

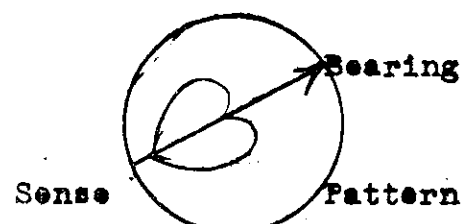
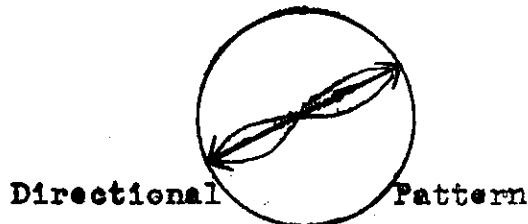
HF/DF EQUIPMENT MODEL DAU

A. INTRODUCTION

The DAV is a DF equipment primarily designed for ship-borne use, but which can be used for land based DF with a different antenna system. It covers the Frequency range from 1.5 to 30 mcs. and utilizes a Cathode Ray tube for bearing indication. The equipment is all mounted in a single rack, and the antenna system consists of a pair of crossed loops. It is particularly useful for work on ground wave signals, but may be used on sky waves as well, although with a low degree of accuracy.

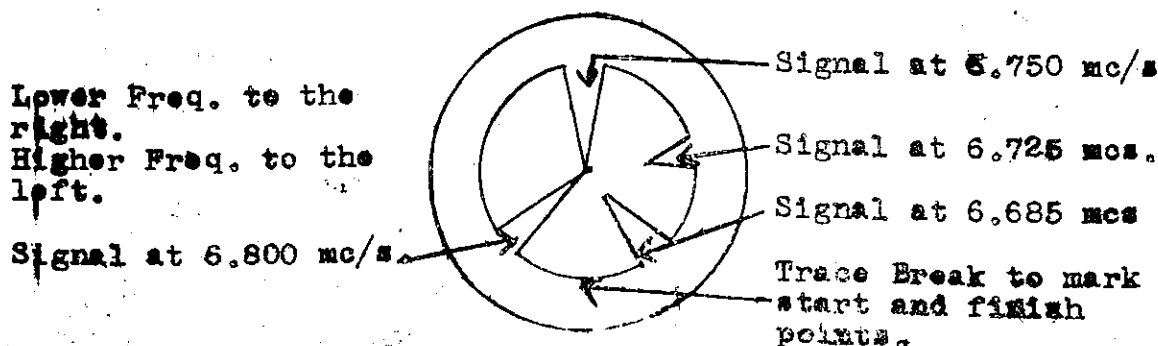
B. THEORY OF OPERATION

1. The DAV uses a spinning Goniometer in conjunction with a CRT in order to convert the directional property of the loop antennas to a visual indication of bearing. The CRT Trace is made by the rotation of the electron beam around the face of the tube, and with no signal input, the trace is a circle just inside the outer edge of the tube. The spot formed by the electron beam rotates in exact synchronism with the Goniometer search coil. When a signal is fed from the Goniometer to the rest of the set, the trace is pulled in from its normal position toward the centre of the tube. However, since the voltage picked up by the Goniometer Search Coil varies as the coil rotates, (the pickup is maximum at two points during one revolution, and zero at two other points) the amount of trace deflection is not the same at all points around the tube. The resultant pattern is in the form of a propeller and the bearing is read by observing the direction of the points of the propeller on an azimuth scale. If Sense is desired, the output of a small vertical mast and counterpoise (mounted above the loops) is combined with the output of the loops, and the resultant pattern of the tube is shown below....



In practice, the sense pattern may depart considerably from the ideal shape shown, but if the trace tends to concentrate the pattern on one end of the direction line, the other end of the line is taken as the true bearing.

2. **SCAN SYSTEM** - A special feature of the DAV Equipment is the provision of facilities for monitoring visually a band of frequencies 150 kcs wide. When the set is switched to 'Scan', it behaves, not as a DF set, but as a wide-band receiver. The CRT presentation is then a circle, with triangular indentations representing signals of different frequency within the limits of plus or minus 75 kcs of the frequency to which the receiver is tuned. The diagram below illustrates the display. Assume the receiver is tuned to 6.750 mcs.



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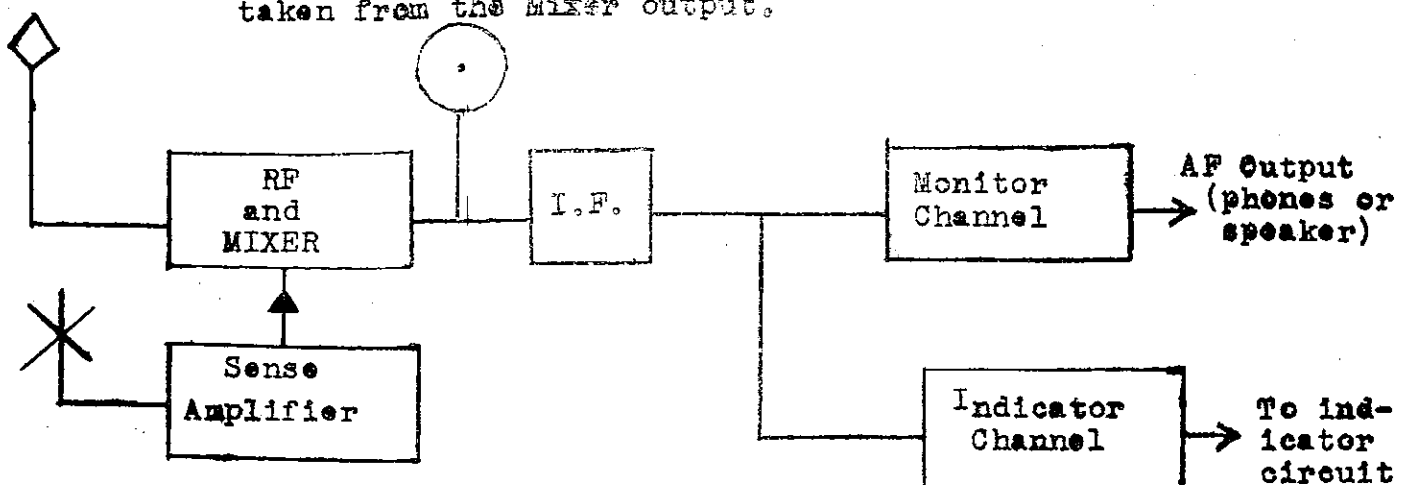
DAU EQUIPMENT continued...)

C. PHYSICAL DESCRIPTION - The DAU EQUIPMENT consists of four main units - Antenna, Receiver, Scan Unit and Indicator Unit.

1. Antenna - The antenna is mounted as high as possible and preferably clear of guy wires, other antennas, etc.,. The other three units are mounted on the rack in the radio cabin.

2. RECEIVER

(a) The receiver is a more or less conventional superhet of the communications variety; consisting of two RF stages; a Mixer and Local Oscillator Stage and a first IF Stage. The circuit then splits into two Channels; a Monitor Channel consisting of a 2nd IF Stage, Detector and BFO, and an AF amplifier; and an Indicator Channel consisting of a 2nd IF stage and a Detector. A third Output, which goes to the Scan circuits, is taken from the Mixer output.



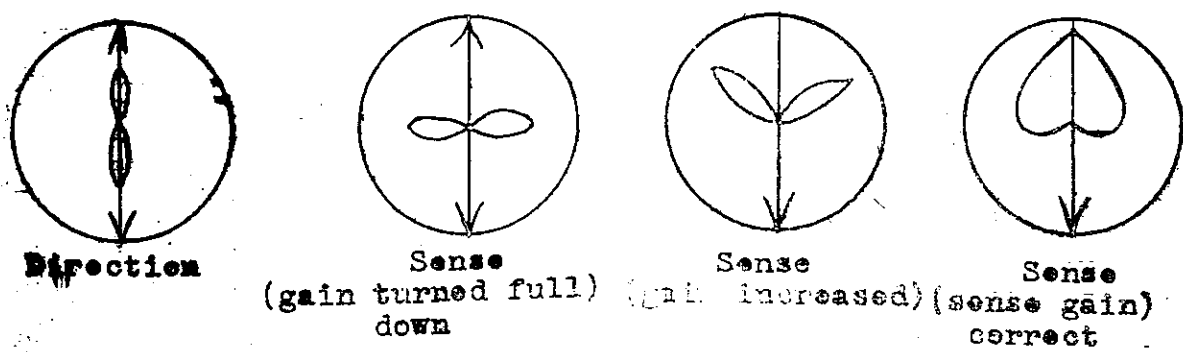
(b) RECEIVER CONTROLS

(i) The uses of the Band Change switch, Tuning Dial, Power Switch, BFO Switch and BFO Adjust are perfectly conventional. The uses of the other controls will be outlined below

(ii) SCAN-DIRECTION-SENSE - This switch controls two relays which determine the type of display obtained on the indicator CRT. In the SCAN position, the tube shows all signals with in a 150 kc band. In the DIRECTION position, the propellor pattern is obtained, and in the SENSE position, the Sense pattern is obtained. The sense position is non-locking, that is the switch must be held in that position as long as the Sense display is required.

(iii) SENSE GAIN - This control varies the gain of the single-stage RF Amplifier which amplifies the output of the sense antenna before mixing it with the output of the loops. The amplifier is not used on Direction, the Sense Gain setting is immaterial in that position. On SCAN: with the Sensitivity control properly adjusted (to be described later), adjust or increase the Sense gain until a slight increase in the noise on the CRT is noted.

NOTE THAT WHEN SWITCHING FROM 'DIRECTION' TO SENSE? THE PROPELLOR SHIFTS 90 Degrees.



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DAU EQUIPMENT continued.....

- (2) (b) (iv) **AF Gain** - This control works on the monitor channel only. It does not affect the crt Trace in any way.
- (v) **SENSITIVITY** /This is the RF Gain control. It is used as follows -
- On direction - with the tuning dial, the desired station is tuned to obtain the narrowest "waist" on the propeller pattern. The sensitivity control is then advanced to the point where the centre of the pattern just closes.
- On scan - with the sense gain tuned down, advance the sensitivity control until noise appears on the trace at the top and bottom.
- On scan - the setting of the sensitivity control used on Direction should be approximately correct. However, if the operation of the sense gain control doesn't produce a satisfactory sense pattern, it may be improved by reducing the sensitivity control setting slightly.

(3) RECTIFIER POWER UNIT

- (a) This unit contains the switches, indicator lamps, and fuses for all circuits except the receiver and the Deflection Amplifier which energizes the rotating deflection coils of the CRT. It has two signal inputs - the Direction and Sense inputs which come from the Indicator output of the Receiver; and the Scan input which comes from the "Scanner" output of the Receiver. The operation of the switches and controls are as follows -
- (b) **MASTER SWITCH** - controls all A.C. power to the equipment including the receiver. Fuses f-201 and f-202 (on left of row of fuses) are in series with the master switch.
- (c) **BEAM SWITCH** - controls the A.C. power to the high voltage rectifier which supplies the voltage needed to produce the CRT spot. Fuse f-203 (third from right) is in series with beam switch.
- (d) **MOTOR SWITCH** - controls A.C. power to the meter, which spins the goniometer search coil and the CRT deflection coils. Fuse f-206 (second from right) is in series with this switch.
- (e) **REMAINING FUSES** - Fuse f-204 (third from left) is in series with the rectifier which produces the H.T. voltage for the deflection amplifier tube and all tubes in the scanner circuit. Fuse f-205 (extreme right) is in the A.C. line carrying power to the receiver. In addition, the receiver itself is fused. The receiver fuses are located in the rear of the receiver chassis.
- (f) **CIRCLE DIAMETER** - This control adjusts the diameter of the CRT trace. It should be adjusted so that the trace lies just inside the azimuth ring around the tube.
- (g) **SCANNER CENTERING** - This control should be adjusted every few hours to ensure that, on scan, a signal precisely at resonance appears at the top of the scan pattern. The signal should first be tuned exactly to resonance on direction (for narrowest propeller pattern), then switched to scan and the control adjusted.

DAU EQUIPMENT - continued....

- C.(3)(h) **MAGNETIC COMPENSATOR** - These two screwdriver controls are used to adjust the CRT Trace by compensating for residual magnetism in the iron cores of the Deflection coils. They are adjustable as follows --
- (i) Turn the sensitivity control full up. The resulting set noise should collapse the trace to a dot or a very small circle.
 - (ii) On Direction, adjust the top control for the smallest circle diameter. Adjust the bottom control so that the circle becomes a dot.
 - (iii) If necessary, go back and forth between the two controls until the best spot is achieved.
 - (iv) Whenever the two sides of the pattern fail to meet exactly at the centre, the magnetic compensator controls should be adjusted

(4) AUTOMATIC BEARING INDICATOR UNIT

- (a) The indicator unit consists of the CRT, its associated rotating deflection coils, the motor and the goniometer. Slip rings and brushes are included on the rotating assembly in order to carry power to and from the Deflection coils. Five controls are present on the Indicator unit. They are -- Horizontal Positioning; Vertical Positioning; Focus, Intensity and Azimuth Lamp. The last is located on the right side of the tube housing, and adjusts the brightness of the Azimuth Scale Lamp.

D. IN THIS SECTION - it will be assumed that the assignment of the Operator is to monitor a frequency range 150 kc/s wide, and to obtain a bearing on any station located in that range.

1. Turn the set on by throwing the Master, Beam and Motor switches on the Rectifier power unit.
2. Turn on the Receiver by throwing the Receiver power switch.
3. Switch to Scan.
4. Adjust the Intensity and Focus controls for a sharp, clear trace, not too bright. Adjust the two positioning controls to centre the trace.
5. Adjust the Circle Diameter and Magnetic Compensator controls as described in C.(3)(f) and C.(3)(h).
6. Adjust the Scanner Centering as described in C.(3)(g).
7. Tune the receiver to the center of the band to be monitored.
8. Adjust the Sensitivity control until noise first appears on the trace, then advance the Sense Gain control until the noise increases slightly.

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- D. 9. When a 'blip' (a signal indication) appears on the Scan trace, tune the signal to resonance by moving it to the top of the Scan trace. This is done with the Receiver tuning dial.

NOTE..The 'blips' on the scan trace will move in the same direction as the tuning dial knob when the tuning knob is rotated.

10. Switch to Direction.
11. Tune the Receiver for the narrowest propeller pattern.
12. Adjust the Sensitivity control to close the centre of the propeller pattern.
13. Move the Cursor over the tips of the propeller.
14. Switch to Sense.
15. Advance the Sense Gain until the ears of the pattern bend together, as described in section C.2.(b)(iii).
16. Read the Azimuth Scale at the end of the Cursor away from the Sense pattern. This is the correct bearing, unless station calibration has shown sense to be reversed on this frequency.
17. Return to Scan; Return receiver tuning to center of band to be monitored and reset Sensitivity and Sense controls.

E. SUMMARY

1. An HF/DF set with a frequency range from 1.5 to 30 mc/s and can be operated as a wide bandwidth search receiver within the above range.
2. Has a bandwidth of 150 kc/s on Scan for operation as a search receiver and provides a visual as well as an aural presentation.
3. Uses a spinning Goniometer in conjunction with a CRT to convert Directional properties of the loop antenna to a visual indication.
4. Four main units - Antenna; Receiver; Scan Unit; Indicator Unit.
5. SCAN/DIRECTION/SENSE Switch -
 - (a) On Scan the set acts as wide band receiver.
 - (b) On Direction a bearing is obtained. (Propeller pattern).
 - (c) On Sense the propeller points shift 90 degrees and when the sense gain is increased a sense bearing is obtained.
6. Accurate ground wave bearings and bearings with low degree of accuracy with sky waves.

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