

**United States Department of the Interior  
National Park Service**

**For NPS use only**

**National Register of Historic Places  
Inventory—Nomination Form**

received

date entered

See instructions in *How to Complete National Register Forms*  
Type all entries—complete applicable sections

**1. Name**

historic Spacecraft Propulsion Research Facility

and/or common Spacecraft Propulsion Research Facility

**2. Location**

street & number Lewis Research Center Plum Brook Station not for publication

city, town Sandusky vicinity of congressional district

state Ohio code 39 county Erie code 043

**3. Classification**

<b>Category</b>	<b>Ownership</b>	<b>Status</b>	<b>Present Use</b>
<input type="checkbox"/> district	<input checked="" type="checkbox"/> public	<input type="checkbox"/> occupied	<input type="checkbox"/> agriculture
<input checked="" type="checkbox"/> building(s)	<input type="checkbox"/> private	<input type="checkbox"/> unoccupied	<input type="checkbox"/> commercial
<input type="checkbox"/> structure	<input type="checkbox"/> both	<input type="checkbox"/> work in progress	<input type="checkbox"/> educational
<input type="checkbox"/> site	<b>Public Acquisition</b>	<b>Accessible</b>	<input type="checkbox"/> entertainment
<input type="checkbox"/> object	<input type="checkbox"/> in process	<input checked="" type="checkbox"/> yes: restricted	<input type="checkbox"/> government
	<input type="checkbox"/> being considered	<input type="checkbox"/> yes: unrestricted	<input type="checkbox"/> industrial
		<input type="checkbox"/> no	<input type="checkbox"/> military
			<input checked="" type="checkbox"/> other: Inactive

**4. Owner of Property**

name National Aeronautics and Space Administration (NASA)

street & number

city, town Washington vicinity of state D.C. 20546

**5. Location of Legal Description**

courthouse, registry of deeds, etc. National Aeronautics and Space Administration (NASA)

street & number Real Property Management Office Code NXG

city, town Washington state D.C. 20546

**6. Representation in Existing Surveys**

title None has this property been determined eligible?  yes  no

date \_\_\_\_\_  federal  state  county  local

depository for survey records

city, town \_\_\_\_\_ state \_\_\_\_\_

# 7. Description

<b>Condition</b>		<b>Check one</b>	<b>Check one</b>
<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> deteriorated	<input checked="" type="checkbox"/> unaltered	<input checked="" type="checkbox"/> original site
<input type="checkbox"/> good	<input type="checkbox"/> ruins	<input type="checkbox"/> altered	<input type="checkbox"/> moved
<input type="checkbox"/> fair	<input type="checkbox"/> unexposed		date _____

## Describe the present and original (if known) physical appearance

The Spacecraft Propulsion Research Facility is at the Plum Brook Station of the Lewis Research Center. This facility is designed for hot firings of full-size space vehicles in an environment simulating conditions at an orbital altitude of 100 miles.<sup>1</sup> The major elements that support this facility are a test building, an equipment building, a three stage exhaust system, a waste treatment retention pond, a propellant oxidizer and fuel storage area, an electrical substation, a refrigeration system and a service building.

The Spacecraft Propulsion Test Building is more than 70 feet high and extends 176 feet below grade. The below-grade spray chamber is 67 feet by 119 feet in diameter and holds 1,750,000 gallons of water. A 2.5-million-gallon retention pond is northeast of the test building. The three-stage steam ejectors are in the back of the test building and an 11 foot diameter duct connects them to the spray chamber. The vacuum test chamber is a stainless steel cylinder that can accommodate space vehicles up to 22 feet in diameter and 50 feet high. Two 6 foot 6 inch access openings are provided at the top and bottom of the test chamber. Five 8 inch viewports are provided at the top, center, and bottom of the test chamber for TV monitors. The test chamber is provided with a 27 foot access door for test spacecraft articles. The heat sink of space is simulated by a Liquid Hydrogen cold wall (maintained at  $-320^{\circ}\text{F}$ ) consisting of copper tube-in-strip panels surrounding the inside wall and top dome of the test chamber. Twelve columns of quartz infrared lamps spaced along an arc of the inside wall of the test chamber simulate thermal radiation and heat from the sun.

In operation, an entire vehicle can be vacuum "soaked" to the proper environmental space conditions in preparation for engine test firing. With the  $-320^{\circ}\text{F}$  cold walls and  $5 \times 10^{-8}$ -torr vacuum, rocket engines can be ignited in the chamber under space conditions. As chamber pressure builds up because of the exhaust gas, an 11 inch diameter valve opens in 0.4-second to connect the chamber to a steam ejector system. Two parallel steam ejectors remove the engine exhaust products from the chamber while maintaining a moderate vacuum level. Three large dump tanks are in the exhaust spray chamber to receive propellants in an emergency situation.

The exhaust system includes a 250,000-gallon-per-minute water spray system for cooling the rocket exhaust. The spray system water is recirculated through the 1.75-million-gallon catch basin under the chamber.

# 8. Significance

Period	Areas of Significance—Check and justify below			
<input type="checkbox"/> prehistoric	<input type="checkbox"/> archeology-prehistoric	<input type="checkbox"/> community planning	<input type="checkbox"/> landscape architecture	<input type="checkbox"/> religion
<input type="checkbox"/> 1400-1499	<input type="checkbox"/> archeology-historic	<input type="checkbox"/> conservation	<input type="checkbox"/> law	<input type="checkbox"/> science
<input type="checkbox"/> 1500-1599	<input type="checkbox"/> agriculture	<input type="checkbox"/> economics	<input type="checkbox"/> literature	<input type="checkbox"/> sculpture
<input type="checkbox"/> 1600-1699	<input type="checkbox"/> architecture	<input checked="" type="checkbox"/> education	<input type="checkbox"/> military	<input type="checkbox"/> social/ humanitarian
<input type="checkbox"/> 1700-1799	<input type="checkbox"/> art	<input type="checkbox"/> engineering	<input type="checkbox"/> music	<input type="checkbox"/> theater
<input type="checkbox"/> 1800-1899	<input type="checkbox"/> commerce	<input type="checkbox"/> exploration/settlement	<input type="checkbox"/> philosophy	<input type="checkbox"/> transportation
<input checked="" type="checkbox"/> 1900-	<input type="checkbox"/> communications	<input type="checkbox"/> industry	<input type="checkbox"/> politics/government	<input checked="" type="checkbox"/> other (specify) Space Exploration
<input type="checkbox"/> invention				
<b>Specific dates</b>	1968	<b>Builder/Architect</b>	NASA	

## Statement of Significance (in one paragraph)

The Spacecraft Propulsion Research Facility's significance rests in its association with the development of the Centaur Rocket. This facility is the only one in NASA's inventory that can hot fire a large rocket while simulating the vacuum, cryogenic temperatures, and thermal radiation of space. The duplication of this space environment was crucial to the development of the Centaur Rocket which was designed to fire from Earth Orbit to send vehicles to explore the planets and Solar System. The Centaur upper stage rocket has launched some of America's most important space probes including the Pioneer, Viking and Voyager Spacecraft. The successful development and use of the Centaur was due in large measure to data that was collected from successful test firings of Centaur engines in this facility.

The importance of the Spacecraft Propulsion Research Facility is in its unique technical capabilities and its association with the Centaur research and development program. At the present time this facility is maintained by NASA on a standby status.

# 9. Major Bibliographical References

See continuation sheets

# 10. Geographical Data

Acreeage of nominated property Less than 1 acre

Quadrangle name Kimball

Quadrangle scale 1:24,000

### UMT References

A 

1	7	3	5	9	1	8	0	4	5	8	0	6	6	0
Zone	Easting			Northing										

B 

Zone	Easting			Northing										

C 

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D 

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E 

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F 

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G 

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H 

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### Verbal boundary description and justification

The boundary of the Spacecraft Propulsion Research Facility is defined by the outside perimeter of Building 3211 at the Plum Brook Station of the Lewis Research Center.

### List all states and counties for properties overlapping state or county boundaries

state	code	county	code
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state	code	county	code
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# 11. Form Prepared By

name/title Harry A. Butowsky

organization National Park Service

date May 15, 1984

street & number Division of History

telephone (202) 343-8168

city or town Washington, D.C. 20240

state

# 12. State Historic Preservation Officer Certification

The evaluated significance of this property within the state is:

national  state  local

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

State Historic Preservation Officer signature

title	date
-------	------

For NPS use only

I hereby certify that this property is included in the National Register

date

Keeper of the National Register

Attest:

date

Chief of Registration

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Footnotes

1. Information taken for the description of the Spacecraft Propulsion Research Facility was derived from the following sources:

Plum Brook Station (Cleveland, Ohio: Lewis Research Center, No Date), p.16.

Spacecraft Propulsion Research Facility "B-2" (Cleveland, Ohio: Lewis Research Center, May 1972), pp. 1-17.

Technical Facilities Catalogue Vol. 1 (Washington, D.C.: National Aeronautics and Space Administration, 1974), pp. 4-89., 4-90.

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Bibliography

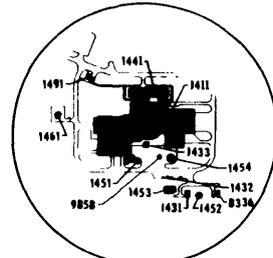
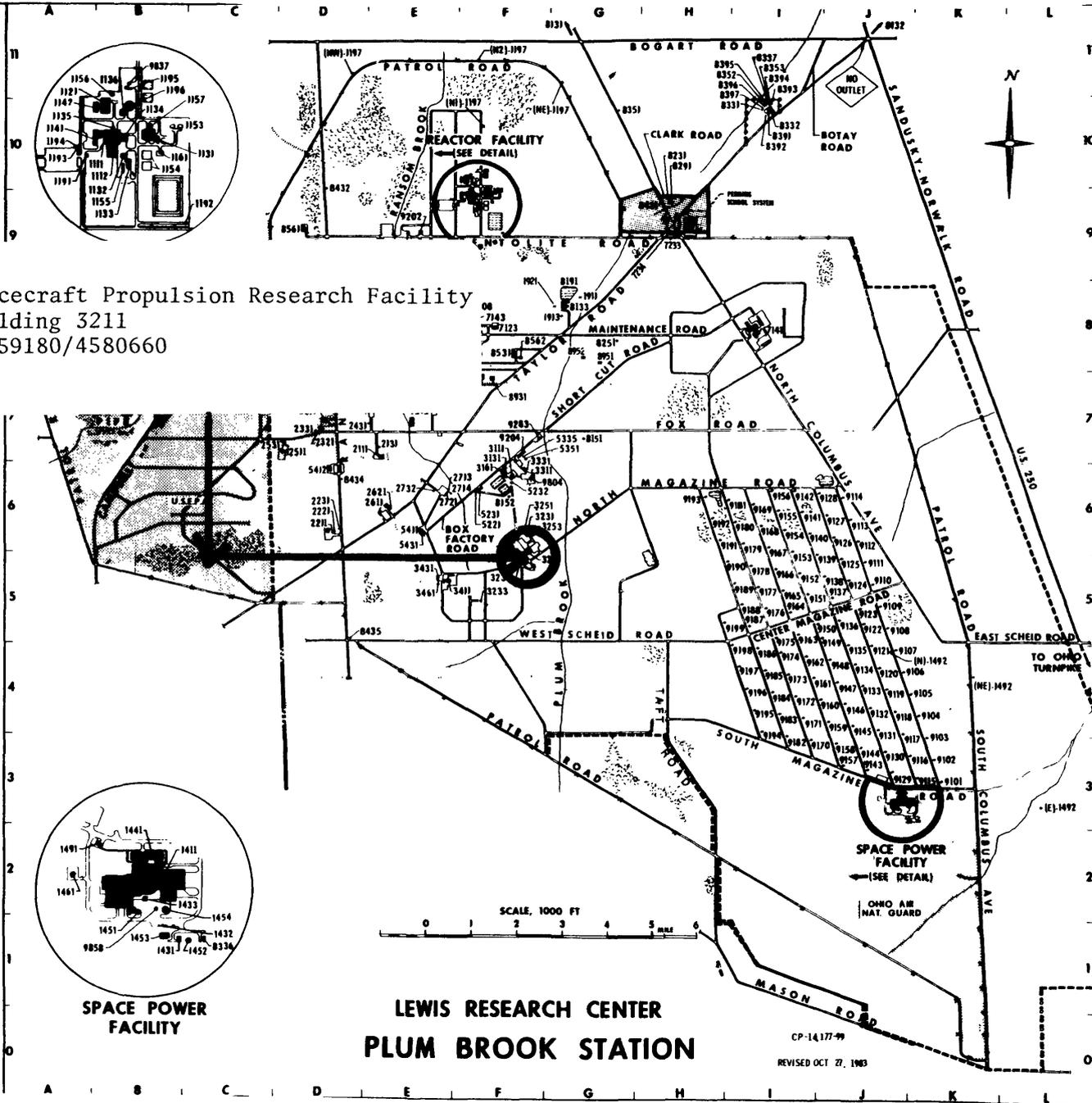
Plum Brook Station. Cleveland, Ohio: Lewis Research Center, No date.

Spacecraft Propulsion Research Facility "B-2". Cleveland, Ohio: Lewis Research Center, 1972.

Technical Facilities Catalog Vol. 1. Washington, D.C.: National Aeronautics and Space Administration, 1974.

- 1111 REACTOR BUILDING. F-9
- 1112 REACTOR HOT LABORATORY. F-9
- 1121 REACTOR ATYS BUILDING. F-10
- 1131 REACTOR SERV. EQUIP. BLDG. F-9
- 1132 REACTOR FAN HOUSE. F-9
- 1133 REACTOR WASTE HANDLING BLDG. F-9
- 1134 REACTOR PRIMARY PUMP HOUSE. F-9
- 1135 REACTOR GAS SERVICES BLDG. F-10
- 1136 REACTOR COMPRESSOR BLDG. F-10
- 1141 REACTOR OFFICE & LABORATORY. F-9
- 1142 REACTOR OFFICE BUILDING. F-10
- 1153 REACTOR SLODGE BASINS. F-10
- 1154 REACTOR COLD RETENTION BASINS. F-9
- 1155 REACTOR HOT RETENTION BASINS. F-9
- 1156 REACTOR ATYS WATER STORAGE TANK (200K GALL. F-10)
- 1157 REACTOR PRECIPITATOR. F-10
- 1161 REACTOR SUBSTATION (E). F-9
- 1191 REACTOR SECURITY BUILDING. F-9
- 1192 REACTOR EFFLUENT METERING STA. F-9
- 1193 REACTOR WEATHER TOWER HOUSE. E-9
- 1194 REACTOR WEATHER TOWER. E-9
- 1195 REACTOR CRYOGENIC AND GAS SUPPLY SYSTEM. F-10
- 1196 REACTOR GAS STOR. STRUCT. F-10
- 1197 REACTOR MONITORING STATIONS. (H01 D-1L, I01) F-10, (H2 F-1L, I01) G-11
- 1411 SPF TEST BUILDING. J-3
- 1431 SPF WATER TREATMENT BLDG. K-3
- 1432 SPF LHZ SERVICE BUILDING. J-3
- 1433 SPF BOTTLE STORAGE BUILDING. J-3
- 1441 SPF OFFICE BUILDING. J-3
- 1451 SPF STACK. J-3
- 1452 SPF WATER TOWER (G). K-3
- 1453 SPF COOLING TOWER. J-3
- 1454 SPF LHZ TANK (200K GALL. J-3
- 1461 SPF SUBSTATION (H). J-3
- 1491 SPF SECURITY BUILDING. J-3
- 1492 SPF MONITORING STATIONS. (H1 J-4, I01) K-4, (E1 L-3
- 1911 100 KW WIND TURBINE. G-8
- 1913 WIND TURBINE WEATHER TOWER. G-8
- 1921 WIG SHOP. G-8
- 2111 A SITE TEST BUILDING. E-7
- 2131 A SITE BOILER HOUSE. E-7
- 2211 C SITE TEST BUILDING. D-4
- 2221 C SITE SHOP BUILDING. D-4
- 2231 C SITE BOILER HOUSE. D-4
- 2311 D SITE TEST BUILDING. D-7
- 2321 D SITE SHOP BUILDING. D-7
- 2331 D SITE BOILER HOUSE. D-7
- 2411 E SITE TEST BUILDING. E-7
- 2431 E SITE BOILER HOUSE. E-7
- 2511 F SITE TEST BUILDING. D-7
- 2531 F SITE BOILER HOUSE. D-7
- 2611 I SITE TEST BUILDING. E-4
- 2621 I SITE SHOP BUILDING. E-4
- 2713 J SITE JS CONTROL TANK. E-4
- 2721 J SITE SHOP BUILDING. E-4
- 2732 J SITE BOILER HOUSE. E-4
- 2811 K SITE TEST BUILDING. D-8
- 2812 K SITE CONTROL BUILDING D-8
- 2831 K SITE BOILER HOUSE D-8
- 3111 B1 TEST STAND. F-4
- 3131 B1 PUMP AND SHOP BUILDING. F-4
- 3161 B1 SUBSTATION (D). F-4
- 3211 B2 TEST BUILDING. F-506
- 3231 B2 REFRIGERATION BUILDING. F-4
- 3232 B2 UTILITY SERVICE BUILDING. F-5
- 3233 B2 LHZ TRANSFER BUILDING. F-5
- 3251 B2 COOLING TOWER. F-4
- 3252 B2 COOLING TOWER (TEST BLDG.). F-5
- 3253 B2 RETENTION POND (2.5M GALL. F-4
- 3261 B2 SUBSTATION (G). F-5
- 3311 B3 TEST STAND. F-4
- 3331 B3 BOILER HOUSE. F-4
- 3411 HIF TEST BUILDING. E-5
- 3431 HIF BOILER AND ELECTRICAL SWITCHGEAR HOUSE. E-5
- 3461 HIF SUBSTATION (F). E-5
- 5131 AIR COMPRESSOR BUILDING. F-7
- 5221 SHOP BUILDING. F-4
- 5231 BOILER BUILDING. F-4
- 5232 VALVE HOUSE. F-4
- 5331 GAS HANDLING HELIUM BUILDING. E-9
- 5332 GAS HANDLING H2 BUILDING. E-9
- 5333 GAS HANDLING H2 BUILDING. E-8
- 5334 GAS HANDLING STORAGE BLDG. E-8
- 5335 LHZ STOR. DENAR CONT. BLDG. F-7
- 5351 LHZ STORAGE DENAR (200K GALL. F-7
- 5401 B CONTROL AND DATA BUILDING. E-4
- 5402 H CONTROL AND DATA BUILDING. D-4
- 5403 GUARANTEE POWER BUILDING. E-4
- 7121 MAINTENANCE SHOP. E-8
- 7122 CARPENTER SHOP. E-8
- 7123 LOCOMOTIVE SHOP. F-8
- 7131 GARAGE. F-8
- 7132 VEHICLE SERVICE STATION. E-8
- 7140 ENGINEERING BUILDING. I-8
- 7149 CHEMICAL LABORATORY. F-8
- 7231 PLANT PROTECTION BUILDING. H-9
- 7232 PLANT PROTECTION BOILER HOUSE. H-9
- 8132 RYE BEACH PUMPING STATION. J-11
- 8133 PUMP STATION NO. 1. G-8
- 8134 PUMP HOUSE. F-7
- 8151 RAW WATER TOWER (D). G-7
- 8152 RAW WATER TOWER (E). F-4
- 8191 RESERVOIR NO. L. G-8
- 8231 DOMESTIC WATER PUMP HOUSE. H-9
- 8232 DOMESTIC WATER TOWER (A). G-8
- 8291 DOMESTIC WATER RESERVOIR. H-9
- 8331 SEWAGE PUMPING STATION
- 8332 SEWAGE PUMP & CHLORIN
- 8334 SEWAGE LIFT STATION. D-
- 8335 SEWAGE LIFT STATION. E-
- 8336 SEWAGE TREATMENT PLANT
- 8337 SEWAGE CHEMICAL BUILD
- 8351 SEWAGE LIFT STATION. G-
- 8352 SEWAGE CHLORINE CONTACT
- 8353 SEWAGE MIXING CHAMBER
- 8391 SEWAGE SETTLING TANK. I
- 8392 SEWAGE DIGESTING TANK.
- 8393 SEWAGE SLUDGE BEDS. I-10
- 8394 SEWAGE SLUDGE BEDS. I-10
- 8395 SEWAGE FLOCCULATOR AND FINAL SETTLING TANK. I-10
- 8396 SEWAGE DIVERSION CHAMBER. I-10
- 8397 SEWAGE TRICKLING FILTER. I-10
- 8431 GAS METER HOUSE. H-9
- 8432 GAS METER HOUSE. D-910
- 8433 GAS METER HOUSE. D-8
- 8434 GAS METER HOUSE. D-4
- 8435 GAS METER HOUSE. D-5
- 8531 POWER HOUSE NO. L. F-8
- 8541 SUBSTATION A. D-9
- 8542 SUBSTATION B. F-8
- 8931 INCINERATOR BUILDING. F-7
- 8951 FUEL STORAGE TANK. G-8
- 8952 FUEL STORAGE TANK. G-8
- 9101-9199 MAGAZINES HK-36
- 9201 WAREHOUSE. E-9
- 9202 WAREHOUSE. E-9
- 9203 WAREHOUSE. F-7
- 9204 WAREHOUSE. F-7
- 9205 WAREHOUSE. E-7
- 9206 WAREHOUSE. E-8
- 9207 WAREHOUSE. F-8
- 9208 WAREHOUSE. F-8
- 9209 WAREHOUSE. F-8
- 9210 WAREHOUSE. F-8
- 9211 WAREHOUSE. E-8
- 9212 WAREHOUSE. E-7
- 9215 WAREHOUSE. D-9
- 9804 GH<sub>2</sub> FARM. F-4
- 9837 GHE FARM. F-10

Spacecraft Propulsion Research Facility  
 Building 3211  
 17/59180/4580660



SPACE POWER FACILITY

LEWIS RESEARCH CENTER  
 PLUM BROOK STATION

CP-14,177-99  
 REVISED OCT. 27, 1963