

UNITED STATES GOVERNMENT

Memorandum**SECRET**

TO : Op-35

DATE: 19 OCT 1961

Op-311H/r1c
EM #00585-61

FROM : Op-31

SECRET

SUBJECT: Requirements for Navigational Systems for Submarines

Encl : (1) Loran-C coverage in SSBN operating areas

1. The following are the requirements for navigational systems for POLARIS missile submarines (SSB(N)'s):

a. The system must permit a high degree of security to the submarine. It must be usable with the submarine submerged with no more than a periscope or mast exposed. If possible, it should be usable with no periscopes or masts exposed and with the submarine below the layer.

b. The system must be available continuously or on a fixed schedule with intervals not to exceed two hours.

c. The system must provide coverage throughout defined broad ocean areas.

d. The system should provide a fix accuracy of 0.1 nautical miles and must provide a fix accuracy of less than 0.25 nautical miles. This is required in order to obtain required system CEP and to obtain a low error rate on SINS gyros.

e. The system must provide the ability to determine azimuth within 150 seconds of arc until mid-1964, and within 70 seconds thereafter. This is necessary in order to obtain required system CEP.

f. The system should possess a high degree of invulnerability.

g. Systems must be redundant to the extent that should one system fail from mechanical or natural causes a second system of different principles is available.

2. The following are the requirements for navigational systems for attack submarines:

a. The system must permit a high degree of security to the submarine. It must be usable with the submarine submerged with no more than a periscope, or mast exposed. If possible, it should be usable with no periscopes or masts exposed and with the submarine below the layer.

b. The system must be available continuously or on a fixed schedule with intervals not to exceed two hours.

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- c. The system must provide world-wide coverage.
- d. The system should provide a fix accuracy of 0.5 nautical miles and must provide a fix accuracy of less than 2 miles.
- e. The system should possess a high degree of invulnerability.
- f. Systems must be redundant to the extent that should one system fail from mechanical or natural causes a second system of different principles is available.
- g. The system must provide fixes to a submarine located under at least 12 feet of ice in the Arctic and Antarctic.

3. The current navigational situation for submarines is as follows:

a. POLARIS Missile Submarines. POLARIS submarines currently utilize LORAN-C and bottom contour for accurate position information. SINS is used to keep accurate position between fixes. The Type 11 Periscope and the 90 alpha gimbal rotation of the SINS provide azimuth information. These systems meet the requirements listed in paragraph 1, with the exception of invulnerability. Bottom contour positioning is the most invulnerable navigation system in use, but it is restricted in coverage at the present time.

b. Attack Submarines. Attack submarines currently utilize LORAN-A and celestial observations through the periscope sextant for position information. Several of the requirements of paragraph 2. have not been met. No system is available for world-wide or continuous coverage. No system is available to permit a submarine to obtain fixes from under the ice. At present, it is necessary for arctic submarines to surface through the ice and obtain celestial fixes if weather permits. For SSN's and some SSG's, SINS is used to keep position between fixes.

4. The anticipated navigational situation for submarines in the 1965-1975 time period is as follows:

a. POLARIS Missile Submarines. In the 1965-1975 time span, SSB(N)'s will continue to utilize LORAN-C and bottom contour for accurate position information in those areas which will be covered by LORAN-C. However, with the increase in range of the A-3 missile and increased numbers and size of SSB(N) patrol areas, LORAN-C is incapable of providing adequate area coverage. This is graphically shown in enclosure (1). It is anticipated that TRANSIT will provide the high accuracy, mid-ocean coverage required for accurate fixes of SSB(N)'s and survey ships to locate bottom contour areas on a world wide basis. OMEGA, when operational, will provide world-wide coverage for SSB(N) transits and will permit fixes with the submarine at deep depth.

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b. Attack Submarines. In the 1965-1975 time span, it is anticipated that OMEGA will satisfy the requirement for a world wide, continuous system capable of being utilized by a submerged submarine (including under-ice). LORAN-C and celestial observations can be used as back-ups. For maximum invulnerability, bottom contour navigation should be the primary means of navigation by the end of the period if sufficient contour surveys have been completed.

5. Subject to successful evaluation of the TRANSIT and OMEGA systems and adequate bottom surveys, the following navigational equipment will be required on submarines during the 1965-1975 time period:

	<u>SSB(N)</u>	<u>SSN</u>	<u>SS</u>	<u>AGSS</u>
LORAN-C receiver	yes	yes	no	no
LORAN-C -LORAN-A converter	no	no	yes	yes
OMEGA receiver	yes	yes	yes	no
TRANSIT receiver	yes	no	no	no
Secure fathometer	yes	yes	no	no
Type II periscope	yes	no	no	no
SINS	yes	yes	no	no
Type 8-B periscope sextant	no	yes	yes	no

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Existing
 LORAN-C
 TCS Approx
 New LORAN
 Potential
 A-3 op Area

Encl 1 (1) to CR-31