MEMORANDUM FOR CHIEF OF STAFF

Subj: Revision of the LORAN INSTALLATION PLAN, 1957

A.I. 32, 13 December 1960 Draft is the final working paper as agreed to by the Working Group on 15 December 1960.

A "Buff" copy of the Staff Study might be made available to the Coast Guard for comment. The Coast Guard will not receive a copy of the final approved Staff Study.

J. A. KERRINS
Chief, Office of Operations
LORAN INSTALLATION PLAN 1957 (Revision of)

THE PROBLEM

1. In response to a request* by the Deputy Secretary of Defense, dated 9 August 1960, to evaluate a United States Coast Guard proposal for the purpose of making comments and recommendations relative to the revision of the "LORAN Installation Plan, 1957".

FACTS BEARING ON THE PROBLEM

2. The Joint Chiefs of Staff have approved** the LORAN Installation Plan, 1957, which includes the installation of LORAN-C facilities to meet requirements of the POLARIS Program and the SEAWARD extensions of the DEW Line and extensive LORAN-A facilities to meet requirements of the Navy, Air Force, and NATO.

3. For additional Facts, see Enclosure "C".

DISCUSSION

4. For Discussion, see Enclosure "D".

CONCLUSIONS

5. It is concluded that:
   
a. The objective of the U. S. Coast Guard is to provide a practical method for integrating the LORAN-A and LORAN-C navigational facilities with the eventual transition to LORAN-C.
   
b. The Department of Defense should endorse the objective of the LORAN Planning Study U.S.C.G. 1960.
   
c. The LORAN Installation Plan 1957 should be revised to include new military requirements for LORAN and the changes that will result from the immediate

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* Memorandum by the Deputy Secretary of Defense to the Chairman, Joint Chiefs of Staff, dt 9 Aug 1960, Subj: LORAN Installation Plan 1957 (U); on file in Joint Secretariat, available through sub-registries
** JCS 141/88
objectives of the LORAN Planning Study U.S.C.G. 1960. Further the LORAN Installation Plan should be reviewed on an annual basis.

d. The Director, Joint Staff should advise the Military Services and the Commanders of unified and specified commands of the revised U.S. Military Policy on LORAN after approval by the Secretary of Defense.

RECOMMENDATIONS

6. It is recommended that the Joint Chiefs of Staff:

a. Approve the conclusions in paragraph 5 above.

b. Forward the memorandum in Enclosure "A" hereto, which reflects the conclusions in paragraphs 5a, b, and c above, together with its Appendices "A" and "B" to the Secretary of Defense.

c. Forward the memorandum in Enclosure "B", which reflects the conclusions in paragraph 5d to the Military Services and all unified and specified commanders.

7. It is recommended that copies of this paper NOT be forwarded to Commanders of unified and specified commands.
MEMORANDUM FOR THE SECRETARY OF DEFENSE

Subject: Revision of the Joint Chiefs of Staff, "LORAN Installation Plan, 1957"

1. In response to a memorandum from the Deputy Secretary of Defense, dated 9 August 1960, the Joint Chiefs of Staff consider that the Department of Defense should endorse the objectives proposed by the United States Coast Guard Loran Program Serial 06780EBE and Planning Study, 1960.

2. The U. S. Coast Guard Loran Program and Planning Study shows how the LORAN-A and LORAN-C systems can be integrated to facilitate the eventual transition to LORAN-C which will provide the greater coverage and higher accuracy required. The study recommends arranging the LORAN-A and LORAN-C stations so that both LORAN-A and LORAN-C are transmitted from the same station and finally phasing out LORAN-A transmission as LORAN-C receivers come into general use. The combination of LORAN-A and LORAN-C facilities will reduce the maximum number of stations required, and a further reduction in operating expenses will occur when LORAN-A is phased out. Modernization programs and rebuilding of stations due to destruction by natural forces will take place over a period of years and will be phased in and coordinated with new military area requirements.

3. The immediate objective of the Coast Guard Plan is to abandon the proposed construction of certain planned LORAN-A stations in the Caribbean, to relocate other stations, and to re-engineer the system to provide dual LORAN A/C capabilities. Funds for the Caribbean LORAN-A program were in the 1961 Military Construction appropriations but were not apportioned pending the review of the Joint Chiefs of Staff Loran Installation Plan, 1957. It is recommended that the
the Director of the Bureau of the Budget be advised that the Joint Chiefs of Staff have approved the immediate objectives of the Coast Guard Plan and that the FY 1961 funds should be apportioned to DOD for further transfer to the U. S. Coast Guard.

4. The world-wide Loran Installation Plan will be revised by the Joint Chiefs of Staff incorporating the objectives of the U. S. Coast Guard Loran Program and Planning Study and existing requirements. The U. S. Coast Guard should be requested to assist in this revision and to present to the Director, Communications Electronics Directorate (J-6), recommended future modifications to the Installation Plan.

5. Submitted herewith for your consideration are recommended memoranda to be transmitted to the Secretary of the Treasury and the Director, Bureau of the Budget to implement the above LORAN policy. The suggested memoranda contained in Appendices "A" and "B" hereto are agreed military positions on the U. S. Coast Guard proposal.
MEMORANDUM FOR: The Secretary of the Treasury

Subject: Revision of the Joint Chiefs of Staff, LORAN Installation Plan, 1957

1. Reference is made to the U. S. Coast Guard LORAN Program and Planning Study 1960 presented to members of the Joint Staff and the Department of Defense. The Department of Defense endorses the objectives, and the immediate plans for the Caribbean area, of the Coast Guard Study. The objectives, and immediate plans of the study with the newly generated military LORAN requirements will be reflected in a revision of the Joint Chiefs of Staff LORAN Installation Plan, 1957.

2. The U. S. Coast Guard LORAN Program and Planning Study shows how the LORAN-A and LORAN-C systems can be integrated to facilitate the eventual transition to LORAN-C which will provide greater coverage and accuracy. The combination of LORAN-A and LORAN-C will reduce the maximum number of stations required thus reducing the necessary operating fund. A further reduction in operating expenses will occur when LORAN-A is phased out. The improvement of coverage, accuracy and operating efficiency will result in fewer aids. This meets the National and Military Long Distance Aid Policies.

3. An estimate was given of the total cost of the Coast Guard Plan, not included was new military and Caribbean LORAN-A requirements, of approximately $71 millions. A substantial portion is expected to be available from the several categories of operating expenses saved from reduced maintenance and rehabilitation funds normally available to the Coast Guard over a period of time. The Coast Guard recommendations have been reviewed and approved by the Joint Chiefs of Staff for the re-engineering and relocation of stations necessary to provide
LORAN A/C capability in the Caribbean area. The $9,000,000 provided under the Department of Defense, Military Construction, Loran Station appropriations, FY 1961, has been requested from the Bureau of the Budget and will be transferred to "Acquisition, Construction and Improvements, Coast Guard" when apportioned. This is the immediate objective of the Coast Guard Study. The Department of Defense considers it advantageous to assist and coordinate with the Coast Guard in the ultimate objective of transition to LORAN-C.

4. The world-wide Loran Installation Plan will be revised by the Joint Chiefs of Staff incorporating the objectives of the U. S. Coast Guard Program and Planning Study and existing requirements. It is requested that representatives of the Coast Guard assist in this revision and present to the Director, Communications-Electronics Directorate (J-6) recommended modifications to the Installation Plan.
MEMORANDUM FOR: The Director of the Bureau of the Budget

Subject: Revision of the Joint Chiefs of Staff, LORAN Installation Plan, 1957

1. The purpose of this memorandum is to inform you of the review of the U. S. Coast Guard LORAN Planning Study particularly as it affects the LORAN requirements in the Caribbean Area.

2. The FY 1961 Military Construction, Department of Defense appropriations included "$19,000,000 for LORAN Stations, Department of Defense". These funds were to be transferred to the Coast Guard Appropriation, "Acquisition, Construction and Improvements" for the construction, by the Coast Guard, of LORAN Stations required by the Department of Defense. However, $9,000,000 was not apportioned pending review of the LORAN-A requirements in the Caribbean Area. These have now been reviewed and the Department of Defense endorses the recommendations for the immediate implementation of LORAN A/C capabilities in the Caribbean Area. It is requested that the $9,000,000 now be apportioned to the Department of Defense for further transfer to the Coast Guard to permit them to initiate plans for implementing construction of LORAN A/C stations.
MEMORANDUM FOR: Military Services
                   All Unified and Specified Commanders

Subject: U. S. Military Policy on Long Range Aid to Navigation (LORAN)

The Secretary of Defense has concurred in a U. S. Coast Guard LORAN Planning Study which has the following objectives:

1. As an interim objective selected LORAN-C and LORAN-A stations will be arranged so that both LORAN-A and LORAN-C data are transmitted from the same station. These changes will take place as new requirements develop or as major maintenance or rehabilitation becomes necessary.

2. This will reduce or limit the total LORAN facilities required and can be accomplished without critical reduction of LORAN-A coverage. The extensive coverage capability of LORAN-C will more than supplement those areas where a minor reduction in LORAN-A coverage is expected.

3. The final objective will be the phasing out of the LORAN-A transmissions from LORAN A/C stations as LORAN-C receivers come into general use.
1. A United States Coast Guard LORAN Planning Study* recommends a revision to the LORAN Installation Plan, 1957, along the following guidelines:

   a. As an interim objective for an overall LORAN Plan, the study recommends arranging selected LORAN-C and LORAN-A stations so that both LORAN-A and LORAN-C data are transmitted from the same station. These changes would take place as new requirements develop, or as major maintenance or rehabilitation becomes necessary. This would reduce or limit the total LORAN facilities required. This can be accomplished without critical reduction of LORAN-A coverage.

   (1) As an immediate proposal in implementing the interim plan the study recommends the abandonment of construction of certain planned LORAN-A stations in the Caribbean and relocation of other stations and re-engineering to provide LORAN A/C capability within the Caribbean area. The LORAN A/C stations will reduce the planned LORAN-A coverage of the Pacific approach to the Panama Canal. However, the LORAN-A coverage in the Caribbean area required by the LORAN Installation Plan, 1957, would be supplanted by LORAN-C coverage of at least as good or better accuracy.

   b. The final objective would be the phasing out of the LORAN-A transmission from dual LORAN A/C stations as LORAN-C receivers come into general use.

2. The U.S. Navy has new LORAN requirements in the areas as listed below:

   Priority 1 - Northwest Pacific, LORAN-C

   The area bounded by a line drawn from Marcus Island to Tokyo, to Okhotsk, USSR, to Adak and back to Marcus Island. Required in 1961.

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*The LORAN Program - Serial 067800BE and LORAN Planning Study USCG 1960
Priority 2 - Chinese Coast, Hong Kong to Shanghai. LORAN-A coverage required pending the implementation of LORAN-C coverage required.

The area bounded by the Chinese Coast from Hong Kong to Shanghai, to 100 miles offshore and to include all of the Formosa Straits. Required in 1961.

Priority 3 - Southwest Asia - LORAN-C

The area bounded by a line drawn from Hong Kong to Tokyo, to Marcus Island to Pelelius Island and back to Hong Kong. Required in 1962.

3. The U. S. Air Force has no new requirements for LORAN.

4. The U. S. Army has no requirements for LORAN.

5. LORAN-C is under consideration as an accurate time source to meet military* and civilian** requirements.

6. The United States National Policy*** on long distance aids to navigation is: inter alia, to promote as a continuing goal, national and international standardization of a single type ground based long distance radio aid to navigation suited to the needs of all users (air, surface and subsurface); in the meantime, to standardize on the minimum number of types of aids necessary to meet the requirements of the various users. LORAN-A and LORAN-C have been accepted among others, as types of aids on which present planning should be based.

7. The Military Policy**** on long distance aids, pending standardization on a single system, is to continue operation and expansion of LORAN-A, non-directional beacons, and LORAN-C. Of the systems thus far developed the Department of Defense endorses LORAN-C as the most promising candidate for international adoption#.


**NBS Report 6720; not available in Joint Secretariat

***Air Coordinating Committee Paper 58/12.1B, 8 Dec 1958, Subj: Long Distance Aids to Navigation (U); on file in Joint Secretariat

****JOREC 536/7, 11 Feb 1957; on file in Joint Secretariat

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1. Implementation of the LORAN Installation Plan, 1957, coupled with existing facilities will provide extensive LORAN-A coverage over a major portion of the ocean waters of the North Atlantic and the sea routes of the Pacific. Much of the LORAN-A coverage satisfies both U. S. Military and NATO requirements. Installation of the additional LORAN-A facilities in the Caribbean area required in the LORAN Installation Plan, 1957, has been delayed due to difficulties of acquiring base rights. The Plan also provides LORAN-C coverage over those areas where the military requires position fixing information with a high degree of accuracy. From FY 1956 to date $68.35 millions have been made available to the U. S. Coast Guard from DOD funds to implement the plan. An additional 9.0 millions was appropriated but was not apportioned pending the outcome of this study. NATO infrastructure funds are being used to implement NATO LORAN-A requirements. NATO has not stated a requirement for LORAN-C.

2. The DOD LORAN-C program was implemented* to satisfy the U. S. requirements in support of the POLARIS program and Seaward extensions of the DEW Line. LORAN-C additionally affords accurate large area coverage to all users and the groundwave recovery will satisfy the Polaris requirement of 2 1/4 mile. Installation is proceeding in accordance with the priorities contained in the LORAN Installation Plan, FY 1957, and is planned for completion by end of FY 1962.

3. LORAN-C, like LORAN-A, permits fix determination utilizing either ground wave or sky wave signals. Characteristics of the groundwave have been thoroughly evaluated** whereas evaluation of skywave operation has been limited. The system is re-

* CYTAC Report & Jansky & Bailey Report

** CYTAC Report & Jansky & Bailey Report
liable, free from operational significant ambiguities and can accommodate an un-
limited number of users.

4. Specially designed LORAN-C receivers are required to realize the full range
and accuracies from the LORAN-C system. Use of LORAN-C at ranges and accuracies
comparable to LORAN-A is possible at a reduced cost by a re-engineered LORAN A/C
receiver or by a properly modified LORAN-A receiver.

5. The U. S. Coast Guard proposal intends to show how the LORAN-A and LORAN-C
systems can be integrated to facilitate the eventual transition to LORAN-C which
will provide the greater coverage and higher accuracy required. The plan recommends
arranging the LORAN-A and LORAN-C stations so that both LORAN-A and LORAN-C data
are transmitted from the same station, and finally phasing out the LORAN-A trans-
mission as LORAN-C receivers come into general use. The consolidating of LORAN A/C
facilities, with the eventual elimination of LORAN-A, follows the U. S. National
Policy to standardize on the minimum number of types of aids necessary to meet the
requirements of the various users until a standard aid is accepted and implemented.
The combination of LORAN A/C will reduce the maximum number of stations required.
A further reduction of the total number of stations will occur when LORAN-A is
phased out. The program envisions a progressive realignment of the existing
facilities without critically reducing the interim LORAN-A area coverage. Im-
plementation will be phased in and coordinated with new area requirements, modern-
ization programs and rebuilding of stations due to destruction by natural forces.

6. The U. S. Coast Guard proposal has taken into consideration the commercial
application of the system and the maritime air and sea routes of the world, especially
those areas which have a concentration of traffic; North Atlantic Area, the Gulf
Coast, some portions of South America and Africa, the Pacific West Coast to Hawaii,
and the Great Circle route from the West Coast to the Orient.

7. The U. S. Coast Guard proposal for the Caribbean area will reduce the LORAN-A coverage of the Pacific approach to the Panama Canal, but LORAN-C coverage would be available in the area denied LORAN-A coverage on at least as good, or better, accuracy. Funds for the LORAN-A program in the 1961 appropriations for the Caribbean Area could be used for the initial phase of the program. These funds would probably provide for the construction of three dual LORAN A/C stations and the installation of an added facility at the present site in Florida in lieu of nine LORAN-A stations proposed in the Loran Installation Plan, 1957. Of the nine proposed sites in the LORAN-A Program, three are located upon foreign soil where political complications have prevented securing the necessary base rights. The securing of base rights for the LORAN A/C stations is favorable.

8. The U. S. Coast Guard proposal envisions the extensive expansion of LORAN-C coverage over a period of many years as new requirements develop or as major maintenance or rehabilitation becomes necessary. The proposal estimates that the total cost not including new military requirements, will be approximately $71 millions, of which a substantial portion will be from operations, maintenance and rehabilitation funds normally available to the U. S. Coast Guard. New Military requirements or acceleration of the time schedule would require additional funds.

9. The new U. S. Navy LORAN-C requirement in the Northwest Pacific covers a critical area, adjacent to primary targets and is being patrolled by REGULUS submarines and patrol aircraft. It is estimated that POLARIS submarines will be patrolling this area by 1966. Presently Japanese LORAN-A stations are covering a small part of this area, however, LORAN-C coverage is required for the navigational accuracy, ASW barrier and surveillance. Due to the relationship of the Soviet Union land mass and the large ocean areas involved LORAN-C is the only existing

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system capable of providing adequate navigational coverage to meet these requirements. The scarcity of suitable sites in this area may limit the ground wave coverage over the Okhotsk Sea, however, skywave coverage will be available over the entire area.

10. The new U. S. Navy LORAN-A requirements, pending installation of LORAN-C in the area between Hong Kong and Shanghai, covers an area under constant patrol by ships and aircraft of the Seventh Fleet. Accurate navigation is essential to prevent international incidents which can and do arise. Although radar is used, it is difficult to obtain accurate positions due to the low profile of the coast. When radar is used, the Chinese Communists can track the unit very easily. Loran coverage in this area is non-existent to weak. The Bashi Channel between Formosa and Luzon has weak Loran coverage, because it is in the area of the extension of the base lines. Any bonus effect possible from improving Chinese coastal coverage should be in the direction of Bashi Channel.

11. The U. S. Navy LORAN-C requirements in Southwest Asia are to provide the navigational accuracy essential for POLARIS submarines.

12. The Atlantic Missiles Range has expressed a need for absolute time correlation to an accuracy of at least 10 microseconds between launch and impact points. A program is under way to determine the accuracy that might be expected by using the JUPITER LORAN-C station to transmit one microsecond timing signal. It is planned that LORAN-C be used if these tests are successful.

13. Both the U. S. National and U. S. Military Policy tend to support the philosophy of the continuous operation and expansion of a minimum number of types of aids necessary to meet the requirements of the various users until a standard
aid is accepted and implemented. A realistic view point may be that a single system cannot satisfy all users. However, LORAN-C is the most promising candidate to meet the needs of all users.

14. The Administrator, FAA, has been requested* by the Secretary of Defense to determine the suitability of LORAN-C for air navigation, with the view to future national acceptance of the system as the United States candidate for standardization. The FAA, which is charged by law with the development and determination of national air navigation systems has started an operational evaluation of LORAN-C. Lack of suitable pilot presentation equipment presently precludes any substantial civil air evaluation of LORAN-C equipment. Airborne equipment should be available in the near future. FAA evaluation, development of more sophisticated airborne equipment, and more extensive air evaluation and demonstration will be required before LORAN-C can be adopted as the U. S. candidate for international standardization.

15. ICAO considers** that LORAN-A operating facilities are providing important coverage over certain vital ocean areas and land masses and recommends that those facilities be retained and the system extended or supplemented to meet air traffic requirements.

16. Both maritime and aviation interests have indicated that the future needs of marine and air navigation will require greater accuracies in navigation than presently existing.

17. Evaluation of LORAN-C indicates that it will satisfy the stated range and accuracy requirements of most maritime users of long distance radio aids to navigation. The degree of LORAN-C reception with an underwater antenna is being investigated and preliminary reports indicate it is usable by a submerged submarine.

* DOD Letter
** Annex 10 to Aeronautical Telecommunications of convention of International Civil Organizations
18. Long distance navigational aids now in use, LORAN-A and non-directional beacons, fail to satisfy the stated Military requirements for range and accuracy; however, these aids are still required by the Military Services. New navigational aids have been and are being developed, but at this time none meets all the requirements for a world-wide standard long distance ground based aid. A relatively long time will elapse before any single international standard aid can be agreed upon and implemented on a large scale.