

Table of Contents for Written Narrative

Provide the following information on continuation sheets. Cite the letter and the title before each section of the narrative. Assign page numbers according to the instructions for continuation sheets in *How to Complete the Multiple Property Documentation Form* (National Register Bulletin 16B). Fill in page numbers for each section in the space below.

	Page Numbers
E. Statement of Historic Contexts (If more than one historic context is documented, present them in sequential order.)	1 - 3
F. Associated Property Types (Provide description, significance, and registration requirements.)	4 - 8
G. Geographical Data	8
H. Summary of Identification and Evaluation Methods (Discuss the methods used in developing the multiple property listing.)	8 - 9
I. Major Bibliographical References (List major written works and primary location of additional documentation: State Historic Preservation Office, other State agency, Federal agency, local government, university, or other, specifying repository.)	9

Primary location of additional data:

- State Historic Preservation Office
- Other State agency
- Federal agency
- Local government
- University
- Other

Name of repository:

Paperwork Reduction Act Statement: This information is being collected for applications to the National Register of Historic Places to nominate properties for listing or determine eligibility for listing, to list properties, and to amend existing listings. Response to this request is required to obtain a benefit in accordance with the National Historic Preservation Act, as amended (16 U.S.C. 470 *et seq.*).

Estimated Burden Statement: Public reporting burden for this form is estimated to average 120 hours per response including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding this burden estimate or any aspect of this form to the Chief, Administrative Services Division, National Park Service, P.O. Box 37127, Washington, DC 20013-7127; and the Office of Management and Budget, Paperwork Reduction Project (1024-0018), Washington, DC 20503.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

U.S. Naval Ordnance Testing Facility, Topsail
Island, Pender County, North Carolina

Section number E Page 1

E. Statement of Historic Context: "Operation Bumblebee". The Development of the Ramjet Missile.

The history of the development and successful testing of ramjet missiles in the United States, from their incubation period in 1945 to the maturing of supersonic aircraft and shipboard missile design in the mid-twentieth century, is rooted at Topsail Island, North Carolina. This was the third of three widespread test sites established along the Atlantic seaboard in the closing years of World War II, and the first permanent proving ground for missile testing.(1) Two earlier sites, at Island Beach, New Jersey, opened in 1945, and at Fort Miles, Delaware, opened in 1946, were temporary installations with mobile equipment and limited facilities.(2) The Topsail Island site, placed in operation in March 1947, incorporated rigid structures that were designed and erected for specific uses related to the assembly, firing, monitoring and perfecting of experimental ramjet missiles. Documentary photographs, taken of the structures and of personnel at various work stations during the tests, give a vivid picture of the operations.(3)

Despite their less than fifty year existence, these buildings are of exceptional significance because they are the only aboveground resources remaining at the three sites, and here the nation's burgeoning ramjet missile program grew from experimentation to maturity.(4) So successful were the tests conducted at the Topsail Island site that the ramjet proved its value, opened the way for the advance of supersonic jet aircraft design, and brought the United States to the threshold of modern space technology with the Talos, Terrier, Tartar and Sea Sparrow missiles aboard naval vessels.(5)

The first explanation of the theory behind the ramjet engine was made in 1908 by a French engineer, Rene Lorin, who speculated that exhausts from a standard internal combustion engine, if directed into diverging nozzles, produced jets that would propel the vehicle. The design consisted of a cylinder or "stove pipe" containing a supply of fuel that was mixed with oxygen drawn into the front of the cylinder after launching. The air was compressed or "rammed" in the chamber, produced ignition and burning of the fuel, and exhausted through the tail. By 1913 Lorin had developed his theory further, stating that air rammed into the end of a divergent duct during flight reduces the speed of the air, raises its intake pressure, and burns the fuel continuously to increase velocity. The combustion gases enter a convergent duct, expand down to atmospheric pressure and to about twice the speed of the original intake air.(6)

During World War I, Lorin brought his theories of the ramjet to the attention of the French government, suggesting that it be used to defeat the Germans. But he and his "gadget" were not taken seriously and little attention was given to refining ramjets and other rocket weaponry at the time.(7) The incentive came in World War II with the impact of Germany's V-2 rocket assaults on France and England in 1944. Thereupon, the research and development of high-altitude warfare became a vital and competitive affair on an international scale.(8)

Early in 1945, the U.S. Navy, in association with the Applied Physics Laboratory at Johns Hopkins University in Maryland, launched a program to put the ramjet theories to the

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number E Page 2

U.S. Naval Ordnance Testing Facility, Topsail
Island, Pender County, North Carolina

test by assembling, firing, tracking, and evaluating the performance of high-speed, extended-range ramjet missiles from a remote base of operations.(9) The purpose of the mission, dubbed "Operation Bumblebee" because of seemingly impossible aerodynamic challenges similar to those experienced by a bumblebee in flight, was to make the ramjet engine successful as a booster for anti-aircraft missiles by bringing it up to supersonic speeds, developing thrust, and measuring its performance in the field with technical instrumentation.(10) The program was managed by the U.S. Navy in association with the Johns Hopkins University Applied Physics Laboratory and the Kellex Corporation, successor to the M.W. Kellogg company, a firm of civilian contractors who built a variety of facilities for the U.S. government.(11)

The first test site was established at Island Beach, New Jersey. It was a temporary operation with portable buildings, truck-mounted tracking equipment and a launching pad. All the remains of this facility are gone, except for the launching pad which is now buried beneath three feet of sand in the midst of a recreational area.(12) The second installation was activated at Fort Miles, Delaware early in 1946. All evidence of this temporary facility has, likewise, disappeared.(13) The third and most significant site, further south at Topsail Island, North Carolina, enjoyed good weather conditions and unexcelled visibility, and its isolated beachfront made it ideal for secret testing operations at a permanent base.(14) All the original structures survive, except for two observation towers which were razed in recent years.

On April 26, 1946, a joint report by the Navy, the Applied Physics Laboratory of Johns Hopkins University, and the Kellex Corporation identified Topsail Island as the most suitable location for a permanent test site because it offered unrestricted space, enjoyed good weather and visibility, was accessible by highway, railroad, and air from Washington, D.C., and was isolated from populated areas and commercial shipping lanes. In addition, the site was already in government hands, having served during World War II by the Army stationed at Camp Davis in Holly Ridge to test the range capabilities of anti-aircraft weapons, and the government held a ninety-nine year lease on the property.(15)

After review and approval of the reports investigating and evaluating the new site, the Camp Davis Army base was consigned for use by the Navy. Naval and marine personnel, numbering five hundred men, and led by Lieutenant Commander Tad Stanwick, officer in charge of the Naval Ordnance Development Unit, arrived at the site by mid-1946 to install water, electrical, and transmission lines, to improve existing roads and bridges, and to erect an assembly-storage building near the south end of the island. Associated structures, including a control tower, launching platform and eight rigid observation towers, were built along the beach front. The latter, placed at precise latitude and longitude positions, were anchored firmly by deep pilings and were constructed with reinforced concrete to eliminate even the slightest structural movement. Concrete block walls enclosed the three levels of each tower to protect the sensitive photo theodolite cameras and precise timing instruments from the elements.(16) Construction of the new facility was completed early in 1947 and the site was placed into full operation by March of that year.(17)

Research, development and testing of the missile components were handled by the

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

U.S. Naval Ordnance Testing Facility, Topsail
Island, Pender County, North Carolina

Section number E Page 3

Applied Physics Laboratory at Silver Spring, Maryland, and the two-stage rockets, consisting of a solid booster to launch the missile and a ramjet engine to bring it up to supersonic speed, were made at Cumberland, Maryland. The units, dubbed "flying stovepipes" because of their peculiar appearance, were transported to Topsail Island where they were assembled, fired, and monitored by special instrumentation to prove whether the ramjet was achieving its required thrust.(18)

During the next eighteen months, an estimated two hundred experimental rockets, each measuring six inches in diameter and between three and thirteen feet in length, were fabricated at the Assembly Building, dispatched to the launch site, and fired along a northeasterly angular deflection of fifteen degrees to the shoreline for a maximum clear distance of forty miles. The series of experimental launches that followed proved so valuable that the propulsion of missiles through the atmosphere reached speeds up to 1,500 miles per hour for distances up to twenty miles.(19) This significant accomplishment, in turn, impelled the development of jet aircraft engines through the application of the ramjet principle, became the impetus for America's subsequent leadership in supersonic technology, and had an impact on missile designs in France and England.(20)

Despite the initial success of the U.S. Naval Ordnance Testing Facility at Topsail Island over its eighteen-month span, its location did not fulfill completely the needs of a permanent base because weather conditions often affected the instrumentation, and increased sea traffic in the area hampered range length.(21) Therefore, the facility was finally abandoned and the equipment was moved to other sites, including Inyokern, California, White Sands, New Mexico, and Cape Canaveral, Florida, where missile operations were combined with ongoing space rocket research.(22) Subsequent development of the anti-aircraft missile apparently was done by private industry, since the testing at Topsail Island had established the viability of the ramjet technology. Archival records documenting this evolution in the 1950s and later are still classified, but the testing facility at Topsail Island is the only surviving record of this technological breakthrough in the country.(23)

In 1948, the land and buildings at the Topsail Island base were deeded to local town and county agencies and sold for commercial and residential uses. Roads and utilities were retained, and the Assembly Building and its associated structures were modified for civilian purposes.(24)

Over the intervening years, residential communities developed along the strand and the island's claim to scientific and military fame was all but forgotten. In succeeding years, seasonal and year-round use has encroached on these landmarks. Nevertheless, the veil of mystery that surrounded them enwrapped residents and visitors alike, generating efforts to identify and protect the buildings, and to interpret them as unique visual remnants of the ramjet missile program.(25) In April 1990, a state historic marker commemorating the fiftieth anniversary of Camp Davis was unveiled at Holly Ridge. The ceremony brought together scores of veterans and peaked further interest in the associations that are reminders of the area's critical role in the nation's World War II and post-war military operations.(26)

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

U.S. Naval Ordnance Testing Facility, Topsail
Island, Pender County, North Carolina

Section number F Page 4

F. Associated Property Type: Resources Associated with Ordnance Testing.

Description:

A variety of resources relating to the "Operation Bumblebee" program were built at Topsail Beach and include an assembly building, a control tower, eight observation towers, a launching platform, an underground bombproof bunker beneath the launching platform, instrument shops, a fueling platform, and a warehouse. They were built in 1947 by George and Lynch of Wilmington, Delaware from plans and specifications prepared by the Kellex Corporation for the U.S. Navy Bureau of Ordnance.(27) The structures are shown on a map of the facility which appeared in an article on Camp Davis printed in 1947.(28) Copies of the blueprints and the map are included in the appendix. Of these structures, two observation towers, the instrument shops, and the fueling platform have been razed. The remaining resources are contained within an area just over ten miles in extent, reaching south to north from Tower #1 at the northwest intersection of Hines Avenue and South Anderson Boulevard in Topsail Beach, Pender County, 6.6 miles south of the intersection of NC 50 and NC 210 in Surf City, to Tower #6 on the eastern side of Ocean Boulevard in North Topsail Beach, Onslow County, 3.5 miles north of the intersection of N.C. 50 and N.C. 210 in Surf City.

The once isolated sand spit, accessible across Topsail Sound five miles southeast of the former mainland Camp Davis Army base, is now populated by modern coastal developments consisting of year-round and summer homes, punctuated by the high silhouettes of the instrument towers of the U.S. Naval Ordnance Testing Facility. Two of the towers were altered in the 1950s and 1960s for use as residences, one structure became a public fishing pier, the assembly building was modified for use as a store, restaurant and community center, and the launching platform and bombproof bunker were incorporated in the ocean front patio of the Jolly Roger Inn.

Assembly Building.

The Assembly Building, where ramjet rockets were fabricated and stored, is a seventy-seven by eighty-two-foot structure with reinforced concrete walls and floors, concrete block upper walls, and timber trusses supporting the gable roof. It is located at the intersection of Channel Boulevard and Flake Avenue, two blocks west of South Anderson Boulevard, the main north-south road that connects the seacoast towns of North Topsail Beach, Surf City and Topsail Beach. Directly behind the building is Topsail Sound, which separates the island from the mainland across tidal flats and the Intracoastal Waterway.

Control Tower.

To the east of the Assembly Building, at the southwest corner of South Anderson Boulevard and Flake Avenue, stands a three-story, sixteen-foot by sixteen-foot reinforced concrete building, which was originally erected as the control tower for the missile testing facility. Documentary photographs of the structure show it much as it remains today, except for the removal of a roof-top observation platform and the substitution of wide eaves and a flat roof over the observation deck.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

U.S. Naval Ordnance Testing Facility, Topsail
Island, Pender County, North Carolina

Section number F Page 5

Launching Platform.

One block east of the control tower, across South Anderson Boulevard and skirting the ocean side of the island, stands the Jolly Roger Inn, a complex of two- and three-story structures that face the sea and flank a sixty-foot by seventy-two-foot concrete patio that formerly served as a part of the launching platform for the missiles wheeled on dollies from the assembly building to the firing site. A reinforced concrete bunker beneath the platform served as an observation post during launching of the missiles and is now used as a storage room for the motel.

Observation Towers.

Eight, three- and four-story, sixteen-foot by sixteen-foot towers were originally built to serve as enclosed platforms for instruments which photographed and located by angular measurement the position in space of missiles ten to twenty miles away traveling at speeds of 1,500 miles per hour. To obtain absolute stability the towers were designed with reinforced concrete foundations, frames and floors and placed on the centers of thirty-foot by thirty-foot concrete slabs supported on concrete piles driven to a minimum depth of twenty feet and fifteen tons bearing.(29)

Two of the eight towers were razed in recent years. Those that remain are located at the following positions along the beach:

Tower # 1: At 930 South Anderson Boulevard (NC 50), at its intersection with Hines Avenue, Topsail Beach, and 6.6 miles south of the intersection of NC 50 and NC 210 in Surf City. A two-story residential addition was attached to the southwest corner of the tower in 1949 and modern windows were installed in the tower walls.

Tower # 2: In the 1000 block of South Anderson Boulevard (NC 50), Topsail Beach, in the Queen's Grant residential development, on the west side of the street overlooking Topsail Sound, 4.9 miles south of the intersection of NC 50 and NC 210 in Surf City, and 0.1 west of South Anderson Boulevard. The tower, in unaltered condition, stands as a lone sentinel overlooking Topsail Sound on the west side of the island and is isolated from the residential development by a narrow channel.

Tower # 3: At 3008 South Shore Drive (NC 50) and Hispanola Avenue, Surf City, and 3.6 miles south of the intersection of NC 50 and NC 210 in Surf City. The structure was altered in the 1950s by the addition of a one-story residential wing on the south side of the tower and a wraparound porch on the ocean side of the building.

Tower # 4: At 1408 North Anderson Boulevard (NC 50), Surf City, and 1.6 miles south of the intersection of NC 50 and NC 210 in Surf City. The tower is now sandwiched between two multi-story residences and retains only its reinforced concrete frame and floors.

Tower # 5: Just southeast of the intersection of North Shore Road (NC 210) and New Bern Avenue, North Topsail Beach, 0.4 miles north of the intersection of NC 50 and NC 210

**United States Department of the Interior
National Park Service**

**National Register of Historic Places
Continuation Sheet**

U.S. Naval Ordnance Testing Facility, Topsail
Island, Pender County, North Carolina

Section number F Page 6

in Surf City, and 0.05 miles east to the Atlantic Ocean. Like Tower #2, the structure stands in its original condition on a bluff overlooking the sea.

Tower # 6: Ocean City Pier, North Topsail Beach, at 3.5 miles north of the intersection of NC 50 and NC 210 in Surf City, and 0.05 miles east to the Atlantic Ocean. The property was developed in the 1950s as a public fishing pier and restaurant, with the tower forming the central mass in the arrangement of newer buildings.

Significance:

The resources associated with the U.S. Naval Ordnance Testing Facility are of exceptional significance in the technological evolution of American military weaponry because the Topsail Island facility was the incubator for the missile program, where the ramjet engine---the basis of supersonic jet aircraft---was proven viable. The Topsail Island facility was the predecessor of Cape Canaveral. It has survived because it was built as a permanent base, unlike earlier temporary sites that were constructed during World War II. The Topsail Island facility is believed to be the earliest surviving missile testing site in the United States.

Registration Requirements:

The unique resources associated with the development of defensive missiles by the United States government at Topsail Island retain the basic integrity of design, location and association. The distinctive forms, in most cases, have been preserved and remain in their original locations along the strand. Because the location was of such importance and was chosen carefully and deliberately, the arrangement of structures along the beach was a primary consideration in the establishment and operation of the base. The symbolic association of the site with the missile testing program retains its strong visual impact because of the arresting form of the structures and their precise siting that remains unaltered after nearly five decades of abandonment of the facility. The Assembly Building, Control Tower and Observation towers retain their structural integrity of form, workmanship and materials, despite the addition of roofs, windows and interior walls. The original setting has been changed by the development of Topsail Beach as a year round beachfront community surrounding the former testing facility, but the distinctive appearance of the structures still retain their symbolic association. The integrity of feeling through the atmosphere of secrecy and isolation has, likewise, been changed because of the abandonment of the site for military purposes and its purchase by private interests, but the mystery surrounding the facility is still felt.

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number F Page 7 U.S. Naval Ordnance Testing Facility, Topsail
Island, Pender County, North Carolina

Endnotes.

1. Dick Brown, "The Topsail Island Secret: Operation 'Bumblebee'". Tidewater magazine, March 1985, pp. 7-8. Reprinted from Fayetteville Observer, September 24, 1978, p. 1-D.
2. Marilyn Treusch, Park Naturalist, Island Beach State Park, Seaside Park, New Jersey. Letter to Edward F. Turberg, November 11, 1992.
3. David A. Stallman, Operation Bumblebee, 1946-1948, Topsail Beach, N.C. (Privately printed, 1992), pp. 13, 14, 21, 22, 23.
4. Treusch; Stallman, p.16.
5. "Rockets and Missile Systems" The New Encyclopaedia Britannica (Chicago: Encyclopaedia Britannica, Inc., fifteenth edition, 1979) V. 15, p. 932.
6. John Day, Engines, the Search for Power (New York: St Martin's Press, 1980) p. 249.
7. Don Bennett, "Bumblebees flew at Island Beach." Ocean County Observer, December 15, 1991.
8. "Rockets and Missile Systems", p. 926-929.
9. Brown, p. 8; Don Bennett, "War effects felt in town by the sea", Ocean County Observer, December 15, 1991.
10. Stallman, p. 16.
11. "Testing Will Begin at Davis March 17" The News, March 1947, p. 3. (Silver Spring, Md.: Johns Hopkins University Applied Physics Laboratory)
12. Treusch.
13. ibid.
14. Stallman, pp. 15-16.
15. "Report of Survey of Camp Davis, North Carolina for use as an East Coast Guided Missile Test Range." April 26, 1946 p. 6.
16. "Camp Davis Test Range - Abstract." Bumblebee Report, March 1947, p. 20. (Silver Spring, Md.: Johns Hopkins University Applied Physics Laboratory)
17. The News, March 1947, p. 3

United States Department of the Interior
National Park ServiceNational Register of Historic Places
Continuation SheetSection number F, G, H Page 8 U.S. Naval Ordnance Testing Facility, Topsail
Island, Pender County, North Carolina

18. Stallman, p. 12
19. ibid.
20. Bennett, "Bumblebees flew at Island Beach."
21. Stallman, p. 16.
22. ibid.; Bennett.
23. Stallman, p.5; Treusch.
24. "All Hands" newsletter, 1948.
25. Treusch.
26. Mark Ippolito, "WW II camp marks 50th year" Wilmington Star-News, April 29, 1990, p. 1-C; Paul Woolverton, "Historical group eyes purchase of testing site" Wilmington Star, January 1, 1991, p. 1-B.
27. Stallman, p. 30.
28. Johns Hopkins University Applied Physics Laboratory, 1947.
29. Naval Ordnance Test Facility press release, January 1948.

G. Geographical Data

The geographical area in which the U.S. Naval Ordnance Testing Facility is located encompasses that portion of Topsail Island extending south 6.6 miles from the intersection of NC highways 50 and 210 in Surf City, North Carolina, and north from the same intersection a distance of 3.5 miles. The communities incorporated in the area include Topsail Beach and Surf City in Pender County, and North Topsail Beach in Onslow County.

H. Summary of Identification and Evaluation Methods.

The multiple property listing of the historic and architectural resources related to the The U.S. Naval Ordnance Testing Facility at Topsail Island, North Carolina, is based on research information collected by David A. Stallman, a local historian and researcher, who obtained access to government files in Washington, D.C. and Johns Hopkins University files of the Applied Physics Laboratory in Silver Spring, Maryland. Other information sources include articles in local newspapers, interviews with military personnel attached to the facility during its operation as a test facility and conversations with civilians who moved into the area after the U.S. Naval Ordnance Testing Facility was abandoned.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number H, I Page 9 U.S. Naval Ordnance Testing Facility, Topsail
Island, Pender County, North Carolina

The properties are grouped under two historical contexts that conform with the major theme of the development of the ramjet missile program during the years from 1945 to 1948, and the subsequent adaptive use of the buildings after the U.S. Naval Ordnance Testing Facility was abandoned and equipment was relocated to sites in California, New Mexico and Florida.

I. Major Bibliographical References.

"All Hands" newsletter, 1948.

Applied Physics Laboratory News, March 1947 and July 1963.

Bennett, Don. "Bumblebees flew at Island Beach", and "War effects felt in town by the sea." Toms River Observer, 5, 1991.

Brown, Dick. "Topsail Island Seedbed Of Missile Program." Fayetteville Observer and Fayetteville Times, September 24, 1978, page D-1.

Brown, Dick. "The Topsail Island Secret: Operation 'Bumblebee'." Tidewater, March 1985, pages 6-8.

"Historical Society Vote To Preserve Arsenal." Pender Sounds, June 1989, pp. 19-21.

Military press release, May 14, 1947.

Specifications drawn by The Kellex Corporation, 1946.

Stallman, David A. "A History of Camp Davis." Privately printed, 1990.

Stallman, David A. Operation Bumblebee, 1946-1948, Topsail Island, N.C. (Privately printed, 1992). pp. 1-32.

Stallman, David A. "Tad Stanwick." Privately printed, 1989.

Stallman, David A. "Topsail Beach Historical Tour." Privately printed, 1990.

Unger, Steve. "Is the Arsenal Worth Saving?" Pender Sounds, June 1989, p. 5.

US Naval Ordnance Testing Facilities, Topsail Island MPS

continued:

The early ramjet missile programs served as a foundation for the later development of jet engine technology and modern naval defense systems. Due to the recent date of the events surrounding the program and the military nature of the work (much of it still classified), an exhaustive context is unavailable for the full history of the ramjet testing and missile development in the United States. The documentation, however, appears to provide an adequate justification for the eligibility of the Topsail Island facilities owing to their pioneering role in the larger military defense program; the overall importance of the government testing programs to national defense and engineering science; and the unique status of these properties as the only extant resources associated with this early experimental period.

The significance of the Topsail Island resources rests not only in the specific work carried out during 1947 and 1948, but also in the fact that the site as a whole represents some of the earliest, tentative experimental steps in what would evolve into a major aspect of twentieth-century military research. As an initial point of experimentation and investigation, Topsail Island is essential for our understanding of the progress and development of this country's missile program during the twentieth century, from its inception to the present time.