Glenn Research Center

Propulsion Systems Laboratory, Cells No. 1 and No. 2

Section 106 Checksheets

Recordation of the Glenn Research Center – Section 106 Process

Project, activity or undertaking:	FY2006 Demolition of Power Systems Laboratory (PSL) Cells 1&2 and adjacent facilities (Bldgs.65,66, 67, 73,95,96 97)
Project Description and reasons for undertaking:	PSL 1 & 2 have not been used for research since the 1980s. The exterior of the facilities are deteriorating and require significant maintenance. Although presently housing personnel in office and shop space, the mechanical and electrical systems are obsolete and in need of replacement, and the life safety systems are inadequate. Without extensive maintenance the facility will become a safety hazard. The project will demolish test cells 1 & 2 of PSL and adjacent facilities. The demolition of a major structure will require the abatement of Lead Based Paint , Asbestos Containing Materials, isolated Mercury contamination and lubricating oils. The demolition will entail the removal of all of test chambers, the test infrastructure, the building structure, and the concrete foundations of PSL 1 & 2. Approximately 1000 tons of steel which will be shipped off site to be recycled as part of the demolition. Demolition will reduce maintenance costs and clear the land for future research facilities.
Ohio Historic Inventory form number	CUY-4587-15
Project manager or Point of Contact:	Eric Patton
Date:	July 19, 2006
Date of GRC Evaluation Checklist/REC:	Not submitted yet.
GRC Facility Preservation Officer:	Leslie Main

Step 1. Initiate Section 106 Process	
Are federal funds involved? If no, then proceed with undertaking since not subject to further Section 106 review.	Yes. The demolition of PSL 1 & 2 will be funded from the NASA Construction of Facilities (CoF) Program
Is undertaking the type of activity that could affect historic properties? If no, then proceed with undertaking since not subject to further Section 106 review.	Yes.
Identify potential consulting parties.	The Ohio Historic Preservation Office, the Western Reserve Historical Society, the Cleveland Landmarks Commission, NASA Retirees, the NASA History Office, the Cleveland Restoration Society, and the cities of Cleveland, Fairview Park, North Olmsted, and Brook Park. There are no known Tribal Historic Preservation Offices (THPO) with interest in Lewis Field.
Develop a plan to provide the public with an opportunity to learn and discuss undertaking.	A Community Awareness meeting was held on April 27, 2006 on the GRC Campus. Meeting announcements were sent to local public libraries (Fairview Park, North Olmsted, Brookpark, Cleveland Public), the Sun Post/Sun Herald, and the Cleveland Plain Dealer. Announcements were sent to NASA retirees and an announcement was published in GRC's Aerospace Frontiers. The meeting discussed the history of PSL 1 & 2, the demolition process, the environmental impact, and the historical mitigation process. The meeting ended with a Question and Answer session.

Submit to SHPO and request consultation.	May 4, 2004
Step 2. Identify Historic Properties	
Identify if Significant:	
A. Significant due to association with events	Yes. PSL 1 was initially used to examine turbojet engines, but after the Sputnik I launch, it was used for mainly missile studies. From the beginning, PSL 2 was used for ramjet and rocket studies, but later became involved in more complex rocket systems. One of the first PSL tests investigated a 48 inch ramjet for the Navajo Missile Program. These ignition and inlet tests lasted for several years. By that time the need for such a missile had diminished, but the research improved future ramjets. Other early tests included the Bomarc ramjet, the J79 engine, and 2.5k and Isentropic rockets. By the 1960s, both PSL chambers were used for rocket engine studies. Some of the PSL's most important tests were in the mid-1960s on the RL-10 engine, which were used to power the Centaur rocket. The RL-10 rocket engine was essential to the Apollo mission. The RL-10 program, like Centaur before it, was transferred from Marshall to NASA Lewis in 1966. By the late 1960s, PSL research returned to turbojets, including exhaust nozzle and hypersonic tests. The PSL chambers were used to improve the GE 1/10, TF30-P-3, TFE-731, and F-104 aircraft's J85 engines.
B. Significant due to association with persons	No association.

C. Significant because it embodies distinctive characteristics	No distinct characteristics
D. May yield information important in prehistory or history.	No. The PSL 1 & 2 was built on top of fill that was placed in the 1930's and 1940's to fill in ravines. This fill can vary from 10 to 65 feet. Because of this fill, no important information could be obtained from this site..
Identify if it has Integrity:	
Property is able to be preserved; has physical integrity to still communicate what made it significant. Contains 1 of the 7 aspects of integrity: location, design, setting, material, workmanship, feeling, or association.	Property retains much of its original integrity, but the two test chambers and the associated high pressure air piping would need to be recertified before any research could be performed. The controls for PSL 1 & 2 have been completely removed from the facility and the former control room is vacant. The supporting mechanical and electrical systems are obsolete and in need of replacement. The structure around the test equipment is intact but deteriorating. The current annual maintenance costs for the facility are $76,000.
Determination of Undertaking's Area of Potential Effects (APE)	
Alternative locations?	Not applicable for PSL 1 & 2.
Disturbance of the ground?	Disturbance is expected during demolition, but due to the fill that the facility was built on, this will have no effect on the area.
Locations from which visible?	Visible from Westover, Walcott and Moffet Roads on GRC campus. The facility is not visible to the general public.
Change in land use, traffic, public access, etc.?	The site will be paved after demolition for stormwater control. The paving will be suitable for parking. Because of the site's proximity to the unique research utilities at GRC, the site could be a location for a future research facility.

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Gather information on the APE	
See Appendix A for the OHI forms, which include the site plan and building plan, and Appendix B for photographs of the facility.	
Identify historic properties within the APE	
The property is located within an area that the Gray & Pape 2002 Survey identified as eligible for listing as a Historic District. The property is in the vicinity of the Zero Gravity NHL.	
Evaluate Historic Significance of Property; NASA Determination of Eligible or Ineligible	
Eligible. Continue to Step 3 of Section 106 process	The PSL #1 & #2 Complex is eligible for listing on the NRHP because of its contributions to the development of the RL-10 engine, which was used in the Apollo program and the development of jet engines.
Step 3. Assessing Adverse Effects	
Finding of Adverse Effect	
NASA finds that the demolition of this property meets the criteria of Adverse Effect. Continue to Step 4 of the Section 106 process.	
Step 4. Resolving Adverse Effects	
Avoiding Adverse Effects	
A. Moving the undertaking to an alternate site	This alternative is not applicable for PSL 1 & 2. There are facilities at GRC that duplicate and expand upon the capabilities of PSL 1 & 2.
B. Using an alternative design	1. Removing all of the test equipment and supporting utilities but leaving the exterior shell is an alternative, but the cost to renovate

	the building structure and install new mechanical, electrical, and life safety systems would be cost prohibitive and would provide no historic benefit. Also, the existing foundations for the Test Chambers were specifically designed and could not be easily modified for any new test equipment. 2. One alternative that NASA is investigating would be to remove one of the test chambers, clean it up, and display the old test chamber outside of newer test facility, PSL 3 & 4 (Building 125), as an historical and an educational interpretive display. The newer test chambers are of a similar arrangement but much larger in size and can simulate higher altitudes.
C. Pursuing an alternative to the undertaking	The rehabilitation of PSL 1 & 2 was considered, but because of the greater capability of the newer PSL 3 & 4, the funds for maintaining and expanding the capability for this type of research would be a better investment if directed to the newer facility.
D. No undertaking at all.	NASA has chosen the approach of minimal investment over the past 20+ years. Modular offices were installed in portions of the facility and the low voltage electrical system was maintained to supply power to these offices. But there has been no other investment in the rest of the structure during the last two decades. As a good steward of government assets, with the increasing awareness of Safety and Environmental concerns of the deteriorating structure, NASA believes that something must be done within the next few years.
Mitigation Measures	
• Alternative design & limiting the magnitude of the project.	NASA is planning the complete demolition of PSL 1 & 2. NASA is considering retaining on of the test chambers, moving it closer to PSL 3 & 4, and preparing it as an historical and an educational

	interpretation area. The test chamber would become a tour stop for guided tours of Lewis Field.
• Alternative location or limiting the magnitude of the project.	There are no alternative locations. Keeping the building shell was considered, but there was no historical or practical benefit to this alternative.
• Rehabilitating some historic properties	Adjacent to the newer facility, PSL 3 & 4, is the Icing Research Tunnel (IRT). The IRT is already considered a national landmark by the American Society of Mechanical Engineers (ASME) and may be eligible for listing on the NRHP. Both the IRT and PSL 3 & 4 are current tour stops for guided tours of Lewis Field. Moving one test chamber near to and improving the educational displays at PSL 3 & 4 are an alternative being considered.
• Planning for preservation and maintenance	Funding for preservation and maintenance will be directed to PSL 3 & 4.
• Moving historic properties or marketing the property for donation, sale, or lease	Due to the size and obsolescence of the structure, this alternative would not be feasible.
• Documenting property before destroying it •	NASA is planning the following Historic Mitigation and Documentation for PSL 1 & 2; 1) NASA is investigating feasibility of retaining one test chamber and setting it up as interpretive educational site and tour stop. If this is feasible, NASA will produce museum quality display boards the show the history of PSL 1 & 2 and the technology that was developed from the testing performed there. 2) A Community Awareness meeting was held on April 27, 2006 on the GRC Campus. Meeting announcements were sent to local public libraries (Fairview Park, North

	Olmsted, Brookpark, Cleveland Public), the Sun Post/Sun Herald, and the Cleveland Plain Dealer. Announcements were sent to NASA retirees and an announcement was published in GRC's Aerospace Frontiers. The meeting discussed the history of PSL 1 & 2, the demolition process, the environmental impact, and the historical mitigation process. The meeting ended with a Question and Answer session. The meeting was video taped. Pamphlets with a brief description and history of PSL 1 & 2 were made available to the public. 3) A monograph will be published recording the history of the AWT. The monograph will include full-sized photographs. 4) A web site with public access will be developed for PSL 1 & 2. Historic photographs of the construction and testing within the test chamber will be available for viewing. Photographs of the current state of PSL 1 & 2 and photographs documenting the demolition of PSL 1 & 2 will also be available for viewing. The text from the monograph will also be available for viewing. 5) HAEB/HAERS documents of the PSL 1 & 2 complex will be prepared and archived. These documents will summarize the construction, historical context, technological significance, and a physical description of the facility. Included in this documentation will be selected photographs and architectural drawings from NASA's files. 6) NASA will collect, appraise, and maintain a collection of historically significant documents that will become a permanent record of PSL 1 & 2. These documents may

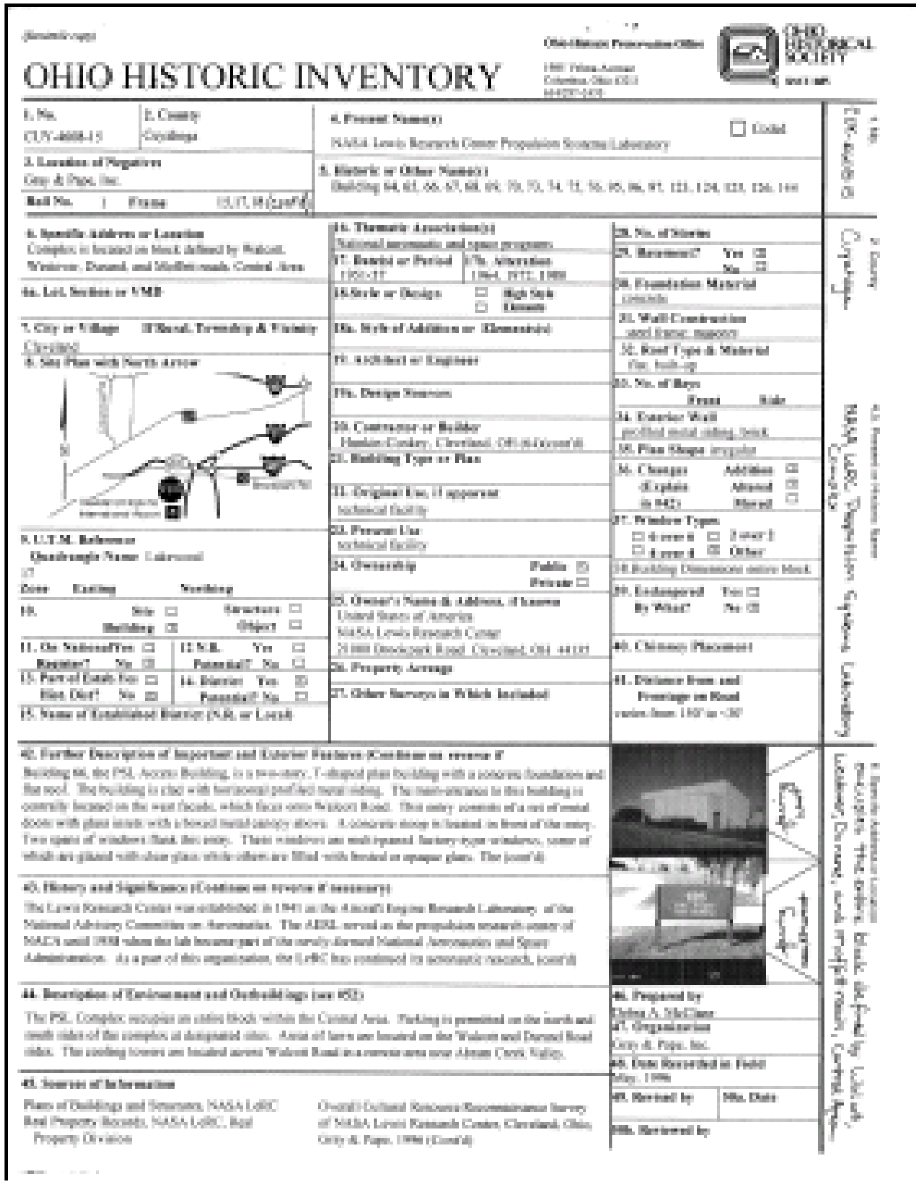
	include correspondence, architectural drawings, maps, scientific or engineering publications, and related materials. 7) NASA will update the photographic images by digitizing unscanned negatives and photographs and uploading them to the GRC Imagenet database. NASA will perform several 360 degree images of PSL 1 & 2 before demolition begins. NASA will compile film and video of tests performed in the test chambers and have the film/video digitized. From the above digitized files, NASA will produce a CD-ROM or DVD that will include photographs, panoramic photographs, video clips, and scanned documents. This disc could supplement the monograph or be distributed separately. 8) Oral interviews will be conducted with NASA retirees, facility and program managers, and others. These interviews will be recorded and transcribed. Selected interviews will be videotaped. 9) NASA will produce a documentary video that would describe the facility, its history, and research programs. The documentary may include interviews from Item 8.
Recovering data from archeological site	See Step 2d.
Accepting loss of historic property	NASA is willing to accept the loss of this property. It is the technology that was developed and tested in PSL 1 & 2 that is significant. Properly documenting these scientific and engineering developments are important. The structure of the PSL 1 & 2 complex, especially in its current state, does not have historical or technological significance.

	NASA Headquarters has concurred with and advocates the proposed demolition of the PSL 1 & 2 complex. With the Aeronautics Research budget being 1/17th of NASA's overall budget, funding for improving Aeronautics research facilities at GRC would be better invested in other wind tunnels (IRT, the 10x10 SWT, the 8x6 SWT) or the PSL #3 & #4. The facility has been out of service for more than 20 years. During that period of time, the control room for PSL 1 & 2 has been gutted and the test chambers left idle. Because the PSL 1 & 2 is a large structure, the maintenance costs for the facility are very high and the facility is in poor condition. There are no current NASA mission requirements for long-term use of the test chambers. The building is currently used to house contractor engineering and maintenance staff, who could be housed in any facility. Currently, NASA GRC is a land-locked site. The area that will be cleared by the demolition of the PSL 1 & 2 complex will allow NASA to locate new research capability at that site. This will allow NASA to facilitate its primary mission.
Notify council – participate in consultation? Consulting parties involved in discussion Public comment & involvement during resolution of adverse effects	Yes. NASA will invite the ACHP to consult in this process.
MOA	

Appendix A

OHI Forms

Recordation of the Glenn Research Center – Section 106 Process



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51. Condition of Property

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

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. Furnished Plan

42. (Cont'd)

symmetrically arranged facade has a long expanse of windows on the second story. The north facade of this building is clad on the first story with metal panels and on the second story with profiled metal siding. A large span of multi-pane, factory-type windows is located on the second floor. A second floor entrance is located on this facade and is accessed by an exterior metal staircase. The south facade of this building has a cargo door flanked by an entry door and short span of multi-pane windows. The second floor contains a large span of these windows. This building was constructed in 1951 by the Sam W. Emerson Co. of Cleveland, Ohio. (Cont'd)

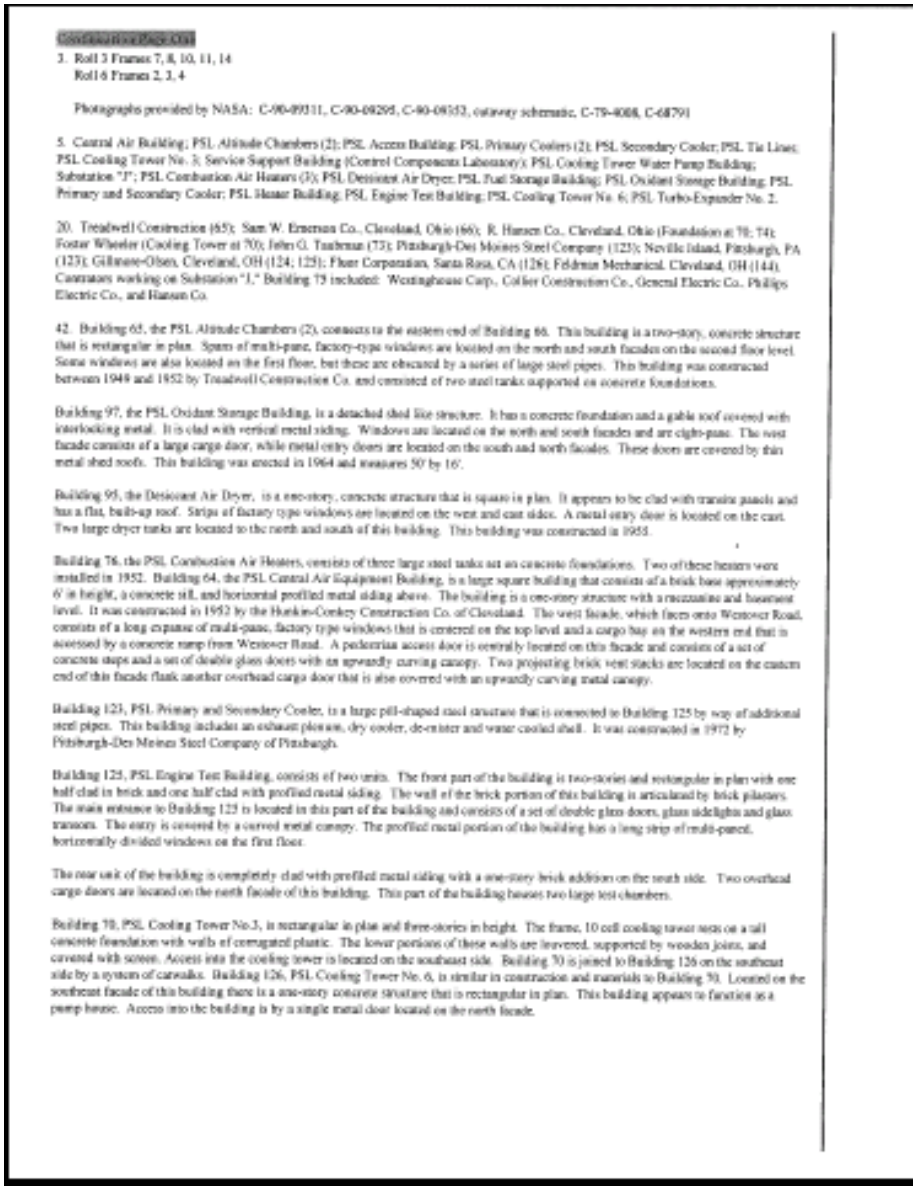
43. (Cont'd)

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

The Propulsion Systems Laboratory is an altitude simulation facility capable of testing full-scale gas turbine engines operating continuously at simulated altitudes up to 70,000 feet and simulated velocities up to Mach 3.0. After components are tested at other facilities at the center, complete engines are tested at the PSL. The facility consists of two engine test cells, which measure 24' in diameter and 38' in length. Flight simulation is achieved by closely controlling test chamber altitude as well as the inlet-air pressure and temperature, so as to match flight conditions. These test chambers are capable of testing large-scale airbreathing engine systems under controlled simulated altitude, temperature, and pressure conditions. Modifications to the test chambers, supplying inlet air in limited quantities at temperatures up to 3000 F, allows testing in the hypersonic regime (up to Mach 6.0). The PSL support complex includes central air system equipment, an exhaust-gas cooler, a closed-coupled air temperature conditioning plant, and a cooling tower water system. System studies in the PSL evaluate engine thrust, fuel consumption, airflow, stall limits, blowout limits, temperature, pressure, fuel distortion and starting characteristics. (cont'd)

44. (Cont'd)

Recordation of the Glenn Research Center – Section 106 Process



Continuation Page One

3. Roll 3 Frames 7, 8, 10, 11, 14
   Roll 6 Frames 2, 3, 4

   Photographs provided by NASA: C-90-89311, C-90-08295, C-90-08353, cutaway schematic, C-79-4088, C-68791

5. Central Air Building; PSL Altitude Chambers (2); PSL Access Building; PSL Primary Coolers (2); PSL Secondary Cooler; PSL Tie Lines; PSL Cooling Tower No. 5; Service Support Building (Control Components Laboratory); PSL Cooling Tower Water Pump Building; Substation "J"; PSL Combustion Air Heaters (3); PSL Desiccant Air Dryer; PSL Fuel Storage Building; PSL Oxidant Storage Building; PSL Primary and Secondary Cooler; PSL Heater Building; PSL Engine Test Building; PSL Cooling Tower No. 6; PSL Turbo-Expander No. 2.

20. Treadwell Construction (65); Sam W. Emerson Co., Cleveland, Ohio (66); R. Hansen Co., Cleveland, Ohio (Foundation at 70; 74); Foster Wheeler (Cooling Tower at 70); John G. Taulbman (73); Pittsburgh-Des Moines Steel Company (123); Neville Island, Pittsburgh, PA (123); Gillmore-Olsen, Cleveland, OH (124; 125); Fluor Corporation, Santa Rosa, CA (126); Feldman Mechanical, Cleveland, OH (144). Contractors working on Substation "J," Building 79 included: Westinghouse Corp., Collier Construction Co., General Electric Co., Phillips Electric Co., and Hansen Co.

42. Building 65, the PSL Altitude Chambers (2), connects to the eastern end of Building 66. This building is a two-story, concrete structure that is rectangular in plan. Spans of multi-pane, factory-type windows are located on the north and south facades on the second floor level. Some windows are also located on the first floor, but these are obscured by a series of large steel pipes. This building was constructed between 1949 and 1952 by Treadwell Construction Co. and consisted of two steel tanks supported on concrete foundations.

Building 97, the PSL Oxidant Storage Building, is a detached shed like structure. It has a concrete foundation and a gable roof covered with interlocking metal. It is clad with vertical metal siding. Windows are located on the north and south facades and are eight-pane. The west facade consists of a large cargo door, while metal entry doors are located on the south and north facades. These doors are covered by thin metal shed roofs. This building was erected in 1964 and measures 50' by 16'.

Building 95, the Desiccant Air Dryer, is a one-story, concrete structure that is square in plan. It appears to be clad with transite panels and has a flat, built-up roof. Strips of factory type windows are located on the west and east sides. A metal entry door is located on the east. Two large dryer tanks are located to the north and south of this building. This building was constructed in 1955.

Building 76, the PSL Combustion Air Heaters, consists of three large steel tanks set on concrete foundations. Two of these heaters were installed in 1952. Building 64, the PSL Central Air Equipment Building, is a large square building that consists of a brick base approximately 6' in height, a concrete sill, and horizontal profiled metal siding above. The building is a one-story structure with a mezzanine and basement level. It was constructed in 1952 by the Hunkin-Conkey Construction Co. of Cleveland. The west facade, which faces onto Westover Road, consists of a long expanse of multi-pane, factory type windows that is centered on the top level and a cargo bay on the western end that is accessed by a concrete ramp from Westover Road. A pedestrian access door is centrally located on this facade and consists of a set of concrete steps and a set of double glass doors with an upwardly curving canopy. Two projecting brick vent stacks are located on the eastern end of this facade flank another overhead cargo door that is also covered with an upwardly curving metal canopy.

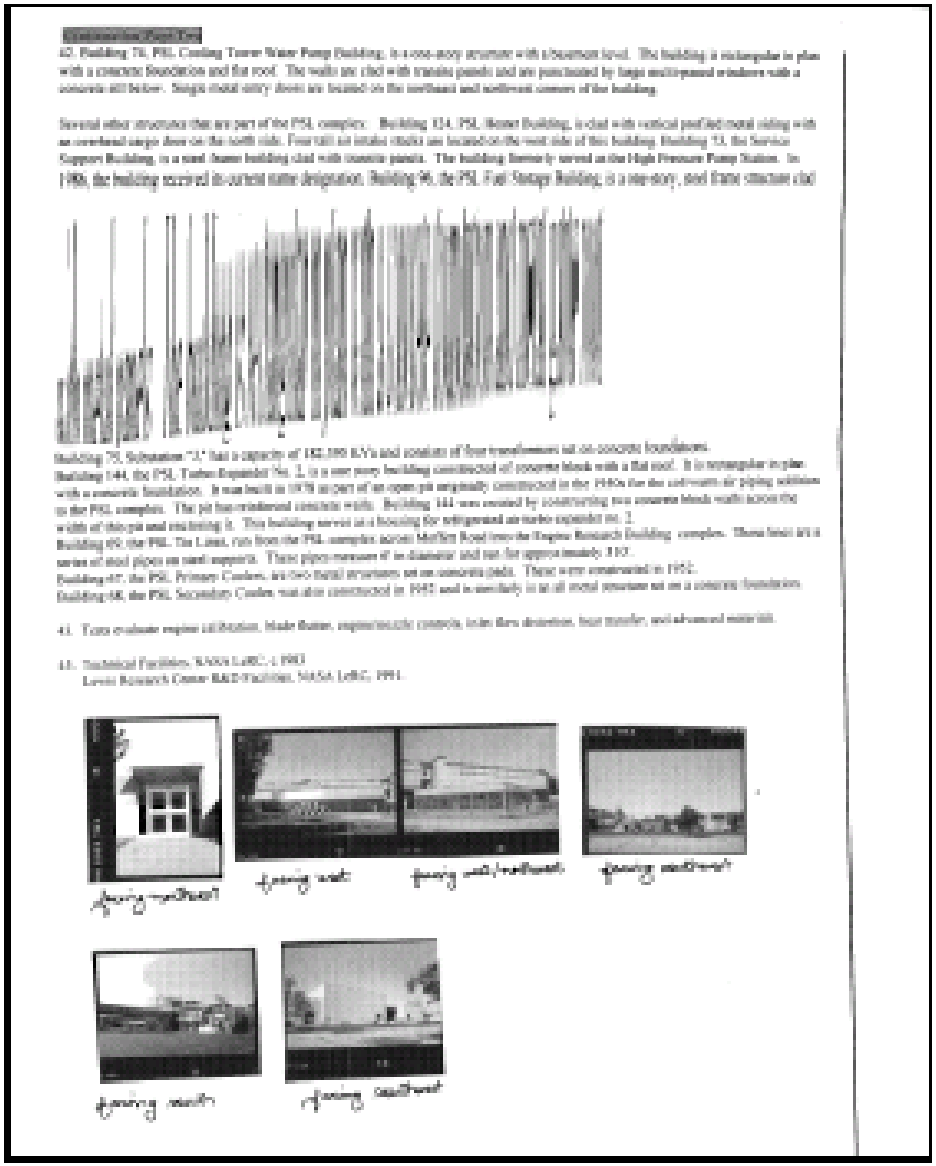
Building 123, PSL Primary and Secondary Cooler, is a large pill-shaped steel structure that is connected to Building 125 by way of additional steel pipes. This building includes an exhaust plenum, dry cooler, de-winter and water cooled shell. It was constructed in 1972 by Pittsburgh-Des Moines Steel Company of Pittsburgh.

Building 125, PSL Engine Test Building, consists of two units. The front part of the building is two-stories and rectangular in plan with one half clad in brick and one half clad with profiled metal siding. The wall of the brick portion of this building is articulated by brick pilasters. The main entrance to Building 125 is located in this part of the building and consists of a set of double glass doors, glass sidelights and glass transom. The entry is covered by a curved metal canopy. The profiled metal portion of the building has a long strip of multi-paned, horizontally divided windows on the first floor.

The rear unit of the building is completely clad with profiled metal siding with a one-story brick addition on the south side. Two overhead cargo doors are located on the north facade of this building. This part of the building houses two large test chambers.

Building 70, PSL Cooling Tower No.3, is rectangular in plan and three-stories in height. The frame, 10 cell cooling tower rests on a tall concrete foundation with walls of corrugated plastic. The lower portions of these walls are louvered, supported by wooden joists, and covered with screen. Access into the cooling tower is located on the southeast side. Building 70 is joined to Building 126 on the southeast side by a system of catwalks. Building 126, PSL Cooling Tower No. 6, is similar in construction and materials to Building 70. Located on the southeast facade of this building there is a one-story concrete structure that is rectangular in plan. This building appears to function as a pump house. Access into the building is by a single metal door located on the north facade.

Recordation of the Glenn Research Center – Section 106 Process



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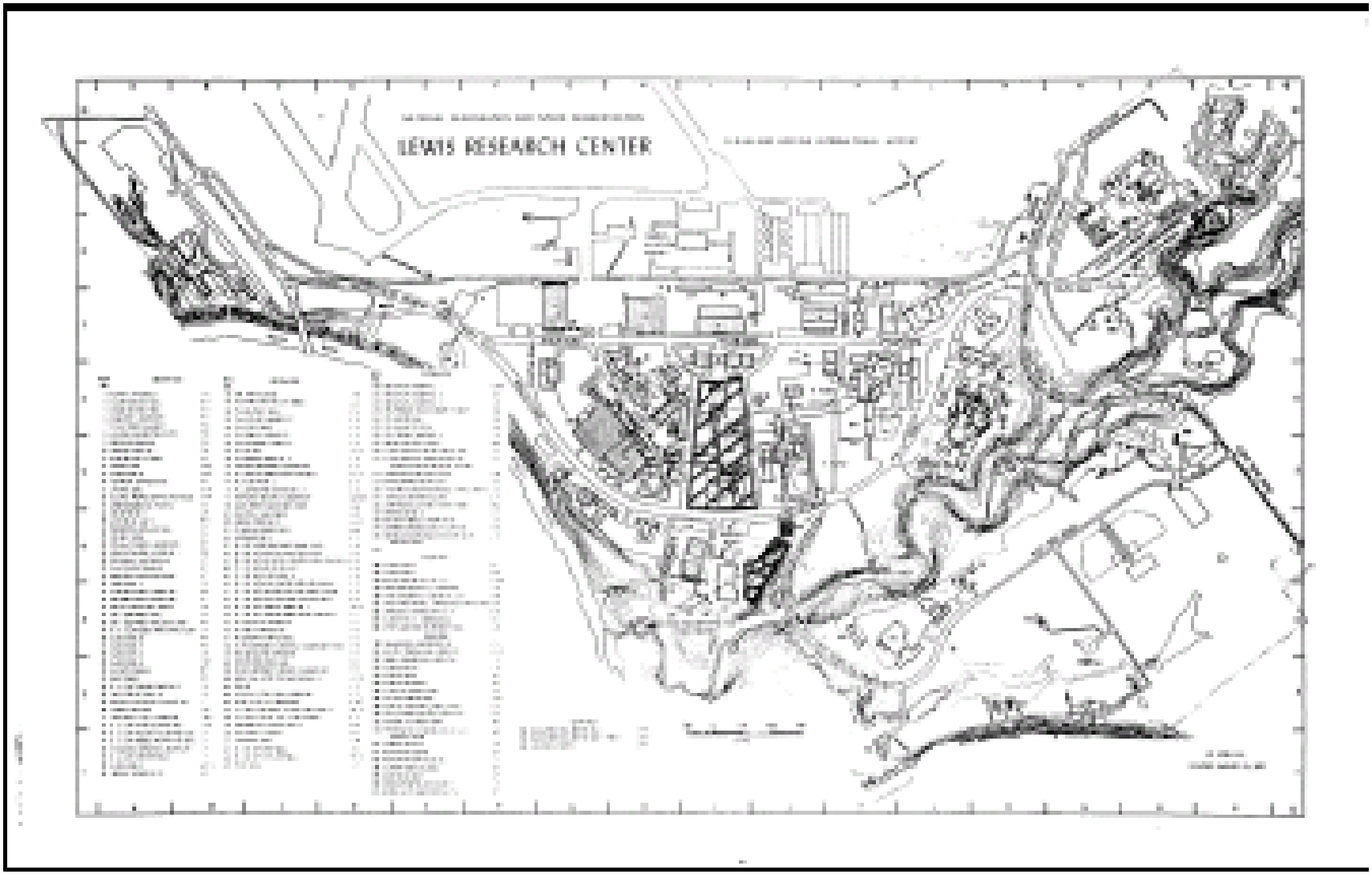

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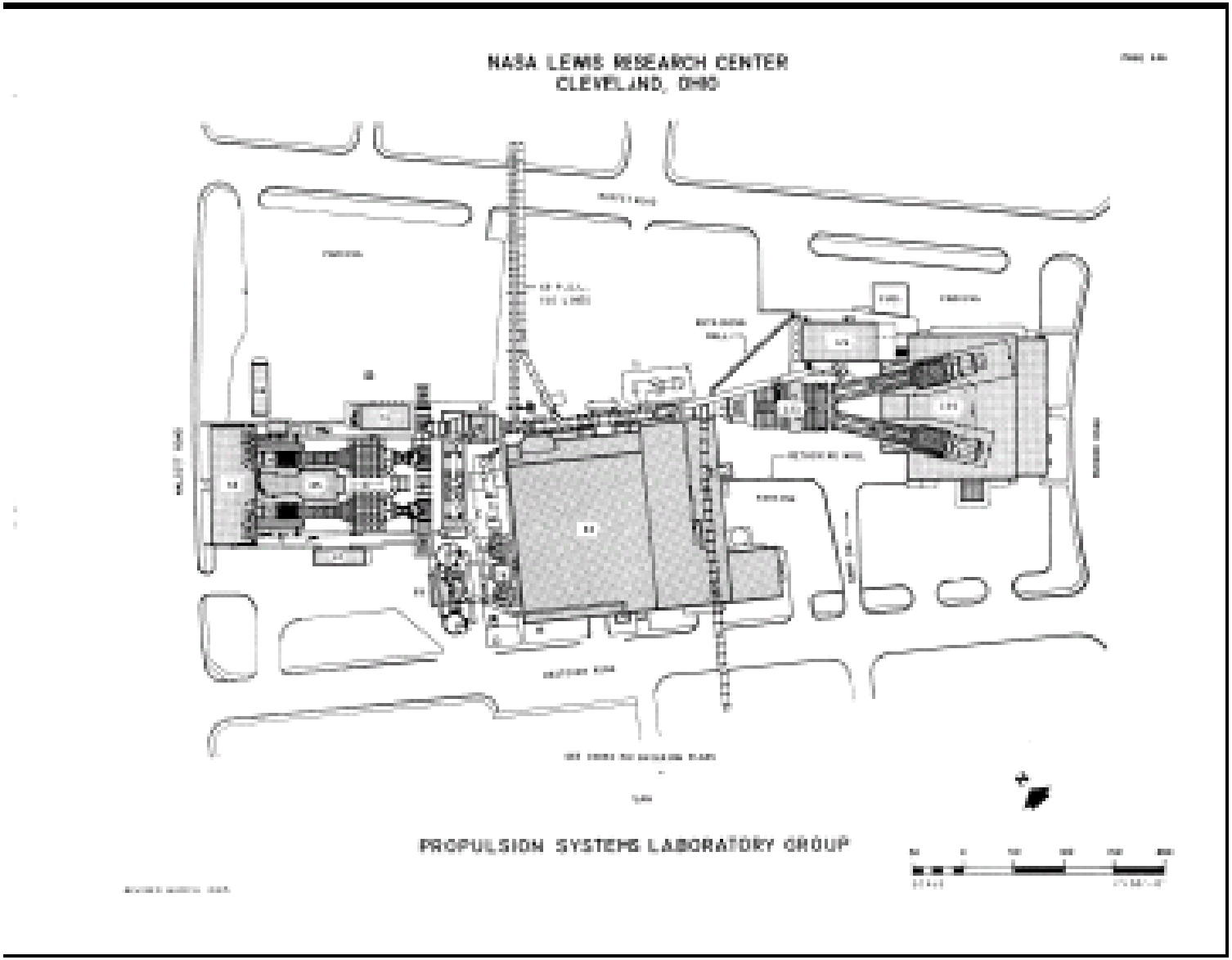

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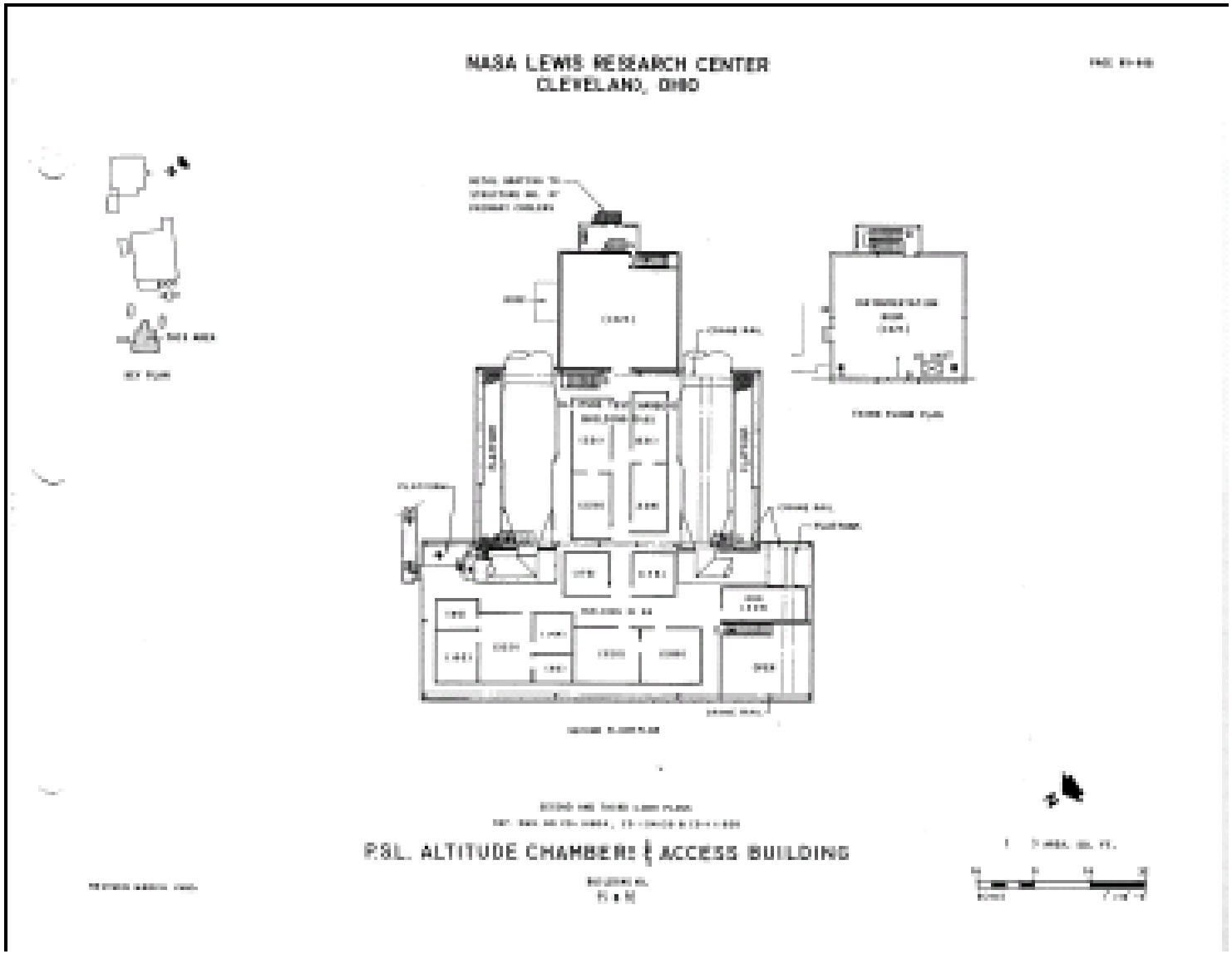

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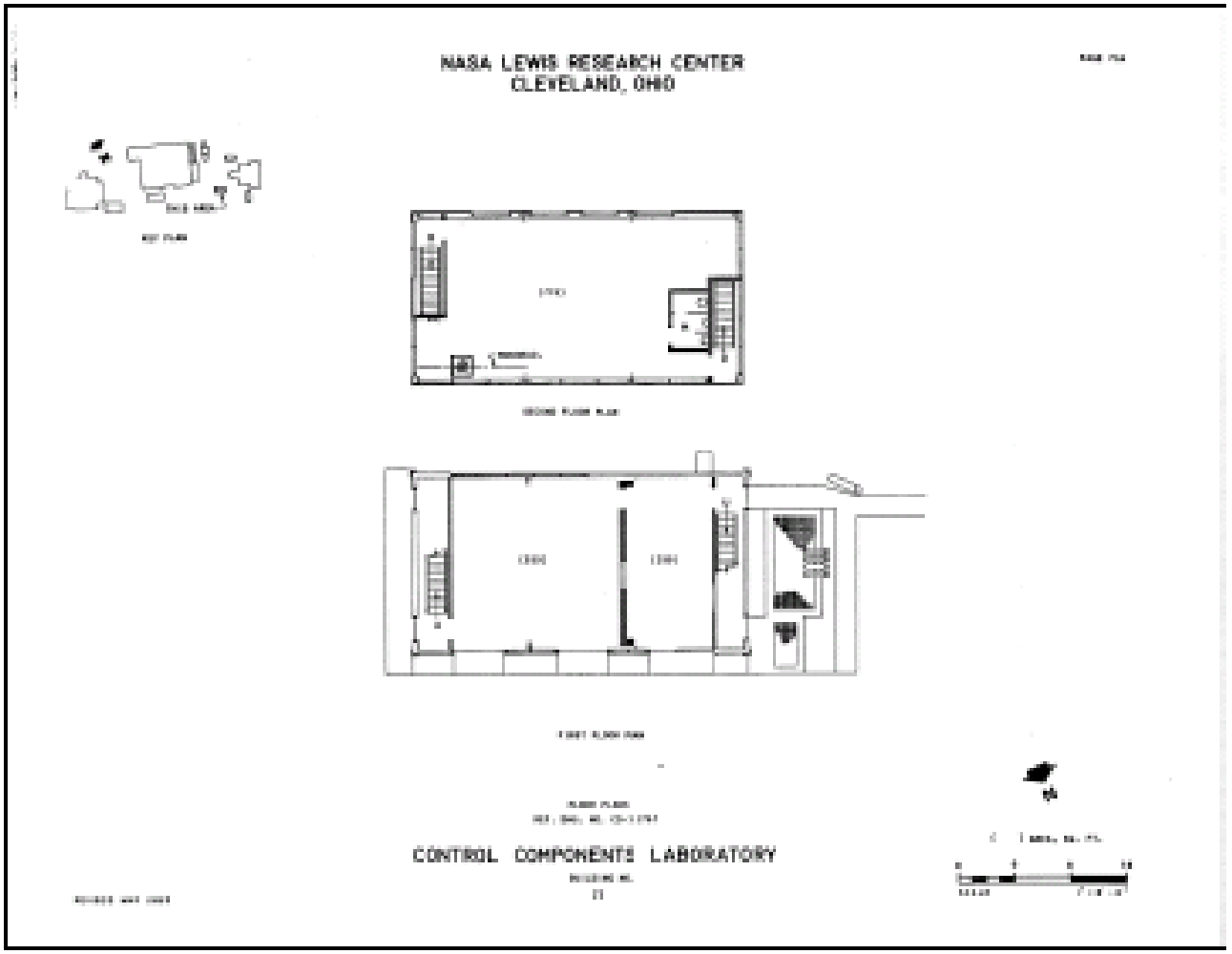
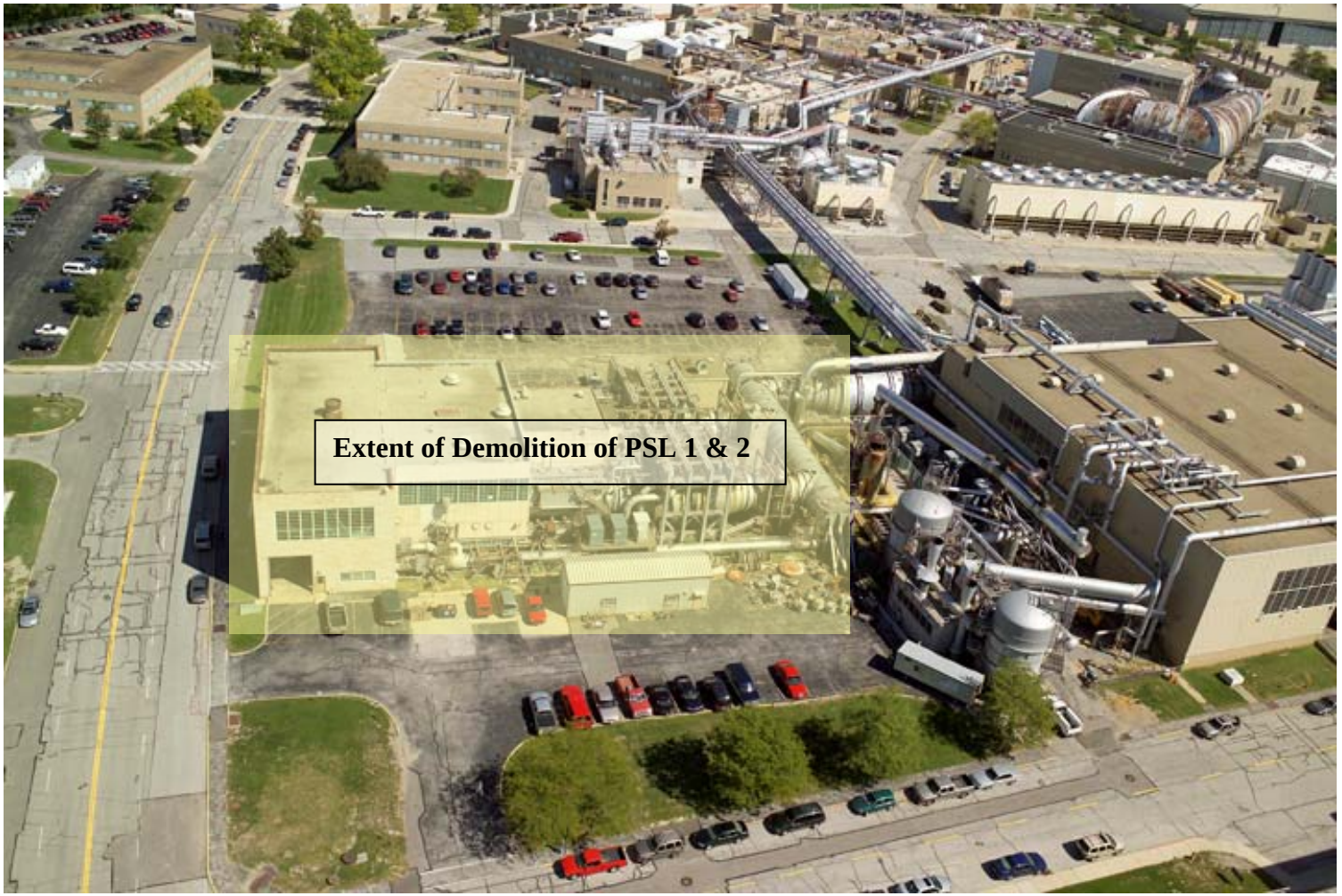


Photograph of PSL 1 & 2 from OHI Forms
View of the Facility from the Southwest

Appendix B

Arial Photographs of the Propulsion Systems Laboratory

Cells No. 1 and No. 2



Photograph of PSL 1 & 2 Viewed from the South

Photograph of PSL 1 & 2 Viewed from the North

Photograph of PSL 1 & 2 Viewed from the Southeast