 square feet. A sketch of the facility is shown on the following page.

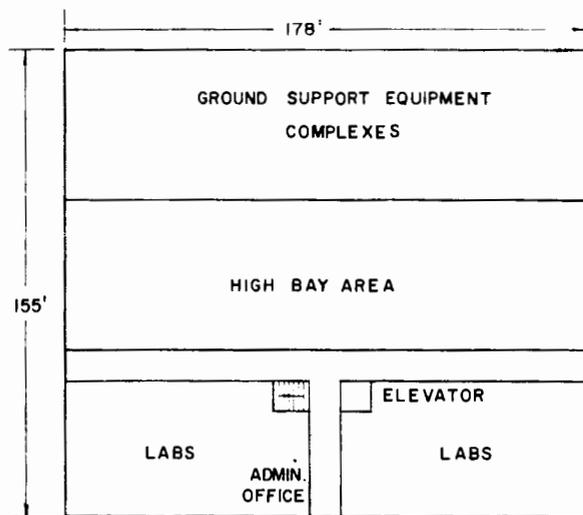
The facility will be constructed of reinforced concrete with masonry curtain walls. The high bay area will be of steel frame construction, with masonry and asbestos siding for the curtain walls. Two 15-ton bridge cranes, each having a hook height of approximately 45 feet will be provided in the high bay area for the handling of spacecraft. The facility is to be designed specifically to meet the requirements for field preparation of unmanned satellites of the size and complexity of the Eccentric-orbiting Geophysical Observatory, Orbiting Astronomical Observatory, Surveyor, and Voyager. The facility will be located immediately west of the spacecraft facility in the existing Industrial Area. The location has been selected for compatibility to present facilities and for proximity to the Atlas-Agena, Centaur, and Saturn launch complexes.

JUSTIFICATION:

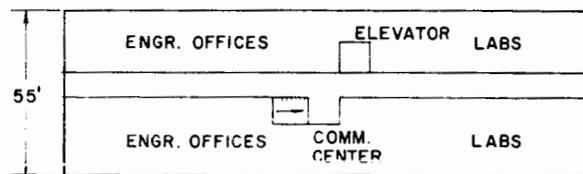
The facility will provide the necessary working space for the preflight preparation, system testing and final assembly of unmanned satellites under closely controlled environments of temperature, humidity, pressure, fungus and spore-free ambients, and radiation to permit close calibration of engineering test and scientific instrumentation under simulated space flight conditions.

The existing unmanned satellite preparation facilities at the Launch Operations Center do not provide enough space to meet the 1965 calendar year flight schedules. The inadequacy of the existing facilities is further emphasized by the concurrent requirements of Atlas-Agena and Centaur-based flight programs, including earth orbiter, lunar soft landing, and Venus and Mars fly-by missions. Provisions must be made for the simultaneous preparation of as many as four satellites with the additional possible requirement of providing back-up satellites. Longer preparation times, plus overlapping launching schedules for lunar and planetary missions, will create a requirement for additional preparation and checkout facilities.

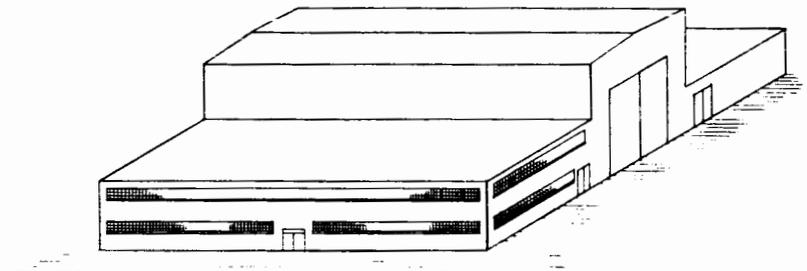
LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
UNMANNED SPACECRAFT OPERATIONS FACILITY



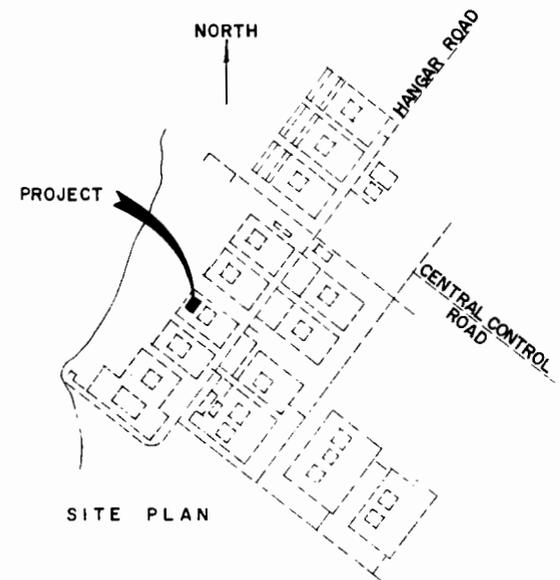
FIRST FLOOR PLAN



SECOND FLOOR PLAN



PERSPECTIVE



SITE PLAN

CF 6-100

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$250,000
Clearing, grubbing, and filling.....	\$20,000	
Roads and parking areas.....	51,000	
Fencing.....	4,000	
Domestic and fire protection water lines.....	25,000	
Sewage lines.....	20,000	
Steam lines.....	20,000	
Industrial power lines.....	45,000	
Critical power lines.....	35,000	
Communications cable line.....	25,000	
Lighting protection.....	5,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,020,000
Building (37,380 square feet at \$27.30 per square foot).....	1,020,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		220,000
Bridge cranes (two).....	100,000	
Laboratory and shop equipment.....	100,000	
Furniture.....	20,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>190,000</u>
Total estimated cost.....		<u>\$1,680,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

UTILITY INSTALLATIONS - NEW AREA

DESCRIPTION:

This proposed project requests additional primary utilities for the new area on Merritt Island in support of the Manned Lunar Landing program.

The fiscal year 1963 program provided for the initial construction of primary utilities in the new area to meet established schedules. This project supplements the fiscal year 1963 project and includes items which did not require early completion plus new requirements to support development of the new area as proposed for the fiscal year 1964. When additional facilities are requested in later programs, additional support utilities, as required, will be programmed concurrently.

The project includes the following items:

Primary interior roads: The construction of the following interior roads is required:

- (1) Nine miles of 24-foot wide, two-lane asphalt road from the industrial area at Orsino to Wilson. These two lanes will parallel the existing two lanes of former State Road A1A (Merritt Island Road) between those points. A two-lane fixed bridge at Banana Creek is included as well as a new two-lane bridge to replace the old existing two-lane bridge of limited capacity (8 tons).
- (2) Three and one-half miles of 22-foot wide asphalt road from the Orsino Road near Banana River, northeasterly, to Banana Creek.

Industrial area roads: Approximately 3.5 miles of 24-foot wide roads with asphaltic concrete surface will be built in the new Industrial Area. Culverts, roadside drainage ditches, and other normal appurtenances are included. These roads will complete the primary roadway net within the Industrial Area and will serve seven new principal facilities.

Water mains: The following additions to the primary water distribution system are required:

- (1) Approximately 2½ miles of 16-inch pipe will be installed from the main at former State Road A1A

and Orsino Road, easterly to the new road serving the Banana Creek area. At this point, approximately two miles of 10-inch pipe will be continued to the Apollo static test stand area. A booster pump station will also be provided,

- (2) Approximately 3 miles of 10-inch pipe will be installed from the main along former State Road A1A near Gate 2, to the central telemetry facility.
- (3) A booster pump station will be installed along the pipe line between the Industrial Area and the vertical assembly building.

Industrial area utilities: The primary utility systems in the Industrial Area will be extended to serve the new facilities that will be constructed under the fiscal year 1964 program. The scope of work consists of approximately three miles of electric power lines, two miles of water mains, two miles of heat mains, and three miles of sewer mains.

Electric power: Improvements will consist of constructing the following:

- (1) Approximately 15 miles of 13.2 kv power transmission line from the existing line on the east bank of Indian River at State Road 402 to Wilson, thence south on former State Road A1A to the vertical assembly building in the launch complex No. 39 area, thence to the Industrial Area.
- (2) Approximately one mile of 13.2 kv line from the repeater building on Orsino Road near Banana River, east to the Bascule Bridge at the barge canal. Also, from the repeater building approximately three miles of 13.2 kv line, north to the Apollo static test stand and instrumentation sites located along Banana River.

Communications: The project includes installation of:

- (1) Approximately five miles of 24-way,

four-inch duct from the central telephone office, north along former State Road A1A to the cable terminal building at launch complex No. 39.

- (2) Approximately 2.3 miles of six-way, four-inch duct from Orsino Road repeater station, north to the Apollo static test stand.
- (3) Installation of communications equipment and cabling relative to the new facilities included in the fiscal year 1964 program.

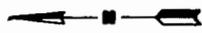
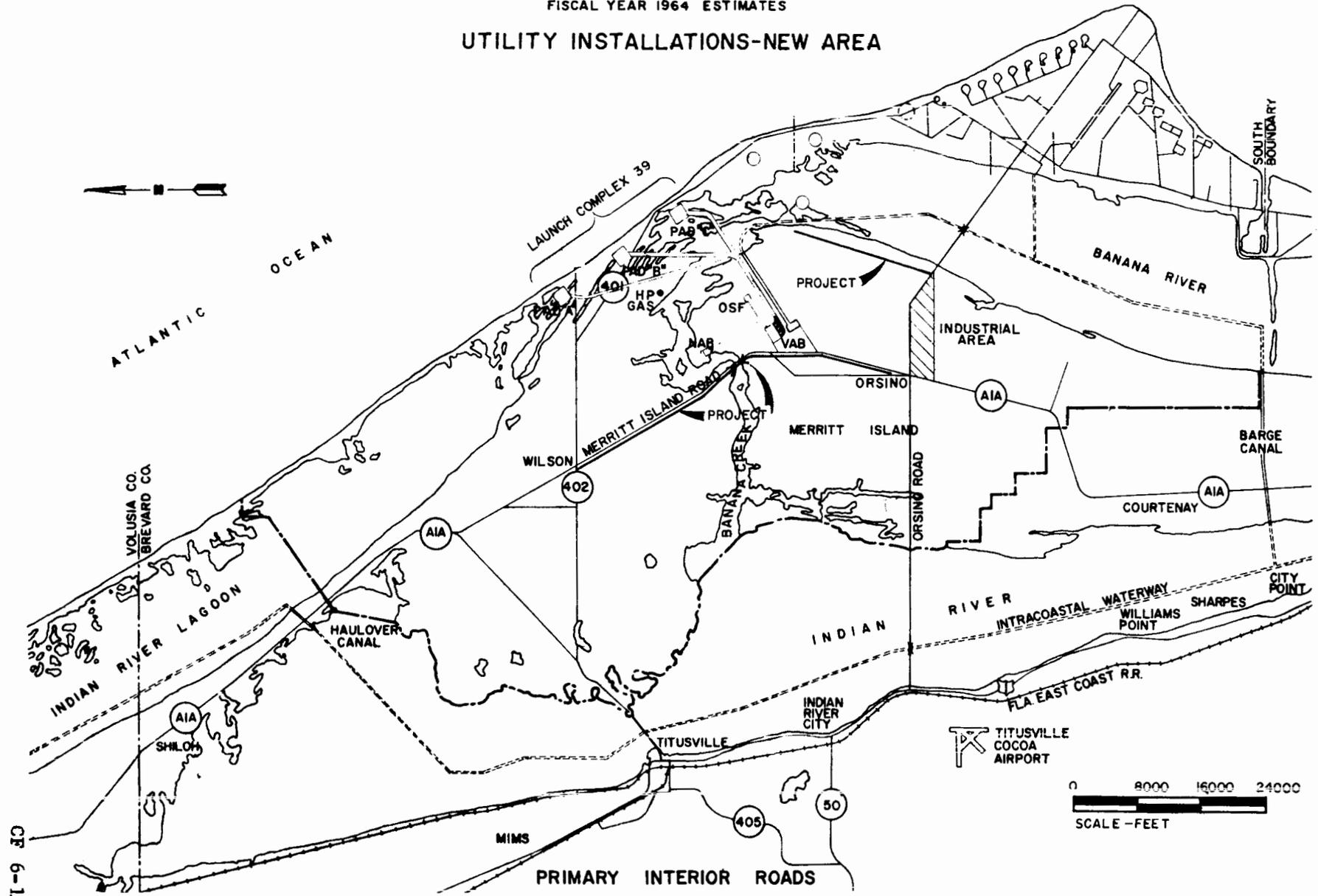
Area improvement: This item provides for general site development in the new area for rodent and insect control. The areas in which the work will be performed are the undeveloped areas immediately adjacent to occupied areas. Other locations which influence the habitability of the new area will also be included. The work consists essentially of clearing, grubbing, diking of low areas, ditching, and filling. Combinations of the above methods may be used in any area as required to control the rodent and insect problem. The above is part of a long-term permanent solution of the environmental problem in this region. Interim short term measures, such as poisoning and spraying, are being pursued separately under the general maintenance program.

Location plans outlining the scope of the work covered by this project are presented on the following five pages.

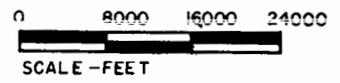
JUSTIFICATION:

Primary interior roads: Projected traffic counts from studies by the Air Force show that a daily traffic count of 7,000 to 10,000 vehicles can be expected on the proposed road in the period from 1965 through 1970. These traffic loads are considerably over the 5,000 vehicles per day considered by the Bureau of Public Roads to be required to fully justify a four (4) lane road. This is the only road past the vertical assembly building at complex No. 39. Spacecraft assembled in the Industrial Area will be transported over Merritt Island Road to the vertical assembly building. The width of the carrier is 17 feet, which will take the full width of a two-lane road, thus greatly hindering the movement of traffic.

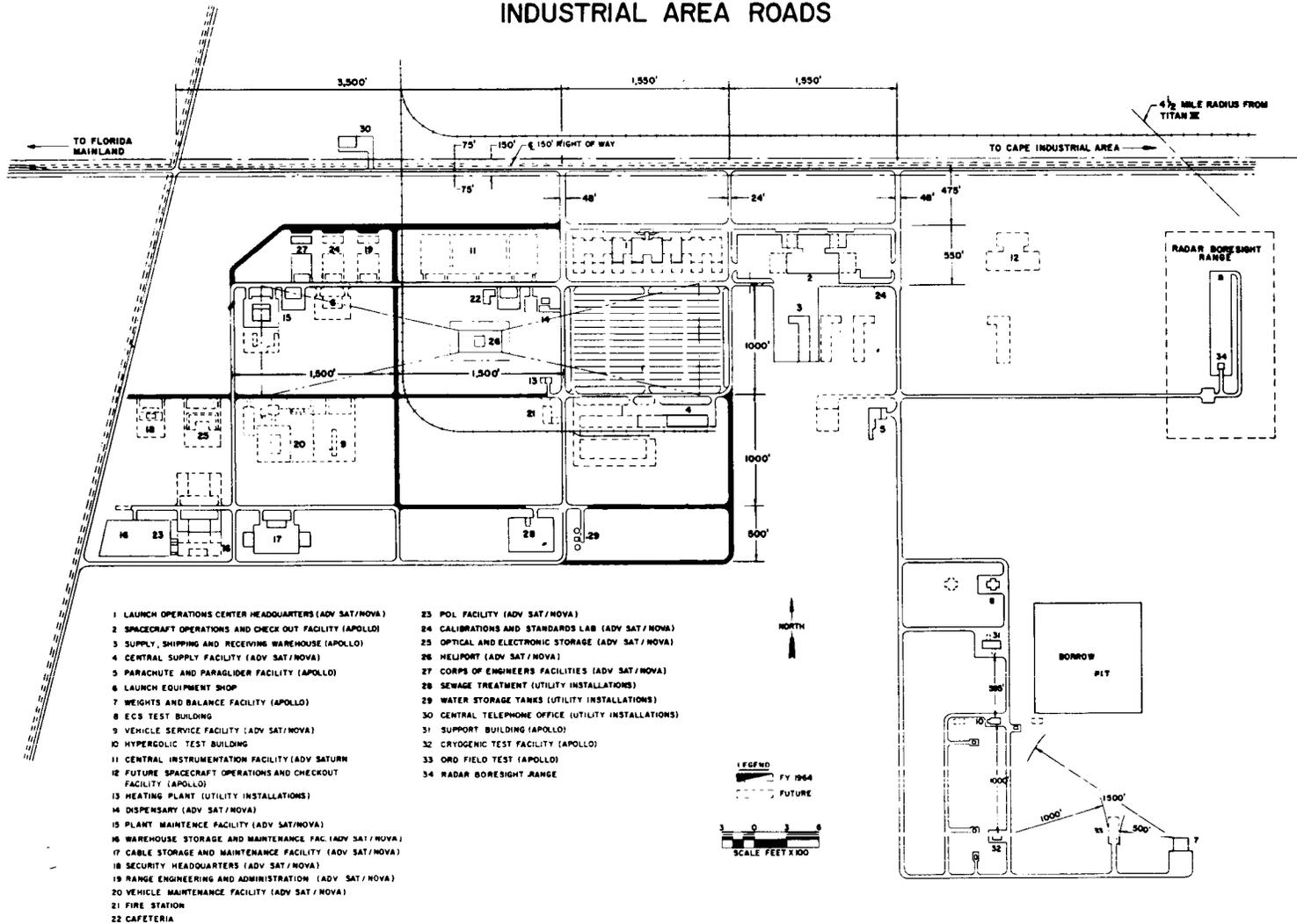
LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
 UTILITY INSTALLATIONS-NEW AREA



CF 6-105

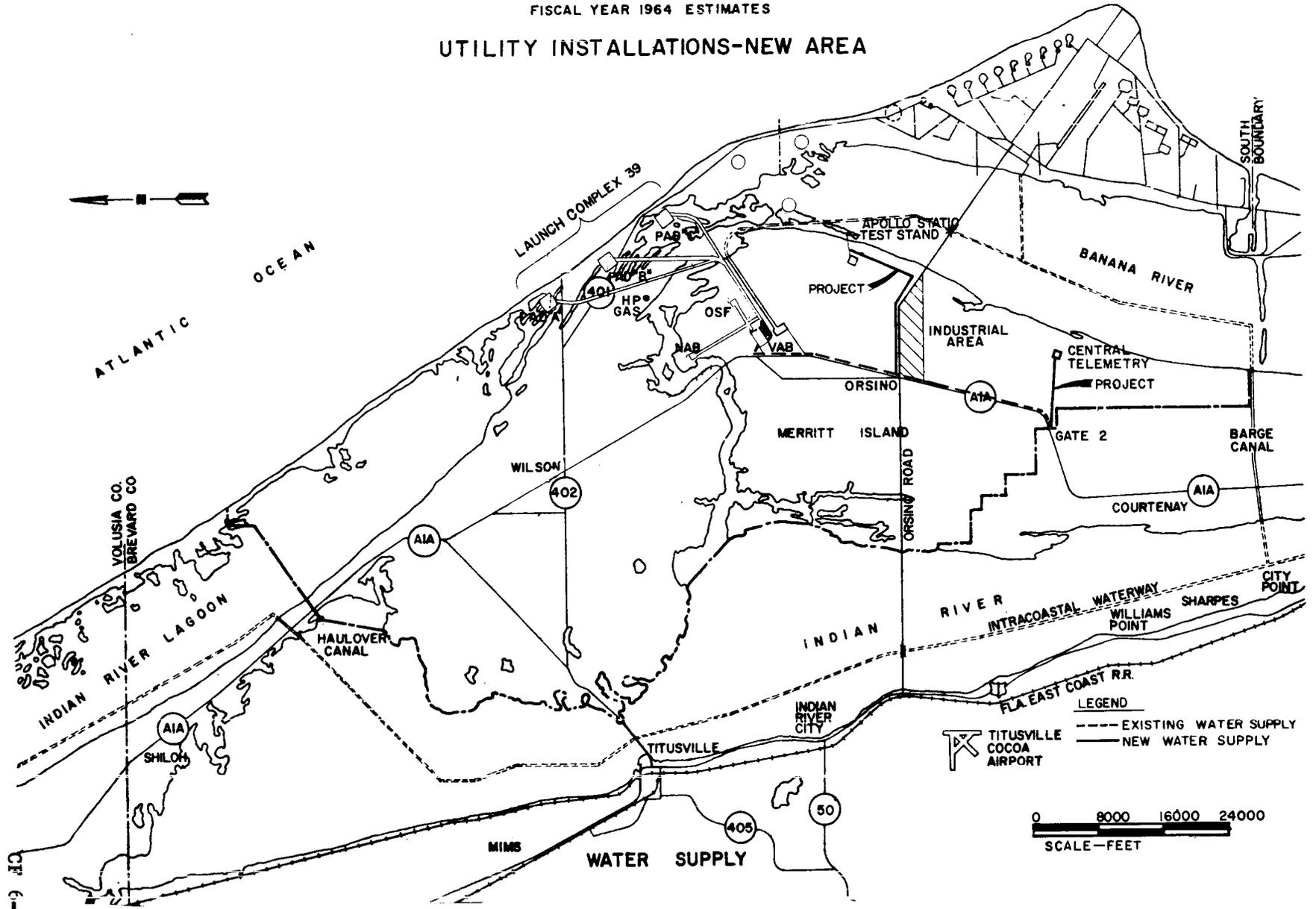


LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES
UTILITY INSTALLATIONS-NEW AREA
INDUSTRIAL AREA ROADS



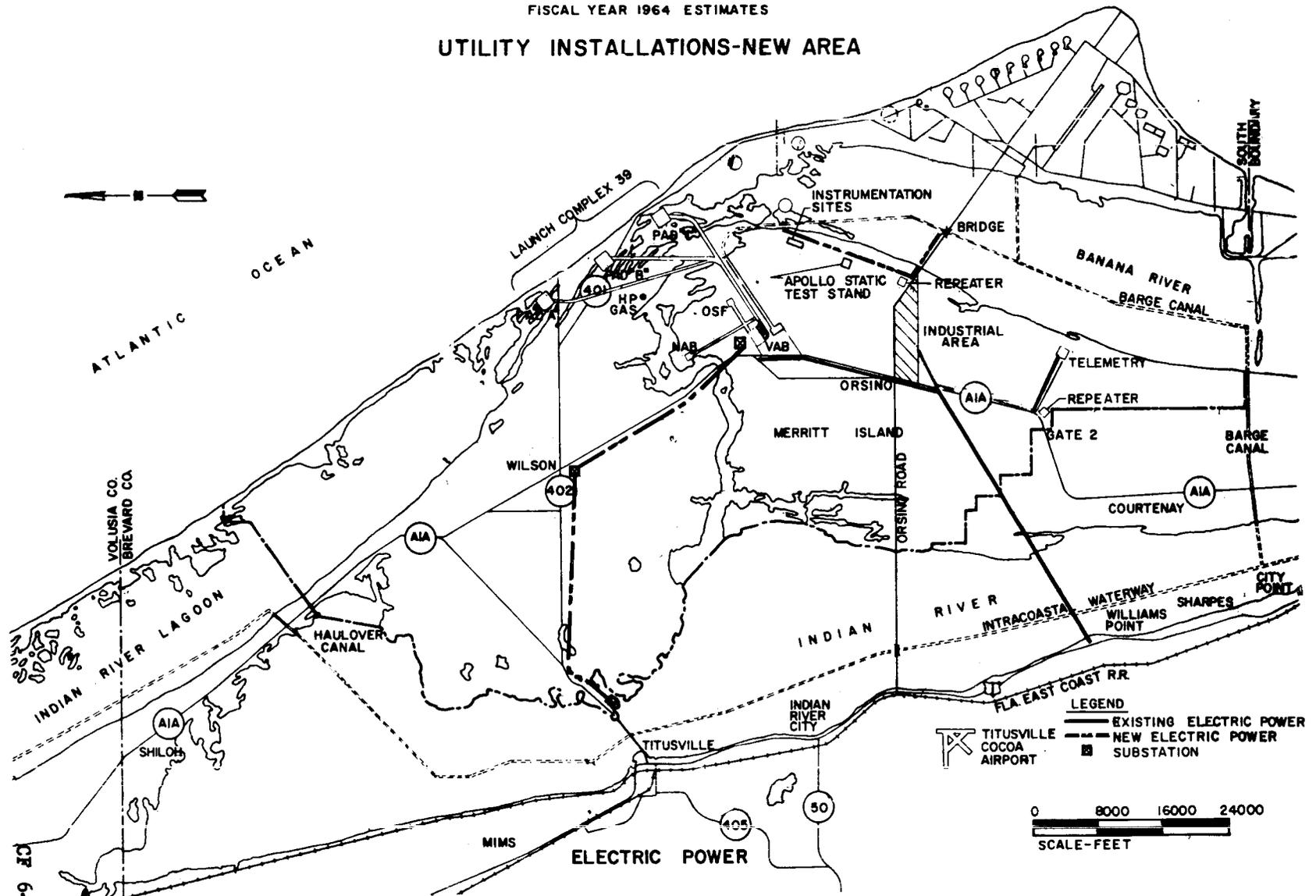
- | | |
|--|---|
| 1 LAUNCH OPERATIONS CENTER HEADQUARTERS (ADV SAT/NOVA) | 25 POL FACILITY (ADV SAT/NOVA) |
| 2 SPACECRAFT OPERATIONS AND CHECK OUT FACILITY (APOLLO) | 26 CALIBRATIONS AND STANDARDS LAB (ADV SAT/NOVA) |
| 3 SUPPLY, SHIPPING AND RECEIVING WAREHOUSE (APOLLO) | 27 OPTICAL AND ELECTRONIC STORAGE (ADV SAT/NOVA) |
| 4 CENTRAL SUPPLY FACILITY (ADV SAT/NOVA) | 28 HELIPORT (ADV SAT/NOVA) |
| 5 PARACHUTE AND PARAGLIDER FACILITY (APOLLO) | 29 CORPS OF ENGINEERS FACILITIES (ADV SAT/NOVA) |
| 6 LAUNCH EQUIPMENT SHOP | 30 SEWAGE TREATMENT (UTILITY INSTALLATIONS) |
| 7 WEIGHTS AND BALANCE FACILITY (APOLLO) | 31 WATER STORAGE TANKS (UTILITY INSTALLATIONS) |
| 8 ECS TEST BUILDING | 32 CENTRAL TELEPHONE OFFICE (UTILITY INSTALLATIONS) |
| 9 VEHICLE SERVICE FACILITY (ADV SAT/NOVA) | 33 SUPPORT BUILDING (APOLLO) |
| 10 HYPERGOLIC TEST BUILDING | 34 CRYOGENIC TEST FACILITY (APOLLO) |
| 11 CENTRAL INSTRUMENTATION FACILITY (ADV SATURN) | 35 ORD FIELD TEST (APOLLO) |
| 12 FUTURE SPACECRAFT OPERATIONS AND CHECKOUT FACILITY (APOLLO) | 36 RADAR BORESIGHT RANGE |
| 13 HEATING PLANT (UTILITY INSTALLATIONS) | |
| 14 DISPENSARY (ADV SAT/NOVA) | |
| 15 PLANT MAINTENANCE FACILITY (ADV SAT/NOVA) | |
| 16 WAREHOUSE STORAGE AND MAINTENANCE FAC. (ADV SAT/NOVA) | |
| 17 CABLE STORAGE AND MAINTENANCE FACILITY (ADV SAT/NOVA) | |
| 18 SECURITY HEADQUARTERS (ADV SAT/NOVA) | |
| 19 RANGE ENGINEERING AND ADMINISTRATION (ADV SAT/NOVA) | |
| 20 VEHICLE MAINTENANCE FACILITY (ADV SAT/NOVA) | |
| 21 FIRE STATION | |
| 22 CAFETERIA | |

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
 UTILITY INSTALLATIONS-NEW AREA



CF 6-107

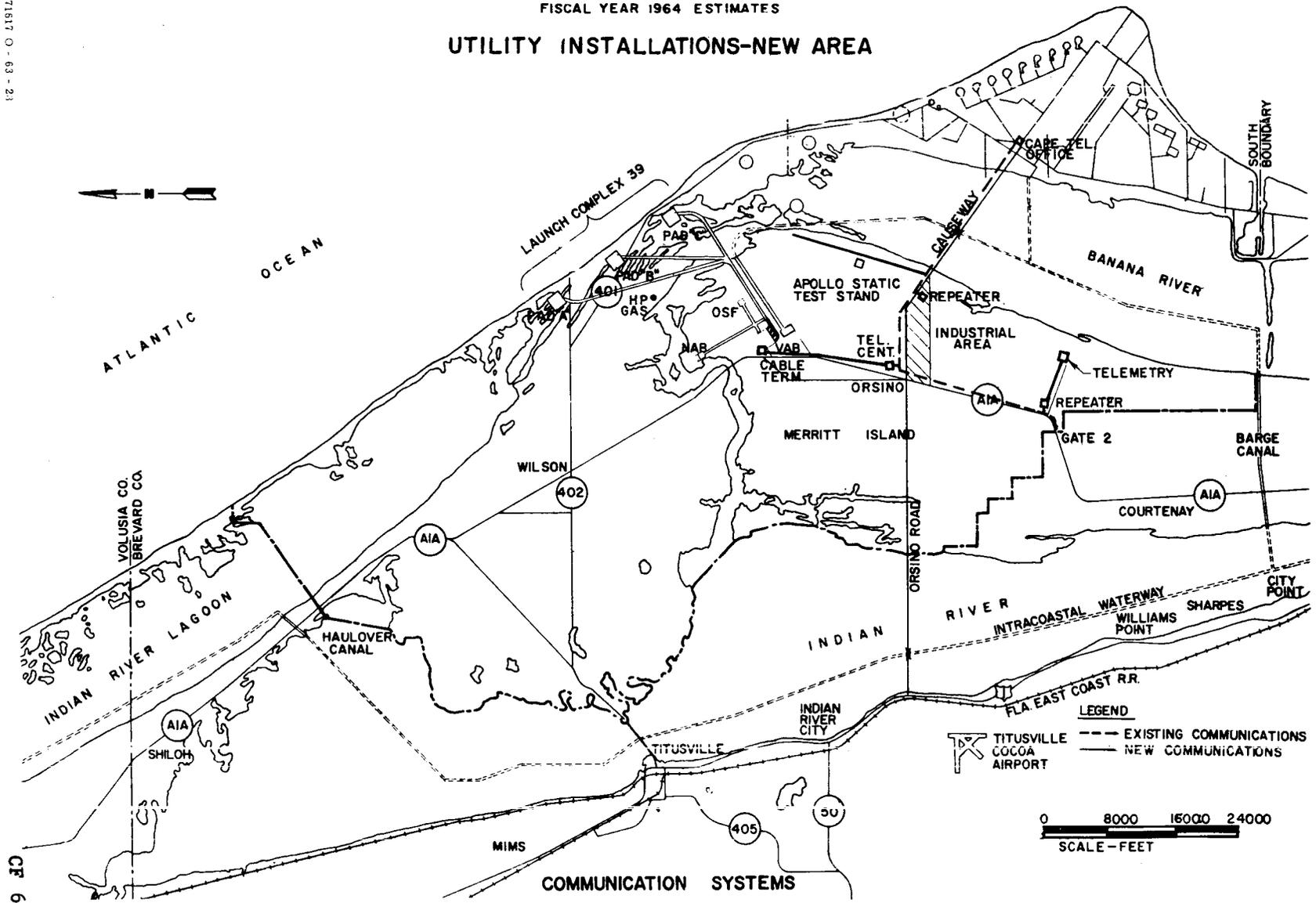
LAUNCH OPERATIONS CENTER
FISCAL YEAR 1964 ESTIMATES
UTILITY INSTALLATIONS-NEW AREA



CF 6-108

LAUNCH OPERATIONS CENTER
 FISCAL YEAR 1964 ESTIMATES
 UTILITY INSTALLATIONS-NEW AREA

671617 O - 63 - 23



LEGEND
 TITUSVILLE COCOA AIRPORT
 --- EXISTING COMMUNICATIONS
 --- NEW COMMUNICATIONS

0 8000 16000 24000
 SCALE - FEET

CF 6-109

COMMUNICATION SYSTEMS

Without this improvement, traffic conditions will be intolerable and travel delays will result in an excessive loss of time.

Instrumentation sites will be located along the Banana River northward of the Ossino Road. Those sites must be provided with vehicle access. If no such access is provided the proposed sites will not be useable for the purposes intended.

Industrial area roads: Additions to the road net at the Industrial Area are needed to permit access to the new buildings now being located beyond the limits of the road net and to complete the network of interior Industrial Area roads so that fire trucks, ambulances, and vehicular traffic will have the shortest route feasible from place to place.

Water supply: The Apollo static test stand was initially sited near the existing water mains. Subsequent developments necessitated resiting this facility to a remote section to provide proper clearance distances. This change was made after the submission of the fiscal year 1963 program and therefore provisions for extending the water mains were not included. The schedule for the first test will allow this service to be installed during the fiscal year 1964. It is essential that water be provided for cooling purposes during the tests.

The initial plan to furnish the water supply for the central telemetry facility was from a separate well at the building site. Subsequent investigations have indicated that this is not feasible because of the quantity of water involved and the excessive maintenance connected with the operation of this type of system. The occupancy schedule for this facility will allow this utility requirement to be furnished in the fiscal year 1964 time frame.

The pump station is needed to maintain the pressure to the launch complex No. 39. Draw-offs required for the new facilities to be constructed in the Industrial Area will substantially reduce the water pressure in the section of the system which supplies complex No. 39.

Industrial area utilities: Additions to the primary utility systems are required to provide those services to the new buildings included in the fiscal year 1964 program which are sited away from existing mains.

Electric power: The extension of the 13.2 kv line to connect to a power source at Titusville will furnish an additional source of power for emergency use in the new area in case of a power outage from the Florida Power and Light source, and at the same time furnish power to instrumentation sites along the route. This item also provides necessary power to instrumentation facilities to be located at strategic points in the area and to the Apollo static test stand.

Communications: The additional work proposed is necessary to connect the outlying instrumentation sites and facilities to be constructed in the fiscal year 1964 program, and the Apollo static test facility, with the existing facilities so that the data gathered can be made available at the use points.

Area improvements: The new area, in a large part, is native undeveloped land. Much is swampy and heavily overgrown. The mosquito situation is so serious that habitation during certain times of the year is barely possible. Rats, mice, and snakes are also prevalent. By means of the proposed development, the problem can be brought under control. Without proper control, a serious health problem from malaria, encephalitis, and other mosquito-carried diseases may develop.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$8,985,000
Primary interior roads.....	\$3,305,000
9.0 miles of new two-lane road and bridges, Orsino to Wilson.....	\$2,675,000
3.5 miles at Banana River Causeway northward.....	630,000
Industrial Area roads, 3.5. miles.....	560,000
Water mains.....	700,000

Industrial area utilities.....		\$1,010,000
Electrical distribution		
system.....	\$260,000	
Water distribution		
system.....	155,000	
Heating distribution		
system.....	455,000	
Sewage collection		
system.....	140,000	
Power transmission lines and sub-		
stations.....		600,000
Communications.....		1,400,000
13,200 linear feet of 6-way		
duct (\$10 per linear		
foot).....	132,000	
26,400 linear feet of 24-		
way duct (\$42 per linear		
foot).....	1,108,000	
Miscellaneous system		
items.....	160,000	
Area improvements.....		1,350,000
30 square miles of		
shoreline at \$40,000		
per square mile.....	1,200,000	
5 square miles of interior		
land at \$30,000 per		
square mile.....	150,000	
Facility site development and utility		
installations.....		60,000
Site preparation.....	30,000	
Utility connections.....	30,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		60,000
Water pumping stations (two, 1,500		
square feet at \$20 per square		
foot).....		60,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS....		13,201,000
Water pumps.....		50,000
Communications equipment and cable		
system.....		13,150,000
Outside plant cable		
(500 miles).....	8,663,500	
Video voice and		
telephone service		
(100 circuit		
transmission).....	3,246,100	

Video switching system...	\$600,000	
Telephone instruments, video receivers, and cameras.....	100,000	
Operating spare parts....	200,000	
Intercom system.....	126,400	
Public address system....	214,000	
Office equipment and furniture.....		\$1,000

E. DESIGN AND ENGINEERING SERVICES.....		\$1,509,000
Total estimated cost.....		<u>\$23,755,000</u>

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

VEHICLE MAINTENANCE AND SERVICE FACILITIES

DESCRIPTION:

This project proposes the construction of two vehicle maintenance facilities in the Merritt Island Industrial Area. Sketches of the two facilities are presented on the following two pages. One facility, hereinafter referred to as the vehicle maintenance facility, is required for use by the Range contractor, and the other, hereinafter referred to as the vehicle service facility, will be used by the contractor who will furnish passenger and freight services. A more detailed description of each facility follows.

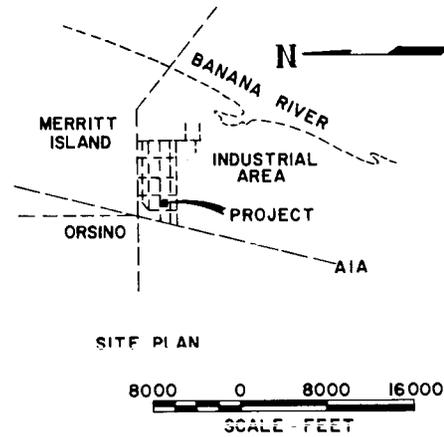
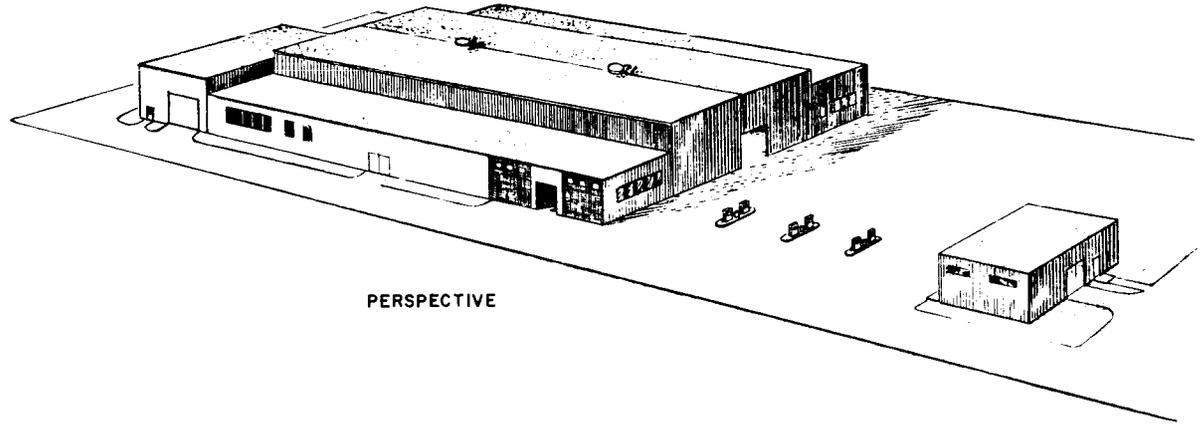
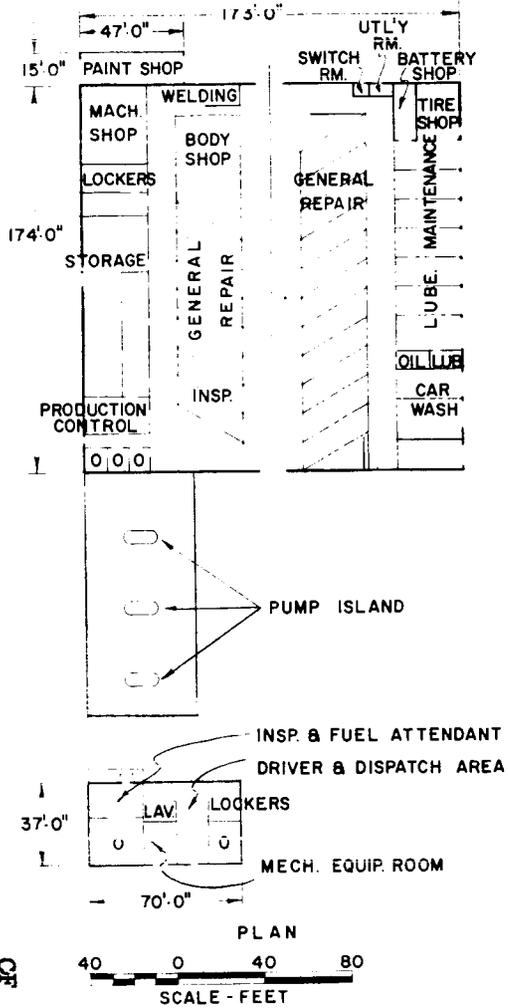
Vehicle maintenance facility: This facility will consist of two buildings and an adjacent parking area for utilization by the Range contractor for maintenance and parking of up to 400 wheeled vehicles in the Merritt Island Industrial Area. The main building, with overall dimensions of approximately 173 feet by 189 feet, and a gross area of approximately 30,800 square feet on one floor, will be a shop for maintenance and repair of vehicles. The dispatch building, with overall dimensions of approximately 37 feet by 70 feet, and a gross area of approximately 2,600 square feet on one floor, will be for driver dispatch and waiting, fueling service, and car check. Heat will be supplied by the central heating plant in the area. Office areas will be air-conditioned. A fire alarm system will be provided within the buildings. A parking area of approximately 30,000 square yards will be provided to park and maneuver large pieces of equipment including mobile cranes; water, sewer, electric power, and communications will be provided to make the facility completely operable. The parking area will be for overnight parking of the motor pool cars, trucks, wheeled carriers, trailers, cranes, generators, compressors, and vehicles which are not specifically assigned elsewhere, such as communications repair vehicles. The shop will provide a complete motor, body, and chassis repair facility. All wheeled vehicles used for Range support will receive periodic and minor service and maintenance at this facility as well as major motor and chassis overhaul, wreck rebuilding, and repainting.

Vehicle service facility: This portion of the project provides for the construction of two metal clad build-

LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

VEHICLE MAINTENANCE AND SERVICE FACILITIES



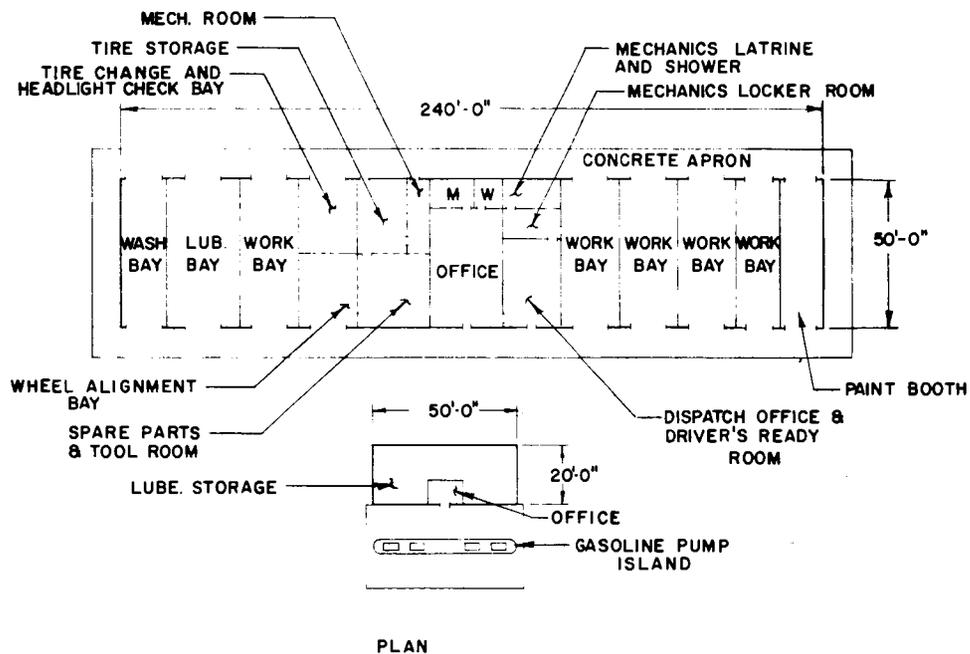
VEHICLE MAINTENANCE FACILITY

CF 6-115

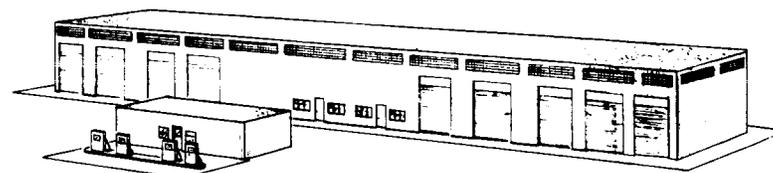
LAUNCH OPERATIONS CENTER

FISCAL YEAR 1964 ESTIMATES

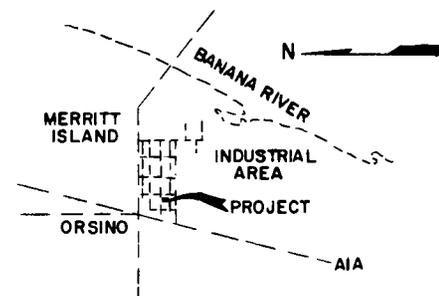
VEHICLE MAINTENANCE AND SERVICE FACILITIES



10 0 10 20 30 40
SCALE - FEET



PERSPECTIVE



SITE PLAN

0 8000 16000
SCALE - FEET

VEHICLE SERVICE FACILITY

CF 6-116

ings and an adjacent parking area. The service structure, with dimensions of approximately 50 feet by 240 feet, and a gross area of approximately 12,000 square feet on one floor, will be used as a general automotive, truck, and other wheeled equipment servicing facility, and will accommodate 30 vehicles at one time. The smaller structure, with dimensions of approximately 20 feet by 50 feet, and a gross area of approximately 1,000 square feet on one floor, will serve as a facility for paint, oil and lubricant storage, and for gasoline dispensing. The parking area of approximately 18,000 square yards will provide overnight parking for the vehicle transportation fleet. Air-conditioning will be provided in the office areas of the service structures. Heat will be supplied by the central heating plant in the area. A fire alarm system will be provided within the facility. Utilities, such as water, sewer, electric power, and communications will be included as required to make the facility completely operable.

The facility will be used as the base of operations for transportation service provided to all NASA organizations in the new area, and for accomplishing first and second order maintenance and service required to keep a fleet of up to 600 wheeled vehicles, including automobiles, generators, compressors, and lights in a safe and operable condition.

JUSTIFICATION:

The vehicle maintenance facility will be used for parking and maintenance of Government-owned (Range-operated) passenger and special service vehicles. Wheeled vehicles of all types are used for transporting personnel and freight, repairing roads, hoisting, emergency power generators, and air-compressors. Accidents, wear, and modifications take these vehicles out of service until they are repaired or updated. This work is presently done at the Patrick Air Force Base, about 25 miles from the Merritt Island Industrial Area. By the end of the fiscal year 1964, at which time the proposed facility should be in operation, there will be approximately 373 Range-operated vehicles in the new area. The added volume of work resulting from these additional vehicles cannot be handled by the capacity of the existing shop. Moreover, the distance between the existing shop and the Merritt Island Area is too great for the economical hauling of the number and size of vehicles involved. Construction of the proposed facility will reduce vehicle downtime, and reduce the time and cost for hauling and driving vehicles to the Patrick Air Force Base.

The Launch Operations Center passenger and freight transportation services are furnished by a contractor. The proposed vehicle service facility is required for the parking, maintenance, servicing, and dispatching of vehicles and is essential to the fulfillment of the contract.

Currently, these service operations are being performed in a building and shack located on the east side of hangar "R" in the Cape Canaveral Industrial Area. The existing facility, which is grossly inadequate for meeting future vehicle service requirements (approximately 537 vehicles of all types by the end of the fiscal year 1964) will be vacated for use by contractors engaged in the Saturn operation in the Cape Canaveral Missile Test Annex area. The minimum road distance between the present vehicle depot and the new Merritt Island Industrial Area, where the major concentration of the Launch Operations Center activities will be focused after the fiscal year 1964, will be 7 miles. This great a distance will not be economical from the viewpoint of travel time and operating costs.

The size of the proposed facility was estimated by comparing records of the quantitative vehicular requirements for serving both past and existing facilities and personnel, with requirements dictated by the greatly expanded activities in the new area. Personnel requiring transportation service will increase from 1,800 in the fiscal year 1962 to 6,350 in the fiscal year 1965. The level of vehicle maintenance to be provided in the proposed facility will be limited, generally, to that which can be accomplished in one eight-hour shift. The facility will not be used for major engine or transmission overhaul, for major body rebuilding, or repainting; such work will be accomplished elsewhere in contractor-furnished facilities.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$375,000
Clearing, grubbing and grading.....	\$46,000
Access roads..(4,700 square yards at \$5.50 per square yard).....	26,000
Parking area..(48,000 square yards at \$5.50 per square yard).....	264,000
Utility extensions.....	39,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	851,000
Vehicle maintenance facility.....	668,000
Main building..(30,800 square feet at \$20 per square foot).....	\$616,000
Dispatch building..(2,600 square feet at \$20 per square foot).....	52,000
Vehicle service facility.....	183,000
Service unit..(12,000 square feet at \$14 per square foot).....	168,000

Paint, oil, and lubricants unit (1,000 square feet at \$15 per square foot).....	\$15,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		\$164,000
Automotive maintenance, service, and repair equipment.....	\$130,000	
Fixtures and furniture.....	14,000	
Gasoline pumps and tanks.....	20,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>171,000</u>
Total estimated cost.....		<u>\$1,561,000</u>

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1964 ESTIMATES

CONSTRUCTION OF FACILITIES - 1964 PROGRAM

LEWIS RESEARCH CENTER

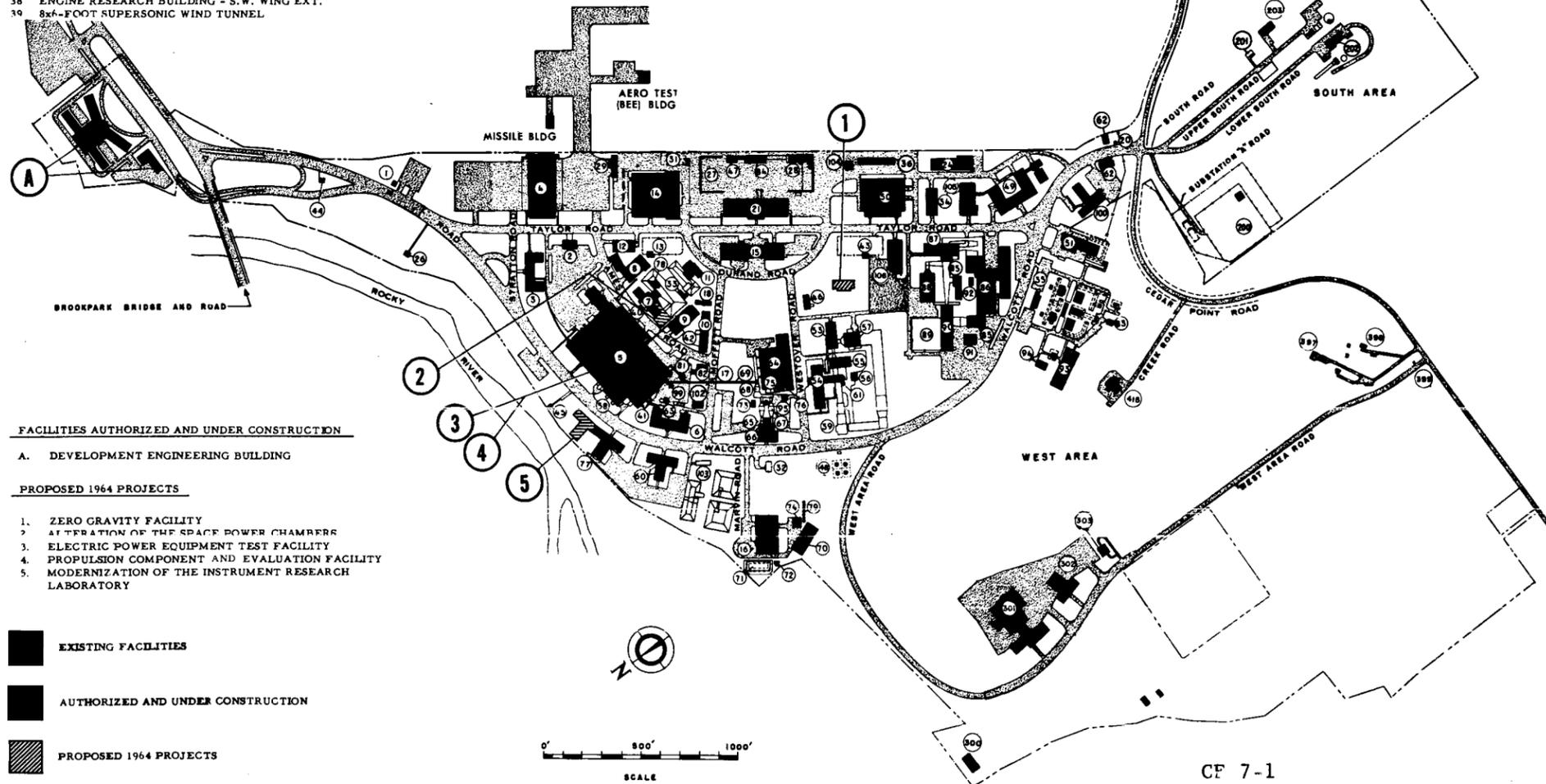
		<u>Page No.</u>
Location plan.....		CF 7-1
Addition to the spacecraft propulsion research facility.....	\$ 3,500,000	CF 7-3
Alteration of the space power chambers.....	5,665,000	CF 7-5
Electric power equipment test facility.....	2,100,000	CF 7-8
Engineering building (Plum Brook Station)...	1,710,000	CF 7-11
Experiment assembly, test, and storage building (Plum Brook Station).....	885,000	CF 7-14
Modernization of the instrument research laboratory.....	2,002,000	CF 7-18
Propellant flow systems facility (Plum Brook Station).....	1,316,000	CF 7-22
Propulsion component evaluation facility....	1,004,000	CF 7-25
SNAP-8 assembly and spacecraft checkout building.....	5,000,000	CF 7-27
Zero gravity facility.....	<u>2,653,000</u>	CF 7-31
Total.....	<u>\$25,835,000</u>	

LEWIS RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN

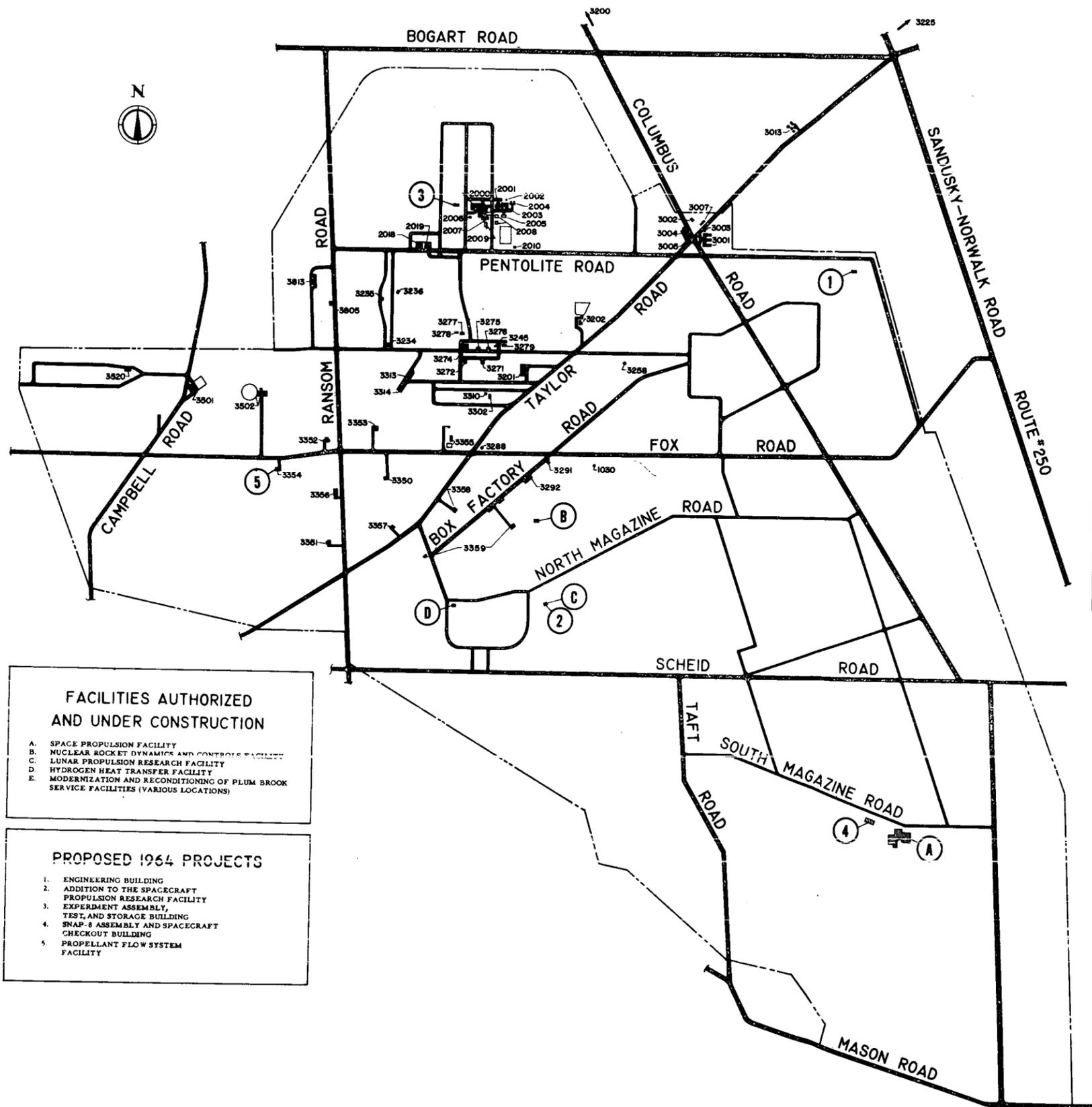
LEGEND

- | | | | |
|--|--|---|------------------------------------|
| 1 GATEHOUSE (MAIN) | 40 SUBSTATION "D" | 74 P. S. L. CIRCULATING WATER PUMPING STATION | 301 ELECTRIC PROPULSION LABORATORY |
| 2 PERSONNEL BUILDING | 41 SUBSTATION "F" | 75 P. S. L. SUBSTATION "J" | 302 ENERGY CONVERSION LABORATORY |
| 3 ADMINISTRATION BUILDING | 42 SUBSTATION "E" | 76 P. S. L. COMBUSTION AIR HEATER | 303 SUBSTATION "M" |
| 4 FLIGHT RESEARCH BUILDING | 43 SUBSTATION "G" | 77 INSTRUMENT RESEARCH LABORATORY | 397 (FORMER MITCHELL GARAGE) |
| 5 ENGINE RESEARCH BUILDING | 44 GAS METER HOUSE | 78 A. W. T. PUMP HOUSE | 398 (FORMER MITCHELL RESIDENCE) |
| 6 CHEMISTRY LABORATORY | 45 DROP TOWER | 79 P. S. L. COOLING WATER DEAERATORS | 399 GATEHOUSE - WEST AREA |
| 7 SPACE POWER CHAMBERS | 46 COOLING TOWER NO. 2 | 81 E. R. B. SPRAY COOLER BUILDING | 415 ROCKET COMBUSTION LABORATORY |
| 8 EXHAUSTER BUILDING | 47 FUEL STORAGE BUILDING NO. 47 | 82 COOLING TOWER NO. 4 | |
| 9 REFRIGERATION BUILDING | 48 FUEL STORAGE TANKS | 83 CRYOGENICS SERVICES BUILDING | |
| 10 COOLING TOWER NO. 1 | 49 MATERIALS AND STRESSES LABORATORY | 84 STORAGE BUILDING NO. 34 | |
| 11 ICING RESEARCH TUNNEL | 50 FABRICATION SHOP | 85 10'x10' SUPERSONIC WIND TUNNEL | |
| 12 STEAM GENERATING PLANT | 51 HIGH ENERGY FUELS LABORATORY | 86 10'x10' - SWT RESEARCH AND CONTROL BUILDING | |
| 13 SUBSTATION "B" | 52 8x6 FOOT SWT DRIVE EQUIPMENT BLDG. | 87 10'x10' - SWT SECONDARY COMPRESSOR AND DRIVE BLDG. | |
| 14 TECHNICAL SERVICE BUILDING | 53 8x6-FOOT SWT RESEARCH AND CONTROL BUILDING (OFFICE) | 88 10'x10' - SWT AIR DRYER BUILDING | |
| 15 UTILITIES BUILDING | 54 8x6-FOOT SWT MODELS PREPARATION BLDG. | 89 10'x10' - SWT SUBSTATION "K" | |
| 16 ELECTRIC PROPULSION RESEARCH BUILDING | 55 8x6-FOOT SWT EXHAUSTER BUILDING | 90 10'x10' - SWT MAIN COMPRESSOR AND DRIVE BUILDING | |
| 17 UNDERGROUND FUEL STORAGE | 56 8x6-FOOT SWT AIR DRYER BUILDING | 91 10'x10' - SWT LOW PRESSURE FUEL PUMPING STATION | |
| 18 AIR DRYER NO. 1 | 57 SUBSTATION "H" | 92 10'x10' - SWT HIGH PRESSURE FUEL PUMPING STATION | |
| 20 SOUTH GATEHOUSE | 58 PROPULSION SYSTEMS LABORATORY | 93 10'x10' - SWT COOLING TOWER NO. 5 | |
| 21 PROCUREMENT & SUPPLY BUILDING | 59 OPERATIONS BUILDING | 94 10'x10' - SWT COOLING TOWER WATER PUMPING BUILDING | |
| 23 ENGINE RESEARCH BUILDING - WEST WING | 60 8x6-FOOT SWT FUEL BUILDING | 95 P. S. L. DESICCANT AIR DRYER | |
| 24 SPECIAL PROJECTS LABORATORY | 61 PLANT SERVICES BUILDING | 99 E. R. B. COMBUSTION AIR HEATER | |
| 26 SEWAGE PUMPING STATION | 62 HIGH TEMPERATURE VAPOR SYSTEM | 100 ROCKET OPERATIONS BUILDING | |
| 27 COAL STORAGE | 63 P. S. L. EQUIPMENT BUILDING | 102 LIQUID METALS POWER LABORATORY | |
| 28 BARREL STORAGE BUILDING | 64 P. S. L. ALTITUDE CHAMBERS (2) | 103 INDUSTRIAL WASTE TREATMENT BASINS | |
| 29 PLANT PROTECTION BUILDING | 65 P. S. L. ACCESS BUILDING | 104 GARAGE | |
| 31 RESERVOIR AND FIRE PROTECTION WATER SUPPLY | 66 P. S. L. PRIMARY COOLERS (2) | 105 MATERIALS PROCESSING LABORATORY | |
| 32 SUBSTATION "C" | 67 P. S. L. SECONDARY COOLERS | 106 BASIC MATERIALS LABORATORY | |
| 33 18"x18", 18"x18" AND 2x2 FOOT SUPERSONIC WIND TUNNELS | 68 P. S. L. TIE LINE | 200 SUBSTATION "A" | |
| 34 LIQUID METALS CORROSION LABORATORY | 69 P. S. L. COOLING TOWER NO. 3 | 201 SUBSTATION "L" | |
| 35 ROCKET LABORATORY | 70 P. S. L. FUEL STORAGE | 202 ROCKET ENGINE FACILITY | |
| 36 TEMPO "A" | 71 P. S. L. LOW PRESSURE FUEL PUMPING STATION | 203 FRACTURE MECHANICS LABORATORY | |
| 37 ENGINE RESEARCH BUILDING - N.W. WING | 72 P. S. L. HIGH PRESSURE FUEL PUMPING STATION | 300 (FORMER GUERIN RESIDENCE) | |
| 38 ENGINE RESEARCH BUILDING - S.W. WING EXT. | | | |
| 39 8x6-FOOT SUPERSONIC WIND TUNNEL | | | |



PLUM BROOK STATION
FISCAL YEAR 1964 ESTIMATES

LOCATION PLAN



LEGEND

- 1030 FIRE WATER TOWER
- 2000 REACTOR BUILDING (OFFICE ETC.)
- 2001 REACTOR SERVICES BUILDING
- 2002 REACTOR WATER TOWER
- 2003 REACTOR COOLING TOWER
- 2004 REACTOR SLUDGE BASINS
- 2005 REACTOR SUBSTATION A
- 2006 REACTOR SECURITY BUILDING
- 2007 REACTOR FAN HOUSE
- 2008 REACTOR COLD RETENTION BASINS
- 2009 REACTOR HOT RETENTION BASINS
- 2010 REACTOR EFFLUENT METERING STATION
- 2018 WAREHOUSE
- 2019 WAREHOUSE
- 3001 ADMINISTRATION BUILDING
- 3002 HEATING PLANT AND ELECTRICAL SHOP
- 3003 GATE HOUSE
- 3004 PLANT PROTECTION BUILDING
- 3005 MEDICAL SERVICES BUILDING
- 3007 PERSONNEL BUILDING (INACTIVE)
- 3013 SEWAGE PLANT
- 3200 BIG ISLAND PUMPING STATION
- 3201 SUBSTATION B (AND POWER PLANT)
- 3202 RESERVOIR AND PUMP STATION #1
- 3225 RYE BEACH PUMPING STATION #1
- 3234 RAILROAD SCALES
- 3235 FUEL OIL TANK AND PUMP
- 3236 GAS HANDLING FACILITY
- 3245 FUEL OIL TANK AND PUMP
- 3258 WATER TOWER (INACTIVE)
- 3271 WAREHOUSE
- 3272 WAREHOUSE
- 3274 MAINTENANCE SHOP
- 3275 WAREHOUSE
- 3276 WAREHOUSE
- 3277 GARAGE
- 3278 GARAGE
- 3279 WAREHOUSE
- 3288 DOMESTIC WATER TOWER
- 3291 WAREHOUSE
- 3292 WAREHOUSE
- 3302 AIR COMPRESSOR BUILDING
- 3310 PUMP HOUSE (INACTIVE)
- 3313 WAREHOUSE
- 3314 WAREHOUSE
- 3350 ROCKET PUMP LABORATORY
- 3351 ROCKET TURBO-PUMP LABORATORY
- 3352 ROCKET TURBINE LABORATORY
- 3353 ROCKET SYSTEMS DYNAMICS LAB.
- 3354 ROCKET SYSTEMS HYDRAULICS LAB.
- 3355 ROCKET TURBINE AND PUMP PILOT LAB.
- 3356 CENTRAL CONTROL AND DATA BUILDING
- 3357 FLUORINE PUMP LABORATORY
- 3358 ROCKET SYSTEMS LAB. --(PORTABLE RIGS)
- 3359 ALTITUDE ROCKET TEST FACILITY
- 3501 SUBSTATION C (AND POWER PLANT)
- 3502 RESERVOIR AND PUMPING STATION NO. 2
- 3520 WAREHOUSE
- 3805 TRUCK SCALE
- 3813 WAREHOUSE

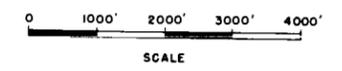
FACILITIES AUTHORIZED AND UNDER CONSTRUCTION

- A. SPACE PROPULSION FACILITY
- B. NUCLEAR ROCKET DYNAMICS AND CONTROLS FACILITY
- C. LUNAR PROPULSION RESEARCH FACILITY
- D. HYDROGEN HEAT TRANSFER FACILITY
- E. MODERNIZATION AND RECONDITIONING OF PLUM BROOK SERVICE FACILITIES (VARIOUS LOCATIONS)

PROPOSED 1964 PROJECTS

- 1. ENGINEERING BUILDING
- 2. ADDITION TO THE SPACECRAFT PROPULSION RESEARCH FACILITY
- 3. EXPERIMENT ASSEMBLY, TEST, AND STORAGE BUILDING
- 4. SNAP-8 ASSEMBLY AND SPACECRAFT CHECKOUT BUILDING
- 5. PROPELLANT FLOW SYSTEM FACILITY

- EXISTING FACILITIES
- AUTHORIZED AND UNDER CONSTRUCTION
- PROPOSED 1964 PROJECTS



671617 O -63

LEWIS RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

ADDITION TO THE SPACECRAFT PROPULSION RESEARCH FACILITY

DESCRIPTION:

An addition to the spacecraft propulsion research facility is requested to provide the capability for space environment simulation. A hard vacuum in the test chamber will be produced by oil diffusion pumps and conventional backing pumps. Mylar vacuum seals will be provided to isolate the test chamber from the exhaust system. The low temperatures of outer space will be simulated by cryogenically cooled panels lining the interior of the test chamber. A remote liquid nitrogen storage area and a piping system to the test chamber will provide a continuous supply of coolant to the cryopanel. Simulation of the thermal gradients due to solar heating will be provided by various types of radiant heaters. One hundred kilowatts of electrical power will be provided for this purpose.

JUSTIFICATION:

The ability of a space vehicle to function properly after an extended exposure to the rigors of outer space is one of the severe problems facing designers of spacecraft. Many vehicle components are being developed and tested in space simulation chambers. The reliability of a completely assembled vehicle, however, is more difficult to ascertain and requires a facility that will not only expose the vehicle to a simulated space environment but also allow a complete functional test including space starting and operation of the rocket engines. The spacecraft propulsion research facility will provide this capability for space vehicles up to 50 feet long and 32 feet in diameter and with thrust levels up to 45,000 pounds with high-energy propellants. Storable propellant rockets up to 50,000 pounds thrust can also be tested. All of the stages in the current Apollo vehicle could, therefore, be accommodated, as well as advanced conceptual designs with large diameter nozzles.

Cryogenic rocket fuels possess the highest efficiency of the propellants currently being used and are favored, therefore, for advanced space vehicle designs. Propulsion systems using cryogenic fuels are complex, sensitive to perturbations and difficult to design for high reliability due to the properties of the propellants and the necessity of maintaining the lowest possible weight for each component. In outer space, this sensitive system will be exposed to extreme temperature gradients and to the leaching effects of the vacuum environment. This may vary from a few days for a translunar trajectory to six months or more for a planetary flight where propulsion is needed on arrival at the planet. Control valves, fuel vents, engine gimbal actuators, ignition systems, pumps, and control sensors are among the critical problem areas affecting satisfactory operation of the engines.

To provide the space soak capability for the spacecraft propulsion research facility, the test chamber must be equipped with a vacuum pumping system including diffusion vacuum pumps and mechanical fore-pumps to provide pressures as low as 10^{-8} torr, and the chamber walls must be lined with cryogenic heat sink panels which use liquid nitrogen and liquid helium. Provision for adequate power to various solar heating simulators must also be included.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	\$1,420,000
Cryogenic panels (14,000 square feet at \$100 per square foot).....	\$1,400,000
Vacuum pump house (1,000 square feet at \$20 per square foot).....	20,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	1,745,000
Liquid nitrogen system.....	286,000
Vacuum system.....	449,000
Heat simulation source.....	400,000
Electrical equipment, wiring, and controls.....	610,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>335,000</u>
Total estimated cost.....	<u>\$3,500,000</u>

LEWIS RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES
ALTERATION OF THE SPACE POWER CHAMBERS

DESCRIPTION:

This project covers modifications and additions to the space power chambers, formerly known as the altitude wind tunnel, to permit the evaluation and development testing of full-scale propulsion systems in a simulated space, planetary, or lunar environment. Two large pressure bulkheads will be installed to isolate the return passage at the western end of the tunnel, inside of which will be installed a high vacuum chamber 40 feet in diameter and approximately 100 feet long. A double wall vacuum chamber will thus be provided, the inner section of which will be exhausted to a pressure of 10^{-6} mm of mercury by oil diffusion pumps. These pumps will discharge into the space between the two chambers at a pressure of approximately 10^{-2} mm of mercury. Utilizing this space as a large manifold, fore-pumps will be used to discharge to atmosphere. This arrangement will result in an inner chamber with very little pressure differential across it which minimizes the effect of small leaks in the inner chamber. A sketch of the proposed alteration is shown on the following page.

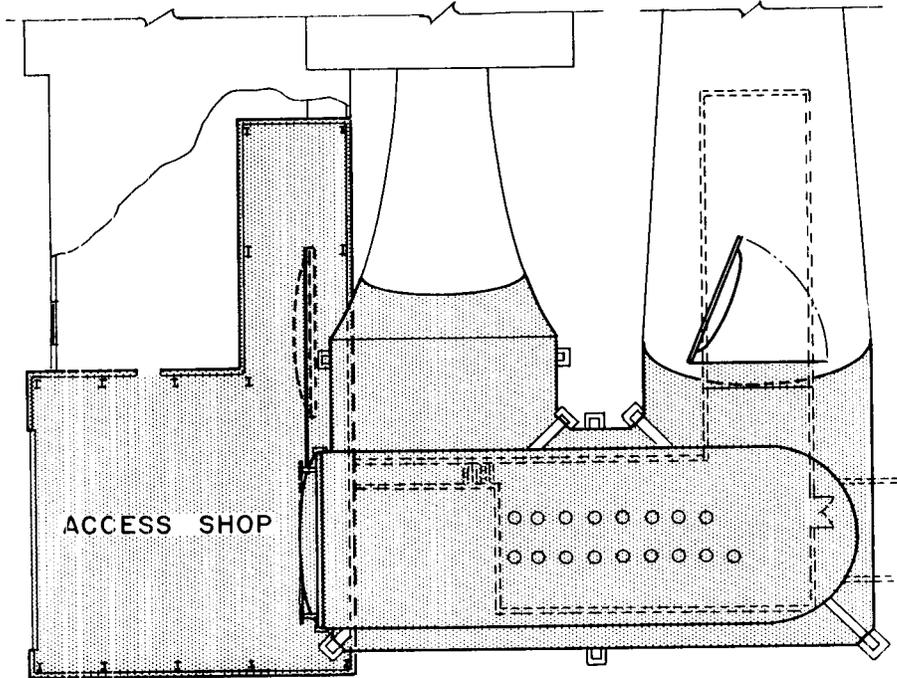
The inner chamber walls will be cooled by a liquid nitrogen system to provide a heat sink and a thermal environment that simulates radiation to deep space or a cold lunar surface. A heat source is also included to simulate solar heating or thermal soaking in the environment of a planet or a lunar day. Thermal conditions approximating either the temperature gradients of space in oriented flight or of extended soaking periods of either the hot or cold environment of the planet or the moon are therefore possible. Engine exhaust diffusers and water cooled exhaust ducting are provided to permit discharge of the engine exhaust jet into the existing exhaust cooling and pumping systems for engine operation following hard vacuum start up.

One of the two isolating bulkheads mentioned earlier in the description would be provided with a 25-foot diameter door to provide access to the long south leg of the existing tunnel. Access to the inner vacuum chamber would be provided by a 40-foot diameter door which would open into the proposed access shop. This building would be of sufficient height to accommodate a bridge crane. The crane would be used to transport vehicles and components about the shop and in the test facilities. High vacuum pumps would be housed in a pump house which would be located below ground under the vacuum chambers. This pump house would be accessible from the outside and from the shop buildings.

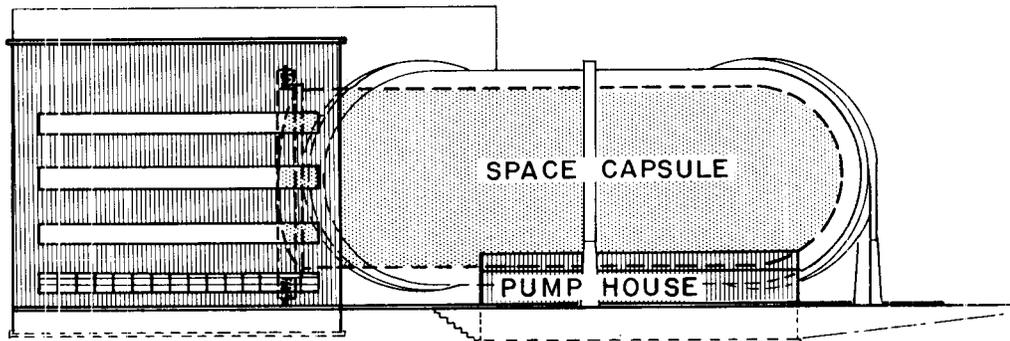
JUSTIFICATION:

The controls and propulsion systems of various space vehicles as well as the operation of space power systems must achieve an extremely high level of reliability on a compressed time schedule. These levels of reliability in system operation can only be realized through the conduct of extensive and thorough development testing and evaluation in ground based facilities.

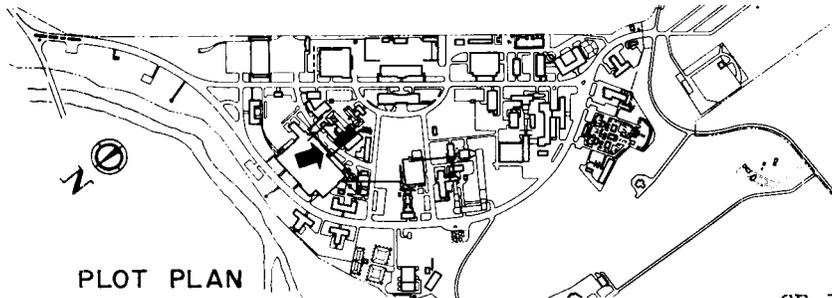
ALTERATION OF THE SPACE POWER CHAMBERS



PLAN VIEW



WEST ELEVATION



PLOT PLAN

The facilities must obviously be capable of complete system operation following extended periods of exposure to a hard vacuum and to the large temperature gradients of space oriented flight. Effort will be devoted to the solution of problems relating to propellant heating, propellant freezing or vapor lock in lines and valves, insulation effectiveness, and pressurization and venting requirements; countdown procedures, system behavior, valve and actuator performance, and engine ignition will also be studied. Thrust buildup and thermal distortion at the system structure are also among the potentially critical problem areas that must be thoroughly evaluated and verified prior to commitment to flight.

To achieve these large and complex facility capabilities necessitates a maximum utilization of currently available high altitude test facilities. The large exhaust gas cooling and pumping system of the Lewis Research Center and the former altitude wind tunnel, with its extensive basic structure, control rooms, and service facilities, provides an excellent base upon which to build.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	\$1,900,000
Vacuum chamber, isolating bulkheads and access openings, modifications of existing tunnel structure.....	\$1,534,000
Access building (6,260 square feet at \$46 per square foot).....	291,000
Vacuum pump and equipment enclosure (5,000 square feet at \$15 per square foot).....	75,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	3,215,000
Vacuum pumping system.....	750,000
Refrigeration system.....	1,150,000
Electrical heaters.....	415,000
Engine exhaust ducting, cooling and valving	450,000
Propellant storage and supply system.....	250,000
Facility instrumentation and controls.....	200,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>550,000</u>
Total estimated cost.....	<u>\$5,665,000</u>

LEWIS RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

ELECTRIC POWER EQUIPMENT TEST FACILITY

DESCRIPTION:

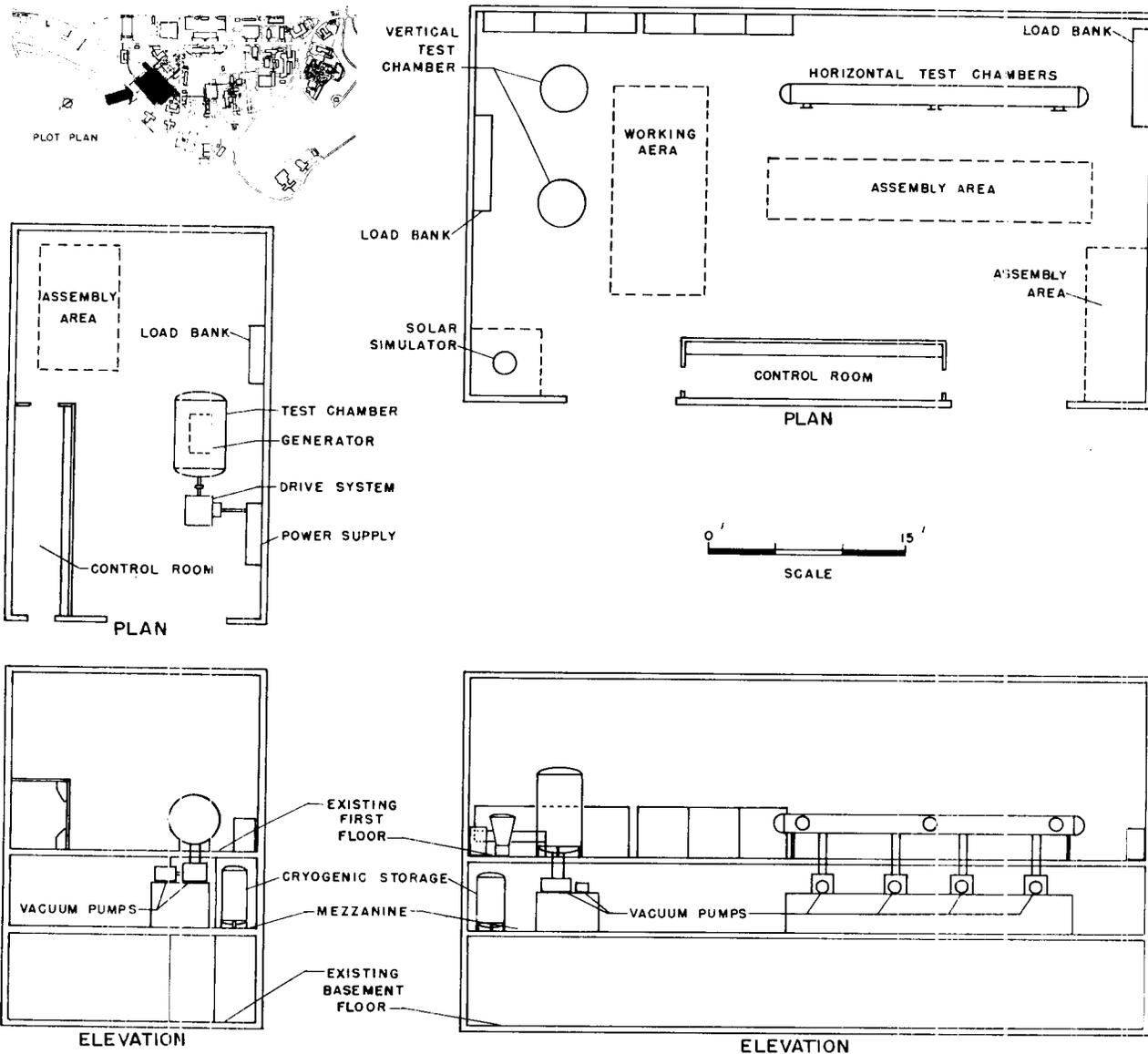
The equipment and building modifications proposed in this project provide the space and facilities required to test electrical generating, power conversion, and control components of electric space power systems. The present engine research building constitutes an excellent location for this equipment because of the availability of large quantities of 60-cycle power, of variable frequency equipment that is well suited to the variable speed drive of up to 15,000-horsepower motors, and of extensive air and cooling tower water services. Existing space in the engine research building will be made available for this purpose. One large test cell will accommodate a cradled motor and gear assembly drive for fractional megawatt electromagnetic generator tests. Two small test cells will be utilized for smaller magnitude electromagnetic and electrostatic generator test stands. All of these test stands will be provided with the environmental equipment to simulate required space operating conditions.

A test area, preferably another large test cell, will contain test stands for electrical components. This test area will have provisions for a transformer and rectifier test stand with high-voltage AC power supply, a transmission line test stand utilizing high-voltage AC and DC power sources, and a control components test stand. Each test stand in this test area will be provided with a vacuum environment, and one test stand will include a solar simulator. Some refurbishing of the existing building will also be required to provide appropriate control rooms and space for power supplies and vacuum pumps in the basement areas. If possible, existing foundations and baseplates will be utilized for the proposed equipment. A sketch of the areas proposed for modification is shown on the next page.

JUSTIFICATION:

Current development activities involving various types of space power systems have emphasized the importance of advancing the technology of electric generators, power conversion equipment, and associated power control components. Projected requirements of future systems impose even more severe problems of weight, materials compatibility, temperature limits, and reliability. At the present time, and in contrast to facility capabilities for testing both nonelectrical components and complete systems, facilities for the testing of electrical power equipment do not exist at the Lewis Center. An extremely valuable base upon which to build this capability does, however, exist in the engine research building. The facilities to be made available by this project will provide an important capability for performance and reliability evaluations of electrical equipment under appropriate test conditions and with a minimum expenditure of time and money.

ELECTRIC POWER EQUIPMENT TEST FACILITY



ELECTROSTATIC CR
 ELECTROMAGNETIC
 GENERATOR TEST AREA

TRANSMISSION LINE & ELECTRICAL COMPONENTS TEST AREA

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	\$116,000
Relocation of existing equipment.....	\$40,000
Construction of four control rooms.....	31,000
Modification of four existing test cells.....	45,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	1,879,000
Transmission line test chamber.....	130,000
Two electrical components test chambers.....	148,000
Electrostatic generator test chamber.....	165,000
Electromagnetic generator test chamber.....	122,000
Fractional megawatt generator environmental test chamber.....	210,000
Solar simulator.....	300,000
Cryogenic storage and supply system for two chambers.....	50,000
Heating systems for two chambers.....	25,000
Drive for fractional megawatt generator test stand.....	90,000
Two drive systems - one each for electrostatic and electromagnetic generator test stands.....	200,000
AC and DC load banks ranging from 5 to 800 KW...	241,000
Instrument data systems for four control rooms..	120,000
AC and DC power supplies.....	78,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>105,000</u>
Total estimated cost.....	<u>\$2,100,000</u>

LEWIS RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

ENGINEERING BUILDING

(Plum Brook Station)

DESCRIPTION:

This project provides for the construction of an engineering building consisting of two sections for the Plum Brook Station. The first section will contain three floors and a partial basement. The above grade area of this section will be approximately 39,000 square feet or 13,000 square feet per floor. The second section, connected thereto, will consist of an auditorium of approximately 5,000 square feet and a one-floor cafeteria of approximately the same area.

The office area will contain space for 300 persons. Conference rooms and service areas will be provided. The auditorium will seat approximately 500 people and the cafeteria approximately 250.

The structures will be of the steel frame, concrete floor type with masonry and glass curtain walls. Interior partitions will be metal lath and plaster. Utilities will be extended from existing Plum Brook Station systems and access roads will be provided. Parking lots will be developed for the auditorium, cafeteria and office areas. Line drawings of the proposed structure are shown on the following page.

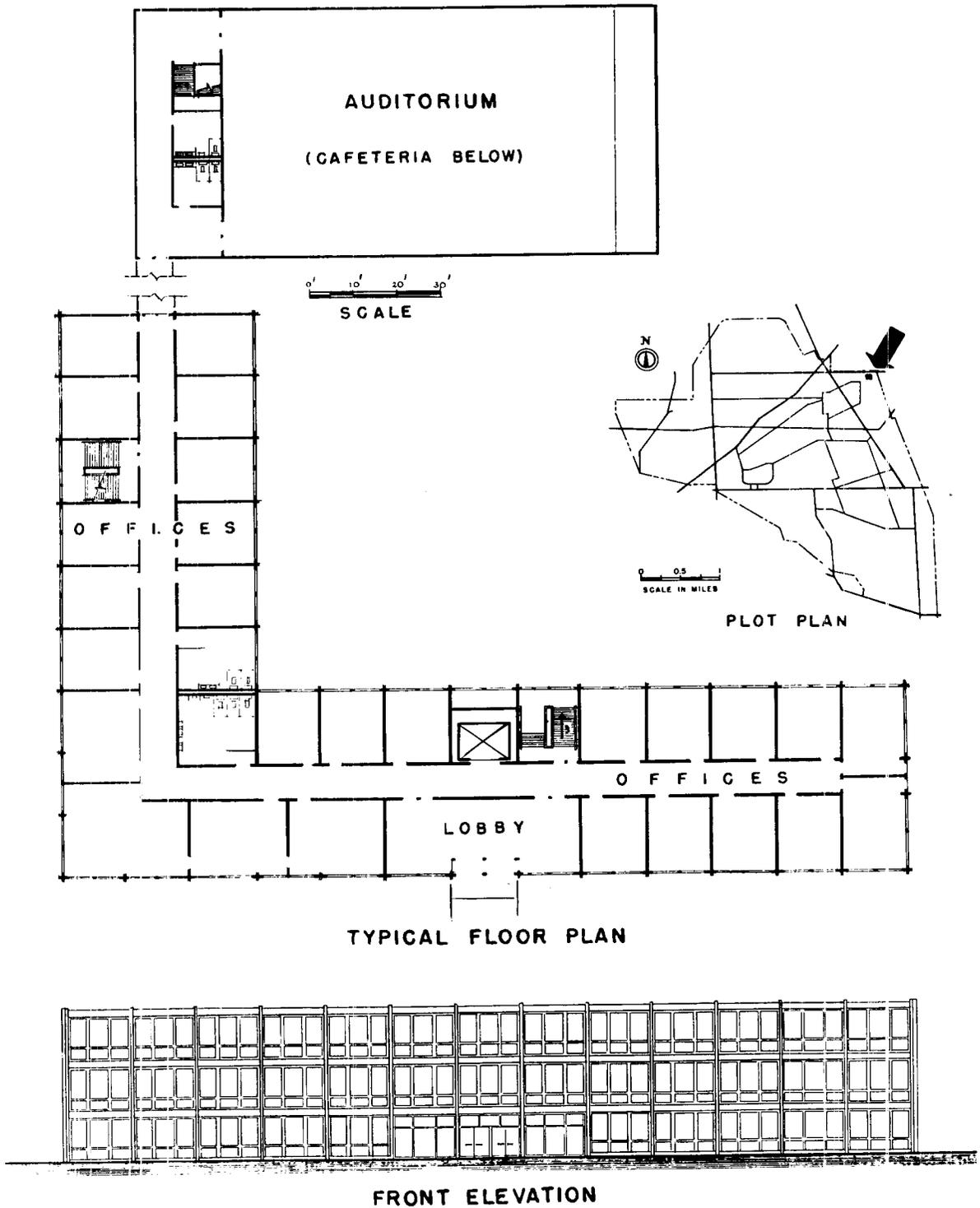
JUSTIFICATION:

The projected total complement of Plum Brook Station by 1966 is 1,000 persons. Upon completion of approved construction projects there will be available at the Station satisfactory office space in the reactor and rocket areas for approximately 160 personnel and in the space propulsion facility for approximately 130 personnel. However, an analysis of the future needs of the Station indicate that permanent offices should be provided for 590 people, an increase of 300 over those now in the approved projects. Currently, most of the office personnel are housed in trailers and in temporary wooden structures built in 1941 that can be used temporarily for office space until completion of the new building. Small expenditures must be made from time to time to keep these buildings in minimum condition for use. However, it is considered impractical to upgrade these old wooden structures for long-term use. Limited but currently satisfactory cafeteria accommodations are provided in one of these old structures. The proposed engineering building will provide for the necessary expansion.

At the present time there is no suitable place on the Plum Brook Station grounds where technical or other meetings of more than approximately 80 people can be convened. The need for such an assembly area is acute. The

LEWIS RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

ENGINEERING BUILDING
(PLUM BROOK STATION)



construction of the engineering building will consolidate the Station's administration and engineering personnel in suitable quarters and, with the auditorium and cafeteria, will provide support facilities compatible with the growth of the station.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$250,000
Water line extension.....	\$20,000	
Natural gas line.....	25,000	
Sanitary sewer lines.....	12,000	
Electrical substation.....	12,000	
Electrical line extension.....	13,000	
Parking areas.....	63,000	
Road extension and intersections.....	75,000	
Clearing, landscaping, and drainage.....	30,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,227,000
Engineering building (39,000 square feet office area and 4,400 square feet partial basement at \$22 per square foot).....	954,000	
Utility tunnel (1,500 square feet at \$15 per square foot).....	23,000	
Auditorium (5,000 square feet at \$25 per square foot).....	125,000	
Cafeteria (5,000 square feet at \$25 per square foot).....	125,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		133,000
Office furniture.....	60,000	
Cafeteria equipment and furniture.....	53,000	
Auditorium equipment and furniture.....	20,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>100,000</u>
Total estimated cost.....		<u>\$1,710,000</u>

LEWIS RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

EXPERIMENT ASSEMBLY, TEST, AND STORAGE BUILDING

(Plum Brook Station)

DESCRIPTION:

A new mill-type building for the Plum Brook Station having a ground floor area of approximately 10,500 square feet will be provided by this project. In addition, a mezzanine floor of approximately 4,000 square feet and a partial basement are included. The structure will be located in the reactor area with easy access to the reactor building proper. A utility tunnel will be provided between the reactor building and this facility for the routing of the required utility services as well as providing space for special experiment services. This building will be located in close proximity to the reactor office building to provide easy liaison between the personnel housed in these two areas.

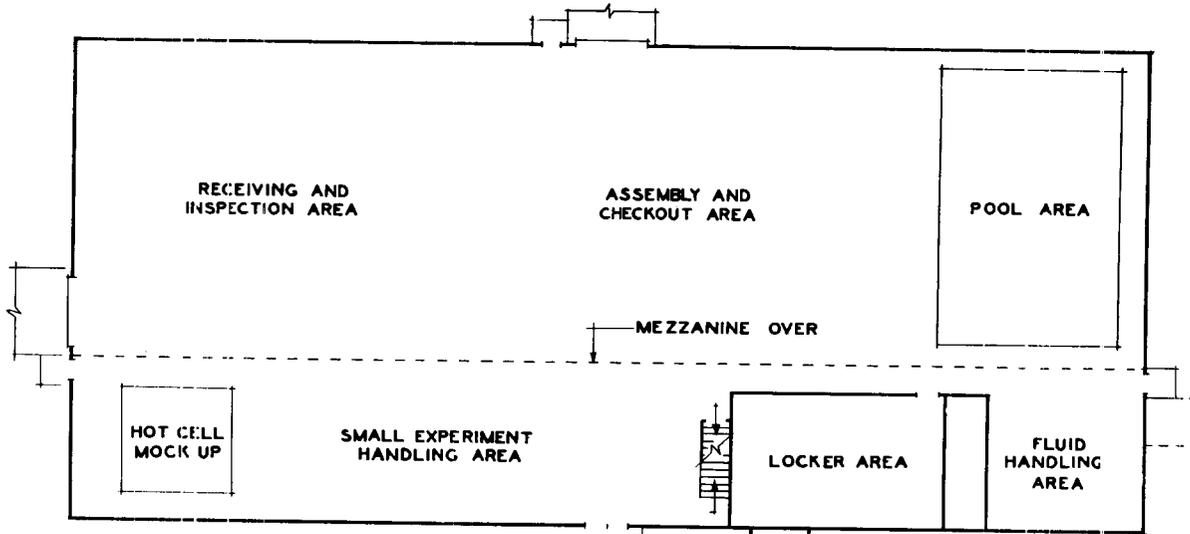
A high bay crane will be provided in the building for the unloading and handling of large experiments. A pool area with the necessary circulation and water purification equipment will be provided at one end of the building for simulation of the actual underwater environment required by the reactor operations. Instrument calibration and electronic test areas in addition to special areas for assembly shops are included. Building utilities will be housed in the partial basement at the end of the utility tunnel. A sketch of the building is shown on the following page.

JUSTIFICATION:

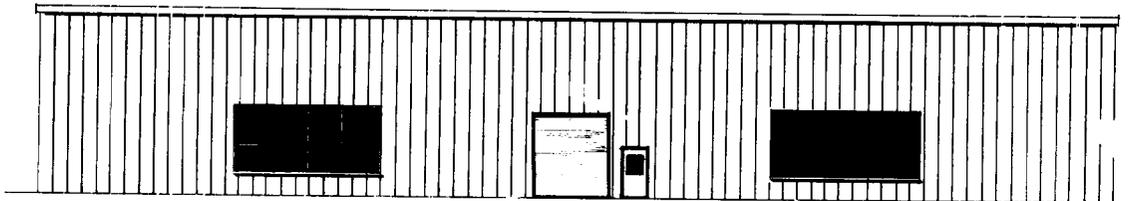
Currently, there are no available facilities or space in the reactor area at the Plum Brook Station to assemble, pre-test, or store experiments. In most cases the larger experiments will be shipped unassembled because they will contain much fragile equipment and instrumentation which cannot be safely shipped by common carrier in an assembled condition. Assembly and pre-test must, therefore, be performed in the reactor area prior to the in-pile radiation. Pre-testing must be done since an untried experiment can cause excessive reactor down time because of undetected design faults, mismatch between the reactor and the experiment, and undetected shipping damage to the experiment components. In addition, the pre-test time provides valuable training for the experiment operators as well as providing insight into the operating characteristics peculiar to any one experiment. Pre-irradiation testing also provides handling experience so that should failures occur after irradiation has started repairs may be more easily effected.

LEWIS RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

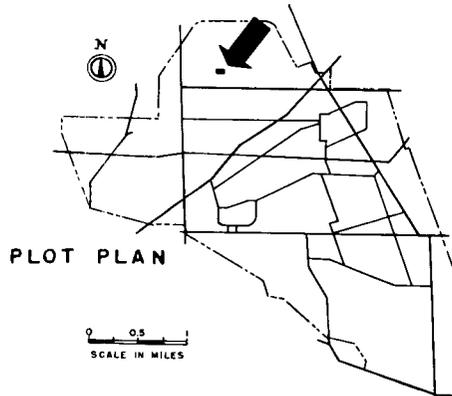
EXPERIMENT ASSEMBLY, TEST, AND STORAGE BUILDING
(PLUM BROOK STATION)



FLOOR PLAN



NORTH ELEVATION



Almost all of the experiments contemplated for the reactor will be subjected to an underwater environment. Leakage of water into an experiment will in most cases cause failure of the experiment, and in some cases can add to the operational hazards. It is mandatory, therefore, that all such experiments be pre-tested in such an environment prior to insertion into the reactor if orderly research investigations are to proceed and the reactor is to operate on a high-use schedule. For larger experiments it is also necessary to determine the underwater handling characteristics so that after radiation these experiments may be safely and efficiently moved into the hot lab area. This facility will provide a pool for such pre-test operations.

The instrumentation and controls associated with any sizable nuclear experiment serve a vital function in the overall safety of the reactor operations in addition to providing desired research information. It is essential that the calibration of such equipment be the best available. It is expected that considerable effort will be expended in this phase of the pre-test work and a large area has been set aside in this facility to handle this requirement.

Many of the in-core experiments are of the "lead" type. This means that the instrument connections and service connections for these experiments extend from outside of the reactor tank to the experiment through long and, in most cases, semirigid leads having lengths in excess of thirty feet. In the assembly and pre-test of such experiments considerable space is needed. This is being provided under the mezzanine floor since crane facilities will not be required. The building proposed and the facilities contained therein are required if the reactor is to achieve the utilization necessary to support the various nuclear rocket and spacepower systems that are a vital part of the overall space program.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$134,000
Fire and domestic water lines.....	\$10,000	
Steam line and boiler.....	40,000	
Cooling tower water lines.....	12,000	
Process water line.....	6,000	
Sewer line connection.....	3,000	
Electrical power line and connections.....	30,000	
Roads, parking area, and landscaping.....	33,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		426,000
Assembly and test building (15,600 square feet at \$18 per square foot).....	281,000	
Utility tunnel (5,000 square feet at \$15 per square foot).....	75,000	
Testing pool (25,000 cubic feet).....	70,000	

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		\$285,000
Crane.....	\$40,000	
Water treatment equipment.....	15,000	
Special tools and shop equipment.....	50,000	
Test equipment and instrumentation.....	180,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>40,000</u>
Total estimated cost.....		<u><u>\$885,000</u></u>

LEWIS RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

MODERNIZATION OF THE INSTRUMENT RESEARCH LABORATORY

DESCRIPTION:

It is proposed to expand the existing instrument research laboratory by adding a wing on its eastern end similar in appearance and function to the existing structure. The new wing will contain offices, laboratories and specialized equipment for conducting research on instrumentation for advanced space applications. The utility services for the new wing will be extended from the present building, and one room in the basement of the older building will be converted to a utility room serving the new wing. A sketch of the proposed addition is shown on the following page.

JUSTIFICATION:

Research in the field of measurement and instrumentation for advanced space propulsion experiments requires laboratory facilities specifically designed for the work. The existing instrument research laboratory was authorized in 1949 to provide office and laboratory space for the instrument research and development required for aeronautical propulsion research programs. Provisions were made for reasonable growth potential of the work-load as visualized at that time. Only one area was provided with high-vacuum facilities in which space conditions could be approached. The greatly accelerated program of the Lewis Center and the substantial changes in the nature of the work caused by shifting emphasis to space research have created instrument laboratory requirements substantially greater than those now available.

Two of the many broad fields of space science for which instrumentation research and development will be conducted with the specialized facilities of the new wing are nuclear electric propulsion and power generating systems for space vehicles. Nuclear electric propulsion research requires vacuum measurements in space chambers that include both partial and total pressures over the range from near earth to deep space conditions. The plasma streams and attendant electric and magnetic fields impose stringent requirements. Additional vacuum facilities for pressure measurements research must be provided in order to keep pace with electric propulsion experimental requirements.

Space propulsion and power generation research requirements in a number of instances can only be satisfactorily met by experiments in space. The specialized problem of data acquisition for those experiments requires ground studies of components and instrument systems at these rigorous conditions of the proposed space experiment, including launch. New ideas must be checked out to insure that proposed space experiments will obtain the required data without violating reliability standards. Additional space environment facilities are required for this area of instrument research.

Space power generation in the range of 100 kilowatts is heavily dependent on successful research and development efforts in metal vapor systems. New facilities are required to study measurement techniques under the environmental conditions existing in such systems. Component and system research measurement requirements, both as to accuracy and difficulty of environment, are expected to increase rapidly.

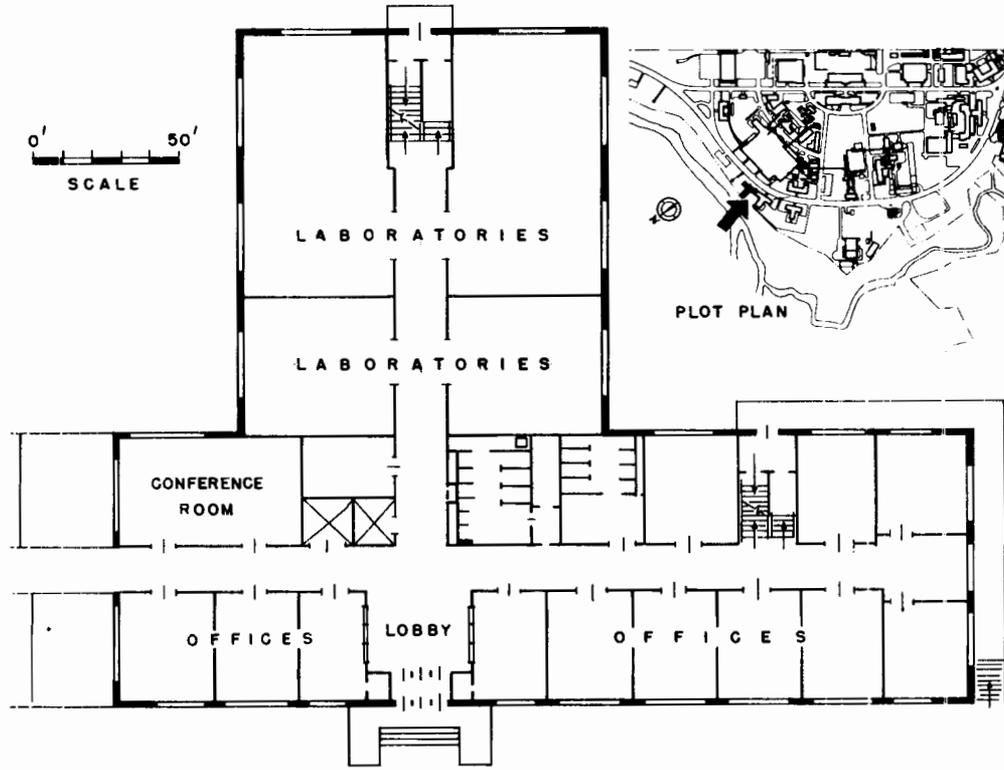
Direct electric power generation from nuclear and solar energy sources is under intensive study. The voltage and frequency of an optimum system varies widely from the requirements of optimum electric propulsion, communication and other space systems that must utilize this power. An additional related area that also happens to fall between the two areas of technology, i.e. power generation and power use, is the conversion of fluid dynamic energy to electrical energy. Additional facilities are required to allow analytical and small experimental research in these power conversion areas.

COST ESTIMATE:

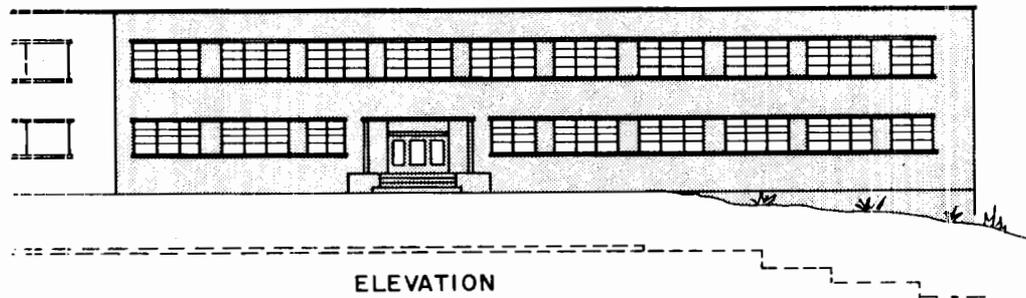
A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$114,000
Site preparation.....	\$18,000
Roads and parking areas.....	17,000
Electric power and communications.....	40,000
Sanitary and storm sewers.....	25,000
Natural gas line.....	3,000
City, fire, and cooling water lines.....	7,000
Steam and condensate lines.....	2,000
Service air line.....	2,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	676,000
Offices (10,000 square feet at \$20 per square foot).....	200,000
Laboratories (24,000 square feet at \$19 per square foot).....	456,000
Modifications to existing building.....	20,000
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	1,062,000
Laboratory equipment.....	90,000
Laboratory mechanical services.....	54,000
Laboratory electrical services.....	64,000
High-vacuum systems.....	184,000
Liquid metal instrumentation research equipment.....	151,000
Low temperature research equipment.....	50,000
Special research and evaluation equipment....	354,000

LEWIS RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

MODERNIZATION OF THE INSTRUMENT RESEARCH LABORATORY



TYPICAL FLOOR PLAN



ELEVATION

Power conversion research equipment		
and instruments.....	\$98,000	
Office furniture.....	17,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>\$150,000</u>
Total estimated cost.....		<u>\$2,002,000</u>

LEWIS RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

PROPELLANT FLOW SYSTEMS FACILITY

(Plum Brook Station)

DESCRIPTION:

This project requests approval of a facility that will have the capability of evaluating the operating characteristics and reliability of propellant flow systems of the M-1 and Centaur size and class under full flow conditions. The test array will consist of a full-scale cryogenic propellant flow system and will be installed in an existing and currently vacant test bay of the rocket systems hydraulics laboratory at the Plum Brook Station. This system will require two liquid hydrogen dewars, one of 24,000 gallons capacity to be used as a supply tank, and a 30,000 gallon one to be a receiver tank. A gaseous pressurizing system will be used to force the propellants through the test equipment and to transfer from one tank to the other. This full-flow system will have the capacity to test components up to approximately 18 inches in diameter. Included in the systems will also be adequate burn-off facilities for gaseous hydrogen, inerting system, vacuum jacketed piping, liquid level measuring devices, and the necessary associated piping and instrumentation.

JUSTIFICATION:

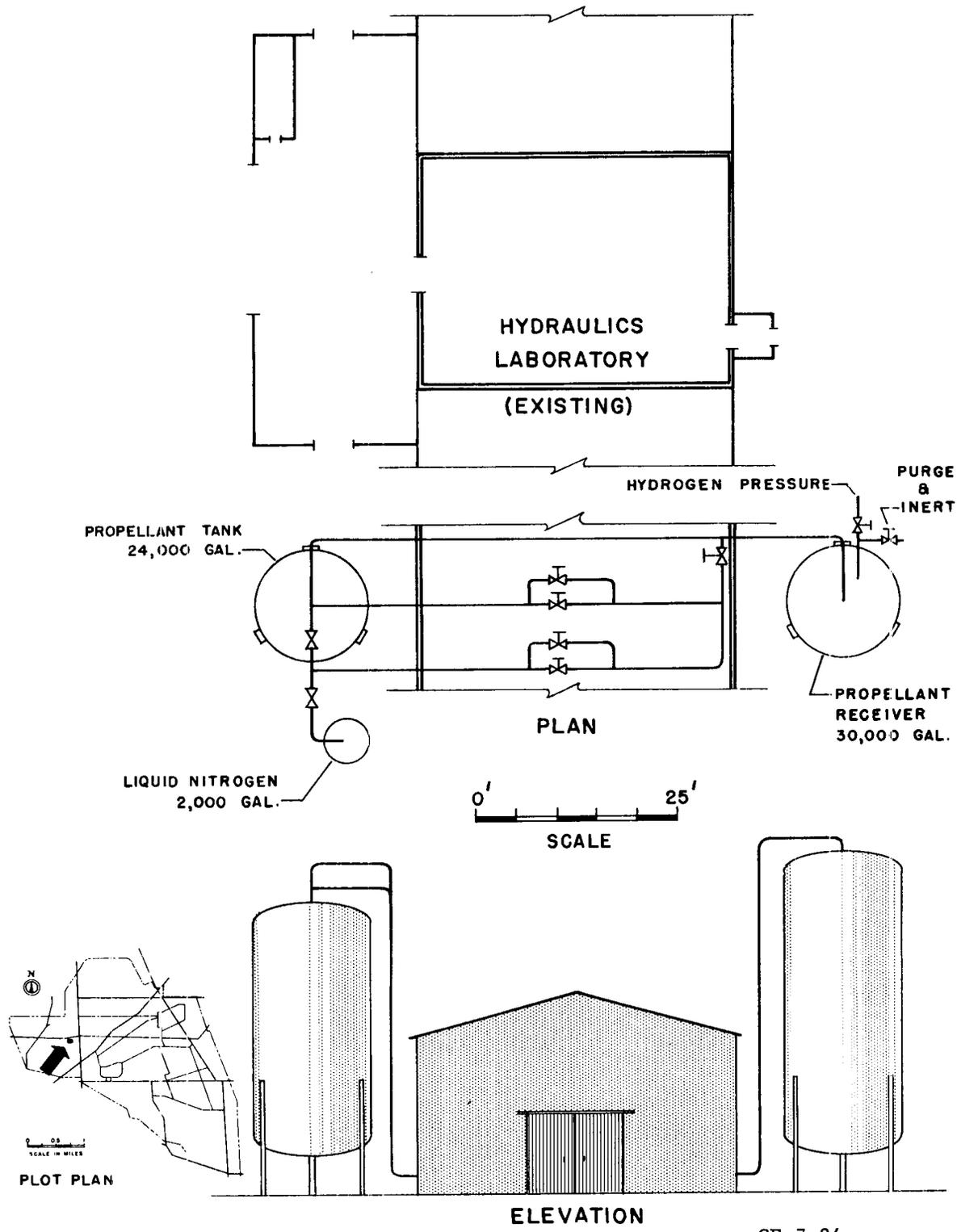
In addition to examining the effects of launch and space environments on components and subsystems, studies which involve the interaction of components and total system stability must be conducted. It is only in this manner that suitable system operating characteristics and the required reliability of systems after exposure to the space environment can be developed. Further, because monitoring and evaluating the results of contractor development efforts require proper in-house test capability plus experienced engineers and scientists, the proposed project is needed not only to meet the equipment requirements, but to provide for the training of the testing and evaluation personnel.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	\$20,000
Footings and pads.....	\$20,000

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	\$1,236,000
Leak detection equipment, instrumen- tation, controls, tools, and control room data handling system.....	\$261,000
Liquid hydrogen flow facility with pressurizing and inerting system.....	750,000
Liquid oxygen flow facility with pressurizing and inerting system.....	225,000
E. DESIGN AND ENGINEERING SERVICES.....	<u>60,000</u>
Total estimated cost.....	<u>\$1,316,000</u>

PROPELLANT FLOW SYSTEM FACILITY
(PLUM BROOK STATION)



LEWIS RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

PROPULSION COMPONENT EVALUATION FACILITY

DESCRIPTION:

A facility is required that will provide the capability of evaluating the operating characteristics and reliability of propulsion components under space environments. A series of small bell-type chambers in sizes up to approximately 100 cubic feet in volume and operating at 10^{-6} to 10^{-9} mm of mercury pressure will be acquired to furnish hard vacuum conditions. Stress and vibration conditions will be supplied by mechanical endurance test rigs and vibration exciters capable of producing 2 to 1000 cycles per second "white noise." Temperature environment chambers will provide for temperature cycling and thermal gradient studies. Special chambers will be used for the simulation of space radiation.

The equipment will be installed in a modified area of the engine research building.

JUSTIFICATION:

Propulsion components and subsystems must exhibit the proper operating characteristics and the highest reliability for sustained or intermittent operation after being subjected to the environment resulting from injection into space, prior operating cycles while in space, and the hard vacuum and radiations in space. The total exposure to these conditions may vary from two weeks for a lunar mission to one or several years for interplanetary missions. The required degree of freedom from degradation and retention of high reliability can be obtained only through extensive prior testing and evaluation under simulated operating conditions. To provide economy for long-soak tests, a large number of small bell-jar space chambers is required along with decreasing numbers of larger sizes up to 100 cubic feet in volume. Because combination effects are important and must be studied, some of the vacuum chambers must be provided with simulated solar radiation.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	\$80,000
Modifications to existing building	\$80,000

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		\$884,000
Six bell-jar chambers (3 cubic feet at 10^{-5} to 10^{-9} mm of mercury pressure).....	\$100,000	
Two vacuum chambers (20 to 100 cubic feet at 10^{-6} to 10^{-9} mm of mercury pressure).....	120,000	
Two vacuum chambers (20 to 100 cubic feet at 10^{-6} to 10^{-9} mm of mercury pressure with simulated solar source radiation).....	220,000	
One vacuum chamber (20 cubic feet at 10^{-11} mm mercury pressure with simulated solar source radiation).....	70,000	
Three vibration test machines (2-1000 cycles per second, white noise, 20 pound capacity).....	20,000	
One vibration test machine (2-1000 cycles per second, white noise, 200 pounds capacity).....	24,000	
Mechanical endurance test rigs for run to failure tests.....	160,000	
Temperature environment chambers for temperature cycling and thermal gradient.....	170,000	
E. DESIGN AND ENGINEERING SERVICES.....		<u>40,000</u>
Total estimated cost.....		<u><u>\$1,004,000</u></u>

LEWIS RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

SNAP-8 ASSEMBLY AND SPACECRAFT CHECKOUT BUILDING

DESCRIPTION:

This facility will consist of a structure to house pre-flight testing and integration equipment for the SNAP-8 flight test vehicle. Space will be provided to check out all subsystems, components, and elements delivered from suppliers; to assemble and integrate them into a flight test vehicle; and to check the completed vehicle prior to packaging for shipment to Cape Canaveral. Because of the requirement for vertical assembly, high bay areas will be provided for assembly of the power conversion system, electronic guidance systems, and flight test vehicle integration. These areas require special material handling equipment such as cranes having high lift capability. The reactor criticality area will include a biologically shielded containment vessel approximately 35 feet in diameter that will be evacuated to a relatively low pressure during criticality tests to minimize hazards in the event of a malfunction. Liquid metal systems, a white room, nuclear materials storage, cold soak equipment, instrument shops, health physics equipment, and other auxiliary items will be provided to complete the facility.

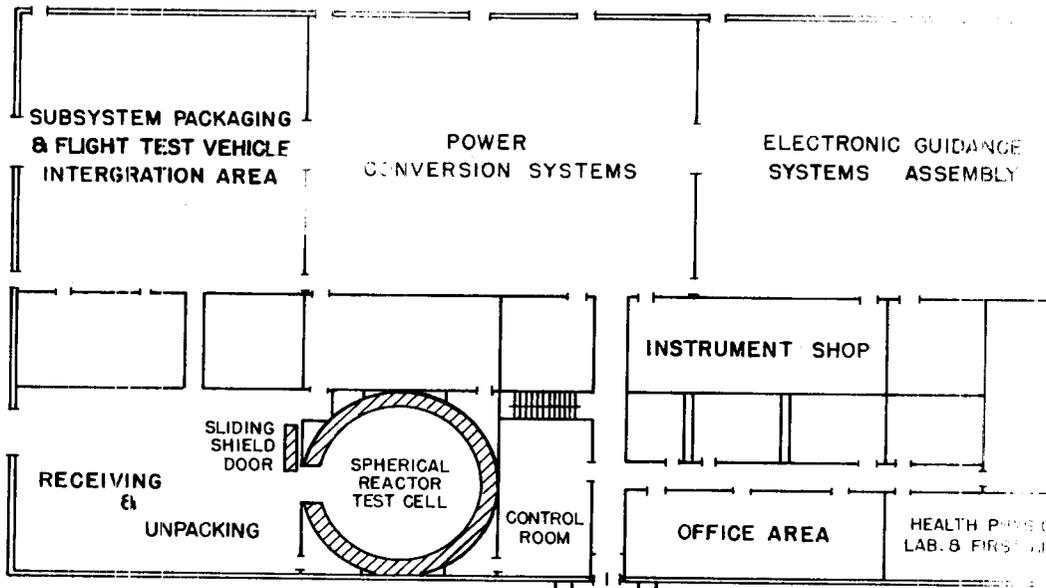
A layout and elevation drawing of the facility is shown on the next page. The structure will be 120 feet by 220 feet in plan. In addition, there will be a partial basement for mechanical and electrical building services and space on the second floor for locker rooms and storage areas. The total floor area will be 36,400 square feet and the volume 1,307,000 cubic feet. The building will be steel frame with metal siding. The facility will be constructed at the Plum Brook Station adjacent to the space propulsion facility as shown on the plot plan. It will utilize the data acquisition system installed in the space propulsion facility. Only necessary additional items will be added.

JUSTIFICATION:

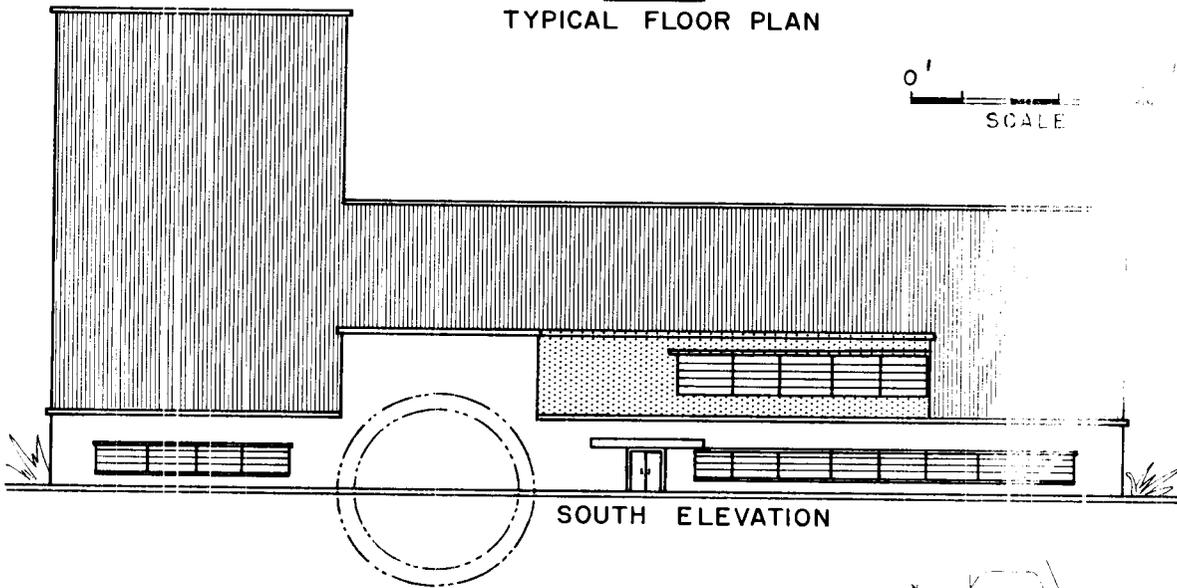
The first of four flights of the SNAP-8 electric generating system is scheduled for the calendar year 1967. The actual flight will be preceded by an extensive ground test of components and subsystems, and by an integration and life test (90 days) of a nonflight model in a simulated space environment. The testing phase is scheduled to begin late in the calendar year 1965, and support facilities for testing and integration should be operational and available at that time.

Because of the stringent restrictions imposed upon the handling and storage of radioactive materials, fissionable fuels, and liquid metals, such as mercury with their attendant biological hazards, facilities normally used

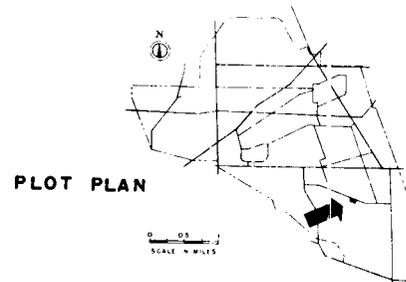
SNAP-8 ASSEMBLY AND SPACECRAFT CHECKOUT BUILDING



TYPICAL FLOOR PLAN



SOUTH ELEVATION



PLOT PLAN

for storage, assembly, maintenance, and test of hardware and electronic items are not suitable for the SNAP-8 electrical generating system vehicle integration and test. Special facilities will be required and their design must be unique and carefully planned to minimize hazards due to the operation of a nuclear reactor and to the generation of radioactive materials. It is essential that AEC regulations for storage and test facilities be observed, and that the possibility of accidental release of liquid metals in an unprotected area frequented by personnel be eliminated.

A flight test of the SNAP-8 will be extremely expensive; the cost of a Saturn B booster itself will be in excess of \$25 million. The cost of all SNAP-8 ground test and integration facilities will be considerably less than the cost of one unsuccessful test flight. This facility will allow sufficient tests of the systems to minimize later checkout problems at the time the SNAP-8 is integrated with the Saturn B booster. This facility, therefore, will help establish a high degree of confidence for a successful flight test.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		\$160,000
Roads and parking.....	\$10,000	
Sewer lines.....	4,000	
Water lines.....	10,000	
Gas lines.....	11,000	
Telephone lines.....	15,000	
Power lines.....	100,000	
Railroad.....	10,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,905,000
Building (36,400 square feet at \$26 per square foot).....	980,000	
Containment vessel.....	460,000	
Concrete shield.....	180,000	
Cranes and staging.....	135,000	
Vault.....	25,000	
Control room.....	125,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		2,485,000
Power conversion system test operation equipment.....	250,000	
Research instrumentation.....	75,000	
Shaker equipment.....	120,000	
Telemetry read-out equipment.....	200,000	

Cold room equipment.....	\$230,000	
Health physics equipment.....	50,000	
Inerting systems.....	80,000	
Safety monitoring system.....	30,000	
Clean room equipment.....	85,000	
Liquid metal loop.....	250,000	
Sequence analysis equipment for flight controls check-out and calibration.....	550,000	
Precision shop equipment.....	100,000	
Special welding and other assembly equipment.....	125,000	
Leak checking and other instruments.....	40,000	
Thermal gradient equipment.....	300,000	
 E. DESIGN AND ENGINEERING SERVICES.....		<u>\$450,000</u>
 Total estimated cost.....		<u>\$5,000,000</u>

FISCAL YEAR 1964 ESTIMATES

ZERO GRAVITY FACILITYDESCRIPTION:

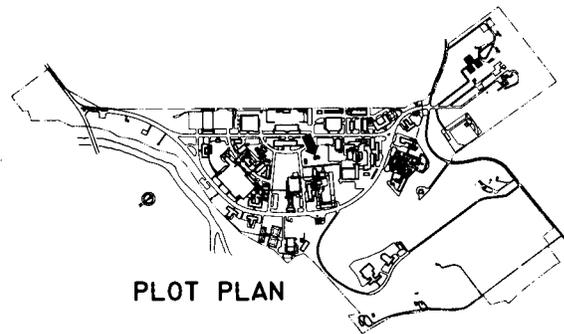
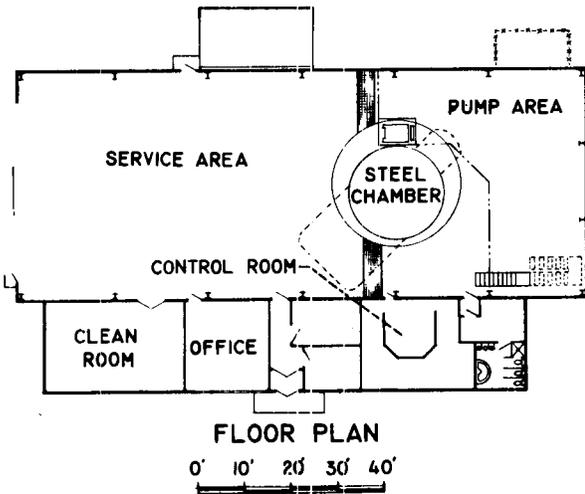
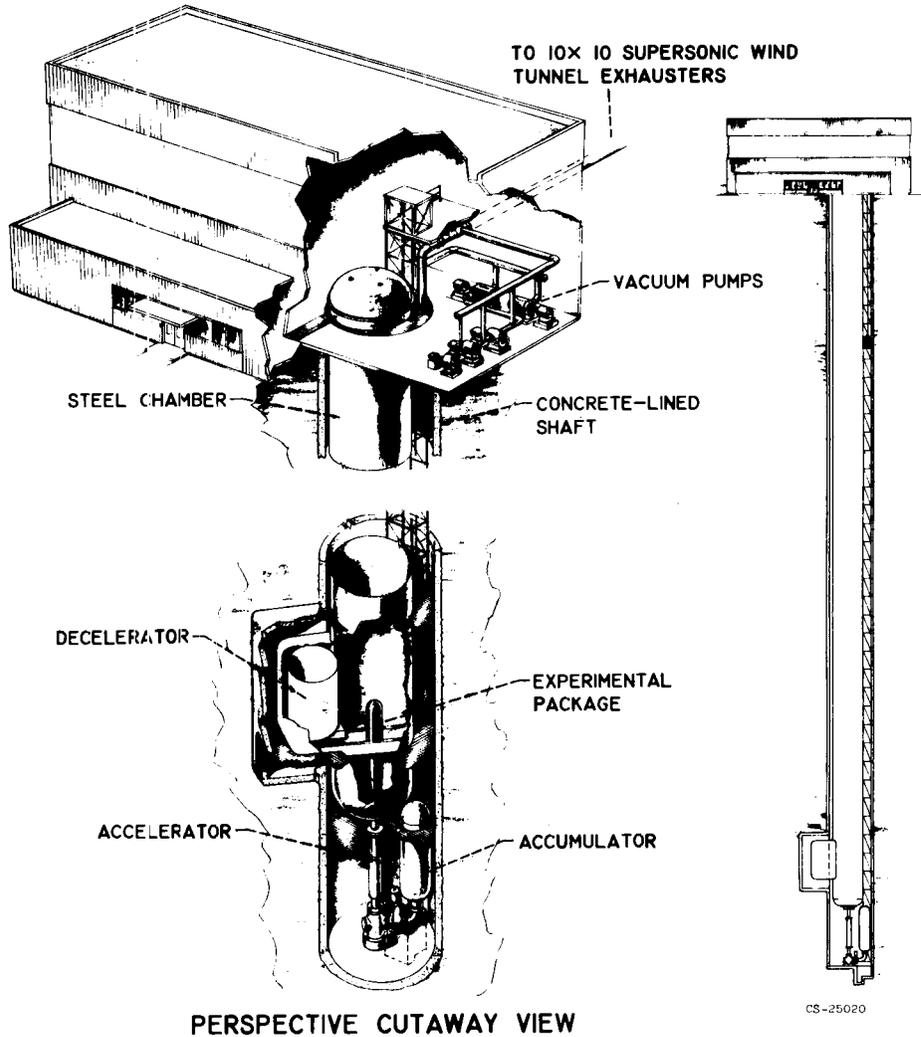
This facility is designed to provide a near zero-gravity environment (less than 10^{-5} G's) with essentially no initial disturbance for periods up to ten seconds. It will employ the method of allowing the experimental package to fall freely to produce the zero gravity effect. It will consist of a 20-foot diameter steel chamber evacuated to 10^{-2} mm of Hg providing a free-fall distance of 400 feet. The steel chamber will be located in an underground concrete-lined shaft. A means of decelerating the experiment without excessive damage is provided at the bottom of the chamber. For times up to five seconds, the experiment will be dropped from the top. For times up to ten seconds, it will be projected from the bottom by the accelerator provided and recovered again at the bottom after traversing the 400-foot distance twice. Two means of eliminating air drag will be provided. Experiments that are compact will be enclosed in a heavy outer-drag shield and allowed to float freely in this drag shield so that as it is held back by air resistance the experiment may still follow the free fall path. This method will allow rapid testing. For those experiments too large and unwieldy for a drag shield, the tube may be evacuated and the experiment dropped in a vacuum. Existing exhaustor equipment of the 10- by 10-foot supersonic wind tunnel will provide first stage evacuation of the chamber to 18 mm of Hg through interconnecting pipe line. Additional vacuum pumps will provide the final pressure in a total elapsed time of one hour.

The principle features of the facility and its proposed location are shown on the drawing on the following page. The shaft will be about 510 feet deep and 28.5 feet in diameter. The test chamber will be placed eccentrically within the shaft, allowing space for an elevator. The top of the shaft will be enclosed by a 48-foot-high service building, which will contain the vacuum pumps, model preparation area, and a crane for handling the models. The crane will also be used to remove and replace the upper head of the test chamber, to retrieve models from the bottom of the chamber, and to service the accelerator and decelerator. A one-story addition on one side of the service building will contain a control room, mechanical services room, a field office, and a "clean" room for preparing liquid containers to be used in the models. A special ventilating system will be required because of the dangerous nature of the liquids to be used.

JUSTIFICATION:

An extensive program for investigating the behavior of liquid and vapor systems in a zero-gravity environment is underway at the present time. Examples of systems being studied are the positioning of liquid and vapor

ZERO GRAVITY FACILITY



in propellant tanks and in the condensers and evaporators of auxiliary power systems. The behavior of the liquid-vapor interface in zero gravity affects such functions as engine restarting, tank venting, propellant transfer during rendezvous, and proper operation of an auxiliary power system. One or more of all of these problems occur in the Apollo vehicle, the SNAP systems, the Centaur vehicle, and indeed any vehicle or system containing liquid and vapor which would be required to coast during part of its mission. The present facilities being used consist of a 100-foot drop tower providing two seconds of excellent zero-gravity time. The two seconds of time has allowed the testing of models only up to the 5 to 10-inch size because of the time required for the interface to reach equilibrium. It is extremely important that model size be increased to test scaling laws over as wide a range as possible thus allowing extrapolation to full-sized vehicles. A time of 10 seconds, to be provided in the proposed facility, will allow tests in the 2 to 4-foot model size to be conducted. Also, a time of 10 seconds will allow propellant transfer studies to be conducted with a better simulation, will allow studies of the startup of auxiliary power systems, and will allow some heat transfer tests to be conducted.

COST ESTIMATE:

A. LAND ACQUISITION.....	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	\$80,000
Site development.....	---
Utility installations.....	---
Grading, parking areas, and walks.....	\$12,000
Electric power (including substation)	
and telephone.....	37,000
Steam, water, compressed air, and sewer	
connections.....	31,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....	2,065,000
Service building (High bay, 51 by 120	
feet, with mezzanine 51 by 28 feet;	
7,548 square feet at \$32.00 per	
square foot. Low bay, 20 by 110	
feet; 2,200 square feet at \$15.00	
per square foot).....	275,000
Concrete lined shaft.....	820,000
Vacuum chamber.....	770,000
Shaft elevator and shaft ventilation.....	---
Shaft elevator and platforms.....	115,000
Shaft ventilation, drainage, lighting and	
power.....	85,000

EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	\$505,000
Vacuum system.....	\$160,000
Model release, accelerator and decelerator equipment.....	190,000
Model preparation equipment.....	10,000
Instrumentation, including gas detection system.....	70,000
Building crane.....	55,000
Special building ventilating system.....	20,000
DESIGN AND ENGINEERING SERVICES.....	<u>3,000</u>
Total estimated cost.....	<u>\$2,653,000</u>