1. NAME OF PROPERTY

Historic Name: Camp Evans

Other Name/Site Number: U.S. Army Signal Corps Laboratory

2. LOCATION

Street & Number: Marconi Road and Monmouth Boulevard Not for publication: N/A

City/Town: Wall Township Vicinity: N/A

State: New Jersey County: Monmouth Code: 025 Zip Code: 07719

3. CLASSIFICATION

Ownership of Property		Category of Property	
Private:	___	Building(s):	___
Public-Local:	X	District:	X
Public-State:	___	Site:	___
Public-Federal:	X	Structure:	___
		Object:	___

Number of Resources within Property

Contributing	Noncontributing	
35	13	buildings
___	___	sites
___	1	structures
___	___	objects
35	14	Total

Number of Contributing Resources Previously Listed in the National Register: 51

Name of Related Multiple Property Listing: N/A

4. STATE/FEDERAL AGENCY CERTIFICATION

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this ____ nomination ____ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ____ meets ____ does not meet the National Register Criteria.

Signature of Certifying Official Date

State or Federal Agency and Bureau

In my opinion, the property ____ meets ____ does not meet the National Register criteria.

Signature of Commenting or Other Official Date

State or Federal Agency and Bureau

5. NATIONAL PARK SERVICE CERTIFICATION

I hereby certify that this property is:

___ Entered in the National Register
___ Determined eligible for the National Register
___ Determined not eligible for the National Register
___ Removed from the National Register
___ Other (explain): _____

Signature of Keeper Date of Action

6. FUNCTION OR USE

Historic: Defense Sub: military facility

Current: Recreation and Culture Sub: museum

7. DESCRIPTION

ARCHITECTURAL CLASSIFICATION: OTHER: Industrial

MATERIALS:
Foundation: Concrete
Walls: Brick/Frame
Roof: Terra Cotta/Asphalt
Other:

Describe Present and Historic Physical Appearance.

SUMMARY

Located near the Atlantic coast of central New Jersey, this property served a variety of civilian and military functions throughout the twentieth century. Named Camp Evans when the U.S. Army Signal Corps acquired the property in 1941, this site functioned as an electronics development, testing, and production facility during World War II, and continued in that general capacity for several decades. During the war Camp Evans became one of the principal U.S. sites associated with the development of radar. The central core of the larger World War II-era facility remains largely intact, and is slated for preservation. This area conveys a strong sense of time and place, and meets NHL Criterion 1 as the best extant historic property associated with the nationally significant development of radar.

DESCRIPTION

The proposed historic district retains the overall appearance of an early- to mid-twentieth century industrial facility made up of numerous buildings situated on a large, primarily level, site. Its buildings are almost exclusively one or two-stories tall, and constructed of wood or brick. Outside the proposed boundary are large tracts that were utilized by Camp Evans during and after World War II. These areas have been partially or completely cleared of their World War II-era buildings. [See Figure #1]

By the end of World War II Camp Evans consisted of approximately 134 buildings and structures on approximately 217-acres. The nominated historic district currently includes 49 buildings and structures located on approximately 27 acres (essentially the northern quarter of the larger World War II-era installation). [See Figure #2] Most of the extant buildings were built during World War II, but five buildings were built before World War I, when the Marconi Wireless Telegraph Company of America established the Belmar Receiving Station here. Thirteen resources within the proposed boundary were built by the Army after World War II. Those 13, plus another building that was relocated from an area outside the proposed boundary, are noncontributing resources.[1]

Located at the northern end of the historic district (near Marconi Road) the five Marconi-era buildings are the oldest resources at Camp Evans. Constructed by the J.G. White Engineering Corporation of New York, these dark red brick buildings feature Craftsman and Spanish Colonial elements in their dormers, eave brackets, and roof tile. Similar building designs were used at other Marconi stations. The most distinctive of the Belmar Receiving Station buildings is the Marconi Hotel (#9001)[2] which was built to house Marconi staff. These buildings were used by subsequent occupants of the site.[3] The Belmar Receiving Station also included a half dozen 400' steel antenna masts running in a line to the north of the Marconi Hotel (an area mostly outside the proposed historic district).[4] The last of these masts was removed in 1924, but the upper 150' portion of one of the Marconi balancing towers lies on the ground near Monmouth Boulevard (outside the proposed boundary).

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[1] No nationally significant archaeological resources were identified in studies conducted during the Army's ownership of Camp Evans: Joel I. Klein, Leonard G. Bianchi, and Lorraine E. Williams, *An Archaeological Overview and Management Plan for Fort Monmouth, Camp Charles Wood, and the Evans Area* (Washington: National Park Service, 1984); Mary Beth Reed, Mark Swanson, Rebecca Proctor, and Marsha Prior, *Evaluation of Selected Cultural Resources at Fort Monmouth, New Jersey* (Plano, TX: Geo-Marine, Inc., 1996); Mark Swanson, *Historical Research into a Select Number of Potential Historical Archaeological Sites at Evans Area, Fort Monmouth, New Jersey* (Stone Mountain, GA: New South Associates, 1999).

[2] The four-digit real property inventory numbers assigned by the Army remain in use today.

[3] Between 1917 and 1941 the former Marconi site was used by: the U.S. Navy (1917-1919); RCA (1919-1925); the Monmouth Pleasure Club Association [members of the New Jersey Ku Klux Klan] (1925-1932); and, King's College (1938-1941).

[4] These tall masts were secured by steel guy wires that angled down to large concrete block anchors.

Only one building was constructed here during the 1920s and 1930s, but that building (the King's College gymnasium) was demolished in 1999. When the Army took over the site in 1941 it quickly built more than two dozen buildings and structures on the open land to the south and west of the Marconi buildings. The World War II buildings and structures, which are more utilitarian in appearance than the Marconi buildings, housed a variety of research, manufacturing, storage, utility, and administrative activities related to Camp Evans' World War II and Cold War activities.

Contributing Resources[5]

Marconi Hotel (#9001) 1914
Administration Annex (#9032) 1942-1943

Located west of Marconi Road**,** the brick Marconi Hotel is two and a half stories tall. [See Photograph #1] A one-story piazza supported by brick piers and covered with Imperial tile, wraps around much of the building's north, east and west elevations. Its three gable roofs are also covered with Imperial tile. Modest exterior modifications include the conversion of a set of double dining room doors to a window, and the addition of a fire escape to the center rear. In 1942-43, a one-story, L-shaped, frame annex building (#9032) was constructed parallel to the Hotel's south and west elevations, which was linked to the Hotel via a new brick corridor.[6] This research library and administration building annex has a center hallway with offices to either side. In 2004, this frame annex was painted light green to reflect its Cold War-era appearance, and in the Spring of 2012, it will be repainted tan with brown to match its World War II-era appearance.

The 1914 building was built as a 45-bedroom hotel for Marconi employees who worked in shifts to man the station's 24-hour service day. Later, during World War I, it housed Navy personnel. During the late 1920s and early 1930s, it served as the main building for the members of the New Jersey chapter of the Ku Klux Klan who purchased the complex. From around 1937 to1941, it served as a dormitory and academic facility for a small Christian college. During and after World War II, the hotel served as offices for Army Signal Corps staff.

The first floor interior features a center foyer with a large fireplace and stairs leading to the second floor. To each side of the foyer a large door leads to hallways. The right hall led to bedrooms (which were converted to offices during World War II). The left hall led to the hotel office, two bedrooms, the lounge hall doors, dining room, and kitchen passage. Also, in the foyer were double doors leading to the lounge. The lounge was originally used as a billiards room, and features a large fireplace. The dining room sat up to fifty people; and the tables near the windows had a view of the ocean. Behind the kitchen were double doors, which led to a pantry. The kitchen contained a walk-in freezer. Behind the kitchen were a laundry room and a stairway that led down to the basement, and up to the servants' bedrooms. During the war the foyer, dining room, kitchen and billiards rooms were sub-divided into offices. At the top of the center foyer stairs a hallway leads to a room that had been the library. To either side are halls which led to bedrooms (which were also converted to offices during the war). Also in the upstairs center hall are stairs to the attic. Before the Army moved in, the servants' area hallway was separate from the main upstairs hallway and rooms. The individual guest room plumbing and closets were removed by the Army in 1941. Radar development workspaces are still intact in the attic. The building's full basement contains the World War II blackout electric panel, as well as the Cold War-era fall-out shelters.

[5] This description section includes information developed by Fred Carl (Executive Director of InfoAge). As a general descriptive comment, it can be noted that replacement windows have been installed in most of the buildings within the proposed historic district.

[6] For NHL purposes, this 1942-3 construction (#9032) is treated as an addition to the hotel, rather than counted as an individual building.

Manager's Cottage (#9002) 1914

Located east of Marconi Road, this cottage originally served as the residence of the Marconi station's Manager. When the college occupied the site before World War II, it served as a professor's residence. It housed Army officers after 1941. [See Photograph #2] The rectangular brick building has a hipped roof finished with Imperial tile and dormers facing front (west) and back. It contains a kitchen, dining room, living room, pantry, four bedrooms, a single bathroom, a brick front porch, and a full basement. A stairway leads to the two upstairs bedrooms. The porch has been subdivided by a masonry wall into a front screen porch near the front door, and a side glass block enclosed sunroom along the south elevation.

Chief Engineer's Cottage (#9003) 1914

Located to the north of its neighboring Manager's Cottage (#9002), this cottage originally served as the residence of the Marconi station's Chief Engineer. It served as a professor's residence before World War II, and as Army officer's housing after 1941. [See Photograph #3] It is nearly identical to its neighbor (#9002), aside from the fact that the front porch was never modified, and the pantry wall was removed to create a larger kitchen.

Operations Building (#9004) 1914

This brick one-story Operations Building measures 83' x 30'. North of the other Marconi buildings, it was built near the edge of the Shark River Inlet. [See Photograph #4] It has a porch supported by brick piers that runs along most of the northeast elevation. The hip roof's original Imperial tile was replaced with composition shingles at some point after World War II. A one-room concrete block addition containing a boiler to heat the building was appended to the northwest elevation at an unknown date. This addition is partially collapsed, exposing the boiler to the elements. The porch railings were removed at an unknown time. Most interior walls were removed during the King's College period**,** converting several offices and operator rooms into a large single room. The brick walls appear sound, but the doors and windows are removed or damaged; the basement is flooded and the roof is heavily weathered.[7]

At each of the Marconi company's receiving stations, the operations buildings were located near an inlet or river that was connected to an ocean, so the salt water could provide effective electrical grounding. An October 1914, *Wireless World* article described how a ring of buried zinc plates electrically grounded this building. In addition to housing offices for the Marconi facility's manager and its engineer-in-charge, this building contained the station's radio tuning and receiving apparatus. It also housed the facility's main operating room where up to 30 wireless operators could work on receiving Morse-coded messages from Wales. Incoming messages were transcribed and then rekeyed for transmission over telegraph landlines to the Marconi offices in New York City or Philadelphia. Those messages, intended for delivery to another link in the global chain of Marconi stations, were transcribed and rekeyed for delivery via telegraph landlines to New Brunswick, New Jersey, where Belmar's associated transmitter station operated.[8] During the King's College period, this building served as a dormitory and a chemistry and physics laboratory.

[7] The Operations Building and the neighboring Operations Annex are the only resources located within the proposed NHL historic district that are still owned by the U.S. Army.

[8] While this building was under construction, an important event in wireless communication history occurred in a nearby shack when inventor Edwin Armstrong conducted the first full-scale test of his new regenerative circuit. With Marconi Company manager (and future RCA president) David Sarnoff present, Armstrong's devise received signals from as far away as Germany and Hawaii, substantially increasing the range of radio reception. Lawrence Lessing, *Man of High Fidelity: Edwin Howard Armstrong* (New York: Bantam Books, 1969), pp. 53 & 180.

Operations Building Annex (#9005) ca. 1917

Slightly south of the Operations Building (#9004), this single-story frame building was built on a concrete slab, and has a hipped roof. [See Photograph #5] It is believed to have been built by the Navy during World War I to provide additional work space for radio operators. Additions to the original rectangular building were added on the southeast and the northeast sides at an unknown date. The roof is in poor condition, and the doors and windows are removed or damaged.

Steam-Electric Power Plant (#9006) 1914

South of Monmouth Boulevard, and west of Marconi Road, this single-story rectangular brick building was the Marconi station's power and electric lighting plant**.** It supplied steam heat to the hotel and the cottages, as well as the electricity necessary to operate the Receiving Station. [See Photograph #6] The original boilers and generators were removed prior to 1938. King's College used this building as a biology laboratory, and the Army used it as an electronics laboratory, and later, as a computer laboratory. The gable roof has two monitor vents. Three sets of double doors were replaced with more modern doors at an unknown date. During World War II a brick one-car garage was added onto the east elevation, and a small brick addition was added along the north elevation to house a heating unit.

"H" Complex (#9010/#9011) 1941
"H" Complex (#9036/#9037) 1942
Heat Plant (#9038) 1942

Located between Second and Fourth streets, this large complex is made up of two connected, H-shaped configurations. The easternmost H-shaped portion (#9010/#9011) was built in 1941, [see Photographs #7 and #8] and the neighboring H-shaped portion (#9036/#9037) was built a year later. [See Photograph #9] The 1942 building was linked to the 1941 building via a long brick corridor that bisects the older H-shaped building, and tangents the two northern elevations of 1942 building.[9] [See Photograph #10] The two parallel stems of each H-shaped configuration measure approximately 60' x 450', and are themselves linked at their centers by an enclosed brick walkway with a gable roof. All four parallel wings are themselves divided into four sections (A, B, C & D), which are separated by firewalls with fire doors. The buildings have 6" concrete slab floors and asphalt shingle gable roofs. The 1941 H-shaped building (#9010/#9011) was designed by New Jersey architect John T. Rowland, but the architect of record for its nearly identical neighbor (#9036/#9037) was William A. Goef. These single-story buildings were built for radar production. The only exterior modifications since World War II are window security gates on some windows, some upgraded windows, and air-conditioning units on concrete pads.

The interiors of each four-section wing featured a central hallway running lengthwise, with offices and laboratories on either side of the hallways. Only one section (in wing #9011) retains its World War II interior configuration (the complexes other fifteen sections were gutted in the 1980s to remediate the presence of asbestos and mold).

The one-story brick heat plant (#9038) is located in the courtyard between the two south wings of #9036/#9037. It is connected to the brick corridor that links the H-shaped building's two wings. The below-grade level interior of the heating plant housed the boilers that serviced buildings #9036/#9037. This is the largest of Camp Evan's World War II-era heating plants, and the only one with a hipped roof.

[9] For NHL purposes, buildings #9010, #9011, #9036, #9037 and #9038 are treated as a single interconnected resource.

Heat Plant (#9012) 1942

Located in the northern courtyard of H-shaped building #9010/#9011, the cellar-deep interior of this one-story brick building housed two boilers that heated building #9010/#9011. [See Photograph #11] The walls feature steel-frame windows, and a single metal door that opens to interior stairways that lead to a basement level. Two sheet metal ventilators sit atop the ridge of the gable roof.

Special Antenna Shelter (#9017) 1942

Located near the southwest corner of H-shaped building #9036/#9037, this is one of twelve Special Antenna Shelters buildings constructed during World War II. [See Photograph #12] These frame, two-story barn-like designs originally included two pairs of oversized double doors, and most distinctively, structural bracing was placed outside of the building to maximize the interior open space needed to fit the secret radar antenna being tested there. New Jersey architect John T. Rowland designed these buildings. This is the only one of the twelve extant antenna shelters at Camp Evans that is located within the proposed boundary. (#9015, #9019, #9021, #9023, #9025, #9045, #9047, #9049, #9051, #9053 and #9055 are in the portion of the Camp Evans reservation that is not slated for preservation.) After World War II the antenna shelters were altered to accommodate their reuse as laboratories, offices, or storage facilities. This particular building's original oversize double doors were replaced with a single metal roll-up door around 1980. Most noticeably, this building no longer retains its external bracing. (Only #9023, which is located outside the proposed boundary, retains its original external bracing.) In 2009, Building #9017 was painted light green to reflect its Cold War-era appearance.

Guard Headquarters (#9029) 1942-1943

North of the younger H-shaped building (#9036/#9037), this large one-story wood frame building is one of several support buildings added during World War II. [See Photograph #13] It includes several paired windows, and a central double entrance door on its southwest elevation. It has a black asphalt roof, and a monitor vent. In 2009, it was painted light green to reflect its Cold War-era appearance.

Heat Plant (#9030) 1942

This one-story brick building sits between the Guard Headquarters (#9029), and the Fire Station (see next entry), southeast of Monmouth Boulevard. The southeast elevation has external steps leading down to the below-grade level of this open-interior building. Two boilers that heated the two neighboring buildings sat inside. A tall brick chimney rises above the roof.

Fire Station (#9031) 1942-1943

The fire station sits north of the younger H-shaped building (#9036/#9037). [See Photograph #14] This frame building has a conventional one-story portion for sleeping quarters, and a slightly taller and wider garage section (at its east end) with two large vehicle entry doors. In 2009, it was painted light green to reflect its Cold War-era appearance.

Heat Plant (#9033) 1942

This one-story brick building is located slightly south of the Marconi Hotel's Administration Annex (#9032).

Its basement contains the two boilers used to heat the hotel annex. The building has a chimney that is nearly three stories tall.

Electric Shop (#9034) 1942-1943

Located south of the older H-shaped building (#9010/#9011), this single-story frame building measures 60' x 100'. [See Photograph #15] Originally an electric shop, it is similar in design (but not materials) to a single section of the H-shaped buildings. It has paired and tripled double-hung windows, and metal rolling overhead doors were added at some point after World War II. The roof ridge has vent monitors. In 2009, this building was painted light green to reflect its Cold War-era appearance.

Heat Plant (#9035) 1942

Located south of the older H-shaped Building (#9010/9011), this one-story brick building has a tall brick chimney. The building housed two boilers in its basement level that were used to heat the nearby Electric Shop (#9034). A concrete block storage room was added to the north elevation at an unknown date.

Garage (#9057) 1942

Located south of the Electric Shop (#9034) and the Heat Plant (#9035), this 30' x 36' one-story frame building has a concrete block foundation, poured concrete floor, wood shiplap siding, and composite gable roof. [See Photograph #16] The northwest elevation has two garage doors with multiple-pane glass windows, and a wide chimney sits east of the roof ridge. The repainting this of building, in order to reflect its World War II-era tan appearance, will be completed during the Spring of 2012.

Telephone Exchange (#9059) 1942-1943

The Telephone Exchange building is located south of the Steam-Electric Power Plant (#9006). [See Photograph #17] This single-story frame building is rectangular in shape and contains several standard windows. Repainting the Telephone Exchange tan, in order to reflect its World War II-era appearance, will be completed during the Spring of 2012. The World War II-era telephone operator switchboards are no longer present**.**

Transformer Vault (#9065) 1944

Located west of the Marconi Hotel (#9001), this small, one-story concrete and stucco building has a concrete foundation and a flat roof, and a transom over the doorway on its north elevation.

Transformer Vault (#9066) 1941

Located in the north courtyard of H-shaped building #9010/#9011 (beside #9011C), this small (16' x 20'), one-story brick building has a concrete foundation and a sloped roofline. [See Photograph #18] A transom is above the entrance's double metal doors.

Transformer Vault (#9067) 1941

This building is located in the north courtyard of H-shaped building #9010/#9011 (beside #9010D). See description of similar Transformer Vault #9066.

Transformer Vault (#9068) 1941

This building is located in the south courtyard of H-shaped building #9010/#9011 (beside #9011A). [See Photograph #19] See description of similar Transformer Vault #9066.

Transformer Vault (#9069) 1942

This building is located in the south courtyard of H-shaped building #9010/#9011 (beside #9010A). [See Photograph #19] See description of similar Transformer Vault #9066.

Transformer Vault (#9070) 1942

This building is located in the north courtyard of H-shaped building #9036/#9037 (beside #9037C). [See Photograph #19] See description of similar Transformer Vault #9066.

Transformer Vault (#9071) 1942

This building is located in the south courtyard of H-shaped building #9036/#9037 (beside #9037A). See description of similar Transformer Vault #9066.

Garage (#9096) 1945

This single-car corrugated metal garage was constructed to the northeast of the Marconi-era Manager's Cottages (#9002) during World War II. It has an asphalt shingle roof and an extended wooden overhang above the garage door on the west elevation.

Switch Building (#9114) 1944

Located south of the Electric Shop (#9034), this 20' x 37' frame building has shiplap siding and a gable roof. It has single and double metal doors and a small square hinged window. Its repainting to World War II tan and brown will be completed during the Spring of 2012.

Gas Cylinder Storage Shed (#9120) 1945

West of section #9011A, this one-story frame building measures 8' x 21'. [See Photograph #20] It has shiplap siding, a composition shingle roof, and only a single door and a fixed window.

Garage (#9201) 1942

This two-car garage was built during World War II to the south of the Marconi-era Manager's Cottage (#9002). This wood-frame building measures 20' x 20', has a hipped, composition-shingled roof, and features a single wide overhead garage door on the west elevation.

Garage (#9202) 1945

This three-car garage was built to the north of the Marconi-era Chief Engineer's Cottage (#9003). The wood-frame building measures 24' x 27' and is covered with composition felt manufactured to look like brick. The

hipped roof has composition shingles. In addition to the three overhead garage doors on the west elevation, the building has an entrance door and a window on its south elevation.

Storage Shed (#9342) 1945

Located south of H-shaped building #9010/9011 (beside #9011A), this 16' x 18' plywood building has a composition shingle gable roof. [See Photograph #21] It has a set of double doors on the north elevation, and single windows on the two other courtyard-facing elevations.

Dymaxion Deployment Units (unnumbered) ca.1944 [5 buildings]

Five pre-fabricated corrugated circular metal buildings remain within the historic district boundary (four in the courtyard between the H-shaped complexes, and one east of the Special Antenna Shelter).[10] [See Photograph #22] Named Dymaxion Development Units (DDUs), these single story buildings were influenced by Richard Buckminster Fuller's innovative Dymaxion House design. The DDUs were manufactured by the Butler Manufacturing Company, a firm that manufactured grain bins. Designed to provide storage and shelter space, they used a minimum of building materials, and could be assembled by two people in a few hours. Each unit featured round porthole windows, and was topped by a round ventilation hatch with a pop-up cover. At Camp Evans, the DDUs were placed on specially formed circular concrete pads that measured 18' across. The historic district's extant DDUs are in fair to good condition and are slated for restoration. The now vacant locations of nine other DDUs are marked by nine empty circular concrete pads at various places within the historic district.

Noncontributing Resources

General Purpose Warehouse/Secure Metal Shop (#9084) ca.1952

This metal building is in the northern courtyard of H-shaped building #9036/#9037. The windowless building is 20' x 80', and sits on a concrete floor. It is a noncontributing resource because it postdates the period of national significance.

General Purpose Laboratory/General Purpose Administration (#9086) ca.1952

This single-story utility building is in the north courtyard of H-shaped building #9036/#9037. Its original dimensions were 20' x 80', and a 12' x 20' end extension, and an 8' x 15' side addition were subsequently added. It has a concrete foundation and floor. The vinyl siding was added ca. 1980. It has a single rear exit door leading into the courtyard. It postdates the period of national significance.

Test Building (#9092) post World War II

Located west of building #9006, and north of building #9010/#9011, this tall one-story metal building measures 20' x 20', with a shorter 8' x 10' frame side wing. The front elevation has a double metal door (surmounted by a transom), three metal awning-type windows, and a gable vent. It postdates the period of national significance.

[10] Another six of these distinctive buildings are located not far outside the boundary: one near building #9013; one near #9246; and two each near buildings #9019 and 9401. The one near #9013 has been painted and stabilized, and the rest are rusted (and two of these sustained additional damage).

Gate 1 Sentry Station (#9093) ca.1951

North of the Marconi Hotel, this narrow one-story building served as the sentry station and guard office for Gate 1. In 2004, this frame building was painted light green to reflect its Cold War-era appearance. The main section is 18' x 13', and the smaller section is 12' x 9'. It is a noncontributing resource because it postdates the period of national significance.

Foundry (#9097) 1949

This single-story, corrugated metal, steel frame building is located west of H-shaped building #9010/#9011. It measures 20' x 42'. It has five steel frame windows and three sets of double doors. Vents on the gable roof suggest this building's original foundry function. Inside, the furnace is no longer in place, but its exhaust hood remains. It postdates the period of national significance.

General Purpose Laboratory/General Storehouse (#9098) 1950

This single-story, corrugated metal, steel frame building is in the southern courtyard of H-shaped building #9010/9011. This 18' x 20' building has steel frame windows. The western elevation includes a small external vestibule that abuts an entrance to section #9011B. This building post-dates the period of national significance.
Gate 3 Sentry Post (#9155) 1942

This sentry post consists of a 5' x 5' guard shack and an open-sided guard shelter that has a gable roof supported by eight 4" x 4" wooden posts. In 2009, this sentry post was relocated from Gate 3's historic location (outside the proposed historic district, at the intersection of Monmouth Boulevard and Sixth Street) to Gate 2, at the intersection of Monmouth Boulevards and Fourth Street. Because it was relocated from its historic location after the period of national significance, it is a noncontributing resource.

Platform/Tower (#9178) ca.1970

This five-story tower is located east of H-shaped building #9036/9037. Supported by eight steel columns, the structure contains three open and enclosed research levels from which various laser and other electronic instruments were tested. It postdates the period of national significance.

Storage Shed (#9312) ca.1952

Located in the southern courtyard of H-shaped building #9010/#9011 (beside #9011A), this single-story corrugated metal building measures 14' x 30'. [See Photograph #19] It has a single door on the south end, a window on the north end, and is topped by a composition shingled gable roof. This building is currently used to store a historic vacuum tube collection. It postdates the period of national significance.

Gas Cylinder Storage Shed (#9344) ca.1952

The southernmost building located in the courtyard of building #9010/#9011 (beside #9011A), this metal frame building measures 8' x 18'. [See Photograph #19] The south end has a covered loading dock that is angled at 45 degrees to accommodate loading of gas cylinders. The building has a composition shingle roof with a heat ventilator. It postdates the period of national significance.

General Purpose Laboratory/General Purpose Administration (#9400) 1952

This single-story, concrete block building is located south of H-shaped building #9010/9011. [See Photograph #23] It has two doors and seven windows on its north elevation. In 2009, it was painted light green to reflect its Cold War-era appearance. This nondescript building housed a highly classified program that collected data from overseas seismic wave monitors used to detect Soviet and Chinese atomic testing. This building also played a minor role in Senator McCarthy's overzealous efforts to root out communists from the U.S. Army, when his committee's chief counsel (Roy Cohn) was denied access to this secure building during a 1953 visit to Camp Evans. This perceived slight further fueled animosities between McCarthy and the Army in advance of the televised hearings that quickened the senator's downfall. This building is a noncontributing resource because it postdates this nomination's period of national significance.

General Purpose Utility Building (#9634) ca.1950

Located north of the Guard Headquarters (#9029), this 8' x 18' building has an iron angle frame sheathed with corrugated metal siding. It has a metal gable roof with a monitor. The entrance door is on the northeast elevation, and a window is on the southwest elevation. It postdates the period of national significance.

General Purpose Utility Building (#T-625) ca.1950

Located in the courtyard between the two H-shaped buildings (west of #9011B), this 8' x 18' building has an iron angle frame sheathed with corrugated metal siding. It has a metal gable roof with a monitor. The entrance door is on the west elevation, and a window is on the east elevation. It postdates the period of national significance.

General Purpose Utility Building (unnumbered) ca.1950

This building is located in the courtyard between the two H-shaped buildings (west of #9011A). See the description to similar Building #T-625. It postdates the period of national significance.

INTEGRITY

The approximately 27-acre historic district was the central core of a larger World War II- and Cold War-era military facility. The nominated area currently includes 49 buildings and structures. Thirty-five of these extant resources are contributing resources because they were part of Camp Evan's World War II-era operations, and retain integrity to that period. The nominated area has lost only a few World War II-era buildings, and only a few extant buildings and structures postdate the war. Original Camp Evans acreage located outside the proposed historic district generally retains a lower degree of integrity due to the loss of many historic resources, and/or the introduction of post-World War II buildings and structures. Immediately outside the southwestern boundary of the proposed historic district is a 25-acre portion of Camp Evans that contained two dozen World War II- and Cold War-era buildings and structures. Some of these resources have been, or will be, removed so the site can be repurposed as a satellite campus for a community college. [See Photograph #24] Even in its reduced size, the proposed National Historic Landmark historic district retains the look and feel of the World War II-era facility, and when compared to properties that were importantly associated with the development of radar, Camp Evans' higher degree of integrity is even more appreciated.

8. STATEMENT OF SIGNIFICANCE

Certifying official has considered the significance of this property in relation to other properties:
Nationally: X Statewide:__ Locally_:

Applicable National Register Criteria:	A__ B__ C__ D__
Criteria Considerations (Exceptions):	A__ B__ C__ D__ E__ F__ G__
NHL Criteria:	1
NHL Criteria Exceptions:	N/A
NHL Themes:	IV. Shaping the Political Landscape 3. Military Institutions and Activities VI. Expanding Science and Technology 2. Technological Applications
Areas of Significance:	Engineering Industry Military
Period of Significance:	1941 - 1945
Significant Dates:	1941, 1942, 1943, 1944, 1945
Significant Person:	N/A
Cultural Affiliation:	N/A
Architect/Builder:	Marconi Wireless Telegraph Company of America U.S. Army Signal Corps John T. Rowland
Historic Contexts:	VIII. World War II A. War in Europe, Africa, and the Atlantic, 1939-1945 B. War in the Pacific, 1941-1945 D. The Home Front XVIII. Technology (Engineering and Invention) E. Military (Fortifications, Weapons, and War Vehicles)

State Significance of Property, and Justify Criteria, Criteria Considerations, and Areas and Periods of Significance Noted Above.

SUMMARY

Located near the Atlantic coast of central New Jersey, this property served a variety of civilian and military functions throughout the twentieth century. Named Camp Evans when the U.S. Army Signal Corps acquired the property in 1941, this site functioned as an electronics development, testing, and production facility during World War II, and continued in that general capacity for several decades. During the war Camp Evans became one of the principal U.S. sites associated with the development of radar. The central core of the larger World War II-era facility remains largely intact, and is slated for preservation. This area conveys a strong sense of time and place, and meets NHL Criterion 1 as the best extant historic property associated with the nationally significant development of radar.

The introduction of long-range bombers during the early twentieth century heightened anxieties about air attacks. In 1932, British politician Stanley Baldwin gave voice to this concern when he famously noted, "I think it is well for the man in the street to realize that there is no power on earth that can protect him from being bombed….Whatever people may tell him, the bomber will always get through."[11] Theories about reflecting electromagnetic waves off solid objects had been raised during the late nineteenth century, and a crude radar-like system was tested in Germany as early as 1904. However, it was a vastly different matter to convert such theories into systems sophisticated enough to perform satisfactorily under real world conditions. By the late 1930s, researchers in 13 nations were independently and secretly working to develop various types of technologies that would eventually be called radar. During World War II, the development of radar became one of the war's most significant technological developments and the United States exceeded all others in its evolution and application of this type of technology.[12] Initial American efforts focused on ground-based systems designed to provide early warning systems and to direct searchlights and anti-aircraft guns. Other radar systems were designed to function in confined spaces on ships and planes to aid navigation and locate enemy targets.

Because radar systems were designed to meet different purposes, it would be an oversimplification to state that radar was "invented" at one time, or at one location.[13] Even once a particular radar system was developed, additional work was necessary to test, battle harden, and manufacture these advanced technological systems in the quantity and quality required for combat. The U.S. Army Signal Corps' Laboratory at Camp Evans, New Jersey became one of the principal facilities where radar work was done during World War II. In many instances Camp Evans radar teams planned, set specifications, directed, contracted and coordinated wartime radar research and production with other radar laboratories. Equipment developed, tested, battle hardened, documented, and upgraded at Camp Evans saw use in all World War II theaters of war and protected American military assets worldwide. The portion of Camp Evans being nominated remains largely intact. When compared to other extant properties importantly associated with the development of radar during World War II, Camp Evans is the most intact historic resource. As such, it meets National Historic Landmarks criterion 1, as the property that best represents the development of radar.

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[11] Stated by the de facto prime minister in a speech before the House of Commons, as quoted in: Robert Buderi, *The Invention That Changed the World* (New York: Simon Shuster, 1996), p. 53.

[12] Raymond C. Watson, Jr., *Radar Origins Worldwide: History of Its Evolution in 13 Nations Through World War II* (Victoria, B.C.: Trafford Publishing, 2009).

[13] For example, it has been noted that at one major radar development site (the Radiation Laboratory on the MIT campus) developed as many as 150 distinct radar systems. James Phinney Baxter, *Scientists Against Time* (Boston: Little, Brown and Company, 1946), p. 142.

BACKGROUND

Following the discovery of electromagnetic radiation by Michael Faraday in England during the 1830s, electromagnetic waves were mathematically defined by James Clerk Maxwell in Scotland and experimentally demonstrated by Heinrich Rudolf Hertz in Germany. Practical applications of electromagnetic waves followed throughout the world; in America, a number of individuals were granted early patents for implementation hardware, including Mahlon Loomis (1872), Amos Dolbear (1882), Thomas Edison (1891), and Isidor Kitsee (1895).

In 1896, 22-year old Guglielmo Marconi demonstrated a wireless telegraph set in Great Britain. Although he was not the first person to build a wireless apparatus, Marconi is often given credit for the invention, and his promotional efforts gave great impetus to the rapid adoption of this technology. A primary commercial advantage of a long-distance wireless network was the ability to charge for telegraph services capable of undercutting the high fees charged by the established undersea cable telegraph companies.[14] In 1897, Marconi established a firm to provide wireless service, with the stated purpose of obtaining a worldwide monopoly in this field. By the turn of the century, a subsidiary, the Marconi Wireless Telegraph Company of America, was in operation.

The best known early demonstration of long-distance wireless – more often called radio in America – occurred on December 12, 1901, when Marconi transmitted a signal across the Atlantic from Cornwall, Great Britain, to St. John's, Newfoundland, a distance of about 2,100 miles. Since electromagnetic waves were known to follow straight-line paths, this led American Arthur Kennelly and Englishman Oliver Heaviside to independently propose that a layer of ions (charged atoms and molecules) was above the atmosphere and reflected certain radio waves back to earth.

The Belmar Station

Marconi came close to having a monopoly in commercial wireless telegraphy. In 1912, he started a wireless network that was intended to eventually extend around the world. At the time, Marconi had already established a wireless network across Europe with a link extending to South Africa, and a trans-Pacific link was being built, connecting California, Hawaii, and Japan. A trans-Atlantic arm was also being developed, with the British receiver at Towyn, North Wales, and the transmitter at Carnarvon. The American arm (Marconi Station No. 6) was opened in 1914 with its receiving station located at Wall Township, New Jersey, about a half mile west of Belmar. The corresponding transmitter, one of the most powerful of that day, was located 32 miles inland near New Brunswick in Franklin Township, but was controlled from Belmar.[15] (Twenty-seven years later, the former Belmar Station would become the U.S. Army Signal Corps' Camp Evans Laboratory.)

At the Belmar Station, located along the Shark River and only two miles from the Jersey coast, Marconi built a development laboratory, a 45-room hotel, and several other facilities. The associated transatlantic wireless station had a mile-long bronze-wire receiving antenna strung on six 400 foot tall masts with three 150 foot balancing towers along the river. Outgoing Morse-code messages were sent via a telegraph land-line from the Belmar Station to the transmitter. There was also a land-line to an office in New York.[16] Before the station was completed the celebrated demonstration by Edwin Armstrong of his first breakthrough innovation, the

[14] F. M. Sammis, "A Wireless Girdle Round the Earth," *The Marconigraph*, October 1912: 255.
[15] Wireless stations at that time commonly separated the transmitter some distance from the receiving station so the transmission would not saturate the receiver, blocking incoming messages.
[16] "Description of Marconi's New Jersey Stations: Belmar and New Brunswick," *Wireless World,* October 1914: 414-418.

Regenerative Circuit, occurred on January 31, 1914 in a construction shack next to the incomplete wireless operations building.

In April 1917, the U.S. Navy commandeered Belmar Station and it became a unit of their Trans-Atlantic Communication System. Lieutenant (Dr.) Albert Hoyt Taylor, later a developer of radar with the Naval Research Laboratory (in Washington, D.C.), headed this activity and personally conducted antenna research at the Belmar Station. This station was extensively used for open communications during the war, and President Woodrow Wilson's speeches were often broadcast (in Morse code) to Europe through this facility.[17] The facility was considered so important that a hundred Marines protected it from enemy sabotage. The team gathered by Dr. Taylor at Belmar Station later made up a good portion of the NRL radio division, the World War II "fathers" of Naval radar. The work of Taylor and Roy Weagant on static elimination during the war was hailed by the national press as the most important radio advance of the decade when disclosed after the war. Wireless operator Frederick Schnell was on duty to receive the German acceptance of the armistice terms for forwarding to Washington, D.C.

After World War I, the newly formed Radio Corporation of America (RCA) acquired the station under a law limiting foreign ownership of vital facilities. RCA closed the station, however, in 1924. Part of a balancing antenna remains as a memorial to this early site, with a plaque that notes its association with the first commercial wireless transatlantic communication installation. In 1925, following closure of the Belmar Station, the site was sold to the Monmouth Pleasure Club Association (comprised of New Jersey Ku Klux Klan members).[18] By the late 1930s, the former Marconi facility's land and buildings were purchased for the campus of King's College, a Christian liberal arts school founded by Philadelphia radio evangelist Reverend Percy B. Crawford. The school operated there until 1941, at which time the campus was purchased by the U.S. Army Signal Corps.[19]

Radio Evolution

In the years leading up to World War I, wireless/radio telegraphy greatly matured. All of the early transmitters were little more than high-voltage sources that caused a spark to jump across a gap and generate an electromagnetic wave that was then radiated from an extended wire – the transmitting antenna. The most used early receiver was called a choerer, primarily consisting of metal filings in a tube that allowed the passage of current when excited by an electromagnetic signal intercepted by a receiving antenna. The current then passed through a buzzer, providing an output in audio form.

The spark transmitter was gradually replaced by several different types of rotating devices that generated radio-frequency signals; these included the vastly superior Alexanderson alternator. A great advantage of these rotating devices was that they produced a continuous signal that could be audio-modulated, rather than the off/on Morse-code signal of the spark transmitters. In mid-1918, the spark transmitter at New Brunswick was replaced by a 200-kilowatt Alexanderson alternator. This provided more reliable communications with troops fighting in Europe, as well as allowing voice transmission.

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[17] A. Hoyt Taylor, *Radio Reminiscences: A Half Century* (Washington, D.C.: U.S. Naval Research Laboratory, 1948), pp. 50-60.

[18] "Klan Has Summer Resort: Buys Old Marconi Radio Station on Shark River," *New York Times,* June 20, 1926, sec. 2: 19; http://infoage.org/html/nyt-06-20-1926.html.

[19] The college then relocated to New Castle, Delaware, and presently operates in New York City. "King's College at Belmar, N.J."; http://infoage.org/html/kings.html; http://www.tkc.edu/abouttkc/history.html.

A major improvement in radio evolution came with the invention of the triode vacuum tube by American Lee de Forest in 1906.[20] Although slow in being adopted, this led to the electronics technology that came to dominate both transmitters and receivers. As noted in the next section, in 1917 the U.S. Army established the Signal Corps Radio Laboratories at Camp Vail (predecessor of Fort Monmouth), and the first activity there involved testing commercial radio tubes for their applicability in communication equipment. The triode vacuum and associated circuits provided the foundation for eventual radar development.

SIGNAL CORPS LABORATORIES[21]

At the beginning of World War I, the Army Signal Corps leased a former race track near Eatontown, New Jersey, for an officer training site. Temporarily called Camp Little Silver (the name of a nearby port), it was officially designated Camp Alfred Vail in September 1917, named for an inventor from that area who partnered with Samuel F. B. Morse in developing the electrical telegraph. The Signal Corps Radio Laboratories under Colonel (Dr.) George O. Squier was established there, conducting research in radio and electronics and testing equipment manufactured by commercial firms for the Signal Corps. The American Marconi Corporation manufactured over $1,000,000 in wireless equipment for the Signal Corps at its Aldene, New Jersey Plant. French and other wireless experts tested receiver designs at the Belmar Station for the navy during this time.[22]

The Signal Corps purchased the Camp Vail property in 1919, and the Army Signal School relocated there from Fort Leavenworth, Kansas. In August 1924, the installation gained permanent status and was renamed Fort Monmouth, honoring American Revolutionary War soldiers who died in the nearby Battle of Monmouth. In early 1930, because of the declining economic conditions associated with the Great Depression, the Signal Corps consolidated a number of research and development operations, relocating them to Fort Monmouth.

On June 30, 1930, these consolidated operations were designated the Signal Corps Laboratories, responsible for the Army's ground radio and wire communications development, as well as improvements in meteorological services. The initial staff was small, consisting of 5 officers, 12 enlisted men, and 53 civilians.

The Army Signal School remained the primary activity at Fort Monmouth. This school trained both soldiers to operate telegraph, telephone, and radio communication facilities, as well as officers to direct these activities. There was even a small unit that trained and used carrier pigeons, a carry-over from World War I, during which these birds had played an important communications role.

Position-Finding Technologies

In 1931, the Director of the Signal Corps Laboratory, Major (Dr.) William R. Blair initiated Project 88, "Position Finding by Means of Light," where 'light' included visible and infrared radiation, as well as radio waves at very short wavelengths.[23] Lieutenant (Dr.) Harold A. Zahl was Blair's primary assistant in these studies. Initial emphasis was on devices to detect infrared signals reflected by a target when illuminated by a searchlight.[24] In 1932, the equipment tracked a blimp at a distance of about a mile, but this technique was abandoned because searchlights could not produce infrared signals of adequate strength.[25]

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[20] Mike Adams, "The Complete Lee de Forest," Perham Collection of History, San Jose State University, 2007; http://www.leedeforest.org.

[21] Dulany Terrett, *The Signal Corps: The Emergency (to December 1941)*, 4th ed. (Washington, DC: Government Printing Office, 2002).

[22] A. Hoyt Taylor: 50-60.

[23] See Attachment A for discussion of wavelength.

[24] "U.S. Army Signal Corps Laboratories, Annual Report for FY 1931." Archives, Department of the Army.

[25] "U.S. Army Signal Corps Laboratories, Annual Report for FY 1932." Archives, Department of the Army.

During 1933, the Signal Corps Laboratories turned to detection methods for radio signals with wavelengths much less than one meter – the microwave region. At that time, these constituted a "no man's land" between the usable radio spectrum on one hand and the optical spectrum on the other.[26] In 1934, RCA demonstrated an elementary detection apparatus using microwaves, but, as with the infrared effort, there were no microwave sources with sufficient power for allowing detection over significant distances.[27]

When a wave originates or is reflected from a moving object, its frequency is shifted, becoming higher to a receiver in the direction of motion and lower in the opposite direction. This is called the Doppler effect and the change in frequency is directly proportional to the velocity.[28] The Signal Corps Laboratories began examining the Doppler-beat technique – mixing the original signal with a Doppler-shifted reflected signal and thus generating a signal equal to the difference. In 1935, they used microwaves and this technique to detect an aircraft at a distance of over a mile. Blair's annual report, however, stated. "To date the distances at which reflected signals can be detected with radio-optical [microwave] equipment are not great enough to be of value."[29] As the economic restrictions of the Great Depression lessened, activities of the Signal Corps Laboratories increased. To house these activities, Squier Hall was built in 1935.[30]

From the start of radio, signals had been received at distances far greater than the line-of-sight between the transmitter and receiver. As earlier noted, Kennelly and Heavierside had hypothesized that the signals were "bounced" by a layer of ionized gas above the atmosphere. In an attempt to measure the height of this layer, Gregory Breit and Merle Tuve of the Carnegie Institution of Washington had a transmitter built by the Naval Research Laboratory that could emit a signal in a short pulse, then remain silent for an adjustable period. In 1925, using an oscilloscope to display a single transmitted and received pulse, Breit and Tuev measured the time interval between these pulses. Knowing the speed of the radio wave to be about 186,000 miles per second, the time interval was used to determine that the height of the layer (today called the ionosphere) varied between about 55 to 130 miles. This was the first known use of radio signals to measure distance.[31]

In December 1935, Robert M. Page at the Naval Research Laboratory used Young's pulse technique in a simple 200-MHz transmitter, and detected a target and also measured the distance (range) to the target. This was the first demonstration in the world of what would later be called radar.[32] In 1940, the acronym RADAR was coined by the Navy as a cover for work in the highly secret Radio Detection and Ranging technology, and the noun 'radar' soon followed.

[26] "U.S. Army Signal Corps Laboratories, Annual Report for FY 1933." Archives, Department of the Army.

[27] "U.S. Army Signal Corps Laboratories, Annual Report for FY 1934." Archives, Department of the Army.

[28] This effect was named after Austrian physicist Christian Doppler, who proposed it in 1842. The Doppler effect is readily discerned in the tone (frequency) of the whistle of a passing train: higher in tone when the train approaches a listener, then lower in pitch as the train departs. For a brief explanation of wavelengths and frequencies, see the attachment at the end of this nomination.

[29] "U.S. Army Signal Corps Laboratories, Annual Report for FY 1935." Archives, Department of the Army.

[30] This facility was named to honor Dr. George O. Squier, a Major General and Chief Signal Officer during World War I, and founder of research at Fort Monmouth. In 1919, he was elected to the National Academy of Sciences for accomplishments in communications.

[31] G. Breit and M. A. Tuve, "A Test of the Existence of the Conducting Layer," *Physical Review* 28 (1926): 554.

[32] Robert Morris Page, *The Origin of Radar* (Doubleday Anchor Books, 1962), pp. 65-66.

The Army's First Radars[33]

At the Signal Corps Laboratories in 1935, Blair had noted that consideration was being given to using pulsed transmission.[34] A modest project in pulsed microwave transmission was started, expecting that the low power might be concentrated during the pulse to make it useful. However, upon learning of the success of Page at the Naval Research Laboratory, the Signal Corps Laboratories decided that the equipment operation should be changed from microwaves to a much longer wavelength (a much lower frequency).

A 110-MHz, pulsed transmitter was built at the Signal Corps Laboratories in early 1936, and a request was made to the War Department for developing a full set; the technique was called Radio Position Finding (RPF). The request was turned down, but eventually $75,000 for support was diverted from a previous appropriation.

Paul E. Watson, the Signal Corps Laboratories Chief Engineer, personally took over the project. For a field test, an experimental RPF transmitter and receiver were set up about a mile apart on the New Jersey coast near the New York Harbor. The separation was to keep the transmitter from overwhelming the receiver. On December 14, 1936, the equipment detected and ranged airplanes at up to 7 miles distance flying in and out of New York City.[35]

Following the successful demonstration of an experimental pulsed apparatus, a Radio Position Finding Section was formed in the Signal Corps Laboratories. Their first RPF system was designed with not only separate antennas for transmitting and receiving, but also separate antenna arrangements for determining the azimuth and elevation of targets. To keep the antennas as small as possible, the operating frequency of the set was increased to 200 MHz (antenna length is inversely proportional to frequency). The entire apparatus was mounted on a rotating platform that also carried positions for three operators, one each for range, azimuth, and elevation, making a very complex arrangement.

The output of the RPF system was used to aim a searchlight. The searchlight, in turn, provided the information to direct air anti-aircraft guns for night-time operation. During cloudless, daylight hours, a more accurate optical range-finder was used.

The first demonstration of the experimental set was made on the night of May 26, 1937. An unlighted bomber was detected by the RPF system and then illuminated by the searchlight. The observers included the Secretary of War, Henry A. Woodring; he was so impressed that the next day orders were given for the full development of the system. A special Congressional appropriation of $250,000 was obtained. Engineers from Western Electric and Westinghouse were brought in to assist in the overall development.

In early 1938, for better security and more space, the RPF activities were relocated about 11 miles northeast to Fort Hancock, New Jersey, an isolated location on a sandbar peninsula reaching into the New York Harbor. The prototype system was designated SCR-268, with SCR meaning either Set Complete Radio or Signal Corps Radio and used interchangeably in documents. During 1938, Colonel Blair's health failed, and Colonel Roger B. Colton took over as the Signal Corps Laboratories Director.

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[33] Roger B. Colton, "Radar in the United States Army," *Proceedings of the IRE* 33 (1947): 740-753; Arthur L. Vieweger, "Radar in the Signal Corps," *IRE Transactions on Military Electronics,* MIL-4, October 1960: 555-561; Sean S. Swords, "United States Army Signal Corps," *Technical History of the Beginnings of Radar* (London: Peter Peregrinus Ltd., 1986), pp. 112-118.

[34] "Annex to U.S. Army Signal Corps Laboratories, Annual Report for FY 1934." Archives, Department of the Army.

[35] "U.S. Army Signal Corps Laboratories, Annual Report on Research for FY 1936." Archives, Department of the Army.

Since it was primarily intended for aiming searchlights associated with anti-aircraft guns, the system required approval by the Coast Artillery Board. In late November 1938, the equipment was taken to Fort Monroe, off the coast near Hampton, Virginia, for a night demonstration to the Board. This was almost a failure because the intended target, a Martin B-10 bomber at 20,000-feet altitude, was blown off course and flew miles out over the Atlantic. After a long return flight, the bomber was first detected by the SCR-268, then it came above an opening in the clouds and, to the delight of the observers, was immediately illuminated by the searchlight.[36]

Production of SCR-268 sets was started by Western Electric in 1939, and they entered service in early 1941. During the war, about 3,100 sets were built. When Corregidor in the Philippines fell to the Japanese in May 1942, an SCR-268 in operating condition was captured, giving Japan vital technical information on American radar.

In parallel with the completion of the SCR-268, then-Major Harold Zahl led a new project. Sufficient funding and a high priority were received; thus, development was quickly completed. This set returned to a lower frequency (106 MHz), and Westinghouse was given a contract to supply a new water-cooled tube (WL-530) that was used in push-pull configuration to deliver 100-kW in peak-pulse power. It had a simplified antenna configuration in layers on a tall mast. Although not as accurate as the SCR-268, it was easier to maintain and had a greater range.[37]

There were two configurations for the new system – the SCR-270 (mobile) and the SCR-271 (fixed-site). Westinghouse received the production contract, and started deliveries near the end of 1940. Eventually, about 800 sets were built; these were the Army's primary early-warning radars throughout the war.

An SCR-270 was in service at Opana Point near Kawela, Hawaii, on the morning of December 7, 1941. At 7:20, the operators reported detecting a flight of planes due north, but the duty officer at the recently opened Aircraft Warning System in Fort Shafter, Honolulu, dismissed it as "nothing unusual," believing the detection to be from a flight of bombers known to be approaching from the mainland. Consequently, the alarm went unheeded. At 7:59, the Japanese hit Pearl Harbor.[38]

In addition to leading the development of the SCR-270 and SCR-271, Zahl made a significant contribution to future systems by developing a transmitter tube (type VT-158) that could deliver 240-kW peak-pulse power at a frequency up to 600 MHz.[39]

Research in Great Britain was also resulting in higher frequency tubes and RDF (their term for radar) equipment. At that time, however, there was no exchange of secret technical information between the United States and Great Britain; thus, their developments proceeded independently. In fact, researchers in both nations were negligent in not examining journal publications from Japan and the USSR, wherein significant advancements in these technologies were openly disclosed.

[36] For a dramatic account of this incident, see: Harold Zahl, "Colton's Baby Comes Through," *Readers Digest*, August 1958.
[37] Harold Zahl, *Electronics Away* (New York: Vantage Press, 1969), pp. 40-46.
[38] Witness Testimony Regarding Opana Point Radar, Joint Congressional Committee, November 15, 1945, to May 31, 1946; http://www.ibiblio.org/pha/myths/radar/.
[39] William I. Orr, "The Secret Tube That Changed the War," *Popular Electronics,* March 1964: 57-59.

Formation of Camp Evans[40]

As the United States edged toward war, the overall activities at Fort Monmouth greatly expanded. During 1941, additional property was acquired for three auxiliary camps: Camp Coles near Red Bank, Camp Charles Wood in Tinton Falls, and Camp Evans in Wall Township. The first two were nearby the main part of Fort Monmouth, and Evans was about 10 miles south. What was originally the Signal Corps Laboratories was divided between these three new facilities and Squier Laboratory.

The Wall Township purchase included the original Marconi buildings and the surrounding 93 acres.[41] Camp Evans became the centerpoint for RPF activities, and the research and development work at Fort Hancock was moved there. The operation was initially called the Signal Corps Radar Laboratory, but, to obscure the purpose of the installation, the name was soon changed to Evans Signal Laboratory. Paul Watson, then a Lieutenant Colonel, was named the Director. A central building, commonly called the Marconi Hotel, became the headquarters. Outdoor testing of hardware was often done at Twin Lights, a lighthouse station on the coast between Camp Evans and Fort Hancock.

In March 1942, the U.S. Army was reorganized into three components: Ground Forces, Air Forces, and Service Forces; the Signal Corps was in the Service Forces. In December, the operations at Squier Laboratory, Camp Coles, and Camp Evans were organizationally consolidated as the Signal Corps Ground Services. Headquarters for this organization was set up in the 150-room Grossman Hotel at Bradley Beach, on the coast about three miles northeast of the main Camp Evans facilities. Technical work on radar remained centered at Camp Evans and, for most purposes this continued to be referred to as the Evans Signal Laboratory. The Secret Monthly Project Reports to the Chief Signal Officer on file at NARA show Camp Evans' central role in World War II radar development.

Facilities at Camp Evans expanded rapidly at the beginning of the war. In addition to the five original Marconi brick buildings in the former Marconi Station antenna field, two huge interconnected 'H'-shaped brick with wooden roof truss buildings were built for radar prototyping, production engineering and testing. Each 'H' was formed from eight 60' by 120' firewalled sections for approximately 56,000 square feet each. The firewalls prevented the loss of the entire building if hit by an enemy aerial attack. Twelve specially-designed 60' x 60' two story barnlike 'Special Antenna Shelters' were constructed to allow work on radar antennae safe from the weather and out of observation of enemy spies. Nearly 50 buildings and structures were constructed to support the various aspects of wartime radar development. All the work had to be done in secret from concept drawings, fabrication of prototypes, testing of prototypes to elicit design failure in the lab. Finally, complete documentation was created for manufacture and quality control, as well as manuals for usage in the field by combat troops and repair manuals for Signal Corps technicians. Many smaller buildings were also built. Besides laboratory research, hardware manufacturing, and equipment testing, there were major activities at Camp Evans in support areas such as drafting, manual preparation, and logistical services. At its peak, about 3,000 military and civilian personnel worked in these facilities. Overall, some 9,000 personnel were at the

[40] CECOM Historian, "Evans Area." http://cecom.army.mil/historian/pubupdates/Ft%20%20Landmarks_Online_Summer2009.pdf.

[41] "Army to Take Over Old Marconi Track," *The Coast Advertiser* August 15, 1941; "Fort Monmouth to Acquire More Land," *Matewan Journal* September 11, 1941; Mark Swanson, *Historical Research into a Select Number of Potential Historic Archaeological Sites at Camp Evans, Fort Monmouth, New Jersey (Stone Mountain, GA: New South Associates, 1999).* Camp Evans was named to honor Paul Wesley Evans who, during World War I, gained recognition for commanding the 101st Field Signal Battalion during the Champagne-Marne, Aisne-Marne, and St. Mihiel operations. Lieutenant Colonel Evans died in the Panama Canal Zone in April 1936 while on duty as Department Signal Officer.

Signal Corps Ground Services, and total personnel at Fort Monmouth and its auxiliary camps peaked at approximately 35,000 military and 15,000 civilian.[42]

Army Wartime Radars[43]

After the surprise bombing of Pearl Harbor, there was concern that a similar attack might be made on the Panama Canal, a vital link connecting military and shipping routes of the Atlantic and Pacific. There were no land areas off the western entrance to the Canal Zone that could be used as radar sites, so picket ships carrying radars were necessary to guard this entrance. At the Evans Signal Laboratory, Captain John W. Marchetti led a 20-person team in using Zahl's VT-158 tube to adapt SCR-268s for this application. A prototype unit operating at 600 MHz was completed in a few weeks and installed on the merchant vessel M.S. *Nordic*. A number of additional units were then built and tested at Camp Evans.[44]

Following this success, Marchetti's team responded to another urgent need: a light-weight, transportable radar that could be assembled and placed into operation by a small crew in 30 minutes. This new system, designated SCR-602, was based on the modified SCR-268 developed for the Canal Zone. Also designated AN/TPS-3, it was used by both Army and Marine forces for early-warning at beachheads, isolated areas, and captured air bases. Many Japanese suicide (kamikaze) aircraft attacks were foiled by this radar.[45] Somewhat later, this was modified to become a mortar-locating radar, the AN/TPQ-3.[46] In addition to those manufactured at Camp Evans, Zenith built about 900 of these two types of sets, with some 200 going to Great Britain.

From the beginning of the use of radio for detection, there had been a major quest for a generator of high-power microwaves. The magnetron, a device capable of producing microwaves, had been invented at General Electric in 1920, but, despite efforts throughout the world, the output power was insufficient for practical applications. In February 1940, John Randall and Harry Boot, researchers at the University of Birmingham in Great Britain, invented a device capable of generating microwave signals with a power in the kilowatt range. Generally called a resonant-cavity magnetron, this device revolutionized the microwave field, particularly for radar.[47]

In mid-1940, the resonant-cavity magnetron was brought to America by the Tizard Mission in a major exchange of secret technologies. A research organization, the Radiation Laboratory, commonly called the Rad Lab, was quickly established by the National Defense Research Committee on the campus of the Massachusetts Institute of Technology to develop microwave radars.[48]

Relatively unknown in America until after the Tizard Mission exchange, there were three major research operations in Great Britain devoted to radar development. These were activities under the Air Ministry, the British Army, and the Royal Navy. They had various names and locations from their start in mid-1935, when a team led by Robert Watson Watt developed their first system. This was called Range and Direction Finding

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[42] "A History of Army Electronics and Communications at Fort Monmouth," (Washington, D.C.: Government Printing Office, 1997): 24.

[43] "Radar: A Report on Science at War," Office of Scientific Research and Development, distributed by Office of War Information, August 15, 1945; http://www.ibiblio.org/hyperwar/USN/ref/Radar-OSRD/index.html.

[44] Fred Carl, "Radar Experts Worked at Camp Evans to Protect Canal," *The Coast Star*, June 12, 2003; http://infoage.org/html/cs-2003-06-12/html.

[45] Lt. Col. Harold A. Zahl, and Major John W. Marchetti, "The TPS-3 Radar," *Electronics* (January. 1946): 98-104.

[46] J. T. Everts, and W. P. Goldberg, "Location of Mortars by Radar," *Coast Artillery Journal* (February-March 1948): 20-24.

[47] J. T. Randall and H. A. H. Root, "Historical Notes on the Cavity Magnetron," *IEEE Transaction On Electron Devices* 39, no. 7 (1976): 724-729.

[48] David Zimmerman, *Top Secret Exchange; The Tizard Mission and the Scientific War* (Quebec: McGill-Queens University Press, 1996).

(RDF). After they invented the resonant-cavity magnetron, all three activities developed a variety of microwave radars (they adopted the American name in 1941).

The Rad Lab opened in November 1940. With 48 employees, it occupied 10,000 square feet in MIT Building 4; the National Guard hangar at Logan Airport was also used. After the start of World War II, still other facilities were added, particularly Building 20, a huge "temporary" structure. Dr. Lee DuBridge was named the director and held this position until the Rad Lab was closed at the end of 1945.

The Rad Lab ultimately employed about 4,000 personnel and was responsible for some 100 different radar designs. Nine former Rad Lab employees or consultants were recipients of the Nobel Prize – for other accomplishments, not their radar work. Most of the professional employees were physicists, drawn primarily from university faculties. The work was mainly in conceptual design, technology advancement, and new component development; their systems were usually militarized, tested, and designed for manufacturing by the Army and Navy, mainly at Evans Signal Laboratory and the Naval Research Laboratory.

The National Defense Research Committee also established an organization devoted to centralized electronic countermeasures (ECM) and electronic counter-countermeasures (ECCM). Located at Harvard University, this was simply and deceptively called the Radio Research Laboratory. ECM involved techniques and technologies used to interrupt the enemy's radar, while ECCM was used to overcome the enemy's ECM efforts.

The main accomplishments of the Rad Lab were documented in the 28-volume MIT *Radiation Laboratory Series*.[49] Work at the Radio Research Laboratory at Harvard associated with electronic countermeasures remained classified for years; thus, the accomplishments were never fully documented. It should be noted that the Bell Telephone Laboratories, as well as several other large industrial laboratories and some university research centers, also made major contributions to many of the microwave systems.

One of the first projects of the Rad Lab was the development of a microwave radar for gun laying (aiming). The U.S. Army knew the performance needed for such a system, and looked to the Evans Signal Laboratory to develop the technical requirements and to oversee the design. Roger Colton, the driving force behind the existing gun-laying SCR-268 radar and now a Brigadier General and Chief of Research and Engineering at the Signal Corps Laboratories, applied his efforts to this new microwave system.

Initially called the XT-1, the system was eventually designated the SCR-584, and preliminary testing was done at Camp Evans in December 1941. The system was carried in a control van with a parabolic dish and directing mechanism on top. After numerous changes were made following these tests, the modified version was taken to Fort Monroe for testing by the Artillery Board. The results showed that it had the required accuracy at a range up to 15,000 yards (8.5 miles), greater than the original Army specifications.

For further improvements, a new electro-mechanical computer called the M-9 Predictor-Collector and developed by the Bell Telephone Laboratories was added. At Camp Evans, IFF was integrated into the system. A prototype of the full system was satisfactorily tested in May 1942, but because of bureaucratic delays within the War Department, production deliveries did not start until early 1944. Eventually, about 1,500 SCR-584s were used in both the European and Pacific war theaters.[50]

Personnel at the Evans Signal Laboratory continued to improve the original SCR-268, SCR-270, and SCR-271. They developed new components to increase performance and reduce costs, and gave consulting services to

[49] Massachusetts Institute of Technology, *Radiation Laboratory Series* (New York: McGraw-Hill Book Company, 1947-53).
[50] "SCR-584," Antiaircraft Command; http://www.antiaircraft.org/SCR584.htm.

users worldwide. Also included was the very important and highly secret activity in electronic countermeasures (ECM) and electronic counter-countermeasures (ECCM). A special organizational unit was set up for ECM/ECCM. This worked closely with the Radio Research Laboratory at Harvard, with particular emphasis on protecting the SCR radars from jamming and interference by German ECM. As part of this activity, some captured German and Japanese radars were sent to Camp Evans for operational testing to find their susceptibility to American ECM.[51]

Attacks on England by German V-1 flying bombs began in early 1944. An SCR-268 radar already held by the British was set up on the Dover Cliffs to check its performance in directing anti-aircraft guns against the V-1s. A model of the V-1 was built and used in a special facility at Camp Evans; there the radar performed very well. When the radar was first used in England, however, the guns' performance did not meet expectations.

Captain Marchetti was sent to England to check the radars. There he found the electronic function was correct but the signal being sent to the gun-aiming analog computer was not the direct reflection from the V-1 but rather a signal reflected from the nearby English Channel. After a change in the equipment, the performance was greatly improved. In a short time, the SCR-586 was put into service and the hit probability increased from a few percent to around 90 percent, subsequently saving thousands of lives.[52]

Even before the start of the war, an effort was underway to improve the kill probability of anti-aircraft guns by adding a sensor to detonate the projectile before it actually hit the target. This sensor was called the Variable Time (VT) or Proximity Fuse, and the National Defense Research Committee established an activity to develop a basic technique that had come from Great Britain under the same technical exchange that brought the new magnetron. This was first set up at the Carnegie Institution of Washington and then transferred to Johns Hopkins University.[53]

The operation centered on developing tiny vacuum tubes, power sources, and other components to make a radar-like device for the head of the projectile. Although Camp Evans was not directly involved in the actual VT Fuse development, the laboratory used in developing vacuum tubes (such as the VT-158) made valuable contributions to the miniature components.[54] Camp Evans also coordinated the manufacture of specific models of the VT Fuse in manufacturing plants, including incorporating engineering improvements based on combat performance. The VT Fuse, together with the SCR-584, is credited with saving many lives in London from the V-1 attacks.

Most of the wartime radar projects at the Evans Signal Laboratory were in association with the Rad Lab, mainly in transferring prototypes from the research state to rugged hardware for field use. None of these projects were worked in cooperation with the Naval Research Laboratory. Essentially all manufacturing was performed by commercial firms. A few of the many such systems will be noted.[55] A notable Army-Navy Joint project was the Joint Army-Navy Tube Standardization (JANS) Laboratory located at Camp Evans. This laboratory quality tested and made sure manufactures used standard vacuum tubes wherever possible. This increased the quality of electronic equipment and reduced war time costs.

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[51] Zahl, *Electronics Away*, pp. 46-48.

[52] John William Marchetti, "Oral History of Radar," Modern Physics Collection, National Museum of American History, Smithsonian Institution, November 2000.

[53] CECOM LCMC Historical Office, "A Concise History of Fort Monmouth, New Jersey, and the U.S. Army CECOM Life Cycle Management Command," 2009.

[54] More than 100 organizations (government, industry, and academic) participated in developing the Proximity Fuse, with only the primary contractor (Johns Hopkins Applied Physics Laboratory) having the major role. This decentralization limited the number of people who knew the full details of this important new military technology.

[55] Robert Buderi, *The Invention That Changed The World* (New York: Simon & Schuster, 1996).

The SCR-582 was an early 10-cm radar developed in cooperation with the Rad Lab. Primarily intended as a harbor-defense system, it had a 48-inch parabolic dish and was usually mounted atop a 100-foot tower. With a plan-position indicator (PPI, a map-like display), it was ideally suited for guiding ships entering harbors and could also detect low-flying aircraft at 25 miles. The SCR-682 was a transportable version.

The Evans Signal Laboratory was responsible for a number of other 10-cm radars used by the Army. Some of their air-transportable radars included the AN/CPS-1, an early-warning set manufactured by General Electric with a range up to 200 miles. The AN/CPS-4, nicknamed "Beaver Tail" from the shape of its beam, was a height-finder set from the Rad Lab; it was used with the SCR-270 and SCR-271.

Representative Evans Signal Laboratory mobile-ground radars included the AN/GPN-2, a search set (for surveillance) with a 60-mile range produced by Bendix, and the AN/GPN-6, a similar search set from the Laboratory for Electronics, Inc. The AN/CPN-18, also made by Bendix, was the secondary surveillance radar[56] portion of an air-traffic control system used by the Army Air Forces.

In February 1945, the Army Air Forces took over Camp Coles near Red Bank from the Evans Signal Laboratory, designating this the Watson Laboratories. This was named in honor of Lieutenant Colonel Paul Watson, who had died in 1943 while serving as the Signal Corps Laboratory Chief Engineer. The Watson Laboratories was authorized to establish the Cambridge Field Station, adjacent to MIT.[57] Fifteen of the projects originally at the Rad Lab were transferred to this new operation. In September 1945, Major John Marchetti was assigned as the Acting Commanding Officer of the Cambridge Field Station.[58]

Post War and Closure[59]

In May 1945, at the end of the war in Europe, the Signal Corps Ground Services was reformed into the Signal Corps Engineering Laboratories; often, however, it was still called the Evans Signal Laboratory. As the focus shifted to the more ambiguous battlefield of the Cold War, the Army continued to utilize this facility to support military communications and electronic warfare preparedness throughout the Cold War, as well as during the hot wars in Korea, Vietnam, and Operation Desert Storm.[60]

While much of the work done at Camp Evans continued to operate in secrecy, one accomplishment the public was informed about was Project Diana, which was conducted in late 1945 on a compound a short distance down the road from Evans Signal Laboratory. Using a modified SCR-271 radar with a special antenna, attempts were made to receive a signal bounced off the Moon. On January 10, 1946, this was successful, with the reflected signal received 2.5 seconds after it was transmitted. This proved that radar signals could penetrate the

[56] A "secondary radar" is one that interrogates target aircraft for identification as to "friend or foe," usually operating in close cooperation with a 'primary radar' that performs the detection and ranging functions.

[57] The Cambridge Field Station ultimately evolved into the Air Force Cambridge Research Laboratories with some 2,500 personnel. John Marchetti became the Director of Research**,** and, in association with MIT, initiated many well-known projects, such as the 12-station SAGE radar network and the gigantic Whirlwind computer.

[58] Marchetti, "Oral History of Radar."

[59] CECOM LCMC Historical Office, "A Concise History of Fort Monmouth, New Jersey, and the U.S. Army CECOM Life Cycle Management Command," 2009.

[60] During 1953, Camp Evans became entangled in Senator Joseph McCarthy's campaign to uncover suspected communist spies from Army facilities. In one such instance, an effort to placate the Senator, several civilian employees were temporarily suspended from their regular duties, and detailed to work in isolation, without access to classified materials. The site of the World War II barracks where they were sent, unofficially referred to as the "leper colony," is along Watson Avenue, a few hundred feet west of the proposed NHL historic district. *Camp Evans Historic District*, National Register of Historic Places Nomination, 1999: 26; W.B. Ewald, Jr., *Who Killed Joe McCarthy?* (New York: Simon and Schuster, 1984): 273-274.

ionosphere, and demonstrated the potential of radio communications beyond the Earth for missiles, space probes and human explorers coursing above the ionosphere. In 1957, replacement equipment, built on the frame of a captured German Wertzburg Reise radar, erected at the Project Diana site helped track the Soviet Union's Sputnik, the first manmade satellite. The equipment would be used to track every American and Soviet launch into the 1970s. Once the U.S. entered the space race, these facilities were available to support early satellite tracking projects. The most notable weather science project was the development of the first earth observing satellite. The goal of the project was to advance weather prediction by placing a television camera in space with the data recording systems and communications controls to only transmit its data to U.S. based ground stations. The first photograph from space was transmitted on April 1, 1960, by the TIROS (Television Infrared Observation System) satellite, and then flown from Camp Evans for presentation to President Eisenhower. Nine days later the surprise discovery was made that the satellite could spot and track hurricanes. The successful program was transferred to the newly created space agency – NASA. This advance has saved countless human lives by giving advanced warning of hurricanes.[61]

In 1958, the Signal Corps Engineering Laboratory was designated the Evans Area. In 1962, it was no longer a Signal Corps installation after it was placed under the Army Materiel Command. There, it became the home of the Army Electronics Command, and later, in 1977, the Army Electronics and Communications Command. In 1993 the Army closed Camp Evans to reduce costs. Its last mission left in 1999. A number of the 1970s and 1980s programs, developed to protect American forces from a Soviet attack, would be fielded against Iraq. These include laser target designation, enemy artillery counter-fire systems, computer assisted enemy tank and vehicle location and identification, remote battlefield sensors and aerial drones. After 80 years as the center of the Army's communications and electronics development, the 2005 Department of Defense Base Realignment and Closure (BRAC) directed that these activities be transferred elsewhere, and all U.S. Army elements of Fort Monmouth be closed by 2011. Thirty-seven acres of the approximately 217-acre Camp Evans facility have been set aside for preservation under the stewardship of InfoAge, a private non-profit organization dedicated to the preservation and interpretation of this site. The remaining Camp Evans acreage has been, or will be, cleared of most of its World War II- and Cold War-era resources, for use by Wall Township as recreational facilities and a community college satellite campus.[62]

ADDITIONAL RADAR-RELATED PROPERTIES

In addition to the millions of men and women serving overseas, millions of civilians back home worked at all types of research and production facilities.[63] Radar-related activities were a relatively small, yet critical, aspect of the Nation's overall mobilization effort. Various aspects of radar work were conducted in great secrecy at a few government laboratories, and at more than a dozen private industrial facilities.[64]

National Historic Landmark consideration of private industrial facilities engaged in radar work is complicated by several factors. First of all, a complete accounting of private companies involved in radar work has not yet been developed. Since the details about this emerging technology were kept as secret as possible during the war, contemporary accounts were limited. While historical accounts of activities conducted at public

[61] The site of the Project Diana radar and the extant satellite monitoring equipment that replaced the Diana equipment are located several hundred feet west of the World War II Camp Evans facility and are not within the proposed NHL boundary.

[62] Email communication from InfoAge President Fred Carl to NHL historian Robie S. Lange, July 21, 2011.

[63] Marilyn M. Harper, ed., *World War II & the American Home Front: A National Historic Landmarks Theme Study* (Washington: National Historic Landmarks Program, NPS, 2007).

[64] Some of the private companies engaged in radar-related work were: Airborne Instruments Laboratory, Bell Telephone Laboratory, Bendix Corporation, Chrysler Corporation, Federal Telegraph and Radio Corporation, General Electric Company, General Radio Company, Philco Corporation, Panoramic Radio Company, Raytheon Manufacturing Company, RCA, Research Construction Company, Sperry Corporation, Stromberg-Carlson Company, Westinghouse Electric Corporation, and Zenith Radio Corporation.

institutions have revealed most of their wartime secrets, the work of private industry has received far less attention. When primary or secondary sources refer to private companies, they often fail to indicate the precise nature of the radar-related work they undertook. Even when they do, insufficient information is available to conclude whether the work done by one company was more or less consequential than the work done by another. Some corporations later advertised their wartime contributions to radar development, but since those accounts were typically presented to serve public relations purposes, their usefulness is often limited. Additionally, even the limited references to private companies often fail to indicate which of that company's several buildings or plants were utilized for radar-related activities. Finally, the likelihood that most World War II-era industrial facilities were subsequently modified or demolished makes evaluations of resource-specific historic integrity particularly challenging. As a result of these complications, a historic context is not yet available to support a determination of whether the work of any private company rises to the level of national significance. Perhaps this information gap can be narrowed in the future, allowing a subsequent assessment of whether any surviving World War II-era resources associated with private industry might meet National Historic Landmark requirements.

Nevertheless, before radar technologies reached the manufacturing stage, most of the initial development, testing, and refinement work was conducted at government research laboratories. These laboratories (military or non-military) also gathered information about the accomplishments, failures and capabilities of private industry, and assisted in the oversight and direction of contracts to private industry. Because of their own innovations in radar development, as well as their ongoing role in monitoring the work of private industry, the government laboratories are the properties most strongly associated with the development of radar. Camp Evans is one of three key Federal facilities associated with major efforts to develop radar. The other two are the Naval Research Laboratory and the civilian Radiation Laboratory.

Naval Research Laboratory

Located along the eastern bank of the Potomac River in Washington, D.C., the Naval Research Laboratory was established after the First World War to support the Navy in a variety of research areas. Since advances in wireless communications were of obvious importance to far-ranging naval operations, the transmission and receipt of radio waves were an aspect of the laboratory's work from the very start. During the 1920s and early 1930s, Laboratory staff made important contributions to the eventual development of radar by confirming the general principle of radar when field tests reflected radio waves off ships and airplanes. By the late 1930s, the pace of radar development at the Laboratory increased, including such important early accomplishments as using short pulses of radar waves (instead of continuous waves), which when combined with the Laboratory's "duplexer" system, allowed radar transmitters and receivers to share a single antenna. Radar systems developed and tested at the Laboratory were particularly important in Pacific theater campaigns, and played an important role in the overall advancement of radar technology.[65]

Today, the Naval Research Laboratory continues its research and development mission for the Navy, and occupies approximately 60 buildings located on a 131-acre campus. More than half of these buildings were built during World War II; 21 predate 1941; and eight postdate the war.[66] An accounting of which extant buildings played a role in radar development is not available, but Laboratory officials believe that at least a few of them survive. Nevertheless, many of those buildings have undergone modifications such as the addition of

[65] David Kite Allison, *New Eye for the Navy: The Origin of Radar at the Naval Research Laboratory* (Washington: Naval Research Laboratory, 1981); James Phinney Baxter, *Scientists Against Time* (Boston: Littleton, Brown and Company, 1946), pp. 139-142; Don DeYoung, et al., *The U.S. Naval Research Laboratory: Fulfilling the Roosevelts' Vision for American Naval Power (1923-2005)*, NRL/MR/1001—06-8651 (Washington: Naval Research Laboratory, 2006), p. 9; Simone Monteleone Moffett, *Architectural Survey and Evaluation of the Naval Research Laboratory, Washington, D.C.* (Springfield, VA: Versar, 2007), p. 33.

[66] Moffett, pp. 1-2.

stair towers, the application of stucco-like sheathing, and most consequential, the complete gutting and remodeling of the key buildings located along the installation's central mall.[67]

Radiation Laboratory

Established in 1940, the Radiation Laboratory operated out of several buildings on and near the Massachusetts Institute of Technology's Cambridge campus. The Rad Lab was an offshoot of the National Defense Research Committee, which was itself established to mobilize civilian scientific talent, and create more productive relationships between civilian scientists and the military. One part of the National Defense Research Committee's work focused on applying extremely narrow (micro) wave-length technology to radar technology. Earlier U.S. efforts to advance microwave technology met with only modest success. These limitations were largely overcome in the Fall of 1940, when the British government made their super-secret resonant-cavity magnetron available to the United States. This game-changing device's narrowed beam and vastly increased power output substantially increased radar accuracy and effectiveness. It promised the development of more effective and compact radar systems that could fit in the confined spaces of ships and airplanes. The Rad Lab was quickly established and its scientists set out to apply microwave technology to three radar priorities: providing early warning of incoming aircraft; anti-aircraft gun aiming; and aircraft-board navigation systems. A clue to the work being conducted there was the distinctive radar domes atop several Rad Lab buildings. Working in consultation with other laboratories, private industry, and our British ally, the Rad Lab played a key role in the development of major radar systems.

During the war, the Rad Lab used both older and newly constructed buildings for laboratories, shop facilities, and offices. The three prewar campus buildings appropriated for Rad Lab use (Buildings #3, #4, and #6) are elements of a larger interconnected string of early twentieth century campus buildings that frame a large open court. Not only were secret Rad Lab activities conducted in buildings that were physically interconnected with buildings housing traditional MIT academic functions, but in some instances, Rad Lab activities were conducted in the same buildings where ongoing MIT activities were conducted. Building #3 was only briefly used by the Rad Lab, and the other two prewar buildings (#4 and #6) reverted to MIT use after the war. A short distance to the north of those buildings, additional work space was provided when three temporary buildings were hastily built specifically for Rad Lad use (Buildings #20, #22 and #24). Building #24 was originally built in 1941 as a two-story temporary building, but one section of which was expanded to seven stories during the war. Building #22, a temporary building added in 1942, was demolished in the mid-1950s. In 1943, Building #20 became the last of the Rad Lab buildings to join the campus. This multi-winged, three-story temporary building survived for 45 years and was perhaps the building most commonly associated with the Rad Lab. Modern buildings now occupy the former sites of Buildings #20 and #22, leaving Building #24 surrounded by distinctly modern buildings.[68] The Rad Lab also used several off-campus buildings, including: the former Hood Milk Company building at 155 Massachusetts Avenue (demolished in 1963), and its neighbor, the former Whittemore Brothers Shoe Polish Company building. Additional Cambridge-area buildings used by Rad Lab included: 185, 224 and 230 Albany Street; a garage at 53 Edgerly Road, Boston; the National Guard Hanger at East Boston Airport; and the Bedford Army Air Base located 15 miles from Cambridge as well as several field stations.[69]

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[67] Moffett, p. 154; Telephone conversation between NHL historian Robie S. Lange and Keith Hull, Director of Research and Development Services Division, Naval Research Laboratory, April 29, 2011.

[68] Inconclusive information suggests the possibility of an additional wartime temporary building built for Rad Lab use. No information about Building #21's appearance or specific wartime use has been located, and there is contradictory information about whether it was located at one end of the campus or the other.

[69] Email communication from Charles M. Sullivan, Cambridge Historical Commission, to NHL historian Robie S. Lange, July 20, 2010; Email communications from Deborah G. Douglas, MIT Museum, to Robie S. Lange, May 11, 23, 25, 2011; Email communication from Joseph Gifun, MIT Facilities, to Robie S. Lange, May 26, 2011; "Personnel Directory Radiation Laboratory," January 15, 1945, MIT Museum; *Five Years at the Radiation Laboratory* (Cambridge: Massachusetts Institute of Technology, 1946),

CONCLUSION

The concept of radar had been hypothesized during the late nineteenth century, and prior to World War II, relatively crude applications of radar were tested in several countries, with each country working independently of the others.[70] With the prospect of a world at war, far greater attention was given to developing the various types of combat-ready radar systems that would be so important. Arguments can be made that some radar systems developed were more important than others, but that debate might be endless. For National Historic Landmark evaluations, such a debate might require conclusions about which historic properties best represent a particular aspect of radar technology. Would it be the location where the development was first theorized; the place where testing models were first fabricated; the place where initial field tests were conducted; the place where the hardware was modified to bring it to battle-hardened standards; or the place where the final version was ultimately manufactured? This nomination concludes that because the three Federal laboratories played such central roles in numerous different aspects of radar-related work, they possess the strongest associations with the nationally significant development of radar.

At the Naval Research Laboratory in Washington, most of the buildings associated with the development of radar have been modified as the active installation continues to serve its historic mission.[71] At the former Radiation Laboratory in Massachusetts, the three prewar buildings used for radar work remain largely unchanged on the exterior, but most have undergone various interior modifications during the past half century. The nearby area where a few buildings were built specifically for Rad Lab use, looks very different now that only one of those wartime buildings remains (#24), and it is surrounded by modern campus buildings. The proposed Camp Evans National Historic Landmark is the central portion of a larger military facility that played a key role in the development of radar. This 27-acre portion of Camp Evans contains a large number of historic resources that retain a high degree of integrity, individually and collectively. It conveys a strong sense of time and place related to the development of radar during World War II. As such, Camp Evans is the historic property that best represents this nationally significant association.

pp. 10-13, 17, 19, 24-25, 64-74; Henry E. Guerlac, *Radar in World War II* (Los Angeles: Tomash Publishers [American Institute of Physics], 1987), pp. 285, 287, 661-6, 684-5; Buderi, pp. 13-14, 49, 51, 100-101, 107, 111, 128, 134, 236; http://libraries.mit.edu/archives/building20/history.htm, p. 4; www.cdc.gov/niosh/ocas/pdfs/sec/mit/hooder.pdf.

[70] Watson, p. ix.

[71] Telephone conversation between Lange and Hull, April 29, 2011.

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Previous documentation on file (NPS):

__ Preliminary Determination of Individual Listing (36 CFR 67) has been requested.
X Previously Listed in the National Register.
__ Previously Determined Eligible by the National Register.
__ Designated a National Historic Landmark.
__ Recorded by Historic American Buildings Survey: #
__ Recorded by Historic American Engineering Record: #

Primary Location of Additional Data:

__ State Historic Preservation Office
__ Other State Agency
__ Federal Agency
__ Local Government
__ University
X Other (Specify Repository): InfoAge Archives (on site at Camp Evans)

10. GEOGRAPHICAL DATA

Acreage of Property: approximately 27 acres

UTM References:

	Zone	Easting	Northing
A	18	580265	4448660
B	18	579900	4448420
C	18	579695	4448780
D	18	579800	4448985
E	18	580200	4449160

Verbal Boundary Description:
The proposed historic district boundary begins at the point where the Laurel Gully Brook intersects with the east side of Marconi Road. The boundary follows the brook eastward to the edge of the Shark River. It turns southeast to follow the river's edge for approximately 300', where it shifts south for approximately 230'along the lower edge of the bluff behind the Manager's Cottage. It then shifts southwest for approximately 170', before heading south for approximately 440', then southwest for approximately 225', and then 220' west until it crosses over Marconi Road to the point where the perimeter fence turns south along the reservation boundary. The historic district boundary follows the reservation boundary southward for approximately 895', to a point between lots 5 and 6. The district boundary turns west for approximately 335' to intersect with the eastern end of Fifth Street, from where it follows along the south edge of that street in a line that intersects the far side of Avenue B. The boundary then turns northeast along that side of Avenue B, and continues along that curb as it shifts north along Fourth Street. After crossing to the opposite side of Avenue A, the boundary follows that edge of the road a short distance where it curves northwest until it intersects with the southeast edge of Monmouth Boulevard. At that point, the boundary turns northeast following that edge of the road, and then

crosses over to the east edge of Marconi Road. The boundary then turns north to the beginning point at Laurel Gully Brook.

Boundary Justification:
The nominated historic district is an extant portion of a U.S. Army Signal Corps Laboratory that was importantly associated with the development of radar during World War II. The boundary excludes adjoining areas that were part of the larger World War II facility, but are not in the acreage that has been slated for preservation, or do not retain integrity.

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NATIONAL HISTORIC LANDMARKS PROGRAM
March 5, 2012

Appendix A

Wavelength and Frequency

Wavelength is the distance between successive crests (high points) of waves. It is commonly designated by the Greek letter lambda (□) and measured in meters (m). Frequency (f) is the number of crests passing per second and is measured in hertz (Hz – cycles per second). Common radio frequencies are in thousands of hertz (kHz – kilohertz) or millions of hertz (MHz – megahertz). Wavelength and frequency are related by the formula:

□□□m) = 300,000 / f (kHz)
or 300 / f (MHz)
or 0.3 / G (GHz)

Ultra-short (less than about 0.3 meter) wavelengths are called microwaves, and the associated frequencies are designated in thousands of MHz or Gigahertz (GHz).

Conventional names and ranges are shown in the following table:

Band Name	Symbol	Frequency Range	Wavelength Range
Low Frequency	LF	30 kHz – 300 kHz	10 km – 1 km
Medium Frequency	MF	300 KHz – 3 MHz	1 km – 100 m
High Frequency	HF	3 MHz – 30 Mhz	100 m – 10 m
Very High Frequency	VHF	30 MHz – 300 MHz	10 m – 1 m
Ultra High Frequency	UHF	300 MHz – 3 GHz	1 m – 0.1 m
Super High Frequency	SHF	3 GHz – 30 GHz	0.1 m – 0.01 m

Photograph #1
Marconi Hotel, #9001 (1914); east and north elevations.
Robie S. Lange, September 30, 2011

Photograph #2
Manager's Cottage, #9002 (1914); west elevation.
Robie S. Lange, September 30, 2011

Photograph #3
Chief Engineer's Cottage, #9003 (1914); west elevation.
Robie S. Lange, September 30, 2011

Photograph #4
Operations Building, #9004 (1914); north and west elevation.
Robie S. Lange, September 29, 2011

Photograph #5
Operations Annex, #9005 (ca. 1917); north elevation.
Robie S. Lange, September 29, 2011

Photograph #6
Steam Electric Power Plant, #9006 (1941); south elevation.
Robie S. Lange, September 29, 2011

Photograph #7
"H" Complex, #9010/#9011 (1941), looking northeast, toward Marconi Hotel and Administrative Annex. (View taken from Platform Tower, #9178).
Robie S. Lange, September 29, 2011

Photograph #8
"H" Complex, #9010/#9011 (1941), north and west elevations of the northern ends of the older H-shaped building.
Fred Carl, October 18, 2011

Photograph #9
Looking northwest over the top of Building #9036/#9037. In the distance at far left and center are Camp Evans buildings along Avenue A that fall outside the NHL boundary. (View from Platform Tower, #9178).
Robie S. Lange, September 29, 2011

Photograph #10
Facing north between the two H-shaped buildings, #9010/#9011 & #9036/#3037, with the connecting corridor running across the top third of this photograph. (View taken from Platform Tower, #9178).
Robie S. Lange, September 29, 2011

Photograph #11
Heat Plant, #9012 (1942), east and north elevations.
Fred Carl, October 18, 2011

Photograph #12
Special Antenna Shelter, #9017 (1942), northwest and southwest elevations.
Fred Carl, October 18, 2011

Photograph #13
Guard Headquarters, #9029, (1942-1943), southwest and southeast elevations.
Fred Carl, October 18, 2011

Photograph #14
Fire Station, #9031 (1942-1943), south and east elevations.
Fred Carl, October 18, 2011

Photograph #15
Electric Shop, #9034 (1942-1943); west and south elevations.
Robie S. Lange, September 29, 2011

Photograph #16
Garage, #9057 (1942); northwest and southwest elevations.
Robie S. Lange, September 29, 2011

Photograph #17
Telephone Exchange, #9059 (1942-1943); east and north elevations.
Robie S. Lange, September 29, 2011

Photograph #18
Transformer Vault, #9066 (1941), east and north elevations.
Robert Perricelli, October 12, 2011

Photograph #19
Facing south courtyard of building #9010/#9011 (wings of which are visible at extreme left and right), showing at right: Transformer Vault #9069; and at left: Gas Cylinder Storage Shed, #9344; Storage Shed, #9312; Transformer Vault #9068; and General Purpose Laboratory, #9098.
Robie S. Lange, September 29, 2011

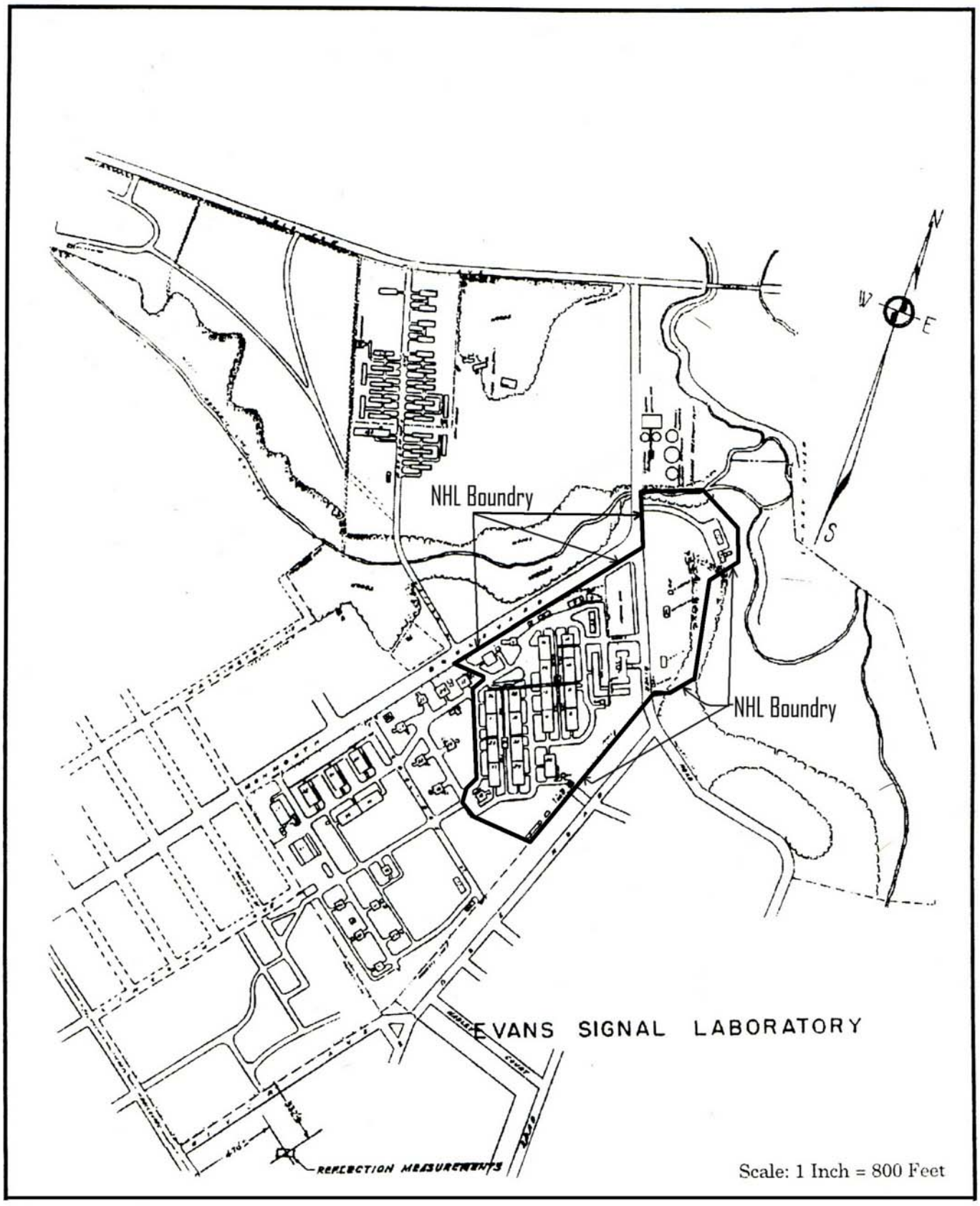
Photograph #20
Gas Cylinder Storage Shed, #9120 (1945), west and south elevations.
Robie S. Lange, September 29, 2011

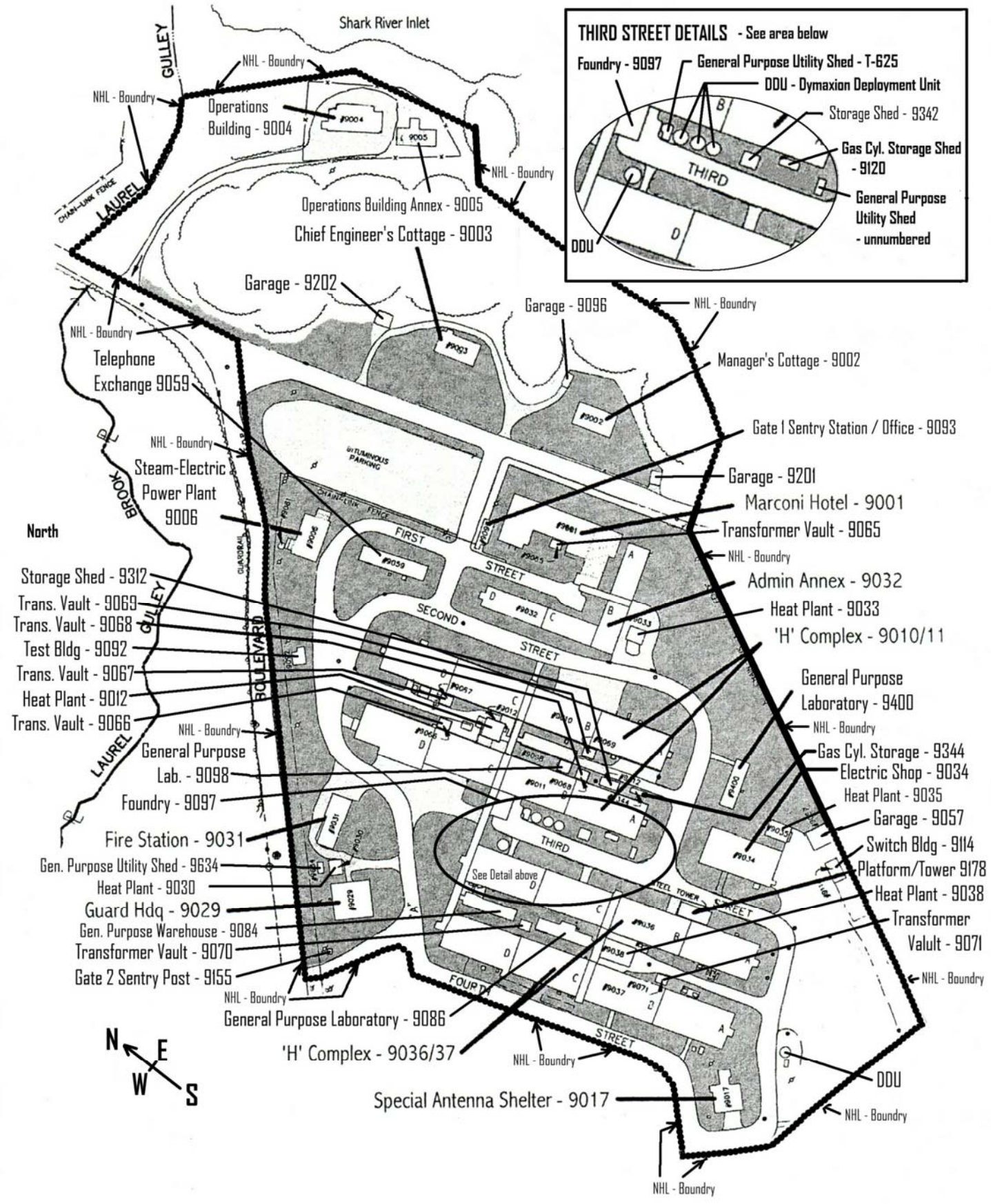
Photograph #21
Storage Shed, #9342 (ca. 1952), between the two H-shaped buildings, west and south elevations.
Robie S. Lange, September 29, 2011

Photograph #22
Three Dymaxion Deployment Units (ca. 1944), between the H-shaped buildings, southwest elevations.
Robie S. Lange, September 29, 2011

Photograph #23
General Purpose Laboratory, #9400 (1952), Secure building where Senator McCarthy's staff was denied access; north and west elevations.
Robie S. Lange, September 29, 2011

Photograph #24
Looking west over the top of Building #9037, showing a portion of Camp Evans located outside of the NHL boundary.
Robie S. Lange, September 29, 2011


N
W
E
S
NHL Boundry
NHL Boundry
EVANS SIGNAL LABORATORY
REFLECTION MEASUREMENTS
Scale: 1 Inch = 800 Feet


Shark River Inlet
GULLEY
NHL - Boundry
Operations Building - 9004
#9004
#9005
Operations Building Annex - 9005
Chief Engineer's Cottage - 9003
Garage - 9202
Garage - 9096
Manager's Cottage - 9002
Telephone Exchange 9059
Steam-Electric Power Plant 9006
LAUREL
BROOK PL
North
Storage Shed - 9312
Trans. Vault - 9069
Trans. Vault - 9068
Test Bldg - 9092
Trans. Vault - 9067
Heat Plant - 9012
Trans. Vault - 9066
General Purpose Lab. - 9098
Foundry - 9097
Fire Station - 9031
Gen. Purpose Utility Shed - 9634
Heat Plant - 9030
Guard Hdq - 9029
Gen. Purpose Warehouse - 9084
Transformer Vault - 9070
Gate 2 Sentry Post - 9155
General Purpose Laboratory - 9086
'H' Complex - 9036/37
Special Antenna Shelter - 9017
Gate I Sentry Station / Office - 9093
Garage - 9201
Marconi Hotel - 9001
Transformer Vault - 9065
Admin Annex - 9032
Heat Plant - 9033
'H' Complex - 9010/11
General Purpose Laboratory - 9400
Gas Cyl. Storage - 9344
Electric Shop - 9034
Heat Plant - 9035
Garage - 9057
Switch Bldg - 9114
Platform/Tower 9178
Heat Plant - 9038
Transformer Valult - 9071
DDU
FIRST STREET
SECOND STREET
THIRD
FOURTH
See Detail above
BOULEVARD
N E W S
THIRD STREET DETAILS - See area below
Foundry - 9097
General Purpose Utility Shed - T-625
DDU - Dymaxion Deployment Unit
Storage Shed - 9342
Gas Cyl. Storage Shed - 9120
General Purpose Utility Shed - unnumbered
DDU

Wall Township, NJ

Asbury Park Quad Map

A 18 580265 4448660

B 18 579900 4448420

C 18 579695 4448780

D 18 579800 4448985

E 18 580200 4449160