
# Mesa Ocean Currents Measurement System

## 7.e Support Documentation Subsystem Coast Guard 155mm Lantern

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Survey
Office of Marine Technology
Engineering Development Laboratory


NOAA
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

# Ocean Currents Measurement System

This documentation package explains the theory and operation of the Ocean Currents Measurement System developed for the MESA Program by the National Ocean Survey's Engineering Development Laboratory. The documentation is divided into seven subsystem manuals (listed below). This modularity provides the flexibility to change or make additions to a particular subsystem manual without replacing the entire package. It also allows two or more people to read different sections of the documentation at the same time.

## Ocean Currents Measurement System Manuals



1. System Description
2. Peopleware Subsystem
3. A. Mooring Subsystem
   B. Recording Current Meter
4. Data Conversion and Processing Subsystem
5. Data Quality Control Subsystem
6. Maintenance and Failure Reporting Subsystem
7. Support Documentation Subsystem
   a. Aanderaa Compass Checkout Fixture
   b. Aanderaa Current Meter Test and Evaluation
   c. AMF Acoustic Release/Pinger
   d. SB-510 Seabeacon Surface Buoy
   e. Coast Guard 155 mm Lantern
   f. Aanderaa Current Meter In Situ Monitoring Group Manual
   g. Time Counter Module For The Aanderaa Current Meter

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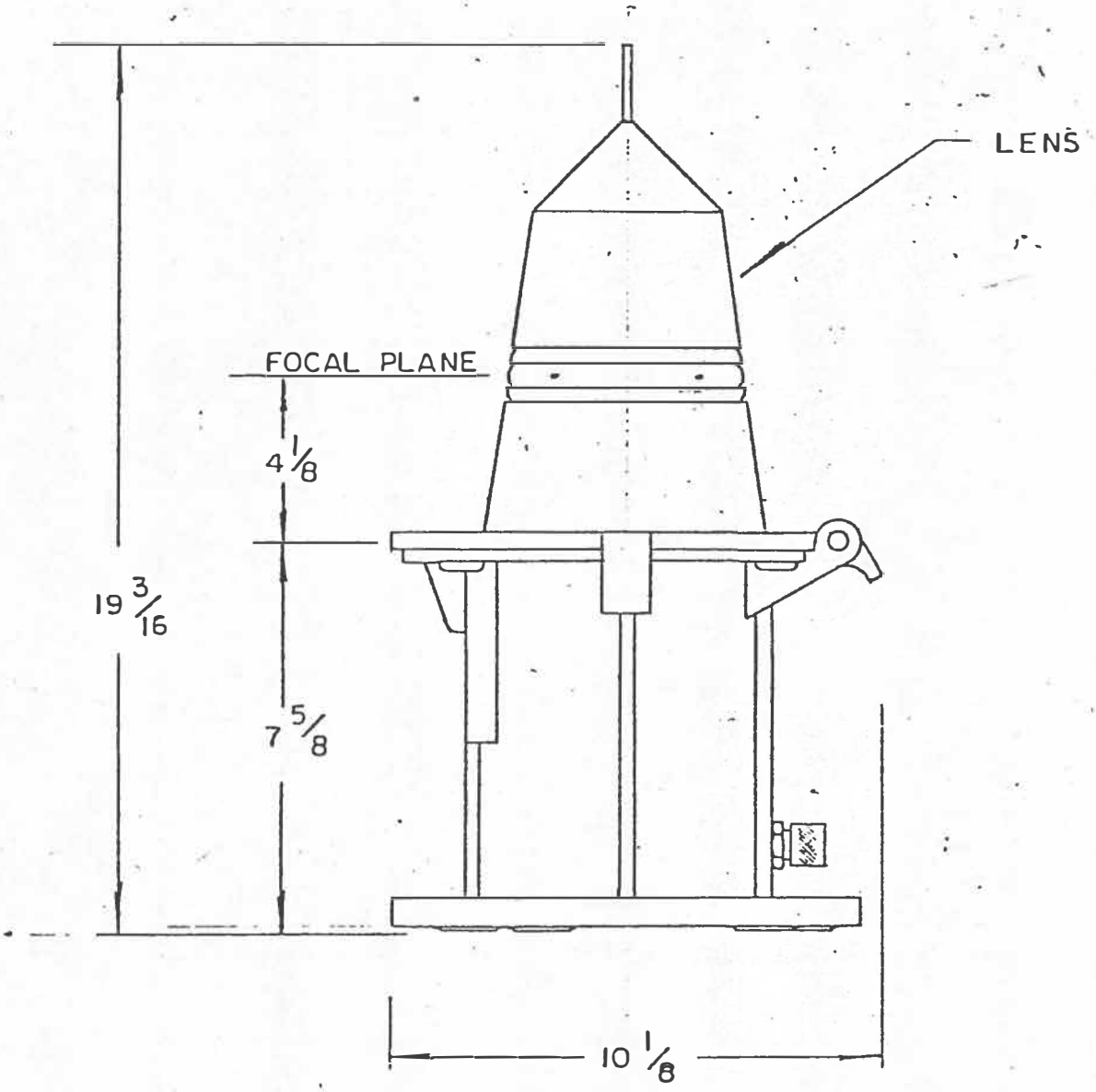
## 7.1 INTRODUCTION

The lantern, Figure 1, is a standard U. S. Coast Guard 155 millimeter aid to navigation light designed for use on buoys, offshore structures, and channel markers. It consists of a molded plastic base, lamp changer, electronic flasher, sun switch, and a 155 millimeter Fresnel Lens. The lantern is produced by various manufacturers to U. S. Coast Guard specifications, and is available through the U. S. Coast Guard Supply System.




LANTERN

FIGURE 1

## 7.2 LANTERN DESCRIPTION

The 155 millimeter lantern is a rugged, compact, light weight, Class B or Class C Aid-to-Navigation unit, designed for use on markers and lighted buoy systems. It is constructed of corrosion-proof materials and will provide long service with minimum maintenance.

The 155 millimeter acrylic Fresnel lens transmits light throughout the 360 degree Azimuth. The lens is injection molded as a single piece under high pressure and exact reproduction of the 38 individual optical elements enables the lens to achieve higher lens-to-lamp light transmission ratio than a glass lens. The candle power output of this lens exceeds that of a conventional 200 millimeter pressed glass lens which translates into more light or a smaller lamp to provide equal candle power output with increased battery life. A bird spike is part of the molded lens. Three screw type fasteners secure the lens directly to the base. An O-ring mounted in the base provides a seal against water intrusion.

The base is constructed from fiberglass - reinforced polyester resin plastic. It houses the flasher mechanism, lamp changer, and sun switch. A bracket upon which the flasher and lamp changer are mounted is secured to the inside of the base section. Two 3/4" threaded taps in the base provide outlets for the electrical connection. Installation of the lantern base on its mounting plate is accomplished by three equally spaced bolt holes in the base flange.

A six place motor driven, lamp changer automatically places a new lamp at the focal center of the lantern lens when a previously centered lamp burns out. A lamp-out sensing circuit rapidly rotates the changer

to the next serviceable lamp but does not continue to search for lamps following use of the sixth lamp.

A solid state sealed flasher can be pre-programmed for a simple flash of the duration desired or a choice of codes. The circuitry uses solid state components which have been pre-tested and certified.

A sun switch allows the light to operate only during hours of darkness. The switch will extend the service period of batteries and lamps by approximately 40% over continuously operating units.

The lantern requires 12 volt D.C. for operation. The current drain from the battery will depend on duty cycle, flash characteristics, and the lamp size installed. Technical data sheets from two suppliers of these lanterns to the Coast Guard are included in the Appendix. Consult these data sheets for lamp size and effective beam luminous intensity.

## 7.3 ASSEMBLY, CHECK OUT AND INSTALLATION

The procedures in this section cover assembly, check out, and installation of the 155 mm lantern. The following table lists the parts required for the lantern assembly.

Coast Guard 155 MM Lantern

| C. G. Part # | Name | Quantity Required |
|---|---|---|
| 5945-101-9430 | Flasher, Interrupted Quick Flash | 1 |
| 6250-G00-3387 | Lamp changer | 1 |
| | Lamp changer bracket | 1 |
| 6210-G00-2288 | Housing | 1 |
| 5961-G00-2878 | Sun Switch (Type C) | 1 |
| 6240-262-8841 | Bulbs (12V - 1.15 amp) | 6 |
| | 20 gauge stranded cu wire, 4¼" long | 3 |
| | Std. solderless connectors, 20 gauge wire | 6 |
| | 1" 10-32 S.S. Bolts | 4 |
| | 10-32 Lock washers | 4 |

The assembly procedures may be divided into four operations:

1. Bolt the lamp changer to the flasher unit
2. Wire the lamp changer and flasher together
3. Lantern check out
4. Align assembly into housing

Some sections of the following procedures were taken from documentation provided by the Coast Guard.

1. Bolting Lamp Changer to Flasher

As shown in Figures 2 and 3, the terminals of the lamp changer are located on the opposite side from the terminals of the flasher. This allows easy access to the studs on the flasher unit for maintenance purposes. The bracket that is supplied with the housing fits between the two units.

NOTE: This bracket must be in the inverted position so that the "bend" is facing downward.

Steps for this installation are:

a. Place the lamp changer bracket on the flasher unit and align the four holes in the bracket with the holes on the top face of the flasher unit.

b. Lower the lamp changer onto the bracket with the terminal of the lampchanger and flasher on opposite sides.

c. Bolt the three pieces together using 1", 10-32 S.S. bolts and S.S. lock washers.

2. Wiring the Lamp Changer and Flasher Together

The wiring diagram, Figure 4A is straight forward and the terminals are color coded for ease of assembly. The sun switch, or day light control, is placed into the circuitry using the "S" terminals on the flasher unit. Assembly of the lamp changer and flasher unit is accomplished by the following steps:

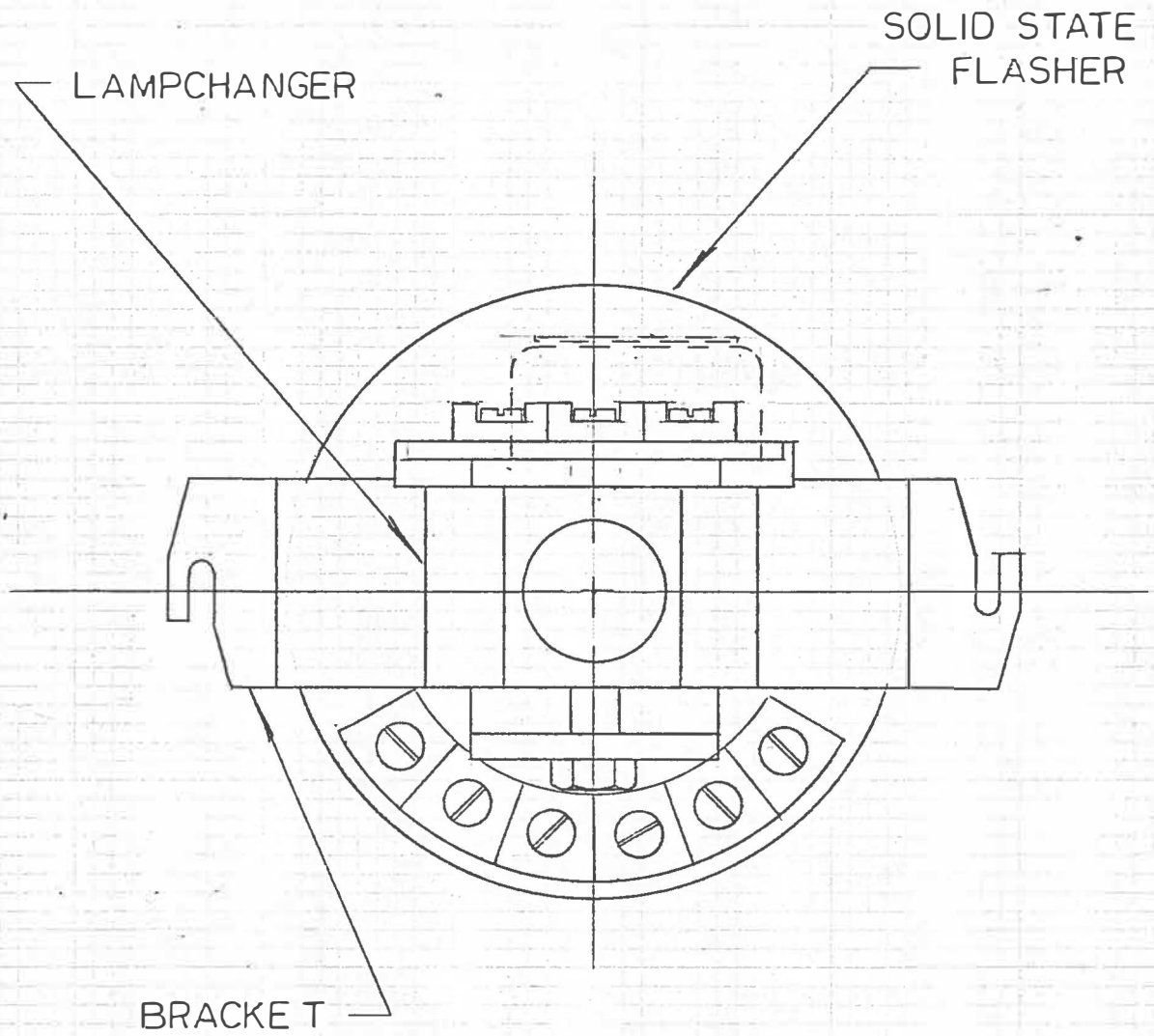



FIGURE 2

LAMPCHANGER FLASHER ALIGNMENT

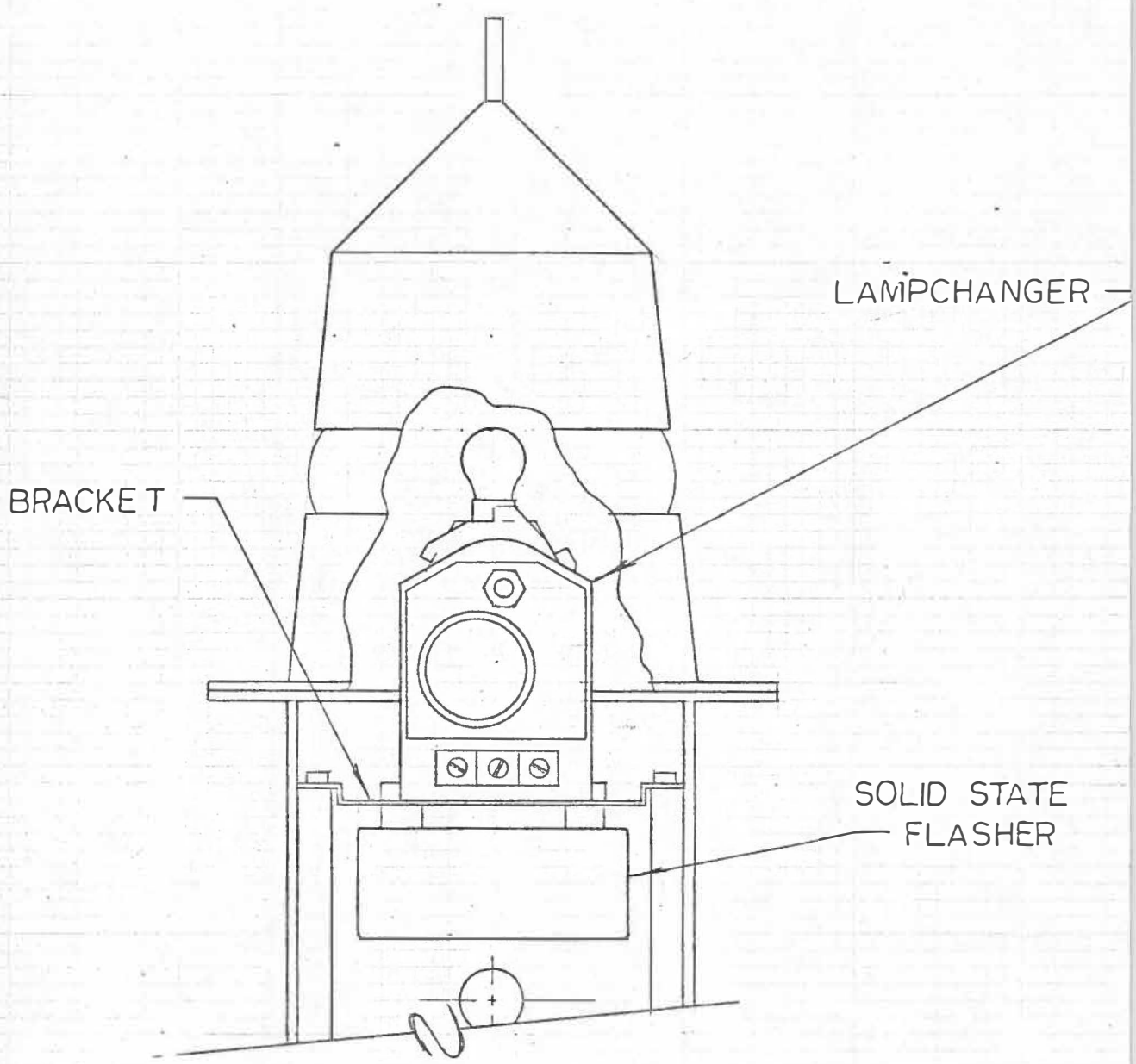



FIGURE 3

155 MM LANTERN

of credibility on the part of personnel completing the forms and increased expenses incurred processing useless data.

Items of field data are useful only when supplied in the appropriate manner, therefore, care must be taken to assure that the data recording format is compatible with the requirements of the analysis. A report form must be designed that will assure efficient data collection of the type required in a suitable form for subsequent analysis and evaluation. The form permits the recording of accurate and meaningful data in a practical and easy to use format. Information should be recorded in a systematic manner with all entries relating to the same topic following one another in logical order. Instructions explaining the use of the form should be clear, concise, and in terminology familiar to those required to use the reporting form. Personnel required to fill out the form should be properly instructed in its use, and emphasis should be placed not only on proper completion of the form, but also on the reasons and benefits that can be derived from conscientious reporting.

### 6.3.2 GENERAL

Following the general guidelines outlined above the FAILog Program was established by the National Oceanographic Instrumentation Center. The Program is a formalized system for recording, analyzing and disseminating failure data.

Timely analysis of all discrepancy or failure reports by an analysis team will identify the basic or underlying causes of failure in parts, materials, processes, and procedures. This analysis will include failures in design, manufacture, procurement, quality control, maintenance, and operation.

Results of these analysis will be fed back to the proper activity for corrective action.

### 6.3.3 THE FAILOG PROGRAM PLAN

#### 6.3.3.1 MAIN ELEMENTS

The FAILog program consists of the following sequence of events:

a. Training;

b. Identification and classification of equipment to be monitored;

c. Identification of data requirements;

d. Design of data collection forms;

e. Design of data transmission system;

f. Design of data reduction system;

g. Design of data analysis procedures;

h. Design of information dissemination system;

i. Development of procedures, handbooks, and instructions and Controls;

j. Review of literature and similar programs.

#### 6.3.3.2 TRAINING

A continuous schedule of training will be established for training personnel in the theory and practice of reliability, maintainability, and effectiveness analysis as well as the mechanics of operating a data collection, analysis, and dissemination system. In addition to theoretical and practical training, personnel must also be made aware of the importance of their individual roles in producing highly reliable and maintainable equipment. Also, an on-site orientation training will be conducted at NOIC to encourage outside data suppliers via improved program understanding.

### 6.3.3.3 EQUIPMENT

Equipment for this data collection program will be reviewed for usefulness and applicability to development of advanced systems or modification of existing equipment and systems. Complete, accurate, and detailed descriptions of all equipment included in the program will either be obtained or developed. These descriptions will include physical characteristics of the equipment as well as the functional and environmental data parameters.

### 6.3.3.4 DATA REQUIREMENTS

Each data item will be critically reviewed to exclude superfluous data. The following items are considered both necessary and sufficient for reliability, availability, and effectiveness analysis:

a. System or subsystem, and defective component identification;

b. Total accumulated operating time on system in which failure occurred;

c. Performance behavior or malfunction symptom which accompanied the failure;

d. Test or "use" conditions at time of failure;

e. Identification, classification, and apparent cause of failure;

f. Repair action taken to restore instrument to operational status;

g. Time required for fault detection and correction (maintainability evaluations);

h. Identification of test activity or organization, and the individual operator or technician making report;

i. Report serial number, date, and time;

j. Failure-diagnosis summary and recommended recurrence-control measures;

k. Operational environment.

Time may be recorded as diagnostic, fault location, active repair, administrative, logistic, and checkout if detailed analysis of maintenance time is required.

#### 6.3.3.5 DATA COLLECTION FORMS

The FAILog form (Figure 3) has been designed for ease of completion, transcription, and reduction of data. The identification and classification of repair action and parts has been devised to permit precise identification of all components involved in a repair action. The development of future data collection forms will be determined by the requirements of analysis procedures and design of new data reduction and transmission systems. User comments will also weigh heavily in any changes made to the FAILog form.

#### 6.3.3.6 DATA PREPARATION

Data preparation or editing is essential to reduce errors and to ensure that data is acceptable. Since each report is screened during editing, it is the obvious place for sorting and coding any information required to simplify data reduction.

#### 6.3.3.7 DATA TRANSMISSION

a. The data transmission system (Figure 4) has been designed for an orderly and timely flow of data from the data source to the data center, and back to the data source. NOIC maintains the responsibility for collecting, recording, checking, and transcribing the information to punch cards. The data transmission system will also provide for transmitting

NOAA FORM 44-6 (4-71)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

# INSTRUMENT FAILURE ANALYSIS INITIATION LOG
(FAILog)

FORM APPROVED OMB NO. 41-R2568

NUMBER

(Please Print or Type Data)

1A

1. REPORTING ACTIVITY | ACTIVITY CODE

2. REPORTING PERSONNEL

3. ADDRESS (Complete only if address is new)
NUMBER AND STREET

CITY | STATE | 5. ZIP CODE

4. TELEPHONE
AREA CODE
NUMBER | EXT.

6. INSTRUMENT NOMENCLATURE

7. MODEL NUMBER

For letter 'O' use 'Ø'
For numeral 'Zero' use 'O'

2A

8. MANFACTURER | MFR. CODE

9. SERIAL NUMBER

10. DATES

| | YR | MO | DAY | TIME |
|---|---|---|---|---|
| FAILURE DATE | | | | |
| DATE RETURNED TO SERVICE | | | | |

11. INSTRUMENT AGE (Check one only)
1 ☐ NEW (First use) 3 ☐ 1 TO 3 YEARS
2 ☐ BELOW ONE YEAR 4 ☐ ABOVE 3 YEARS

TOTAL HOURS OPERATED (If known)

12. TOTAL OPERATION TIME BETWEEN FAILURES hrs.

13. TOTAL DOWN TIME hrs.

14. QUANTITY OWNED

15. FOR NOIC USE ONLY
ACTION CODE | DATE | REVIEWER (Initials)

16. FAILURE CAUSE (Check one only in each of items 16 thru 20)
1 ☐ ELECTRICAL 2 ☐ MECHANICAL 3 ☐ HUMAN ERROR

17. FAILURE EFFECT
1 ☐ NON-OPERATIONAL 2 ☐ MARGINAL 3 ☐ NONE

18. STAND-BY MODE ON INSTRUMENT?
1 ☐ NO 2 ☐ YES →
NUMBER OF HOURS OPERATED INSTAND-BY PRIOR TO FAILURE hrs.

19. STAGE OF OPERATION AT FAILURE
1 ☐ DURING ACCEPTANCE 3 ☐ IN SITU (Field use)
2 ☐ ROUTINE CALIBRATION 4 ☐ OTHER (Explain in item 23)

20. FINAL DISPOSITION OF INSTRUMENT
1 ☐ RETURNED TO SERVICE 2 ☐ USAGE DISCONTINUED 3 ☐ OTHER (Explain in item 23)

3A

21. REPLACED PARTS

| QUAN. | PART NOMENCLATURE | DESCRIPTION | IDENTIFICATION NO. | REPLACEMENT DIFFERENT FROM ORIGINAL? YES (1) | NO (0) | MFR'S PART NO. (1) | MFR'S INSTR. NO. (2) | FED. STK. NO. (3) | OTHER (List in 23) (4) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

3Z

22. ELAPSED TIME METER READING

Check (√) One

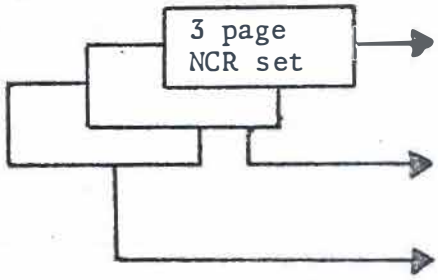
Check (√) One

23. FAILURE DESCRIPTION AND/OR ADDITIONAL INFORMATION (Please check form for omissions)

Figure 3. INSTRUMENT FAILURE ANALYSIS INITIATION LOG

changes in procedures and coding conventions to, personnel responsible for completing data collection forms. In general, transmittal of data on forms or cards designed for direct punching by mail will suffice. However, if volume becomes a factor, alternative forms of data transmission (i.e., tape, microfilm or land line) will be investigated.

b. FAILog Data Distribution




First (white) copy--reviewed by analysis group then utilized for card punching.

Second (yellow) copy--filed at intermediate data source.

Third (pink) copy--retained by data source.

c. FAILogs received by NOIC will be reviewed and stored in an "Action File".

1. All records requiring normal repair action and returned to service will be filed in Action Code "1".

2. All records of instruments that are not being used because of a logistical delay in repair parts--Action Code "2".

3. Operable instruments whose usage is desired to be discontinued--Action Code "3".

4. Instruments lost at sea--Action Code "4".

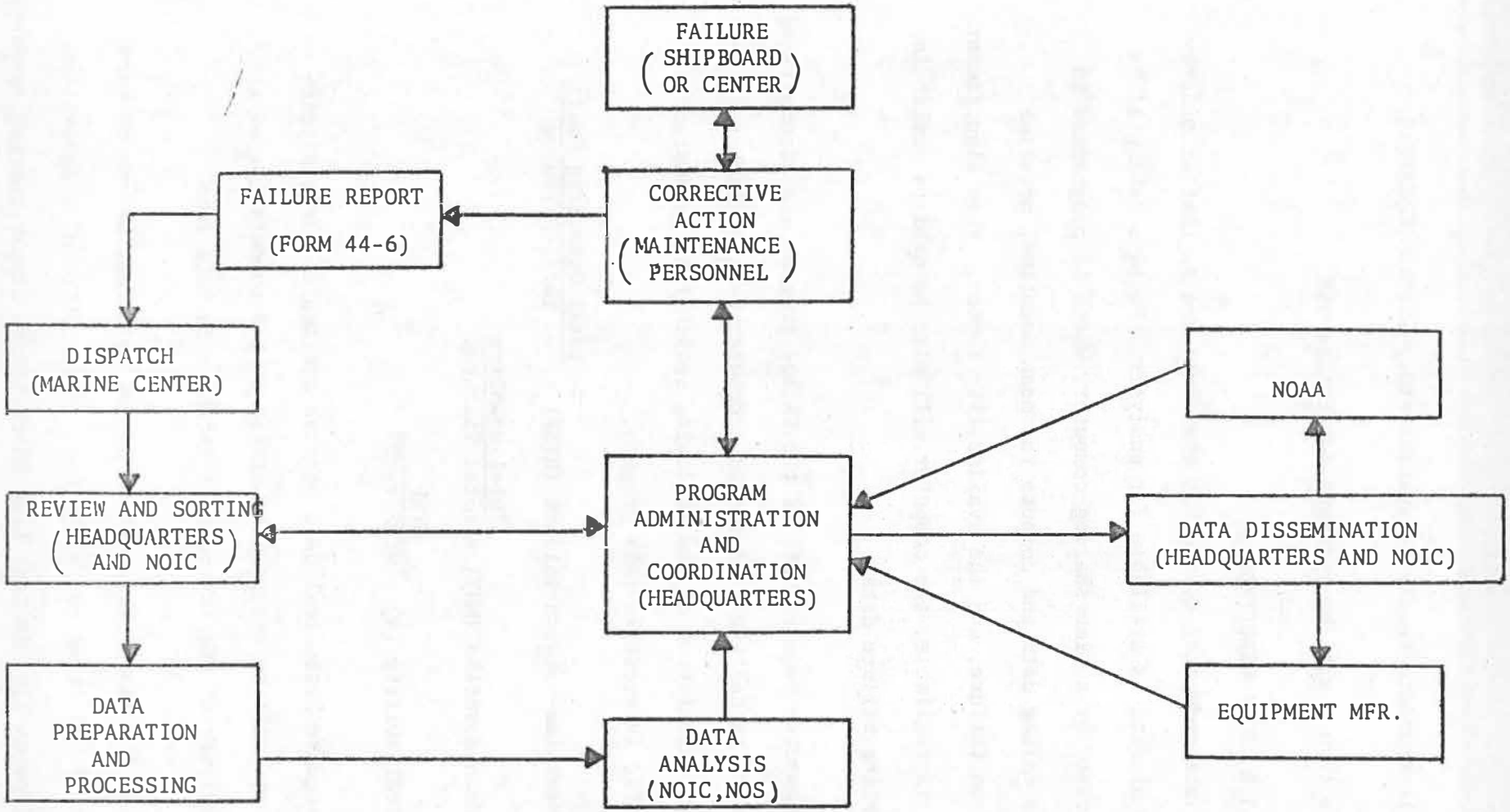



Figure 4. DATA FLOW CHART

5. Instruments requiring special study--Action Code "5".

6. 6 thru 9 will be reserved for future use.

### 6.3.3.8 DATA REDUCTION

The data reduction system has been designed so that an orderly flow of data is available for analysis. Failure data will be processed by a time-sharing computer, which is programmed to store FAILog data and compute the mean downtime, meantime between failure, and the availability factor. When significant data is available, the computer will also be used to assist in analyzing failure data.

The computer requirements of the FAILog program are accomplished by using an on-line time shared, computer system which readily allows calculation of the following reliability parameters of specific interest in this program:

1. Meantime-between-failure (MTBF) = $\frac{\text{Total Operating Hours}}{\text{Total Failures}}$

2. Mean downtime (MDT) = $\frac{\text{Total Downtime}}{\text{Total Failures}}$

3. Availability (A) = $\frac{\text{MTBF}}{\text{MTBF + MDT}}$

As adequate historical data becomes available, curve fitting programs will be utilized to assist in the computation of the reliability of the instruments included in Data Base.

Data in the master file can be sorted by selecting one or more (up to five) items on the FAILog. Most sorts and computations are done on line in real time which allows almost instant response.

The advantages of disc, tape, and cards for data storage will be periodically evaluated as the volume of data increases. Again, this information will be available to the FAILog program participants.

### 6.3.3.9 DATA ANALYSIS AND REPORT GENERATION

The objective of the data feedback process is to provide information relating to a systems performance. Through the analysis of these reports, reliability is measured and improved on a continuing basis. As a result, reports are complete and accurate and a methodical and documented procedure can then be employed to establish:

1. The cause and effect of failures.
2. Planned action to eliminate recurrence of failures.
3. Documented information for:
    a. Timely distribution to program management.
    b. Use in cost effective allocation of program funds.
    c. Determination of testing programs and/or possible adjustment to the program schedule

The FAILog data analysis procedures consists of two parts. Standard and routine analysis performed by computer are disseminated immediately. However, all routine analysis are reviewed by trained analysts to determine developing trends which indicate a need for corrective action or more detailed analysis. A comprehensive failure analysis and corrective action feedback loop will determine:

1. What failed?
2. How it failed?
3. Why it failed?

When a number of failures of the same type are reported, a priority study can be initiated to solve the problem. The pooling of instrument reliability data from a large number of sources will allow faster identification of the instrument problems by the oceanographic community. The pooled reliability data will also assist in listing who is using what instrument and how it is being used.

The FAILog program will also allow better oceanographic instrumentation decisions to be made. By consulting the FAILog program data, the best instruments may be selected for the particular application.

After the instrument has been selected, the estimation of its probable maintenance requirements can be obtained from the FAILog program data. This maintenance information will also aid management and scientist in scheduling the maintenance and survey times for best efficiency.

The recorded results of all testing provides a valid estimate of the achieved reliability from the early phases of program design through final phases establishing a baseline for comparison with reliability predictions and reliability program requirements, and estimating degradation and wear-out characteristics, and logistic support requirements.

The groups that actively use such data are the:

1. Reliability groups that perform the basic data analysis and provide reports identifying problem areas.

2. Design groups which utilize the information from such reports in defining the areas requiring engineering effort and in evaluating the effectiveness of previous design efforts.

3. Management groups that utilize information such as logistic and manpower expenditures as bases for policy revisions to improve management and operational effectiveness.

6.3.3.10 INFORMATION DISSEMINATION

NOIC presently maintains information channels throughout the oceanographic community and with other groups interested in oceanographic instrumentation performance. These same channels will provide the main avenues for reliability data dissemination.

6.3.3.11 PROCEDURES, HANDBOOKS, INSTRUCTIONS, AND CONTROLS

The success of the FAILog will depend on the clarity and usefulness of the software for day-to-day continuity of operations. Such documentation will continuously be generated and updated.

6.3.3.12 REVIEW OF LITERATURE AND SIMILAR PROGRAMS

Other oceanographic instrument reliability data gathering programs will be studied. This investigation will determine:

a. What reliability information is available?

b. What form is used to report the data?

c. How the data is collected?

d. How NOIC can get the information?

e. What parameters are collected?

f. How the outside activity accumulates, sorts, and has printed-out the gathered data?

g. How the data is interpreted?

h. What is done with the data and the interpretations?

i. What are the program's costs and savings?

j. If there are any major problems that a new program should avoid?

Since the inception of FAILog, many outside reliability programs have been reviewed. Those programs, even though they do not gather data on oceanographic instruments, will be continuously contacted in the course of this investigation to gain additional insight in the "state-of-the-art" of effective gathering, using, and disseminating of reliability data for the oceanographic community.

# APPENDIX

# FAILOG INSTRUCTIONS

I. Introduction

A. The purpose of NOAA Form 44-6, Instrument Failure Analysis Initiation Log, is to provide adequate documentation of instrument failure. This failure data will be utilized to monitor and improve the reliability and maintainability of present and future data acquisition systems.

In addition, the revised Failog form has been designed to provide the Marine Centers and Headquarters with the following types of information:

1. Items of equipment which have been installed or de-installed on board ship

2. Equipment transferred between vessels or vessels and Marine Centers

3. Field changes including installation of elapsed time (ET) meters

4. Equipment lost at sea which should be deleted from the Electronic Equipment Inventory

5. Equipment which is no longer repairable and which is surveyed

In summary, any action which will effect the status of the Electronic Equipment Inventory as well as all failures of shipboard electronic systems should be reported by submission of a Failog form.

B. The following instructions are listed by Item Number and explain the type and format of the desired data. Any further explanation may be acquired by contacting the Electronic Systems Branch, Office of Fleet Operations, Code C722, on area code 301, telephone 496-8013.

C. Failog Routing

1. The third (pink) copy is to be retained by the originator of failure report.

a. Vessels forward remaining copies to respective Marine Center.

b. Marine Centers forward remaining (2) copies to Headquarters (Code C722).

2. Marine Centers retain one copy (yellow) when receiving reports from vessels and forward remaining (white) copy to Headquarters (Code C722).

D. Data Submission

1. Vessels - Failog forms should be dispatched to Marine Center at the earliest possible time as soon after the data in Item 13 (Instrument Disposition) is recorded.

2. Marine Centers--Failogs forms should be dispatched twice monthly.

E. Notation of Failure

Equipment down and up times should be noted at time of occurance to maximize the accuracy of Failog records.

II. Instructions

A. Please print, write legibly or type all data requested on the form.

B. The numbers in the items near the check-off boxes are for the purpose of coding the data for transfer to a computer program.

1. Reporting Activity - Name of the activity (Government or private) making Failure Report.

2. Reporting Personnel - Name of person responsible for generating Failure Report. Please print last name, and first initial.

3. Date - The date on which the Failure Report is filled out.

4. a. Equipment - Name of item that has failed. This field should agree with the nomenclature outlined on the NOS Electronic Equipment Inventory.

b. ID Code - Numeric code obtained from the Electronic Equipment Inventory which completely defines failed equipment item.

5. Manufacturer - Name of instrument or equipment maker.

6. & 7. Model and Serial Number - Equipment identification numbers obtained from the Electronic Equipment Inventory or from the piece of failed equipment.

8. Stage of Operation at Failure - Check all boxes that apply.

9. Dates

   A. Failure Date - date (time, month, day, and year) the instrument fell below required operational specifications and deemed failed. Use Military (24-hour clock) time.

   B. Date returned to Service - Date (time, month, day and year) the instrument was returned to operation and performance met design specifications.

10. Failure Cause - Check all boxes that apply.

11. ET Meter Reading or Operation Time Since Last Failure - If instrument has an elapsed time (ET) meter insert that value here. If not, the number of hours the instrument has operated since the last failure should be used.

12. ATTR - The Actual Time To Repair the failed equipment.

13. Final Disposition of Equipment - check one box that applies.

14. Replaced Parts - Common name of actual part(s) that failed.

   A. Quantity - Enter the number of parts of each type replaced.

   B. Description - Words and/or numbers describing part name, type or operational parameters, and function.

   C. Identification Number - The preferred identifying replacement part numbers are in the following decreasing order: part manufacturer's part number; instrument manufacturer's part number; federal stock number, or any other identifying number not mentioned in the previous list.

   D. From Spares - Check whether the replaced part was taken from the ship's or activity's spares' inventory.

15. Failure Description and/or Additional Information -

Failure is defined as either the controlled or uncontrolled shutdown of a piece of equipment due to some malfunction in its operation. Uncontrolled shutdown occurs when the components that fail cause the operation to cease. Controlled shutdown is performed by an operator who makes a decision to cease operation becasue complete failure is anticipated or corrections are deemed necessary because performance is below acceptable level. In case of uncontrolled shutdown, briefly describe the conditions that existed when failure was discovered and if possible a diagnosis of the cause. For controlled shutdown, describe the conditions that existed when the decision was made to cease operation and the failure anticipated. It is also appropriate and desirable to describe the corrective action in this block if possible.

16. Marine Center Action - To be completed by Marine Center personnel.

17. Headquarters - To be completed by Headquarters personnel.

NOTE: If a piece of equipment is returned to the Marine Center for further action items 1-8, 9 and 15 of the Failog form must be filled out and the form sent with the item. The Marine Center should fill in all missing data and return the form to C722. A copy should also be returned to the originating activity in order that they may be informed of the Marine Center's corrective action. For vendor repair, the Failog form should be filled out in the field or by the Marine Center and held until the equipment is returned from the manufacturer. Any missing information should then be included on the form (such as replaced parts data) and the form sent to C722.

In the case of instruments requiring calibration by the National Oceanographic Instrumentation Center (NOIC) or one of its regional centers the following guidelines should be observed:

1. Instruments that require only calibration should be forwarded without Failog forms. NOIC has been instructed to complete a Failog report for instruments that fail during calibration.

2. For instruments that have failed during operation and have been returned to the Marine Center either for calibration or for repair and calibration the Failog form should be submitted to the NOIC laboratory as an aid in performing the calibration. NOIC will then forward the report to C722.

Reports other than for equipment failures should contain the following data:

1. Items 1-7

2. Item 9, under failure data, report date of installation, de-installation, field change, equipment survey, transfer, etc.

3. Item 11

4. Item 15, indicate action taken

See Failog Examples 4 and 5