(facsimile copy)

OHIO HISTORIC INVENTORY

Ohio Historic Preservation Office
1985 Velma Avenue
Columbus, Ohio 43211
614/297-2470

OHIO HISTORICAL SOCIETY SINCE 1885

1. No.	2. County
CUY-4587-15	Cuyahoga

3. Location of Negatives
Gray & Pape, Inc.
Roll No. 2 Frame 8,9,10,12

4. Present Name(s) ☐ Coded
NASA Lewis Research Center Microwave Systems Laboratory & Solar Power Lab Annex

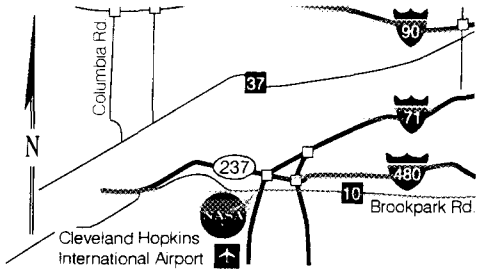
5. Historic or Other Name(s)
Building 7, Altitude Wind Tunnel, Space Power Chambers; Building 78, AWT Pump House

6. Specific Address or Location
south side of Ames Road just west of Visitor Center, Central Area

6a. Lot, Section or VMD

7. City or Village **If Rural, Township & Vicinity**
Cleveland

8. Site Plan with North Arrow



9. U.T.M. Reference
Quadrangle Name

17	427,900.00	84,900.00
Zone	Easting	Northing

10. Site ☐ Structure ☐ Building ☒ Object ☐

11. On National Register?	Yes ☐ No ☐	12 N.R. Potential?	Yes ☐ No ☐
13. Part of Estab. Hist. Dist?	Yes ☐ No ☐	14. District Potential?	Yes ☐ No ☐

15. Name of Established District (N.R. or Local)

16. Thematic Association(s)
National aeronautic and space programs

17. Date(s) or Period	17b. Alteration
1942-44	1951, 1960s

18. Style or Design ☐ High Style ☐ Elements

18a. Style of Addition or Elements(s)

19. Architect or Engineer

19a. Design Sources

20. Contractor or Builder
Pittsburg DesMoines Steel Co., Pittsburg, PA

21. Building Type or Plan

22. Original Use, if apparent
wind tunnel, offices, shop

23. Present Use
offices, shops

24. Ownership Public ☒ Private ☐

25. Owner's Name & Address, if known
United States of America
NASA Lewis Research Center
21000 Brookpark Road Cleveland, Ohio

26. Property Acreage

27. Other Surveys in Which Included

28. No. of Stories 3.0

29. Basement? Yes ☒ No ☐

30. Foundation Material
Concrete

31. Wall Construction
Steel Frame

32. Roof Type & Material
Flat, built-up

33. No. of Bays
Front 11 Side 3

34. Exterior Wall
Tan brick

35. Plan Shape T-shaped

36. Changes (Explain in #42) Addition ☐ Altered ☒ Moved ☐

37. Window Types
☐ 6 over 6 ☐ 2 over 2 ☐ 4 over 4 ☒ Other

38. Building Dimensions 186' x 45'

39. Endangered By What? Yes ☐ No ☒

40. Chimney Placement

41. Distance from and Frontage on Road
<20' from Ames Road

42. Further Description of Important and Exterior Features (Continue on reverse if

Building 7 consists of a T-shaped building, which faces onto Ames Road, with a wind tunnel loop located behind. The top of the T-shaped building is two stories tall while the tail of the T is a four-story tower that intersects and divides the two-story wing at a right angle. The two-story shop and office section has a concrete foundation and is clad with tan brick. Both wings have flat roofs. The front facade of the building is 11 bays long with the main entrance located in the fifth bay from the left at the junction of the two wings. (Cont'd)

43. History and Significance (Continue on reverse if necessary)

The Lewis Research Center was established in 1941 as the Aircraft Engine Research Laboratory of the National Advisory Committee on Aeronautics. The AERL served as the propulsion research center of NACA until 1958 when the lab became part of the newly-formed National Aeronautics and Space Administration. As a part of this organization, the LeRC has continued its aeronautic research, (cont'd)

44. Description of Environment and Outbuildings (see #52)

Building 7 is located on the south side of Ames Road bewtween the Visitor Center (Building 8) and the Refrigeration Building (Building 9). A sidewalk leads from the road to the main entrance. There is also a curb cut for the overhead door on the north side of the tower wing. The wind tunnel loop is (cont'd)

45. Sources of Information

Master Facilities Plan, 1985
Engines and Innovation, Dawson, 1991
Plans of Buildings and Structures, NASA LeRC
Real Property Records, NASA LeRC, Real Property Division (cont'd)

46. Prepared by
Debra A. McClane

47. Organization
Gray & Pape, Inc.

48. Date Recorded in Field
May, 1996

49. Revised by	50a. Date

50b. Reviewed by

1. No. CUY-4587-15
2. County Cuyahoga
4,5. Present or Historic Name NASA Lewis Research Center Microwave Systems Laboratory and Solar Power Lab Annex
6. Specific Address or Location Southside of Ames Rd. just west of Visitor Center, Central Area

51. Condition of Property

- ☐ Excellent
- ☒ Good/Fair
- ☐ Deteriorated
- ☐ Ruin
- ☐ Destroyed/Burned

Date

52. Historic Outbuildings and Dependencies

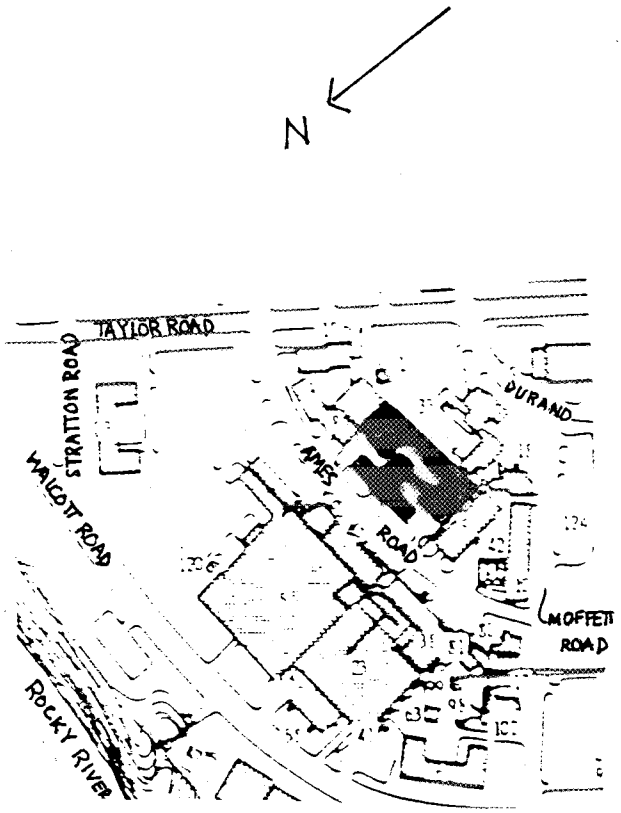
Barn Type(s)

Corn Crib or Shed ☐	Smoke House ☐	Privy ☐
Summer Kitchen ☐	Spring House ☐	Garage ☐
Silo ☐	Ice House ☐	
	Designed landscape ☐	

53. Affiliated OAI Site and multiple

Archaeological Features:	Observed	Expected on Basis of Archival Research
Well		
Privy		
Cistern		
Foundation		
Structural Rubble		
Formal Trash Dump		
Other		

54. Farmstead Plan



42. (Cont'd)

In 1995, a one-story, three by one bay, 3,000 square foot addition was constructed on the north facade of the west "wing" of Building 7. This addition matches the original building in construction and materials.

The bays of the two-story wing are delineated by paired and single plate glass pivoting windows with continuous concrete sills and spans of alternating projecting courses of brick between each set. These windows replace the original grouped sets of horizontally-divided, multi-paned stell sash windows. The main entry into Building 7 is from Ames Road (north) through a set of double glass doors with a glass transom and box (cont'd)

43. (Cont'd)

while also advancing technologies in aerospace propulsion, and space flight systems.

The Altitude Wind Tunnel (AWT) has been cited as historically the most important facility at the LeRC. The AWT was designed as a closed circuit tunnel with a 31' diameter fan capable of producing air velocity as high as 425 mph at simulated altitudes of 30,000 feet and as low as 250 mph at 1,000 feet. The U.S. Army pressed for the design and construction of the AWT in 1942 because of its need for a full-scale testing unit to analyze and solve problems of adequate engine cooling. Private industry could not afford such a large and expensive facility, so it was left to NACA to delve into solving such engine problems and, in doing so, became involved in development.

Steel shortages slowed construction of the nickel-steel shell of the tunnel. Design was slowed also by the requirement for an extensive refrigeration system to serve both the AWT and the Icing Research Tunnel, also in construction. The Carrier Corporation was brought in to design this system, which broke ground in terms of large scale engineering feats and contributed, through testing performed with its help, to (cont'd)

44. (Cont'd)

located to the rear of the shop and office building. Parking is allowed in the paved area underneath the tunnel when tests are not being run.

3. Photographs provided by NASA: C-3992, AERL 4804, AERL 5064-A, C-5681, C-5308, C-8983, C-19794

20. Sam W. Emerson Co., Cleveland, Ohio; The Carrier Company

38. Building Dimensions: one wing measures 74' x 23'.

42. metal canopy above. A similar entry existed in the seventh bay (on the west "wing" of the office section), but the construction of the one-story addition filled in this space. A secondary entry is located on the west facade of the two-story wing and consists of paired glass and metal doors, a glass transom and a box metal canopy. A narrow overhead door is also located on this facade.

The tail section of the T-shaped building contains a shop area in its northern end and a hatch into the tunnel on its southern end. The northern end of this tower intersects with the office/shop wing. Its north facade faces onto Ames Road. This facade contains a large, overhead door, which leads into an open shop area. The exterior of this four-story tower is clad with tan brick on its northern end and is partially clad with horizontal metal siding on its southern end. The northern section formerly held horizontal ribbon windows on the three upper floors. These windows have been filled in with brick, but the concrete sills are still visible. To the rear of the tower, some of the original horizontally divided multi-paned windows have been covered over with metal siding.

The wind tunnel intersects the tower on its southern end where one of the test sections is located. The tunnel creates a rectangular loop that is larger on its western end than on its eastern end. The tunnel structure is supported by large concrete piers and steel supports. The interior of the tunnel, designed as a closed circuit system, has been modified several times over the years. In 1962, the facility was modified as the Space Power Laboratory to allow for environment testing of the Atlas/Centaur vehicle. The latest modifications, designed to allow research tests on icing, propeller-powered and V/STOL vehicles, were not successful. In 1991, the name of the facility was changed to the Microwave Systems Laboratory.

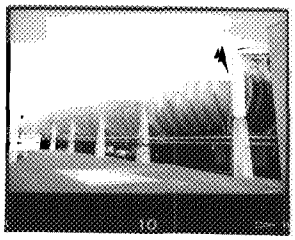
Building 78
Building 78, constructed between 1951 and 1952, is positioned crosswise underneath the eastern end of the wind tunnel loop. It is a one-story, flat-roofed structure with a basement and measures 47' by 28'. The building has a concrete foundation and is clad with tan brick. The main access into Building 78 is through a metal door on the east side. A metal, box canopy is located above this entry. Access doors are also located on the south and west facades. The west entry consists of a metal door with metal side panels flanked by horizontally-divided, multi-paned windows. A vented transom is located above. The south entry consists simply of a pair of metal doors. The north facade has a large opening filled-in with glass block. An areaway on this facade is open to the basement level with a metal pipe railing surrounding the opening. The cooler pit of the wind tunnel is located directly under the east leg of the loop and is adjacent to the north end of Building 78. It is a concrete structure with metal cladding. Originally, this building served as the Water Pump House for the Altitude Wind Tunnel. It was equipped with four Fairbanks-Morse 250 horsepower pumps. Around 1964, two of these pumps were removed for use at the Plum Brook Station. Also in the 1960s, the facility was modified as the Solar Mirror Cleaning/Solar Power Laboratory Pump House, which involved the installation of four cleaning tanks and new ventilation and plumbing systems.

43. shortening the war. Carrier built and tested many original components in its design for the refrigeration system. The refrigeration plant contained 14 Carrier centrifugal compressors and a unique heat exchanger capable of producing a minimum temperature of -48 F. The new compressor developed in this endeavor became one of the company's standard products after the war.

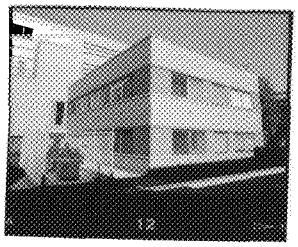
The first unofficial test in the AWT was performed in February 1944. Although the tunnel had been constructed with piston engine tests in mind, the first engine to be tested was the I-16 turbojet, which had been secretly designed by the General Electric Company. For the test, an entire fuselage of a Bell Aircraft P-59A with its wings sawed off was squeezed into the 20' diameter test section. The first official tests in the AWT, run in May, were conducted on the Wright R-3350 piston engine, which was used in the B-29 Superfortress used in strategic bombing of Japan from the China mainland.

After the war, the AWT was adapted to test early turbojet and turboprop engines at simulated altitude conditions. With the NASA change in mission, the AWT was converted to a vacuum facility to test rockets in 1958. In the early 1960s, the "Space Power Chamber" was used to test the Centaur rocket, the important upper stage rocket fueled by liquid hydrogen.

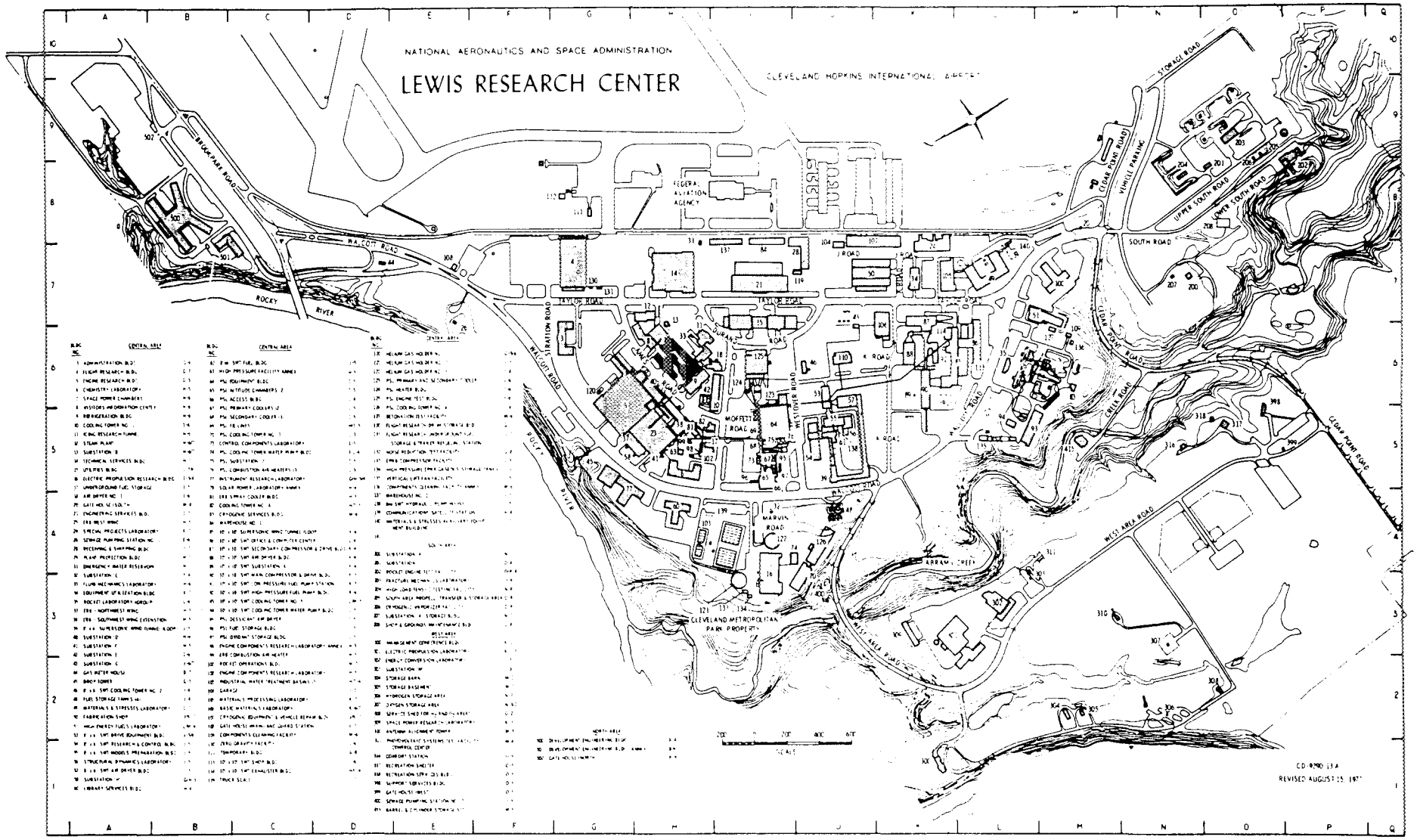
45. Overall Cultural Resource Reconnaissance Survey of NASA Lewis Research Center, Cleveland, Ohio, Gray & Pape, Inc., 1996



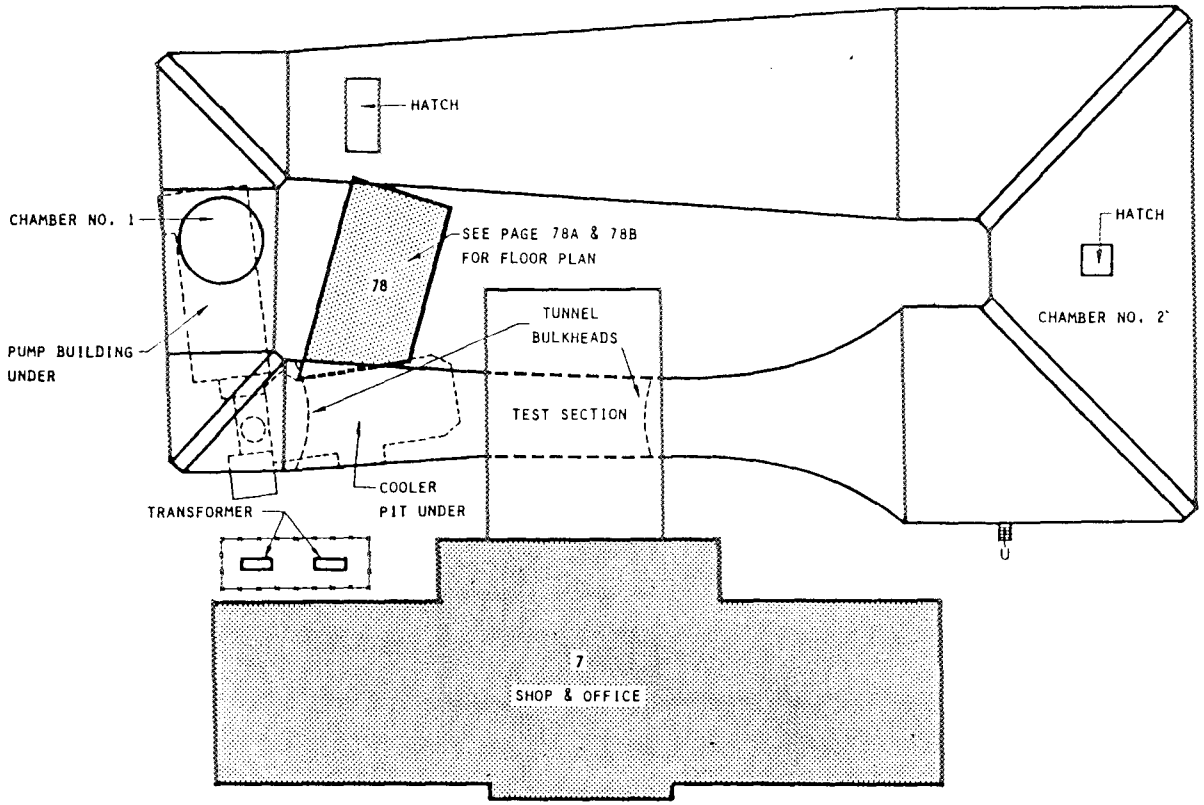
facing northwest



facing west


NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LEWIS RESEARCH CENTER
CLEVELAND HOPKINS INTERNATIONAL AIRPORT
FEDERAL AVIATION AGENCY
BRUCKNER PARK ROAD
WALCUTT ROAD
ROCKY RIVER
TAYLOR ROAD
STRATTON ROAD
WESTOVER ROAD
MOFFETT ROAD
MARVIN ROAD
CLEVELAND METROPOLITAN PARK PROPERTY
ARRAM'S CREEK
WEST AREA ROAD
CEDAR POINT ROAD
VERMILLE PARKWAY
STORAGE ROAD
UPPER SOUTH ROAD
LOWER SOUTH ROAD
SOUTH ROAD
CENTRAL AREA
NORTH AREA
SOUTH AREA
SCALE
CD-8900-13-A
REVISED AUGUST 15, 1977

NASA LEWIS RESEARCH CENTER
CLEVELAND, OHIO



SEE FOLLOWING PAGES FOR BUILDING PLANS

TUNNEL PLAN

REF. DWG. NO. ED-602

N

ALTITUDE WIND TUNNEL GROUP

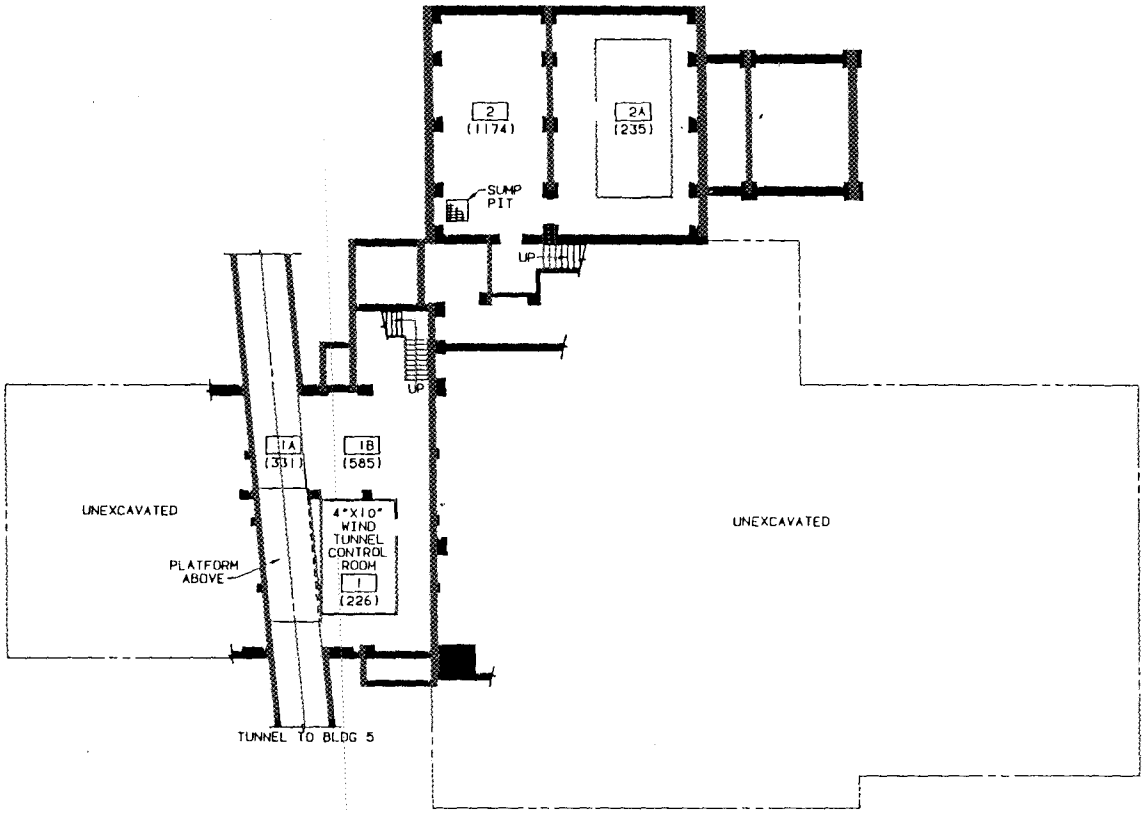
BUILDING NO.

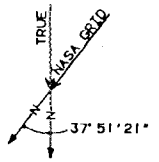
7

25 0 25 50

SCALE 1" = 25'-0"

REVISED JAN 1985





XXX — ROOM NUMBER
(XXX) — AREA SQ. FT.

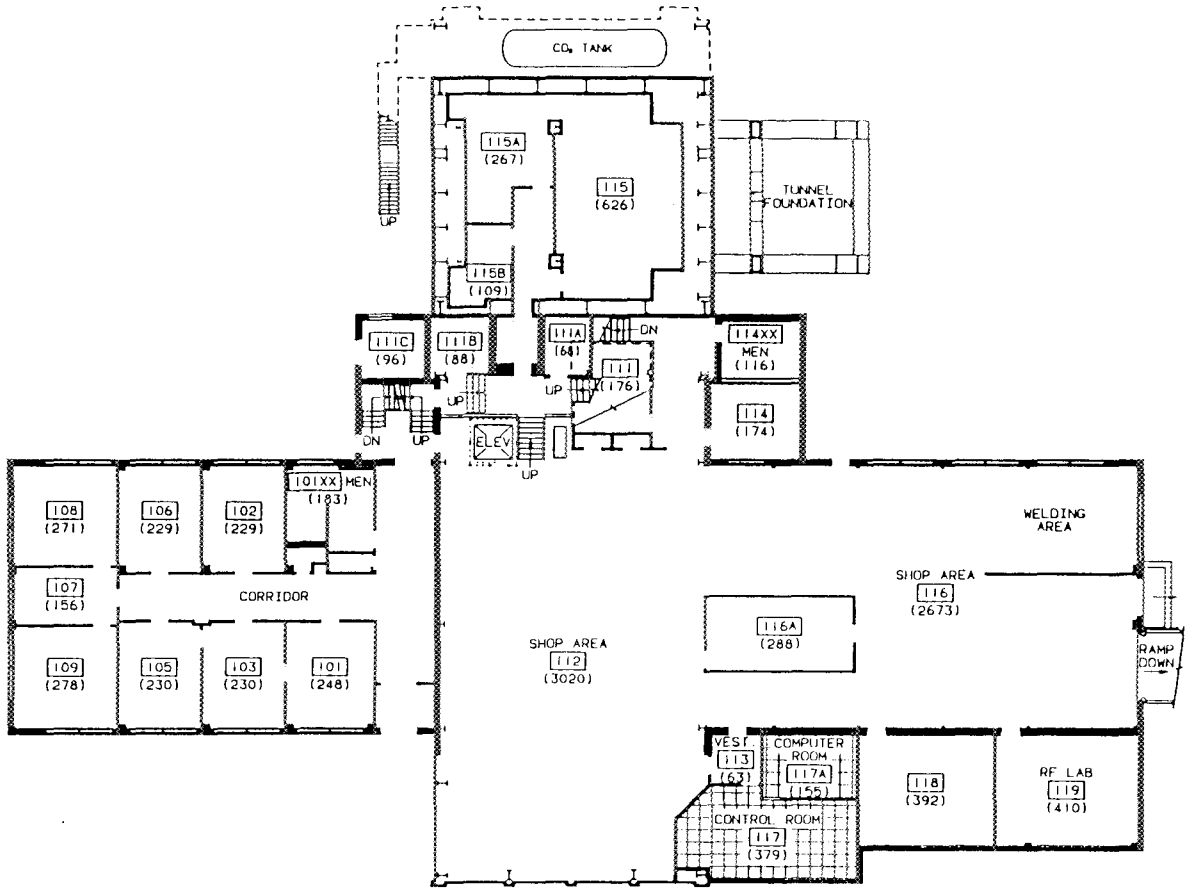
GRAPHIC SCALE

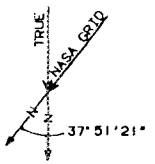
MICROWAVE SYSTEMS LABORATORY
BUILDING 7
BASEMENT FLOOR PLAN

REF DWG CD-1670 & CF-106744

REVISED 10/02/92
DRAWING IS AVAILABLE ON CADAM

NASA LEWIS RESEARCH CENTER
CLEVELAND, OHIO





[XXX] — ROOM NUMBER
(XXX) — AREA SQ. FT.

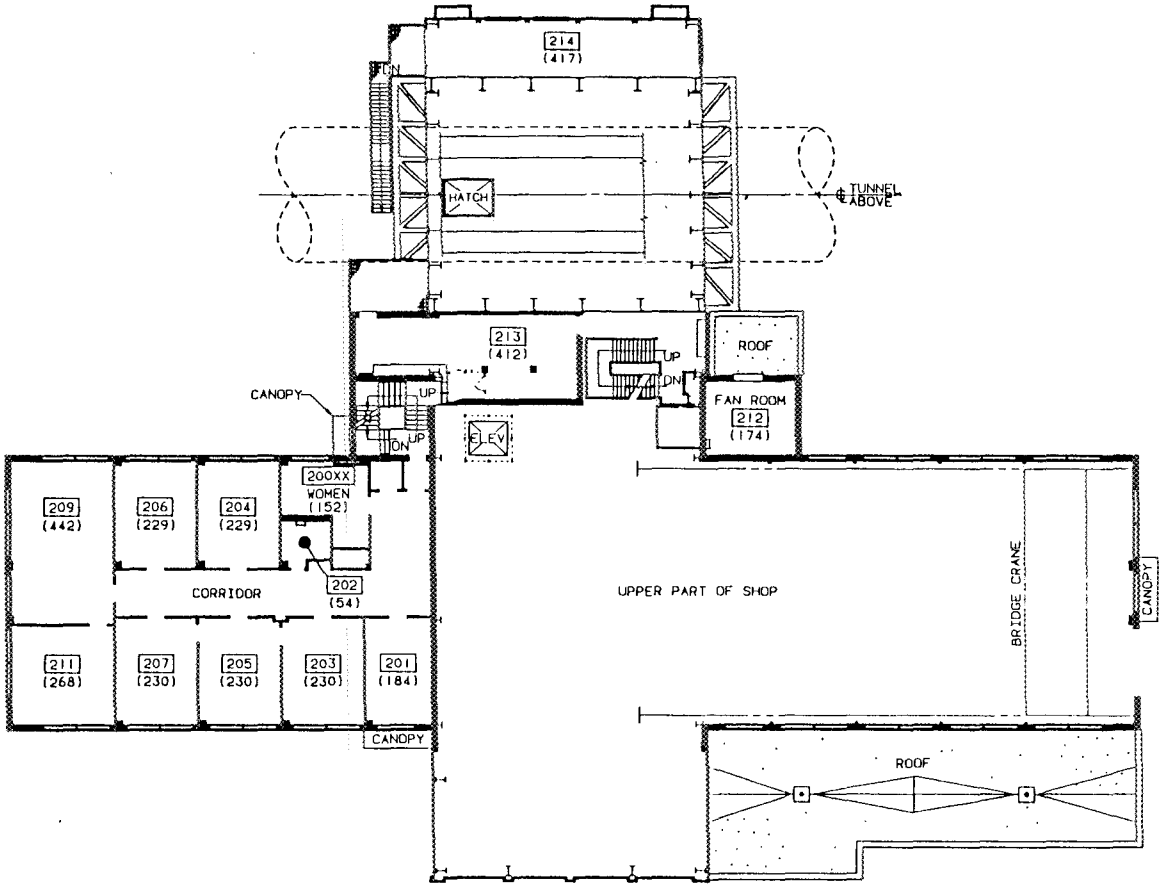
GRAPHIC SCALE

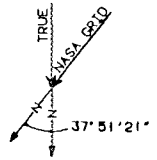
MICROWAVE SYSTEMS LABORATORY
BUILDING 7
FIRST FLOOR PLAN

REF DWG CD-243, & CF-106745

REVISED 10/02/92
DRAWING IS AVAILABLE ON CADAM
DRAW.007

CLEVELAND, OHIO





XXX — ROOM NUMBER
(XXX) — AREA SQ. FT.

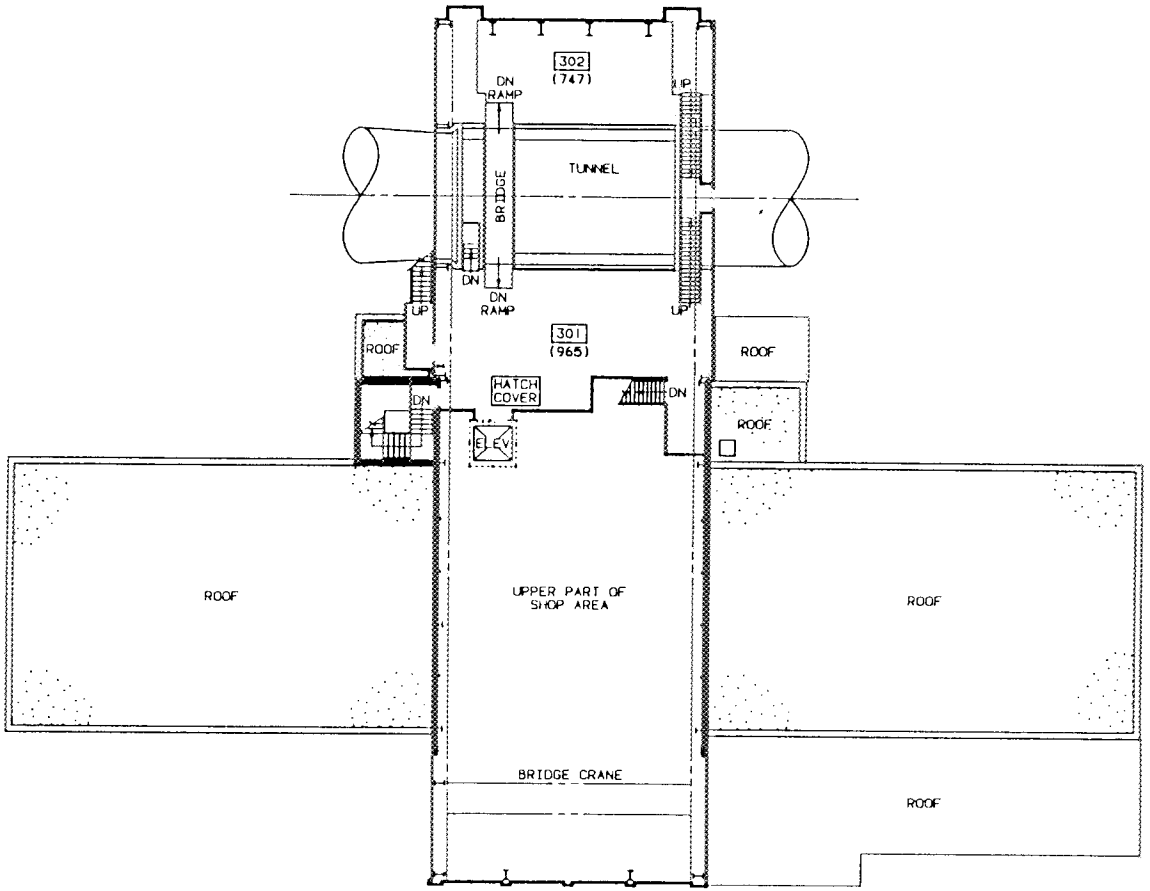
0 4 8 16 24

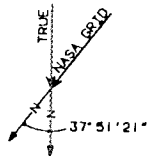
GRAPHIC SCALE

MICROWAVE SYSTEMS LABORATORY
BUILDING 7
SECOND FLOOR PLAN

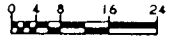
REF DWG CO-244 & CF-106746

REVISED 10/02/92
DRAWING IS AVAILABLE ON CADAM
DRAW.007





[XXX] — ROOM NUMBER
(XXX) — AREA SQ. FT.

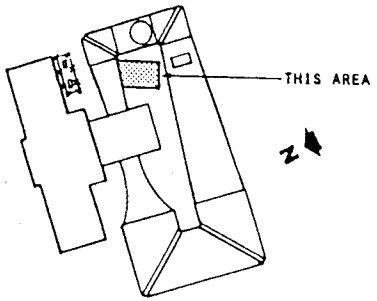


GRAPHIC SCALE

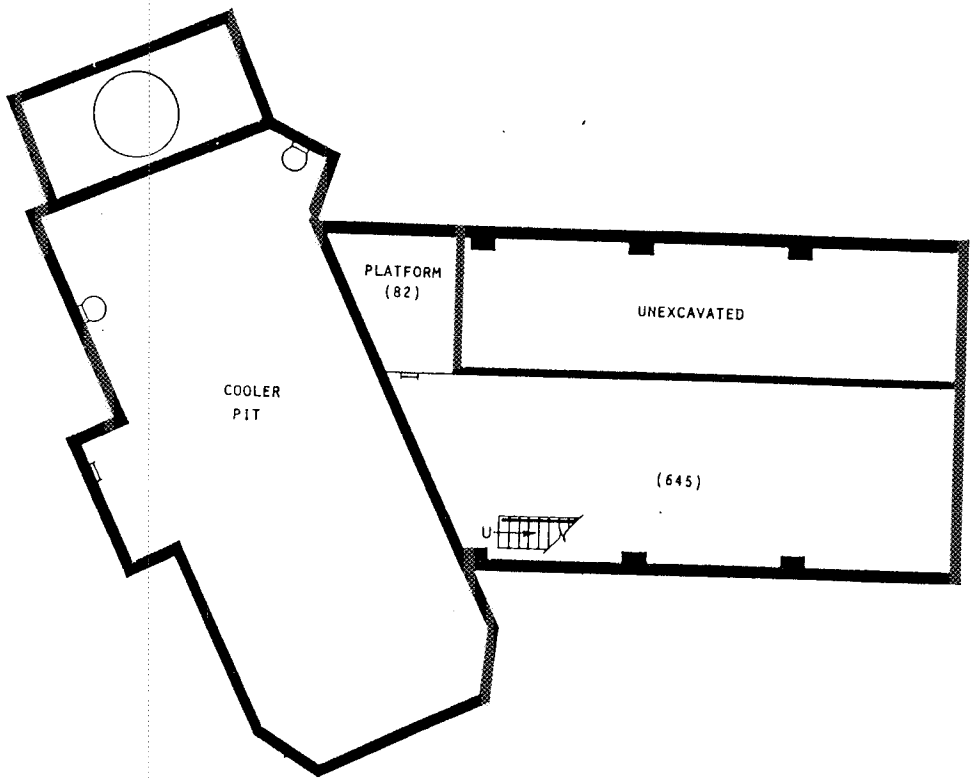
MICROWAVE SYSTEMS LABORATORY
BUILDING 7
THIRD FLOOR PLAN

REF DWG CC-246 & CF-106747

REVISED 10/02/92
DRAWING IS AVAILABLE ON CADAM
DRAW.007



KEY PLAN



BASEMENT FLOOR PLAN

REF. DWG. NO. CE-106795 & CD-154912

SOLAR POWER LABORATORY ANNEX

BUILDING NO.
78

REVISED JAN. 1985

N

( ) AREA, SQ. FT.

8 0 8 16
SCALE 1" = 8'-0"

NASA Lewis Research Center Microwave Systems Laboratory
(formerly the Altitude Wind Tunnel)
Building 7
Laser Prints Courtesy of NASA Lewis Research Center Imaging Technology Center

1. C-3992, February 29, 1944
   Interior view of the throat section of the wind tunnel.

2. AERL-4804, May 4, 1944
   View of Altitude Wind Tunnel and Refrigeration Building from across Ames Road. View to south.

3. AERL-5064-A, May 27, 1944
   Aerial view of Altitude Wind Tunnel, flanked by Building 8 (Visitor Center, then Exhauster Building for the AWT) and Building 9 (Refrigeration Building). View to south.

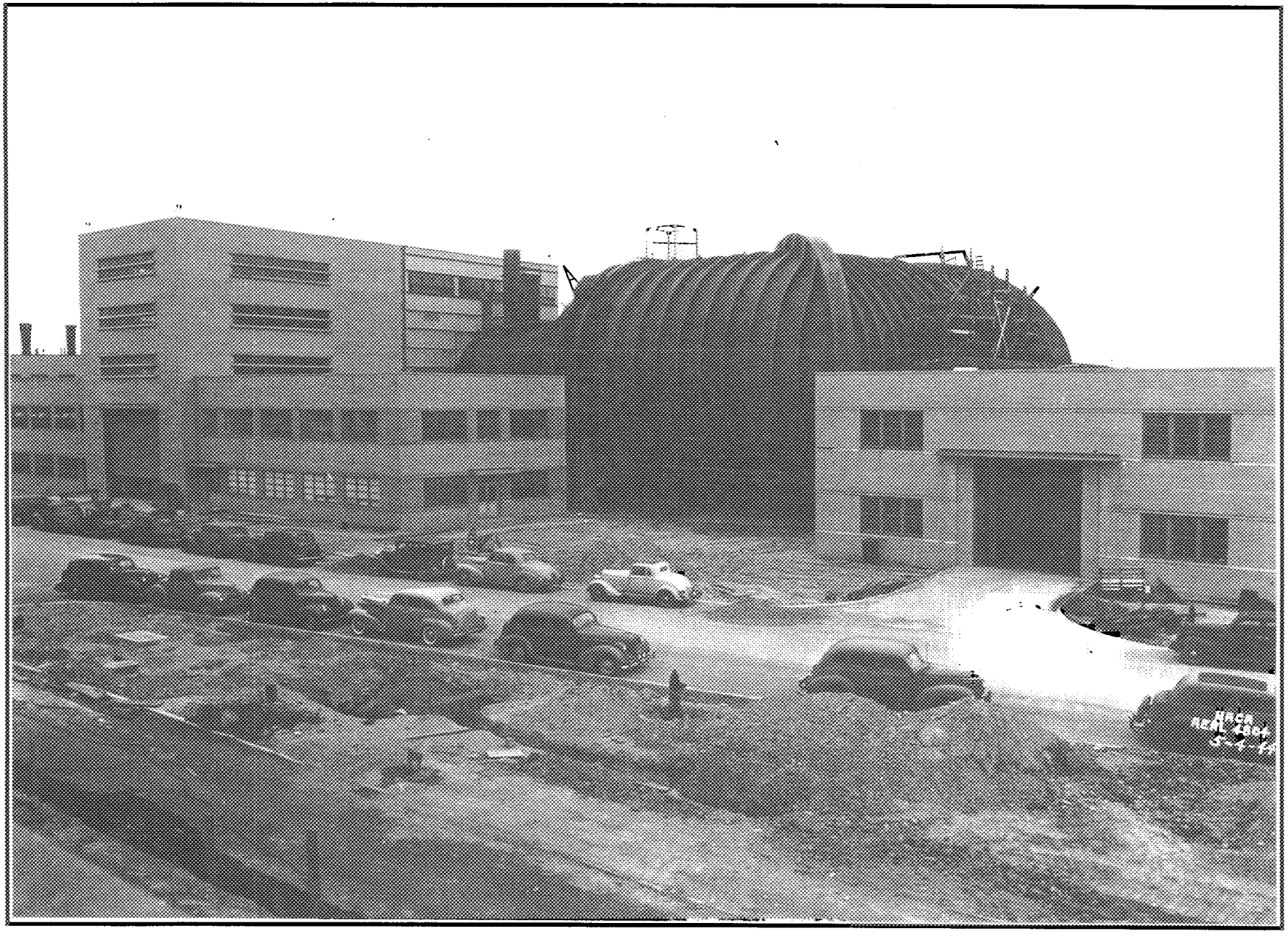
4. C-5681, July 14, 1944
   Original Fact Sheet on the Altitude Wind Tunnel listing facility description, purpose, and research projects to be undertaken.

5. C-5308, June, 16, 1944
   Schematic drawing showing Altitude Wind Tunnel and associated buildings. "Probably most unique among the research facilities of the National Advisory Committee for Aeronautics at its Aircraft Engine Research Laboratory in Cleveland, Ohio, is the altitude wind tunnel where research is conducted on problems relating to the combining of the aircraft power plant with the remainder of the airplane structure."

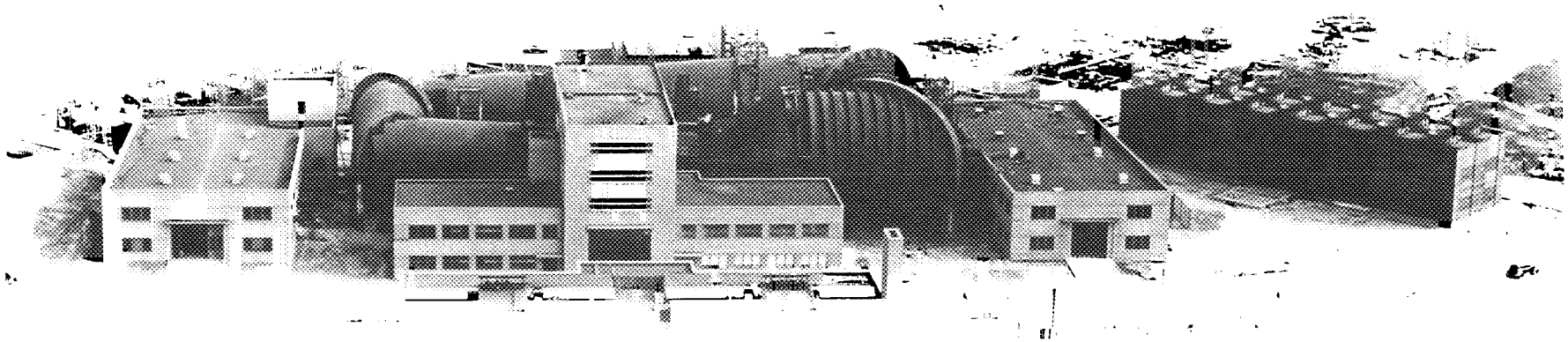
6. C-8983, March 16, 1945
   "In the Altitude Wind Tunnel at the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics, Cleveland, Ohio, aircraft engine installations can be subjected to trial under simulated altitude conditions. Here is shown a -80 airplane, with wings removed, mounted in the test section of the tunnel for determination of its jet engine performance."

7. C-19794, October 21, 1947
   View of full sized turbojet engines inside the Altitude Wind Tunnel, showing a heavily instrumented axial-flow engine installed in the tunnel test section.

NACA
A-35552
5-14-47



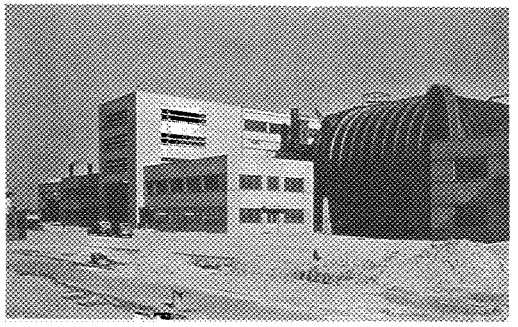
A 1944 photograph of the Altitude Wind Tunnel.

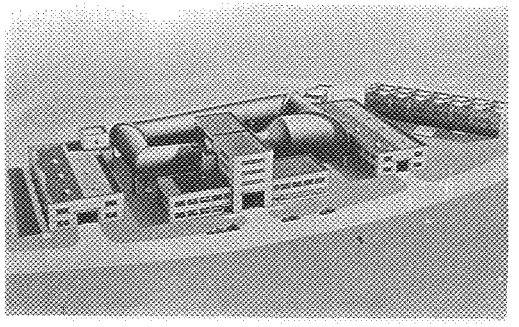


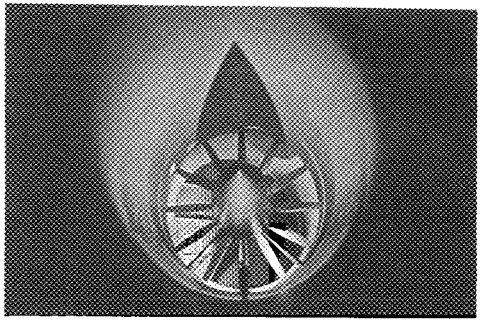
NACA
AERL 5064-A
5-27-44

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AIRCRAFT ENGINE RESEARCH LABORATORY
CLEVELAND, OHIO

Altitude Wind Tunnel

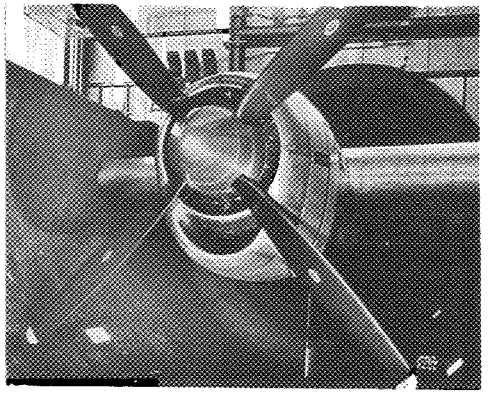






Tunnel Drive Propeller

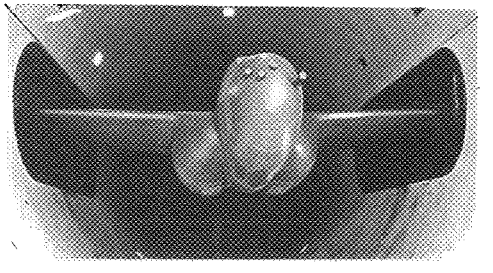
Description:
- Test section 20 foot diameter, closed throat
- Power 18,000 hp
- Speed 500 mph (at 30,000 feet altitude)
- Pressure and temperature - Variable from ground level conditions to those existing at 30,000 feet altitude
- Refrigeration capacity - Sufficient to test a 4000 hp engine at 48 degrees below zero



B-29 engine nacelle in tunnel

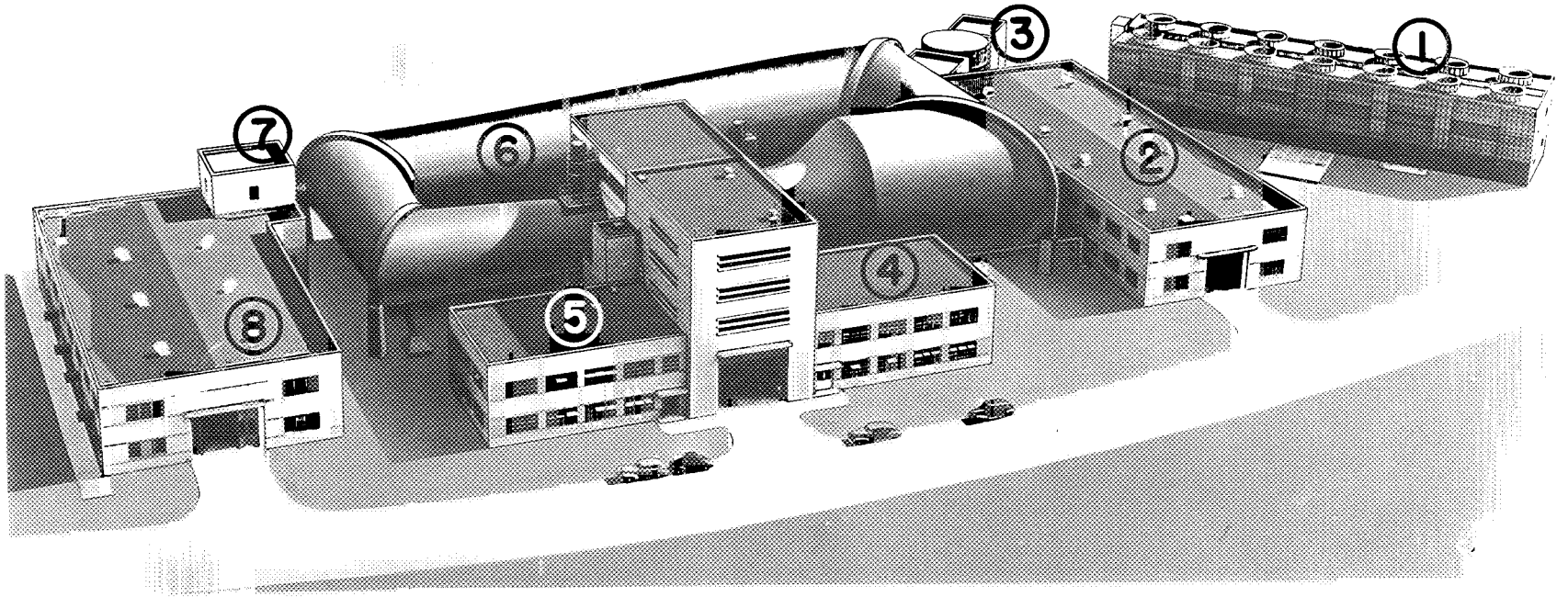
Purpose:
To conduct research on all problems relating to the combining of the aircraft power plant with the remainder of the airplane structure

Research projects:
(a) Jet-propulsion research
(b) Cowling and cooling of aircraft engines
(c) Variation of engine power with altitude
(d) Propeller performance at high-speed, high altitude conditions



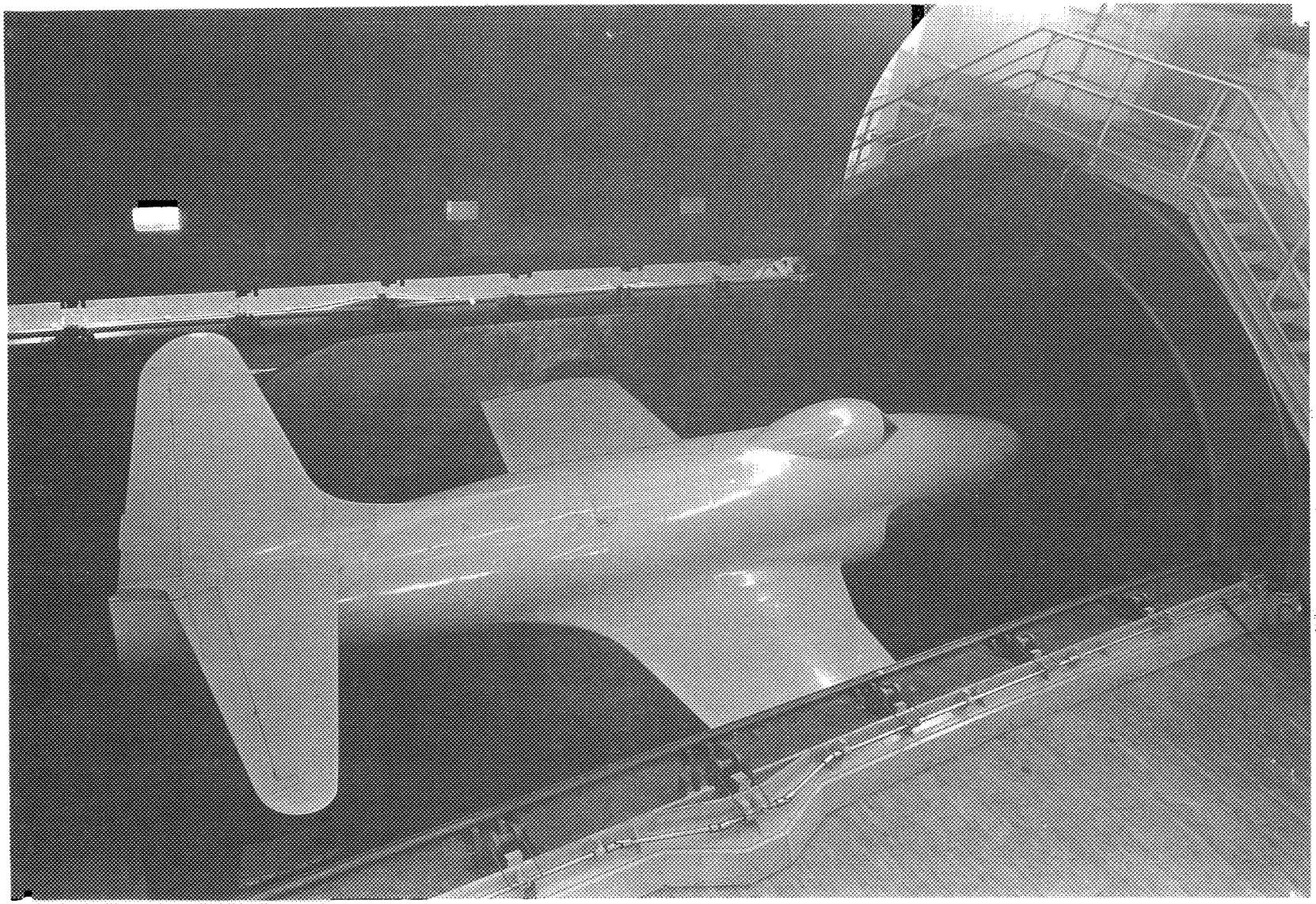
Model of a jet-propelled airplane

NACA
C-5681
7-14-44



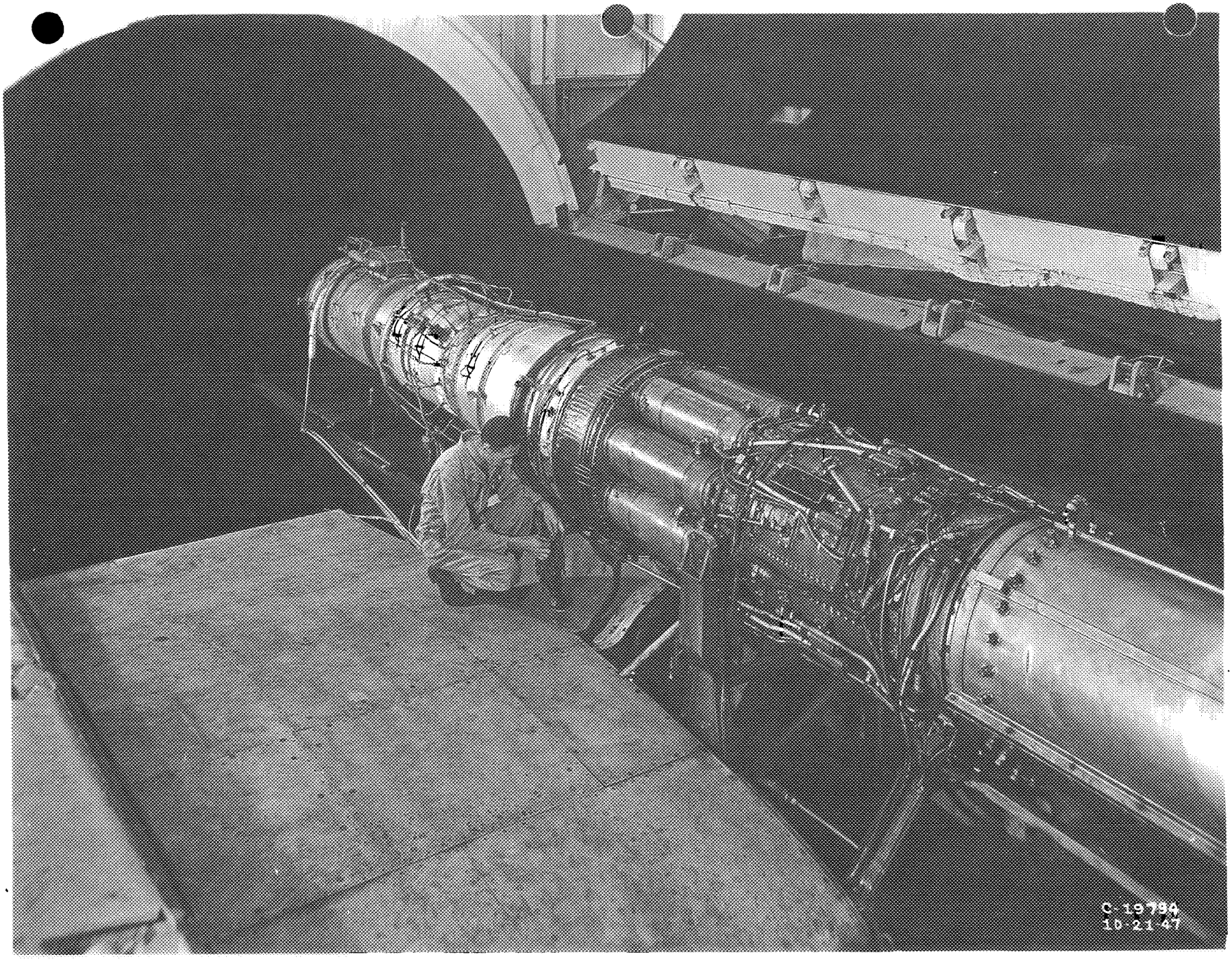
Probably most unique among the research facilities of the National Advisory Committee for Aeronautics at its Aircraft Engine Research Laboratory in Cleveland, Ohio, is the altitude wind tunnel where research is conducted on problems relating to the combining of the aircraft power plant with the remainder of the airplane structure.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AIRCRAFT ENGINE RESEARCH LABORATORY
CLEVELAND, OHIO



C-8983
3-16-45

In the Altitude Wind Tunnel at the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics, Cleveland, Ohio, aircraft engine installations can be subjected to trial under simulated altitude conditions. Here is shown a P-80 airplane, with wings removed, mounted in the test section of the tunnel for determination of its jet engine performance.


C-19734
10-21-47