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Lawrence Livermore National Laboratory, Site 300 Hydrodynamic Test Facilities Historic District (Buildings 850 and 851A) HABS/HAER Report

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HISTORIC AMERICAN ENGINEERING RECORD

LAWRENCE LIVERMORE NATIONAL LABORATORY, SITE 300 HYDRODYNAMIC TEST FACILITIES HISTORIC DISTRICT

BUILDINGS 850 AND 851A

HAER NO. CA-XXXX-A

Location: West of Route 4 in the northwestern section (West Firing Area) of Lawrence Livermore National Laboratory's (LLNL) Site 300, in the Altamont Hills, north of Corral Hollow Road, San Joaquin County, California

Present Owner: U.S. Government

Present Occupants: LLNL Site 300 testing organizations

Present Use: Building 850 is inactive. Building 851A is currently used primarily for conventional explosives testing.

Significance: As one of the nuclear physics package design laboratories for the U.S. nuclear weapons complex, LLNL designed and tested the nuclear core of its weapon designs. While full-scale nuclear testing was conducted at the Nevada Test Site, LLNL obtained Site 300 for explosives testing. A large part of that testing was hydrodynamic—understanding the behavior of the materials in the physics package at the moment of and immediately following a detonation. As two of the facilities added to Site 300 as the West Firing Area, Buildings 850 and 851A together represent the rapid growth of both the number and variety of nuclear weapons in the U.S. stockpile beginning in the mid-1950s. They also represent the critical role of hydrodynamic testing in LLNL's internal nuclear weapon design efforts. The district was determined to be eligible for the National Register of Historic Places under Criterion A; Building 851A was also determined to be individually eligible under Criteria A and C. The period of significance for the Site 300 Hydrodynamic Test Facilities Historic District is 1960-1992.

Part I. HISTORICAL INFORMATION

A. Physical History

1. **Date of erection:** [1]
   Building 850
   Designed: May 22, 1958
   Completed: December 31, 1959

   Building 851A
   Designed: May 1, 1959
   Completed: November 24, 1960

2. **Architect:** Indenco Engineers, Inc.
   Indenco Engineers, Inc., of San Leandro, California, designed and built Buildings 850 and 851A. Indenco was incorporated in California on April 1, 1952. Its founder, Joe Salley, had worked for the Manhattan Engineer District during World War II. Indenco specialized in military and industrial facilities, but also served as general contractor on various other projects, working with different architects on school projects, for example. The firm was dissolved in 1989.

3. **Original and subsequent owners, occupants, uses:** The test facilities have always been owned by the U.S. Government, as part of one of the laboratories of the Atomic Energy Commission (AEC) and its successor agencies (currently the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA)).

   Building 850 was designed and built as a Diagnostics Bunker housing cameras and related diagnostic equipment to photograph detonations of explosive devices on the firing table on top of and extending to the west of the building. It retained that mission until it was taken out of operation in 2008.

   Building 851A was also designed and built as an explosives testing facility. Housing a LINAC (a linear induction accelerator) to generate gamma rays in support of X-ray photography of explosives tests, it was the largest of the first five firing facilities built for hydrodynamic testing at

[1] The following drawings were used in determining the dates of the physical history of Buildings 850 and 851A: "Site 300 General Plans, Civil, Site Location Plan & Vicinity Map," PSZ1958-0850-0002J, Plant Engineering Library (PEL); "Site 300, Diagnostics Bunker 850, Civil, Site and Grading Plan," PSZ1958-0850-0004JA, PEL; "Site 300, Diagnostics Bunker 850, Architectural, Floor Plan," PSZ1958-0850-0006JA, PEL; "Site 300, HELAC Building No. 851, Title Sheet, Architectural, Index & Notes," PSZ1958-0851-0101JA, PEL; "Site 300, HELAC Building No. 851 and R.F. Shop, Civil, Site Plan," PSZ1958-0851-0202JA, PEL; "Site 300, HELAC Building No. 851, Architectural, Main Floor Plan," PSZ1958-0851-108JD, PEL; and "Site 300, HELAC Building No. 851, Architectural, Exterior Elevations and Roof Plan," PSZ1958-0851-0110JA.

Site 300. Although used primarily for conventional explosives testing in recent years, it retains its core purpose as a test facility and remains in use.

4. **Builder, contractor, suppliers:**
Indenco Engineers served as architect/engineer and construction manager for the initial construction of the buildings.

Holmes & Narver, Inc., undertook the addition to Building 851A in 1986.

LLNL's Plant Engineering organization oversaw all design and construction. It was also responsible for the minor modifications to both buildings.

5. **Original plans and constructions:**
Indenco Engineers, Inc., of San Leandro was involved in the design and construction of several facilities for LLNL, particularly at Site 300. It provided the original designs for Building 850 in May 1958 and for Building 851A a year later. The designs were based on LLNL specifications for its hydrodynamic testing needs. Indenco also undertook the original construction, completing Building 850 in December 1959 and Building 851A in November 1960.

Both buildings are reinforced concrete—floors, ceilings, and walls. The back portion of each is built into the hillside and essentially buried in earth and gravel. Each is topped with a firing table that extends beyond the building's exterior walls. Building 850 is one story; Building 851A is one story with a high-bay extending two stories to house the LINAC. Both were designed to house diagnostic equipment and cameras, as well as the related controls; Building 851A also housed controls for the LINAC.

6. **Alterations and additions:**
Building 850 underwent very little change in the years it was in use. A changing room (Room 1215) was added on the north end of the south side in 1961. Some activities were relocated within the interior rooms. Room 1006, originally the control room, became a camera repair room when the control room activities moved to Room 1010. Raised cable-access flooring was installed in Room 1010 when the control room moved. The room had housed Z raster oscilloscopes for test diagnosis. No longer in use, those were removed when the control room was relocated. The building otherwise remains as originally designed and built.

The building was decommissioned as a hydrodynamic test facility in 2008 and is no longer in use.

Building 851A experienced more significant and numerous changes over its history, although it, too, remains largely intact in purpose and basic design.

In the years immediately after the building opened, a few minor improvements were undertaken. In 1961, additional stand-by power for the LINAC injector was added via a new generator in the electrical equipment room (Room 119) and new electrical switches and panels in the electrical and mechanical equipment rooms (Rooms 119 and 122).[2]

In 1962, a new 12' x 12' generator cover was installed. In 1963, a change room was added (Room 120). It was a small room formed by partitioning the existing storage and ready room (Room 124) and giving the existing room a new doorway.[3]

In 1968, the entire LLNL built environment underwent a renumbering effort to more clearly align building numbers with locations. Site 300's facility numbers were changed from 300-series to 800-series. Building 350 became 850 and Building 351 became 851 and was later renumbered again to Building 851A. Their current numbers are used throughout this report.

In 1975, the two camera ports emerging from the west side of the camera room (Room 105) were replaced on the Firing Table. The existing cast steel cubicles were removed, as were the caulking, waterproofing, and port liner itself. New 26" long pipes 16.5" in diameter were installed and epoxy grout used to seal them. 26" in. diameter steel plate covers were installed.[4]

Also in 1975, an overhead bridge crane and 1-ton capacity hoist was installed in the LINAC room.[5] In 1977, the original detector room located north of the camera room (Room 105) was removed.[6]

Building 851A gained additional diagnostic capacity in 1986 when Holmes & Narver, Inc. completed a significant modification to the west side. The addition included a diagnostics corridor supporting additional cameras, an extension to the existing camera room, and a room to house a Fabry-Perot interferometer.

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[2] "Site 300, Building 851A, HELAC Bunker, Floor Plan, Stand-by Power for Injector," PSE1961-0851-0106CA, PEL.
[3] "Site 300, Building 851, Change Room Addition, Architectural, Plumbing, Ventilation, and Electrical Plans," PSA1968-0851-0601D, PEL.
[4] "Site 300, Building 851A, Room 105, Camera Port Modification," PSS1975-0851-0101D, PEL.
[5] "Site 300, Building 851, Bridge Crane Installation," PSS1975-081-0102D, PEL.
[6] "Site 300, Building 851, Detector Room, Detector Room Removal and Camera Stand Installation," PSS1977-0851-0101D, PEL.

In 1989, raised computer (cable access) flooring was installed in the control room (Room 117) and camera rooms (Rooms 105 and 128).[7]

In 1997, the earth-filled space between the Fabry-Perot Room and the Control Room was opened up and turned into Room 131, a diagnostics room. A double door frame was cut in the south wall and double leaf doors hung, a new cable trench (12" wide x 12" deep) was dug in the floor along the north and east walls, and a McMaster-Carr 1000-lb. capacity jib crane was mounted on the north end of the west wall. The floor slab was sealed, the membrane waterproofing was removed from the walls and they were painted, and a new concrete roof was built.[8]

The activities housed in the building have moved around and the equipment upgraded over the years. The control room equipment, in particular, has been upgraded to accommodate processing and electronic improvements (Figures 11 and 16; Photos 34 and 35).

B. Historical Context:

Buildings 850 and 851A are part of LLNL's West Firing Area at Site 300. The buildings were added to the site's suite of explosive test facilities as the lab expanded its testing capabilities in the late 1950s. Both were built to support hydrodynamic testing of nuclear physics package designs.[9] Hydrodynamic testing, as its name implies, is the observation of liquids in motion. Nuclear physics packages for nuclear weapons do not contain liquids, but the materials of which they are made, when under extreme pressure, behave like liquids. They are also moving at extremely fast speeds, but not necessarily at a consistent velocity. The goal in the testing is to determine in detail how the materials behave during and immediately after detonation.

LLNL Origins

In September 1952, the AEC established LLNL as a second nuclear weapons design facility as part of the overall build-up in the U.S. nuclear weapons complex at the time. Physicists Ernest O. Lawrence of the University of California Radiation Laboratory and Edward Teller of the University of Chicago advocated the founding of a second physics laboratory to accelerate the design and production of a thermonuclear weapon, arguing that these were the next advance

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[7] "Site 300, Building 851A, Computer Floor, Plan," PSA1989-0851-0102DA, PEL.

[8] "Site 300, Building 851A, Room Addition, Floor Plan and Notes," PSA1996-0851-0001DA; and "Site 300, Building 851A, Room Addition, Partial Floor Plan and Partial Roof Plan and Structural General Notes," PSS1996-0851-0001DA.

[9] The items being tested were not full-up physics cores for the nuclear weapons, but designs containing little or no radioactive material. None of the tests at Site 300 involve radioactive materials achieving criticality. Full-scale nuclear testing was conducted at U.S. test sites in the Pacific or at the Nevada Test Site.

in atomic weaponry. Neither Lawrence nor Teller felt that Los Alamos National Laboratory (LANL)[10] was working aggressively enough to achieve this goal. Their argument was well-received within the AEC, as the Soviet Union had detonated its first atomic weapon in 1949, adding a nuclear arms race element to the early Cold War. American policymakers, fearing the potential actions of an enemy armed with nuclear weapons, determined to deter their use by significantly increasing the U.S. stockpile's size and capability.

Although the primary goal of LLNL was to design and develop a thermonuclear weapon, Herbert York, the laboratory's first director, insisted on including non-weapons research in the mission of the laboratory. The four missions he articulated for LLNL were designing thermonuclear weapons, providing diagnostic measurements for weapons tests for Los Alamos and Livermore, developing a controlled thermonuclear reaction for power sources, and basic physics research. He hoped to attract the brightest young scientists in the country and felt that there should be breadth and depth of research options beyond nuclear weapons investigations to attract them.[11]

The lab was initially established as another site of Lawrence's University of California Radiation Laboratory, from which it would ultimately separate. Although it pursued non-weapons research, its early growth and focus were predominantly on nuclear weapons. Specifically, the physics package—or core—design, including the high explosives used to compress the radioactive material to criticality. There were a variety of new nuclear weapon designs proceeding through the nuclear weapons complex in the second half of the 1950s, supporting the U.S. policy of deterrence. LLNL's designs were part of that and the design effort including testing.

As early as 1953, LLNL administrators noted the need for a remote site to conduct high explosive tests for the weapons program. Obtaining land for a self-sufficient test site was deemed critical to the long-term success of LLNL's weapons design program. Without one LLNL would be reliant on LANL to provide both fabrication and test firing of new device designs. LLNL began the search for suitable land. It needed to be remote, with sufficient space (at least one mile in radius) for a 1000 lb. detonation, as near as possible to Livermore (less than a one-hour drive and accessible in all weather conditions), and reasonably free of cover to avoid fire hazards.[12] The site selected was named Site 300.

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[10] The current names of the national laboratories are used throughout this report to avoid repeated explication of titles.

[11] University of California, Lawrence Livermore National Laboratory, *30 Years of Technical Excellence* (Livermore: Lawrence Livermore National Laboratory, 1982), 4; and Herbert York, "Making Weapons, Talking Peace," *Physics Today* (April 1988): 44–45.

[12] "Preliminary Proposal for Site 300," 1 July 1953, Ernest Orlando Berkeley National Laboratory Declassified Records, 43–95, Box 4, File 19–10–364, LBNL Archives; and Herbert York to General Kenneth E. Fields, "UCRL High Explosive Test Requirements," Ernest Orlando Lawrence Berkeley National Laboratory Declassified Records, 434-95-19-10-364, Box 1, File 13, LBNL Archives.

Site 300

LLNL's Site 300 occupies approximately 7000 acres in the rolling hills of the Diablo Range. It is approximately 17 miles southeast of Livermore and 12 miles southwest of Tracy, by road. It houses LLNL's explosives and developmental testing facilities. "Site 300 provides the facilities that allow the multiple, simultaneous diagnostics capability that has become the single most outstanding feature of the LLNL approach to hydrodynamic testing."[13] As other non-nuclear weapons mission areas have expanded, diagnostic facilities at Site 300 used in support of them, as well.

In 1954, the University of California Regents authorized the University to negotiate a ten-year land lease near Tracy for a research facility.[14] Rather than lease, in 1955 the AEC acquired 3,400 acres of ranch land from William J. Kelley, F. B. Kelley, and Bert Banta to conduct HE experiments.[15]

In 1957, LLNL purchased 3000 additional acres to the west of the existing Site 300. This area, identified as the West Firing Area, was acquired to host additional and larger hydrodynamic testing as program needs expanded in response to the demands for a growing U.S. nuclear stockpile. Buildings 850 and 851A were built in the West Firing Area.

Facilities at Site 300 are grouped by function. Support activities are primarily located in the General Services Area in the southeastern tip of the site, near the entrance. The Physical Environment and Dynamic Test Areas are just north of the General Services Area. The Process and Chemistry areas are in the southeast portion of the site, just west of the General Services and Environmental Test areas.

The East and West Firing Areas take up the northern portion of Site 300, occupying most of the site, "with 1785 and 2155 acres respectively."[16] They require a great deal of space, not just for the test activities they house, but also for the buffer zones around the facilities. The East Firing Area was established first, with the decision to expand the number of facilities as well as the size of the shots fired pushing the acquisition of additional land for the West Firing Area.

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[13] Ruth and Going, Inc., "Development Plan: Site 300," n.d., Box 178, Folder 1662 Site 300: Development Plan, LLNL Archives, 9.
[14] Copy of page from October 22, 1954 UC Regents Minutes, in "Summary of the Attached Correspondence, Subject: LLL/UC Regents/ERDA-San Agreements for Safety of Site 300 Operations," Box 178, Folder 1663 Site 300 Safety, LLNL Archives.
[15] "Proposed Weapons Research Remote Site," Site 300 Memorandum, 18 October 1954, Administrative Files Donald Cooksey, Lawrence Berkeley Laboratory, 1960, Folder Reactors, Plant, Livermore Site 300, LBNL Archives.
[16] Ruth and Going, 22.

The key facilities forming the West Firing Area were Buildings 850 and 851A. These facilities could handle larger high explosive shots than the East Firing Area. Once completed, they became LLNL's primary hydrodynamic test facilities and 851A remained a key part of hydrodynamic testing until completion of the renovation of Building 801 into a Confined Firing Facility in 2001.

Completed first, Building 850 opened in 1959 as a diagnostics bunker. It housed multiple diagnostic features that could be deployed to capture data from explosives tests on its firing table. These included high-speed cameras and pin systems to capture images and track velocity of the materials in the test devices as detonation occurred.

Building 851A, housing a linear accelerator, was originally identified as the HELAC Building. HELAC stood for high explosive linear accelerator; the term was later dropped and replaced with the more generic and widely used LINAC.

Like 850, Building 851A had cameras and pin diagnostics capabilities. In addition, it was designed specifically to house the linear accelerator. In a slightly unusual deployment of an accelerator at the time, the 851A LINAC was used to produce gamma rays for taking high-speed photographs of test items during an explosion.

Based on an LLNL design, the LINAC was built by ARCO.[17] Approximately 35' long, 6' high, and 3' wide, the machine could pulse electrons to 35 million electron volts (MeV). It produces long (up to 30 microseconds) pulses of electrons, which ride a radiofrequency envelope down the length of the accelerator. The beam pulses continuously into a heavy metal target and generates gamma rays. The gamma rays are directed at the firing table and generate images of the test objects.

The LINAC is on the mezzanine level in the LINAC high bay of Building 851A. The rest of the building is single story. A capacitor bank sits on the main level below the LINAC, sending power to it. Radiofrequency modulators generate the pulse, which is then injected into the LINAC. Winding coils and steering magnets keep the beam straight as it moves along the accelerator to the tungsten target, which is inside a heavily reinforced concrete bullnose between the mezzanine and the firing table.

The machine has been modified over the years. The injector was replaced in the early 1980s, the modulators were moved from the building's main level to the mezzanine and various components have been replaced. Its basic operation and purpose remained intact over time, however.

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[17] J. S. Norton to D. A. Bruce, memorandum, 8 January 1959, Administrative Files Donald Cooksey, Lawrence Berkeley Laboratory, 1959, LBNL Archives.

High-speed cameras also capture the shot in detail. Using cameras to capture high explosive detonations was not a new development when Site 300 opened, but LLNL's decision to place cameras in a bunkered building under the firing table and point them upward to film the tests was unusual. Part of the overall effort to get in closer to the explosive shot without destroying the equipment and emphasizing stability and repeatability in test set-ups, the design was remarkably effective. LLNL also pursued improved camera designs, by the 1980s working with industry to produce a high-speed image converter camera system that allowed dynamic spatial resolution, provided multiple optical paths with different magnifications and could operate at a high-ambient-light level.

In 1986, an addition was put on the north end of Building 851A. This included a diagnostics corridor that extended under the firing table, a Fabry-Perot room, and an extension to the existing camera room. This added 14 camera ports to the firing table (6 in the diagnostics corridor, 7 in the extension of the camera room, and 1 in the new Fabry-Perot Room).[18]

The new Fabry-Perot room housed a Fabry-Perot interferometer, which measures the Doppler shift of light as an object moves. This gives velocity, not as the overall distance over time, but as it changes as the object moves. It offers a more granular understanding of how the materials in a test item are moving during detonation and how the blast wave and its forces move.

New image converter cameras, powered by a ruby laser, were added to Building 851A in the 1990s. As described in 2008, cameras and mirrors on the firing table were set up around a test object. Data from all sources is captured within Building 851A. 70 mm camera film captures 26 separate sets of images of each shot. The film is loaded and hand-processed within the building.

Over time, the numbers of new weapons entering the stockpile declined and, by the 1970s, Building 850 was used for a variety of conventional high explosives tests and finally decommissioned in 2008. Building 851A also had conventional high explosive testing added to its mission in later years and is still active.

Building 851A did all of the hydrodynamic shots needed prior to full-scale nuclear testing at the Nevada Test Site until the mid-1980s when Building 801 came online. At this point, it does mostly conventional HE shots.

In 2011, LLNL began planning the removal of the LINAC from Building 851A and pursuing other modifications to the facility including upgrading computers

[18] "Site 300, Bunker 851A, Modifications, Legend and Site Plan," PSE1986-0851-0101D, PEL; "Site 300, Bunker 851A, Modifications, Lighting Plan," PSE1986-0851-0103D, PEL; "Site 300, Bunker 851A, Modifications, Floor Plan and Section," PSS1986-0851-0101D, PEL; "Site 300, Bunker 851A, Modifications, Roof Plan and Details," PSS1986-0851-102D, PEL; and "Site 300, Bunker 851A, Modifications, Retaining Walls," PSS1986-0851-0108D, PEL.

and monitors in the control room, adding metal panels over camera ports and replacing the metal front-piece on the bull-nose with a newer metal panel. And in 2014, several employee support rooms were renovated and updated. Because Building 851A is an active facility for ongoing hydrodynamic testing, LLNL proposes to continue modifications as new uses for the equipment are found and as space within the facility is re-purposed to support research programs.

Part II. ARCHITECTURAL INFORMATION

A. General Statement:

1. **Architectural character:** Both facilities have an industrial look and feel. **Building 850** is a heavily reinforced concrete bunker built into the hillside and topped with a firing table that extends to the northwest. The thick concrete walls and roof, as well as the camera ports extending from the camera room up to the firing table, reflect its purpose as a diagnostic facility for high explosive testing. The camera room (Room 1203) and control room (Room 1010) reinforce the impression in their combinations of rugged concrete construction with technologically sophisticated (for their era) camera mounts, ports, and equipment racks. Rooms referenced in this description and in the following text are identified in the building's key plan (Figure 1).

   Building 851A is a heavily reinforced concrete building housing a LINAC in the mezzanine of a high bay on its north side. The building sits under a firing table that extends to the west and south. The building's design, particularly the reinforced concrete walls and ceiling and the blast doors reflect its purpose as a high explosive test facility. Rooms referenced in the following descriptions are identified in the building's key plans (Figures 2 and 3).

2. **Condition of fabric:**
   Building 850 is in fair condition. The building is inactive and the cameras, related diagnostic equipment, and controls have been removed.

   Building 851A is in good condition. The building is in active use and is maintained by LLNL's plant engineering organization.

B. Description of Exterior:

1. **Overall dimensions:**
   Building 850: The main section of Building 850 is a rectangle with the northwest corner cut off (the north and west walls do not meet at a right angle, but are connected by a northwest wall). The loading dock area is also a rectangle aligned with the main building on their south sides, but extending past the main building on the north side. The sub-station attached to the building extends from the loading dock's south side (Figure 1).

   The main building's east wall is 61', south wall 59', west wall 47', northwest wall 19'8", and north wall 45'.

   The loading dock is 29' wide x 73'4" long with the substation 10'8" x 14'8".

The resulting building footprint is approximately 88'8" wide x 90'2" long.

Building 851A: The main floor of Building 851A is basically a rectangle with an L-shaped extension off of its west end (Figure 2). The front (east) side is 86'3" wide, including the exterior loading docks/walkways that extend around the north, east, and south sides. The south wall extends 107'6" from the east end to the end of the original building's west wall. The addition begins 19'11" north of the south exterior edge. The south wall of the addition is 36'2 1/8", extending from the west wall of the original building to the east wall of the tall leg of the L-shaped addition. The east wall of the addition then extends 28'8" to the south. A 15'6" wall forms the top of the L. The west wall of the addition is 119'. The north wall of the addition is 53'8 1/8" and meets the north end of the LINAC high bay. The west wall of the high bay is 27' and the building's north wall is 105'6".

The LINAC mezzanine of the high bay is a rectangle with the bullnose extending from its west end (Figure 3). The east and west sides are 26' and the north and south are 54'6". The bullnose extends another 19' to the west. It is 9' wide at the nose (the west end).

The resulting building footprint is approximately 146' wide x 143'8 1/8" long.

2. **Foundations:**
   Building 850 has a reinforced concrete foundation.

   Building 851A has a reinforced concrete foundation on a 6" rock fill base course.

   The LINAC high bay has 2' of filter material fill at its base. Above that is a 6" rock fill followed by a vibration insulator. A poured concrete foundation rests on that and extends to the floor of the mezzanine level, where the LINAC sits.

   The bullnose sits on a 3' steel-reinforced concrete foundation, with draining channels.

3. **Walls:**
   Building 850: The south and east exterior walls are 1' thick reinforced concrete; the west, north, and northwest walls are 2' thick concrete. The south, west, northwest and north walls have membrane waterproofing on their outer layer, where the gravel buildup to the firing table meets the building.

Building 851A: The east and south exterior walls are 1' thick reinforced concrete; the west walls are 2' thick reinforced concrete. The east portion of the north wall is 1' thick reinforced concrete but the west portion of that wall (the exterior of the LINAC high bay area) is 3' thick reinforced concrete. The walls are 15' high on all sides except the LINAC high bay, which rises to 26'4" above the loading dock level.

4. **Structural system, framing:** These are both steel-framed concrete buildings with extensive steel reinforcing in the poured walls. The LINAC foundation includes a vibration insulator that separates the LINAC and its beam from the rest of the building's activities.

   The bullnose has steel reinforcement closely spaced throughout its design. In addition, steel mesh is placed in the concrete of its outer edges.

5. **Porches, stoops, balconies, porticoes, bulkheads**: There are none. Both buildings have loading docks on their front entrance sides (Photos 5 and 17).

6. **Chimneys:** There are no chimneys in either building.

7. **Openings:**
   a. **Doorways and doors:**
      Building 850 has two doors on the east side. The main entrance is a large steel blast door in a 4" thick frame. It opens to an inner two-leaf metal swinging door with a window in each side (Photos 3 and 5).

      The building also has a metal naval hatch-type door just to the north of the main door. This leads into the shower/change room addition (Photo 5).

      Building 851A has several exterior doors. The front (east) side is the primary building entrance, with two large steel blast doors providing access to Corridor 2 and Room 122 (Figure 2; Photos 17 and 18). The entrance to Room 121 is open (Photo 18). Room 119 has two openings on its east side. The north doorway is open with no door and the larger, south doorway has a chain link fence and gates (Figure 2; Photo 17).

      There are two pedestrian blast doors on the building's north side. One is near the west end of the wall and leads from the firing table, just behind the bullnose, into the mezzanine (Figure 3;

Photos 19 and 41). The other is slightly further west, on the north side of the bullnose (Figure 3; Photo 21).

There are two pedestrian doors in the diagnostics corridor addition. A single-leaf door opens from the south side of the equipment room (Room 130) and a double pedestrian door opens from the south half of the east side of Room 27.

b. **Windows and shutters:**
Building 850 has no exterior windows. The double swinging doors inside the main entrance have a window in each leaf.

Building 851A has no windows.

c. **Camera and equipment ports**
Building 850: Four camera ports extend from Room 1203 up through the roof and to the firing table. They are in cast steel cubicles at the top. They are arranged in a northwest line; their centers sit 6'8" from the outer edge of the building's northwest wall (Photo 8).

Building 851A: There are 8 camera ports extending up from the original camera room (Room 105) and 7 from its extension (Room 128). In addition, there are 6 ports in the diagnostic corridor (Room 127) and one near the north wall of the Fabry-Perot room (Room 129) (Photos 30, 32, and 33). They rise as steel tubes and have steel covers at the firing table level (Photos 22 and 24).

8. **Roof:**
Building 850's roof is flat. It is 1' thick reinforced concrete covered with a light concrete fill, a waterproofing membrane, grout, and then gravel fill to the firing table above. An 8" wide concrete curb extends 2' above the roof to hold the gravel fill below the surface of the firing table. Steel plates are in place on part of the firing table surface.

Building 851A's roof is flat. It is constructed of 1' thick square poured concrete slabs with steel reinforcing running both north-south and east-west through them. A 1' wide concrete curb extends 2' above the roof along the east wall, forming the edge of the firing table. The roof is topped with #8 x 5/8" graded gravel cover 2' deep, forming the firing table.

The roof of the LINAC high bay is also 1' thick reinforced poured concrete topped with a 5" deep gravel cover

9. Firing Tables

Building 850: Above the roof the building is covered in 2' of gravel, which forms the top of the firing table. The firing table extends beyond the edge of the building 40' to the north, 55' to the northwest, and 68' to the west. Beyond the building's roof, the firing table is covered in a 4' gravel fill.

There are two poles on the firing table for suspension shots with conventional high explosives. There is also a 155 mm Howitzer on the table (in a tented space). This is Gun No. 3927 made by the Vermont Arsenal in 1945; it was used previously at the drop tower and at Building 812 at Site 300.

Building 851A: Above the roof, the building is covered in 2' of gravel, which forms the firing table. Beyond the building's edge the firing table is 4' thick.

10. Bullnose

Building 851A's LINAC beam extends out to the firing table through a heavily reinforced concrete structure referred to as the bullnose. The bullnose meets the building at the west end of the LINAC high-bay mezzanine. It is a protective shield for the vacuum tube and target of the LINAC, allowing the beamline to reach the test object (Photos 39 and 40). It effectively separates the LINAC from the explosives testing.

Named for its shape, the bullnose is a heavily reinforced concrete structure extending 19'6" from the outer wall of the west end of the LINAC high bay and standing 17'2". The bottom of the west edge of the bullnose flares out slightly—the top of the structure is 19' from the LINAC high bay's outer wall. The bulnose's east side is 21'8" wide. The north and south sides of the bullnose extend straight out from the high bay for 8'10" then taper towards the nose, which is 9' wide. Similarly, the top extends for 13'6" from the high bay wall and then tapers down towards the nose, the top of which stands 14'2".[19]

The bullnose walls are thick, It sits on a 3' thick concrete foundation and then has a 2'2" thick concrete floor. The ceiling is 4'2" thick and the front wall is 2'6" thick. It is all reinforced concrete, with a steel mesh in the outer portion of the concrete forming the tapered walls to the nose. The nose is capped with 4" steel plating with an opening for the beamline to exit (Photo 23). The purpose of the reinforcement and steel plating is

[19] Details of the bullnose's construction are taken from a site visit and "Site 300, HELAC Building No. 851A, Architectural, Bullnose Details," PSZ1958-0851-0118JA, PEL; "Site 300, HELAC Building No. 851A, Structural, Elastic Bullnose Plan and Details," PSZ1958-0851-0129JB, PEL; and "Site 300, HELAC Building No. 851A, Structural, Elastic Bullnose Details," PSZ1958-0851-0130JB, PEL.

evident in the scarring on the bullnose's face and sides from the explosives testing that has taken place on the firing table in front of it (Photos 20, 21, 23, and 24).

In addition to the front opening allowing the beamline through, the bullnose has two other openings. It has a steel blast door on the north side leading out to the firing table (Photo 21). It also has a 6'x4' steel hatch in the top to access the interior.

A jib crane is mounted on the top of the bullnose, just north of the center steel hatch plate (Photos 19 and 20).

C. Description of Interior:

1. Floor plans:

Building 850: The current floor plan is shown in Figure 1.

Personnel access the building via the loading dock area on the building's east side. An east-west corridor (Corridor 1 on the floor plan) leads into the building and intersects with an east-west corridor. All rooms are accessed off of these corridors, except Room 1010A, which is accessible through Room 1010, and two exterior rooms, Room 1018 and 1215, which sit on the front of the building in the loading dock area.

Rooms and their purpose prior to the building's shutdown are described below. They are listed in counterclockwise order beginning with at the building's entrance.

Room 1215 is the shower/change room. It is not accessed from the building's interior, but via the steel naval hatch on the loading dock.

Room 1216 is an office.

Room 1213 originally housed a bank of capacitors; it was converted to office space.

Room 1203 is the camera room.

Room 1008 is an office.

Room 1006 was originally the control room. When the control room moved to Room 1010, this space was converted to camera repair.

Room 1010 originally housed the Z raster oscilloscopes. It then became the control room.

Room 1010A is an electronics shop.

Room 1009, formerly a lab, is empty.

Room 1210 is a restroom.

Room 1212 originally was the machine shop, housing a lathe, drill press, and mill. That activity was moved to the Arco building north of Building 850.

Room 1018 is on the south end of the loading dock/parking area. It is accessed via steps from the parking area.

Building 851A: Current floor plans are shown in Figures 2 and 3.

The primary personnel entrance to the building is via the door into Corridor 2 on the loading dock on the east side. The corridor proceeds westward, passing offices and laboratories on the south side and the large control room (Room 117) to the north. The corridor extends past Rooms 131 and 129 before reaching the diagnostic room (Room 127) at the far west end of the building. The rooms along the building's north side are accessed via the control room (Room 117), the diagnostics room (Room 127) or the mechanical room space (Room 121). A stairway to the LINAC high bay mezzanine is located in Room 115.

The extant rooms and their purposes are listed below. They are listed as encountered when entering the building at the east end of Corridor 2 and moving roughly clockwise.

Room 124 is a storage and ready room.

Room 120 is a restroom.

Room 118 is a restroom.

Room 118A is a janitor's closet.

Room 117 was built as the electronic rack room, which over time was referred to as the control room. It houses controls for both the firing table and the LINAC (Figures 11 and 16; Photos 34 and 35).

Room 116 is a dark room. The facility has always processed its own film.

Room 114 is an electronics maintenance area.

Room 112 is an office.

Room 110 is currently an office space.

Room 108 housed the flash x-ray and its capacitors. It is now referred to as the FXR Darkroom.

Room 131 is a diagnostic room. It was added in 1997. After the 1986 addition, it was an earth-filled void area between the control room (Room 117) and the Fabry-Perot room (Room 129).

Room 129 was created as part of the 1986 addition. It was built to house the Fabry-Perot interferometer and was designated the Fabry-Perot room. It is now known as the laser room. Until recently, it housed a laser to support the interferometer, as well as a ruby laser illuminator for the image converter cameras. The lasers were brought from another facility and installed here in the 1990s.

Room 127 was built as part of the 1986 addition. It is the diagnostics corridor and has additional hardening, as it sits under the firing table.

Room 128 is the extension of the original camera room (Room 105). It was created as part of the 1986 addition.

Room 105 is the original camera room.

Room 107 is an office.

Room 113 was originally the modulator room for the LINAC (Figure 14). When the modulators were upgraded and moved to the mezzanine, pulsed regulators were installed in Room 113 (Photo 36).

Room 115 is a work area. The capacitors for the LINAC are housed near the stairs to the mezzanine.

Room 119 is an electrical equipment room.

Room 121 is a mechanical area housing gas bottle racks.

Room 122 is the building's mechanical room.

The second floor is the mezzanine of the LINAC high bay.

2. Stairways:

Building 850: There are no interior stairways in Building 850.

Building 851A: A straight flight of stairs leads up from the north side of Room 115 on the building's main floor into the east end of the mezzanine in the LINAC high bay area.

There is a short flight of concrete steps down from the entrance into the mechanical room (Room 122).

3. **Flooring:**
Building 850 has poured concrete floors in all rooms and corridors. Corridors and laboratory spaces (including the camera room) have 12" wide cable trenching with steel covers along the edges or across workspaces (Figures 8 and 9; Photos 12 and 14). Trenches extend between each of the camera mounts and the northwest wall in Room 1203 (Figure 6; Photo 12).

There is raised access flooring above the concrete floor in the control room (Room 1010). The corridor rises in a ramp at the connection to Room 1010 (Photos 13 and 14).

Building 851A has poured concrete floors throughout; some are covered in other flooring materials.

The camera rooms (Rooms 105 and 128), control room (Room 117), and laser room (Room 129), have 2'x2' raised access floor tiles above their concrete floor, allowing access to cable configurations (Photos 29, 30, 32, 33, 34, and 35).

There is 12"x12" vinyl floor tile in the FXR dark room (Room 108), the modulator room (Room 113), and the offices (Photos 26, 27, and 37).

4. **Wall and ceiling finish:**
Building 850's exterior walls and roof are concrete. As a result, the exterior walls of the interior are concrete (Photos 12 and 13). Although they are painted, they are not covered in other materials. The interior south wall of the camera room (Room 1203) is metal. All other interior walls are gypsum board, painted (Photos 14 and 15).

Building 851A's exterior walls and roof are concrete and the exterior walls of the interior rooms are often concrete, painted but otherwise uncovered. With few exceptions, the ceiling also remains uncovered but painted concrete.

The camera rooms (Rooms 105 and 128) have concrete walls painted white and concrete ceilings painted black. In Room 108 the west and south walls are concrete and the east and north are painted gypsum board. The ceiling is concrete. Room 113 has metal walls and ceiling. The control room (Room 117) has gypsum board walls, although the racks of control equipment effectively form their own walls. It has a suspended ceiling of ceiling tile panels. Room 127's walls and ceiling are painted concrete. Room 129 has concrete walls and a painted concrete ceiling; sound deadening panels were installed on the walls to reduce disturbances to the laser beams. In Room 131 the east and north walls are concrete and the west and south walls are painted gypsum wall board. The ceiling is 2'x2' suspended ceiling tiles.

5. **Openings:**
   a. **Doorways and doors:** There are both wood and metal doors providing pedestrian access to offices and labs throughout these buildings.

      Building 850 has two sets of swinging two-leaf doors. One set is immediately inside the main entrance (just inside the steel vault-type exterior door); the doors are metal with windows for pedestrian views of oncoming traffic (Photo 15). The other is at the entrance to the control room (Room 1010). This set is wood, also with windows in each leaf (Photo 14).

      The office doors are single-leaf wood doors. The door between Rooms 1006 and 1203 is a single-leaf pedestrian door. It is wood (Figure 9).

      Building 851A has wood office doors and predominantly metal doors for laboratories and technical areas. The access between Rooms 108 and 110 is provided via a metal-and-cloth revolving door (Photo 27). Room 115 has a sliding lead door for shielding. Room 129 has a metal door (Photo 29). Room 131 is a metal double door.

   b. **Windows:**
      Building 850: There are windows in each of the double doors just inside of the steel door at the main entrance (Photo 15). A second set of double doors at the entrance to the control room also has a window in each swinging door (Photo 14).

      Building 851A has no internal windows.

c. **LINAC:** In Building 851A, the LINAC beam runs through an opening in the west end of the bullnose to reach the firing table (Photos 23 and 39).

6. **Decorative features and trim:** There are no decorative architectural features on or in either building. The buildings' designs are in keeping with the other test facilities of the same era at Site 300. They are basic and industrial in appearance.

7. **Hardware:** There is no historic hardware in either building.

8. **Mechanical Equipment:**
   a. **Heating, air conditioning, ventilation**:
   Building 850 has a substation on the east end of its south side, a colling tower on the south end of its east side, and a mechanical room (Room 1018) supplying heating, ventilation, and air conditioning to the building. Ductwork is apparent in the ceilings of the building's rooms (Figures8 and 9; Photos 12, 13, 14, and 15)

   Building 851A's electrical and mechanical rooms (Rooms 119 and 122) bring heating, air conditioning, and ventilation into the building. It is routed via ductwork in the ceiling (Photos 28, 31, and 33).

   b. **Lighting:** There are no historically significant light fixtures in either building.

   Building 850 has dropped fluorescent lights suspended throughout the corridors, control room and camera room (Photos 12, 13, 14, and 15).

   Building 851A has fluorescent lighting throughout. There are dropped fluorescent light panels suspended from the ceiling in Rooms 127 and 129. In the camera room (Rooms 105 and 128) the lights are mounted at an angle at the top of the walls. In the rest of the building, fluorescent lights are mounted at the ceiling level.

   c. **Plumbing:** There are no historically significant plumbing fixtures in either building. Water is supplied via LLNL's infrastructure.

   d. **Cranes:**

Building 850: There is a 2000-lb. crane rail (no crane) running east-west in the loading dock ceiling (Photo 5). There is a small crane rail (200 lb. capacity) in the ceiling of the camera room (Room 1203) (Figure 7; Photo 12).

Building 851A: A McMaster-Carr 1000-lb. capacity jib crane is mounted on the north end of the west wall of Room 131 (Photo 28). There is an overhead bridge crane and 1-ton capacity hoist in the LINAC high bay. There is also a crane and hoist in the bullnose (Photo 40).

9. **Original Furnishings:** There is no historic furniture in either building.

D. **Site:** Buildings 850 and 851A form a non-contiguous historic district in the West Firing Area of Site 300. Both sit in the rolling hills of Site 300 in locations chosen for their rising hillsides. The locations thus serve as natural buffers for explosives testing, directing the energy from detonations up instead of out toward other facilities.

1. **Historic landscape design:** Neither building has a historic landscape design.

   Building 850 is built into the hillside, with the land contoured and shaped around it to form a road that rises along the south side of the building to the firing table. The parking area in front of the east side of the building is paved and there is no foliage on or around it or near the building and its firing table, although the hillsides are covered with native plants. The firing table on top of the building extends beyond the building to the north and west. Recent decontamination of the site and erosion control efforts resulted in some re-contouring of the hillsides around the building (Photo 1).

   Building 851A is built into the hillside. The land around it is contoured and shaped to form the firing table that sits on the building's roof and extends to the west of it. A large earth berm is formed to rise behind the firing table, providing an observation area, on which equipment can be mounted (Figure 17; Photo 24). A road curves from the front (east side) of the building around to the north of the facility to the west side behind the earth berm (Figure 17).

2. **Outbuildings:**
   Building 850: A small (14'8" x 10'8") sub-station is attached to the east end of the building's south exterior wall. Its south and west walls are 8" thick concrete and its east side is open, with a woven wire fence and gate (Photo 2).

A small metal bunker sits to the north of Building 850. It is a corrugated steel Arco building with naval hatch doors on its east side. It served as a machine shop supporting Building 850 activities and housed lathes, drill presses, and grinders (Photos 6 and 16).

Building 851A has two outbuildings.

Building 851B was built at the same time as Building 851A. It was designed to be a Radio Frequency (RF) Development and Repair Shop supporting the LINAC activities in 851A. It is currently used as a machine shop. It is located to the east of Building 851A, across the road/parking area (Figure 4). The restroom and shower were remodeled in 1998.

Building 851C, an Armco arch building, is connected to the loading dock close to the north end of the east side of Building 851A (Figure 5). It was built in the 1960s to house loading of film cassettes. It has since been turned into a machine shop.

Part III. SOURCES OF INFORMATION

A. **Architectural Drawings:** Architectural drawings are held in the Lawrence Livermore National Laboratory Plant Engineering Library.

"Site 300 General Plans, Civil, Site Location Plan & Vicinity Map," PSZ1958-0850-0002J.

"Site 300, Diagnostics Bunker 850, Civil, Site and Grading Plan," PSZ1958-0850-0004JA.

"Site 300, Diagnostics Bunker 850, Architectural, Floor Plan," PSZ1958-0850-0006JA.

"Site 300, Diagnostics Bunker 850, Architectural, Sections and Details," PSZ1958-0850-0007JA.

"Site 300, Diagnostics Bunker 850, Structural, Foundation Plan," PSZ1958-0850-0008J.

"Site 300, Diagnostics Bunker 850, Structural, Roof Plan," PSZ1958-0850-0009JA.

"Site 300, Diagnostics Bunker 850, Structural, Wall Elevations," PSZ1958-0850-0010J.

"Site 300, Diagnostics Bunker 850, Structural, Wall Elevations," PSZ1958-0850-0011J.

"Site 300, Diagnostics Bunker 850, Structural, Sections," PSZ1958-0850-0012J.

"Site 300, Diagnostics Bunker 850, Structural, Sections," PSZ1958-0850-0013J.

"Site 300, Diagnostics Bunker 850, Structural, Sections," PSZ1958-0850-0014JA.

"Site 300, Diagnostics Bunker 850, Structural, Miscellaneous," PSZ1958-0850-0015JA.

"Site 300, Diagnostics Bunker 850, Civil, Grading Cross Sections," PSZ1958-0850-0005JA.

"Site 300, Typical Details, Architectural, Blast Door Details," PSZ1958-0850-0029J.

"Site 300, Typical Details, Architectural, Interior Details," PSZ1958-0850-0030J.

"Site 300, Typical Details, Architectural, Exterior Details," PSZ1958-0850-0031JA.

"Site 300, Bunker 851, Bullnose Openings," PSC1958-0851-0101A.

"Site 300, Title Sheet, Architectural, Index and Notes," PSZ1958-0851-0101JA.

"Site 300, General Plans, Civil, Site Location Plan and Vicinity Map," PSZ1958-0851-0102JA.

"Site 300, HELAC Project, Civil, Site Plan," PSZ1958-0851-0103JA.

"Site 300, HELAC Building No. 851A and R.F. Shop, Civil, Site Plan," PSZ1958-0851-0104JA.

"Site 300, HELAC Building No. 851A, Civil, Grading Plan," PSZ1958-0851-0105JB.

"Site 300, HELAC Building No. 851A, Architectural, Main Floor Plan," PSZ1958-0851-0108JD.

"Site 300, HELAC Building No. 851A, Architectural, HELAC Room and Mezzanine Plans," PSZ1958-0851-0109JC.

"Site 300, HELAC Building No. 851A, Architectural, Exterior Elevations and Roof Plan," PSZ1958-0851-0110JA.

"Site 300, HELAC Building No. 851A, Architectural, Cross Sections," PSZ1958-0851-0111JA.

"Site 300, HELAC Building No. 851A, Architectural, Blast Door Details," PSZ1958-0851-0116JA.

"Site 300, HELAC Building No. 851A, Architectural, Bullnose Details," PSZ1958-0851-0118JA.

"Site 300, HELAC Building No. 851A, Architectural, Miscellaneous Details," PSZ1958-0851-0119JA.

"Site 300, HELAC Building No. 851A, Structural, Foundation Plan," PSZ1958-0851-0121JC.

"Site 300, HELAC Building No. 851A, Structural, Roof Plan and HELAC Foundation Plan," PSZ1958-0851-0122JC.

"Site 300, HELAC Building No. 851A, Structural, HELAC Roof Plan and Wall Elevations," PSZ1958-0851-0124JB.

"Site 300, HELAC Building No. 851A, Structural, Elastic Bullnose Plan and Details," PSZ1958-0851-0129JB.

"Site 300, HELAC Building No. 851A, Structural, Elastic Bullnose Details," PSZ1958-0851-0130JB.

"Site 300, HELAC Building No. 851A, Structural, Revised Bullnose Details," PSZ1958-0851-0131JA.

"Site 300, Water Tank and Well, Civil, Site and Grading Plans," PSZ1958-0851-0146JB.

"Site 300, Water Tank, Civil, Plan, Elevation, Sections and Details," PSZ1958-0851-0147JB.

"Site 300, HELAC Road, Civil, Plan and Profile," PSZ1958-0851-0151JA.

"Site 300, Roads and Parking, Civil, Paving and Road, Typical Details," PSZ1958-0851-0153JA.

"Site 300, Title Sheet, Architectural, Index and Notes," PSZ1958-0851-0201JA.

"Site 300, HELAC Building No. 851A and R.F. Shop," PSZ1958-0851-0202JA.

"Site 300, HELAC Building No. 851A, Structural, Roof Plan and HELAC Foundation Plan," PSZ1958-0851-0205JC.

"Site 300, R. F. Development and Repair Shop, Architectural, Plan, Elevations, Schedules and Details," PSZ1958-0851-0210JA.

"Site 300, HELAC Bunker, Building 851A, Stand-by Power for Injector, Floor Plan," PSE1961-0851-0106CA.

"Site 300, Building 851A, Generator Cover," PSC1962-0851-0101CA.

"Site 300, Cooling Towers at Building 851A, Shrapnel Shelter for Cooling Towers, Floor Plan, Roof Plan, and Elevations," PSS1962-0851-0201DA.

"Site 300, Building 851B, R.F. Development and Repair Shop, Shrapnel Shelter for Cooling Towers, Details and Sections," PSS1962-0851-0202DA.

"Site 300, Building 851, Change Room Addition, Architectural, Plumbing, Ventilating, and Electrical Plans," PSA1963-0851-0001D.

"Site 300, Building 851A, Check In Station," PSE1966-0851-0101BA.

"HELAC Complex, Key Plan," PSE1968-0851-0101B.

"Site 300, Building 851, Tube House Relocation, Section View," PSC1971-0851-0102C.

"Site 300, Building 851B, Rain Shelter," PSC1972-0851-0201C.

"Site 300, Building 851A, Room 105, Camera Port Modification," PSS1974-0851-0101D.

"Site 300, Building 851, Firing Table Road, Plan," PSC1975-0851-0101D.

"Site 300, Building 851, Bridge Crane Installation," PSS1975-0851-0102D.

"Site 300, Building 851A, Steel Washer Bullnose," PSM1976-0851-0106A.

"Site 300, Building 851A, Proposed Building Additions, Floor Plan and Sections," PSA1977-0851-0101D.

"Site 300, Building 851, Detector Room Removal and Camera Stand Installation, Plans, Sections, Details," PSS1977-0851-0101D.

"Site 300, Building 851, HELAC Complex, Ready Room Addition, Floor Plan, Details, Foundation Plan," PSA1978-0851-0101DA.

"Site 300, Building 851, HELAC Complex, Ready Room Addition, Sections, Elevations, Details," PSA1978-0851-0102D.

"Site 300, Building 851, Building Modification for VISAR Installation," PSA1978-0851-0105C.

"Site 300, Building 851, Room 109, PAKO Dark Room, Architectural," PSA1979-0851-0101C.

"Site 300, Building 851, Room and Hallway Modification, Floor Plan, Elevation, and Details," PSA1981-0851-0102D.

"Site 300, Building 851, Bullnose Roof Shield," PSS1981-0851-0101D.

"Site 300, Building 851, Survey Monument, Monument Modification," PSC1982-0851-0101D.

"Site 300, Building 851, Camera Room Hoist and Assembly, Plans and Details," PSS1983-0851-0101D.

"Site 300, Bunker 851 Modifications, Project Location," PSC1986-0851-0101D.

"Site 300, Bunker 851 Modifications, Sections and Details," PSC1986-0851-0104D.

"Site 300, Bunker 851 Modifications, Legend and Site Plan," PSE1986-0851-0101D.

"Site 300, Bunker 851 Modifications, Bill of Materials and Removal Plan," PSE1986-0851-0102D.

"Site 300, Bunker 851 Modifications, Lighting Plan," PSE1986-0851-0103D.

"Site 300, Bunker 851 Modifications, Floor Plan and Section," PSS1986-0851-0101D.

"Site 300, Bunker 851 Modifications, Roof Plan and Details," PSS1986-0851-0102D.

"Site 300, Bunker 851 Modifications, Retaining Walls," PSS1986-0851-0108D.

"Site 300, Building 851A, Computer Floor, Title Sheet, Location, and Vicinity Map," PSA1989-0851-0101DA.

"Site 300, Building 851A, Computer Floor, Plan," PSA1989-0851-0102DA.

"Site 300, Building 851, Room Addition, Floor Plan and Notes," PSA1996-0851-0001DA.

"Site 300, Building 851, Room Addition, Partial Floor Plan and Partial Roof Plan, and Structural General Notes," PSS1996-0851-0001DA.

"Site 300, Building 851B, Restroom, Floor Plan, Sections and Scope of Work." PSA1998-0851-0201D.

"Site 300, Building 851A, Restroom Remodel, Demolition and New Floor Plans, Specifications and Scope of Work," PSA2003-0851A-0002D.

B. Early Views: Historic photographs of the Site 300 facilities reside in the LLNL Archives.

C. Interviews: No oral history interviews were conducted.

D. Bibliography: *Energy and Technology Review, The Magnet,* and *Newsline* are LLNL publications.

"Building Numbers at Livermore Site to Change Aug. 1." *The Magnet,* July 1967, 3.

"Buildings Go Up at Site 300 to Provide New Facilities." *The Magnet,* January 1961, 1-2.

"High-Explosive Science." *Energy and Technology Review,* July 1983, 5-6.

"A High-Speed Image-Converter Camera System." *Energy and Technology Review,* July 1982, 42-44.

"Inside Site 300," *Newsline,* Fall 1981, 5-9.

Lawrence Livermore National Laboratory. *Site 300.* UCRL-BR-224872-REV-1. Livermore, California: Lawrence Livermore National Laboratory, 2011.

"The Multibeam Fabry-Perot Velocimeter: Efficient Measurement of High Velocities." *Science & Technology Review,* UCRL-52000-96-7 (July 1996): 12-19.

"New Buildings Completed at Site 300." *The Magnet* (June 1959) 3.

"New Linear Accelerator Completed at Site 300." *The Magnet* (July 1960): 6.

"Ramrods Shepherd Hydrodynamic Tests." *S&TR* (September 2007): online edition.

"Site 300." *Energy and Technology Review* (July 1979): 12-13.

"Site 300…" *The Magnet* (April 1958): 4.

"Site 300: Inside the Gates of LLNL's High Explosives Outpost." *Newsline* (Fall 1981): 5-9.

"Site 300 Adds Land and Buildings." *The Magnet* (October 1959): 7.

"Site 300 Keeps High-Explosives Science on Target." Lawrence Livermore National Laboratory, website, accessed April 14, 2014.

Sullivan, Michael Anne and Rebecca Ann Ullrich. *Historic Context and Building Assessments for the Lawrence Livermore National Laboratory Built Environment.* UCRL-TR-234717. Livermore, California: Lawrence Livermore National Laboratory, 2007.

University of California Lawrence Livermore Laboratory. *30 Years of Technical Excellence*. Livermore: Lawrence Livermore National Laboratory, 1982.

University of California Lawrence Radiation Laboratory. *Status Report: Fiscal Year 1958*. Berkeley and Livermore: University of California Lawrence Radiation Laboratory, 1958.

_____. *Status Report: Fiscal Year 1959*. Berkeley: University of California Lawrence Radiation Laboratory, 1959.

_____. *Status Report: Fiscal Years 1960 and 1961*. Berkeley: University of California Lawrence Radiation Laboratory, 1961.

_____. *Status Report: Fiscal Year 1962*. Berkeley: University of California Lawrence Radiation Laboratory, 1962.

_____. *Status Report: Fiscal Year 1963*. Berkeley: University of California Lawrence Radiation Laboratory, 1963.

_____. *Status Report: Fiscal Year 1965.* Berkeley: University of California Lawrence Radiation Laboratory, 1965.

York, Herbert. "Making Weapons, Talking Peace." *Physics Today* (April 1988): 40–52.

E. Likely Sources Not Yet Investigated: There is extensive technical information on hydrodynamic research, explosives testing, and LLNL's nuclear weapon design responsibilities in technical reports issues by LLNL, as well as in the broader scientific literature.

F. Supplemental Material: None.

Part IV. PROJECT INFORMATION

This report was prepared in 2014 by Rebecca Ann Ullrich under LLNL Memorandum Purchase Order (MPO) No. B583693 with Sandia National Laboratories.

In 2006, LLNL and DOE/NNSA/LFO completed consultation with the California State Historic Preservation Officer regarding the historic significance and eligibility of the hydrodynamic test facilities to the National Register of Historic Places, concluding that Buildings 850 and 851A are eligible together as the Hydrodynamic Test Facilities Historic District. This report is part of the mitigation of potential negative effects of undertakings in and around Buildings 850 and 851A.

LLNL photographer Michael P. Anthony provided large-format photography. John Scott approved Site 300 visits and Dave White provided access to and information about Building 850. Fred Sator provided detailed tours of both buildings. Maxine Trost provided research advice and support in the LLNL Archives. Kelly Heideker oversaw the initial phase of the project, including the photographic documentation, and provided extensive research support and guidance. Crystal Quinly oversaw the final phase of the project, including preparation of this written report.

Figure 1 is the key plan of Building 850. Figures 2 through 5 are key plans of Building 851A and its associated structures, Buildings 851B and 851C. Original engineering drawings are located in the LLNL Plant Engineering Library. Figures 6 through 18 are historic photos of the buildings.

Figure 1 Drawing PKS1996-850-001BC, Rev. August 2007.
FACILITY KEYPLAN, BUILDING 850.

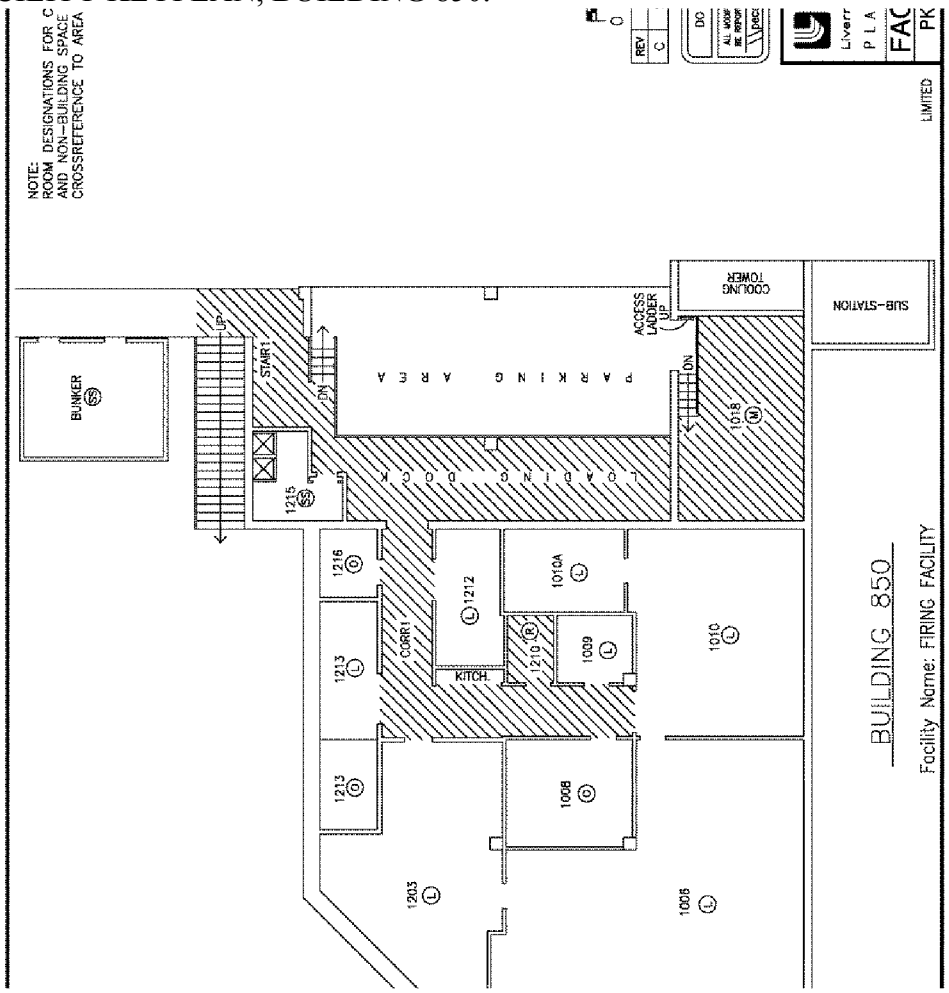


Figure 2 Drawing PKS1996-851-001BF, Rev. May 2013.
FACILITY KEYPLAN, BUILDING 851A, FIRST FLOOR.

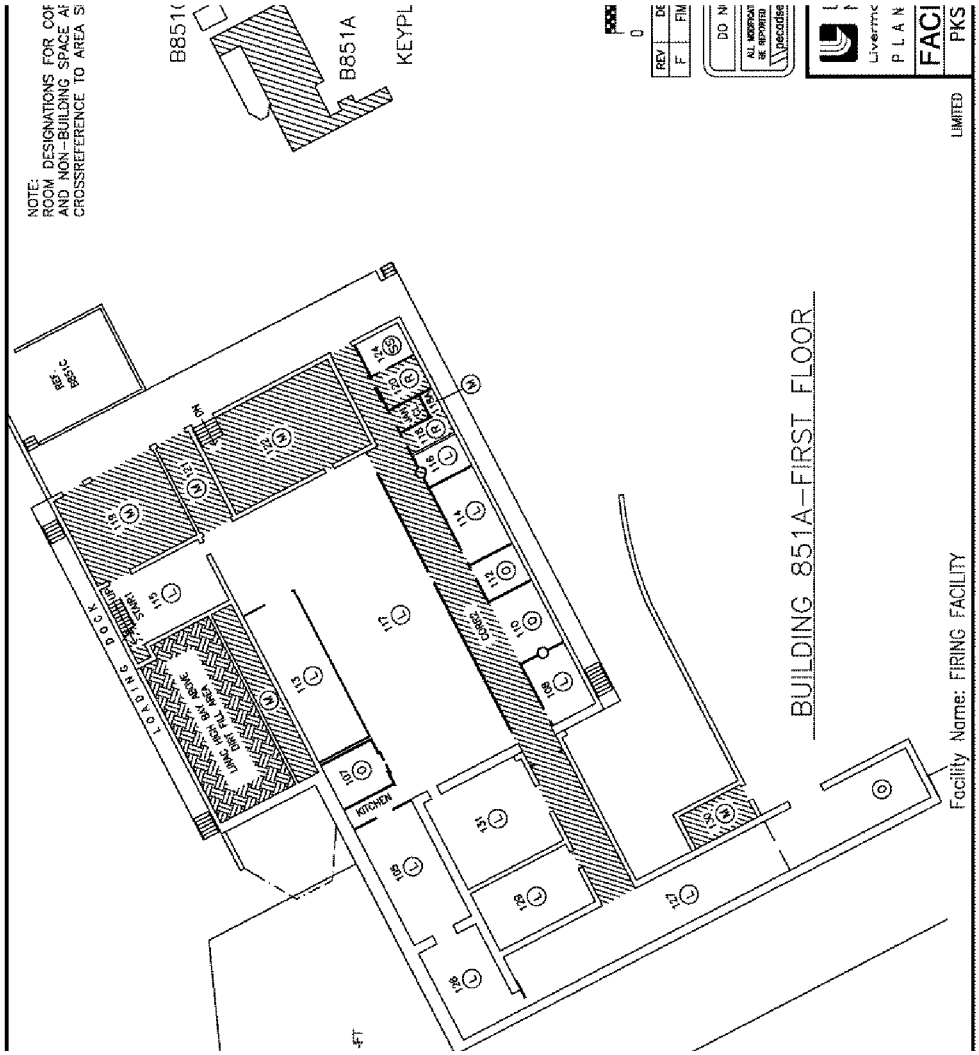


Figure 3 Drawing PKS1996-851-002B, Rev. May 2013.
FACILITY KEYPLAN, BUILDING 851A, SECOND FLOOR.

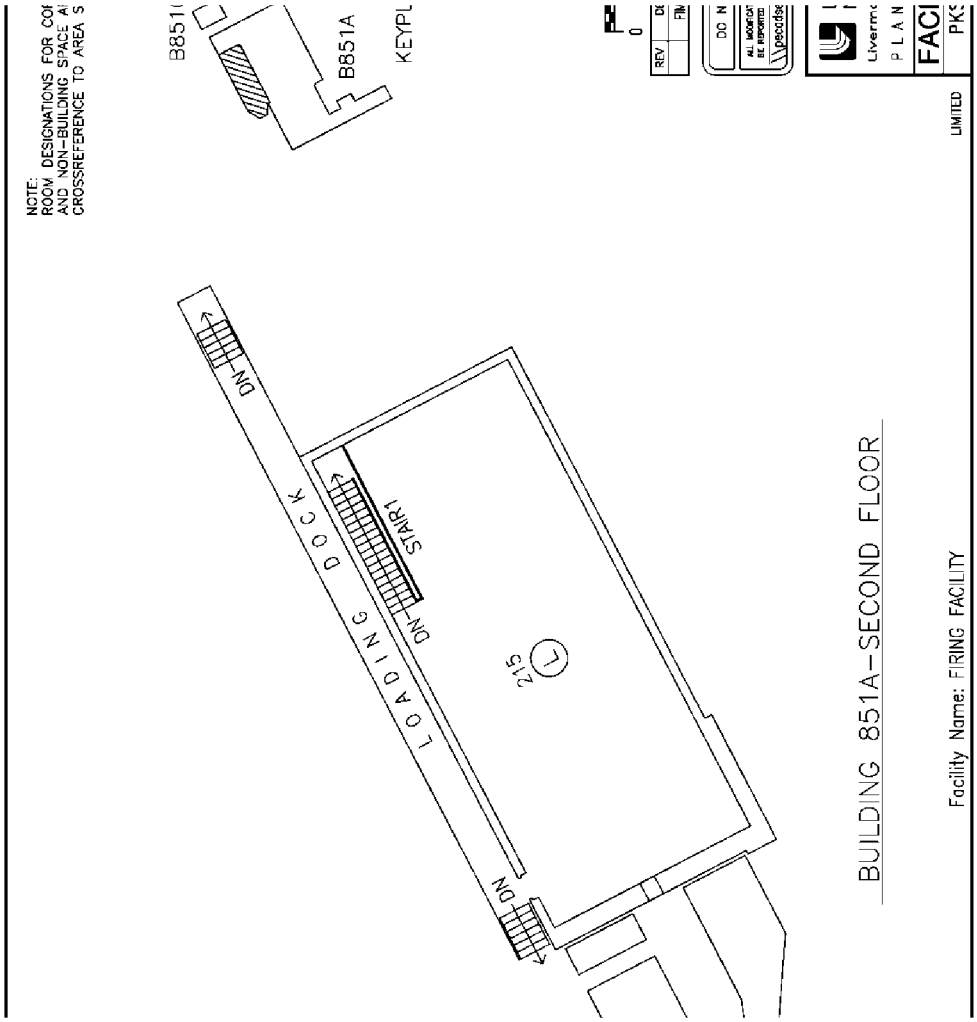
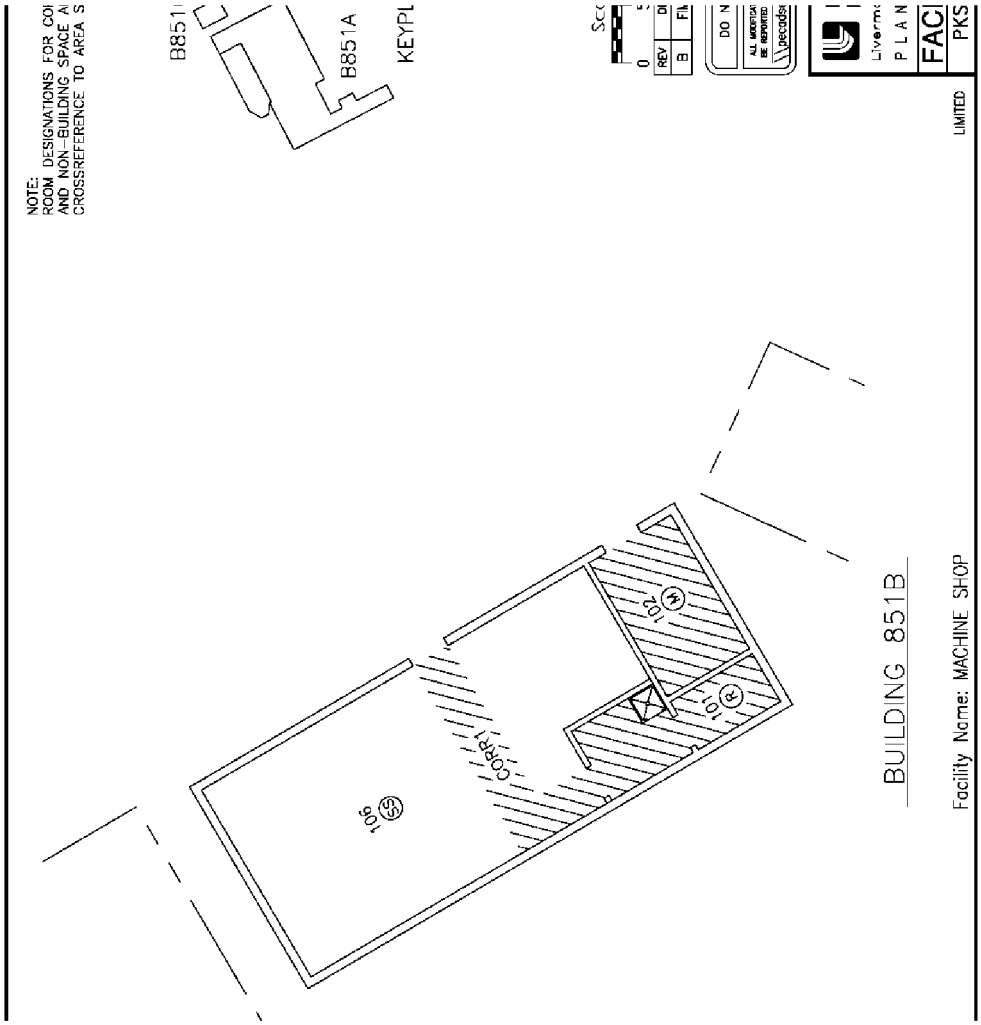


Figure 4 Drawing PKS1996-851-003BB, Rev. May 2013.
FACILITY KEYPLAN, BUILDING 851B.


NOTE:
ROOM DESIGNATIONS FOR CO
AND NON-BUILDING SPACE A
CROSSREFERENCE TO AREA S
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BUILDING 851B
Facility Name: MACHINE SHOP

Figure 5 Drawing PKS1998-851-004BB, Rev. May 2013.
FACILITY KEYPLAN, BUILDING 851C.

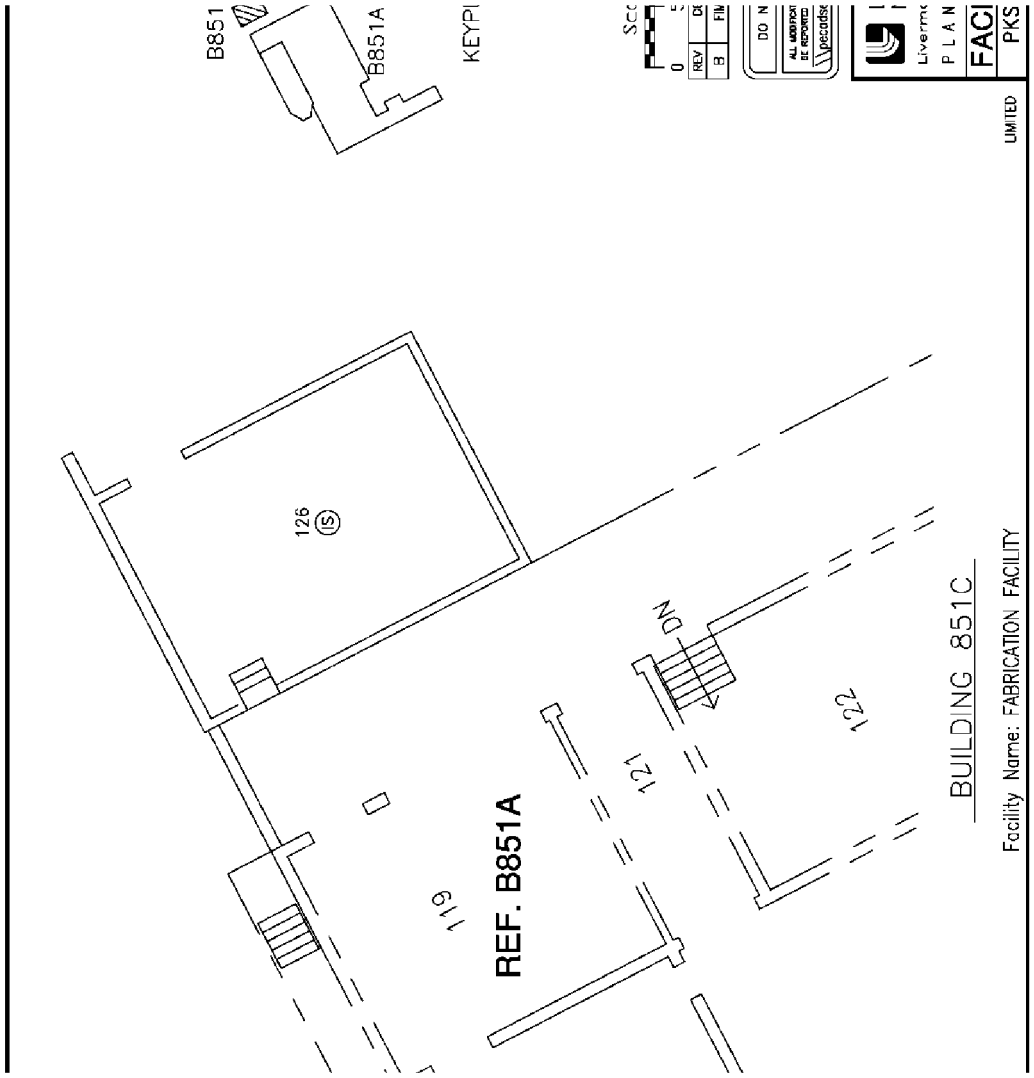

Figure 6 Photographer unknown, n.d.
CAMERA ROOM (ROOM 1203); ROOM'S SOUTH WALL IS ON LEFT; VIEW FROM EAST; BUILDING 850.

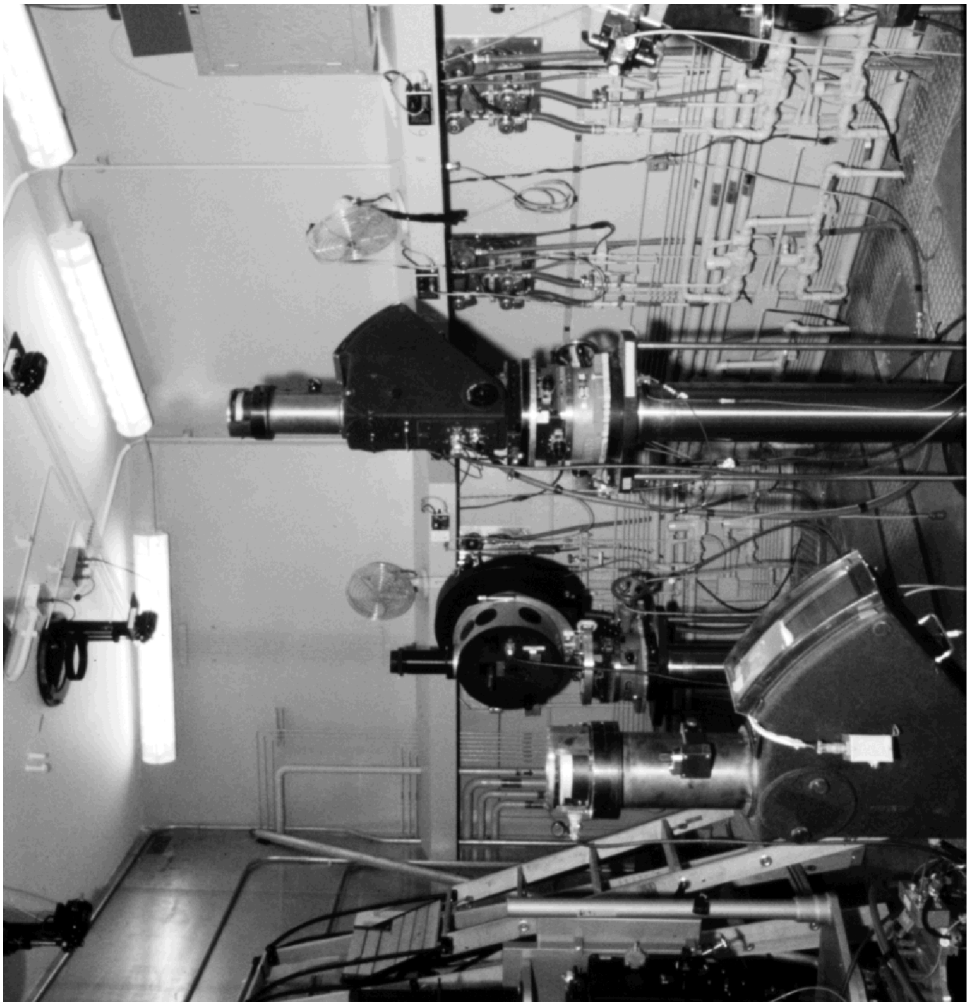

Figure 7 Michael P. Anthony, photographer, January 23, 2008.
CAMERA ROOM (ROOM 1203); CAMERA MOUNTS IN FLOOR AND PORTS IN CEILING; CEILING IS PAINTED MATTE BLACK; VIEW OF NORTHWEST WALL FROM SOUTHEAST; BUILDING 850.

Figure 8 Michael P. Anthony, photographer, January 23, 2008.
CAMERA REPAIR ROOM (ROOM 1006); EQUIPMENT RACKS AND CABLING IN ROOM; HVAC DUCTWORK AND UTILITIES ON CEILING; VIEW OF WEST WALL FROM SOUTHEAST; BUILDING 850.

Figure 9 Michael P. Anthony, photographer, January 23, 2008.
CAMERA REPAIR ROOM (ROOM 1006); EQUIPMENT RACKS, CONCRETE FLOOR WITH 2' WIDE TRENCHES; CONNECTING DOOR TO CAMERA ROOM (ROOM 1203); VIEW FROM SOUTH; VIEW FROM EAST; BUILDING 850.

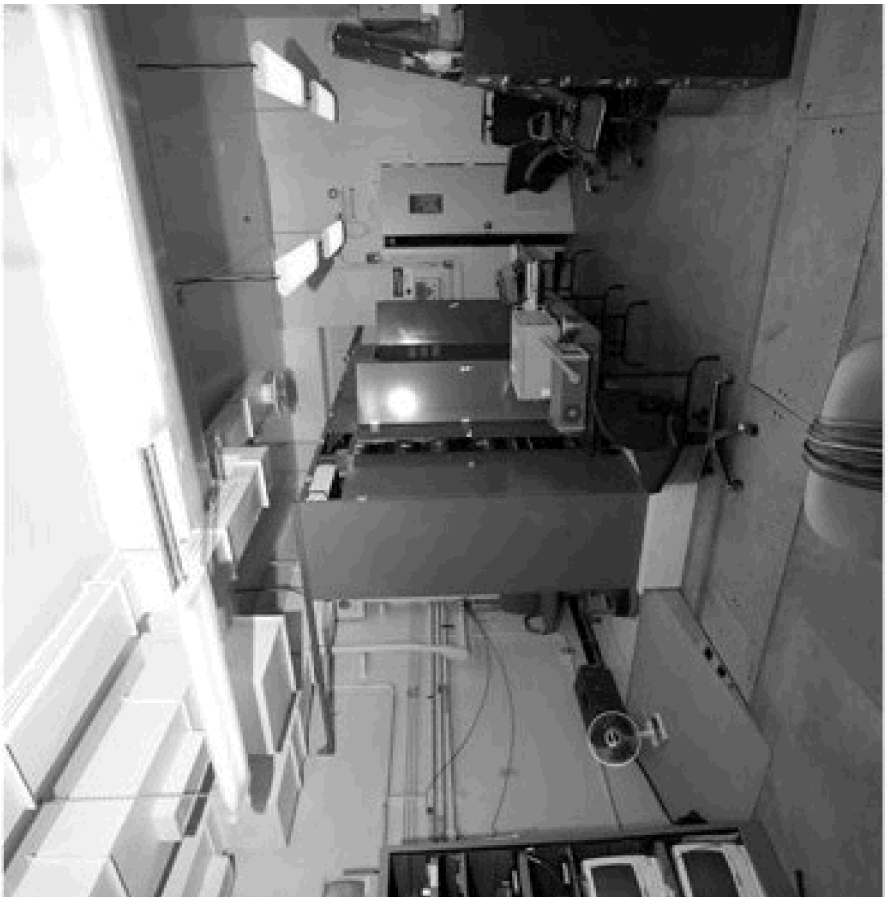

Figure 10 Photographer unknown, Camera set-up for test on firing table, ca. 1960.
CAMERA SET-UP IN FRONT OF (WEST OF) BULLNOSE FOR TEST ON FIRING TABLE; VIEW FROM WEST; BUILDING 851A.

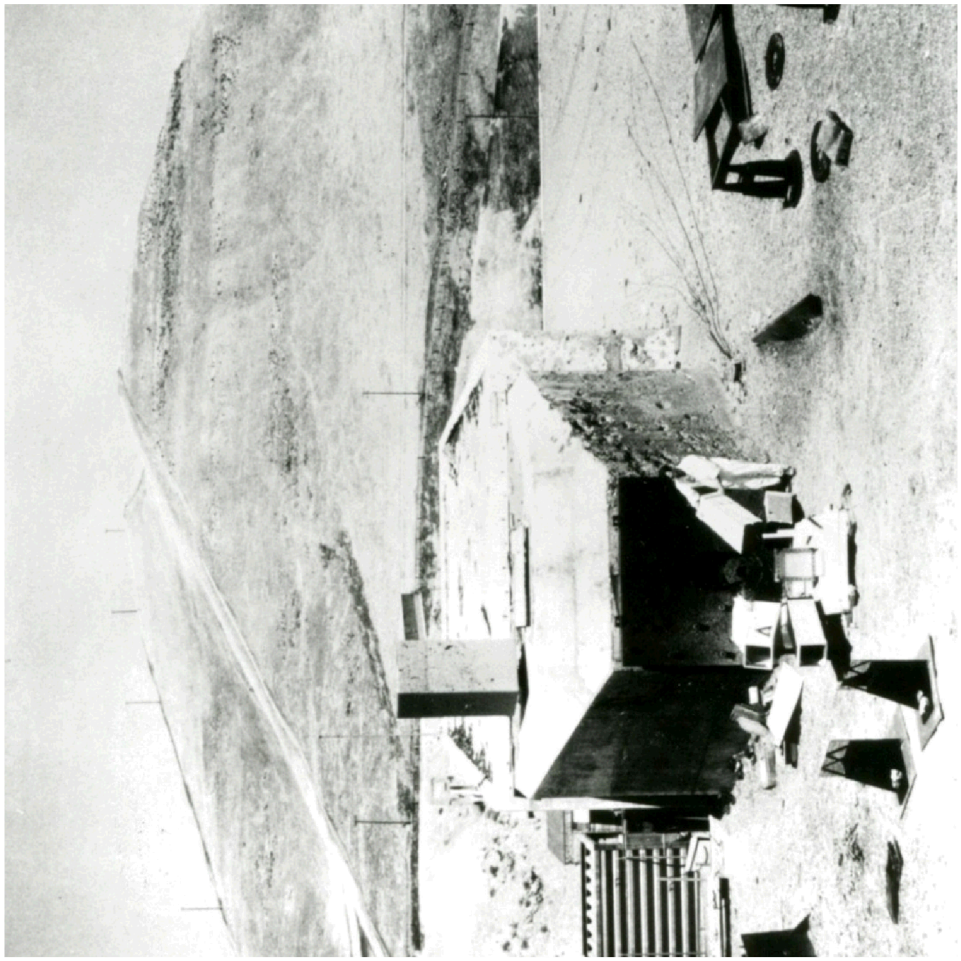

Figure 11 Photographer unknown, n.d.
INTERIOR; FIRING TABLE CONSOLE IN CONTROL ROOM (ROOM 117); BUILDING 851A.

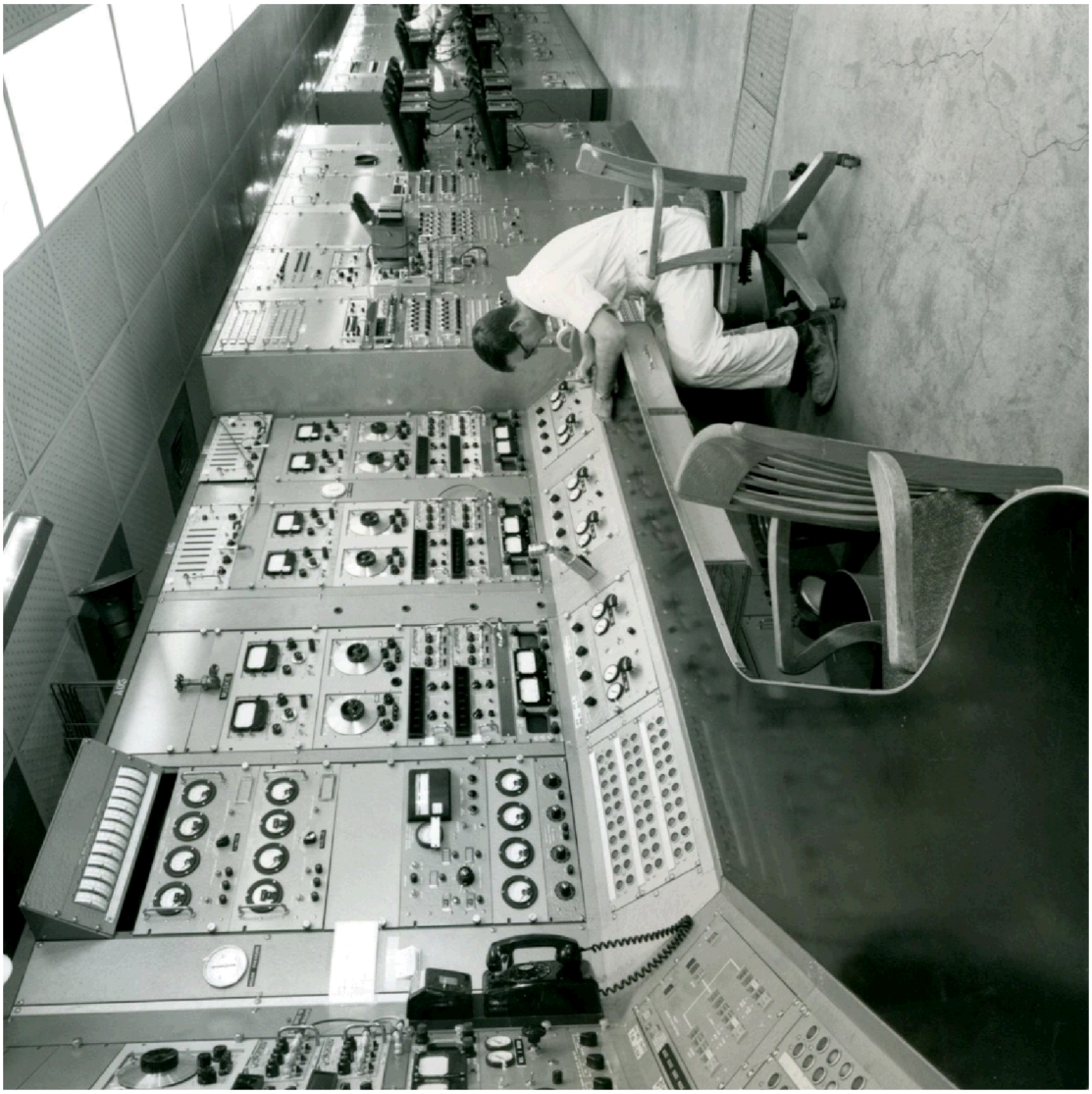

Figure 12 Photographer unknown, n.d.
INTERIOR; EARLY IMAGE OF LINAC ON MEZZANINE IN LINAC HIGH-BAY; VIEW FROM NORTHEAST (LOOKING ALONG NORTH SIDE OF LINAC TOWARD BULLNOSE); BUILDING 851A.

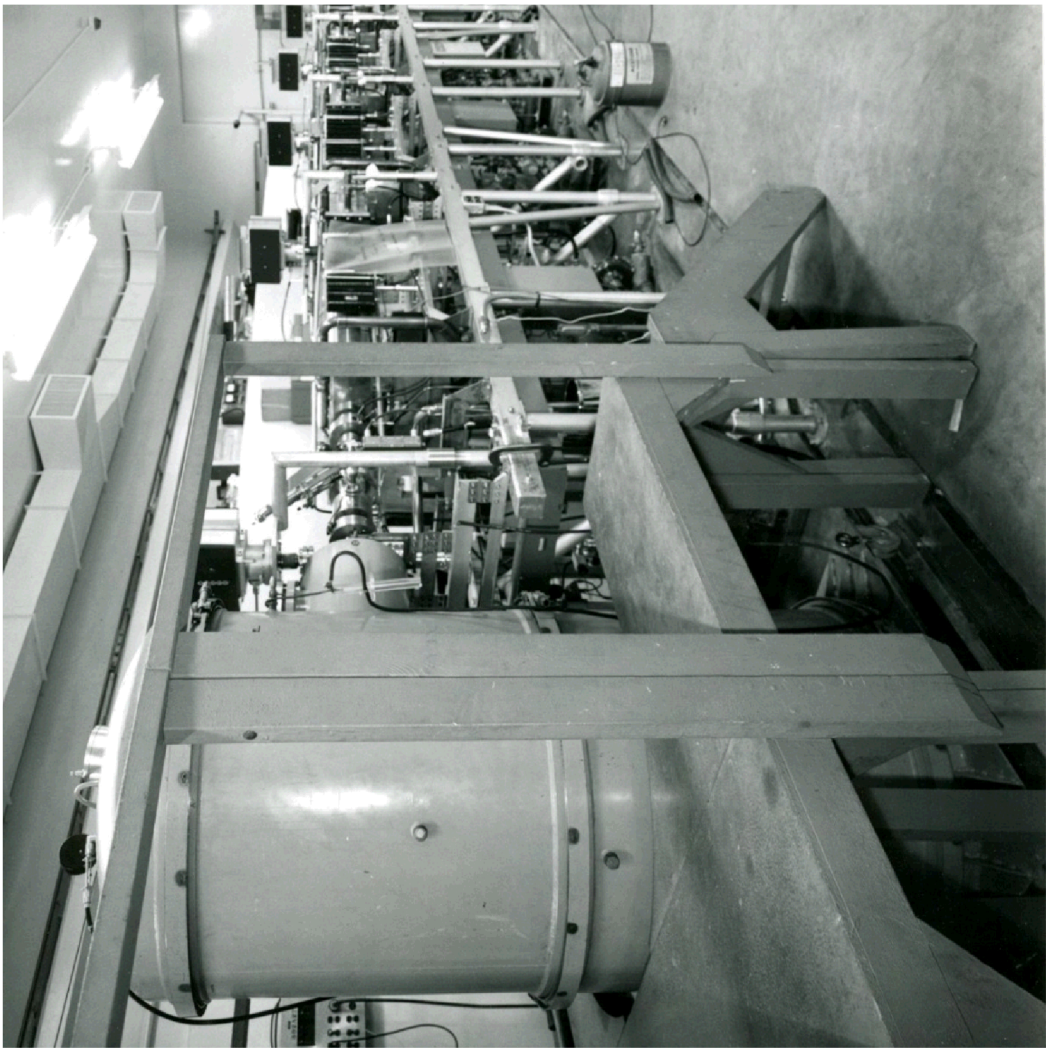

Figure 13 Early image of LINAC in mezzanine, n.d.
INTERIOR; EARLY IMAGE OF LINAC ON MEZZANINE IN LINAC HIGH-BAY; VIEW FROM SOUTHEAST (LOOKING ALONG SOUTH SIDE OF LINAC TOWARD BULLNOSE); BUILDING 851A.

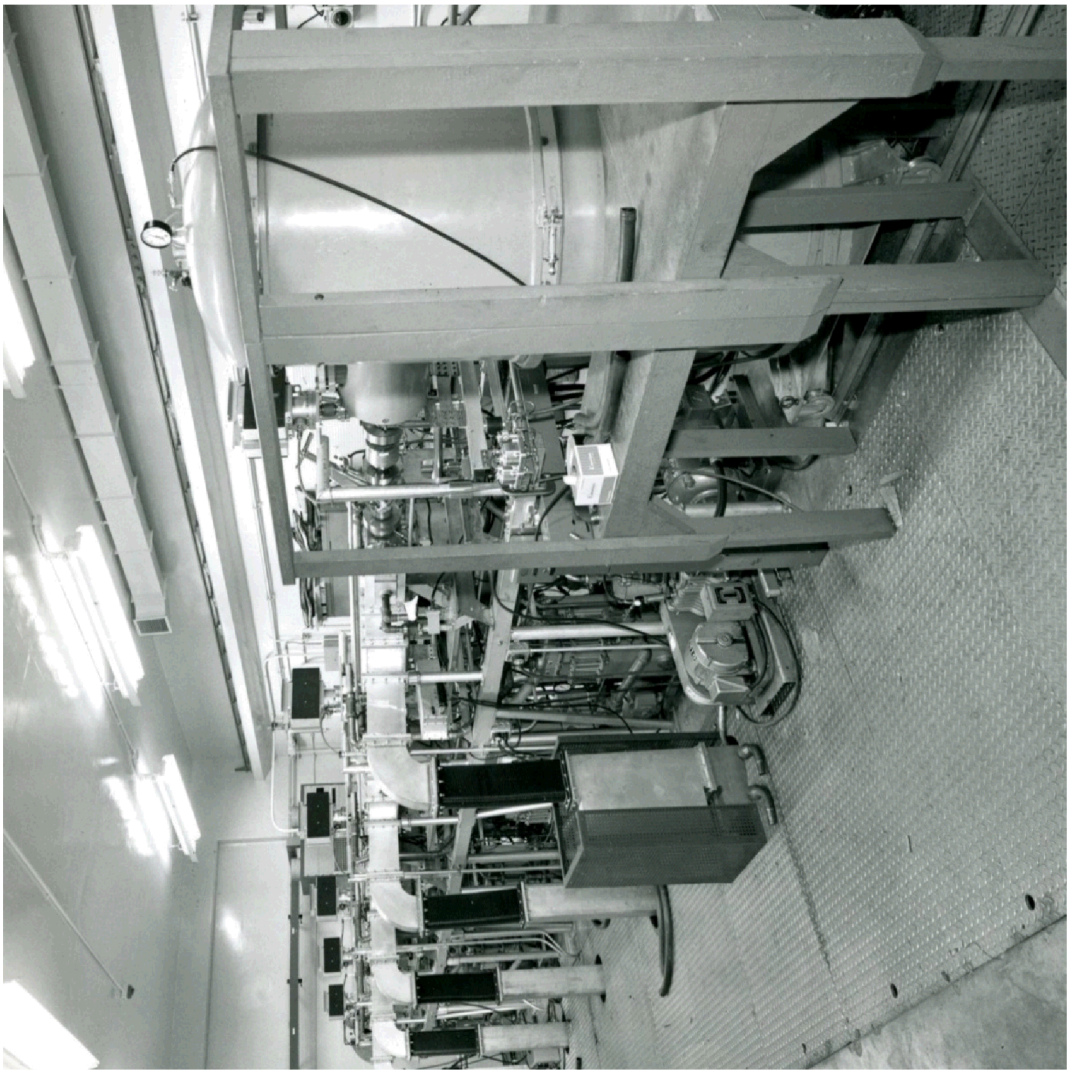

Figure 14 Photographer unknown, n.d.
INTERIOR; EARLY VIEW OF MODULATORROOM (ROOM 113); KLYSTRON MODULATORS; BUILDING 851A.

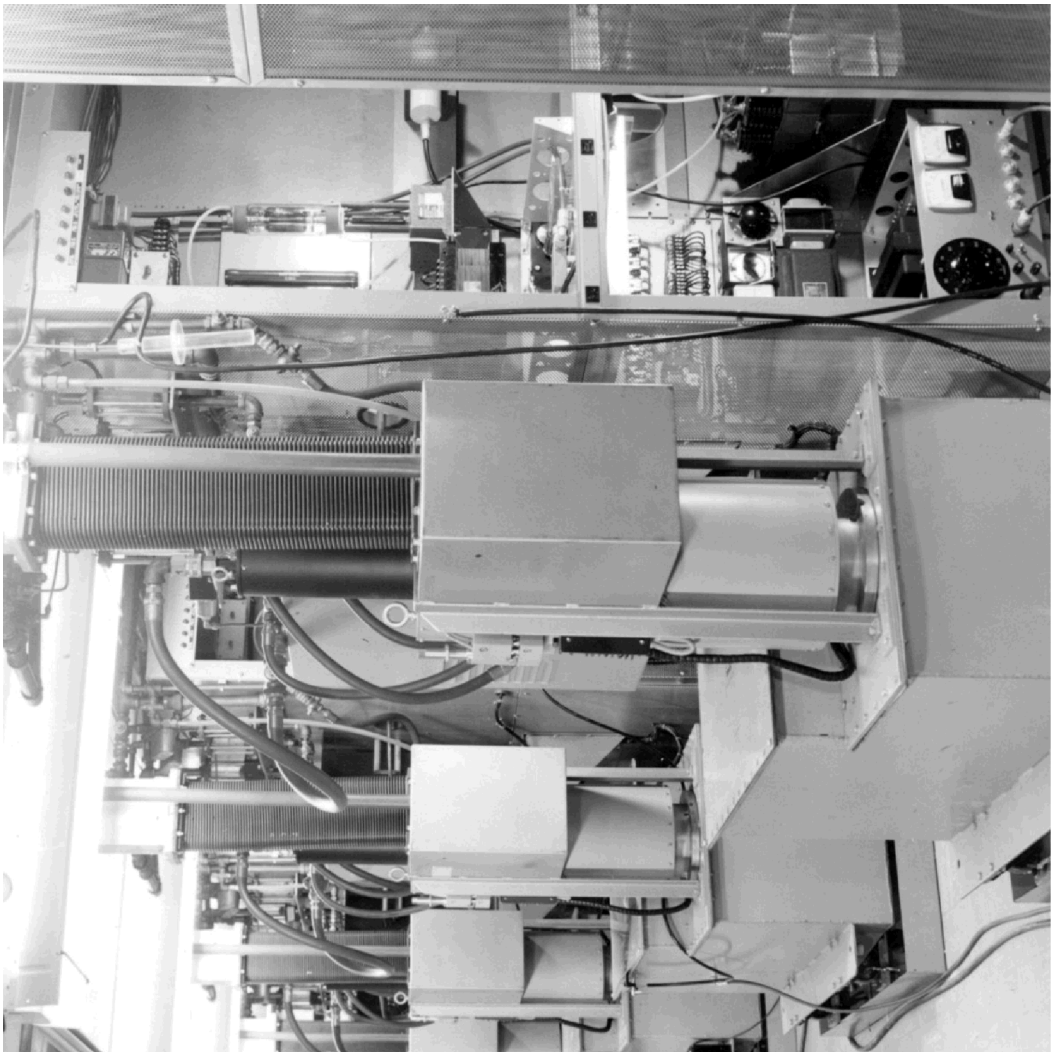

Figure 15 Photographer unknown, ca. 1973.
INTERIOR; LINAC ON MEZZANINE IN LINAC HIGH-BAY; VIEW FROM NORTHEAST (LOOKING ALONG TOP OF LINAC TOWARD BULLNOSE); BUILDING 851A.

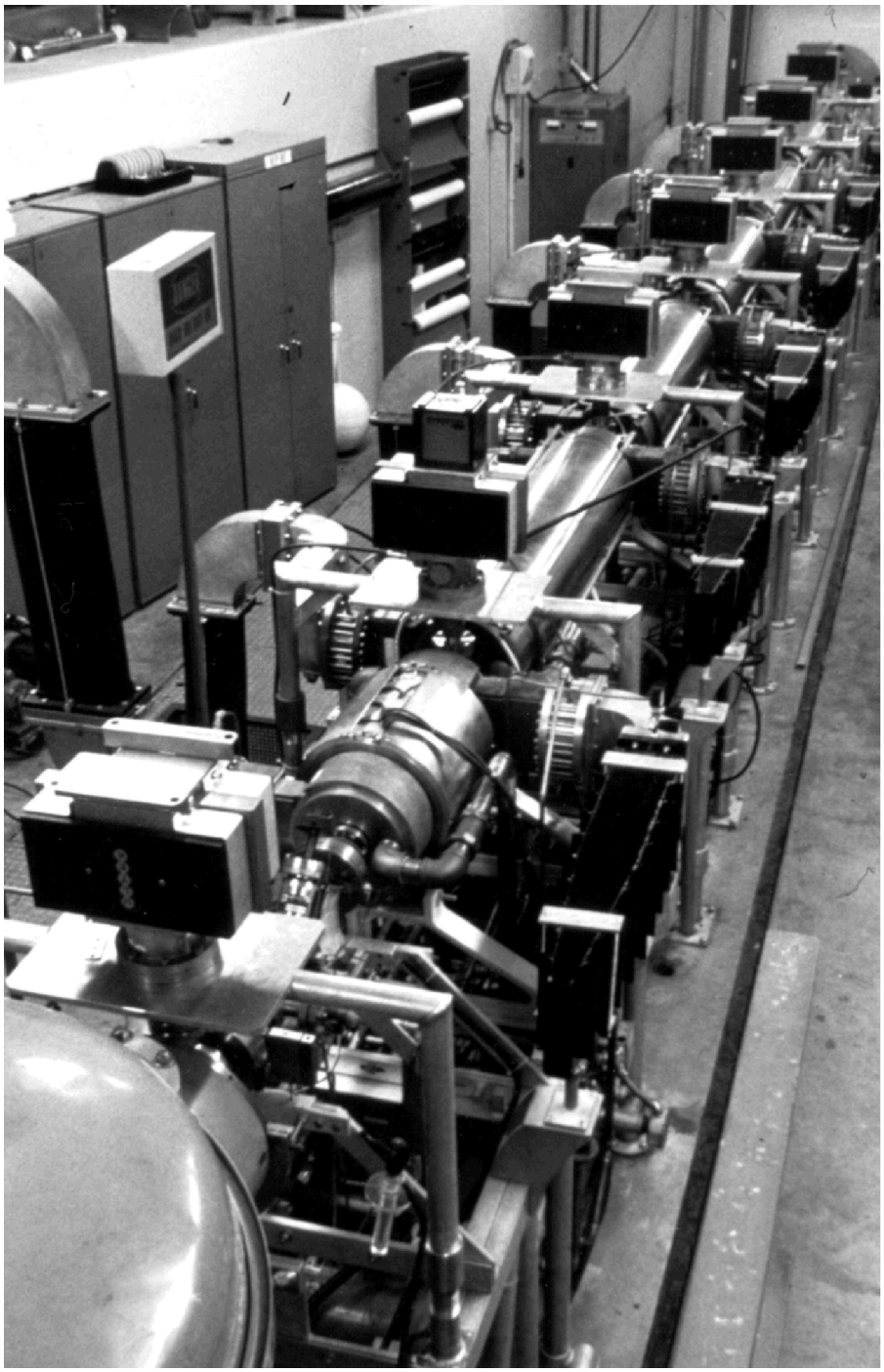

Figure 16 Photographer unknown, ca. 1973.
INTERIOR; LINAC CONTROL CONSOLE (ROOM 117); BUILDING 851A.

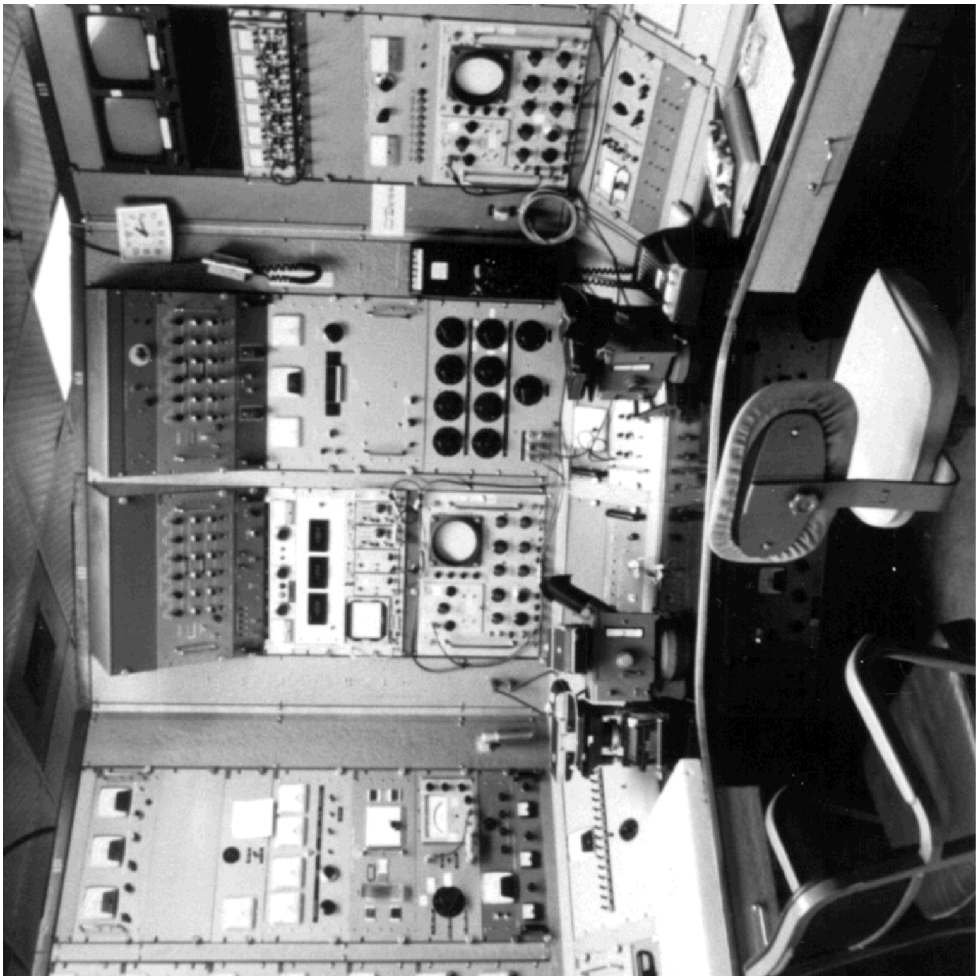

Figure 17 Photographer unknown, ca 1975.
AERIAL, VIEW OF NORTH SIDE OF BUILDING AND FIRING TABLE; VIEW FROM NORTH; BUILDING 851A.
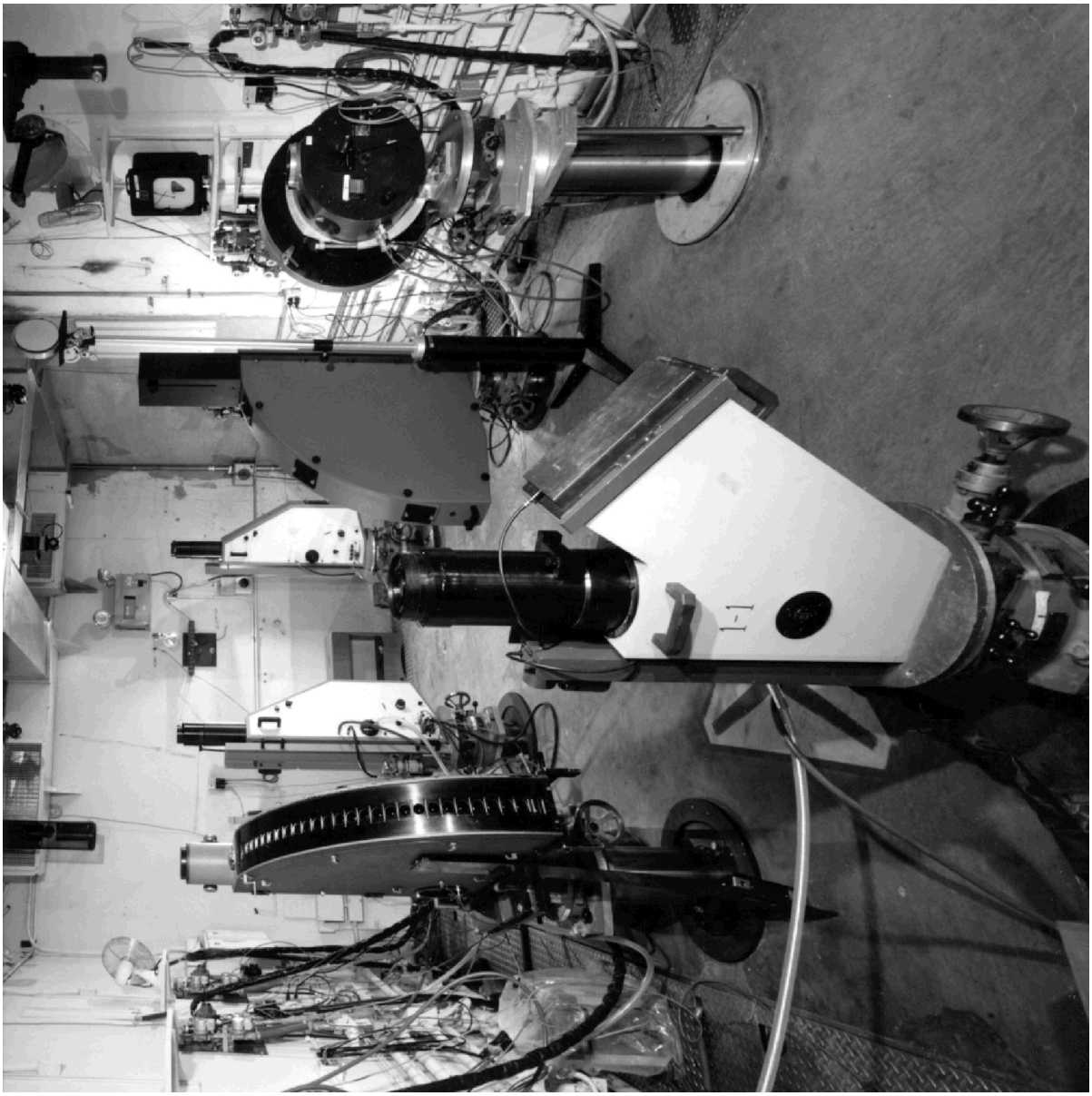
Figure 18 Photographer unknown, ca. 1980.
INTERIOR; CAMERA ROOM (ROOM 128); BUILDING 851A.