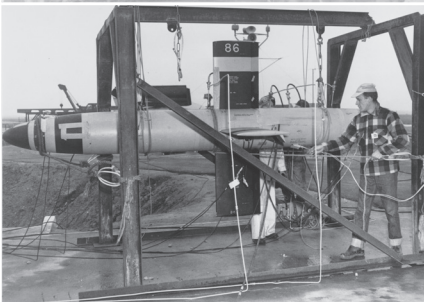


Helping to Win the Cold War

RADAR AND MISSILE GUIDANCE SYSTEMS
DEVELOPMENT AT NAVAL WEAPONS INDUSTRIAL
RESERVE PLANT (NWIRP)

BEDFORD, MASSACHUSETTS



Reserved for use by U.S. Navy



Statement A: Approved for Release for NAVSEA equities

Top: USGS aerial image 1995. Collage: (Clockwise from top left) Lark missile test firing, Bedford complex oblique aerial, Sea Sparrow firing, Flight Test Facility under construction.

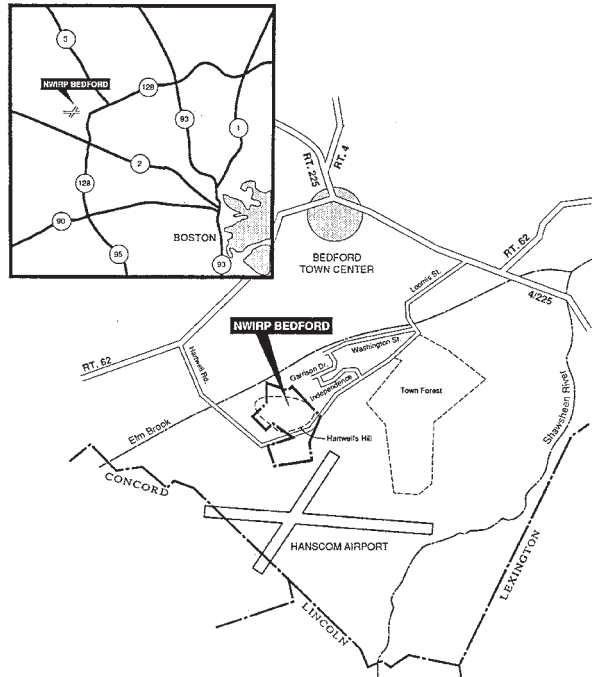
Introduction

Naval Weapons Industrial Reserve Plant (NWIRP) Bedford is located in eastern Massachusetts in the Town of Bedford, in Middlesex County, Massachusetts. Situated in the southwest portion of Bedford, the site is approximately 14 miles northwest of downtown Boston. Immediately south and adjacent to NWIRP Bedford is the Lawrence G. Hanscom Field (Hanscom Field) and Hanscom Air Force Base to the south.

NWIRP Bedford is a 46-acre facility created in 1952 as a government owned-contractor operated (GOCO) facility. U.S. Naval Air Systems Command (NAVAIR) originally served as the government entity and the Raytheon Manufacturing Company of Waltham, Massachusetts (Raytheon) served as the contractor. U.S. Naval Sea Systems Command (NAVSEA) eventually took over operation of the facility. The facility continued to operate for nearly 50 years until December 2000 when Raytheon operations ended and U.S. Navy declared the property as excess.

In 2016, the U.S. Navy and Massachusetts Historical Commission concurred that the NWIRP Bedford facility is eligible for listing in the National Register of Historic Places (NRHP) as a historic district. At its maximum, NWIRP consisted of 28 buildings and structures of various size and functions. With demolition of 5 buildings in 1995, the facility had 23 extant buildings at the time of its closure in 2000.

The primary mission of NWIRP Bedford was to provide Raytheon with facilities for engineering, research, testing and development of radar and missile guidance systems. The NWIRP buildings and facilities were essential components of Raytheon's Bedford

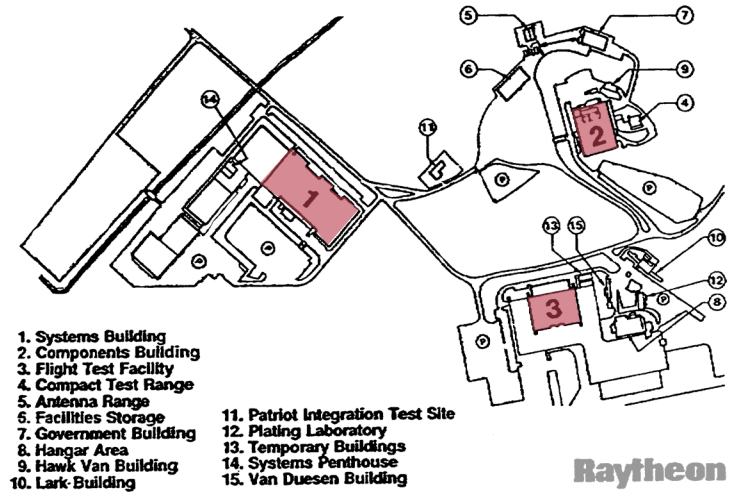


NWIRP Site Location Map ca. 1992

Complex that served as the Missile and Radar Division for decades starting in 1952. Over those years, Raytheon workers at Bedford designed, fabricated, and tested prototype equipment for several significant missile guidance and control systems during the Cold War, including the Hawk, Sparrow III, SAM-D, and Patriot missile systems.

NWIRP Bedford is divided into northern and southern sections that are separated by Hartwell Road. The northern section (North Activity) is located on Hartwells Hill, and includes the Components Laboratory and its auxiliary buildings, the Compact Test Range (formerly the Advanced Medium Range Air-to-Air Missile Development [AMRAD] Building), the Hawk Van Building,

BEDFORD COMPLEX



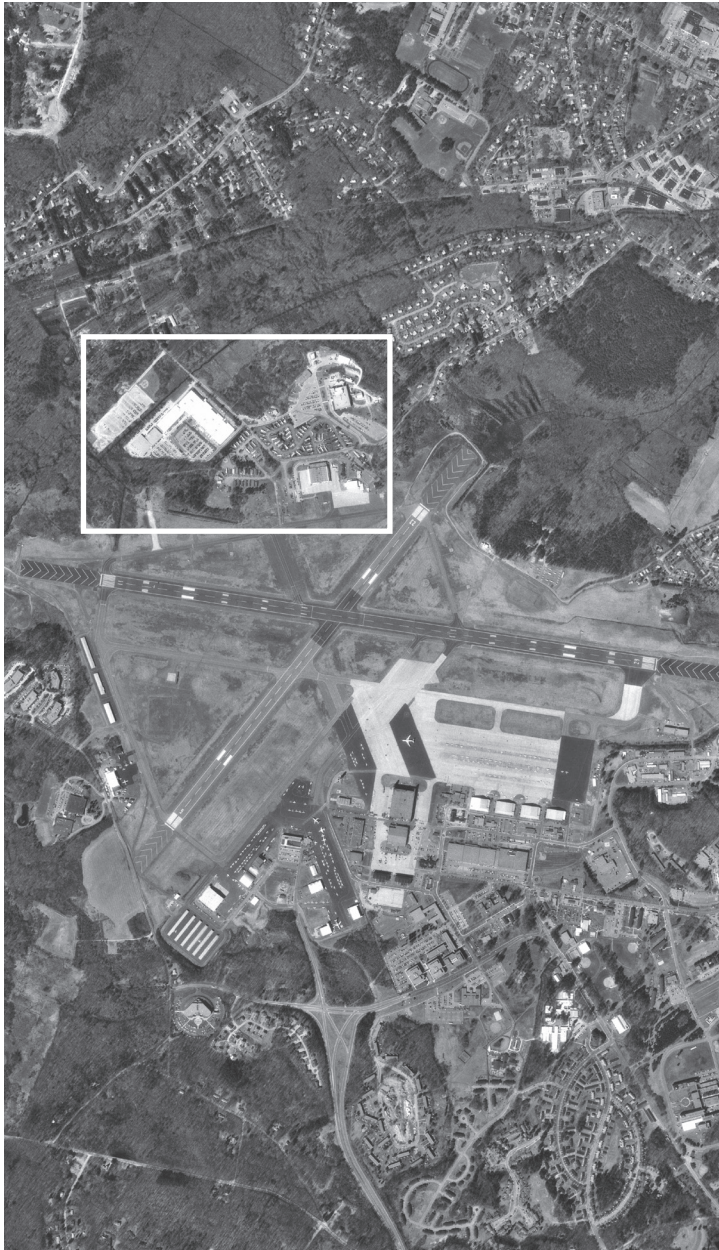
Raytheon

Major Buildings involved in Raytheon operations

the Antenna Range Building, the Short-Range and Intermediate Range Towers, and the Government Building.

The southern section (South Activity), located adjacent to Hanscom Field immediately south of Hartwells Hill, consists of the Flight Test Facility (FTF), the Deluge Pump Station, and a concrete apron surrounding three quarters of the FTF with access to the taxiways and runways of Hanscom Field. Other important buildings that were on-site until demolition in 1995 were the Old Hangar, the Van Duesen Building, the Plating Laboratory, the Lark Building, and the Hawk Building.

The significant research and development activities at Raytheon's Bedford Complex were conducted primarily in three main structures. These included Raytheon's Systems Building located just west of NWIRP Bedford as well as the Components Laboratory in the



1998 Aerial Photo. White Box outlines Raytheon Bedford Complex including NWIRP Bedford

northern section of NWIRP Bedford, and the Flight Test Facility in the southern section.

Government-Owned and Contractor-Operated (GOCO) Facilities

Most Navy industrial sites during the Cold War period were government-owned and contractor-operated (GOCO) facilities. The establishment of the GOCO arrangement began during World War II when the government's role in promoting and even managing defense-related industries rose to unprecedented levels, with the government financing, building, and operating plants on a large scale. Due to the Great Depression of the 1930's and the immense demand for weapon production, it was difficult for private industry to invest in space and equipment that may not be needed after the war. In response, Congress chartered the Defense Plant Corporation in 1938, which, in anticipation of hostilities, was assigned the task of expanding production capabilities for military equipment. Its charter permitted both the building and equipping of new facilities and the expansion of existing facilities (NRC: 89).

Through the GOCO system, private industry companies signed cost-plus-fixed fee contracts to operate the various facilities. The facility was designated a military installation and a small military staff remained on the premises to inspect the work and act as a liaison with the private company (referred to as the contractor). Overall management of the facility was the responsibility of the contractor.

During World War II the majority of GOCO facilities were associated with guns, ammunition, and aircraft plants. By the end

of World War II, the Navy had more than 100 field facilities, 11 ordnance plants and a big-gun factory as well 100 aircraft plants scattered throughout the country (Shiman: 7-15). The U.S. Army and Navy ended the war with an enormous industrial establishment and decisions had to be made about the GOCO sites.

The leadership of the armed services remembered all too well the experience following World War I when the government abandoned the defense-related industries in 1918 in the belief that the “War to End All Wars” would be just that, only to be recreated from scratch 20 years later at enormous expense. The growing Cold War tensions with the Soviet Union and the ever-increasing complexity and expense of defense technology helped ensure that government involvement in industry would remain high (Shiman:1).

The National Industrial Reserve Act of 1948 signed by President Truman authorized the Department of Defense (DoD) to maintain a nucleus of government-owned industrial plants and a reserve of machine tools and other manufacturing equipment to supply the needs of the Armed Forces in a national emergency. The military retained ownership of the plants while shifting the day-to-day operational duties to a private contractor, who paid a nominal rental fee.

Numerous industrial sites established in the 1940’s were retained and further expanded in the 1950’s during the Korean War (Shiman: 42-43). At the end of the Korean War in 1954, the DoD had 288 government owned plants and 39 plants in the National Industrial Reserve consisting of specialties in explosives, weapons, shipyards, aircraft, metals, chemicals and research and development (Shiman:53). There were approximately 100



Douglas F3D Skyknight used in development of the Sparrow (later AIM-7) air-to-air missile, 1954

GOCO sites throughout the country. This was the peak of the government’s share of the military-industrial base, and the number of facilities it owns, has been steadily shrinking since the Korean War (Shiman:1).

The emphasis on readiness and having industrial capabilities in place was one hallmark of the Cold War era. Another was the shift in resources toward strategic systems such as bombers and missiles and the growing reliance on contractors for the design and production of complete systems instead of just components. (Shiman:53). The demand grew for plants with large assembly buildings, test cells for rocket motors and jet engines, and clean environments for electronic components (Shiman, 1976:2).

As the Cold War continued with the Vietnam War, the new Secretary of Defense, Robert McNamara, made changes to military organization, and he was determined to divest of the government industrial sites and GOCO’s. Government owned

facilities decreased from 261 in 1960 to 216 in 1966 and further decreased to 131 by 1977 (GAO 1978). This trend continued throughout the 1980's (Shiman:70).

The Raytheon Company

The Raytheon Company was established in 1922 in Cambridge, Massachusetts, home of the Massachusetts Institute of Technology (MIT). The company's founders were Vannevar Bush, who would become dean of MIT's School of Engineering; Laurence Marshall, an engineer; and Charles G. Smith, a scientist who had done work on the electrical properties of gases. The company's revolutionary innovation of the S gas rectifier tube made home radios affordable and established the company in the field of electronics (Earls: 9). During World War II, the Raytheon Company played a large role in the war efforts by supplying 80% of the magnetron tubes for radars, pioneering the production of shipboard radar systems for the US Navy, and developing critical parts in weapon systems.

By the time of the Cold War era, Raytheon Company had a well-established relationship with Department of Defense and was an integral partner in the development of radar and weaponry systems for the military. In the period of 1946 to 1950, the company developed the Lark Missile which was the first missile-mounted guidance system capable of intercepting moving objects; subsequently Raytheon also developed the Hawk and Sparrow III guided missiles. In the 1970's and 1980's, the company developed the SAM-D program, which later became the Patriot missile system utilized during the First Persian Gulf War (Raytheon.com, "Raytheon Company: History").



Raytheon Radio and Television Tube Data booklet, 1957.

Raytheon's Lab 16

The end of World War II was challenging for defense contractors as war spending plummeted. That said, Raytheon's newly won reputation in radar ensured continued government investment. Of particular interest was the work of Raytheon's

Royden Sanders on continuous wave radar that would harness the Doppler effect, thereby reducing clutter and more effectively identifying and tracking low-flying objects such as aircraft and missiles (Earls: 36). Further strengthening Raytheon's position in 1946, the company expanded its electronics capability through acquisitions that included the Submarine Signal Company (founded in 1901), a leading designer and manufacturer of maritime safety equipment including sonar systems widely employed by the US Navy (Scott: 182).

Sanders was considered by many to be a genius and his small group at Raytheon became known as Lab 16; they soon received US Navy contracts to further their research and development of a "seeker" or guidance system that could track and target incoming missiles or aircraft (Scott: 175). After several frustrating years of field test failures and adjustments in design, Raytheon's Lab 16 developed the first missile guidance system that could intercept a flying target. On December 1, 1949, Raytheon's team intercepted a target drone with a missile guided by a continuous-wave active seeker (Scott: 213). With this success, defense funding to Lab 16 increased and the team grew to 600 engineers, scientists and technicians divided between the headquarters in Waltham, MA where theoretical and design work was performed and the missile testing grounds at Point Mugu, CA. On December 18, 1950, Lab 16 achieved its next big success when a Lark missile became the first such weapon to make a direct hit on an aircraft in flight (Scott: 227).

Late in 1950 as part of the Lark Missile program, Lab 16 obtained a hangar at Bedford, MA where they used a B-26 with

a semi-active seeker antenna in its nose for testing (Scott: 224-226). Although not confirmed, the hangar used in 1950 for the Lark program may be the "Old Hangar" that was in operation beginning in 1941 and stood on the southern section of NWIRP until its demolition in 1995 (Brown & Root: 3-9). The success of the Lark missile program, including the work at Bedford, at the start of the Korean War was fortuitous for Raytheon and directly resulted in U.S. Navy contracts to develop the Sparrow III air-to-air missile (Scott: 230). This investment in Bedford was the first step in the eventual establishment of Bedford as the new home of Lab 16 with the opening of the "missiles" building in 1952 (Scott: 240). The missile and guidance system work at Lab 16 thrived, having grown from a small research effort into a new and important part of Raytheon's manufacturing business (Scott:239).



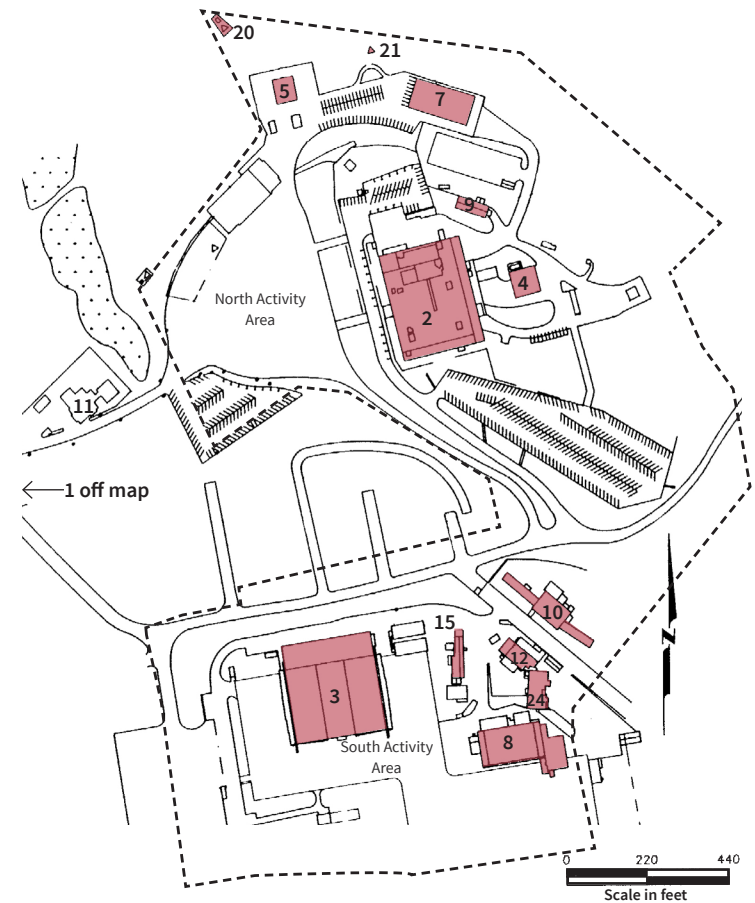
Lark missile being test fired in 1950.

Establishment of Naval Weapons Industrial Reserve Plant (NWIRP) Bedford

In 1952, the Navy sought to further the Raytheon Company's research and development facilities with the establishment of NWIRP Bedford as a GOCO facility. The NWIRP facilities eventually occupied approximately 46 acres; Raytheon owned most of the 133-acre industrial plant site dedicated to advanced technology research in weapons systems (Rogers: 4-1). The importance of Bedford continued to advance with investment by the government at NWIRP Bedford. In early 1955, the Lab 16 facilities became Raytheon's Missile & Radar Division headquartered in Bedford with a test site in White Sands, New Mexico (Scott: 289).

In October 1952, construction of NWIRP Bedford began under the name of Naval Industrial Reserve Aircraft Plant (NIRAP). The construction was authorized under a facilities contract with the Raytheon Company to centralize and expand critical capacity for research and development of radar for missiles, missile guidance systems and related equipment (Rogers: 4-2). The first building constructed by Raytheon for the Navy was the Components Laboratory to house the missile and radar development lab at the north end of Hanscom Airfield where Raytheon had leased several buildings in recent years for flight testing activities.

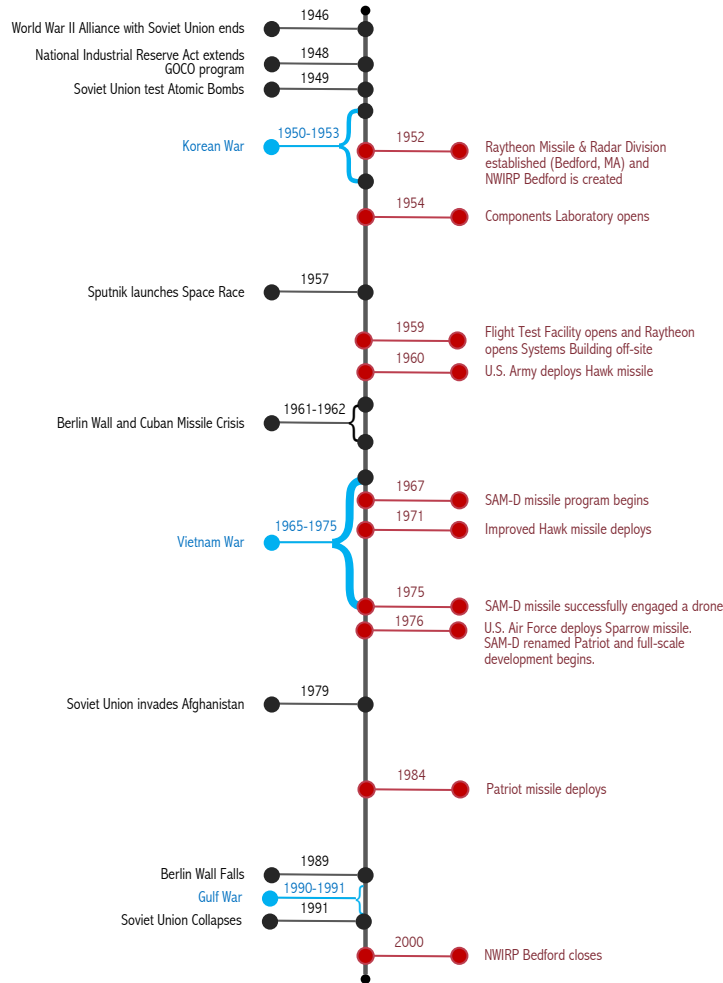
The \$2M research laboratory situated atop Hartwells Hill was dedicated on April 21, 1954 in ceremonies attended by the U.S. Navy, State of Massachusetts, and Raytheon officials. The facility was hailed as "one of the most advanced laboratories ever built for the development of electronics equipment used in conjunction with aircraft and guided missiles control systems" (Boston Daily Globe: 1954). Approximately 700 workers were to be housed



	No.	Name	Function	Year Open
Raytheon Facilities not on NWIRP Bedford	1	Systems Building	Research & Development (R&D)	1959
	11	Patriot Integration Test Site	Patriot Missile Testing	ca. 1966
NWIRP Bedford – Northern Section	2	Components Building	Engineering, Labs, R&D	1954
	4	AMRAD/Compact Test Range	R&D Functional Labs	1962
	5	Antenna Range Building	Control Center for Antenna Range ops.	1970
	7	Government Building	Engineering, R&D, Creative Services	1968
	9	Hawk Van Building	R&D Prototype Fabrication	1955
	20	Short-Range 90 ft Tower	Antenna R&D Functions	1970
	21	Intermediate Range 50 ft Tower	Antenna R&D Functions	1975
NWIRP Bedford – Southern Section	3	Flight Test Facility	Aircraft R&D Functions	1959
	8	Old Hangar	Storage, Labs	ca. 1941
	10	Lark Building	Publications	1952
	12	Plating Laboratory	Plating Operations	1952
	15	Van Duesen Building	Storage, R&D for Plating	1952
	24	Hawk Building	Plating Operations	1952

NWIRP Site Plan ca. 1992 with approximate facility boundary shown as a dashed line

NWIRP Bedford timeline during the Cold War



in the new building, which has 21 specially designed bays for testing radar equipment. The research laboratory was intended to centralize personnel from other plants and offices in the region who have been working on missile and radar work since 1944 (Boston Daily Globe: 1954).

The architectural firm of Cleverdon, Varney & Pike designed the Components Laboratory in 1952-1954. The Components Laboratory building represents the Late International style popular from 1946 to 1965. The focus of the style is on the expression of volume rather than mass, emphasis on balance rather than symmetry, and the absence of applied ornament. The use of glass and the glass curtain wall became increasingly popular. The defining features of the style are a box-shape, flat roof, structure is the ornament, exposed structural systems, cantilevers, smooth walls, glass curtain walls, and metal windows (Michael:70-71).

In the Components Building, hardware prototypes were fabricated, assembled from components, and run through vibration, drop and nondestructive testing. The Components Laboratory building also has office space and areas for spray painting,



Components Building sitting atop Hartwells Hill

welding, and machine work (Brown & Root: 3-5). The Components Building is a two-story structure with basement and penthouse that is made of reinforced concrete with brick and block exterior walls and a foundation of piles covered with a concrete slab. Total floor area is approximately 172,094 square feet.

Additional support facilities were constructed in the Northern facility and by the mid-1950s most of the construction was completed with 98,000 square feet of usable floor space and another 53,000 square feet for guard houses and test shelters (Ibid). Completed in 1955, the Hawk Van Building was used to service electronic equipment on vans as part of the Hawk Missile Project (Brown & Root: 3-9). The AMRAD / Compact Test Range building was completed in 1962 and it housed a variety of electronic programs over the years as they expanded from the Components Building. This building participated in a major Patriot antenna project in the late 1970s and early 1980s (Rogers: 5-11).



INSPECT MISSILE—Rear Adm Robert E. Dixon and Charles F. Adams, Raytheon president, check a Sparrow III missile on a F3H-2 jet fighter at dedication of Hanscom Air Force Base flight and missile test lab.

Newspaper clipping from The Boston Globe 17 Sep 1959

The Government Building was built in 1968 and originally served as a packaging and shipping operation, later changed to research offices, maintenance operation and a model shop (Brown & Root: 3-8). The Antenna Range Building was completed in 1970 and served as the control center for Antenna Range work (Rogers: 5-11). Further supporting the antenna range research are the Short-Range and Intermediate-Range towers erected on the northern edge of NWIRP Bedford in 1970 and 1975, respectively.

In 1959, the Flight Test Facility (FTF) building was designed and constructed on the southern tract of NWIRP Bedford. The FTF was dedicated September 16, 1959 as a combined laboratory and hangar costing approximately \$1.7M that would support the ongoing Sparrow III air-to-air missile program (Boston Daily Globe: 1959). The cantilevered roof design provides two hangars large enough to accommodate the largest aircraft using Hanscom Field, including B-52's and Constellations (Boston Daily Globe: 1959). The facility was designed to reduce time needed for installations, modifications and testing of electronic components of aircraft



Flight Test Facility showing cable system for cantilever roof and large hanger doors, ca. 1959



Flight Test Facility sitting adjacent to the airstrip.

and missiles (Flanders: 284). The FTF has approximately 95,000 square feet of floor area.

The architect-engineering firm of Fay, Spofford & Thorndike, Inc. (FST) designed the Flight Test Facility as well as the AMRAD building, deluge pump station and the fire protection reservoir. FST was established in 1914 by three engineers, Frederic H. Fay, Charles M. Spofford and Sturgis H. Thorndike. The three men met at Massachusetts Institute of Technology before forming their company. The firm was utilized throughout the Cold War to design various facilities in addition to those at NWIRP Bedford (Moore:121-124).

The Flight Test Facility (FTF) supported flight testing of product models and consisted of two hangar bays, an aircraft maintenance area, small laboratory areas and office space. The main floor was used to stock and do minor maintenance on aircraft and to fit them with radar equipment. The first floor and upper floor wings of the FTF contain small electronic labs, engineering shops, computer rooms, offices and a lunch room (Brown & Root: 3-4). The FTF

was able to support captive missile tests, ground-to-air flyovers and air-to-air flight tests. The FTF also supported Raytheon's corporate aviation operations. All testing at NWIRP Bedford was conducted indoors, within enclosed facilities (Brown & Root: 3-5).

Several support buildings existed on the Southern facility prior to completion of the FTF in 1959. These facilities included the Old Hangar, which dates to 1941 and originally served as an aircraft hangar but later was used for a paint shop, carpenter shop and storage (Brown & Root: 3-9). The Lark Building dated to 1952 and was used as the publications department until its demolition in 1995. The Plating Laboratory was located adjoining the Hawk Building and together they housed the plating operations from 1968 to 1995. In addition, the buildings served as a small-scale printed circuit etch and fabrication facility during those years (Brown & Root: 3-10). Finally, the Van Duesen Building also dates to 1952 and was originally used for storage of Hawk missile equipment and served as the research office of the Plating Laboratory. In later years, it was used as offices (Rogers: 5-14).

In order to supplement the GOCO facilities provided by NWIRP, Raytheon constructed a 122,000 square foot missile systems building just west of the Government property in 1958-1959 (Boston Daily Globe: 1958). This building, which came to be known as the Systems Building, was required to relieve the overcrowding in the Components Building and to provide space for expansion of the overall laboratories at the Raytheon Bedford Complex. The facility housed 800 employees when opened in March 1959 and contained offices, laboratories and shops (Boston Daily Globe: 1958).

Sparrow III Missile System

Raytheon's spectacular success with the Lark missile program resulted in U.S. Navy contracts to develop the Sparrow III air-to-air missile starting in 1951 (Scott: 230) The Sparrow III missile development, much of which was performed at NWIRP Bedford facilities, was successful, and the missiles were originally deployed in 1956. Over the years, the missile has been modified and improved; the current version is the AIM-7 Sparrow.

The Raytheon AIM-7 Sparrow is a radar-guided, air-to-air missile with a high-explosive warhead. The versatile Sparrow has all-weather, all altitude operational capability and can attack high-performance aircraft and missiles from any direction. It has been a staple fighter weapon in the US inventory for more than 50 years. Although external dimensions of the Sparrow have remained relatively unchanged from model to model, the internal components of newer missiles represent major improvements with vastly increased capabilities. The AIM-7



U.S. Navy F-14A Tomcat from Fighter Squadron 111 "Sundowners" fires an AIM-7M Sparrow missile, 1991

Sparrow is a widely deployed missile used by U.S. and North Atlantic Treaty Organization forces (USAF, 2003).

Adaptation of the Sparrow III for protection of naval vessels began in 1954. The SEASPARROW Missile is a radar-guided, surface-to-air missile based on the Navy and Marine Corps AIM-7 Sparrow air-to-air missile. The SEASPARROW has a cylindrical body with four mid-body wings and four tail fins. The U.S. Navy employs the RIM-7 Missile aboard three ship classes (CVN, LHA, and LHD) using the MK 57 NATO SEASPARROW Missile System (NSSMS) and MK 29 Guided Missile Launching System (GMLS).

SEASPARROW is a short-range, semi-active homing missile that makes flight corrections via radar uplinks. The missile provides reliable ship self-defense capability against a variety of air and surface threats, including high-speed, low-altitude anti-ship cruise missiles (ASCMs). It is widely deployed by U.S., NATO, and other international partner navies (US Navy, 2019).



NATO Sea Sparrow missile is launched during a live fire Missile Exercise aboard the Nimitz-class aircraft carrier USS Harry S. Truman (CVN 75)

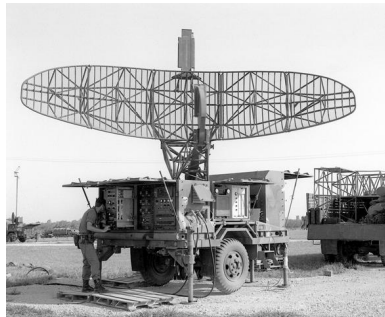
Hawk Missile System

Building on the success of the Lark and Sparrow III missiles, Raytheon successfully competed for the Army's Hawk surface-to-air missile program in 1954. In 1956, Raytheon's Hawk missile successfully demonstrated a direct hit, only 23 months after program started.

The HAWK is a medium range, surface-to-air guided missile that provides air defense coverage against low-to-medium-altitude aircraft. It is a mobile, all-weather day and night system. The missile is highly lethal, reliable, and effective against electronic countermeasures. The Basic HAWK was developed in the 1950s and initially fielded in 1960. The system has been upgraded through a series of product improvements beginning with the Improved HAWK in 1970. The Phase III product improvement and the latest missile modification were first fielded in the early 1990s to the U.S. Army and U.S. Marine Corps (US Army Redstone Arsenal, undated).

Although HAWK missile batteries were deployed by the U.S. Army during the conflicts in Vietnam and Persian Gulf, American troops have never fired this weapon in combat. The first combat use of HAWK occurred in 1967 when Israel successfully fired the missiles during the Six Day War with Egypt.

The Hawk was superseded by the MIM-104 Patriot in U.S. Army service by 1994. The



MIM-23 HAWK PAR radar, the primary source of high- to medium-altitude aircraft detection, ca. 1960s



US Army M-727 self-propelled Hawk system, 1983

last American user was the Marine Corps, who used theirs until 2002 when they were replaced with the man-portable short-range FIM- 92 Stinger.

SAM-D / Patriot Missile System

The research and development effort that eventually produced the MIM-104 Patriot air and missile defense system began in 1965 due to similar work in the Soviet Union that resulted in the fielding of the first Russian tactical ballistic missile in the early 1960s. The US Army awarded a contract to Raytheon in 1967 for a new air defense missile to be called Surface-to-Air Missile-Developmental (SAM-D). The system was initially designed as an anti-aircraft, surface-to-air defense battery, but subsequent upgrades allow for defense against a wide array of air targets.

Development test launches began a few years later and by 1975, the SAM-D missile successfully engaged a drone. In 1976, the SAM-D missile was renamed the Patriot and full-scale engineering development began. As a result, the research and development staff working at Raytheon Bedford grew to 3,800 people in September 1977 (Lowell Sun: 1977)

By 1985, the US Army deployed the Patriot Missile Systems and declared the system as fully operational. The first series of Patriot missiles was approximately seven feet long, and had a speed that exceeded Mach 3 and a range of forty-three miles. The two-thousand-pound missile had a forty-three-pound blast-fragmentation high-explosive warhead designed to destroy enemy aircraft and missiles by detonating in their proximity (Schubert: 239).



Patriot missile launchers ca. 2019

MSD Bedford Laboratories



Getting There First with Tomorrow's Technologies

The Bedford Laboratories of Fortune-100 Raytheon's Missile Systems Division is enjoying continued achievements and expansion in the research, design and development of several of the world's most sophisticated air defense systems. We are also involved in integrating breakthrough technologies and applications for our missile systems that are internationally recognized.

Areas of expertise include advanced software development, systems design, missile guidance and radar systems, digital and electro-optical systems and product assurance.

Raytheon-Bedford, a million-square-foot facility, is located in one of suburban Boston's most desirable areas—convenient to the city's incomparable educational, cultural and entertainment resources and the innumerable four season, recreational activities of nearby New Hampshire, Maine, Vermont and Cape Cod.

Radar Systems

Radar Systems Design
Must be able to perform conceptual design and analysis of advanced radar systems. Generate performance requirements and implementation of trade-offs. Engage in proposal activities, technical reports and presentations. BSEE with a minimum of 8 years experience.

Radar Test Site Manager
Should have demonstrated background in technical leadership as well as being knowledgeable in managerial techniques. Experience on the PATRIOT radar system and/or a major subsystem of the radar is most desirable. BSEE with a minimum of 10 years experience.

Digital Systems

Digital Production Support
Hands-on test/troubleshooting of digital equipment in the radar production environment. Field service/maintenance/test background required with knowledge of standard MSI/SSI integrated circuits. BSEE with a minimum of 5 years experience.

ATE Digital Test Development
Subsystems functional test on Teradyne L200 automatic test station to troubleshoot PC boards and solve digital modular production and system problems. Familiarity with VAX, PDP/11, HP/1000 and L200. Will work with TTL, RAMS, FPLA, DMA and Z8000 and 68000 microprocessors. Will also support manufacturing test. Should know "C", FORTRAN, PASCAL, Assembly, and Laser.

Systems Design

Operations Analyst
Studies to establish weapon systems requirements on sensors, engagement operations and deployments; evaluation of alternative system concepts.

Guidance and Control Analyst
Design, analysis and simulation of missile flight control systems, guidance algorithms, seeker stabilization loops and wing servo systems.

Systems Requirements
Responsible for specifying systems requirements necessary to meet operation objectives. Will be involved in radar systems, communications, software development and conceptual design. Must have experience in radar tracking, ECM/ECCM, signal processing and systems programming.

Software

Diagnostic Application Software
Design and development of test diagnostics for digital and analog hardware. Also software support for diagnostic real-time computers using FORTRAN and Assembly language. Hardware includes computer systems, radar systems and communication equipment.

Real Time Application Software
Development of embedded microprocessor application for command and control, real-time executive, display software, radar/signal processors and missile guidance. Utilize a structured high level language as well as microcode and Assembly language.

Radar Tactical Software

Design and development of tactical/simulation radar software using VAX running under VMS operating systems as host computer. Will use Ada as a PDL, "C" and Assembly for target generation using Motorola 68020. Will also support digital integration and development of engineering work station for radar support.

A BS degree in an engineering discipline is necessary. Both experienced engineers and recent college graduates will be considered. Raytheon offers an excellent salary/company-paid benefits program, including Investment Savings and Stock Ownership Plans. Please send resume with salary requirements to: Stephen S. King, Raytheon Company, Missile Systems Division, Hartwell Road, Bedford, MA 01730. An Equal Opportunity Employer. U.S. Citizenship required.

Quality Starts with Fundamentals

Raytheon

Raytheon Bedford MSD Employment, advertisement ca 1985

The MIM-104 Patriot is the US Army's primary air and missile defense system. Unlike the older Nike Hercules system, Patriot is truck-mounted and mobile. A firing battery can roll into position and be ready to fire in a less than an hour. A battery consists of a phased array radar set, engagement control station, electric power plant, an antenna mast group, communications relay group, and up to eight launching stations controlling four missiles each.

Initially designed as an anti-aircraft system, the Patriot gained attention in the 1991 Gulf War when it was used as an impromptu defense against Iraqi Scud missiles. Since then, Patriot and its related interceptors have been optimized for defense against tactical ballistic missiles but remains capable against aerial threats such as aircraft and cruise missiles.

NWIRP Bedford Comes to a Close

The US Navy and Raytheon operations at NWIRP Bedford were central in the development of several missile and radar systems over five decades spanning the full extent of the Cold War Era (1954 – 1989). During this time, the Raytheon Bedford Complex was the center of research and development, and engineering through production of several notable missile programs including the Sparrow III air-to-air system for the Navy, the Hawk surface-to-air missile program for the Army and the SAM-D (later Patriot Missile) programs in the 1960s through the 1990s.

Over the decades, the Raytheon company grew and diversified; other facilities and testing sites were developed and used for missile and missile guidance programs (Earls: 108). The central role of NWIRP in these programs diminished over time and in 1999, the Missile Systems Division was transferred to Tucson, Arizona. After many years of successful collaboration between industry and the US Navy, Raytheon operations at the site ceased in December 2000. Soon after, the U.S. Navy declared the property as excess. The NWIRP Bedford site, except for a few buildings, is now cleared and vacant.



2001 Aerial Image NWIRP Bedford

Photo Credits

Cover: (Clockwise from top) USGS 1955; Halliburton NUS Env Corp, 1992; J.P. Taylor, 2004; The Military Engineer, July-August 1959; National Archives, 1950

Page 4 (4): Excerpt from Halliburton NUS Env. Corp., 1992

Page 5 (5): Excerpt from U.S. Navy Contract with Raytheon, 1991

Page 6 (6): USGS Earthexplorer, 2019

Page 8 (20): Boston Daily Globe 17 Sep 1959, public domain

Page 9 (14): U.S. Navy Naval Aviation News, July 1954

Page 11: Raytheon Manufacturing Company, 1957

Page 15 (15): Excerpt from Halliburton NUS Env. Corp., 1992

Page 17 (16): Halliburton NUS Env Corp, 1992

Page 19: Naval History and Heritage Command

Page 20 (17): Halliburton NUS Env Corp, 1992

Page 21 (19): 1985 Raytheon Missile Systems Division MSD Bedford Laboratories Vintage PRINT AD purchased on eBay, December 2019

Page 22 (11): U.S. Navy National Museum of Naval Aviation, photo No. 1996.488.067.043

Page 24 top (23): U.S. Navy photo by Photographer's Mate 2nd Class Jason P. Taylor, Sept. 11, 2004

Page 24 bottom (21): Wikimedia Commons, public domain

Page 25 (10): U.S. National Archives, Combined Military Service Digital Photographic Files

Page 25 (25): U.S. National Archives, Combined Military Service Digital Photographic Files

Page 26: (top) Wikimedoa Commons, public domain; (bottom) Gary Sheftick, Army News Service, 2019

Page 28 (26): Image MassGIS, Commonwealth of MA EOEA, Google

References

Boston Daily Globe. *Navy Research Center Opened at Bedford Base*. April 21, 1954.

Boston Daily Globe. *New Lab to Be Built for Raytheon in Bedford*. September 28, 1958

Boston Daily Globe. *Missile Lab Dedicated by Navy at Hanscom: Raytheon to Operate it*. September 17, 1959.

Brown & Root. *Environmental Baseline Survey for Naval Weapons Industrial Reserve Plant Bedford, Massachusetts*. Prepared for Northern Division Naval Facilities Engineering Command. December 1997.

Earls, Alan R. and Robert E. Edwards. *Raytheon Company: The First Sixty Years*. Arcadia Publishing, 2005

Encyclopedia.com. "Raytheon Company: History." Updated November 22, 2019. <https://www.encyclopedia.com/social-sciences-and-law/economics-business-and-labor/businesses-and-occupations/raytheon-company> . Accessed November 2019.

Flanders, Royal C. *Cantilever Hangar Design*. The Military Engineer. July-August 1959

Michael, Michelle. *The Architecture of the Department of Defense: A Military Style Guide*. U.S. Army Construction Engineering Research Laboratories. Prepared for DoD Legacy Resource Management Program. December 2011.

Center for Strategic and International Studies . "Patriot." Missile Defense Project: Missile Threat. June 14, 2018, last modified November 4, 2019. <https://missilethreat.csis.org/system/patriot/>.

Moore, David W. Jr., Justin B. Edgington, Emily T. Payne. *A Guide to Architecture and Engineering Firms of the Cold War Era*. Hardy Heck Moore, Inc. Prepared for DoD Legacy Resource Management Program. March 2010.

National Research Council (NRC). *Defense Manufacturing in 2010 and Beyond: Meeting the Changing Needs of National Defense*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/6373.19ww99>

Raytheon Company "Raytheon Company: History." <http://www.raytheon.com/ourcompany/history/>. Accessed November 2019.

Robbins, Heather. *National Register of Historic Places Eligibility for Naval Weapons Industrial Reserve Plant (NWIRP) Bedford, Massachusetts*. Memorandum for Record, June 2016

Rogers, Golden & Halpern. *Initial Assessment Study Naval Weapons Industrial Reserve Plant, Bedford, Massachusetts*. Prepared for Environmental Restoration Department Naval Energy and Environmental Support Activity Port Hueneme, California. April 1986.

Schubert, Frank N. and Theresa L. Kraus. *The Whirlwind War: The United States Army in Operations DESERT SHIELD and DESERT STORM*. Center of Military History, United States Army, Washington, D.C., 1995 .

Scott, Otto J. *The Creative Ordeal: The Story of Raytheon*. Atheneum Publishing, 1974.

Shiman, Philip Dr. *Forging the Sword Defense Production in the Cold War*. U.S. Army Construction Engineering Research

Laboratories. Prepared for DoD Legacy Resource Management Program. July 1997.

USA Today. *Military Spending Defense Contractors Profiting from War Weapon Sales*. February 21, 2019.

US Air Force. *AIM-7 Sparrow. Fact Sheet*. Published October 1, 2003. <https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104575/aim-7-sparrow/>. Accessed December 2019.

US Army Redstone Arsenal Historical Information. *Hawk*. Published Date Unknown. <https://history.redstone.army.mil/miss-hawk.html>. Accessed December 2019.

US Navy. *SeaSparrow Missile (RIM-7). Fact File*. Published January 17, 2019. https://www.navy.mil/navydata/fact_display.asp?cid=2200&tid=900&ct=2. Accessed December 2019

Yoshpe, Harry B. and Charles F. Franke. *National Security Management: Production for Defense*. Washington, D.C.: Industrial College of the Armed Forces, 1968.