NPS Form 10-900
(7-81)

United States Department of the Interior
National Park Service

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received
date entered

National Register of Historic Places Inventory—Nomination Form

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street & number Lewis Research Center Plum Brook Station ___ not for publication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

Category	Ownership	Status	Present Use	
___ district	X public	___ occupied	___ agriculture	___ museum
___ building(s)	___ private	___ unoccupied	___ commercial	___ park
X structure	___ both	___ work in progress	___ educational	___ private residence
___ site	**Public Acquisition**	**Accessible**	___ entertainment	___ religious
___ object	___ in process	X yes: restricted	___ government	___ scientific
	___ being considered	___ yes: unrestricted	___ industrial	___ transportation
		___ no	___ military	X 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

Condition		Check one	Check one
X excellent	___ deteriorated	X unaltered	X original site
___ good	___ ruins	___ altered	___ moved date _____
___ fair	___ unexposed		

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.[1] 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^{0}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^{0}F cold walls and 5 X 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				
___ prehistoric	___ archeology-prehistoric	___ community planning	___ landscape architecture	___ religion	
___ 1400–1499	___ archeology-historic	___ conservation	___ law	___ science	
___ 1500–1599	___ agriculture	___ economics	___ literature	___ sculpture	
___ 1600–1699	___ architecture	X education	___ military	___ social/ humanitarian	
___ 1700–1799	___ art	___ engineering	___ music	___ theater	
___ 1800–1899	___ commerce	___ exploration/settlement	___ philosophy	X transportation	
X 1900–	___ communications	___ industry	___ politics/government	X other (specify) Space Exploration	
		___ invention			

Specific dates 1968 **Builder/Architect** 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

Acreage of nominated property Less than 1 acre

Quadrangle name Kimball **Quadrangle scale** 1:24,000

UMT References

	Zone	Easting	Northing		Zone	Easting	Northing
A	17	359180	4580660	B			
C				D			
E				F			
G				H			

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
state	code	county	code

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

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.

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 ATS 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 SLUDGE BASINS. F-10
1154 REACTOR COLD RETENTION BASINS. F-9
1155 REACTOR HOT RETENTION BASINS. F-9
1156 REACTOR ATS WATER STORAGE TANK (200K GAL). 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. STRUC. F-10
1197 REACTOR MONITORING STATIONS. (NW) D-11, (N1) F-10, (N2) F-11, (NE) G-11
1411 SPF TEST BUILDING. J-3
1431 SPF WATER TREATMENT BLDG. K-3
1432 SPF LN2 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 LN2 TANK (200K GAL.). J-3
1461 SPF SUBSTATION (H). J-3
1491 SPF SECURITY BUILDING. J-3
1492 SPF MONITORING STATIONS. (N) J-4, (NE) K-4, (E) L-3
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1913 WIND TURBINE WEATHER TOWER. G-8
1921 WTG SHOP G-8
2111 A SITE TEST BUILDING. E-7
2131 A SITE BOILER HOUSE. E-7
2211 C SITE TEST BUILDING. D-6
2221 C SITE SHOP BUILDING. D-6
2231 C SITE BOILER HOUSE. D-6
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-6
2621 I SITE SHOP BUILDING. E-6
2713 J SITE J5 TEST BUILDING. E-6
2714 J SITE J5 CONTROL TANK. E-6
2721 J SITE SHOP BUILDING. E-6
2732 J SITE BOILER HOUSE. E-6
2811 K SITE TEST BUILDING. D-8
2812 K SITE CONTROL BUILDING D-8
2831 K SITE BOILER HOUSE D-8
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3131 B1 PUMP AND SHOP BUILDING. F-6
3161 B1 SUBSTATION (D). F-6
3211 B2 TEST BUILDING. F-5#6
3231 B2 REFRIGERATION BUILDING. F-6
3232 B2 UTILITY SERVICE BUILDING. F-5
3233 B2 LN2 TRANSFER BUILDING. F-5
3251 B2 COOLING TOWER. F-6
3252 B2 COOLING TOWER (TEST BLDG.). F-5
3253 B2 RETENTION POND (2.5M GAL). F-6
3261 B2 SUBSTATION (G). F-5
3311 B3 TEST STAND. F-6
3331 B3 BOILER HOUSE. F-6
3411 HTF TEST BUILDING. E-5
3431 HTF BOILER AND ELECTRICAL SWITCHGEAR HOUSE. E-5
3461 HTF SUBSTATION (F). E-5
5131 AIR COMPRESSOR BUILDING. F-7
5221 SHOP BUILDING. F-6
5231 BOILER BUILDING. F-6
5232 VALVE HOUSE. F-6
5331 GAS HANDLING HELIUM BUILDING. E-9
5332 GAS HANDLING N2 BUILDING. E-9
5333 GAS HANDLING H2 BUILDING. E-8
5334 GAS HANDLING STORAGE BLDG. E-8
5335 LH2 STOR. DEWAR CONT. BLDG. F-7
5351 LH2 STORAGE DEWAR (200K GAL). F-7
5411 B CONTROL AND DATA BUILDING. E-6
5412 H CONTROL AND DATA BUILDING. D-6
5431 GUARANTEE POWER BUILDING. E-6
7121 MAINTENANCE SHOP. E#F-8
7122 CARPENTER SHOP. E-8
7123 LOCOMOTIVE SHOP. F-8
7131 GARAGE. F-8
7132 VEHICLE SERVICE STATION. E-8
7141 ENGINEERING BUILDING. I-8
7143 CHEMICAL LABORATORY. F-8
7239 PLANT PROTECTION BUILDING. H-9
7234 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-6
8191 RESERVOIR NO. 1. G-8
8231 DOMESTIC WATER PUMP HOUSE. H-9
8251 DOMESTIC WATER TOWER (A). G-8
8291 DOMESTIC WATER RESERVOIR. H-9
8331 SEWAGE PUMPING STATION
8332 SEWAGE PUMP & CHLORINI
8334 SEWAGE LIFT STATION. D-
8335 SEWAGE LIFT STATION. E-
8336 SEWAGE TREATMENT PLANT
8337 SEWAGE CHEMICAL BUILDI
8351 SEWAGE LIFT STATION. G-
8352 SEWAGE CHLORINE CONTAC
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-9#10
8433 GAS METER HOUSE. D-8
8434 GAS METER HOUSE. D-6
8435 GAS METER HOUSE. D-5
8531 POWER HOUSE NO. 1. F-8
8561 SUBSTATION A. D-9
8562 SUBSTATION B. F-8
8931 INCINERATOR BUILDING. F-7
8951 FUEL STORAGE TANK. G-8
8952 FUEL STORAGE TANK. G-8
9101-9199 MAGAZINES H/K-3#6
9201 WAREHOUSE. E-9
9202 WAREHOUSE. E-9
9203 WAREHOUSE. F-7
9204 WAREHOUSE. F-7
9205 WAREHOUSE. E-7
9206 WAREHOUSE. E-8
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9208 WAREHOUSE. F-8
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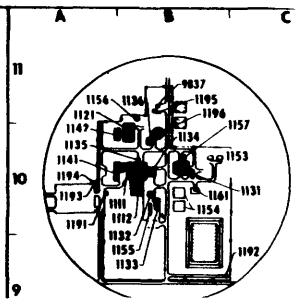
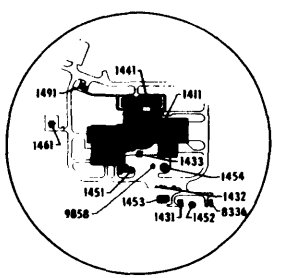
9210 WAREHOUSE. F-8
9211 WAREHOUSE. E-8
9213 WAREHOUSE. E-7
9215 WAREHOUSE. D-9
9804 GN_2 FARM. F-6
9837 GHE FARM. F-10

Spacecraft Propulsion Research Facility
Building 3211
17/59180/4580660





SPACE POWER FACILITY