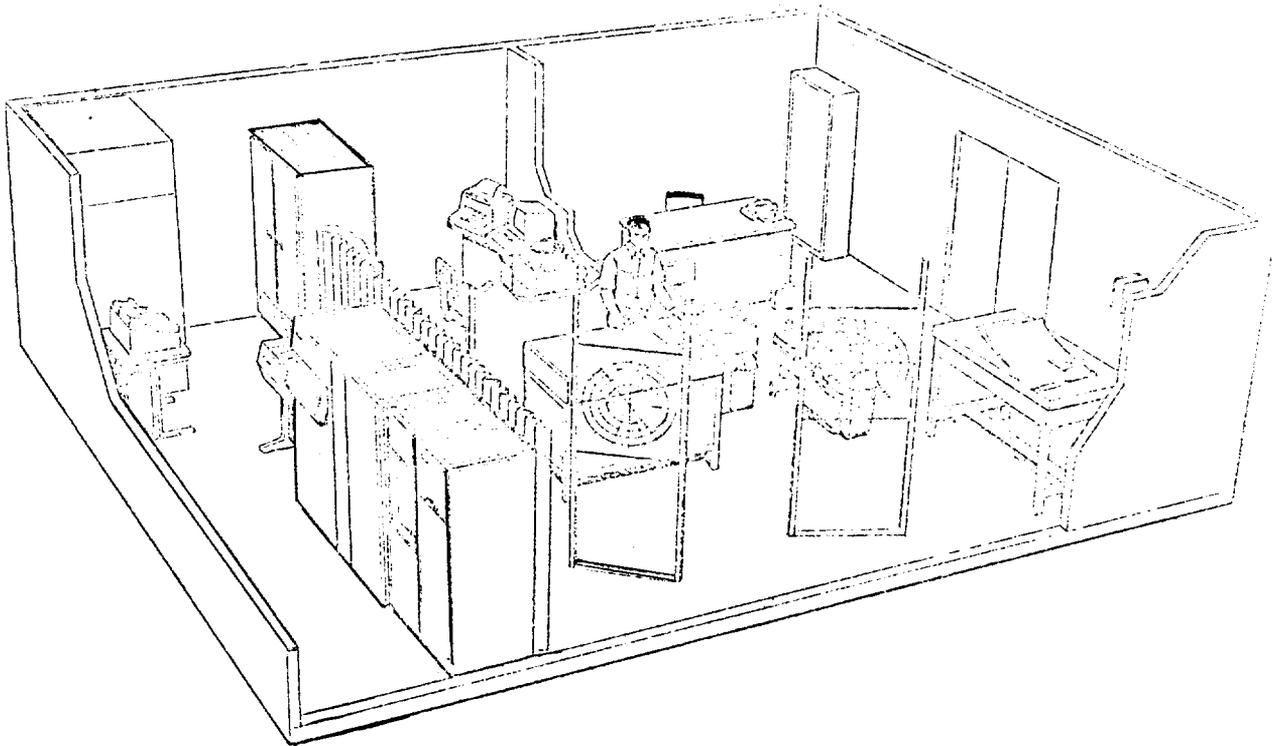


## DIRECTORY OF NAVAL TRAINING DEVICES



### RADAR NAVIGATION TRAINER, DEVICE 15F12

**TRAINING CATEGORY:**

RADAR (CIC)

**ORIGINATING AGENCY:**

CNET

**SECURITY CLASSIFICATION:**

Device 15F12 is unclassified.

**INTENDED USE:**

As training equipment installed at the Fleet Combat Director Systems Training Center, Dam Neck, VA for training radar operators and plotting teams in procedures and techniques required for at-sea electronic navigation, restricted water piloting, fire control plotting, and sonar target plotting.

**PURPOSE:**

To provide dynamic real-time practical team training in at-sea electronic navigation and in restricted waters piloting procedures and techniques, to provide practical team training in fire

control plotting techniques and procedures, and to provide progressive training in navigation and piloting techniques and procedures for sonar target plotting techniques.

**FUNCTIONAL DESCRIPTION:**

Training is accomplished by creating a dynamic simulated radar display on AN/SPA-25 Plan Position Indicators (PPI's) typical of surface search radar sets. In addition, the ownship position is coordinated with sea depth indicator readings and a dead reckoning plot.

The trainee area consists of plotting boards, dead reckoning tracer (DRT), and two PPI's. The PPI's provide a radar display of landmass surface targets, and discrete objects within radar range of ownship. The DRT provides a plot of ownship course and speed. The instructor's area includes an additional PPI, teletype unit, and a visual display/keyboard terminal for controlling and monitoring the training problems. The simulation equipment consists of a radar display generator and an SEL-85 general-purpose digital computer.

## DIRECTORY OF NAVAL TRAINING DEVICES

During trainer operation, the instructor maneuvers the ownship in accordance with the engine and helm orders as communicated by the trainees. Other controlled features include: 12 maneuverable surface targets, radar characteristics, and sea state as a function of wind and current.

Radar simulation is adjustable over a broad range of antenna, receiver, and transmitter characteristics. Variable parameters include:

- Vertical antenna pattern
- Horizontal antenna pattern
- Antenna height
- Antenna rotation rate
- Transmitter power
- Pulse width
- Pulse repetition rate
- IF gain

The most significant feature of Device 15F12 is its ability to operate directly from a digitized topographical chart. A chart feature is either a line (vector) or a point. A digitized chart consists of vector strings and points which are described by location together with information describing the feature by type and elevation. Features are characterized by type as:

- Boundaries - shoreline, cities, residential area, lakes
- Discrete Vectors - bridges, piers, railroads
- Discrete Points - towers, buoys
- Contours - elevations

The conversion of the digitized map into landmass video is accomplished directly in real-time on a scan-by-scan basis. A new computation is performed each antenna revolution (3 seconds minimum) on at least 64,000 vectors. A vector can be anywhere from 64 nautical miles (nmi) long to as short as 26' and represents one straight line segment of a feature.

The digital radar landmass simulation system of Device 15F12 consists of three (3) storage areas, each separated by a digital processor. Each processor serves to change the digital data it receives into a form that is one step closer to the radar video. The first storage area is a fixed head disc which contains map data representing a 64 x 64 nmi area; map data is stored in 64, 8 x 8 nmi cells. The first processor is the SEL-85 computer which transfers the disc data, cell-by-cell, to the vector processor. The first cell transferred is the cell containing ownship. The remaining cells are transferred in a spiral fashion moving away from the ownship location. This output method provides rough range ordering to ensure the closest range objects are not discarded when the antenna has completed one revolution.

The vector processor converts vector position from X-Y map coordinates to ownship relative polar coordinates and then converts the vectors into events, where an event is the intersection of an azimuth cut (0.35° per cut, 1,024 cuts total) and a vector. Events from the vector processor are stored in the event memory, which is organized to store up to 64 events per azimuth cut. Output from the event memory to the event processor is synchronized with antenna rotation. The event processor is a range sorter which places the events in the current azimuth cut in range order and performs reflectivity and masking calculations.

The output from the event processor is stored in the azimuth cut memory. This memory is accessed by the beam-forming processor, which can combine up to 30 adjacent azimuth cuts for azimuth antenna pattern simulation. Output of the beam-forming processor is digital amplitude data in real-time, which is converted to video for display on the PPI.

### PHYSICAL INFORMATION:

**Number of Pieces:** Nineteen (19)

**Sizes: (H" x W" x D")**

Unit 1, Radar Display Generator -  
77.50 x 56.13 x 32.50

Unit 2, Computer Station -  
2A1, SEL 32/55 Computer (CPU) -  
67 x 71 x 33  
2A2, Peripheral Cabinet - 67.50 x 23 x 30  
2A3, Moving Head Disc - 34 x 19 x 35  
2A4, Line Printer - 39.25 x 37.50 x 27  
2A5, Card Reader - 45.25 x 34 x 21  
2A6, Teleprinter - 36.25 x 32.50 x 27.50

Unit 3, Instructor Station -  
3A1, Instructor Console - 59.60 x 32.50 x 49  
3A2, Teleprinter - 31 x 20 x 26.5  
3A4, Plan Position Indicator (PPI) -  
30 x 20 x 30

Unit 4, Plotting Station -  
4A1, Dead Reckoning Tracer -  
15.60 x 52.25 x 39  
4A2, Plotting Table - 38 x 28 x 18  
4A4, Dead Reckoning Analyzer -  
10 x 20 x 14

Units 8 & 9, Radar Operator Stations -  
Plan Position Indicator (PPI) - 30 x 20 x 30

Unit 12, Depth Indicator - 4 x 10.50 x 5.50

Unit 14, Speed Indicator - 15 x 30 x 20

Unit 15, Course Indicator - 15 x 30 x 20

## DIRECTORY OF NAVAL TRAINING DEVICES

**Weight (lbs):**

Unit 1 - 1612

## Unit 2 -

2A1 - 1150

2A2 - 415

2A3 - 218

2A4 - 375

2A5 - 75

2A6 - 100

## Unit 3 -

3A1 - 530

3A2 - 100

3A4 - 200

## Unit 4 -

4A1 (Tracer) - 270

4A2 - 150

4A4 (Analyzer) - 30

Units 8 &amp; 9 - 400

Unit 12 - 8

Unit 14 - 50

Unit 15 - 50

**Total System (including cables) - 5,933 lbs.****EQUIPMENT REQUIRED (NOT SUPPLIED):**

1. Drafting Machine and Scales
2. Drafting and Navigation Kits
3. Kits, Slide Rule
4. Protractors, and Parallel Rules
5. Chart Table, Maneuvering Board Papers
6. Sound Powered Telephones, H202/U

**INSTALLATION AREA:**

1. Plotting Lab - 31' x 18'
2. Floor Loading: 250 lbs/sq ft (uniformly distributed)
3. Air Conditioning: 84,000 BTU/HR
4. Temperature: 18° - 32 ° C
5. Humidity: To 60%

**POWER REQUIREMENTS:**

120/208 VAC, 60 Hz, 3-Phase, 4-Wire, 25 KVA

**PUBLICATIONS FURNISHED:**

1. NAVTRADEV P-4123, Integrated Design Disclosure Report
2. NAVTRADEV P-4123-1 through -8, Vendor Equipment Documentation
3. NAVTRADEV P-4124, Planned Maintenance System Documentation
4. NAVTRADEV P-4125-1 through -8, Computer and Peripheral Equipment Documentaion

**PERSONNEL:****Instructor:** QMI, Two (2) per Shift**Operator:** Instructor Operated

**Maintenance:** For one (1) 8-hour operating shift per day: One (1) TD1, Two (2) TD2 and One (1) FTG1/2

For Two (2) 8-hour operating shifts per day: Two (2) TD1, Four (4) TD2, and Two (2) FTG1/2

**CONTRACT IDENTIFICATION:**

Manufactured by AAI Corporation, Cockeysville, MD under NAVTRASYS SCEN Contract Nos. N61339-74-C-0139 and N61339-79-C-0023.

**LOCAL STOCK NUMBER:**

6940-LL-C00-3989