OPERATIONS INSTRUCTION NO. 28-61

Subj: Instructions for the preparation of Report of Loran Station Operation and Electronics Engineering (Reports Control Symbol OAN-2076)

1. Purpose - To issue instructions for the completion of Form CG-2899, Report of Loran Station Operation and Electronics Engineering to be used by LORAN-A, LORAN-C and LORAN A/C Transmitting Station and LORAN-C Area Monitor Stations.

2. Directives Affected - Operations Instructions 21-57 is hereby cancelled.

3. Action - Form CG-2899 has been revised to permit its use for LORAN-C and LORAN A/C Transmitting Stations and LORAN-C Area Monitor Stations as well as LORAN-A stations. All LORAN-A, LORAN-C and LORAN A/C Transmitting Stations and LORAN-C Area Monitors Stations shall prepare and submit this form as prescribed by Enclosure (1).

4. Forms - An initial supply of forms will be distributed to using units. Further supplies may be obtained from Supply Centers or Supply Depot, Honolulu.

5. Effective date - This directive is effective for reports for the month of November due on or before 10 December 1961.

D. MCG. MORRISON
Chief, Office of Operations

Encl: (1) Instruction for the preparation of Form CG-2899
(2) Form CG-2899 (Rev. 5-61)
(3) Supplementary Loran Station Operating and Maintenance Instruction

Dist: (SDL No. 73)

A: None
B: c(15); e(8); h(6); g(5); l(3); d(2); b(1); i(1); j(1); o(1); p(1)
C: l(1); s(1)
D: ae(1)
E: k(1); l(1)
C: l(2) extra
E: l(2) extra
TREAS. CGHQ. WASH., D.C.
Instructions for Completing Report of Loran Station Operation and Electronic Engineering, Form CG-2899 (Rev. 5-61)

1. Each Loran Transmitting & Monitor Station shall submit the combined Operation and Engineering Report Form CG-2899 prior to the 10th day of each month. The report shall cover the period from the first through the last day of the month preceding and shall be prepared in accordance with the instructions promulgated herewith.

2. The report shall include, in addition to other data required, a complete summary of all Loran technical matters of interest, such as unusual equipment failures, field changes and modifications completed, condition of electronic equipment, technical matters pending and recommendations to improve station efficiency. Any and all operational matters that will assist the District and Headquarters in administering Loran stations should be included.

3. The report shall be carefully prepared with special attention to accuracy and completeness of information. If necessary to complete information, additional sheets of plain paper may be used. Prepare original for the Commandant (OAN), 1 copy for the Commandant (EEE), 2 copies for the District Commander, 1 for the Command Unit (if applicable), and 1 copy for the unit file. Submit via chain of command.

4. Personnel preparing the electronic information for this report should bear in mind that the data submitted is used by the Commandant in developing and improving operations and equipment in the entire Loran system.

5. Detailed instructions for completion of Form CG-2899 at LORAN-A Stations are as follows:

   a. Block A: (Major Equipment Data)
      (1) Enter Timer type.
      (2) Enter Transmitter type and Amplifier Type, if used.
      (3) Enter Switching Group types (Both input and output).
      (4) Not used for LORAN-A.
      (5) Enter serial numbers of all spare crystal oscillators.
      (6) Enter transmitting antenna type.
      (7) Enter transmitting antenna resistance measured at the bowl feed-through insulator at the output of the Antenna Coupling Unit. Internal connection to the bowl insulator must be disconnected when the antenna resistance is measured.
      (8) Enter Antenna Coupler type for both receiving and transmitting antenna couplers.
(9) Enter type of receiving antenna used.

(10) Enter assigned tolerance in microseconds.

(11) Not used for LORAN-A.

b. Block B: (System Engineering Data)

(1) Enter rate being reported on in corresponding blocks of columns 2 through 8. This will include rates being monitored.

(2) Enter type of operation.

(3) Enter Master Standard Time Difference or Slave Coding Delay.

(4) Enter the average observed time delays of local and opposite rate(s). Every four hours watchstanders shall obtain and record the observed S/N ratio is consistently 2/1 or better. These observed time differences should be obtained manually on the standby timer estimating to the nearest tenth of a microsecond. Operating timer chart recordings at master stations should not be used for this purpose. The time differences should be averaged at the end of the month and reported in this block.

(5) Not used for LORAN-A.

(6) Not used for LORAN-A.

(7) Enter total minutes covered in report.

(8) Enter minutes of primary power failure.

(9) & (10) Transmission lines should be physically labeled lines 1 & 2. All blocks must be filled in each month. Readings are taken from on-air equipment only. Line current is the value of the transmission line current at the transmitter (amplifier if applicable). Antenna current is the value of the Coupling Unit Antenna Current. SWR is the value of the standing wave ratio for each line reported to two decimal places. Example: 1.01.

(11) Enter rates being reported on in corresponding block of columns 12 through 23.

(12 thru 18) To be filled out by stations reporting types 1 & 2 operation.

(12) Enter total minutes master blinks.

(13) Enter total minutes slave blinks.

(14) Enter total minutes when both are blinking.

(15) Enter total minutes master is off the air.
(16) Enter total minutes slave is off the air.

(17) Enter total minutes both stations are off the air.

(18) Enter total minutes out of tolerance with neither station blinking.

(19 thru 21) To be filled out by stations reporting types 3 and 4 operation.

(19) Enter total minutes of local blink as shown on elapsed time indicator on the ME-814/FPN-30

(20) Enter total minutes off sync as shown on elapsed time indicator on the ME-814/FPN-30

(21) Enter total minutes local R.F. off as shown on the elapsed time indicator on the AN/FPA-3. Stations not having this equipment shall maintain a log of off-air time (not including primary power failure) and enter the total in this column.

(22) Enter total minutes of unusable service time as computed: Type 1 or 2. \( (22) = (12) + (13) + (14) + (17) \). Type 3 or 4 - The item entered in this block may not be the true unusable service time for Type 3 or 4 operation. It is possible for more than one elapsed time indicator to be operating for a single malfunction. However, in order to keep the report standard and obtain a useful figure of merit; the unusable time shall be computed as follows:

\[
(22) = (8) + (19) + (21) \text{ (Master only)}
\]

\[
(22) = (8) + (20) + (21) \text{ (Slave only)}
\]

(23) Enter percent of usable service time as computed:

\[
(23) = 100 - \frac{(22) \times 100}{(7)}
\]

All computations of minutes should be reported to the nearest tenth. All other computations, should be reported to the nearest hundredth.

c. Block C: (Electronic Equipment) Make comments on conditions and suggestions as to general operation. Report completion of field changes, compliance with directives, failures and shipment of oscillators to Washington Radio Station, calibration of monitor oscilloscopes or other factors pertinent to the operation of Loran equipment.

d. Block D: (System Quality Evaluation) Make comments on signal to noise ratio, sync accuracy, time delay variations, interference, number of periods of unusable time exceeding five minutes or other factors pertinent to Loran system quality.

6. Detailed instructions for completion of Form G9-2899 at LORAN-C Stations as follows:
a. Block A: (Major equipment)
   (1) Enter Synchronizer type numbers.
   (2) Enter Transmitter type numbers.
   (3) For LORAN-A use only.
   (4) Enter type(s) of Crystal Oscillator actually installed.
   (5) Enter Serial Numbers of Installed Crystal Oscillator.
   (6) Enter Transmitting Antenna type.
   (7) For LORAN-A use only.
   (8) Enter Antenna Coupler type numbers for both Receiving and Transmitting Antenna Coupler.
   (9) Enter type of Receiving Antenna used.
   (10) Enter assigned Envelope tolerance in microseconds.
   (11) Enter assigned phase tolerance in microseconds.

b. Block B: (System Engineering Data)
   (1) Enter rate being reported on in corresponding blocks of columns 2 through 8. This will include rates being monitored.
   (2) Enter Type of Operations.
   (3) Enter Standard Time Delay Reading.
   (4) Enter observed average Time Delay for monitored rates. This shall be an average of all the observed 15 minute readings.
   (5) Enter the maximum and minimum coding delay for the month.
   (6) Enter the total number of coding delay adjustments made during the month.
   (7) Enter total number of minutes covered by this report.
   (8) Enter primary power failure in minutes.
   (9) & (10) For LORAN-A only.
   (11) Enter rates being reported on in corresponding blocks of columns 12 through 23.
   (12) Enter total minutes Master 9th Pulse Coded.
(13) Enter total minutes Slave blinked.
(14) Enter total minutes both blinked.
(15) Enter total minutes Master off air.
(16) Enter total minutes Slave off air.
(17) Enter total minutes both off air.
(18) Enter total minutes out of tolerance without Master 9th Pulse Code or Slave Blink (Monitor Stations Only).

(19-21) LORAN-A Only.

(22) Enter total minutes of Unusable Service Time as computed:

\[(22) = (12) + (13) + (14) + (17) + (18) \text{ if Monitor Station}\]

(23) Enter percent of Usable Service Time as computed:

\[
(23) = 100 - \frac{(22) \times 100}{(7)}
\]

All computations should be rounded off to one decimal place.

c. Block C: (Electronic equipment) Same as Paragraph 5-C.

d. Block D: (System quality evaluation) Same as Paragraph 5-D.

7. At combined Loran stations (those transmitting both LORAN-A and LORAN-C) only one form shall be submitted. This will be a combined form for both the LORAN-A and the LORAN-C Operations.

8. LORAN-C Monitor Stations will fill in pertinent LORAN-C information.

9. Block E through G should contain pertinent information to permit the District and Headquarters to better administer all LORAN Stations.
# Report of Loran Station Operation and Electronics Engineering

## A. Major Equipment Data

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SYNCHRONIZER OR TIMER TYPE</th>
<th>XMTR TYPE</th>
<th>SWITCH GEAR TYPE</th>
<th>XTAL. OSC. TYPE</th>
<th>SERIAL NUMBER</th>
<th>TRANS. ANT. TYPE</th>
<th>COUPLING UNIT TYPE</th>
<th>RECEIVING ANT. TYPE</th>
<th>TOLERANCE</th>
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## C. Electronic Equipment (Comments on condition, modifications, suggestions, etc.)

## B. System Engineering Data

### Loran-C and/or Loran - A Stations Using Type 1 or 2 Operation

<table>
<thead>
<tr>
<th>RATE(S)</th>
<th>MIN. MASTER BLINKS</th>
<th>MIN. SLAVE BLINKS</th>
<th>MIN. BOTH BLINK</th>
<th>MIN. MASTER OFF AIR</th>
<th>MIN. SLAVE OFF AIR</th>
<th>MIN. BOTH OFF AIR</th>
<th>MIN. OUT OF TOLERANCE</th>
<th>MIN. LOCAL BLINK E.T.I.</th>
<th>MIN. OFF SYNC. E.T.I.</th>
<th>MIN. OFF E.T.I.</th>
<th>TOTAL UNUSABLE SERVICE TIME (Min)</th>
<th>TOTAL % USABLE SERVICE TIME</th>
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### Loran-A Stations Using Type 3 or 4 Operation

### All Stations

|          |                    |                  |                 |                     |                    |                   |                      |                        |                        |                |                                   |                           |

## Reports Control

Symbol DAN-2076
**D. System Quality Evaluation**

(Comment S/N ratio, accuracy or sync. variations in TD, etc.)

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**COMPLETE BLOCKS E THROUGH G ONLY UPON DIRECTION OF DISTRICT COMMANDER**

**E. Mechanical Equipment**

(Comment)

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**F. Personnel**

<table>
<thead>
<tr>
<th>Authorized</th>
<th>On Board</th>
<th>Comments (Adequacy, rate, proficiency, etc.)</th>
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**G. General Remarks**

(Morale, mail, training, inspections, communications, etc.)

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**DATE**

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<tr>
<th>Commanding Officer/OIC (Rank/rate)</th>
<th>Signature</th>
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**Endorsement No.**

<table>
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<th>From:</th>
<th>To:</th>
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**DATE**

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<th>Signature</th>
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**Endorsement No.**

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<th>To: Commandant (OAN)</th>
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**DATE**

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<tr>
<th>Signature (By direction)</th>
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SUPPLEMENTARY LORAN STATION-OPERATING AND MAINTENANCE INSTRUCTIONS

A. TYPES OF OPERATION - DEFINITIONS.

Inasmuch as Loran stations in the field have been equipped and authorized to operate with various degrees of automation, the following definitive descriptions are adopted to provide standardization in nomenclature.

1. Type 1 Operation: Type 1 operation is defined as that mode of operation wherein all Loran synchronization, log keeping and equipment switching functions are accomplished by hand under continuous watch by station personnel.

2. Type 2 Operation: Type 2 operation is defined as that mode of operation wherein Loran synchronization is accomplished by means of an automatic synchronizer (such as the SN-108/PR used with the UE-1 Timer). Log keeping and switching functions are accomplished by hand under the continuous watch of station personnel.

3. Type 3 Operation: Type 3 operation is defined as that mode of operation wherein Loran synchronization and recording features (log keeping) are accomplished by an Automatic Synchronizer and Recorder Unit. Local (and in some instances, remote) alarms are provided to indicate off sync and sync error conditions and blink is automatically initiated by the master station when rate tolerance is exceeded. Automatic recording of rate performance is accomplished on a continuous roll chart. Elapsed time indicators totalize "off sync" and "local blink" time at both master and slave stations. Stations utilizing Type 3 Operation are generally equipped with AN/FPN-30 and AN/FPA-2 Loran equipment. The foregoing type of operation requires only that one technician be in the range of the aural alarms.

4. Type 4 Operation: Type 4 operation is defined as that mode of operation which encompasses all features of Type 3 operation and additionally provides automatic output switching and remote alarm circuits to alert personnel to all aspects of station failure. Stations authorized to employ Type 4 operation are generally equipped with AN/FPN-30, AN/FPA-2 and AN/FPA-3A Loran equipment. Type 4 operation requires only that one technician be within aural range of the loud horn alarm or remote aural alarm. The basic functions of the AN/FPA-3A Loran Automatic Alarm and Switching Set are as follows:

   a. Provides visual and aural alarms whenever warning voltage is supplied by the timer (visual indication is instantaneous whenever "off sync" or "sync error" conditions are detected; aural alarms - horn and buzzer - are actuated after a preset delay has elapsed).
b. Provides visual and aural alarms whenever the RF power output from the local transmitting antenna falls below approximately 64% of normal output.

c. Automatically switches the operating transmitter/amplifier to standby status, and the standby transmitter/amplifier to operate status one minute following a decrease in RF power below approximately 64% of normal output.

d. Provides facilities for switching the operating transmitter/amplifier to standby status and the standby transmitter/amplifier to operate status, semi-automatically or manually as desired.

e. Provides an aural alarm whenever there is a failure of primary power.

f. Provides facilities for installation of the Type IM-105/U Standing Wave Ratio Indicators in the Electrical Equipment Cabinet of the AN/FPA-3A equipment.

g. Provides an Elapsed Time Indicator which totalizes the time that RF power is decreased to less than 64% of normal output.

B. GENERAL OPERATING PROCEDURES.

1. Stations authorized to employ Type 1 or Type 2 modes of operation shall continue to follow the operating instructions promulgated in CG-155, "Loran Station Operating and Maintenance Instructions."

2. Loran stations employing AN/FPN-30 and AN/FPA-2 Loran equipment shall generally be authorized to utilize Type 3 mode of operation by the District Commander. Stations so authorized will utilize automatic synchronization, automatic alarms, automatic recording and automatic blink (master only). Continuous manual monitoring is not required and usable time shall be computed from elapsed time indicators in accordance with these instructions.

3. Loran stations employing AN/FPN-30, AN/FPA-2 and AN/FPA-3A Loran equipment shall generally be authorized to utilize Type 4 mode of operation by the District Commander. Stations so authorized will utilize automatic synchronization, automatic alarms, automatic recording, automatic transmitter switching and automatic blink (master only). As with Type 3 operation, continuous manual monitoring is not required and usable time shall be computed from elapsed time indicators in accordance with these instructions.

4. Loran stations employing AN/FPN-30 and AN/FPA-2 Loran equipment but which are paired with stations using UB-1/UM type Loran equipment shall use all features of the newer equipment authorized by the District Commander. When use of these features is authorized, blinking procedures outlined in these instructions shall be utilized; such blinking procedures will be correlated by the District Commander(s) involved.

5. The senior electronics technician shall be responsible to the Commanding Officer or OIC for the proper instruction of all assigned electronic technicians in the operation, maintenance and capabilities of the Loran equipment.
C. TYPE 3 AND TYPE 4 OPERATION - OPERATING PROCEDURES

When authorized by the District Commander to employ Type 3 (or Type 4) modes of operation, stations utilizing AN/FPN-30, AN/FPA-2 (and AN/FPA-3A) equipment shall be governed by the following:

1. Blinking Procedures.

a. Master Station. The master station of a Loran rate shall use automatic blink. When an alarm sounds, the master station operator shall check the equipment for possible malfunction and correct, if required. If the difficulty is at the slave station, the master will continue to blink until the slave station has corrected the error; if the slave does not observe an error in synchronization the slave will blink for approximately five seconds at approximately one minute intervals to notify the master no error is observed; master and slave station operators shall continue efforts to locate the difficulty until the rate is operational, after which the master will automatically stop blinking.

b. Slave Station. The slave station of a Loran rate shall not use automatic blink and shall use manual blink as follows: When an alarm sounds the slave station operator shall check the equipment. If the master is blinking the slave operator shall proceed to correct the difficulty. A short period of time after the rate is again operational, the master will automatically cease blinking. If, after checking the equipment, the slave operator can observe no error, the slave shall blink for approximately five seconds at approximately one minute intervals to notify the master that the rate is apparently synchronized. The slave operator shall continue to check the equipment for possible malfunction until the rate is again operational. When an alarm sounds and it is determined that the rate is not properly synchronized and the master station has not initiated blink, the slave shall initiate blink and continue until the master picks up the blink or the rate is synchronized. In addition, the slave shall initiate and maintain blink when the master is "off the air".

D. DUTIES OF WATCHSTANDERS.

a. Carry out station orders, engineering instructions and provisions of CG-155 that are not modified herein.

b. Record approximate duration of power failures to be totalized and entered on report of Loran Station Operation and Electronics Engineering, Form 2899.

c. At Loran stations not utilizing AN/FPA-3A equipment, the watch-stander shall maintain a log of off-air time not caused by power failure, the monthly total to be entered on Form 2899.

d. Note directly on the chart paper cause and approximate duration of malfunctions causing an alarm to sound.

e. Keep recorder chart paper synchronized with the G.M.T. printed on the chart paper.
f. Make notations directly on the chart paper of heavy noise or other conditions that may be pertinent to the operation of the rate.

g. Maintain close visual monitoring of the equipment when heavy noise or other conditions endanger rate performance.

h. Perform maintenance to Loran equipment in accordance with CG-155, instructions contained in instruction book, and applicable station orders.

i. Thoroughly check the performance of "in use" and "standby" equipments and make adjustments required at four-hour intervals, paying particular attention to adjustments noted in paragraph E.1.h. of these instructions. Whenever the watch is relieved, specific notation shall be made on the recorder chart that equipment operation and Loran rate performance is (or is not) satisfactory and the record shall be signed by the relieved and relieving watchstander.

B. EQUIPMENT ADJUSTMENTS

1. Timer Adjustments. Routine adjustment and maintenance of the AN/FPN-30 timers is covered in the various chapters of the instruction book; additional requirements are outlined in the following paragraphs.

a. Motor Speed Range Selector. High and low motor speed ranges are available in the AN/FPN-30 timers; the low speed range shall be used at all times when the timer is in use.

b. Motor Speed Control. The motor speed control is calibrated in microseconds per minute (1 to 10) and shall be adjusted to the 5 microseconds per minute position and locked; this speed adjustment shall not be increased without authorization from the District Commander. Difficulties such as sluggish response, etc., can usually be traced to synchronizer mis-adjustment, lack of gear train lubrication or other causes.

c. Sensitivity Controls.

(1) The off sync sensitivity control shall be adjusted according to paragraph 28 (k), page 3-71, of the timer instruction book.

(2) The sync error sensitivity control shall be adjusted for a tolerance of ± 2 microseconds or other tolerance that may be designated for a particular Loran rate (see par. 28 (j), page 3-70, of the timer instruction book).

d. Gate Delay Control. The blink gate delay control R614 shall be adjusted according to the instruction book, paragraph 24 (a), page 3-55.
e. Blink Duty Cycle. The blink duty cycle is adjusted at the factory to provide a 50% blink, 50% no blink period; this adjustment can be verified as follows: Connect a reliable 60 cps 115V synchronous clock with a sweep second hand between terminals 1 or 2 on TB502 and one of the two poles of BLINK SWITCH S505 (DPST). Operate Blink motor for about four (4) minutes (timed by separate clock) and note elapsed minutes on synchronous clock. Then change clock connection to the other pole of S505 and repeat the foregoing procedure. Adjust blink duty cycle as outlined in instruction book, page 3-55, until two successive readings of elapsed times agree. This will then be the condition of 50% duty cycle. This procedure is valid only if S505 is wired as shown in instruction book. Some equipments have S505 connections inverted.

f. Sync Error Aural Alarm Delay, Master and Slave Stations. The sync error time delay relay K-1503 shall be adjusted for 5 seconds delay at the master station and 15 seconds delay at the slave station.

g. Off Sync Aural Alarm Delay, Master and Slave Stations. The off sync time delay relay K-1505 shall be adjusted for a 15 second delay.

h. Synchronizer Adjustments, Master and Slave. Optimum performance of the automatic slave synchronization and automatic master monitor features of the AN/FPN-30 Loran timer depends on adequate maintenance and regular checking and/or adjustment of certain controls. In particular the following adjustments shall be carefully checked at four-hour intervals and/or on relief of watch.

(1) Slave Station

a. A and B Delays (on Time Delay).
b. Sync Bias (on Electrical Synchronizer).
c. Sync Balance (on Electrical Synchronizer).
d. Fine Local Delay (on Electrical Synchronizer).
e. The final adjustment of the FINE LOCAL DELAY control should precisely position the local gate on the local signal so that with the remote signal removed synchronizer motor rotation will be stopped.

(2) Master Station

a. A and B Delays (on Time Delay).
b. Sync Bias (on Electrical Synchronizer).
c. Sync Balance (on Electrical Synchronizer).
d. Fine Local Delay (on Electrical Synchronizer).
e. The final adjustment of the FINE LOCAL DELAY control should precisely position the local gate on the local signal so that with the remote signal removed synchronizer motor rotation will be stopped.
2. **Operation and Adjustment of Timer in the Presence of Noise.**

   a. A video limiter designed to reduce noise burst peaks is incorporated in the radio receiver. Use of the limiter is recommended when it will be of value in maintaining sync.

   b. A reduction in motor speed will integrate information obtained from sampling the Loran signal over a longer period of time and reduce false corrections due to noise bursts. Under severe noise conditions a motor speed of from 1-2 microseconds per minute is recommended.

3. **Assigned Master Time Difference.** Signal delay lines are incorporated in the AN/FPA-2 for compensation of system errors due to position of the receiving antenna. The District Commander may authorize insertion of delays as required; the Commandant (O and EEB) shall be advised of insertion of such delays.

4. **AN/FPA-3A Adjustments.** The R.F. power Decreased (OFF) time delay relay shall be set for thirty seconds delay.