ATTACHMENT 5.E

LEWIS RESEARCH CENTER

FISCAL YEAR 1964 ESTIMATES

ALTERATION OF THE SPACE POWER CHAMBERS

FOR PROPULSION SYSTEM EVALUATION IN SPACE ENVIRONMENT

DESCRIPTION:

This project provides appropriate 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 is thus 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.

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 provide a simulation of 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. Levels of reliability and operational complexity, with a minimum of attendance must be achieved on a compressed time schedule. These levels of reliability and system operation can only be realized through the conducting of extensive and thorough development testing and evaluations in ground based facilities. These 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. Problems and uncertainties of propellant heating, propellant freezing or vapor lock in lines and valves, insulation effectiveness, pressurization and venting requirements must undergo a complete checkout. Countdown procedures, system behavior, valve and actuator performance and engine ignition must also be checked. 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.

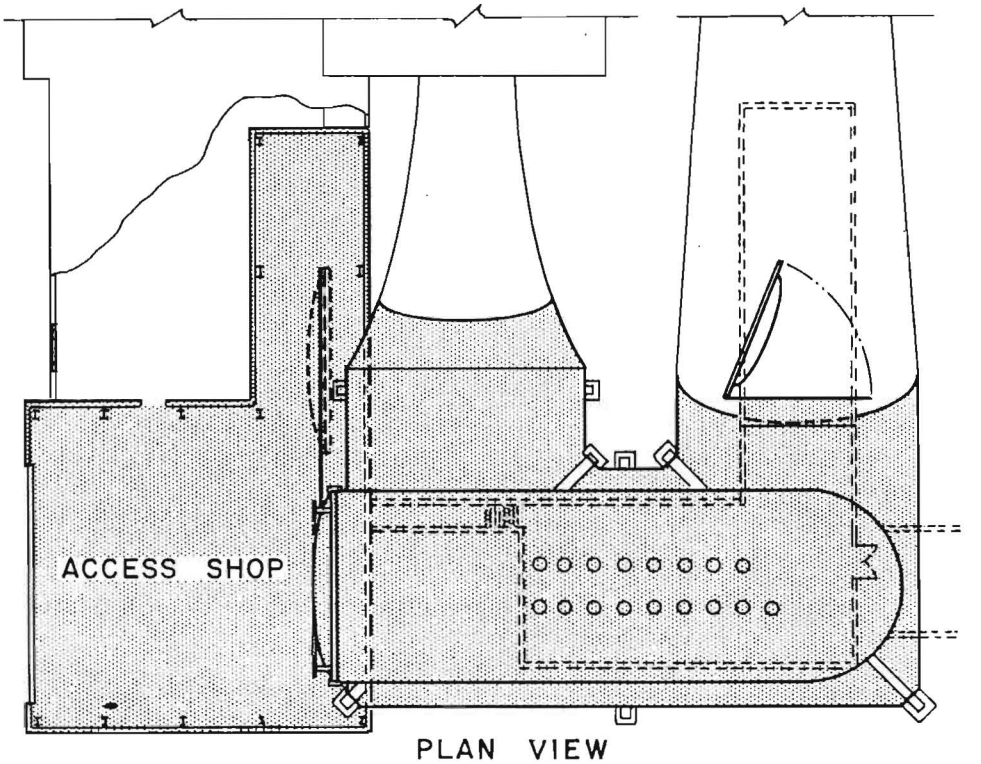
To achieve these large and complex facility capabilities necessitates a maximum utilization of currently available high altitude test facilities. The large exhaust gas cooling and pumping system of the Lewis Research Center and the former Altitude Wind Tunnel, with its extensive basic structure, control 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.	ENGINEERING AND DESIGN SERVICES		550,000
	Total estimated cost		$5,665,000

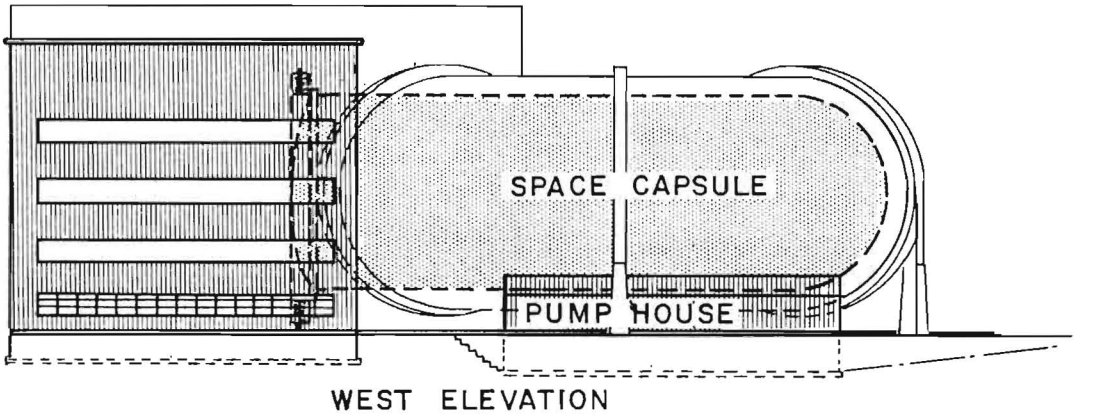
LEWIS RESEARCH CENTER
FISCAL YEAR 1964 ESTIMATES

ALTERATION OF THE SPACE POWER CHAMBERS

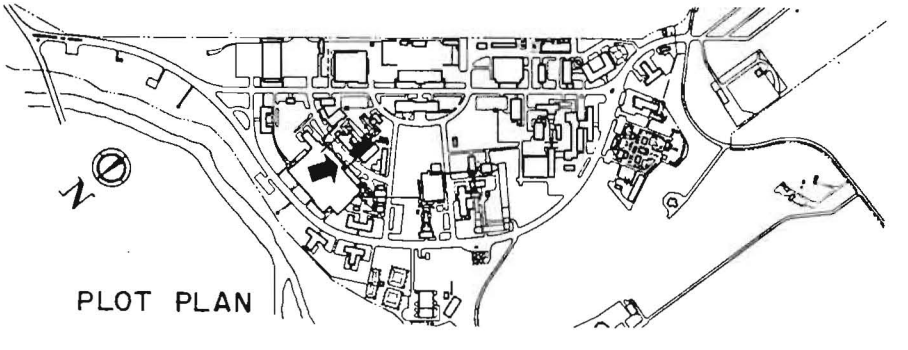


PLAN VIEW

0 50
SCALE



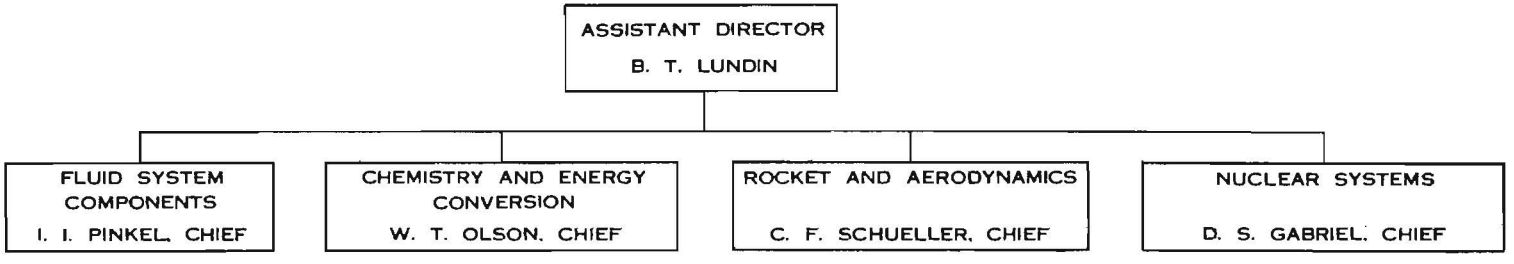
WEST ELEVATION



PLOT PLAN

LEWIS RESEARCH CENTER

RESEARCH DIVISION FUNCTIONS



R E S E A R C H A R E A S

1. FLOW PHYSICS
2. LIQUID PROPELLANT FLOW SYSTEMS
3. PUMP AND TURBINE RESEARCH
4. LUBRICATION AND BEARING RESEARCH

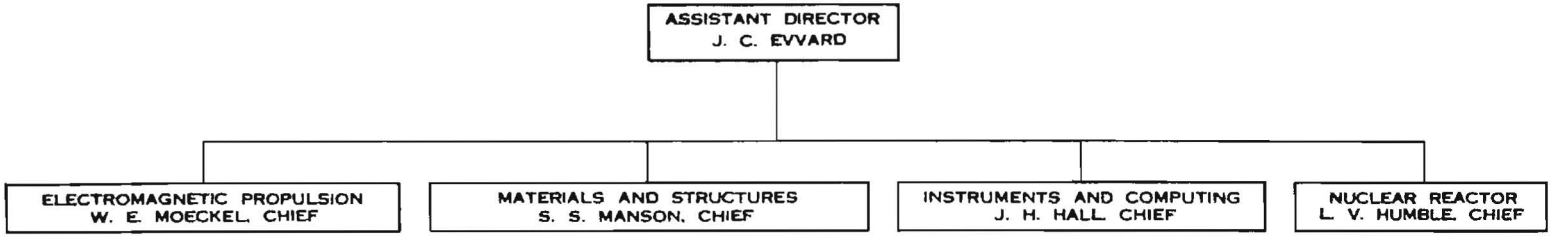
1. FUNDAMENTAL CHEMISTRY AND THERMODYNAMICS
2. ROCKET COMBUSTION RESEARCH
3. HEAT TRANSFER AND NOZZLE COOLING
4. DIRECT ENERGY CONVERSION

1. HIGH-ENERGY ROCKET THRUST CHAMBERS
2. CHEMICAL ROCKET SYSTEMS
3. PROPULSION AERODYNAMICS PROBLEMS
4. UNITARY TUNNEL PROGRAMS
5. ADVANCED MISSION ANALYSES AND APPLICATION STUDIES

1. NUCLEAR ROCKET AND POWER GENERATION SYSTEMS
2. NUCLEAR SYSTEMS CONTROLS RESEARCH
3. MISSION AND APPLICATION STUDIES
4. ZERO-GRAVITY PROPELLANT HANDLING PROBLEMS
5. TECHNICAL SUPPORT OF OLVP NUCLEAR ENGINES PROJECT OFFICE

/CS-20426/

LEWIS RESEARCH CENTER
RESEARCH DIVISION FUNCTIONS



RESEARCH AREAS

1. ELECTRIC PROPULSION
2. MAGNETO FLUID DYNAMICS
3. FLUID PHYSICS
4. EXTREME TEMPERATURE PHYSICS
5. SPACE ENVIRONMENT STUDIES
6. JET NOISE RESEARCH

1. SOLID STATE PHYSICS
2. STRENGTH OF MATERIALS
   STRESS RUPTURE,
   FATIGUE NOTCH SENSITIVITY
3. IMPROVEMENT IN MATERIALS
   SUPER ALLOYS, REFRACTORY METALS,
   CERAMICS, POWDER METALLURGY
4. PROPULSION SYSTEMS STRUCTURES
   CRYOGENIC FUEL TANKS,
   SOLID ROCKET CHAMBERS
5. INFLUENCE OF SPACE
   ENVIRONMENT ON MATERIALS

1. RESEARCH INSTRUMENTS
2. DATA TRANSMISSION
3. AUTOMATIC DATA PROCESSING
4. MACHINE MATHEMATICS

1. ADVANCED NUCLEAR
   ROCKET RESEARCH
2. REACTOR PHYSICS
3. RADIATION PHYSICS
4. NUCLEAR POWER
   PRODUCTION
5. SHIELDING RESEARCH
6. THEORY OF HEAT
   TRANSFER AND
   TURBULENCE

/CS-20425/