AECOM
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Memorandum

To: Jonathan Ikan, Cultural Resources Manager, NASA Ames Research Center

CC: Peter Jacobs, AECOM

Subject: Section 106 Consultation on the N-226 Motor Pool Relocation Project, NASA Ames Research Center, Moffett Field, Santa Clara County, California

From: Trina Meiser, Senior Architectural Historian
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Date: May 31, 2022

1. Introduction

The National Aeronautics and Space Administration (NASA) Ames Research Center (ARC) proposes the N-226 Motor Pool Relocation Project (project or undertaking) at NASA ARC, Moffett Field, Santa Clara County, California. As the lead federal agency, NASA is responsible for compliance with Section 106 of the National Historic Preservation Act of 1966 (54 United States Code §306108), as amended, which requires federal agencies to take into account the effects of their activities and programs on historic properties, and its implementing regulations in 36 Code of Federal Regulations (CFR) Part 800. The purpose of this memorandum is to provide necessary information for compliance with Section 106, including a description of the undertaking and the Area of Potential Effects (APE), the methodology used to identify and evaluate historic properties within the APE, a description of the affected historic properties, and an assessment of potential effects resulting from the undertaking.

1.1 Project Location

Building N-226 is southwest of the intersection of Parsons Avenue and De France Avenue on the NASA Ames Campus at NASA ARC, Moffett Field, Santa Clara County, California (see Figures 1 and 2 in Appendix A). The building is within the boundary of, and is a contributor to, the NASA Ames Wind Tunnel Historic District that is listed in the National Register of Historic Places (NRHP) and is also within the proposed National Advisory Committee for Aeronautics (NACA) Ames Historic District, which is potentially eligible for listing in the NRHP.

1.2 Project Personnel

This study was conducted by cultural resources professionals who meet the Secretary of the Interior's Professional Qualifications Standards (48 Federal Register 44738). Trina Meiser, M.A., Senior Architectural Historian, served as the Principal Investigator; Jennifer Redmond, M.A., RPA, addressed archaeological resources; Heather Miller, M.A., and Evan Mackall, M.A., contributed to the report; Rob'yn Johnston, M.A., RPA, provided map figures; and Kirsten Johnson, M.A., served as the lead verifier of this document.

2. Description of the Undertaking

The project involves the relocation of the Motor Pool program to Building N-226. The Motor Pool is currently located in Building N-251 with an adjacent fuel station that would be demolished to make room for the new engineering facility at Building N-278 (see OHP NASA_2020_0918_001 for previous Section 106 consultation). The Motor Pool supports ARC's mission through the maintenance of vehicles and equipment. Building N-226, built in 1948 as the 6' x 6' Supersonic Wind Tunnel building, was identified as the optimal spot to relocate the Motor Pool, because it is on the NASA Ames Campus within the secure area of ARC, is currently vacant, and has a compatible layout with existing bay doors that can accommodate large vehicles and equipment.

The project would modify the interior of the north wing of Building N-226 to accommodate the Motor Pool. Two sections of the existing 6"-thick first floor concrete slab in the north wing would be removed and replaced with 1'- thick concrete slabs for auto lift foundations. One section of concrete measures 14' by 5', and the other is 13' by 4'. Other first floor modifications include the installation of two new hydraulic auto lifts and other maintenance equipment, and the removal of an existing rollup door on the south wall of the north wing. The door opening would be infilled with a 2-hour wall to separate occupancies in the building. Modification of the second floor of the north wing is limited to the enclosure of an exhaust shaft that would extend from the first-floor facility to the roof of the north wing.

Alterations to the exterior of Building N-226 envelope are limited to the modification of a multi-lite metal sash window north of the primary entrance in the center section on the façade. One panel of the window would be replaced with a louvered vent. Vertical elements that imitate the window mullions of the removed window would be affixed to the vent to retain visual cohesion.

The project would construct a new fuel station and car wash rack northwest of Building N-226 in a paved area south of Parsons Avenue. This includes removal of a sewer line and associated cleanouts; a waterline; a storm drain inlet; a curb on the west side; and asphalt and the underlying base. Project work at this location consists of new concrete pavement in the fuel station and car wash rack; a concrete curb along the east side of a paved area immediately south of the fuel station; a gutter along the north side of the new paved area; and a 12'-tall and 12"-thick concrete masonry unit (CMU) fireproof wall between the fuel station and the car wash rack. The fuel station would include two new 2,000-gallon fuel tanks and diesel and gasoline fueling pumps on a 1'-thick concrete slab surrounded by a 6'-tall security fence. The car wash rack structure would be immediately adjacent to the new fuel station and separated by the fireproof wall. The car wash rack would consist of a steel-frame canopy measuring 25'-long by 22'-wide by 16'-tall on a 1'-thick concrete slab, plastic drop sheet siding, a water hose bib, electrical outlets, and drainage. New lighting would be installed for the fuel station and the car wash rack. The project would include approximately 170' of trenching up to 30" deep from the northeast side of Building N-226 along Parsons Avenue for utility lines to connect the car wash and rack and fuel station, and approximately 140' of excavation up to 40″ deep for sewer, storm drain, and water lines.

The project would also provide Americans with Disabilities Act (ADA)-compliant parking, sidewalk, and ramp improvements at the north, east, and south sides of Building N-226. The parking area along the north side of Parsons Avenue would be re-striped and feature new site lighting and low-voltage electric vehicle (EV) charging stations. Approximately 1,330 square feet of sidewalks on the east side of Building N-226 along DeFrance Avenue and on the south side to the parking lot would be replaced. The new sidewalks would match existing grades at tie-in points. Two detectable warning strips would be installed on the east side near the primary entrance on the façade (east side) and an ADA-compliant parking space and ramp would be installed on the south side. Minimal ground disturbance (6" to 12" deep) for the sidewalk replacement and installation of EV charging stations is anticipated.

Select project drawings are provided in Appendix B.

3. Area of Potential Effects

The APE is defined to address both direct and indirect impacts on potential historic properties and encompasses areas that may be affected by both temporary and permanent construction activities (see Figure 3 in Appendix A). The APE is located within the NASA Ames Wind Tunnel Historic District and the potential NACA Ames Historic District (NACA District). It accounts for potential indirect effects on the districts but does not include the entire boundaries of the districts due to the project's scale.

For archaeological resources, the APE is limited to the project area, including areas of temporary staging and construction ground disturbance. The APE related to ground disturbance extends to a maximum vertical depth of approximately 40″ below grade to install utilities and new foundations for the fuel station, car wash rack, hydraulic lifts, and EV stations, and sidewalk replacement.

For architectural resources, the APE is limited to a 75' buffer around the project area due to the relative scale and location of the project improvements. Any potential visual, audible, or atmospheric effects resulting from the project are unlikely to affect historic properties beyond Building N-226's immediate surroundings. Above-ground activities include temporary staging, which is unlikely to have indirect impacts on historic properties; construction

of the fuel station, car wash rack, and ADA-compliant sidewalk and parking improvements; interior rehabilitation of the north wing of Building N-226; and replacement of a window panel in the center section on the façade of Building N-226. Construction of the fuel station and the car wash rack would occur within the boundaries of the NASA Ames Wind Tunnel Historic District and the proposed NACA Historic District but would be located at the rear of Building N-226 near two non-contributing facilities, Building N-225 (Substation) and Building N-263 (Telecommunications Building). Exterior improvements at the perimeter of Building N-226 are within view of two historic properties, Building N-227 (Unitary Plan Wind Tunnel) and Building N221 (National Full-Scale Aerodynamics Complex).

4. Identification of Historic Properties

Historic properties are defined as any district, site, building, structure, or object that is included in, or is eligible for listing in, the NRHP. The APE has been previously surveyed for architectural resources that have been evaluated for NRHP eligibility. The following sections address the methodology and efforts to identify historic properties in the APE.

4.1 Archaeological and Tribal Resources

The land that comprises ARC has changed dramatically since the early 20th century from predominantly agricultural use to an extensive military airfield installation beginning in 1931 and aeronautical research and development beginning in 1939. Extensive surface disturbance occurred throughout ARC with grading and fill to create the airfield and the campuses with hundreds of buildings and structures to support operations.

A comprehensive investigation of previous archaeological studies at ARC was completed in 2017 (AECOM 2017). The *NASA Ames Research Center Archaeological Resources Study* involved a desktop survey of archival resources and a geoarchaeological assessment of the entire ARC site and included an assessment of archaeological sensitivity and the potential for buried archaeological resources. The study concluded that there is low potential for more deeply buried prehistoric archaeological resources across the majority of the ARC.

A review of the 2017 investigation indicates that the proposed work is located in an area of low prehistoric and historic-era archaeological sensitivity (see Figure 4 in Appendix A). No archaeological resources have been previously identified in or near the project area. The nearest previously identified archaeological resources (CA-SCL-21 and CA-SCL-23) are more than 0.5-mile from the project area. Two areas of heightened historic-era archaeological sensitivity are more than 500 feet to the northwest and southwest.

The project site includes Building N-226 and adjacent exterior areas. The larger eastern portion of the project area is highly disturbed (by the existing Building N-226) and entirely paved. Additionally, several utility lines are known to exist in the project site. A review of historical aerial photographs indicates that no structures ever existed on the smaller western portion of the APE, the majority of which remains unpaved. An archaeological survey of the portions of the APE with ground visibility was conducted on February 8, 2021, by an AECOM archaeologist. No indications of prehistoric or historic-era archaeological resources were observed at the surface or in rodent burrow back-dirt piles.

The expected depth of ground disturbance is up to approximately 40" below existing grade. The foundation for the new fuel station would consist of a 1' -thick concrete slab with footings 2' deep. The foundation for the new car wash structure would consist of a 2'-6" concrete foundation. Removal and replacement of associated utility lines and the existing parking lot asphalt and curbs would require ground disturbance to a maximum depth of 40" below existing grade.

The eastern portion of the project would be limited to previously disturbed areas and no indication of archaeological resources were observed in the accessible western portions of the APE. The entire APE has a low potential for more deeply buried prehistoric sites. Therefore, it is not anticipated that archaeological resources will be encountered as a result of this undertaking. Given the low sensitivity, further archaeological survey or testing related to the undertaking is not necessary, and no potential effects on potentially significant archaeological resources are anticipated.

Should the project uncover previously unknown subsurface archaeological resources, contractors would immediately halt construction, secure the site, and notify NASA of the unanticipated discovery. NASA would follow the Standard Operating Procedure for unanticipated discoveries as outlined in the Integrated Cultural

Resources Management Plan for ARC. With the exception of the potential to affect unknown subsurface archaeological resources, the project is not anticipated to have any direct effects on archaeological resources.

4.1.1 Consultation Efforts

No federally recognized Tribes are associated with the geographical boundaries of NASA ARC or this undertaking. As part of a previous archaeological study of the entire ARC property (AECOM 2017), a Sacred Lands File search and a list of Native American tribes and representatives with a known interest in the area was requested from the Native American Heritage Commission (NAHC). The NAHC responded on April 27, 2016, indicating that the Sacred Lands File search was negative and provided a list of five Native American representatives who may have additional information regarding cultural resources in the vicinity if the ARC property. In 2021, NASA ARC updated the request and the NAHC responded on July 28, 2021, again indicating that the search was negative and provided an updated list of Native American representatives. NASA ARC has consulted with these non-federally recognized representatives on undertakings that had the potential to affect cultural resources at known sites and in areas with high sensitivity for prehistoric archaeological resources. These representatives have not provided any additional information regarding known sacred lands or previously undocumented archaeological resources. Due to the highly disturbed nature of the current project site and the low sensitivity for prehistoric archaeological resources, NASA ARC has not consulted with the non-federally recognized representatives on this undertaking. In the event that an inadvertent discovery of prehistoric archaeological resources or human remains of Native American origin are encountered, NASA ARC will consult with these representatives.

4.2 Architectural Resources

4.2.1 Previous Studies

Previous efforts to identify historic properties at ARC that have covered portions of the APE include thematic studies of Apollo Program-era and Space Shuttle Program-era facilities, a reconnaissance survey, the NRHP nomination for the NASA Ames Wind Tunnel Historic District, and a historic resource evaluation of the potential NACA Historic District. Table 1 lists relevant evaluation efforts in previous surveys at ARC.

Table 1. Previous Built Environment Studies in the APE

Date	Author	Title	Findings
2006	Architectural Resources Group, Inc.	*National Register Nomination for the Ames Aeronautical Laboratory 6 x 6 Supersonic Wind Tunnel*	N-226 individually eligible for NRHP under Criterion A and Criterion C
2007	Architectural Resources Group, Inc.	*Building N-226 Reuse Guidelines, NASA Ames Research Center, California*	Reuse guidelines developed for Building N-226, including identification of character-defining features and opportunities for reuse.
2017	AECOM	*National Register Nomination for the NASA Ames Wind Tunnel Historic District*	Nominated historic district with five contributing facilities to the NRHP, including nine buildings: N-215, N-220, N-221 and N-221B, N-226, and N-227 and N-227A-C; listed in 2017.
2022	AECOM	*Historic Evaluation of the NACA Historic District*	Evaluated potential NACA Historic District based on common historical and architectural themes; N-226 is a contributor.

4.2.1.1 National Register Nomination for the Ames Aeronautical Laboratory 6' x 6' Supersonic Wind Tunnel (Architectural Resources Group, Inc. 2006)

In 2006, Architectural Resources Group (ARG) prepared a NRHP nomination form on Building N-226, “Ames Aeronautical Laboratory 6 x 6 Supersonic Wind Tunnel.” The building was found individually eligible for the NRHP under Criterion A for its role in supersonic testing and research and association with many significant aeronautic discoveries, and under Criterion C for its significant engineering accomplishments in the context of wind tunnel construction. The nomination stated that the building had a high degree of integrity, but did not identify the building’s character-defining features. The nomination received concurrence from the California State Historic Preservation Officer on June 17, 2008.

4.2.1.2 Building N-226 Reuse Guidelines, NASA Ames Research Center (Architectural Resources Group, Inc. 2007)

In 2007, ARG developed reuse guidelines for Building N-226 to assist NASA ARC staff, tenants, and consultants in planning for the rehabilitation of Building N-226. The document identified the significant and contributing character-defining features of Building N-226 and directed those features should be considered prior to the reuse of Building N-226. The building's character-defining and contributing features, include, but are not limited to, the overall form of the building, its fenestration patterns and materials, and surrounding open space. It concluded that changes to non-character-defining features may be undertaken, but impacts to the character-defining and contributing features necessitated evaluation. These reuse guidelines were consulted for the design of the current undertaking. A copy of this report is included in Appendix C.

4.2.1.3 National Register Nomination for the NASA Ames Wind Tunnel Historic District (AECOM 2017)

In 2016, AECOM prepared the nomination for the NASA Ames Wind Tunnel, which was listed in January 2017. For further information about the district, see Section 5.1 below.

4.2.1.4 Historic Evaluation of the NACA Historic District

In 2022, AECOM conducted a study for NASA ARC's Building N204A Window Replacement Project. The study included a survey and evaluation for a potential historic district and identified the potential NACA District. NASA ARC consulted with the SHPO on the project (see OHP NASA_2021_0525_001), but concurrence on the potential NACA District has not yet been received. This study assumes that the potential NACA District is eligible for the NRHP. For further information about the district, see Section 5.2 below.

4.2.2 Current Study

The APE overlaps the NASA Ames Wind Tunnel Historic District and the proposed NACA District. Five architectural resources are in or adjacent to the APE: Buildings N-221, N-225, N-226, N-227A-C, and N-263 (Table 2). Building N-225 is a substation that is not individually eligible for the NRHP and does not contribute to the NASA Ames Wind Tunnel Historic District. Building N-263 is less than 50 years old, does not appear to have exceptional significance to meet Criteria Consideration G that would warrant evaluation under the NRHP criteria, and is not eligible for individual listing in the NRHP.

Table 2. Architectural Resources in the APE

Name	Description	Year Built	NRHP Evaluation Status
N-221	40-ft. x 80-ft. Wind Tunnel (National Full-Scale Aerodynamics Complex)	1944	Listed – Ames Wind Tunnel Historic District Eligible for individual listing
N-225	Electrical Substation	1940	Non-contributing/Not eligible
N-226	6-ft. x 6-ft. Supersonic Wind Tunnel	1948	Listed – Ames Wind Tunnel Historic District; NRHP-eligible – NACA District
N-227	Unitary Plan Wind Tunnel	1955	National Historic Landmark Listed – Ames Wind Tunnel Historic District
N-263	Telecommunications Building	1989	Non-contributing/Less than 50 years old

5. Affected Historic Properties

5.1 NASA Ames Wind Tunnel Historic District

The NASA Ames Wind Tunnel Historic District was listed in the NRHP in 2017. The district consists of five contributors (consisting of nine buildings), including N-226, and 10 non-contributors, including Buildings N-225 and N-263. Contributing structures primarily are wind tunnels and buildings that support the functions of the wind tunnels. Although many of the structures have their own building numbers, they are functionally related and connected, and are counted as one resource. Located within the NASA Ames campus, the district is surrounded by various administrative and research-related buildings that represent successive eras of the campus's development. Within the district are mature trees, shrubs, manicured lawns, and hardscape features (i.e.,

DeFrance Avenue and Durand Road) that contribute to its landscape and setting. The district retains all seven aspects of integrity and has the ability to convey its significance at the national level. The district meets NRHP Criterion A in the areas of science, invention, and engineering at the national level of significance because this district contributed greatly to advancements in the aeronautical and space industries and the evolution of wind tunnel technology in the United States (U.S.). The district also is eligible under NRHP Criterion C in the area of engineering because the wind tunnels represent a significant work of engineering. The period of significance begins with the construction of Building N-220 in 1940 and ends in 2011, the year that the Space Shuttle Program (SSP) ended. The tunnels and their supporting buildings performed critical roles in aeronautical research and design and were among the most sophisticated scientific tools constructed and used by the U.S. government and commercial businesses. The research conducted within the wind tunnels was crucial to aircraft and spacecraft research and design. As the district's period of significance extends to a time period less than 50 years old, the district meets the requirements of Criteria Consideration G because the facility is exceptionally significant as the leading research and development facility in the areas of aeronautics and space in the U.S.

5.2 NACA District (Potential)

The NACA District includes 14 contributors based on their thematic Moderne architectural features and place in the development of the NACA Ames Aeronautical Laboratory. Developed between 1939 and 1955, the NACA District is significant under NRHP Criterion A for its association with the development of the second NACA aeronautical laboratory (the first on the West Coast) in anticipation of World War II and continued post-war research, and under NRHP Criterion B for its association with Smith J. DeFrance, Engineer-in-Charge/Director, and John F. Parsons as Construction Lead/Assistant Director, who designed the campus. The District is also significant under NRHP Criterion C for exemplifying the Moderne architectural style used on early NACA-era campuses as part of a building campaign to express modernity with an economic design that was continued after the initial frenzied construction phase and well into the post-war period because of lack of funding, and for its representation as a significant and distinguishable entity whose components may lack individual distinction. The period of significance for the District begins in 1939 with the establishment of the NACA Ames Aeronautical Laboratory and ends in 1955 with the shift towards early space research projects and the construction of the last building utilizing Streamline Moderne architecture during the NACA period. Overall, the NACA District retains sufficient historic integrity to its period of significance under all seven aspects to physically convey its historic significance.

5.2.1 Building N-226

Building N-226 is the 6' x 6' Supersonic Wind Tunnel building, which was built in 1948. It is a two-story building with a flat roof and includes a center section flanked by two wings (Photographs 1 and 2). The building features concrete siding and steel-framed three-over-three hopper windows separated by a concrete band. The main entrances are on the east elevation, with each wing having a pair of aluminum storefront doors. The center section has a pair of steel-framed sliding doors with multi-light glazing. Above this entrance is a cantilevered concrete canopy with rounded edges. Below the canopy is a sign that reads "NASA 6 x 6 Ft Supersonic Wind Tunnel." A secondary entrance is on the south elevation, which is set with a single-entry aluminum storefront door accessed by an open steel staircase. A similar secondary entrance is on the second story's southwest corner on the west elevation. The wind tunnel structure is west of the building. It is a closed circuit, single-return type wind tunnel. The tunnel is steel framed with steel sheets on the exterior. It has an asymmetric, sliding-block nozzle, and the test section features a perforated floor and ceiling. The test section is 6' high, 6' wide, and 14.4' long.

Photograph 1. South and east sides of Building N-226; view facing northwest

Photograph 2. East side (façade) of Building N-226, detail of center section. Window that will be replaced with a vent is the upper sash in the window array on the bottom right of the center section (behind tree); view facing west

Building N-226 has been determined individually eligible for listing in the NRHP under Criterion A for its role in supersonic testing and research and association with many significant aeronautic discoveries and under Criterion C for its significant engineering accomplishments in the context of wind tunnel construction. Building N-226 is also a contributor to the NRHP-listed NASA Ames Wind Tunnel Historic District and the NRHP-eligible NACA Historic District.

Building N-226 functioned as a research facility for testing supersonic craft and missiles until it was decommissioned in 1988. Since then, it has primarily operated as an educational resource for middle school students and is now used for storage. The wind tunnel is intact and exhibits exterior and interior character-defining features that contribute to the historic district, including its banded Classical and Streamline Moderne-style concrete façade and steel sash windows, and wind tunnel elements such as the testing section, cooling coils and tower, compressor, drive motor, and tanks. It has had no substantial alterations to date.

Significant and contributing character-defining features of Building N-226 were identified by ARG in 2007 in *Building N-226 Reuse Guidelines, NASA Ames Research Center, California.* ARG defined *Significant Character-Defining Features* as “features that convey the building’s historic character and significance. Alteration or removal of these features could result in a loss of integrity and should be avoided” (ARG 2007:10). More details specific to this building are included in the Reuse Guidelines, included in Appendix C.

Significant Character-Defining Features

- Overall form: large, central block with exposed wind tunnel on rear (west) elevation;
- Cantilevered streamline style concrete canopies (east elevation);
- Recessed front façade flanked by wings;
- Walls
  - Reinforced concrete walls;
  - Concrete surface articulated with Classical style striping (central block and south and north wings);
  - Concrete wall surface articulated with grid of control joints (center block and elevator/toilet room blocks);
  - Ornamental striping (center block parapet);
  - Louvered openings (above second floor windows on center block);
  - Ornamental banding over doors and below canopies at wings (east elevation);
  - Openings with glass block (elevator/toilet room blocks)
- Windows
  - Large metal hopper windows (see Building Summary photo at beginning of section III);
  - Multi-lite metal sash windows with operable hopper segments (on center block and south and north wings);
- Doors
  - Metal roll-up doors;
  - Multi-lite metal panel sliding doors and door tracks (east elevation);
  - 3-lite wood door (south elevation center block);
  - 3-lite, 1-panel wood door (center block);
  - 3-lite, 1-louver panel wood door with cantilevered awning (west elevation south wing);
  - Vertical acting counterbalanced door at freight elevator;
- Stairs
  - Configuration of stairs;
  - Interior stair handrails and guardrails (south wing/north wing);
- Interior freight elevator (including machine room);
- Center wing (shop)
  - Large open volume;
  - Trench pit and manhole (west side of shop);
  - Exposed steel columns in shop;
  - Exposed open web steel trusses and joists, and diagonal floor sheathing in shop;
  - Monorail and ceiling hatch (east side of shop);
  - Test section tunnel;

- o Configuration of original walls and floors;

- North wing (storage)
  - o Large open volume;
  - o Exposed concrete columns;
  - o Exposed concrete beams, joists, and decking;
  - o Configuration of original walls and floors (second floor);
  - o Corridors (north wing second floor)
    - - Configuration
    - - Floors
    - - Walls
    - - Ceilings
  - o Office wood flush veneer doors and frames (north wing first floor);
- South wing (offices, first and second floor)
  - o Film reading room (second floor);
  - o Dark room (second floor);
  - o Corridors (south wing, first floor)
    - - Configuration
    - - Floors
    - - Walls
    - - Ceilings
- Test Chamber (center wing second floor)
  - o Large open volume;
  - o Original configuration of walls and floors;
  - o 3' by 3' plates (floor);
  - o Exposed open web steel trusses and corrugated metal roofing;
  - o Test Section tunnel;
  - o Stairs over the wind tunnel test section tunnel (provide access to either side of test chamber room, over the wind tunnel);
  - o Steel ladder rungs and platforms to elevator machine room and fan room;
  - o Crane assembly (suspended “I” beam tramrails, crane hoist, and traveling crane dolly);
  - o Optical Laboratory (west side north wing second floor)
  - o Original ceilings; and
  - o Wood flush veneer doors and frames.

ARG also defined *Contributing Character-Defining Features* as “important elements that contribute to the understanding of the original design. Alteration or removal of these features may be necessary for programmatic or building system requirements. However, removal should be minimized and where necessary mitigated” (ARG 2007: 12-13).

Contributing Character-Defining Features

- South wing (offices, first and second floor)
  - o Interior configuration of offices (south wing first floor);
  - o Interior walls (south wing first floor);
  - o Interior ceilings (south wing first floor);
- Film Reading Room (south wing second floor)
  - o Original configuration of interior walls and ceiling;
  - o Wood flush veneer door and frame;
- Dark Room, south wing second floor
  - o Original configuration of interior walls and ceiling;
  - o Wood flush veneer door and frame;
- Toilet Rooms
  - o Interior configuration of toilet rooms; and
  - o Plumbing fixtures in toilet rooms (south wing/north wing)

6. Assessment of Effects

The Criteria of Adverse Effect pursuant to 36 CFR 800.5(a)(1) are applied to assess effects of the undertaking on historic properties within the APE:

> An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative.

Several examples of adverse effects are listed in 36 CFR 800.5(a)(2). The following assessment examines the undertaking under each of those examples, including an analysis of compliance with the Standards.

(i) Physical destruction of or damage to all or part of the property

The project will not demolish Building N-226 but will include limited demolition of some interior and site features to rehabilitate the former 6' x 6' Supersonic Wind Tunnel building into the Motor Pool facility (see Appendix B for demolition plans). *Guidelines for Rehabilitations of Historic Buildings* state: "Some exterior and interior alterations to a historic building are generally needed as part of a Rehabilitation project to ensure its continued use, but it is most important that such alterations do not radically change, obscure, or destroy character-defining spaces, materials, features, or finishes. Alterations may include changes to the site or setting, such as the selective removal of buildings or other features of the building site or setting that are intrusive, not character defining, or outside the building's period of significance" (NPS 2017:78).

The project will demolish and replace site features such as pavement and curbs, which are not significant or character-defining features of Building N-226 (Photograph 3).

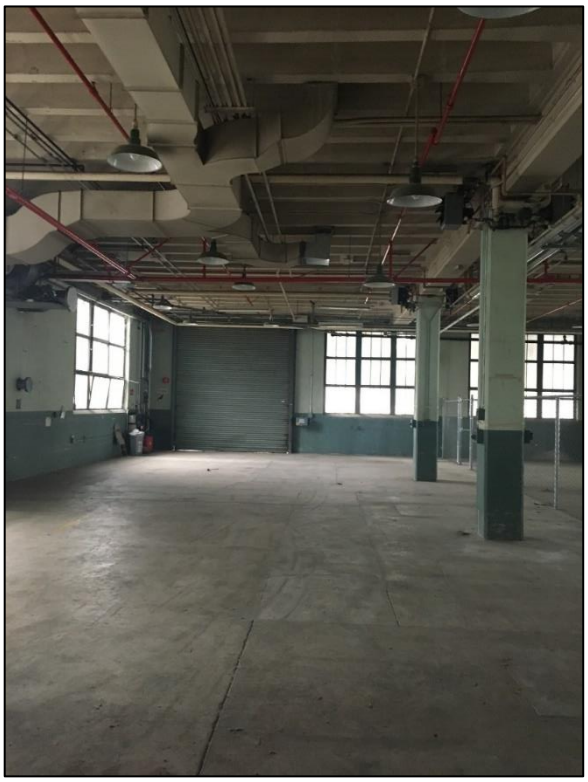
Photograph 3. Proposed site for ADA-compliant parking space and ramp and sidewalk replacement on south side of Building N-226; view facing northeast

The project will remove two sections of the concrete floor slab in the north wing that will be replaced with thicker concrete slab foundations for hydraulic auto lifts (Photographs 4 and 5). The concrete decking in the north wing is identified as a significant character-defining feature of the historic property in the *Reuse Guidelines for Building N-226.*

The project will also modify a multi-lite metal sash window north of the primary entrance on the façade by removing one panel of the window and replacing it with a louvered vent. The multi-lite metal sash windows with operable hopper segments on center block and south and north wings were also identified as significant character-defining features of the historic property in the *Reuse Guidelines for Building N-226.*

These minor alterations to two significant character-defining features would not diminish the physical characteristics of the historic property to such an extent that it would no longer retain sufficient integrity to remain listed in the NRHP; therefore, the project would not result in an adverse effect on Building N-226 under this example.

Photograph 4. Building N-226, interior, 1st floor north wing. Proposed auto lift site; view facing east



Photograph 5. Building N-226, interior, 1st floor north wing. Proposed auto lift site is on the far right; view facing north

(ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's standards for the treatment of historic properties (36 CFR part 68) and applicable guidelines

With the SHPO's agreement, if a property is restored, rehabilitated, repaired, maintained, stabilized, remediated, or otherwise changed in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*, then it will not be considered an adverse effect. The following is an assessment of the undertaking for compliance with the Standards for Rehabilitation (Standards) and guidelines (NPS 2017).

1. *A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces and spatial relationships.*

   Building N-226 was historically used as the 6' x 6' Supersonic Wind Tunnel building but was decommissioned in 1988 and has since been used as an educational and storage space. The intent is to change the building into a Motor Pool facility. The project would remove and replace two concrete floor slabs from the north wing with thicker concrete slab foundations for an auto lift. A multi-lite metal sash window, north of the primary entrance on the façade, would be removed and replaced with a vent. The concrete decking in the north wing and multi-lite metal sash windows are significant character-defining features of the historic property, but these changes would be minimal.

2. *The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.*

   The concrete decking in the north wing and multi-lite metal sash windows with operable hopper segments (on center block and south and north wings) are identified as significant character-defining features of the historic property in the *Reuse Guidelines for Building N-226.* Removal and replacement of two concrete floor slabs from the north wing with 6-inch taller concrete slab foundations for an auto lift will not alter substantially alter the feature or the historic character of Building N-226.

One multi-lite metal sash window, north of the primary entrance on the façade, will be replaced with a vent and a shade that imitates the window mullions of the removed window will be affixed to the vent to retain visual cohesion. The *Guidelines for Rehabilitations of Historic Buildings* state, "Using compatible window treatments (such as frosted glass, appropriate shades or blinds, or shutters) to retain the historic character of the building when it is necessary to conceal mechanical equipment, for example, that the new use required be placed in a location behind a window or windows on a primary elevation of highly-visible elevation" (NPS 2017: 109).

These minor alterations to two significant character-defining features would not diminish the historic character of the historic property to such an extent that is would no longer retain sufficient integrity to remain listed in the NRHP.

3. *Each property will be recognized as a physical record of its time, place and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.*

   No conjectural features will be added to Building N-226.

4. *Changes to a property that have acquired historic significance in their own right will be retained and preserved.*

   No alterations to Building N-226 appear to have acquired significance in their own right.

5. *Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.*

   While the concrete decking in the north wing and multi-lite metal sash windows with operable hopper segments (on center block and south and north wings) are identified as significant character-defining features of the historic property in the *Reuse Guidelines for Building N-226*, the minor alterations to these features are trivial due to the proportion of these significant character-defining features in and on Building N-226. The remainder of Building N-226 will be preserved and the overall distinctive features, finishes, construction techniques, or examples of craftsmanship that characterize the property will be preserved.

6. *Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.*

   The project will not include work to repair or replace any deteriorated historic features.

7. *Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.*

   Project plans state that it should be assumed that all surfaces in Building N-226 contain lead based paint. For lead abatement, the gentlest removal methods available to meet industry standards will be used. Historic materials will otherwise be protected from any treatments that might cause physical damage to them.

8. *Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.*

   Based on this study, there are no known archaeological resources within the project footprint. However, in the event of discovery of unknown subsurface archaeological resources, NASA will follow its standing operating procedures for unanticipated discoveries as outlined in the 2014 Draft Integrated Cultural Resources Management Plan (AECOM 2014), which would halt work in the vicinity of the discovery and engage a qualified archaeologist to evaluate the discovery and determine the need for mitigation and consultation with the SHPO.

9. *New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated*

from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.

The project proposes construction of a fuel station and car wash rack west of Building N-226 at the northwest corner of the project site. These structures are physically removed from Building N-226 and this vacant paved area west of Building N-226 was not identified as a significant or contributing character-defining feature of Building N-226 in the *Reuse Guidelines for Building N-226* and excluded from the boundary description in the individual NRHP nomination (ARG 2006). The fuel station and car wash rack will be located at the rear of Building N-226, and neither exhibit significant architectural features.

10. *New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.*

    Because the fuel station and car wash rack are physically removed from Building N-226, if they are removed, the integrity of Building N-226 would be unimpaired.

In summary, the project meets the Standards for Rehabilitation. The minor alterations to two significant character-defining features would not diminish the physical characteristics of the historic property to such an extent that is would no longer retain sufficient integrity to remain listed in the NRHP; therefore, the project would not result in an adverse effect on Building N-226. The project, which includes rehabilitation and provision of ADA-compliant access to Building N-226, is designed to be consistent with the Standards.

(iii) Removal of the property from its historic location

No historic properties within the APE will be relocated.

(iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance

The project will change of the character of Building N-226's use, which is an important aspect of its historic significance. The Motor Pool does not reflect the supersonic research and development that Building N-226 was designed and built to support. However, Building N-226 was decommissioned in 1988 and has since been used as an educational and storage space. The reuse of the shop area for vehicle maintenance is a compatible use for the open space on the 1st floor of the north wing. The open space that will serve as a shop area will require minor changes to accommodate the new use which supports the overall mission of ARC. Additionally, the project will not change any physical features within the settings of Building N-226, the NASA Ames Wind Tunnel Historic District, or the proposed NACA Historic District that contribute to their historic significance. The project would not result in an adverse effect on Building N-226 or the historic districts due to these changes.

(v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features

The project will introduce visual, atmospheric or audible elements particularly related to the Motor Pool’s fuel station and car wash rack; however, those elements will not diminish the integrity of Building N-226's significant historic features, which relate to its wind tunnel engineering, or the integrity of the NASA Ames Wind Tunnel Historic District, or the proposed NACA District as a whole. The new Motor Pool elements will be utilitarian in design, located at the rear of Building N-226, and obscured from view (Photograph 6). Motor Pool elements may be tangentially visible to Building N-221 (National Full-Scale Aerodynamics Complex) and Building N-227 (Unitary Plan Wind Tunnel), but the large-scale nature of these facilities would make any visual intrusion related to the Motor Pool elements negligible (Photographs 7 and 8). The nearest contributing building in the proposed NACA Historic District is 0.15-mile to the south. Therefore, the project would not result in an adverse effect on Buildings N-226 or any contributing buildings in the NASA Ames Wind Tunnel Historic District or the proposed NACA Historic District under this example.

Photograph 6. Proposed site for the fuel station and car wash rack behind Building N-226; view facing southeast

Photograph 7. Proposed site for the fuel station and car wash rack on far left (see lamp post as also shown in Photograph 6). Building N-263 (single-story white building) at center left; Building N-225 (Substation) at right; and Building N-221 (National Full-Scale Aerodynamics Complex) at far right; view facing west

Photograph 8. View of Building N-227 (Unitary Plan Wind Tunnel) from main entrance to Building N-226. Two detectable warning strips will be installed on both sidewalk approaches in foreground, and the sidewalk on the left side will be replaced and match at existing grades at tie-in points; view facing east

(vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization

Building N-226 has been vacant due to the need for the construction activities proposed through this undertaking. The property has been secured during those years to protect against further deterioration.

(vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance

Not applicable.

7. Summary of Findings

The criteria of adverse effect were applied to the historic property in the APE, which includes Building N-226 and accounts for potential effects on the NASA Ames Wind Tunnel Historic District and the potential NACA District. Adjacent historic properties and district contributors, Building N-221 (National Full-Scale Aerodynamics Complex) and Building N-227 (Unitary Plan Wind Tunnel), were also taken into consideration. The significance of these historic properties is primarily associated with research and development, important researchers, and exceptional engineering dating to the 1940s and continuing through the 20th century. This assessment of effects found that the proposed rehabilitation design for the Motor Pool and site improvements at Building N-226 are consistent with the Standards. Direct effects on two character-defining features of Building N-226 are so minor that they would not diminish the physical characteristics of Building N-226 to such an extent that it would no longer retain sufficient integrity to remain listed in the NRHP; therefore, the project would not result in adverse effects on Building N-226. Motor Pool elements may be tangentially visible to Building N-221 (National Full-Scale Aerodynamics Complex) and Building N-227 (Unitary Plan Wind Tunnel), but the large-scale nature of these facilities would make any visual intrusion negligible in relation to these historic properties and the NASA Ames Wind Tunnel Historic District. The nearest contributing building in the proposed NACA District is 0.15-mile to the

south. The proposed undertaking would not indirectly alter any of the characteristics of the historic properties in the APE. Therefore, the project would not result in an adverse effect on Building N-226, the NASA Ames Wind Tunnel Historic District, or the NACA District. Furthermore, no archaeological resources, which may qualify as historic properties, are known to exist in the APE and there is a low potential for unanticipated archaeological resources within the heavily disturbed vertical APE. Therefore, the proposed undertaking would have no adverse effects on historic properties per 36 CFR § 800.5(b) and a finding of No Adverse Effect is recommended.

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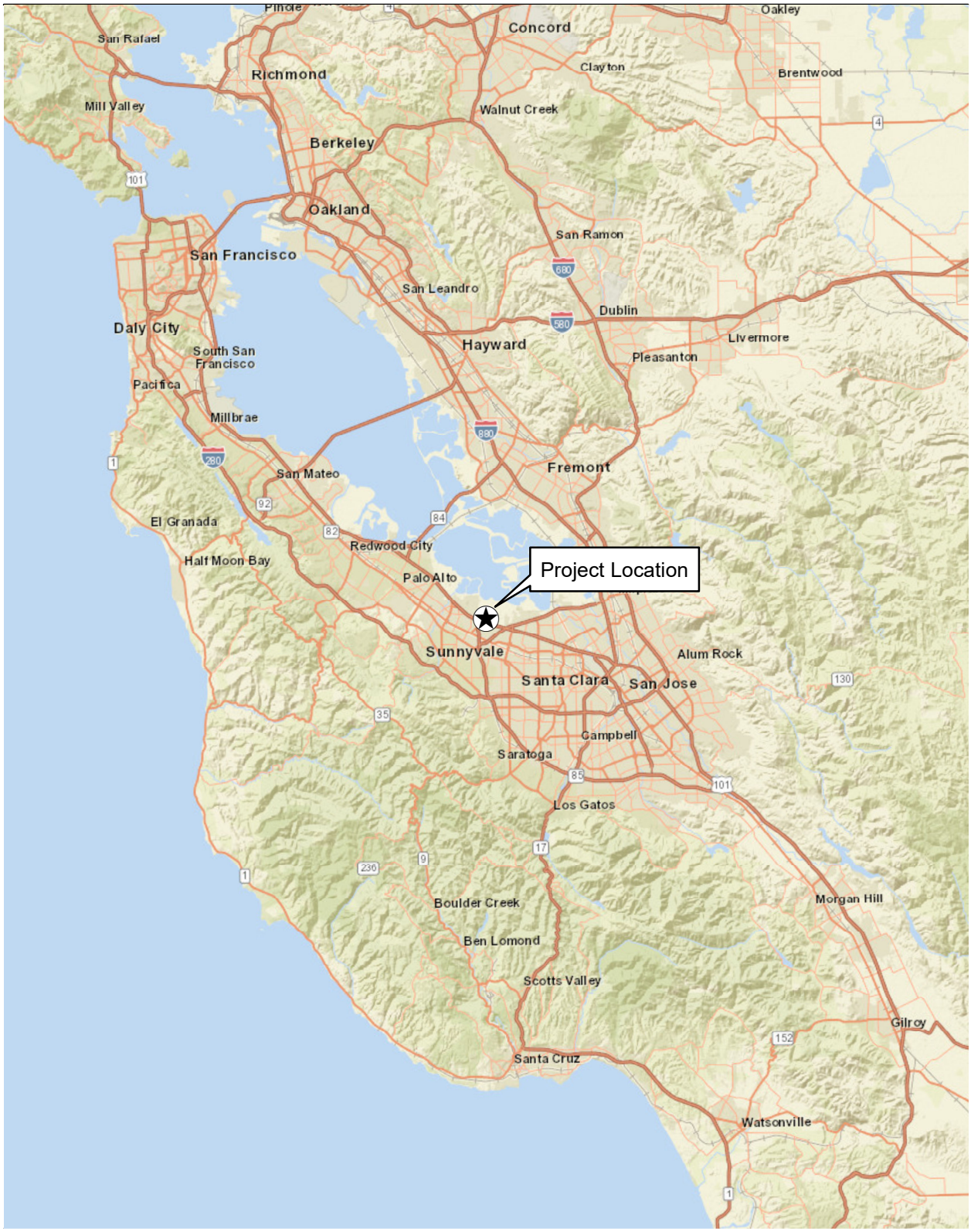
Appendices

A. Figures

B. Select Project Drawings

C. Reuse Guidelines

Appendix A – Figures



Source: ESRI, AECOM, NASA

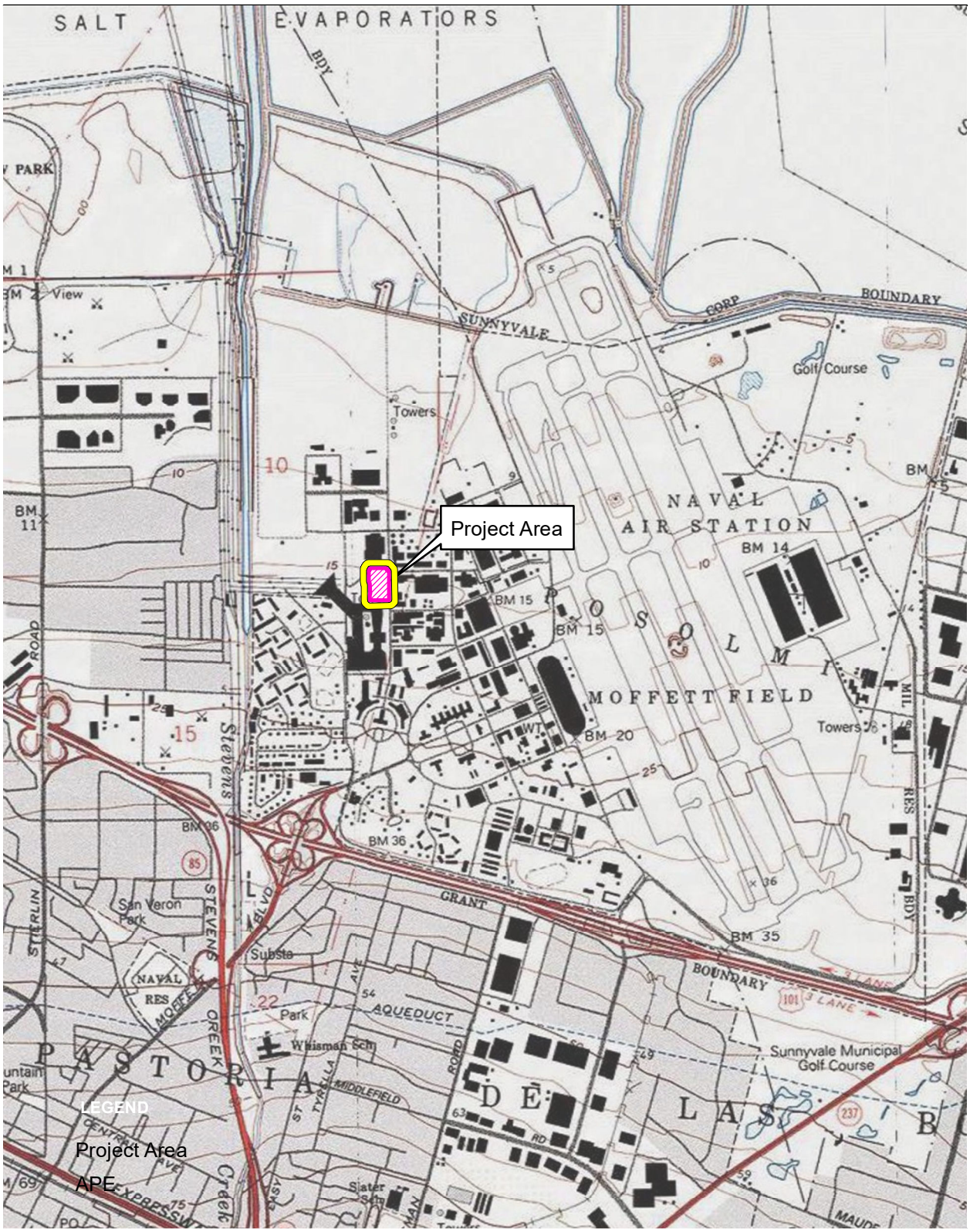
0 5 10 20 Miles

Scale: 1 = 633,600; 1 inch = 10 mile(s)

Figure 1
Project Location

N226 Motor Pool Relocation Project

Path: \\na.aecomnet.com\lfs\AMER\SanDiego-USSDG1\DCS\Projects\NASA\900-CAD-GIS\mxd\Bldg_N226\BldgN226_Figure01_ProjectLocation.mxd, 4/8/2022, stevensona1



Source: ESRI, AECOM, NASA, National Geographic Society; USGS 7.5' Topographic Quadrangle: Mountain View

0 1,000 2,000 4,000 Feet

Scale: 1 = 24,000; 1 inch = 2,000 feet

Figure 2
Project Vicinity Map

N226 Motor Pool Relocation Project

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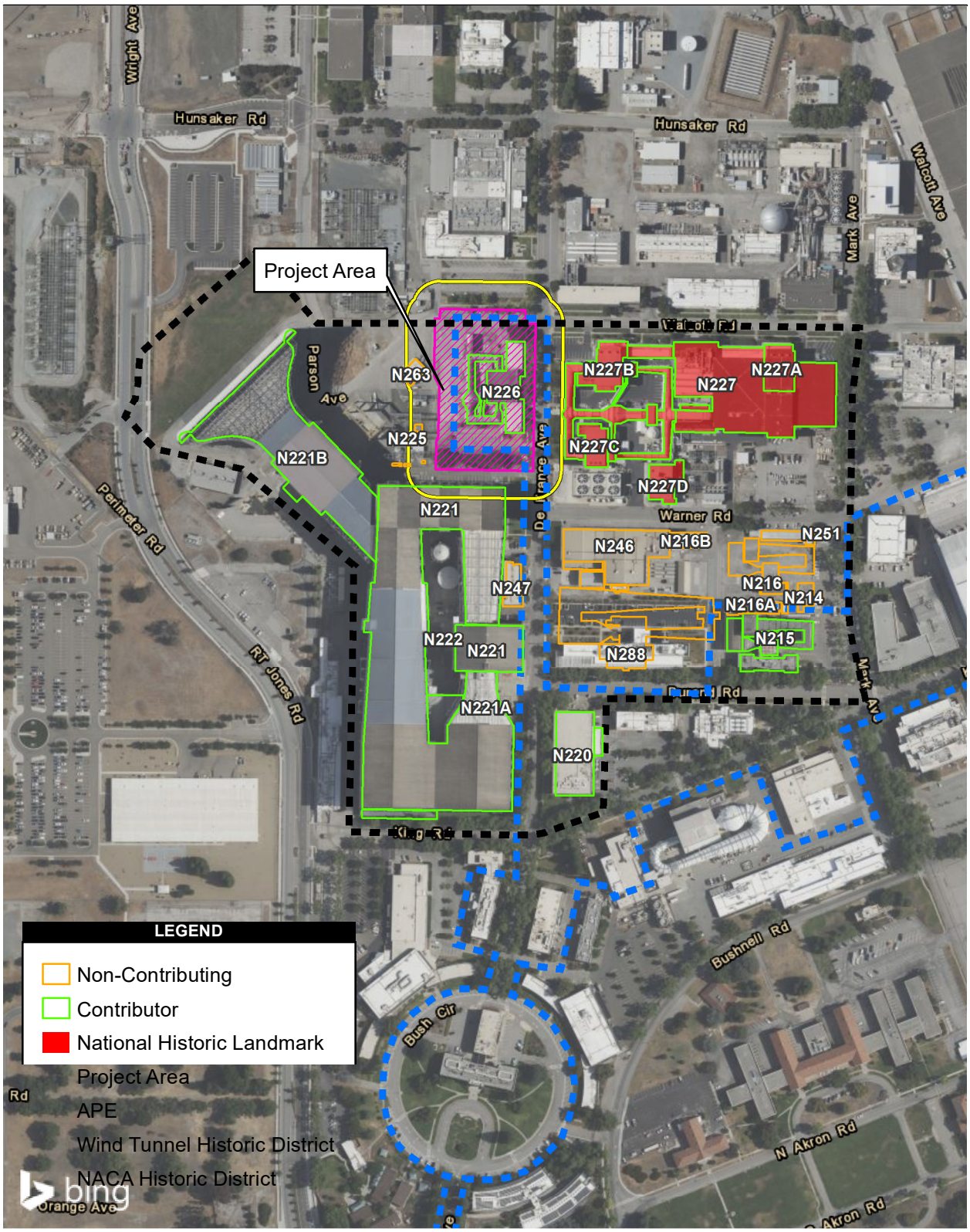

Source: ESRI, AECOM, NASA

0 200 400 800 Feet

Scale: 1 = 4,800; 1 inch = 400 feet

Figure 3
APE Map

N226 Motor Pool Relocation Project

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The following content was redacted from this public posting:

Archaeological sensitivity map

The following content was redacted from this public posting:

Appendix B: Select Project Drawings

Appendix C – Reuse Guidelines

Building N-226 Reuse Guidelines

NASA Ames Research Center, California

prepared for:

NASA/Ames Research Center

prepared by:

Architectural Resources Group

Architects, Planners & Conservators, Inc.

San Francisco, California

October 2007

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Appendix 1. Character-Defining Features
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Introduction

NASA Ames Research Center and Architectural Resources Group, Architects, Planners & Conservators, Inc. (ARG) have developed Reuse Guidelines for the 6 Foot by 6 Foot Supersonic Wind tunnel, Building N-226, at NASA Ames Research Center, California. The Reuse Guidelines have been designed to assist NASA Ames professional staff, tenants, and their consultants in rehabilitating historic structures by identifying character-defining features, outlining the opportunities for reuse and evaluating code deficiencies for each building.

I. Executive Summary

Constructed in 1948 along Moffett Field's western boundary, Building N-226, also known as the 6 foot by 6 foot Supersonic Wind Tunnel Laboratory Building, is a two-story, reinforced concrete, stripped classical-style building with Streamline Moderne and International style influences. Roughly T-shaped in plan, the building has a flat roof with steel truss framing, and consists of a central mass with projecting wings on either side. The building historically functioned as a supersonic wind tunnel used for supersonic flight research discoveries and testing for supersonic craft and missiles. There have been no significant alterations or additions to the building since 1948. (Refer to Appendix 6 for historic building plans.) The wind tunnel remained in operation until 1988, when the wind tunnel was decommissioned.

Building N-226 is individually significant at the national level for the National Register of Historic Places (NRHP) under Criterion A, for its role in supersonic testing and research and association with many significant aeronautic discoveries, and under Criterion C for its significant engineering accomplishments in the context of wind tunnel construction. The NRHP nomination was submitted to the State Historic Preservation Office (SHPO) for Historic Eligibility Determination in November 2006. (See Appendix 7 for Building N-226 National Register Nomination.) The building has a high degree of integrity; the building's character-defining features are intact on the exterior and interior. (Character-defining features, including significance and condition ratings are listed in section VII and Appendix 1.)

Rehabilitation of the building should comply with *The Secretary of the Interior's Standards for Rehabilitation (The Standards). The Standards* can be accessed on the National Park Service website (www.nps.gov) and are presently located at the following URL: http://www.nps.gov/history/hps/tps/tax/rhb. Plans for the reuse of Building N-226 should take into consideration the preservation of the building's character-defining and contributing features, including, but not limited to, the overall form of the building, fenestration pattern, materials, and open space. Changes to non-character-defining features may be undertaken, but the impact to the character-defining and contributing features evaluated.

Future renovations will require Fire/Life Safety and Disabled Accessibility upgrades to comply with current codes. These include, but are not limited to, the addition of fire sprinklers, exit path of travel and exit door upgrades, and disabled access improvements to door and door hardware, restrooms, and locker rooms. The impact of these upgrades to the character-defining and contributing features should be carefully considered before changes are made.

Further analysis is required for the management of hazardous materials and upgrades to the mechanical, electrical and structural systems. Existing mechanical flues, ducts and conduits protruding from windows and exposed on the exterior should be removed unless original. The impact of these upgrades to the character-defining and contributing features should also be carefully evaluated.

II. Project Team

Client
National Aeronautics & Space Administration (NASA)
Ames Research Center
Mail Stop 19-12
Moffett Field, CA 94035-1000

Consultant
Architectural Resources Group, Inc.
Pier 9, The Embarcadero
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Kim Sykes, AIA, Designer
Serpil Gezgin, Designer
Vanessa Miller, LEED AP, Designer
Sara Cone, Designer
Anny Su, Architectural Historian
Lauren MacDonald, Architectural Historian
Nicole Fannin, Intern

III. Methodology

ARG staff conducted site reviews of Building N-226 in January and October 2006. During the site visits, notes were taken on the character-defining features of the building and photographic documentation was completed on the exterior as well as major interior spaces. ARG staff utilized the available documents provided by the NASA Ames Research Center to assist in the development of this report. The documents provided by NASA Ames Research Center were used as a general reference in the production of this report. The verification of the accuracy of the documents was not included in the scope of work.

Site reviews were conducted with the understanding that the current use of the building would be continued. The site reviews were limited to a general observation of the buildings and building components and detailed survey of all interior spaces was not included in the scope of work. Furthermore, limited access to some areas of the building were required due to issues of security, privacy, safety, or other limitation.

ARG staff reviewed both primary and secondary research materials at the following institutions:

- Engineering Documentation Center located in building N-213; and
- Ames Imaging Library in building N-241.

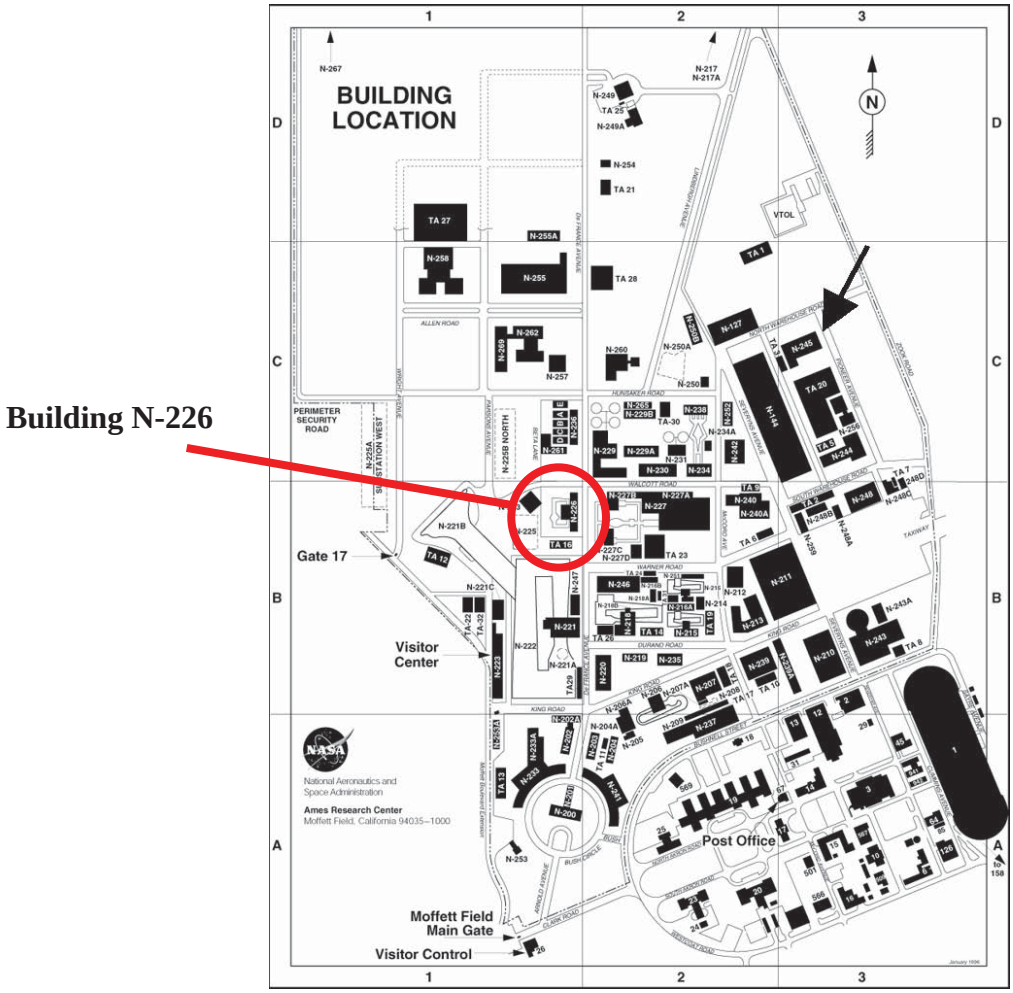
The following documents were utilized as the main sources of information:

- The 1994 National Register of Historic Places Nomination Form for the US Naval Air Station Moffett Field Central Historic District;
- Aerial photographs dating from 1931 through 1944;
- Architectural Drawings including;
    - Ames Aeronautical Laboratory, Moffett Field, California. "Building N-226: 6 by 6 Foot Supersonic Wind Tunnel First Floor Plans." Drawings dated 23 December 1945;
    - Ames Aeronautical Laboratory, Moffett Field, California. "Building N-226: 6 by 6 Foot Supersonic Wind Tunnel Laboratory Building Second Floor Plan." Drawings dated 23 December 1945;
    - Ames Aeronautical Laboratory, Moffett Field, California. "Building N-226: 6 by 6 Foot Supersonic Wind Tunnel Elevations." Drawings dated 23 December 1945;
    - Ames Aeronautical Laboratory, Moffett Field, California. "Building N-226: 6 by 6 Foot Supersonic Wind Tunnel Entrance Details and Overall Sections." Drawings dated 23 December 1945.

View of the East and South Elevations of Building N-226.

IV. Building N-226 Summary

Location:	Moffett Field, California
Area:	NASA Ames Research Center
Date of Construction:	1948
Historic Structure:	Draft National Register Nomination submitted to SHPO Nov. 2006 for Historic Eligibility Determination.
Historic Use:	Offices and 6 by 6 Foot Supersonic Wind Tunnel
Current Use:	Offices, Education, and Museum
Hazard Level:	Ordinary, building is partially fire sprinklered
Number of Floors:	Two
1st Floor:	16,412 gross ft^2
Second Floor:	16,412 gross ft^2
Total:	32,824 gross ft^2
Exterior Materials:	Reinforced concrete
Construction Frame:	Reinforced concrete



"Ames Research Center, Moffett Field, California, Building Location Plan," February 2000.

V. Historical Background and Site Context

The NASA Ames Research Center was initially founded on December 20, 1939 as an aircraft research laboratory by the National Advisory Committee on Aeronautics (NACA), the forerunner agency of NASA. Ames has played a pioneering role in science and technology for over six decades. The center was named for Dr. Joseph S. Ames, NACA Chairperson from 1927 to 1939. Ames was NACA's second laboratory, established after the Langley facility in Hampton, Virginia. In 1958, Ames became part of the National Aeronautics and Space Administration (NASA). Since its inception, Ames researchers have broken new ground in all flight regimes—the subsonic, transonic, supersonic, and hypersonic—using a collection of wind tunnels and research aircraft, the sophistication of which has increased over time. Ames has evolved into a diverse and sophisticated research campus of buildings influenced by the clean lines and materials of the International style, fussed with elements of the Streamline Moderne; both styles

are very well suited to industrial building types.

Ames specializes in research geared toward creating new knowledge and new technology, encompassing the fields of supercomputing, networking, numerical computing software, artificial intelligence, and human factors to enable advances in aeronautics and space. In aeronautics, Ames is the leading NASA agency in airspace operations systems, including air traffic control and human factors. Ames also has major responsibilities in the creation of design and development process tools and wind tunnel testing. Ames houses one of the world's largest collections of wind tunnels and simulation facilities.

The National Aeronautics and Space Administration (NASA) Ames Research Center borders the northern California towns of Sunnyvale and Mountain View near the heart of Silicon Valley. The Ames campus occupies approximately 430 acres of the approximately 2,000-acre Moffett Field site, which once served as a United States Naval Air Station – Sunnyvale. (See Appendix 4 for historic aerial photographs.)

The 6 by 6 Foot Supersonic Wind Tunnel Building is located on the western edge of Moffett Field, directly north of the 40 by 80 Wind Tunnel Structure. Identified as Building N-226, the 6 by 6 Supersonic Wind Tunnel Building is located on the southwest corner of the intersection of Boyd Road and De France Avenue. The two-story building is 32,800 total ft^2 (gross). Of that amount, the first floor contains 16,400 ft^2 (gross) of floor area and the second floor contains 16,400 ft^2 (gross) of floor area.

Exterior wind tunnel components are visible along the rear elevation. The original wind tunnel cooling tower is located behind the west (rear) elevation of the 6 by 6, and the spherical dry-air storage tank is immediately northwest of the 6 by 6. Both of these structures date to c.1948, when the 6 by 6 was originally constructed, and both structures contribute to the significance of the 6 by 6 Foot Wind Tunnel.

VI. Building Description

Historic Appearance
The 6 by 6 wind tunnel was originally constructed in 1948 as a two-story, stripped Classical and Streamline Moderne style concrete building with metal and wood tunnel support elements visible along the rear exterior walls. The front elevation of the building featured a symmetrical composition with a center volume flanked by projecting wings.

The wind tunnel's design was unique in that the building's design alluded to the supporting administrative functions inside, while the rear elevation hosted the exterior wind tunnel elements including the cooling coils, compressor, drive motors, and dry air storage tank.

Interior
The original interior ground floor configuration of the 6 by 6 Supersonic Wind Tunnel Laboratory Building consisted of office and meeting rooms (identified as rooms 103 through 109) on the southern end, one large open space (identified as Room 115) on the northern end, and a central shop section where models were produced for testing in the 6 by 6. Identified as Room 101, the Shop measured approximately 102 ft. by 90 ft. and contained wind tunnel machinery and equipment. Vacuum pumps and

compressors for the wind tunnel were also located in this section.

The second floor originally consisted of office and meeting rooms on the southern end (identified as Rooms 204 through 208), additional rooms on the northern end (identified as Rooms 218 through 222), as well as the Optical Laboratory (identified as Room 217). The center portion of the second floor, the test section, contained the actual test chamber of the 6 by 6 Foot Supersonic Wind Tunnel, from which the tunnel's name is derived. The majority of the interior tunnel portions were located in the second floor test section, and along with the actual tunnel and test chamber. The second floor also featured a system of steel trusses, on which a moveable bridge crane and hoist system operated. The crane was used to hoist aerodynamic models from the first floor model shop up through an opening in the ceiling and then over and down into the 6 by 6 foot test chamber of the wind tunnel.

Also included in the second floor test chamber was the Schlieren photography equipment box, located on the east interior wall. The Schlieren system is an optical high-speed photography imaging system used for visualization of supersonic shock wave patterns. In addition to the equipment box, the wind tunnel test chamber contained a set of Schlieren disks that the laser beam passed through in order to photograph the effects of the airflow and shock patterns of the models.

The two windows weighed more than one ton, each and measured six inches thick, and fifty-two inches in diameter. According to one observers account in 1950:

> The most interesting thing to me about the 6 by 6 Foot Wind Tunnel were the side windows used to observe the behavior of the models being tested. The two windows are the largest optically ground glass lenses in the world. The glass was poured by the Corning Company and ground by Tinsley Company in Oakland.[1]

Modifications to the 6 by 6 Wind Tunnel
While the 6 by 6 was still in use as a wind tunnel, the structure underwent few alterations and/or modifications. Early in the life of the 6 by 6, researchers discovered that the tunnel could not obtain data in the transonic ranges. This discovery prompted Ames staff member Charles Hall to explore modifications to the original design of the 6 by 6 wind tunnel. The alterations to the tunnel were completed in 1955 and the exact specifications of these alterations are unknown. No other modifications were made to the structure between 1955 and the late 1980s, when the wind tunnel was decommissioned.

After the 6 by 6 was decommissioned, the center portion of the building's second floor was adaptively remodeled for use as the Ames Aerospace Encounter, which opened in October 1991. The Ames Aerospace Encounter is a math and science-based educational program that teaches 4th, 5th and 6th grade students about science and technology in relation to space and aeronautics. The interior elements of the historic wind tunnel were incorporated into the educational program.

Current Appearance of the 6 by 6 Wind Tunnel
Overall, in form, materials and details, the 6 by 6 Supersonic Wind Tunnel Laboratory Building retains its historic appearance. The building was designed in a stripped Classical style with an observable influence by the International and Streamline Moderne styles. The two-story, flat roofed building has a general rectangular plan. The symmetrically designed building is divided into three sections with a center section flanked by a wing on each side. Each wing measures 79 ft. 4 in. in by 50 ft. 4 in. wide (depth of wing portion) and the center section is 90 ft. long by 120 ft. deep.

The front (east) elevation features a central slightly recessed element measuring approximately 47 ft. tall and flanked on each side by a long wing. The recessed façade contains double doors that lead to the ground floor model shop space that now serves several miscellaneous uses. Above the entrance is a pre-cast mitered concrete panel that is now partially covered with signage displaying "NASA 6 by 6 Foot Supersonic Wind Tunnel." The original pre-cast panel most likely displayed lettering reading "NACA" indicating the building was originally constructed during the administration of the National Advisory Committee on Aeronautics (NACA). Above the double doors is a cantilevered concrete canopy featuring rounded corner edges indicative of the Streamline style. The central façade contains eight windows; two on the ground floor, three on the second floor, and, three rectangular shaped louvered windows above the second floor windows.

The two wings are horizontally divided into three sections by alternating bands of smooth concrete, separated horizontally by rusticated concrete wall portions. A large metal hopper window with a nine-pane sash separates each rusticated wall section.

The exterior body of the wind tunnel and its related machinery obstructs view of the building's rear (west) elevation. This includes the cooling coils, the compressor and the drive motors.

In close proximity to the cooling tower are two spherical dry air storage tanks. The tall metal structures consist of a spherical tank supported by steel wide-flange posts and a concrete foundation.

Currently, the interior spaces on the first floor serve as a storage facility and likely house other miscellaneous uses. The southern portion of the second floor is used for office and meeting spaces. The current use of these interior spaces is consistent with the original use. The interior wind tunnel elements located in the second floor test section, including the Schlieren photography box, the original control panels, tunnel sections, and model craft test chamber, are extant and were incorporated into the educational format of the Ames Encounter program.

(Footnotes)
[1] "Work At Ames Lab. Proves Eye Opener," *Daily Palo Alto Times*, July 11, 1950.

VII. Historic Character-Defining Features

Refer to Appendix 1 for a matrix of character defining features, including specific location of building components. For illustrated plans and elevations, see Appendix 3, Significance Diagrams.

Alteration of significant and contributing building components shall be in keeping with original design, configuration and material. For more information, see *The Secretary of the Interior's Standards for the Treatment of Historic Properties. The Standards* can be accessed on the National Park Service website (www.nps.gov) and are presently located at the following URL: http://www.nps.gov/history/hps/tps/tax/rhb.

See Appendix 5, Current Conditions Photographs for photos showing the character-defining building components listed below. For building floor plans, see Appendix. 2, Existing Floor Plans and Rehabilitation.

1. Significant Character-Defining Features: these are the features that convey the building's historic character and significance. Alteration or removal of these features could result in a loss of integrity and should be avoided.

The following are significant features:

- Overall form—large, central block with exposed wind tunnel on rear (west) elevation;
- Cantilevered streamline style concrete canopies (east elevation);
- Recessed front façade—flanked by wings;
- Walls
    - o Reinforced concrete walls;
    - o Concrete surface articulated with stripped Classical style striping (central block and south and north wings);
    - o Concrete wall surface articulated with grid of control joints (center block and elevator/toilet room blocks);
    - o Ornamental striping (center block parapet);
    - o Louvered openings (above second floor windows on center block;
    - o Ornamental banding over doors and below canopies at

Illustration 1: Cantilevered streamline style concrete canopies are significant features. (Source: ARG, October 2007)

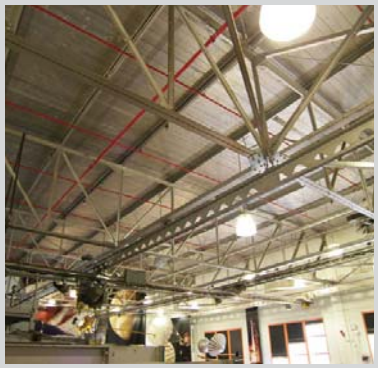


Illustration 2: Exposed open web steel truss system are a significant feature. (Source: ARG, October 2007)

Illustration 3: Multi-lite, steel-sash windows with hopper segments are significant features. (Source: ARG, October 2007)

Illustration 4: Three-lite, wood panel doors are significant features. (Source: ARG, October 2007)

Illustration 5: Ornamental striping throughout exterior is a significant feature. (Source: ARG, October 2007)

Illustration 6: The vertical acting counterbalanced door is a significant feature. (Source: ARG, October 2007)

wings (east elevation);

- o Openings with glass block (elevator/toilet room blocks)

- Windows
  - o Large metal hopper windows (see Building Summary photo at beginning of section III);
  - o Multi-lite metal sash windows with operable hopper segments (on center block and south and north wings);
- Doors
  - o Metal roll-up doors;
  - o Multi-lite metal panel sliding doors and door tracks (east elevation);
  - o 3-lite wood door (south elevation center block);
  - o 3-lite, 1-panel wood door (center block);
  - o 3-lite, 1-louver panel wood door with cantilevered awning (west elevation south wing);
  - o Vertical acting counterbalanced door at freight elevator;
- Stairs
  - o Configuration of stairs;
  - o Interior stair handrails and guardrails (south wing/north wing);
- Interior freight elevator (including machine room);

Center wing (shop)

- Large open volume;
- Trench pit and manhole (west side of shop);
- Exposed steel columns in shop;
- Exposed open web steel trusses and joists, and diagonal floor sheathing in shop;
- Monorail and ceiling hatch (east side of shop);
- Test section tunnel (no photo available);
- Configuration of original walls and floors;

North wing (storage)

- Large open volume;
- Exposed concrete columns;

- Exposed concrete beams, joists, and decking;
- Configuration of original walls and floors (second floor);
- Corridors (north wing second floor)
    - Configuration
    - Floors
    - Walls
    - Ceilings
- Office wood flush veneer doors and frames (north wing first floor);

South wing (offices, first and second floor)

- Film reading room (second floor);
- Dark room (second floor);
- Corridors (south wing, first floor)
    - Configuration
    - Floors
    - Walls
    - Ceilings

Test Chamber (center wing second floor)

- Large open volume;
- Original configuration of walls and floors;
- 3 ft. by 3 ft. plates (floor);
- Exposed open web steel trusses and corrugated metal roofing;
- Test Section tunnel;
- Stairs over the wind tunnel test section tunnel (provide access to either side of test chamber room, over the wind tunnel);
- Steel ladder rungs and platforms to elevator machine room and fan room;
- Crane assembly (suspended "I" beam tramrails, crane hoist, and traveling crane dolly);
- Optical Laboratory (west side north wing second floor)
- Original ceilings; and
- Wood flush veneer doors and frames.

2. Contributing Features: these features are important elements that contribute to the understanding

of the original design. Alteration or removal of these features may be necessary for programmatic or building system requirements. However, removal should be minimized and where necessary mitigated.

The following are contributing features:

South wing (offices, first and second floor)

- Interior configuration of offices (south wing first floor);
- Interior walls (south wing first floor);
- Interior ceilings (south wing first floor);

Film Reading Room (south wing second floor)

- Original configuration of interior walls and ceiling;
- Wood flush veneer door and frame;

Dark Room, south wing second floor

- Original configuration of interior walls and ceiling;
- Wood flush veneer door and frame;

Toilet Rooms

- Interior configuration of toilet rooms; and
- Plumbing fixtures in toilet rooms (south wing/north wing).

3. Tertiary Features: these features are original elements of the building that are of a lower importance relative to the understanding of the original design. Alteration or removal of these features, if necessary, would have a limited affect on the integrity of the building.

There are no tertiary features.

4. Non-Contributing Features: these features are elements of the building that have been remodeled or areas where additional alteration would not affect the original integrity of the building. In some cases, removal of the non-contributing features may be beneficial to the historic integrity of the building.

The following are non-contributing features:

Doors

- Metal aluminum storefront door (east elevation);
- Metal panel doors single-lite metal door with transom (south elevation, infilling 1 section of multi-lite metal sash window on south elevation);
- Metal panel doors single-lite metal door with transom (infilling 1 section of multi-lite metal sash window on west elevation);

- Single-lite metal door with transom (infilling 1 section of multi-lite metal sash windows on north and south wings);

Floors (no photos available)

- Interior office floors (south wing first floor);
- Film Reading Room floor;
- Dark room floor;
- Optical laboratory floor;

Ceilings

- Acoustic suspended ceiling/tile; and

Equipment

- AC units in windows.

5. Conservation of Intact Historic Fabric

The following materials require special care and treatment in their maintenance and rehabilitation:

- Concrete: Concrete cleaning and concrete spall repair should be undertaken with an architectural conservator; and
- Steel sash windows: If replacement of any of the steel sash windows is undertaken in the future, then it is important that architectural specifications be developed that require frames and muntin bars be duplicated exactly as they appear in the original windows with respect to dimensions and surface texture.

VIII. Opportunities for Reuse

The building currently functions well as an educational facility at the second floor with supporting offices at the north and south wings. The former shop area at the first floor center bay and the generator/electrical room at the first floor north bay are used for ad hoc storage. A more developed use for the shop area could include interpretive and educational uses in support of the second floor science/space curriculum.

IX. Code Evaluations and Recommendations

A. Fire/Life Safety

Description

Constructed in 1946, Building N-226 is a two-story building, with the main entrances fronting on De France Avenue. The exterior of the building has remained largely the same as originally constructed. Throughout the building there have been upgrades to the life safety systems and disabled accessibility components. The offices at the south and north wings have been remodeled, with changes primarily to finishes, along with the addition of some interior partitions. The second floor area adjacent to the test chamber has been converted to a children's aerospace educational use, with the addition of interpretive exhibits. The shop area at the first floor center bay has had offices added at the northeast corner of the room. The building has a gross floor area of 32,824 ft^2 and consists of concrete exterior walls, concrete floors at second floor office wings and first floors, steel trussed roof and floors at center bay (test chamber and shop), and a concrete roof structure at the office wings. The building was reviewed for general code compliance with the provisions of the 2001 California Building Code (CBC).

Building N-226 is a mixed occupancy building with the office areas classified as B occupancy, the education area at the second floor center bay (test chamber) classified as E2, and the shop areas at the first floor center and north bays classified as F2. The construction type is Type III-N. The following review is based on the occupancies remaining the same. If a change in occupancy is proposed, further detailed code analysis will be required. Section VIII B. includes a glossary of building Construction Types and Occupancy Types that exist within the scope of this report.

California's State Historical Building Code (SHBC), located in chapter 34 of the CBC, shall be used in conjunction with the California Building Code as stated in section 8-102.1: "These regulations are applicable for all issues regarding building code compliance for qualified historical buildings or properties. These regulations are to be used in conjunction with the regular code to provide alternatives to the regular code to facilitate the preservation of qualified historical buildings or properties. These regulations shall be used whenever compliance with the regular code is required for qualified historical buildings or properties."

Fire/Life Safety Analysis

1. Construction type: Building N-226 is currently classified as a mixed occupancy B, E2, and F2 occupancies, and Type III-N construction. Table 5A of the CBC allows Occupancy B, E2, and F2 to be construction type III-N. There is a fire alarm and perimeter door security system in place, and a fire suppression system in the exit stairs, and in the E2 and F2 occupancies (Center bay Test Chamber and Shop areas). The north and south office wings do not have a fire suppression system.

> *Recommendation*: The building Construction Type is allowable for the Occupancy Type currently housed in the building.

2. Location on Property: CBC Table 5-A limits the exterior bearing walls to be minimum four-hour non-combustible for E2 occupancy; for F2 and B occupancies bearing walls shall be four hour non-combustible less that 5 ft. from property lines and two hour non-combustible elsewhere. Building N-226 exterior walls are 8 in. thick concrete walls and they meet the requirement. Exterior openings for all occupancies are required to be protected less than 20 ft. from property lines. Building N-226 is separated more than 20 ft. in width on four sides and does not need exterior opening protection. The wind tunnel at the west is considered part of the building for purposes of opening protection.

> *Recommendation*: Modifications to the building based on the location of property are not required.

3. Occupancy Separation: According to CBC Table 3B, the following occupancy separations are required: there is no required occupancy separation between B and F2 occupancies; there is one-hour occupancy separation between F2 and E2, and between E2 and B. CBC section 8-302.3 states, "Required occupancy separations of one hour may be omitted when the building is provided with an approved automatic sprinkler system throughout." The areas of the building that house the F2 and E2 occupancies are fully sprinklered, including the adjacent exit stairs.

> *Recommendation*: Building occupancy separations conform to the requirements of the occupancy types currently housed in the building.

4. Allowable Area: Building N-226 is separated on three sides by yards in excess of 20 ft. (for a total of 40 ft. minimum on all sides.) CBC 505.1.2 allows for an area increase at the rate of 2.5% for each foot where the yard exceeds 20 ft., resulting in an area increase of 50% for building N-226. By using CBC Table 5-B and the allowable area increase, the net allowable areas for the mixed occupancies for Type III-N construction is as follows: B occupancy allowable area is 24,000; E2 occupancy allowable area is 20,250; F2 allowable area is 36,000 ft^2.

CBC section 504.3 states, "When a building houses more than one occupancy, the area of the building shall be such that the sum of the ratios of the actual area for each separate occupancy divided by the total allowable area for each separate occupancy shall not exceed one." When the calculation for a mixed occupancy building is performed in accordance with CBC section 504.3, building N-226 mixed occupancy does not exceed the allowable area.

> *Recommendation*: The building is within the allowable area.

5. Allowable Height: Table 5-B of the CBC limits the number of stories of the building to 2 stories and an overall height of 65 feet for Construction Type III-N. SHBC section 8-302.5 allows the height of the structure to not be limited, "provided such height or number of stories does not exceed that of its designated historical design."

> *Recommendation*: The building is within the allowable height.

6. Means of Egress Identification: Section 1003.2.8.2 requires the path of travel to and within exits to

be identified with code compliant exit signs. Illuminated exit signs with battery back-up power source have recently been installed. CBC 1003.2.9 requires the means of egress serving the occupied portion to be illuminated at an intensity of not less than 1 footcandle at the floor level. The emergency lighting in building N-226 corridors, exit stairs, and high-occupancy spaces appears to comply with this requirement.

Recommendation: The Means of Egress system appears to be code compliant.

7. Doors: CBC Section 1003.3.1.3 requires a clear opening of 32 inches. A general survey of the doors found that doors are typically a compliant width, a detailed survey should be undertaken to confirm door width compliance. CBC section 1003.3.1.5 requires the door to swing in the direction of egress. Section 1003.3.1.6.2 requires a level landing on each side of all doors that are part of the means of egress system. This section also requires the landing to be 44 in. in length when the door swings away and 60 in. in the direction of the door swing. Currently, all of the exits and doors appear to meet these requirements.

Recommendation: A detailed survey of all doors should be undertaken to confirm compliant door width, clearances and hardware operation.

8. Stairs and Guardrails: CBC section 1003.3.3.3 requires the rise and run of the stair to be a minimum of 7 in. and 11 in. respectively. CBC section 1003.3.3.6.1 requires all stairs (two or more risers) to have a handrail on each side. CBC section 1133B.4.2.6.1 requires handrails to have a maximum cross section dimension of 1-1/2 in., the existing handrails are 2 in. in width and are non-compliant. The exterior exit stairs lack required handrails. Section 509 of the CBC requires 42 in. high guardrails at all unenclosed floor or roof openings, open or glazed stairways, aisles, landings, ramps, balconies, or porches, which are over 30 in. above grade or the floor below. Interior guardrails at stair landings are 36 in. high and are non-compliant. Exterior exit stairs meet this requirement. SHBC section 8-502.1 exception 5 allows the enforcing agent to accept "any other condition which will allow or provide for the ability to quickly and safely evacuate any portion of a building with out undue exposure and which will meet the intended exiting and life safety stipulated by these regulations."

Recommendation: At exterior stairs, provide compliant handrails. At interior exit stairs, augment existing guardrail with compliant guardrail and add a compliant handrail at each side of the stair.

9. Ramps: There are no ramps in the building.

10. Exiting: CBC section 1003.2.5 requires exit continuity: "The path of exit travel along a means of egress shall not be interrupted by any building element other than a means of egress component as specified in this chapter." The exit stair from the second floor center bay (Test Chamber) is enclosed at the second level, but terminates in the Shop area, resulting in the exit path of travel through an intervening space. CBC Section 1004.3.4.2 requires corridors to be a minimum width of 44 in., or if serving an occupant load of less that 50, shall be a minimum width of 36 in. The existing 72 in. wide corridors are compliant. Emergency exterior exit stairs have been added to the ends of each of the office wings to provide a second means of egress from each of the three office wings. To access the stairs, a steel ladder is provided at the windowsill height.

Recommendation: At the egress stair from the Test Chamber (southwest corner of room) provide an exit enclosure that leads directly to the exterior, the existing exit door at the first floor could be used for exiting to the exterior. At the emergency exits at the Second Floor offices, provide compliant stairs, handrails, and guardrails to replace the existing steel ladder that leads to the emergency exit at the windows.

11. Travel distance: Section 1004.2.5.2.1 requires that the maximum travel distance in non-sprinklered buildings not exceed 200 ft. (building is partially sprinklered.) Travel distance is that distance an occupant must travel from any point within occupied portions of the exit access to the door of the nearest exit. Where path of travel includes unenclosed stairways or ramps, the distance of travel on such components must be included in the travel distance measurement. The interior stairways are well within the travel distance required. The travel distance from any portion of the building to the exterior is within the required travel distance.

Recommendation: Travel distance for exiting is within the required travel distance.

Summary of Fire/Life Safety Recommendations

1. Construction type: The building construction type is allowable for the Occupancy Type currently housed in the building.

2. Location on Property: Modifications to the building based on the location of property are not required.

3. Occupancy Separation: Building occupancy separations conform to the requirements of the occupancy types currently housed in the building.

4. Allowable Area: The building is within the allowable area.

5. Allowable Height: The building is within the allowable height.

6. Means of Egress Identification: The Means of Egress system appears to be code compliant.

7. Doors: A detailed survey of all doors should be undertaken to confirm compliant door width, clearances and hardware operation.

8. Stairs and Guardrail: At exterior stairs, provide compliant handrails. At interior exit stairs, augment existing guardrail with compliant guardrail and add a compliant handrail at each side of the stair.

9. Ramps: There are no ramps in the building.

10. Exiting: At the egress stair from the Test Chamber (southwest corner of room) provide an exit enclosure that leads directly to the exterior, the existing exit door at the first floor could be used for exiting

to the exterior. At the emergency exits at the Second Floor offices, provide compliant stairs, handrails, and guardrails to replace the existing steel ladder that leads to the emergency exit at the windows.

11. Travel distance: Travel distance for exiting is within the required travel distance.

B. Glossary of Terms: Construction and Occupancy Types

The following is a summary description of the Construction and Occupancy Types for building N-226:

Glossary of Construction Types, referenced from the 2001 California Building Code:

Type III-N	Structural elements in Type II buildings may be of any materials permitted by this code. Exterior walls shall be constructed of noncombustible materials and shall comply with the fire-resistive requirements set forth in CBC Section 503 and Tables 5-A and 6-A. Bearing partitions, when constructed of wood, shall comply with CBC Section 2308.

Group B	A building or structure, or a portion thereof, for office, professional or service-type transaction, including storage of records and accounts; eating and drinking establishments with an occupant load of less than 50.
Group E2	Any building used for educational purposes through the 12th grade by less than 50 persons for more than 12 hours per week or four hours in any one day.
Group F2	Low-hazard factory and industrial occupancies include facilities producing noncombustible or nonexplosive materials that during finishing, packing or processing do not involve a significant fire hazard.

C. Disabled Accessibility

Disabled Accessibility Analysis

1. Accessible Parking: CBC section 1129B.1 requires that where parking is provided for the public as clients, guests, or employees, accessible parking will also be provided. Section 1129B.4 requires one van accessible space for every eight accessible spaces, with a minimum of one van space. Van accessible parking spaces require an 8-foot wide loading area adjacent the parking space instead of the 5-foot wide loading area required for accessible parking stalls. Total number of parking spaces at the south parking lot for Building 226 is approximately 10. CBC Table 11B-6 requires a minimum of one van accessible parking spaces for this lot capacity.

Recommendation: Provide disabled accessible parking at the existing parking lot.

2. Accessible Route: CBC section 1114B.1.2 requires an accessible route of travel to all portions of the building that are required to be accessible. The SHBC Section 8-604 allows for equivalent facilitation to be provided in lieu of a path of travel to all areas of the building where providing access "would threaten or destroy the historical significance or character-defining features of the building or site or cause unreasonable hardship." There is no compliant disabled accessible path of travel from the parking lot to the entrance door. The entrance Foyer to the south wing (offices) has a two-riser stair at the corridor. There is no disabled accessible route to the second floor; there is only a freight elevator. The test chamber room lacks disabled access to all parts of the room due to the existence of the wind tunnel within the room. There is access over the wind tunnel by way of a steel stair construction, and a circuitous path of travel at the second floor level that travels through the wind tunnel.

Recommendation: Provide disabled accessible path of travel from the parking area to the front entrance. Modify the existing entrance to the south wing to allow for disabled accessible travel to first floor level. Provide disabled access to the second floor level by means of an elevator or other vertical access system. Recommend study of the use of the existing freight elevator as a possible passenger elevator location, or other central location within the building. At the test chamber room, disabled access to the western portion of the room is necessary if the room continues to be used in its current arrangement.

3. Doors: Section 1133B.2.4 of the CBC requires a level landing on each side of a door. Section 1133B.2.4.2 requires maneuvering clearance to be 60 in. on the swing side of interior doors and 48 in. on the non-swing side of the door with a closer (44 in. without closer). The clearance on the swing side shall extend 18 in. beyond the strike side of the door for interior doors and 24 in. on exterior doors. The clearance for the non-swing side shall extend 12 in. when the door has a closer. Section 1133B.2.5.2 requires hardware that is hand operable with a single effort without requiring the ability to grasp. Most doors at Building N-226 lack lever-handled hardware. At the east elevation, the entrance doors to the south Office wing is approximately 1 in. below the finish floor, and does not comply with the maximum ½ in. level change at doors required by CBC section 1133B.2.4.1.

Recommendation: Provide replacement lever-handled door hardware at existing doors, where

knobs are non-compliant. Correct the difference in floor level between the entrance walk to the south wing and the finish floor level. This work should be undertaken as part of the disabled accessible upgrades to access to the first and second floors described in Item 2 above.

4. Stairs: Section 1133B.4.4 of the CBC requires striping for the visually impaired on the lowest and upper most treads of a run of stairs. Currently most of the interior and exterior stairs meet this requirement. CBC Section 1133B.4.2 requires handrails to extend 12 in. beyond the top nosing and 12 in. plus the tread width, beyond the bottom nosing. Interior and exterior stairs do not meet this requirement.

Recommendation: Correct the stair handrail extensions to comply with current code.

5. Restrooms: CBC section 1115B.1 requires buildings that are required to be accessible to have accessible restrooms. The restrooms have been made partially accessible at the second floor; the restrooms at the first floor have not been upgraded for disabled access. A detailed confirmation of non-conforming conditions should be undertaken at a future phase of project development.

Recommendation: Correct non-compliant disabled accessible bathroom fixtures, heights, and clear area requirements.

6. Drinking Fountain: Section 1117B.1.1 of the CBC requires where water fountains are provided, they shall comply with the requirements of this section. Section 1117B.1.2 of the CBC requires water fountains to be located in an alcove not less than 32 in. wide and 18 in. in depth, or so as not to encroach in the pedestrian ways. The drinking fountain complies with the accessibility requirements of the code.

Recommendation: Drinking fountains appear to be code compliant.

7. Signage: Sections 1103.2.4, 1127B.3, 1129B.5, and 1115B.5 of the CBC require code-compliant signage identifying accessible entrances, parking, areas of refuge, passenger loading zone, toilet and bathing facilities, and exit signage at the exit stairs. In addition to the international symbol of accessibility, each unisex toilet or bathing room shall be identified by a tactile sign including raised letters and Braille. There is compliant disabled accessible signage at the separate Men's and Women's restrooms at the second floor only. There is no accessible signage at the main building entrance.

Recommendation: Provide disabled accessible building entrance signage at the main entrance; coordinate this work with the correction of the building path of travel upgrade work.

Summary of Disabled Accessibility Recommendations

1. Accessible Parking: Provide disabled accessible parking at the existing parking lot.

2. Accessible Route: Provide disabled accessible path of travel from the parking area to the front entrance. Modify the existing entrance to the south wing to allow for disabled accessible travel to first floor level. Provide disabled access to the second floor level by means of an elevator or other vertical access system.

Recommend study of the use of the existing freight elevator as a possible passenger elevator location, or other central location within the building. At the test chamber room, disabled access to the western portion of the room is necessary if the room continues to be used in its current arrangement.

3. Doors: Provide replacement lever-handled door hardware at existing doors, where knobs are non-compliant. Correct the difference in floor level between the entrance walk to the south wing and the finish floor level. This work should be undertaken as part of the disabled accessible upgrades to access to the first and second floors described in Item 2 above.

4. Stairs: Correct the stair handrail extensions to comply with current code.

5. Restrooms: Correct non-compliant disabled accessible bathroom fixtures, heights, and clear area requirements.

6. Drinking Fountain: No improvements needed.

7. Signage: Provide disabled accessible building entrance signage at the main entrance; coordinate this work with the correction of the building path of travel upgrade work.

D. Energy Conservation

Analysis

The historic structure was designed with some energy-conserving features; monolithic concrete floors throughout the building and thick concrete walls contribute to passive climate control for the building. Insulation in the exterior walls could not be confirmed without destructive testing. The majority of the window sashes are single glazed. The building has a mixed mechanical system comprised of a forced air mechanical system, and window-mounted packaged air conditioning units. Consideration should be given to replacing the packaged air conditioning units with an energy efficient single-source system. The efficiency of the mechanical systems could not be confirmed. Energy efficient fluorescent lighting is the primary lighting source.

> *Recommendation:* Building N-226 has been submitted to SHPO for a determination of eligibility for the National Register of Historic Places and could be exempt from energy code requirements. However, measures to reduce energy consumption and provide for user comfort are recommended. These actions may include insulating the ceiling and exterior walls during future construction work. The existing steel sash windows are historic features and should be repaired and weather-stripped rather than replaced. High efficiency mechanical systems should be used to replace mechanical systems that have reached the end of their useful life.

X. Future Studies Needed

A. Hazardous Materials

Although a hazardous materials report has not yet been completed, there are several types of historical materials and finishes are known to contain asbestos and other hazardous materials in the building construction. Most painted older surfaces in the building likely have some lead-based paint residues, and should be confirmed through testing.

It is recommended that a complete hazardous materials report be completed on the building.

B. Mechanical and Electrical Systems

The mechanical and electrical systems were not inspected as part of this report. It is assumed that should the rehabilitation and reuse of Building N-226 be undertaken, it will entail the installation of an upgrade to mechanical and electrical systems, and potentially the plumbing drainage/waste system. All new mechanical and electrical systems should be designed to preserve the character of the significant materials and spaces identified in this report.

C. Structural Systems

The exterior walls of Building N-226 are reinforced concrete. The roof and floor structures are reinforced concrete construction. The first floor center and north bay floor construction is a concrete slab on grade. Exterior stairs are steel frame construction.

The building appears to be in excellent condition. In the course of rehabilitating the building the structural system should be analyzed for seismic and gravity load deficiencies and reinforced as necessary. Strengthening provisions should be designed to preserve significant materials and spaces.

NASA Ames Research Center
Building 226 Reuse Guidelines

Appendix 1. Character-Defining Features

Character-Defining Features

Elements	Significance	Condition	Comments
Exterior			
North Elevations			
Concrete surface articulated with classical style striping, emphasized horizontality	S	G	board form smooth concrete, soiled and discolored
Windows:			
Multi-lite metal sash windows with operable hopper segments (wing and center block beyond)	S	F	window mounted air conditioners, wire mesh on lower left and right bay
Louvered openings (center block beyond- with fans behind)	S	F	
Doors:			
Metal roll-up door	S	G	
Ornamental striping (center block parapet)	S	G	
East Elevation (including courtyard)			
Concrete surface articulated with classical style striping, emphasized horizontality (south and north wings)	S	G	soiled and discolored
Concrete surface articulated with grid of control joints (center block and elevator/toilet room blocks)	S	G	soiled and discolored
Windows:			
Multi-lite metal sash windows with operable hopper segments	S	F	window mounted air conditioners, black-out shades inside
Louvered openings (center block above second floor windows)	S	F	
Openings with glass block (elevator/toilet room blocks)	S	F	
Doors:			
Multi-lite metal panel sliding doors	S	F	
Metal aluminum storefront doors with sidelights	N	G	

Significance Rating
S=Significant
C=Contributing
T=Tertiary
N=Non-contributing

Condition Rating
G=Good
F=Fair
P=Poor

Cantilevered streamline style concrete canopies with rounded corners over doors	S	P	spalling and deterioration
Ornamental banding (over doors and below canopies at wings)	S	P	spalling and deterioration
Ornamental striping (center block parapet)	S	G	
South Elevation			
Concrete surface articulated with classical style striping, emphasized horizontality	S	G	stained
Windows			
Multi-lite metal sash windows with operable hopper segments (wing and center block beyond)	S	F	one modified to provide an exit door; window mounted air conditioners
Doors:			
Single-lite metal door with transom (infilling one section of multi-lite metal sash window)	N	G	
3-lite 1-panel wood door with cantilevered awning (center block)	S	P	
Ornamental striping (center block parapet)	S	G	
Cantilevered streamline style concrete canopy with rounded corners over doors at the corner (center block)	S	P	spalling and deterioration
West Elevation			
Concrete surface articulated with classical style striping, emphasized horizontality	S	G	stained, north and south wings
Concrete surface articulated with grid of control joints (center block)	S	G	
Windows			
Multi-lite metal sash windows with operable hopper segments	S	P/F	two modified to provide metal doors; window mounted air conditioners

Significance Rating
S=Significant
C=Contributing
T=Tertiary
N=Non-contributing

Condition Rating
G=Good
F=Fair
P=Poor

Louvered openings (center block beyond- with fans behind)	S	F	
Doors:			
Single-lite metal door with transom (north and south wings)	N	G	
3-lite 1-panel wood door (center block)	S	P	
3-lite 1-louver panel wood door With Cantilevered Awning (south wing)	S	P	
Ornamental striping (center block parapet)	S	G	
Interior			
Offices (south wing first floor)			
Configuration	C	G	
Floors	N	G	
Walls	C	G	
Ceilings	C	G	
Doors:			
Wood flush veneer doors and frames	S	G	
Blackboards			removed
Corridors (south wing first floor)			
Configuration	S	G	
Floors	S	G	
Walls	S	G	
Ceilings	S	G	
Toilet Rooms (south wing first floor, toilet room block first floor and mezzanine landing/south wing second floor/toilet room block second floor)			
Configuration	C	G	
Floors	C	G	
Walls	C	G	
Ceilings	C	G	
Plumbing fixtures	C	G	
Stairs (south wing/north wing)			

Significance Rating
S=Significant
C=Contributing
T=Tertiary
N=Non-contributing

Condition Rating
G=Good
F=Fair
P=Poor

Configuration	S	G	
Floors	S	G	
Walls	S	G	
Ceilings	S	G	
Handrails/guardrails	S	G	metal handrail-later additon and non-contributing
Elevator (including machine room)			
Walls	S	G	
Floor	S	G	
Ceiling	S	G	
Doors:			
Vertical acting counterbalanced door	S	G	
Shop (center wing first floor)			
Large open volume	S	F	partitions-later addition
Floor	S	P	
Trench pit, and manhole (west side)	S	G	trench pit covered and runs partial length of floor
Door track (east side)	S	P	
Walls	S	G	
Exposed steel columns	S	F	
Exposed open web steel trusses and joists, and diagonal floor sheathing	S	G	
Doors:			
Metal roll-up door	S	F	
Test Section Tunnel	S	F	
Stairs	S	G	
Monorail and ceiling hatch (east side at exterior door)	S	G/F	
North Wing (current use-storage)			
Large open volume	S	G	

Significance Rating
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C=Contributing
T=Tertiary
N=Non-contributing

Condition Rating

G=Good
F=Fair
P=Poor

Floor	S	F	grating in floor covers engines
Walls	S	F	
Exposed concrete columns	S	G	
Exposed concrete beams, joists, and decking	S	G	
Offices (south wing second floor, north wing second floor)			
Configuration	C	F	
Floors	N	G	
Walls	C	G	
Ceilings	C	G	
Doors:			
Wood flush veneer doors and frames	S	G	
Corridors (south wing second floor, north wing second floor)			
Configuration	S	G	
Floors	S	G	
Walls	S	G	
Ceilings	S	G	
Film Reading Room (south wing second floor)			
Floor	N	G	
Walls	C	G	dividing wall between film reading room and dark room has been removed
Ceiling	C	G	
Wood flush veneer door and frame	C	G	
Dark Room (south wing second floor)			
Floor	N	G	
Walls	C	G	
Ceiling	C	G	

Significance Rating
S=Significant
C=Contributing
T=Tertiary
N=Non-contributing

Condition Rating
G=Good
F=Fair
P=Poor

Doors:			
Wood flush veneer doors and frames	C	G	one door missing
Test Chamber (center wing second floor)			
Large open volume	S	G	
Floor	S	G	
3 ft. x 3 ft. flush metal plates	S	G	
Walls	S	G	
Exposed open web steel trusses and corrugated metal roofing	S	G	
Doors:			
Wood flush veneer doors and frames (at elevator machine room and fan room)	S	G	
Test Section Tunnel	S	G	
Stairs (to test section tunnel)	S	G	
Steel ladders and platforms (to elevator machine room and fan room, east side)	S	G	
Crane assembly (suspended “I” beam tramrails, crane hoist, and travelling crane dolly)	S	G	
Optical Laboratory (west side north wing second floor)			
Open volume			partition added
Floor	N	G	
Walls	C	G	
Ceiling	C	G	
Doors:			
Wood flush veneer doors and frames	S	G	

Character Defining Features Matrix

Significance Rating
S=Significant
C=Contributing
T=Tertiary
N=Non-contributing

Condition Rating

G=Good
F=Fair
P=Poor

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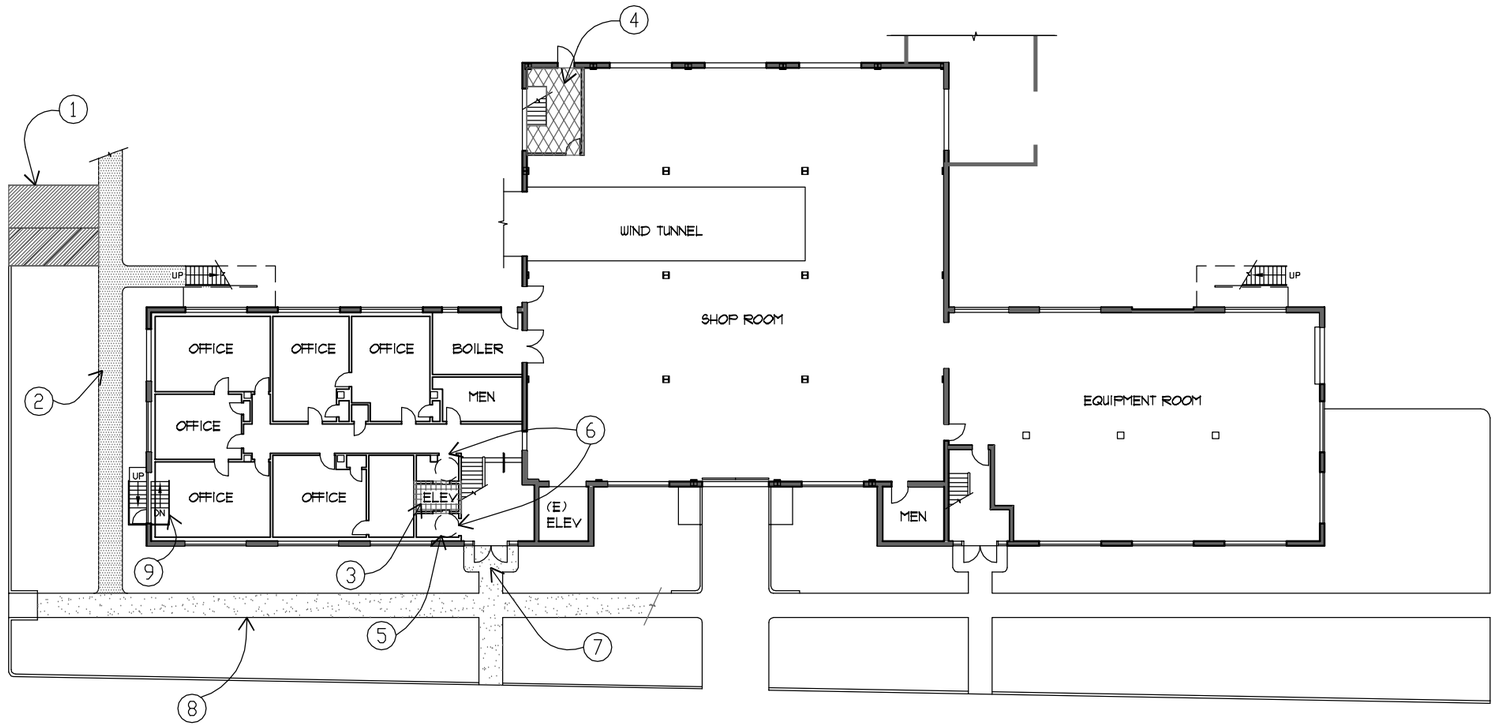
Building 226 Reuse Guidelines

Appendix 2. Existing Floor Plans & Rehabilitation



N-226 FIRST FLOOR PLAN

REHABILITATION LEGEND & KEY NOTES

1. SUGGESTED AREA FOR NEW VAN ACCESSIBLE PARKING AND DEPRESSED SIDEWALK
2. SUGGESTED AREA FOR ACCESSIBLE PATH FROM PARKING AREA
3. SUGGESTED LOCATION FOR NEW ELEVATOR - FRONT AND REAR OPENING / 90"x70" CLR INSIDE - AND ELEVATOR LOBBIES
4. PROVIDE EXIT STAIR ENCLOSURE TO MAINTAIN EXIT CONTINUITY
5. 5' DIAMETER, TYP. (REQUIRED CLEARANCE)
6. PROVIDE NEW OPENING IN THE WALL FOR LOBBY
7. PROVIDE ACCESSIBLE ENTRY TO THE BUILDING
8. EXISTING ACCESSIBLE PATH
9. PROVIDE EXIT STAIR AND LANDING AT EMERGENCY EXIT

GENERAL NOTES

1. NOT ALL KEY NOTES AAPPEAR ON ALL SHEETS, KEY NOTES MAY APPLY TO ONE FLOOR ONLY.
2. REFER TO SECTION VIII. "CODE EVALUATIONS AND RECOMMENDATIONS" FOR DETAILED DESCRIPTION.

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EXISTING PLANS & REHABILITATION

32 0 32

1/32" = 1'-0"

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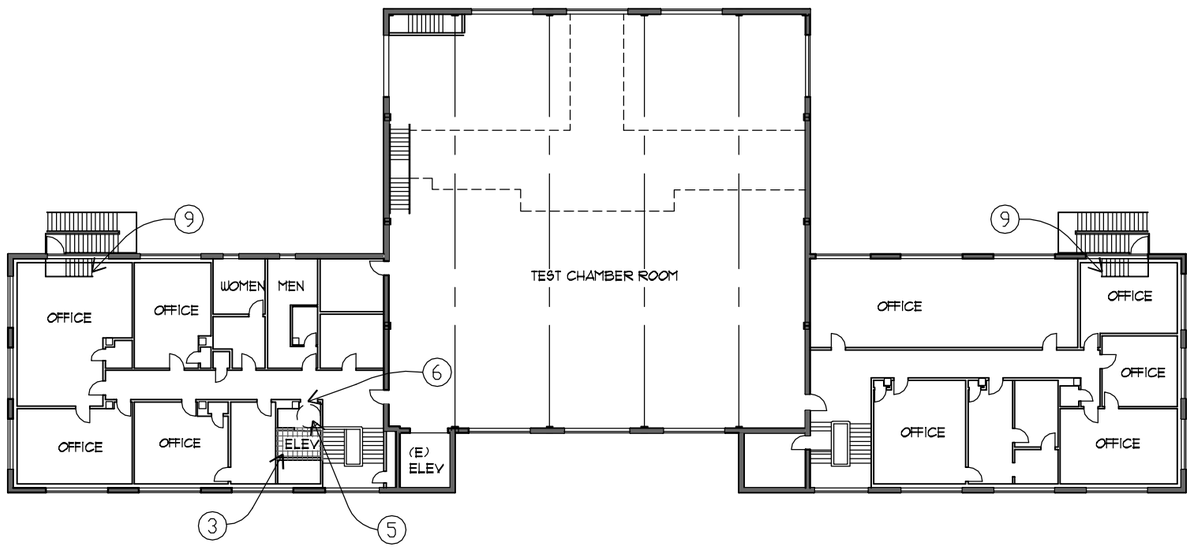
Sunnyvale, CA

October, 2007

N



N-226 SECOND FLOOR PLAN

REHABILITATION LEGEND & KEY NOTES

1. SUGGESTED AREA FOR NEW VAN ACCESSIBLE PARKING AND DEPRESSED SIDEWALK
2. SUGGESTED AREA FOR ACCESSIBLE PATH FROM PARKING AREA
3. SUGGESTED LOCATION FOR NEW ELEVATOR - FRONT AND REAR OPENING / 90"x70" CLR INSIDE - AND ELEVATOR LOBBIES
4. PROVIDE EXIT STAIR ENCLOSURE TO MAINTAIN EXIT CONTINUITY
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8. EXISTING ACCESSIBLE PATH
9. PROVIDE EXIT STAIR AND LANDING AT EMERGENCY EXIT

GENERAL NOTES

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ARCHITECTURAL RESOURCES GROUP
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EXISTING PLANS & REHABILITATION

32 0 32
1/32" = 1'-0"

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NASA Ames Research Center
Sunnyvale, CA

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N

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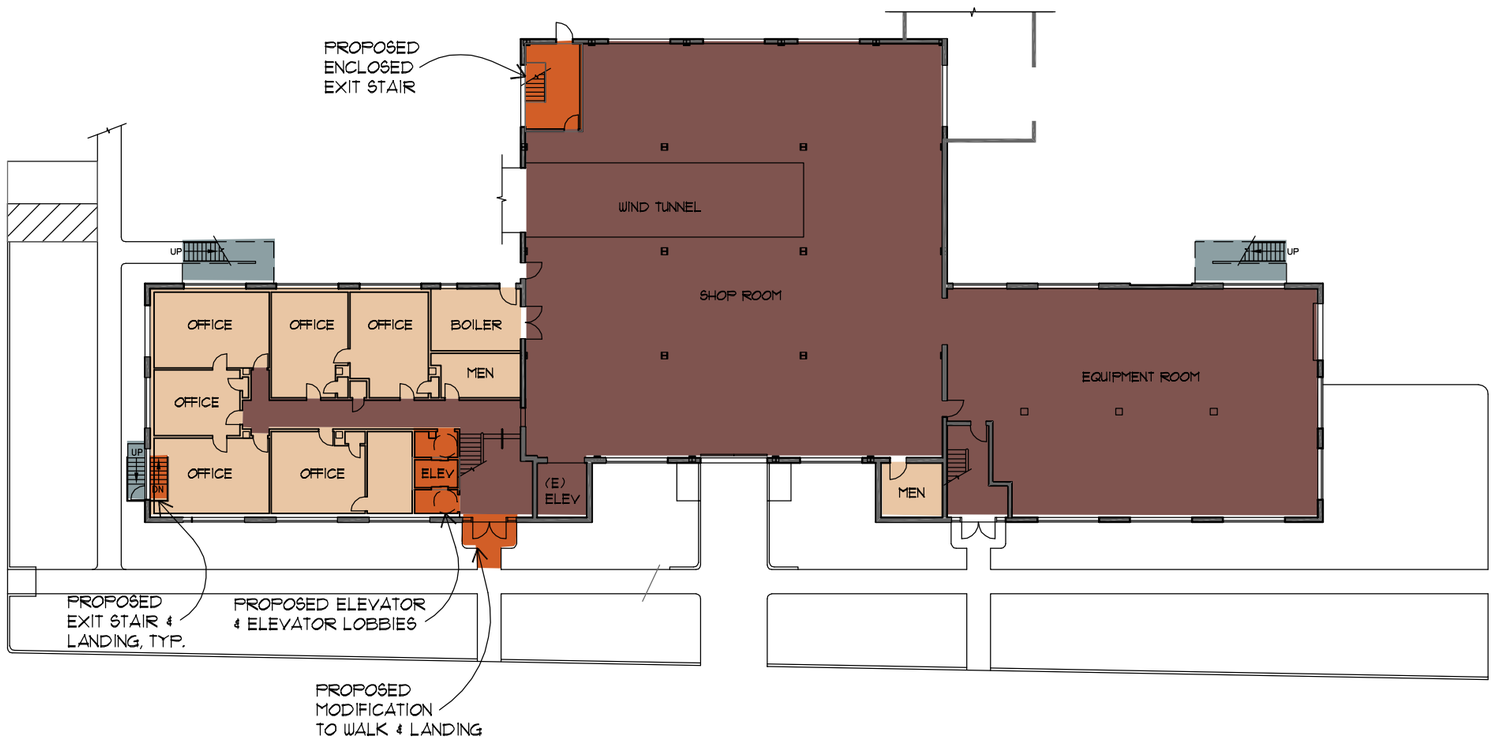
Building 226 Reuse Guidelines

Appendix 3. Character-Defining Significance Diagrams



N-226 FIRST FLOOR PLAN

GENERAL NOTES

1. THESE DIAGRAMS ARE INTENDED TO SHOW THE PRINCIPAL CHARACTER-DEFINING FEATURES, NOT SPECIFIC COMPONENTS.
2. FOR A MATRIX OF SIGNIFICANCE RATINGS FOR INDIVIDUAL BUILDING COMPONENTS, REFER TO APPENDIX 1. "HISTORIC CHARACTER-DEFINING FEATURES".

CHARACTER-DEFINING SIGNIFICANCE DIAGRAMS LEGEND

- SIGNIFICANT FEATURE
- CONTRIBUTING FEATURE
- TERTIARY FEATURE
- NON-CONTRIBUTING FEATURE
- NEW CONSTRUCTION - PROPOSED

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HISTORIC CHARACTER-DEFINING SIGNIFICANCE DIAGRAMS - PLANS

32 0 32
1/32" = 1'-0"

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Sunnyvale, CA

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N

N-226 SECOND FLOOR PLAN

GENERAL NOTES

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CHARACTER-DEFINING SIGNIFICANCE DIAGRAMS LEGEND

- SIGNIFICANT FEATURE
- CONTRIBUTING FEATURE
- TERTIARY FEATURE
- NON-CONTRIBUTING FEATURE
- NEW CONSTRUCTION - PROPOSED

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HISTORIC CHARACTER-DEFINING SIGNIFICANCE DIAGRAMS - PLANS

32 0 32 64
1/32" = 1'-0"

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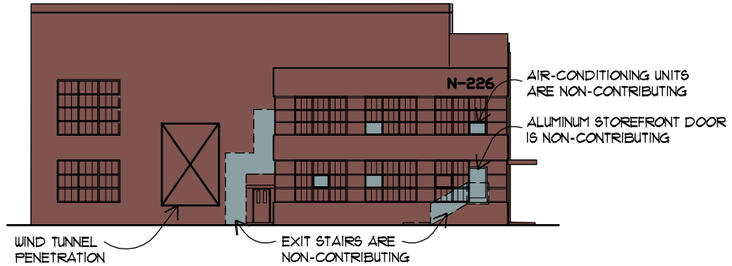
OCTOBER, 2007

N-226 EAST ELEVATION



N-226 SOUTH ELEVATION

GENERAL NOTES

1. THESE DIAGRAMS ARE INTENDED TO SHOW THE PRINCIPAL CHARACTER-DEFINING FEATURES, NOT SPECIFIC COMPONENTS.

2. FOR A MATRIX OF SIGNIFICANCE RATINGS FOR INDIVIDUAL BUILDING COMPONENTS, REFER TO APPENDIX I. "HISTORIC CHARACTER-DEFINING FEATURES".

CHARACTER-DEFINING SIGNIFICANCE DIAGRAMS LEGEND

- SIGNIFICANT FEATURE
- CONTRIBUTING FEATURE
- TERTIARY FEATURE
- NON-CONTRIBUTING FEATURE
- NEW CONSTRUCTION - PROPOSED

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HISTORIC CHARACTER-DEFINING SIGNIFICANCE DIAGRAMS - ELEVATIONS

32 0 32 64
1/32" = 1'-0"

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OCTOBER, 2007

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Building 226 Reuse Guidelines

Appendix 4. Historic Aerial Photographs

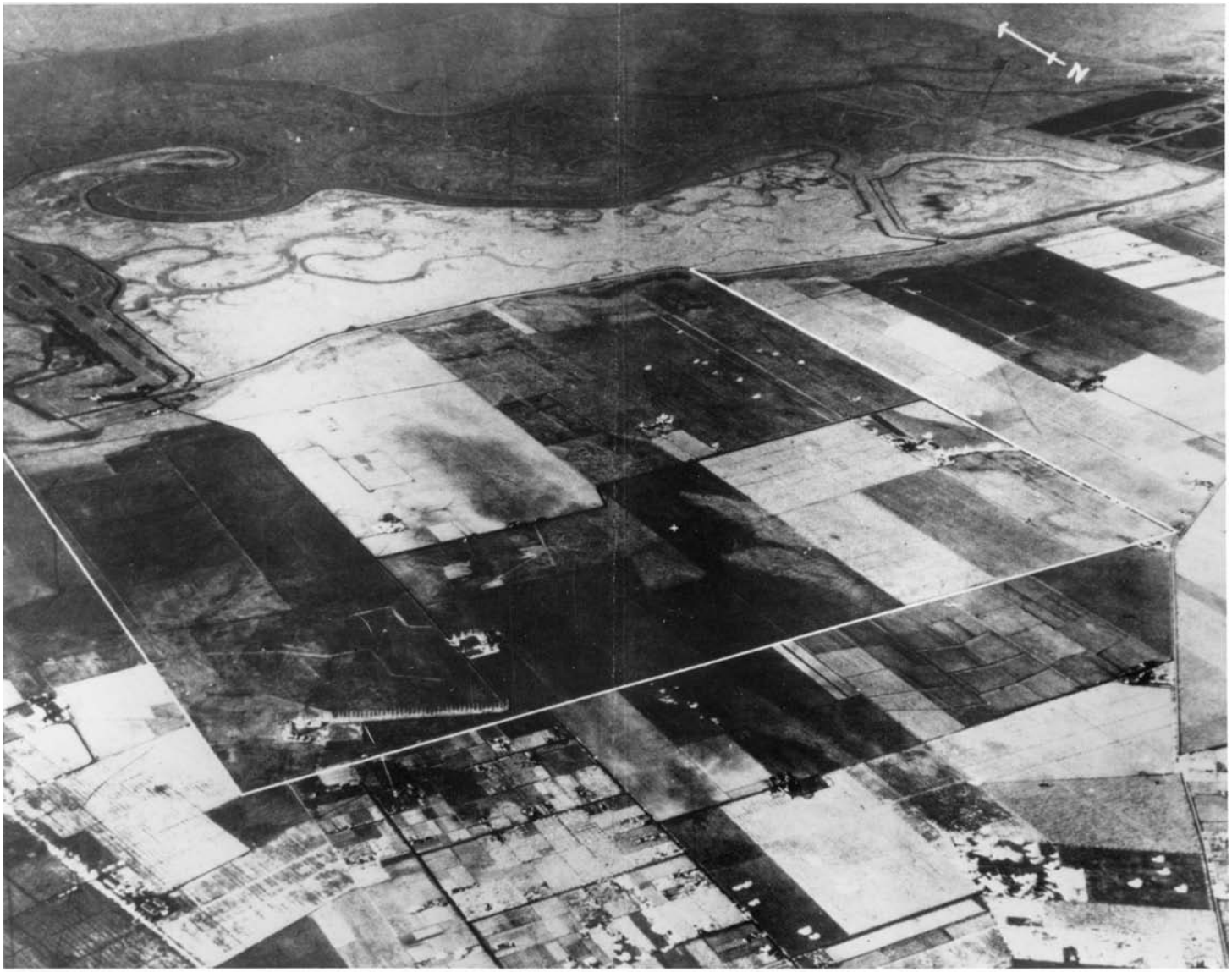

Figure 1: 1930 aerial photograph of future Moffett Field

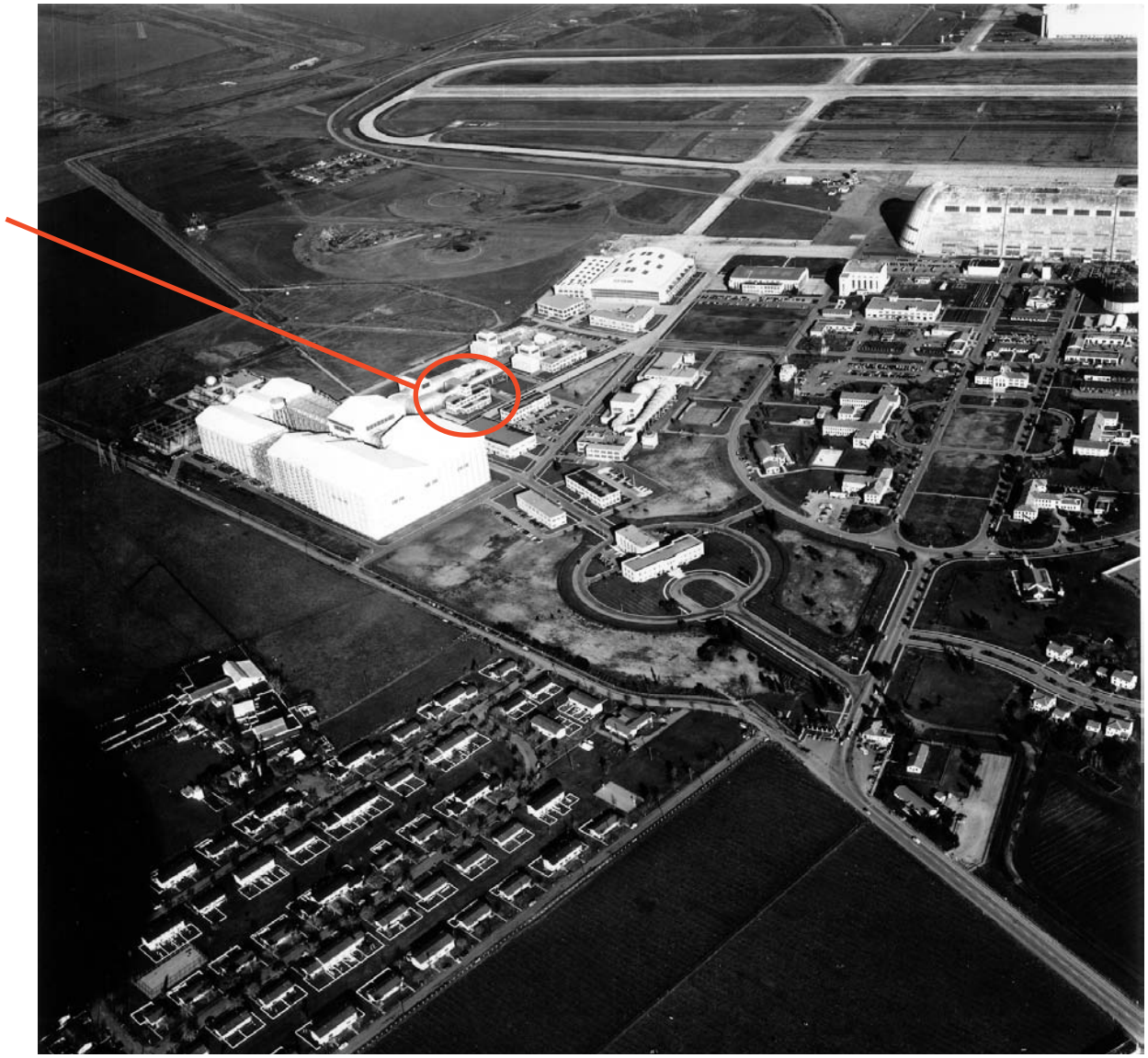

Figure 2: 1944 aerial of Moffett Field

Figure 3: 1982 aerial of Moffett Field

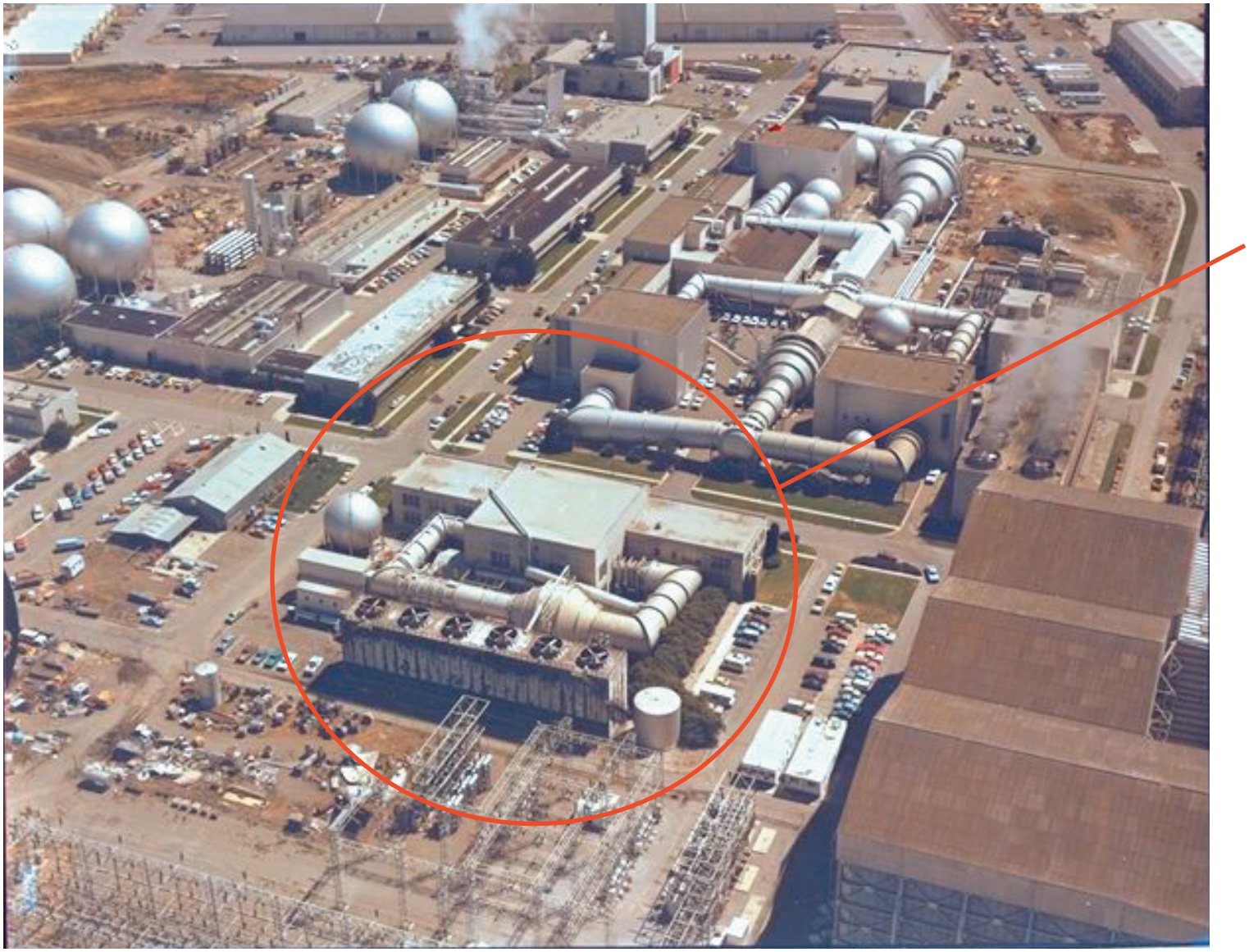

Figure 5: 1973 aerial showing Bulding N-226, center

Figure 6: 1989 aerial showing Building N-226, bottom left


Building N-226

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Appendix 5. Current Conditions Photographs (2006)

Figure 8. East façade

Figure 9. East proposed accessible entry

Figure 10. East entries and restroom tower with glass block band windows

Figure 11. East 6 by 6 Foot Wind Tunnel entry

Figure 12. North elevation

Figure 13. West elevation of north wing

Figure 14. West elevation

Figure 15. 3-lite doors with cantilevered awning at west façade

Figure 16. South elevation

Figure 17. Interior shop room

Figure 18. Interior shop room

Figure 19. Interior view of the east center door

Figure 20. Interior equipment room

Figure 21. Interior Test Chamber room

Figure 22. Test Chamber Room looking north east

Figure 23. Test chamber room looking north

Figure 24. Test chamber room ceiling

Figure 25. Stair inside test chamber room

Figure 26. Office room interior and exit door at the north-west corner

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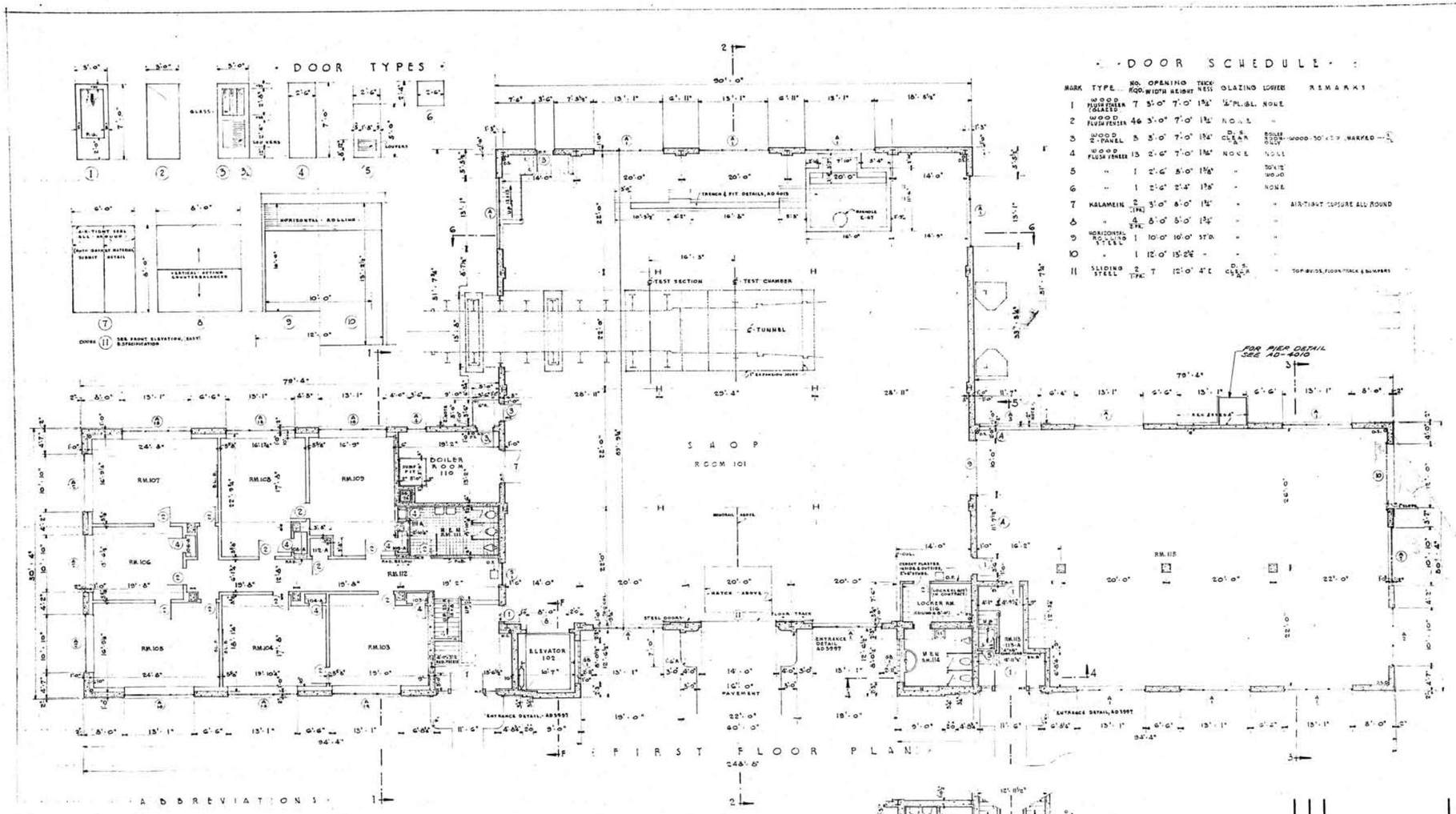
Building 226 Reuse Guidelines

Appendix 6. Construction Plans



DOOR SCHEDULE

MARK	TYPE	NO. REQD.	OPENING WIDTH	OPENING HEIGHT	THICKNESS	GLAZING	LOUVER	REMARKS
1	WOOD FLUSH VENEER (GLAZED)	7	3'-0"	7'-0"	1¾"	¼" PL. GL.	NONE	
2	WOOD FLUSH VENEER	46	3'-0"	7'-0"	1¾"	NONE	–	
3	WOOD 2-PANEL	5	3'-0"	7'-0"	1¾"	DIS. CLEAR GLASS	BOILER ROOM-WOOD-30"x12", WARPED	
4	WOOD FLUSH VENEER	13	2'-6"	7'-0"	1¾"	NONE	NONE	
5	"	1	2'-6"	5'-0"	1¾"	–	30"x12" WOOD	
6	"	1	2'-6"	2'-4"	1¾"	–	NONE	
7	KALAMEIN	2 TYPE	3'-0"	8'-0"	1¾"	–	–	AIR-TIGHT CLOSURE ALL ROUND
8	"	4 TYPE	8'-0"	8'-0"	1¾"	–	–	
9	HORIZONTAL ROLLING STEEL	1	10'-0"	10'-0"	3"D.	–	–	
10	"	1	12'-0"	15'-2½"	–	–	–	
11	SLIDING STEEL	2 TYPE	7	12'-0"	4"D.	DIS. CLEAR GLASS	–	TOP GUIDES, FLOOR TRACK & BUMPERS

ABBREVIATIONS

A.C. = ASBESTOS-CEMENT MATERIAL
BL.B. = BLACKBOARD
BM.B. = BULLETIN BOARD
D.F. = DRINKING FOUNTAIN
DN. = DOWN
D.S. = DOWNSPOUT - LEADER
EL. = ELEVATION - ABOVE GRADE
F.A. = FRESH AIR VENT
F.H.C. = FIRE HOSE CABINET
F.H.R. = FIRE HOSE REEL
M.T. = METAL THRESHOLD
R. = RADIUS (CURVE), RISER, STAIR
RAD. = RADIATOR
RM. = ROOM
S.J. = SURFACE JOINT

REVISIONS

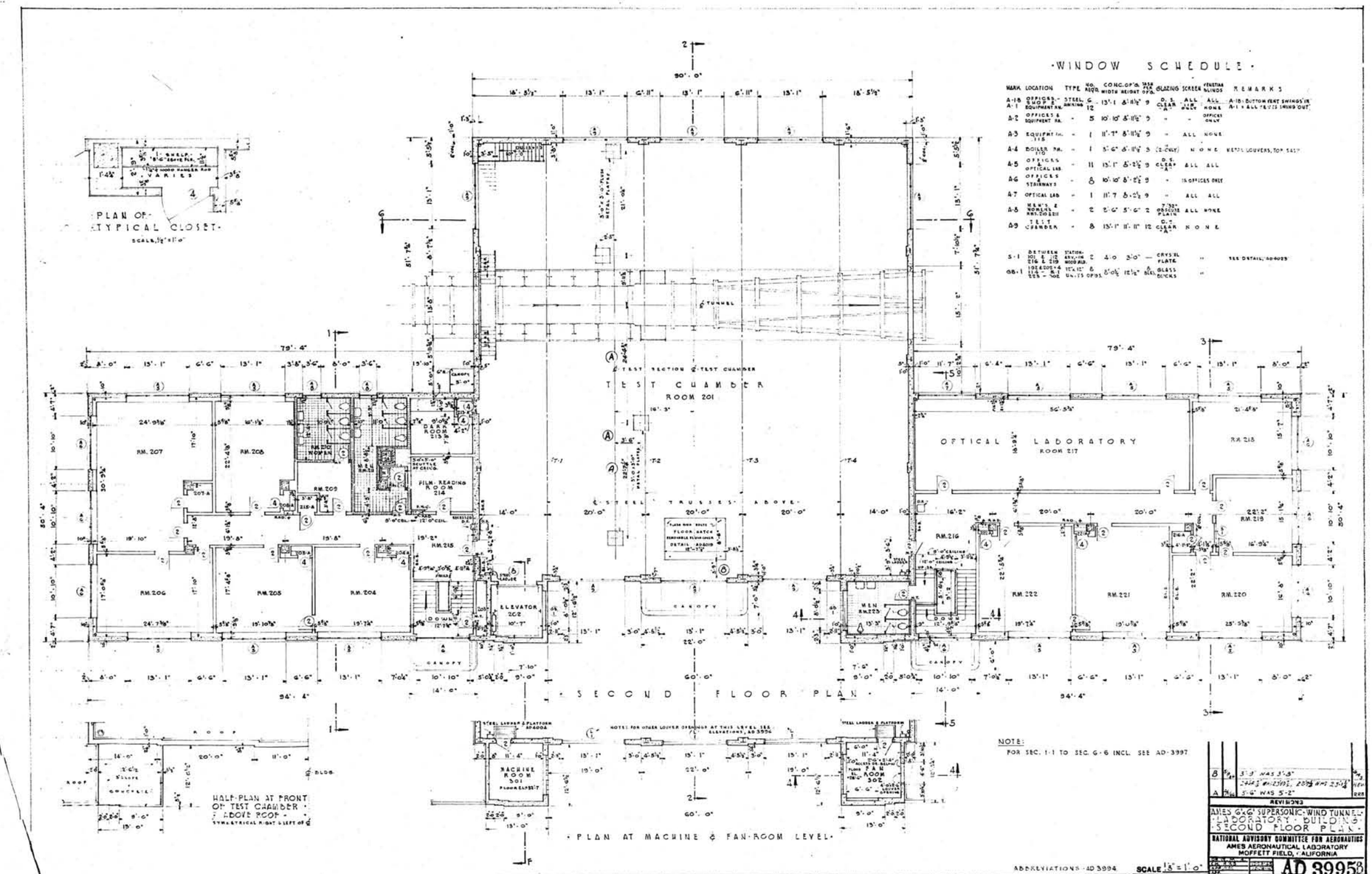
AMES 6'x6' SUPERSONIC WIND TUNNEL
LABORATORY BUILDING
FIRST FLOOR PLAN

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIFORNIA

SCALE 1/8" = 1'-0"

AD 3994

AD 3994A



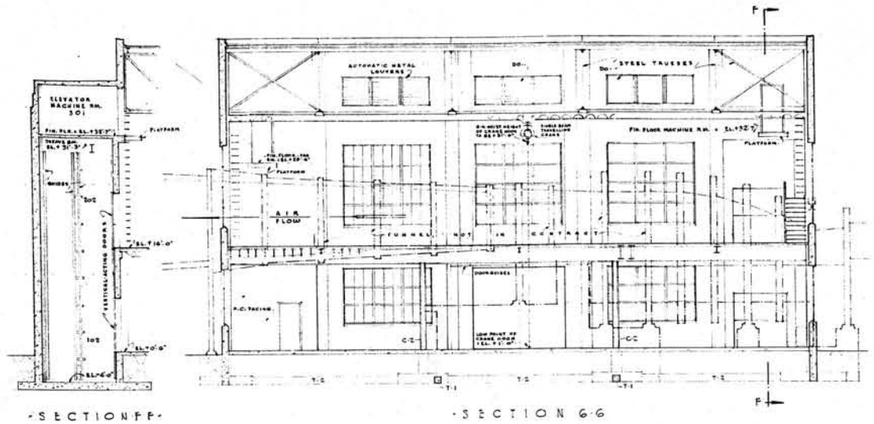
WINDOW SCHEDULE

MARK	LOCATION	TYPE	NO. REQ'D.	CONC. OP'G. WIDTH	CONC. OP'G. HEIGHT	SILL FR. FLR. OP'G.	GLAZING	SCREEN	VENETIAN BLINDS	REMARKS
A-1A A-1	OFFICES & EQUIPMENT RM.	STEEL AWNING SASH & FRAME	6 12	13'-1	5'-11½"	9	O.S. CLEAR "A"	ALL	ALL ALL	A-1A: BOTTOM VENT SWINGS IN A-1: ALL TILTED SWING OUT
A-2	OFFICES & EQUIPMENT RM.	-	5	10'-10"	5'-11½"	9	-	-	NONE OFFICES ONLY	
A-3	EQUIPMENT RM. 115	-	1	11'-7"	5'-11½"	9	-	ALL	NONE	
A-4	BOILER RM. 110	-	1	5'-6"	5'-11½"	3	(2 ONLY)	NONE		METAL LOUVERS, TOP SASH
A-5	OFFICES & OPTICAL LAB.	-	11	13'-1"	5'-2½"	9	O.S. CLEAR "A"	ALL	ALL	
A-6	OFFICES & STAIRWAYS	-	8	10'-10"	5'-2½"	9	-	IN OFFICES ONLY		
A-7	OPTICAL LAB.	-	1	11'-7	5'-2½"	9	-	ALL	ALL	
A-8	MEN'S & WOMEN'S RM. 208 & 220	-	2	5'-6"	5'-6"	2	7'-0" OBSCURE PLATE	ALL	NONE	
A-9	TEST CHAMBER	-	8	13'-1"	11'-11"	12	O.S. CLEAR "A"	NONE		
S-1	BETWEEN 201 & 123 ETC. & 219	STATIONARY WOOD AUD.	2	4'-0	3'-0"	—	CRYSTAL PLATE	"		SEE DETAIL, AD-4023
GB-1	108 & 205 & 206 ETC. — 108	15"x15" & 24"x15" OP'G.	6	5'-0½"	12½"	8" SILL	GLASS BLOCKS	"		

B	3'-3" WAS 3'-8"	
A	3'-6" WAS 5'-2"	

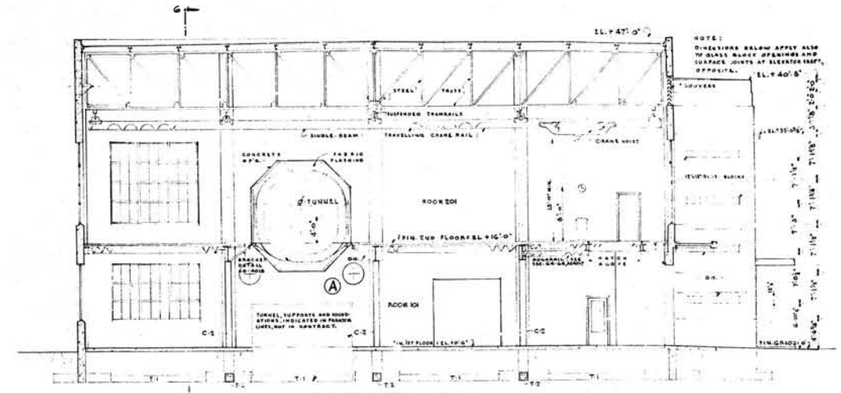
REVISIONS

AD 3995B

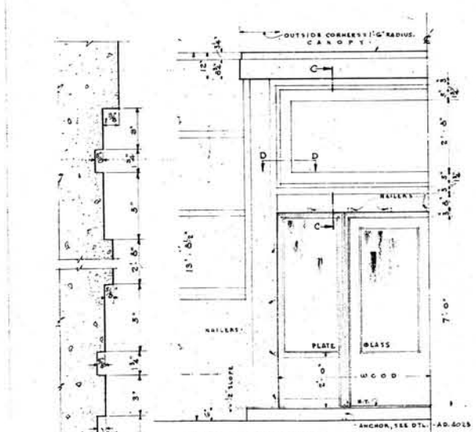


·SECTION F-F·

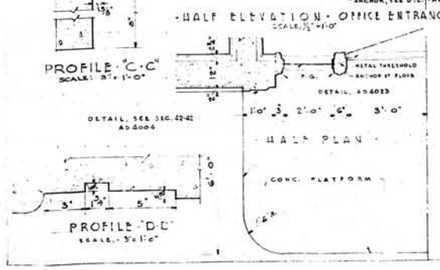
·SECTION G-G·



·SECTION "2-2"·



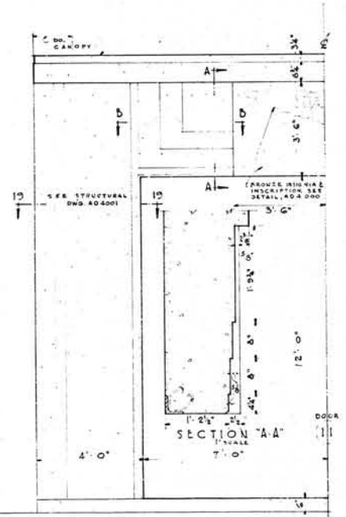
·HALF ELEVATION, OFFICE ENTRANCE·
SCALE: 1/4"=1'-0"



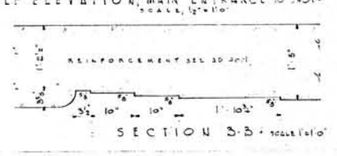
·HALF PLAN·

PROFILE "C-C"
SCALE: 3"=1'-0"

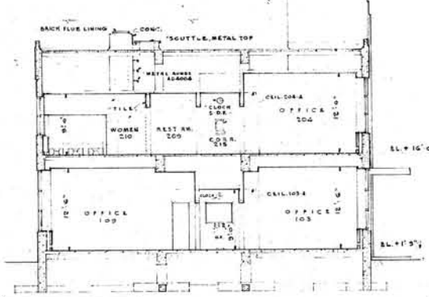
PROFILE "D-D"
SCALE: 3"=1'-0"



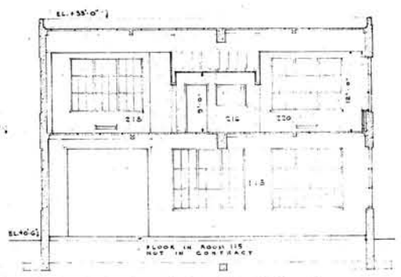
·HALF ELEVATION, MAIN ENTRANCE TO SHOP·
SCALE: 1/2"=1'-0"



SECTION B-B · SCALE 1"=1'-0"



·SECTION 1-1·



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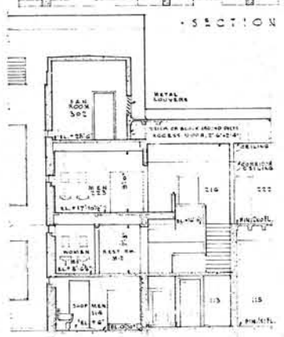
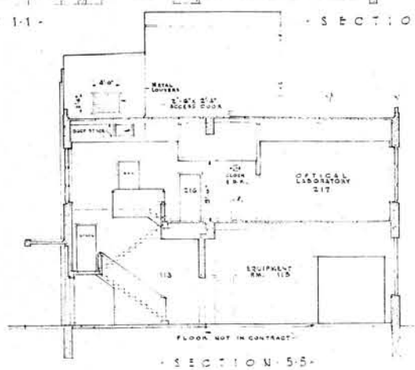


·SECTION 4-4·



·SECTION 5-5·

A	4/4/49	FIN OPENINGS ADDED	RRS

REVISIONS

AMES SUPERSONIC WIND TUNNEL LABORATORY BUILDING
·ENTRANCE DETAILS & OVER-ALL SECTIONS·

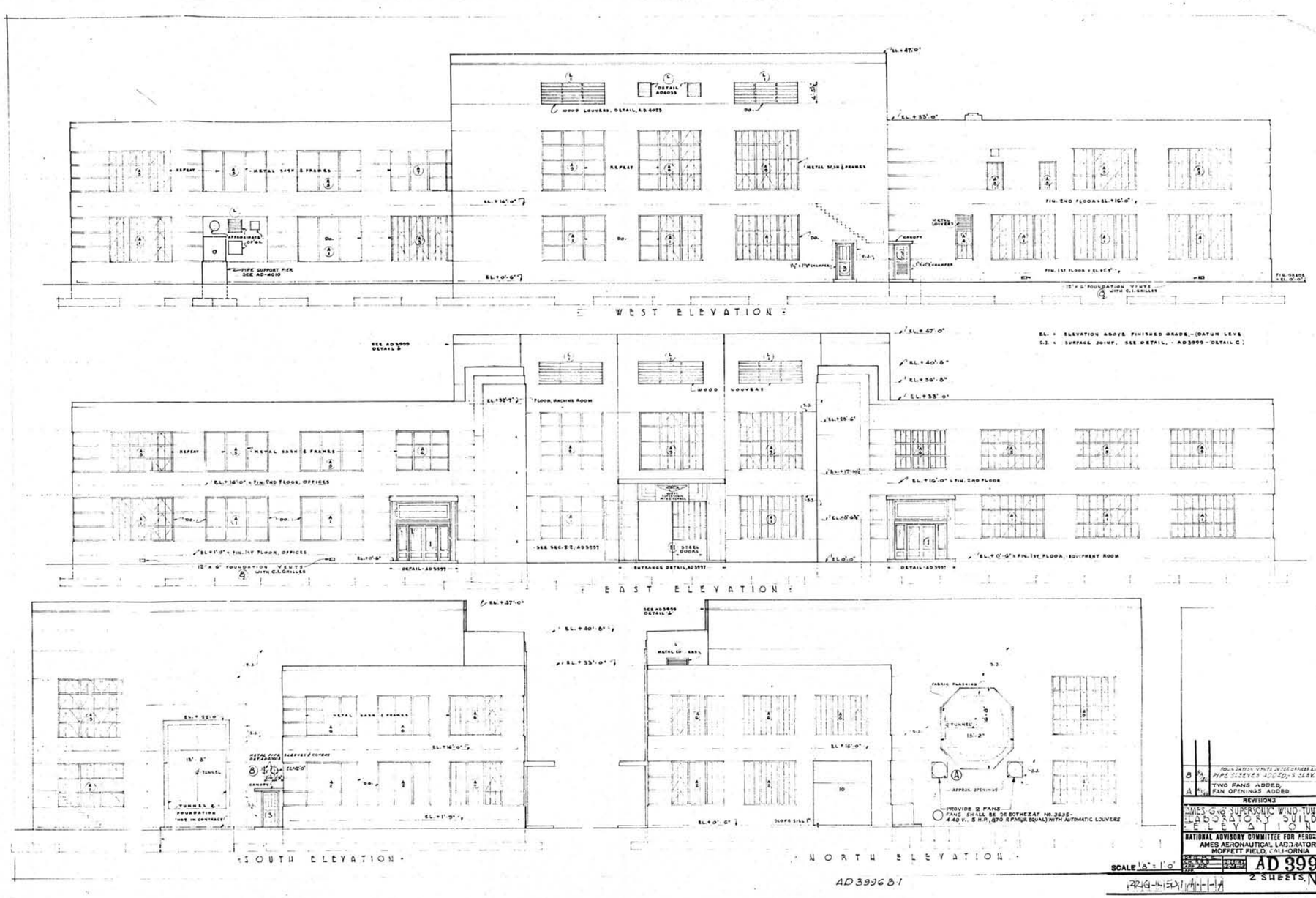
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIFORNIA

EXCEPT AS NOTED SCALE 1/4"=1'-0"

AD 3997

AD 3997

PH-20



AD 399681

PH-20

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Building 226 Reuse Guidelines

Appendix 7. NRHP Nomination

SETTING

Situated at the southern end of San Francisco Bay, the National Aeronautics and Space Administration (NASA) Ames Research Center borders the towns of Sunnyvale and Mountain View, near the heart of Silicon Valley. The Ames facility occupies approximately 430 acres of land and hosts a number of other federal, civilian, and military resident agencies on the adjoining 1,500-acre former United States Naval Air Station, now known as Moffett Field.

The 6 x 6 Supersonic Wind Tunnel Building is located on the western edge of Moffett Field, directly north of the 40 x 80 Wind Tunnel Structure and the 80 x 120 leg. Identified as Building N-226, the 6 x 6 Supersonic Wind Tunnel Building is located on the southwest corner of the intersection of Boyd Road and De France Avenue. The two-story building with mezzanine contains 33,383 gross square feet. Of that amount, the first floor contains 14,839 square feet of usable floor space and the second floor contains 11,824 square feet of usable floor space.

HISTORIC APPEARANCE OF THE 6 X 6 SUPERSONIC WIND TUNNEL BUILDING

Constructed between 1946 and 1948, historic photographs of the 6 x 6 Supersonic Wind Tunnel Building reveal that the configuration and exterior building materials have remained unchanged from the time of original construction. Although the setting of the building has changed, the types of changes that have occurred are consistent with the original uses employed at the site. The addition of other Ames buildings and structures in close proximity to the Administration Building has enhanced the feel of the building and do not detract from the historic appearance of the building or its surrounding environment.

Interior Space

The original interior configuration of the 6 x 6 Supersonic Wind Tunnel Laboratory Building ground floor consisted of office and meeting rooms (identified as Rooms 103 through 109) on the southern end, one large open space (identified as Room 115) on the northern end, and a central Shop section where models were produced for testing in the 6 x 6. Identified as Room 101, the Shop measured approximately 102’ x 90’ and contained wind tunnel machinery and equipment. Vacuum pumps and compressors for the wind tunnel were also located in this section.

The second floor originally consisted of office and meeting rooms on the southern end (identified as Rooms 204 through 208), additional rooms on the northern end (identified as Rooms 218 through 222), as well as the

Optical Laboratory (identified as Room 217). The center portion of the second floor, the test section, contained the actual test chamber of the 6 x 6 Supersonic Wind Tunnel, from which the tunnel's name is derived. A majority of the interior portions of the tunnel were located in the second floor test section, and along with the actual tunnel and test chamber, the second floor also featured a system of steel trusses on which a moveable bridge crane and hoist system operated. The crane was used to hoist aerodynamic models from the first floor model shop up through an opening in the ceiling and then over and down into the 6 x 6 Foot test chamber of the wind tunnel.

Also included in the second floor test chamber was the Schlieren photography equipment box, located on the east interior wall. The Schlieren system is an "optical high-speed photography imaging system used for visualization of supersonic shock wave patterns. In addition to the equipment box, the wind tunnel test chamber contained a set of Schlieren disks that the laser beam passed through in order to photograph the effects of the airflow and shock patterns on the models.

The two windows weighed more than one ton each and measured six inches thick, and fifty-two inches in diameter. According to one observers account:

> "…The most interesting thing to me about the 6 x 6 foot wind tunnel were the side windows used to observe the behavior of the models being tested. The two windows are the largest optically ground glass lenses in the world. The glass was poured by the Corning Glass Company and ground by Tinsley Company in Oakland. The guide told me they cost $50,000.00 each."[1]

MODIFICATION HISTORY OF THE 6 X 6 SUPERSONIC WIND TUNNEL BUILDING

Historic research has revealed that while the 6 x 6 was still in use, the wind tunnel building underwent few alterations and or modifications. Early on in the life of the wind tunnel researchers began to discover that the tunnel could not obtain data in the transonic ranges. This discovery prompted Ames staff member Charles Hall to explore modifications to the original design of the 6 x 6 wind tunnel. The alterations to the tunnel were completed in 1955 and the exact specifications of these alterations are unknown.

After the 6 x 6 test section was decommissioned in the late 1980s, the northern portion of the building's second floor was remodeled for use as the Ames Aerospace Encounter, which opened in October 1991. The Ames

[1] "Work At Ames Lab. Proves Eye-Opener," *Daily Palo Alto Times*, July 11, 1950.

Aerospace Encounter is a math and science based educational program that teaches 4th, 5th, and 6th grade students about science and technology in relation to space and aeronautics. The actual wind tunnel and related equipment is extant and is incorporated into the educational program. The first floor is currently used as a storage facility and most likely houses other miscellaneous uses. The southern portion of the second floor is used for office and meeting spaces. This current use is consistent with the original use. Overall, in form, materials and details, the 6 x 6 Supersonic Wind Tunnel Building retains its historic appearance.

CURRENT APPEARANCE OF THE 6 X 6 SUPERSONIC WIND TUNNEL BUILDING

The 6 x 6 Supersonic Wind Tunnel Laboratory Building was designed in a stripped classical style with an observable influence by the International and Streamline Moderne styles. The two-story, flat roofed building has a general rectangular, or modified T-shaped plan. The symmetrically designed building is divided into three sections with a center section flanked by a wing on each side. Each wing measures 79’ 4” in length by 50’ 4” in width (depth of wing portion) and the center section is 90’ long by 102’ deep.

The front, east elevation features a central slightly recessed façade flanked on each side by the building’s wing. The central portion of the building is taller than the two wings and measures approximately 47’ tall. The recessed facade contains double doors that lead to the ground floor model shop space that now serves several miscellaneous uses. Above the entrance is a pre-cast mitred concrete panel that is now partially covered with signage displaying “NASA 6 x 6 Foot Supersonic Wind Tunnel.” The original pre-cast panel most likely displayed lettering reading “NACA” indicating the building was originally constructed during the administration of the National Advisory Committee on Aeronautics (NACA). Above the double doors is a cantilevered concrete canopy featuring rounded corner edges indicative of the Streamline style. The central facade contains eight windows; two on the ground floor, three on the second floor, and, three rectangular shaped louvered windows above.

The two wings are horizontally divided into three sections by alternating bands of smooth concrete separated horizontally by rusticated concrete wall portions. A large metal hopper window with a nine-pane sash separates each rusticated wall section.

The exterior body of the wind tunnel and its related machinery obstructs view of the building’s rear, west elevation. This includes the cooling coils, the compressor and the drive motors. In addition, located directly

west of the building is the original wind tunnel cooling tower. In close proximity to the cooling tower is the spherical-shaped dry storage air tank.

INTEGRITY

Both the interior and exterior portions of the Ames Aeronautical Laboratory 6 x 6 Supersonic Wind Tunnel Building retain a good degree of integrity according to the seven aspects of integrity defined by National Register Bulletin 36: location, design, setting, materials workmanship, feeling, and association. The building remains at its original historic location. The building's original stripped classical design with Streamline Moderne elements remains intact. The current setting of a research facility with various buildings and structures surrounding the building is consistent with the original setting of the 6 x 6 Wind Tunnel Building. The historic materials originally employed on the exterior portions of the building are extant today. The workmanship is still evident in the exterior and interior portions of the building, and the feeling or historic sense of the 6 x 6 Wind Tunnel building is articulated through its form and modern, stripped classical details and through its current use. Moreover, the original wind tunnel and its components are completely intact and extant on the site.

SUMMARY OF SIGNIFICANCE

The Ames 6 x 6 Supersonic Wind Tunnel Building is significant at the national level under National Register Criterion A for its direct association with supersonic flight research and for its use as supersonic wind tunnel testing facility.

The 6 x 6 Supersonic Wind Tunnel Building is eligible for inclusion on the National Register of Historic Places at a national level of significance under Criterion A (event) in the areas of aeronautics and space exploration (1948-1988) for its association with important events in the areas of supersonic research and development. In addition, as an exceptional engineering accomplishment in the context of wind tunnel construction, the 6 x 6 Supersonic Wind Tunnel is also eligible for inclusion on the National Register under Criterion C.

HISTORICAL BACKGROUND

The NASA Ames Research Center was initially founded on December 20, 1939, as an aircraft research laboratory by the National Advisory Committee on Aeronautics (NACA), the forerunner of NASA. Ames has played a pioneering role in science and technology over six decades. The center was named for Dr. Joseph S. Ames, NACA Chairperson from 1927 to 1939. Ames was NACA's second laboratory, established after the Langley facility in Hampton, Virginia. In 1958, Ames became part of the National Aeronautics and Space Administration (NASA). Since its inception, Ames researchers have broken new ground in all flight regimes--the subsonic, transonic, supersonic, and hypersonic--using a collection of wind tunnels and research aircraft, the sophistication of which has increased over time. Ames has evolved into a diverse and sophisticated research campus of buildings influenced by the clean lines and materials of the International style, fused with elements of the Streamline Moderne, both styles are very well suited to industrial type buildings.

Ames specializes in research geared toward creating new knowledge and new technology, encompassing the fields of supercomputing, networking, numerical computing software, artificial intelligence, and human factors to enable advances in aeronautics and space. In aeronautics, Ames is the leading NASA agency in airspace operations systems, including air traffic control and human factors, and the lead center for rotorcraft technology. Ames also has major responsibilities in the creation of design and development process tools and wind tunnel testing. Ames houses one of the world's largest collections of wind tunnels and simulation facilities.

According to the NASA history publication, the *Wind Tunnels Of NASA*, the need for supersonic wind tunnels emerged out of a theory proposed by Langley scientist, Robert T. Jones, who hypothesized that the sound

barrier would be pierced more easily if an aircraft's wings were swept back. The first supersonic test was conducted in 1945 in the Langley 9-inch supersonic tunnel.[1]

While testing was conducted at Langley, the Ames staff was also pondering supersonic wind tunnel design. In May 1944 the Ames staff presented plans to NACA for the design and construction of a supersonic wind tunnel large enough for a person to work in. Prior to this time, the supersonic wind tunnels that had been constructed were small scale, and at Ames this consisted of the 1 by 3 foot supersonic wind tunnel and the 8-inch by 8-inch supersonic wind tunnel that served as a prototype of the 6 x 6.[2] Claiming lack of funds, the NASA administrators denied the Ames request to build a larger supersonic wind tunnel. Shortly after the Ames request was denied, Navy engineers approached NACA for assistance in building a supersonic wind tunnel. Seeing the need at Ames, and the Navy's availability of funds, the two agencies agreed to construct a new supersonic wind tunnel with a test chamber large enough for a person to work inside.[3]

Construction of the Ames Aeronautical Laboratory 6 x 6 Foot Supersonic Wind Tunnel Building began after the Navy had transferred the project funds to the Ames Aeronautical Laboratory in January 1945 and by June 16, 1948, the 6 x 6 began operations.

PERIOD OF SIGNIFICANCE

The Ames Administration Building is significant from 1948, upon completion of construction, through c.1988, when the wind tunnel was decommissioned. During this forty-year period, significant supersonic flight research discoveries occurred and designs for supersonic craft and missiles were created based on specifications derived from testing in the 6 x 6. This determination means that a majority of the events have taken place within the past fifty years. These events are considered exceptional in national aviation and aeronautics history.

[1] http://www.hq.nasa.gov/office/pao/History/SP-440/ch5-3.htm

[2] *Atmosphere of Freedom*, 27-34.
[3] *Ibid*.

DISCUSSION OF SIGNIFICANCE

Criterion A:

The 6 x 6 Supersonic Wind Tunnel is significant under National Register Criterion A in the area of aeronautics and space exploration due to its use as a supersonic testing and research facility where many significant discoveries were made that helped man fly at speeds above Mach 1.

Upon completion of construction in 1948, the Ames 6 x 6 was used to test every major jet aircraft and guided missile of the 1950s. This included drag reduction, stability and control, and inlet design – all at varying mach numbers.[4] The 6 x 6 was able to test models in the subsonic range, supersonic range, and transonic range producing speeds from Mach 0.6 to Mach 2.2. After other supersonic wind tunnels were constructed at Ames, namely the Unitary Plan 9 x 7 Wind Tunnel, the 6 x 6 was then used for basic research in the areas of inlet design for supersonic speeds, canard-type controls, vortex flows, and conical cambers.[5]

Criterion C:

The 6 x 6 Supersonic Wind Tunnel is significant under Criterion C because it is considered to be an exceptionally important engineering accomplishment in the context of wind tunnel construction.

Originally constructed in 1948, the design of the 6 x 6 Supersonic Wind Tunnel differed from other wind tunnels at Ames in that its design responded to the problems identified with conventional supersonic wind tunnel design. Conventional supersonic wind tunnels had to shut down and change the nozzle contours every time tests were to be run at different Mach numbers.[6] The 6 x 6 diverged in that it employed a design that enabled the tunnel to be continuously operated while the nozzle contour was modified in order to accommodate various Mach number tests. Originally conceived by Ames researcher and Director (1965-1969), H. Julian Allen, the 6 x 6 design consisted of a one fixed nozzle wall with the opposite nozzle wall sliding axially. The fixed and sliding wall design resulted in a changing contour, which was necessary in order to test for a range of Mach numbers. "Thus, the tunnel is asymmetric but variable. The key to the whole idea was the recognition that unique contours could be found, using one fixed wall and one moving wall, that would provide uniform supersonic velocities over a range of Mach numbers. In the 6 x 6 this range was Mach 1.3 to Mach 1.8. Later

[4] *Atmosphere of Freedom*, 33.
[5] *Ibid*., 33.
[6] http://www.hq.nasa.gov/office/pao/History/SP-440/ch5-3.htm

wind tunnels, notably the Ames 9 x 7-foot Unitary Plan Wind tunnel Mach 1.5 to Mach 2), and the Langley Unitary Plan Tunnel (Mach 1.5 to Mach 4.6) employed this novel concept."[7]

The Ames Aeronautical Laboratory 6 x 6 Supersonic Wind Tunnel was the first to incorporate the revolutionary fixed and moving wall design conceived by H. Julian Allen at Ames. It served as a pioneering example of a supersonic wind tunnel constructed large enough to accommodate a person inside the test chamber and moreover, it was the first supersonic wind tunnel to have the ability to continuously operate while changing the nozzle contour in order to test for different Mach numbers.

[7] http://www.hq.nasa.gov/office/pao/History/SP-440/ch5-3.htm

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VERBAL BOUNDARY DESCRIPTION

The boundary for the historic property encompasses the building envelope for the wind tunnel building and related machinery collectively identified as N-226 and located at the southwest corner of the intersection of Boyd Road and De France Avenue.

BOUNDARY JUSTIFICATION

The boundary was selected in order to include the original wind tunnel building that housed the test section and interior portions of the wind tunnel, and to also include the exterior wind tunnel portions located directly behind the building (to the west). The exterior portions include the original cooling coils, compressor and drive motors, the wind tunnel cooling tower, and the dry air storage tank.