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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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The Honorable George H. Mahon
Chairman, Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

We reviewed the factors the Navy considered in selecting the Bangor Annex, Naval Torpedo Station at Keyport (near Bangor), Washington, as the site for the proposed Trident Support Complex. The enclosures respond to your February 2, 1973, request that we study the Navy's plans to construct facilities which will support the Trident submarine program and to our subsequent agreement to give you an interim report on this segment of the request.

The Navy's decision to deploy the Trident submarines in the Pacific Ocean was a major factor influencing selection of a west coast site for the Navy's proposed Trident Support Complex. Although we are not in a position to evaluate the Navy's strategic considerations in deploying the submarines in the Pacific, we found no basis for disagreeing with its selecting the Bangor site as the appropriate location for the proposed Support Complex.

As agreed with your Office, we have not obtained comments from the Navy on the contents of this interim report. However, as agreed, information in this report will be included in our final report responding to your overall request and we will obtain Navy comments on that report.

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We trust this information meets your needs, and we will be pleased to discuss the matter further with you or your staff.

We do not plan to distribute this report further unless you agree or publicly announce its contents.

Sincerely yours,

Elmer B. Staats

Comptroller General
of the United States

Enclosures - 6

SUMMARY OF GAO's STUDY OF FACTORS CONSIDERED BY THE NAVY IN SELECTING A SITE FOR THE TRIDENT SUPPORT COMPLEX

By letter dated February 2, 1973, Congressman George H. Mahon requested GAO to study the Navy's plans to construct facilities supporting the Trident submarine program. Specifically, we were requested to study the major factors involved in the site selection, the scope and scheduling of construction of the facilities, and the impact of this construction on possible displacement or disruption of other major Government activities. This summary deals with one segment of the request--the factors the Navy considered in selecting a site for the Trident Support Complex.

SCOPE OF REVIEW

We reviewed the factors the Navy considered (1) in selecting a site for the proposed Trident Support Complex and (2) in deciding that periodic maintenance and supply replenishment for the Trident submarines should be provided at a separate Support Complex rather than at an existing Navy shipyard. We did not review the need for the Trident system, the appropriateness of the operating goals established for the Trident submarines, or the feasibility of the maintenance and support concepts planned to be provided by the Support Complex. Neither did we attempt to evaluate the strategic considerations involved in the Navy's decision to deploy the Trident submarines in the Pacific rather than the Atlantic Ocean.

In our study, carried out at the Office of the Chief of Naval Operations and the Office of the Trident Project Manager, Naval Material Command, we reviewed internal Navy studies and reports and interviewed cognizant Navy officials.

MISSION OF THE TRIDENT SUPPORT COMPLEX

The Trident Support Complex will provide maintenance and logistic support for the Trident system and serve as the homeport for Trident crews. The Complex (often referred to by the Navy as the Refit Complex) will comprise four areas of facilities.

1. Ships area--maintenance activities and facilities required for submarine maintenance.

2. Explosive weapons area--facilities required for receipt, inspection, storage, disassembly, modification, maintenance repair, checkout, and packaging and unpackaging of missiles, torpedoes, and other explosive components.

3. Administrative and support area--facilities required for base administration, command offices, and general base support.

4. Training and personnel support area--facilities required for crew training, medical, living quarters, messing, etc.

The Complex is intended to assist the Navy in accomplishing its operating goals for the Trident system. The Navy plans to get improved use from the Trident submarine over previous submarines by keeping it on patrol longer each outing and by speeding up the turnaround time spent off patrol for periodic refit (maintenance and supply replenishment). For example, the Navy now plans for the Trident submarine to be on patrol 70 days each outing and off patrol for refit for 25 days before going on patrol again. Experience with existing submarines shows that they are on patrol 60 days each outing and off patrol for refit for 30 days before going on patrol again.

SELECTION OF A SITE FOR THE TRIDENT SUPPORT COMPLEX

The Navy considered 89 potential sites for the Trident Support Complex before it decided on the Bangor Annex, Naval Torpedo Station at Keyport (near Bangor), Washington. (See enc. II.) Although many factors were weighed in the decision, key ones were the Navy's decisions--apparently for strategic reasons--to deploy the Trident submarines in the Pacific Ocean and to locate the Support Complex on U.S. territory, preferably in the continental United States. These decisions strongly supported selection of a west coast site.

Among other influential factors were the availability of adequate land and waterfront to support the Trident system and the Navy's desire to locate the Complex near a skilled work force and a Navy shipyard.

Measured against the other potential west coast sites, the Bangor site appeared the most advantageous for supporting and operating the Trident system.

Criteria used to select potential sites

In the fall of 1970 the Navy initiated a study which would recommend potential sites for the Trident Support Complex and estimate military construction costs for its facilities. A study group of nine teams was organized to determine the facilities required in assigned areas of the Complex and to prepare a list of potential sites. Criteria given the teams for picking potential sites were (1) proximity of Navy support activities, (2) ready access to the sea, (3) waterfront dredging requirements, (4) jetty construction, (5) fill and material disposal requirements, (6) degree of shelter provided within the harbor, (7) readily available skilled work force, (8) land availability, (9) existing facilities, (10) availability of military and civilian air, rail, and road transportation, and (11) siting for an Underwater Monitor Range Facility.

The study group was instructed to assume that the Trident system would be supported at no more than two dedicated refit bases on U.S. territory--one for the Atlantic and the other for the Pacific. The initial Complex was to be on the Atlantic coast, and the Trident system was to be initially deployed in March 1980.

Screening of the 89 potential sites

To reduce the number of potential sites, each was reviewed for (1) land and waterfront availability and adequacy (an estimated 8,000 acres of land and 20,000 feet of waterfront) and (2) 11 special site characteristics: terrain, harbor shelter, harbor depth, egress channel operability, egress security, ship repair work force, highway accessibility, railway accessibility, airfield proximity, climatic temperatures, and inclement weather.

The sites scored as excellent, good, fair, or poor in each of the above factors; however, harbor depth, egress security, and the availability of land and waterfront and a ship repair work force were considered dominant factors.

This screening reduced the potential sites to 17. Enclosure III summarizes the reasons why sites were eliminated and enclosure IV lists the 17 potential sites.

Screening of the 17 potential sites

The Navy study group intended to reduce the 17 potential sites to a very limited number but did not intend to select the single best site. For each site, the study group prepared a proposed land-use plan, then applied a rating and scoring system, and finally prepared a narrative analysis and summary.

The site rating and scoring system evaluated ship operations and egress and base operations and construction. The study group defined 41 separate factors, or elements, and applied them to the two operating areas. The elements applicable to each site were scored (from 1 to 4 with 4 being the best score), multiplied by a weighted factor, and totaled. (Enc. V lists the elements and the weights given each.) A score of 2,000 was possible for each of the two areas.

Using this process, the Navy study group reduced the potential sites to five: Bangor; Charleston, South Carolina; Camp Peary, Virginia; Cape Kennedy, Florida; and St. Marys, Georgia. Enclosure VI briefly summarizes the scores of the 17 final sites and gives the study group's recommendation on which sites warranted further consideration. Roosevelt Roads, Puerto Rico; Point Arguello, California; and Yorktown, Virginia, scored as well or better than the five recommended sites, but use as a Trident site would conflict with an existing mission at each of these three sites. Other disadvantages of these sites were labor, terrain, and logistics problems; for example, the Puerto Rico site would not be located in the continental United States so the Navy would have to rely on sea transport to resupply the base.

In its final report dated January 28, 1972, the study group reduced the five sites to four by dropping Camp Peary because the extent of dredging required could influence river-flow patterns and downstream erosion and thus adversely affect operation at the Naval Weapons Station in Yorktown and the environment of the immediate area. The group recommended that site selection be made in the near future to meet the then-planned deployment date for the Trident submarine. The group stated that the Bangor site might have significant

advantages for an early deployment date because minimum channel dredging would be required and the soil was excellent for construction.

Decision to deploy in the Pacific and its effect on site selection

The Naval Material Command forwarded the site study to the Office, Chief of Naval Operations, in October 1972. From a logistics standpoint, Charleston, South Carolina, and Bangor, Washington, were identified as the leading candidates. After making strategic studies, the Navy announced in February 1973 its plans to initially operate the Trident submarine in the Pacific Ocean and to expand facilities at the Bangor site to provide the base for Trident operations.

The Navy has stated that the reasons for deploying the Trident in the Pacific Ocean were strategic in that such deployment would complicate Soviet antisubmarine warfare by (1) requiring current Soviet antisubmarine forces to be "stretched thin" by having to cover the Atlantic and the Pacific and (2) giving the new Trident submarines a much larger area in which to hide. The deployment in the Pacific should give the Navy more flexibility in target selection.

The decision to deploy the submarines in the Pacific strongly supported selection of a west coast site from the leading candidates recommended during the Navy's site selection study. Since Bangor had been the recommended west coast site, it was chosen.

As shown in enclosure IV, two other west coast sites--Humboldt Bay and Point Arguello, California--were among the final 17 potential sites. Therefore, we compared the recognized advantages and disadvantages (as shown in the Navy's studies) of these sites with those of the Bangor site, as follows.

Bangor:

Advantages:

1. Mostly Government-owned land.

2. No building problems anticipated.

3. Minimal dredging required.

4. Limited relocation of facilities required.

5. Rail, road, and pier facilities available.

6. Missile and ship skills available.

7. Navy and Department of Defense support facilities nearby.

8. Excellent shelter provided.

Disadvantages:

1. Purchase of some high-value land required.

2. Long egress (access route to open sea). (Navy officials advised us that they now consider this an advantage because it provides multiple egress to the open sea.)

Humboldt Bay:

Advantages:

1. Flat site, fronts directly on the ocean.
2. Excellent egress.
3. Adequate rail service.

Disadvantages:

1. All property now privately owned.

2. Complete channel and turning-basin dredging required.

3. Available labor force inadequate.

4. No existing military installation for support.

5. Danger of heavy annual flooding.

6. Extremely limited port accessibility in heavy seas.

Point Arguello:

Advantages:

1. All Government land.
2. Good rail and highway access.
3. Excellent egress.
4. Missile labor skills available.

Disadvantages:

1. Extensive site and harbor development required.

2. Potential problems with Vandenburg Air Force Base, California, space-flight program.

3. Unsheltered harbor area.

4. Railroad right-of-way to be relocated.

5. Ship labor skills unavailable.

Potential for locating the Complex at a base to be closed

As shown by the criteria on page 3, the Navy did not specifically consider military bases planned to be closed as potential sites for the Complex. However, the 89 potential sites considered did include certain of the locations--Newport, Rhode Island (Narragansett Bay); Boston Naval Shipyard (Boston Harbor); Hunters Point Naval Shipyard (San Francisco Bay); certain naval activities in New York City (New York Harbor); and Point Mugu, California--that were in the May 1973 base closures and realignment announcement by the Secretary of Defense. These locations had been found unacceptable during the site selection process. Our discussions with Navy officials concerning the potential for locating the Complex at other west coast bases included in the Secretary's base closures and realignment announcement indicate that none of the bases would be more appropriate for the Complex than the Bangor site.

NEED FOR PROVIDING SUBMARINE
REFIT CAPABILITY AT A SEPARATE COMPLEX

As mentioned on page 2, one goal of the Trident system is quick refit turnaround time so that the deployed submarines can be on patrol longer than earlier types of submarines. To assist in accomplishing this quick turnaround, the Navy's planned maintenance concept calls for

--intermediate-level maintenance to be done by the off-going and oncoming crews and by a facility work force onboard the ship and in the Complex shops,

--depot-level maintenance of equipment and components beyond the capability of the Complex to be accomplished at a Navy shipyard or at vendor facilities,

--a pool of rotatable equipment and components to serve as a buffer between the Complex and depot-level repair facility, and

--ship design features (larger hatches, rapid connection and disconnection features, equipment arrangement, etc.) to facilitate rapid removal and reinstallation of equipment and components.

In addition to the above, missiles are to remain onboard during refit to further improve the turnaround time. The Navy estimates that not having to unload and reload the missiles saves 11 days each time the submarines are taken off patrol for refit. Also, frequent handling of the missiles apparently degrades missile safety and adversely affects missile life and reliability.

Since the missiles are to remain onboard during refit, refit facilities must be located in a large area of uninhabited land and waterfront to provide adequate explosive safety distances. As a result of this requirement, it was necessary to eliminate all potential sites of existing Navy shipyards since they are located in relatively densely populated areas. Locating the refit facilities at the Bangor site will require purchasing only a small amount of land to allow submarine refits without removing all missiles from the submarines.

Before deciding to locate the proposed Trident Support Complex at the Bangor site, the Navy studied several

alternative methods of providing the required submarine refit which included using existing facilities at the Navy shipyards. For each alternative, the Navy analyzed the effects on system availability (amount of time the submarines would be on patrol), the cost of military construction, and the system cost effectiveness. The Navy did not, however, attempt to quantify the possible cost and impact of having to either (1) relocate non-Trident workload from the selected shipyard to make room for the Trident workload or (2) provide additional facilities to handle the non-Trident workload.

The alternatives considered by the Navy can be classified as (1) establishing--as is planned for the Bangor site--a separate (dedicated) support complex for maintenance and supply support for the entire Trident system, (2) establishing a separate complex for maintenance and supply support for the entire Trident system, except annual drydocking refit to be done at an existing shipyard, (3) setting aside a portion of a selected shipyard for use only on the Trident submarine refit workload with missile maintenance and supply support to be done at a separately located missile facility, and (4) integrating the Trident submarine refit workload with the existing workload at a selected Navy shipyard and providing missile maintenance and supply support at a separately located missile facility.

The results of the study of the four alternatives with the currently anticipated force of 10 Trident submarines as shown in a July 17, 1972, Navy report are briefly summarized below. The military construction costs discussed contain escalation, and, when use of a Navy shipyard was studied, the Charleston Naval Shipyard is used to illustrate costs.

1. Separate complex for maintenance and supply support. Estimated military construction costs would range from $540 million to $745 million depending on the depth of shop, service, and personnel support facilities provided. The Navy concluded that it could meet the 75-percent submarine availability goal[1]

[1]Revised to 73.6 percent after the July 1972 report as a result of revising the expected refit period from 23 days to 25 days. The submarine availability percentages discussed under the four alternatives do not reflect the added 2 days.

established for the Trident system with the $540 million in facilities. This means that the Navy estimated that using the separate Complex would keep 180 Trident missiles at sea.

2. Separate complex for maintenance and supply support with annual drydocking at a shipyard. Estimated military construction cost would be $500 million. The Navy concluded that this arrangement would not meet the 75-percent submarine availability goal because missiles would have to be unloaded for the annual drydock refit and reloaded after the refit. The Navy estimated that using this alternative would make submarines available or on patrol about 72 percent of the time, thereby keeping 172 missiles at sea.

3. Dedicated portion of shipyard facilities. Estimated military construction costs would be $422 million. The Navy concluded that this method would not meet the 75-percent submarine availability goal because missiles would have to be unloaded for each refit (after 70 days on patrol) and reloaded after the refit. The Navy estimated that using this alternative would make the submarines available about 66 percent of the time, thereby keeping 160 missiles at sea.

4. Trident submarine refit workload mixed with other shipyard workload. Estimated military construction costs would be $417 million. The Navy concluded that this method would not meet the 75-percent submarine availability goal because the missiles would have to be unloaded for each refit and there would be additional delay in actual refit. The Navy estimates that using this alternative would make the submarines available about 60 percent of the time, thereby keeping 145 missiles at sea.

In summary, it appears that locating all or part of the needed submarine refit capability at an existing shipyard--whether or not a portion of the yard was devoted solely to the Trident refit workload--would decrease the availability of the submarines for patrol by extending the time required for periodic refit. Although military construction costs are estimated to be the highest for alternative 1 (such costs decrease as submarine availability decreases for each

alternative studied), the Navy considers the separate, or dedicated, complex to be the most cost effective. The Navy estimates that keeping an equivalent number of missiles at sea under alternatives 2, 3, or 4 would require the additional acquisition of one, two, or three missile-loaded submarines, respectively. Each additional missile-loaded submarine was estimated to cost $490 million.

ENVIRONMENTAL IMPACT AT BANGOR

Soon after completing its site selection study report in January 1972, the Navy prepared an in-house Candidate Environmental Impact Statement on each of the four final potential sites. Navy officials said that these statements were prepared on the basis of information available in the Washington, D.C., area and identified no major environmental problems at the Bangor site.

Navy officials said that a few potential environmental problems at Bangor have been identified since completing the statement but they would not affect the location of the Complex, although they might require special measures during construction. The problems concern the temporary displacement of shellfish during waterfront construction, the temporary turbidity in the water caused by construction and its effect on fish, the temporary loss of flora in areas that have to be excavated, and insuring that new facilities built along the waterfront blend into the environment.

In June 1973 the Navy entered into a contract for evaluating the environmental impact that construction and operation of the Complex will have on the physical resources and the community at the Bangor site. The preliminary results of this evaluation should be available by November 1973 and the final results are expected about mid-1974.

ENCLOSURE II

89 SITES CONSIDERED FOR THE

TRIDENT SUPPORT COMPLEX

PACIFIC

Washington:
- Bangor
- Miller Peninsula
- Pillar Point
- Gray's Harbor
- Willapa Bay

Oregon:
- Astoria
- Tillamook Bay
- Winchester Bay
- Coos Bay

California:
- Crescent City
- Humboldt Bay
- Bodega Bay
- San Pablo Bay
- San Francisco Bay
- Monterey Bay
- Morro Bay
- Point Arguello
- Port Hueneme
- Point Mugu
- San Miguel Island

California (cont.):
- Los Angeles Harbor
- Oceanside
- San Diego
- San Clemente Island

Alaska:
- Ketchikan
- Anchorage
- Kodiak Island

Hawaii:
- Oahu

Midway Islands:
- Guam

GULF

Texas:
- Corpus Christi Bay
- Matagorda Bay
- Galveston Bay
- Port Arthur

Louisiana:
- NASA Michoud

Mississippi:
- NASA Test Facility
- Pascagoula

Alabama:
- Mobile Bay

Florida:
- Pensacola Bay
- Choctawatchee Bay
- St. Andrews Bay
- St. Josephs Bay
- Apalachicola Bay
- St. George Sound
- Apalachee Bay
- Tampa Bay
- Charlotte Harbor
- Ponce de Leon Bay

ATLANTIC

Maine:
- Cobscook Bay
- Moose Cove
- Machias Bay
- Little Kennebec Bay
- Gouldsboro Bay
- Kennebec River
- Casco Bay
- Saco River Entrance

New Hampshire:
- Portsmouth Harbor

Massachusetts:
- Plum Island Sound
- Salem Harbor
- Boston Harbor

Rhode Island:
- Narragansett Bay

Puerto Rico:
- 2 sites

Virgin Islands:
- St. Thomas

Connecticut:
- Thames River

New York:
- New York Harbor

New Jersey:
- Great Bay
- Maurice Cove

Pennsylvania:
- Philadelphia

Delaware:
- Breakwater Harbor

Maryland:
- Baltimore

Florida:
- St. Johns River
- Mayport
- Cape Kennedy
- Biscayne Bay
- Key West

Virginia:
- Potomac River Entrance
- Camp Peary
- Yorktown
- Jamestown
- Norfolk

North Carolina:
- Beaufort Inlet
- Cape Fear River

South Carolina:
- Winyah Bay
- Charleston
- Port Royal Sound

Georgia:
- Savannah River
- St. Catherine Sound
- St. Marys River (Kings Bay)
- St. Simons Sound

ENCLOSURE III

RESULTS OF NAVY'S SCREENING OF 89 POTENTIAL SITES FOR THE TRIDENT SUPPORT COMPLEX

Total candidate sites	89
Sites approved for further consideration	17
Sites eliminated from consideration	72

Reasons for eliminations	Number of sites affected (note a)
Serious land problems	33
Surrounding area densely populated	18
Wildlife refuge and parks	7
Terrain	7
Access	6
Poor harbor location potential	6
Shallow water	6
Marshy land	6
Remote location	5
Distance from open sea	4
Resort area	3
Relocation of highway	3
Land mostly under water	1
Sand bars and shoals	1

[a]Sites were eliminated for more than one reason, so these numbers will not total 72.

17 POTENTIAL SITES SELECTED

FOR FURTHER CONSIDERATION

Atlantic:
- Machias Bay, Maine
- Breakwater Harbor, Del.
- Yorktown, Va.
- Camp Peary, Va.
- Charleston, S.C.
- Savannah River, Ga.
- St. Johns River, Fla.
- St. Marys River, Ga.
- Mayport, Fla.
- Cape Kennedy, Fla.
- Roosevelt Roads, P.R.

Pacific:
- Bangor, Wash.
- Humboldt Bay, Calif.
- Pt. Arguello, Calif.

Gulf Coast:
- Pensacola, Fla.
- Mobile Bay, Ala.
- Pascagoula, Miss.

SCORING ELEMENTS AND WEIGHTS GIVEN THE ELEMENTS

IN RATING FINAL 17 POTENTIAL SITES FOR THE

TRIDENT SUPPORT COMPLEX

Ship operations and egress:

	Element	Weight
1	Diving conditions (territorial waters)	50
2	Channel widths	41
3	Submerged exit width	40
4	Channel surface traffic	40
5	Number of egress channels to sea	39
6	Channel current (cross)	36
7	Effect of environmental factors on assist forces	33
8	Channel depth	29
9	Reverberation conditions in egress area	28
10	Expected ambient noise	24
11	Channel hazards	23
12	Days that egress is unsafe	21
13	Time for assist forces to reach egress area	16
14	Channel currents (axial)	16
15	Channel-spanning structures	16
16	Visual and radar security of site	16
17	Channel length	13
18	Distance to 100-fathom curve	11
19	Turning basin size	8

Base operations and construction:

	Element	Weight
1	Land and waterfront availability	110
2	Labor force (ship skills)	45
3	Harbor shelter	30
4	Channel and harbor maintenance	30
5	Climatic conditions	30
6	Dredging	25
7	Airport proximity	25
8	Channel transit time	25
9	Proximity to other military bases	20
10	Relocation of existing facilities	20
11	Usable facilities	20
12	Land topography	15
13	Soil type and bearing	15
14	Supplemental acreages	15
15	Labor force (missile skills)	15
16	Highway proximity	10
17	Railroad proximity	10
18	Frequency of major storms	10
19	Jetty breakwater requirements	10
20	Availability of emergency diving basin	10
21	Frequency of electrical storms	5
22	Mean tide range	5

ENCLOSURE VI

SUMMARY OF SCORES OF 17 FINAL CANDIDATE SITES

Site	Score	Recommended for further consideration
Atlantic:		
Machias Bay, Maine	2431	no
Breakwater Harbor, Del.	2132	no
Yorktown, Va.	2558	no
Camp Peary, Va.	2537	yes
Charleston, S.C.	2571	yes
Savannah River, Ga.	2059	no
St. Marys River, Ga.	2464	yes
St. Johns River, Fla.	2379	no
Mayport, Fla.	2211	no
Cape Kennedy, Fla.	2488	yes
Roosevelt Roads, P.R.	3020	no
Gulf Coast:		
Pensacola, Fla.	2348	no
Mobile Bay, Ala.	2093	no
Pascagoula, Miss.	2232	no
Pacific:		
Bangor, Wash.	3007	yes
Humboldt Bay, Calif.	1918	no
Pt. Arguello, Calif.	2648	no