



STUDY RELATING TO
LOCATION OF A HARBOR OF REFUGE
ON
VANDENBERG AFB, CALIFORNIA

Prepared by:

AIR FORCE WESTERN TEST RANGE
Directorate of Range Operations (WTO)

and

1ST STRATEGIC AEROSPACE DIVISION
DCS for Civil Engineering (DE)

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(2000)*

PART I

HARBOR OF REFUGE ON
VANDENBERG AFB

PART II

VALIDATION OF RANGE USERS
SOUTHEASTERLY LAUNCH AZIMUTH REQUIREMENT

PART III

RANGE SAFETY HAZARDS EVALUATION
ASSOCIATED WITH SOUTHEASTERLY LAUNCHES

~~UNCLASSIFIED~~

PART I
HARBOR OF REFUGE ON
VANDENBERG AFB

~~UNCLASSIFIED~~

PART I
LOCATION OF A HARBOR OF REFUGE
ON VANDENBERG AFB

I. Background:

A joint AFWTR/1STRAD Study Relating to Relocation of the AFWTR Impact Limit Line and Public Encroachment Problems, dated 27 April 1968, discussed in detail the history of the State of California Harbor of Refuge program and the effect of a proposed Cojo Bay harbor on the mission of AFWTR. That study strongly recommended, among others, that Hq USAF request the Chief of Engineers, U.S. Army Corps of Engineers to deny a permit for construction of the Cojo Bay Refuge Harbor requested by the State of California.

As an alternative to the above, this command has reviewed all aspects of a refuge harbor relocation which would satisfy humanitarian needs, yet provide a measure of control by the Air Force for evacuation and the ability to impede commercial and public development detrimental to the AFWTR launch support mission. The following refuge harbor study examines possible siting locations on Vandenberg AFB which would satisfy these requirements.

II. Rationale:

It has been recognized that the catalyst to land development on the south coast between Gaviota (on the east) and Jalama Beach (on the northwest) could be the construction of a harbor, refuge or not, at Cojo Bay.

It was assumed that this harbor development would precede commercial development of adjacent land areas because of availability of state funds, completed construction plans and submission on 28 November 1967 of a request to the U.S. Army Corps of Engineers for a permit to start construction of the harbor.

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Speculation perhaps, that the State of California would be successful in establishing the Cojo Bay refuge harbor may have spurred land owners and developers to the most recent purchase by MACCO Corporation of 14,000 acres of Hollister ^{RANCH} Range property approximately 4 miles east of Cojo Bay. This land purchase/development plan has preceded announcement of final plans for Cojo Bay. Since MACCO is continuing the development phase of their Santa Barbara Del Mar subdivision independent of Cojo Harbor developments, MACCO, shown in Area B, attachment 1, will not be discussed in this study.

On the other hand, commercial facilities and private land developments foreseen in the Cojo Bay area and private land development adjacent to the Jalama Beach County Park area in the immediate future must be tied to development of harbor facilities at Cojo Bay. These potential developments are shown in Area A, attachment 1. Jalama Park and beach provide only facilities for overnight camping, fishing and beachcombing, the water being treacherous and posted against swimming. No pier facilities have been constructed. Good access to the park is provided from the north. With harbor facilities (Cojo) only 5 miles to the south, the adjacent Richfield area could be expected to develop much the same as MACCO or the Cojo area.

It is therefore felt that relocation of the Refuge Harbor from Cojo would impede development of those properties generally contained in Area A. Additionally, by impeding development in Area A, protection of our present capability can be more readily assured. Population buildup in the Jalama/Cojo areas not only raises the risk factor beyond acceptable limits for

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more easterly launch azimuths but would surely jeopardize launch azimuths currently approved in the 170°/180° area.

III. Site Selection:

On 2 August 1968, the Los Angeles District Engineer, U.S. Army Corps of Engineers assumed the task of evaluation the coastline from Point Conception northward to Point Sal with a view toward possible location of a suitable alternate refuge harbor site to Cojo Bay. The report was completed on 4 September 1968 and is submitted as Attachment 2. Of three possible sites investigated, the site recommended was the Point Arguello Boathouse area.

The possibility exists that relocation of the refuge harbor at the Boathouse and directly under the launch azimuths for all present satellite programs would create more hazard and problems than would be encountered by permitting the harbor to remain at Cojo. The overriding consideration in this case must be that the risk factor rises sharply with increases in population density near the launch azimuth and launch azimuth approvals are based on an acceptable risk level for a particular program.

The location of a refuge harbor at Cojo Bay provides no means of satisfactorily evacuating personnel, requiring harbor evacuation or controlling the associated commercial/public land development. On the other hand, location of a refuge harbor at the Boathouse, South Vandenberg, allows the measure of control necessary to both evacuate boat crew personnel from the hazard area to reduce the risk factors, and prevent associated land developments, thereby insuring against prohibitive personnel risk.

It is assumed therefore for the purpose of this study that non-essential personnel will be evacuated from this area prior to all southerly launch operations. Evacuation must be accomplished to answer both debris and toxic hazards to personnel and create essentially a zero risk factor for the area. It must be pointed out that risk to public property, i.e. boats in the harbor, will certainly exist and monetarily could represent a sizable figure.

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IV. Evacuation Requirements:

The Point Arguello Boathouse is located within AFWTR Offshore Danger Zone #1. The Code of Federal Regulations, Title 33, Part 204.202 provides the AFWTR with a capability of zone closure to all surface craft.

It may be assumed therefore that within 24 hours prior to launch operations, AFWTR notice of zone closure provided to the general boating public through the Santa Barbara, Port San Luis (Avila Beach) and Morro Bay harbor masters would alert most transient boat traffic to detour the area beyond the 3 mile limit. Personnel on boats still remaining within the proposed harbor of refuge would be evacuated by military bus prior to launch. Evacuees would be taken on base to a civilian cafeteria for required 2/4 hour evacuation period. No food or entertainment costs to the Air Force are anticipated. Estimated cost to AFWTR per evacuation would approximate:

Day Launch:

30/35 passenger Air Force Bus:

2 round trips plus standby	12 hours @ \$2.10/hour	<u>\$25.20</u>
	Total Cost:	\$25.20

Night Launch:

30/35 passenger Air Force Bus

2 round trips to Boathouse,

2 round trips to Lompoc

12 hours @ \$2.10/hour \$25.20

Motel Accommodations:

Typical 3 person/room rate

10 rooms @ \$15.00/nite 150.00

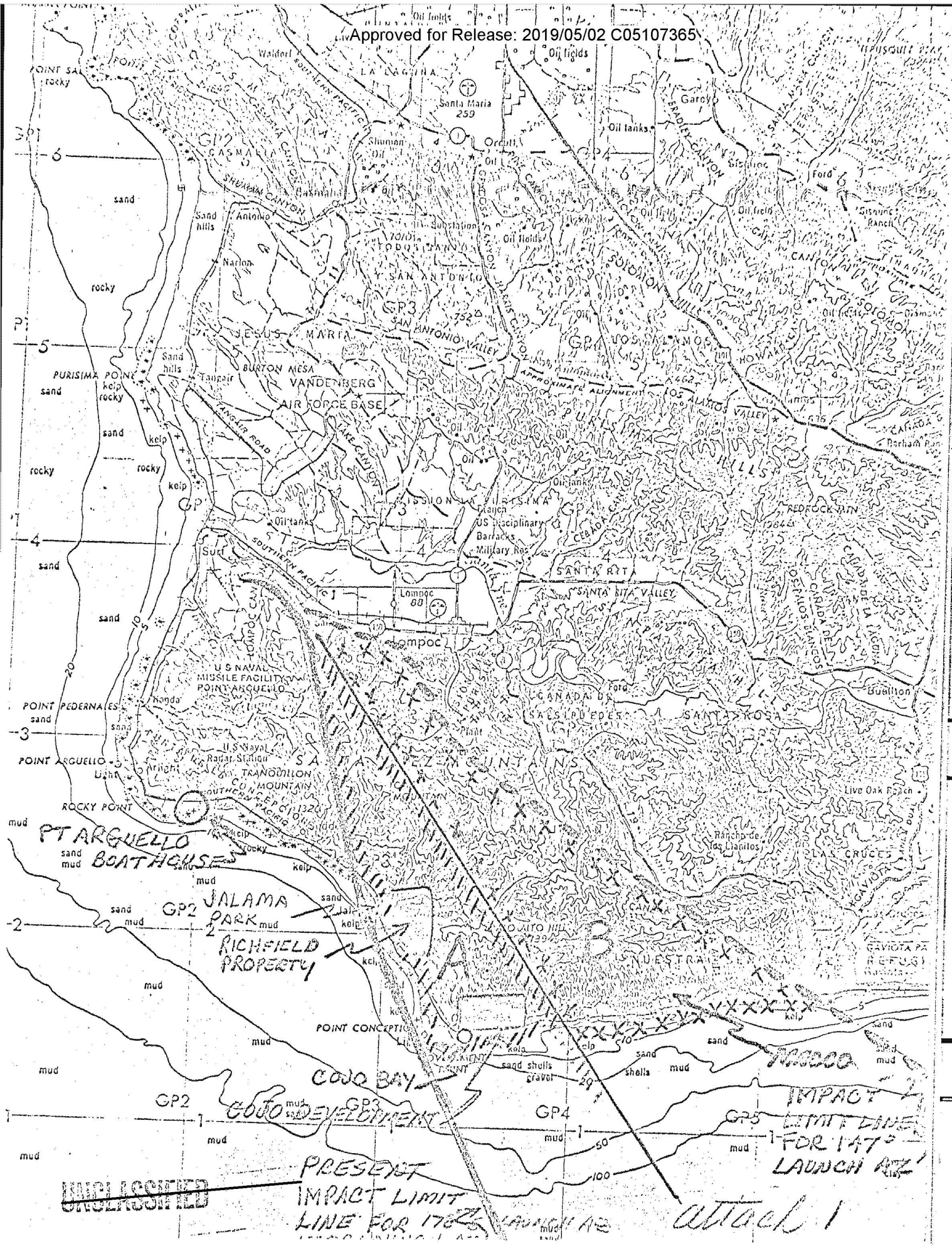
Meals/person

30 meals @ \$5.00/meal 150.00

Total Cost \$325.20

V.. Conclusions and Recommendations:

This study has dealt only with the aspects of a Harbor of Refuge at Cojo Bay vs an alternate site on Vandenberg AFB. The Range Safety evaluation of hazards associated with population buildups at Cojo Bay and adjacent areas is presented in Part III. Based on these evaluations, this command is still of the firm opinion that the ability of AFWIR and Vandenberg AFB to support both present and future launch requirements to the south is dependent on; (1) acquisition of leasehold interest on those properties described in the 27 April study and (2) complete denial of a refuge harbor on the coast between Gaviota and Point Sal. In the event all efforts to deny a permit for the refuge harbor fail, it is recommended that the Point Arguello Boathouse be offered as an alternative. ✓



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DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2711
LOS ANGELES, CALIFORNIA 90033

IN REPLY REFER TO
SPLGK-N

4 September 1968

SUBJECT: Harbor of Refuge at Vandenberg Air Force Base, California

TO: Department of the Air Force
Headquarters Air Force Western Test Range (AFSC)
Vandenberg Air Force Base, California 93437
ATTN: AFWTR(WTOOP), Mr. Payer

1. This responds to the request by the Systems Command Civil Engineering representative in the meeting on 2 August 1968 for comments and recommendations concerning the feasibility of construction of a small-craft harbor of refuge at Vandenberg Air Force Base, California. The recommended location would serve in lieu of a multiple-purpose harbor sited previously at Cojo Anchorage, Point Conception, California by a study conducted in this office in 1964-65. Primarily because of objections raised by officials at Vandenberg Air Force Base, the Cojo Anchorage report was not submitted to higher authority as a recommended project. In our opinion, however, Cojo Anchorage offers superior navigational features and better storm protection than any other sites investigated in the general area.

2. A comprehensive report prepared for the Division of Small Craft Harbors, Department of Parks and Recreation, State of California (now known as Department of Harbors and Watercraft) dated March 1964, outlined desirable requirements for a harbor of refuge, and determined that a chain of such harbors is needed at a minimum desirable spacing of 35 nautical miles. These requirements should generally provide the following major components as a minimum:

- a. Entrance channel must be safe for navigation under all but extreme sea conditions, and must be of adequate depth and width to allow for maneuvering of boats.
- b. Appropriate navigation aids.
- c. An anchorage for moorage protected from wave action.
- d. A public landing which might be a floating wharf, pier, or quay, equipped with a small derrick or hoist to transfer disabled persons, equipment or supplies to and from boats.
- e. Land access by means of roads, an airstrip or helicopter landing pad.

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attach 2

SPLGK-N

4 September 1968

SUBJECT: Harbor of Refuge at Vandenberg Air Force Base, California

f. Communication facilities so that medical or mechanical aid, or supplies may be summoned.

g. Adequate fast land to support water facilities.

In addition to these major components, it is highly desirable that each harbor of refuge have available:

a. A fuel supply for transient boats.

b. A potable water supply.

c. A resident harbor attendant available at all times to supply first aid, place calls for assistance, post weather warnings, operate communication facilities, do maintenance tasks, enforce regulations, make emergency fuel deliveries, keep records of harbor usage and offshore traffic, and supplement daily coastal weather reports to the United States Weather Bureau of the Environmental Science Services Administration.

3. Research made in connection with the Cojo Anchorage study revealed that the 1964 transient intracoastal traffic approximated 1,000 passages in the Vandenberg Area. Projections of future berthed ownership indicate the estimated 1975 intracoastal transient traffic will be about 2,100 passages. Authorities familiar with the intracoastal cruising conditions agree that virtually all intracoastal small craft traffic would put in overnight at a harbor of refuge in the vicinity of Point Conception and Point Arguello, if such a harbor were available. If current patterns of use continue, about 1,000 of these overnight stops would occur during July, August, and September, with about 500 overnight stops occurring in the month of August. The possibility of several cruising groups arriving at a harbor of refuge on the same day is likely, and therefore the harbor should afford capacity sufficient to accommodate the peak demand, which is considered to be 50 boats. With regard to other than recreational traffic, Morro Bay is the home port of about 50 abalone fishing boats. About 20 of these boats would operate as far south as Point Arguello, and would use a harbor of refuge to extend their fishing time. It is assumed that there would be about 160 stops a month during the 10 months season from October to July. Because this use would not coincide with the recreational small craft peak day use, no capacity over and above the 50 boat capacity previously recommended would be required.

4. Among the sites investigated as possible locations for a harbor of refuge within the limits of Vandenberg Air Force Base

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SUBJECT: Harbor of Refuge at Vandenberg Air Force Base, California

are Point Sal, Purisma Point, Ocean Beach near the mouth of the Santa Ynez River, and Point Arguello Boathouse. Point Sal appears to be a potential harbor site, but has the disadvantage of being at the greatest distance from Santa Barbara Harbor, 74 nautical miles, and only 17 nautical miles from Port San Luis. Similarly, Purisma Point would not be desirable. The site is only 10 nautical miles closer to Santa Barbara Harbor and is less protected. Ocean Beach, near the mouth of the Santa Ynez River, would probably incur high maintenance costs for dredging of shoals caused by the coastal littoral drift as well as silt carried by the river during flood conditions.

5. Our recommended site on existing Government property for a potential harbor of refuge is the Point Arguello Boathouse area. The distance between adjacent harbors for refuge compares favorably with Cojo Anchorage. The distance to Santa Barbara Harbor on the south is 50 nautical miles, and to Port San Luis on the north is 41 miles. The coastline generally runs east and west at this location, and has a natural protection from storms and wave action from the west and northwest. Although land access from the south is considered possible, the desirable access is from the north on an improved road to Lompoc, a distance of 19 miles. In addition, the Southern Pacific Railroad line passes within a half of a mile of the site.

6. A preliminary study of the wave conditions revealed the following information. Long period swells can reach Point Arguello from a ninety degree sector from due south to due east. Short period sea waves have a larger exposure, south-southeast to west. In order to determine wave heights at the proposed harbor, numerous refraction diagrams were drawn. It was determined that the design wave height (average height of the one-third highest waves) at the harbor site is eighteen feet, with periods from 11 to 13 seconds. The deep water design wave direction is 163 degrees (south-southeast) and the direction of the design wave at the harbor is approximately 168 degrees. The average depth at the proposed breakwater site is about -20 feet MLLW. For this depth, the breaking wave height would be approximately 15.6 feet. With a +6 feet tide, the breaking wave height would be 20.3 feet. Although an entrance with a depth of 25 feet is desirable and would increase the number of boats able to utilize the harbor; an entrance 20 feet deep is considered the minimum acceptable. As this wave study was brief and of limited scope, additional refraction diagrams, particularly for waves from the west and southwest, would be required to obtain a more accurate picture.

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4 September 1968

SUBJECT: Harbor of Refuge at Vandenberg Air Force Base, California

7. Our preliminary design of the Point Arguello Boathouse area as a harbor of refuge consists of a south breakwater connected to the shore, 2,450 feet in length, 18 to 20 feet in height, with slopes $1\frac{1}{2}:1$ on the ocean side, and $1\frac{1}{4}:1$ on the harbor side. An east breakwater approximately 1,400 feet long and 16 feet in height, with similar slopes, will enclose the easterly side of the harbor. A 600-foot by 800-foot anchorage area, limited to fore-and-aft moorings would be dredged to a depth of -15 feet MLLW. The anchorage area would comprise about 11 acres and would accommodate 50 vessels with an average length of 42 feet. In addition, improvements to the existing potable water supply and communication system would be made, and a fuel loading facility provided. An emergency helicopter landing pad and some improvements to the road access are desirable. Navigational equipment suggested includes lights and a radio-synchronized fog horn. If a caretaker is provided, a radio with a distress marine frequency and a radar installation with a 5 mile range would be desirable for assistance to vessels in periods of dense fog. The existing boat landing, with minor modifications, would be acceptable for off-loading personnel.

8. A preliminary estimate has been made of the first cost for a harbor of refuge facility at Point Arguello Boathouse site, based on 1968 price levels, amounts to \$4,700,000.

Costs include:

- a. Dredging channels and anchorages to -15 feet MLLW.....\$259,000
- b. Construction of 2,450 feet of breakwater, heights of 18 to 20 feet above MLLW, complete with navigational aids.....\$2,892,000
- c. Construction of 1400 feet of breakwater, height +16 feet MLLW, complete with navigational aids.....\$1,105,000
- d. Miscellaneous costs associated with modifications to the water supply system, boat landing, communication system, road work, etc.....\$20,000
- e. Engineering and design.....\$150,000
- f. Supervision and administration of construction..\$235,000

In addition to the above, an annual cost of \$50,000 per year for dredging maintenance is anticipated.

SPLGK-N

4 September 1968.

SUBJECT: Harbor of Refuge at Vandenberg Air Force Base, California

9. Summary of sites for Harbor of Refuge, Vandenberg Air Force Base.

<u>Location</u>	<u>Lat. and Long.</u>	<u>Water Area</u>	<u>Total Estimated First Cost 1968 Prices</u>
Pt. Arguello Boathouse	34°33'15"N 120°36'25"W	53.4 Acres	\$4,700,000
Pt. Sal	34°54'00"N 120°39'45"W	35.0 Acres	\$5,500,000
Ocean Beach	35°41'55"N 120°35'50"W	92.0 Acres	\$6,200,000

10. It must be pointed out that the study of these sites for a harbor of refuge was made without regard to the number, proximity, or type of missile shots to be anticipated in the future.

11. It is believed that the public reaction to a proposed harbor of refuge in the Vandenberg area would be very favorable. Local interests, as well as the Department of Harbors and Watercraft, and the Department of Parks and Recreation, State of California, have actively sought a harbor of refuge in this area for sometime, and should be consulted in its development if it is to occur on Air Force property. A more comprehensive study could be made if deemed necessary, but due to the urgency and the time allotted, it is felt that the above recommendations will serve your needs.

Norman E. Pehrson

NORMAN E. PEHRSON
Colonel, CE
District Engineer

3 Incl

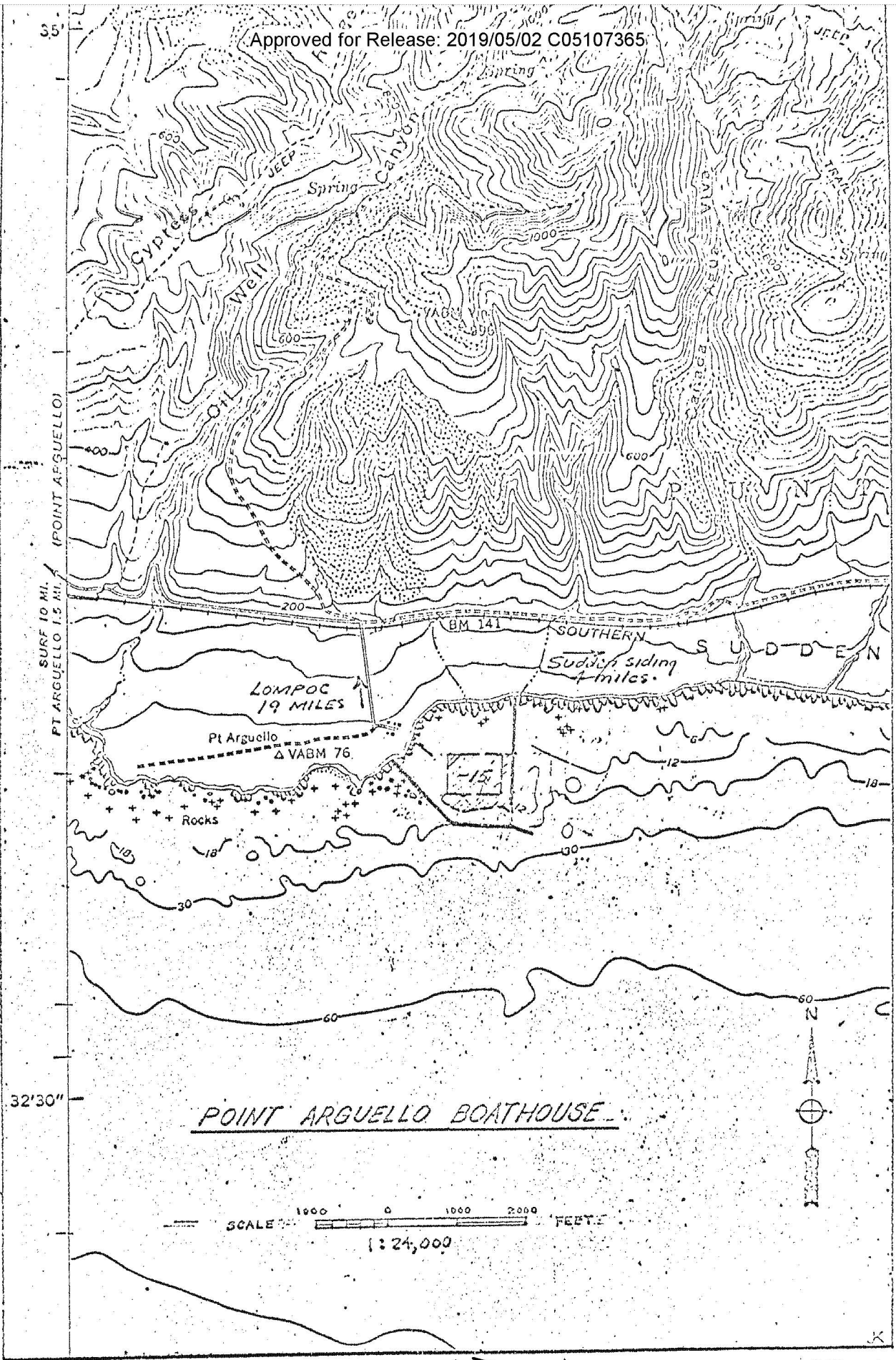
1. Plate 1-Pt Arguello Boathouse
2. Plate 2-Pt Sal
3. Plate 3-Ocean Beach

CE:

WRFP (Mr. Lefkowitz)
1 Strat Aerosp Div (DE Mr. Fick)

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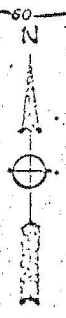


SURF 10 MI.
PT ARGUELLO 1.5 MI.

32'30"

POINT ARGUELLO BOATHOUSE

SCALE 1:24,000
1000 0 1000 2000 FEET



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PLATE I.

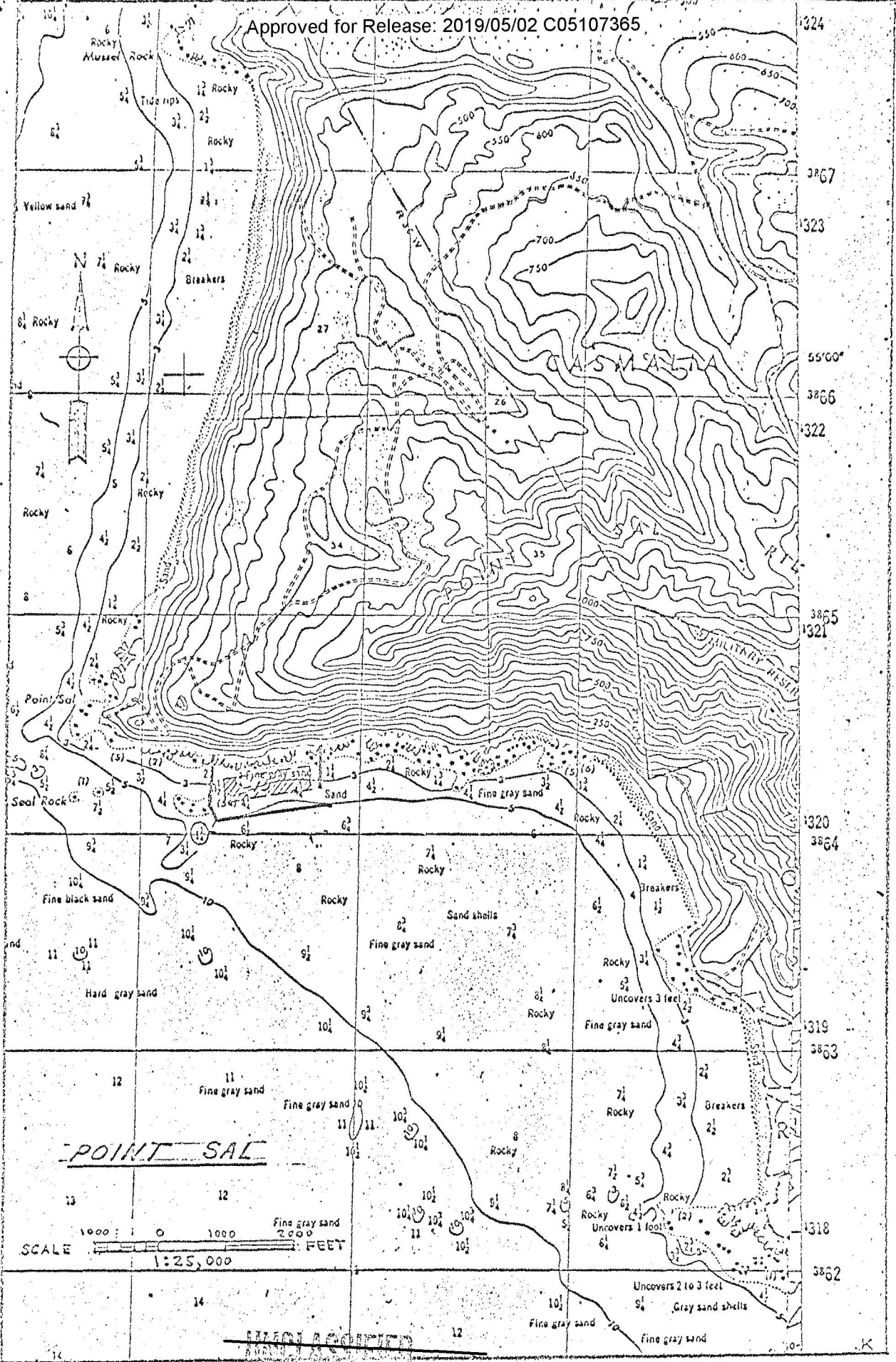


PLATE 2

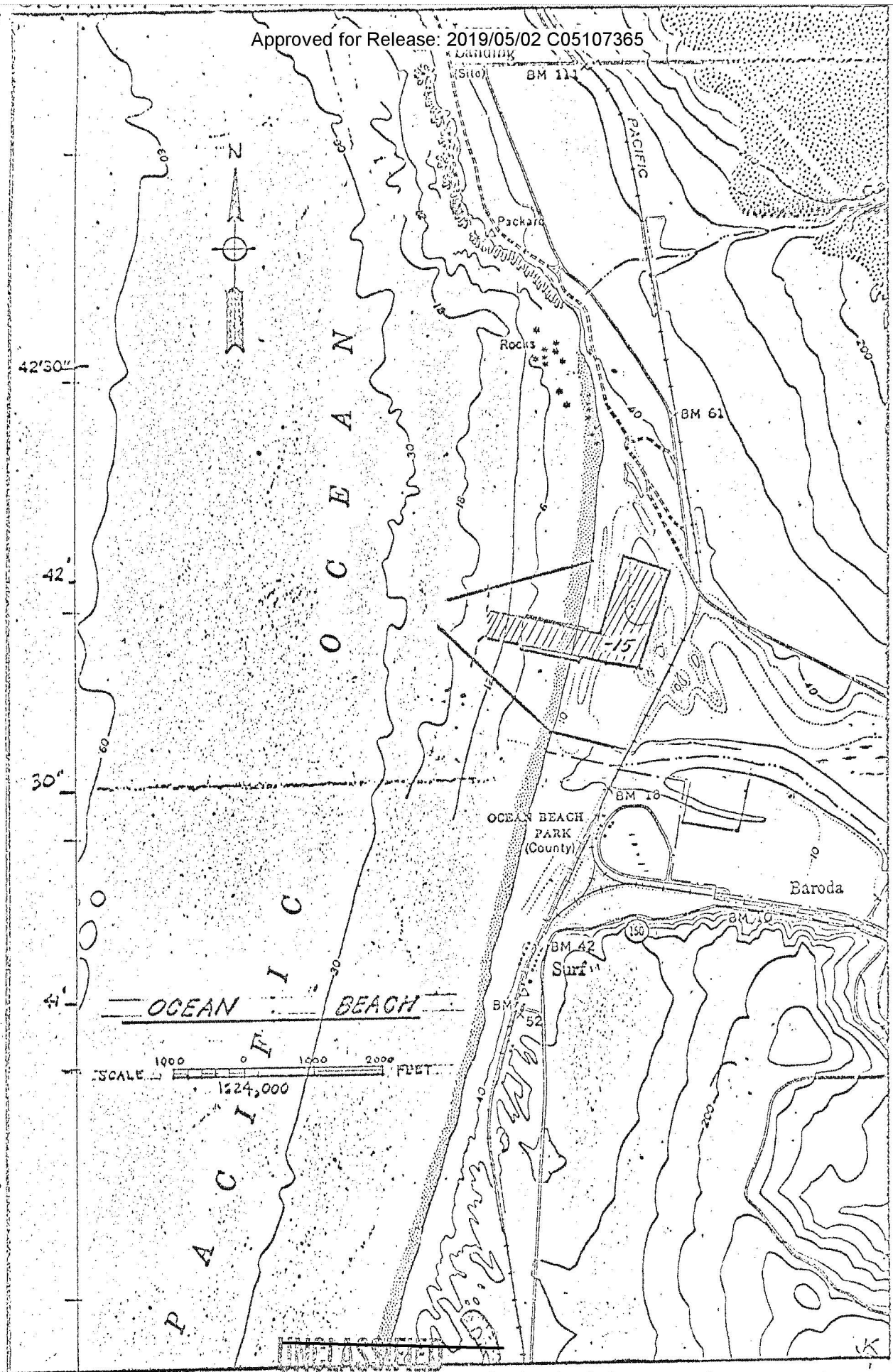


PLATE 3

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PART II
VALIDATION OF RANGE USERS SOUTHEASTERLY
LAUNCH AZIMUTH REQUIREMENTS

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PART II

VALIDATION OF RANGE USERS SOUTHEASTERLY

LAUNCH AZIMUTH REQUIREMENTS

I. The following is a consolidation of program launch azimuth requirements forwarded to this command for inclusion in the Harbor of Refuge Study.

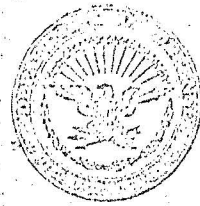
Copies of the letter responses are shown as Attachments 1 and 2.

<u>Current Programs</u>	<u>Launch Azimuth Requirements</u>	<u>Period</u>
Program 846	170°-220°	Now
Program 110	170°-220°	"
Program 770	170°-220°	"
Program 770C	170°-220°	"
<u>New Programs</u>		
Program 467	170°-270°	1972/71
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Hard Guidance Development Program less than 180°		1972/1976
** Multipurpose Reusable Spacecraft (MRS)	145°/172°	--
Program 632A (PE dated 17 Jul 67)		
* Launch Azimuth approval per WFG letter 14 Dec 67 to 6595th ATW (VWZ).		
** Nonavailability of launch azimuth may require new launch site selection.		

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W T O O D - 6 8 - 2 1 1

DEPARTMENT OF THE AIR FORCE
DIRECTORATE OF SPECIAL PROJECTS (OSAF)
AF UNIT POST OFFICE, LOS ANGELES, CALIFORNIA 90045



Who's the boss?

REPLY TO
ATTN OF: SP-1

8 - AUG 1968

SUBJECT: COJO Bay (U)

to: Commander (WIG)
Air Force Western Test Range
Vandenberg AFB, Calif.

LIMITED DISTRIBUTION

1. (U) Hq USAF (AFRDSE) has requested this office provide you a current statement of launch azimuth requirements and planning estimates or guidance for possible future launch azimuth requirements. The information which follows addresses itself only to programs under the control of the Director of Special Projects Office of the Secretary of the Air Force (SAFSP) using the AFWTR.

2. (S) The major on-going programs are 846, 110, 770 and 770C. These programs presently use launch azimuths between 170° and 220°. Although studies have been done on some of the aforementioned programs, examining the use of launch azimuths as low as 160°, there is no validated requirement for the use of such azimuths.

3. [Redacted]

4. [Redacted]

5. (U) The SECRET classification of this letter is required to protect information categorized in Para 2-4, AFR 205-1, 2 Jan 68, which would reveal mission objectives.

John L. Martin, Jr.
JOHN L. MARTIN, Jr.,
Maj Gen, USAF
Director

Cy to:
Brig Gen Berg (SAFSS/SS-1)

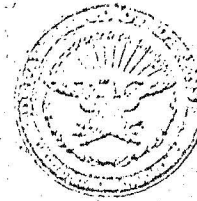
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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE AND MISSILE SYSTEMS ORGANIZATION (AFSC)
AF UNIT POST OFFICE, LOS ANGELES, CALIFORNIA 90045



30 AUG 1968

REPLY TO
ATTN OF: SML

SUBJECT: AFWTR Launch Hazard Area Encroachment (U)

TO: AFWTR/WTG

WTG
WTG
WTG

1. (U) This letter lists anticipated SAMS0 requirements for launch azimuths less than 180° True North (TN) in the post-1970 time period and outlines the SAMS0 position on AFWTR launch hazard area encroachment as our input to the HQ AFSC study. Secretary of the Air Force Special Projects (SAFSP) requirements were outlined in SAFSP letter, subject: "Cojo Bay," dated 8 August 1968. Requirements for the MOL Program are classified Secret/Special Access Required and are being transmitted by the program office via the 6595th AIW. The MOL Planning Estimate dated 17 July, 1967 is being revised.

2. (S) (Gp-3) The Strategic Systems Division (SMAS) anticipates requirements for launch azimuths of less than 180° TN. One of the design requirements for the advanced guidance system proposed in the Development Plan for the Hard Guidance Development Program and Advanced P&V Technology (U) (HQ SAMS0, 12 August 1968) is that this system have an all attitude capability and be able to launch on any azimuth without realignment or degradation of the accuracy goal.

3. (S) (Gp-3) This Development Plan outlines three options, all requiring flight test programs. These options are as follows:

a. Option 1 - Integration of guidance system into Minuteman Weapon System.

First Flight Test - November 1972
IOC - December 1975

b. Option 2 - Integration of guidance system into advanced ICBM Weapon System.

First Flight Test - February 1973
IOC - June 1976

c. Option 3 - Evaluation flight test program without decision to deploy. (Prototype on Minuteman)

First Flight Test - September 1972
(Flight testing to continue throughout FY 1973)

4. (S) (Gp-3) A brief description of the Multipurpose Reusable Spacecraft (MRS) Request Surveillance Mission is contained in the document, "Preliminary Concept Formulation Package for a Multipurpose Reusable Spacecraft," dated March 1968 (S/AF/Gp-3). The program office (SMAOR)

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has stated that denial of the launch azimuth sector between 172° TN and 145° TN (to include yaw steering) would suggest that MRS look for a new launch site in order to conduct single pass request surveillance over Sino-Soviet territories.

5. (U) The SAMSO position on the encroachment problem remains as stated in Major General Cooper's 3 May 1968 letter. We believe that the relocation of the impact limit line to the east would be of benefit from both a range safety and a range user standpoint. You would gain the assurance that you could continue to protect the civilian population at your currently accepted hazard level. We desire the assurance of being able to utilize the launch sector between 145° TN and 180° TN.

6. (U) Relocating the ILL would allow doglegs to be reduced or eliminated. For example, the NASA ISIS and OGO programs desire launch azimuths less than 180° TN but existing range safety constraints force them to launch on azimuths greater than 180° TN and dogleg to the desired inclination angles.

7. (U) While only a few programs presently anticipate launch azimuth requirements of less than 180° TN, we are reasonably certain that other programs will develop which will have requirements to utilize the 145°-180° TN launch sector in the 1970-1980 time period. Further, the use of radioactive materials in space applications can be expected to increase, posing further hazards to personnel and property. Steps to insure the availability of the 145°-180° launch sector must be taken now if the effectiveness of VAFB as a launch range is to be preserved. If the development between Point Conception and Gaviota is allowed to continue and you do not accept a higher hazard level, we will be forced to drastically reshape trajectories resulting in large payload reductions and increased performance costs. This point should be emphasized to higher headquarters.

Frank R. Haggerty
FRANK R. HAGGERTY, Colonel, USAF
Chief, Plans and Operations Office

Copy to:
6595 ATW/VWG
Aerospace Corp/Test Opr
Dept/Mr. O. Refling

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