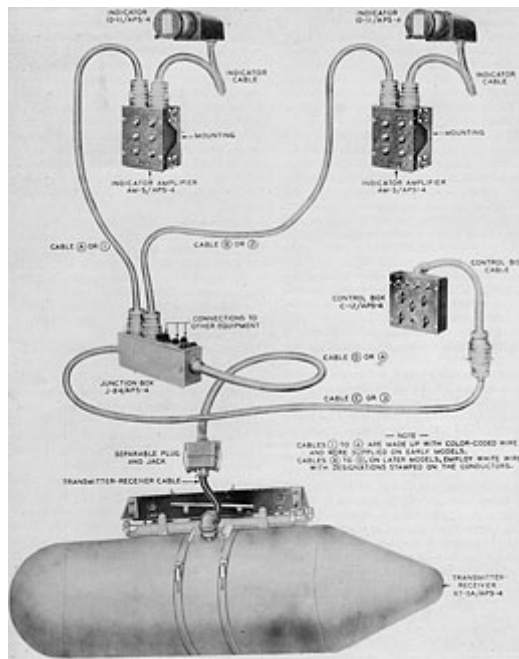


**RÁDAR BULLETIN NO. 2 A
(RADTWO A)
THE TACTICAL USE OF RADAR IN AIRCRAFT
NAVY DEPARTMENT
OFFICE OF THE CHIEF OF NAVAL OPERATIONS**



AN/APS-4

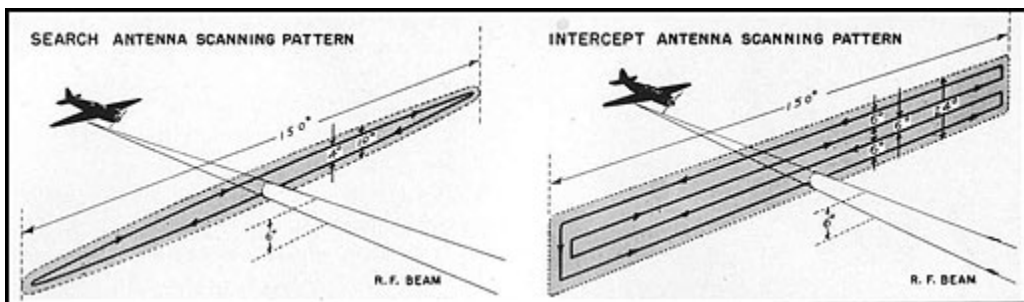


Figure 2-54.--With the APS-4 set for search its antenna executes a two-line scan. When the equipment is set for intercept the scanned area is broadened vertically, the antenna executing a four-line scanning pattern.

AN/APS-4

I. FUNCTION

A. PRIMARY PURPOSE. AN/APS-4 is an airborne X-band radar employed mainly for search. Its simplified construction allows it to be used in almost any type of aircraft.

B. SECONDARY USES. AN/APS-4 contains control and design features which permit its use for aircraft interception. In addition, it can be used for radar navigation, radar beacon homing and radar bombing. When used with appropriate 1W equipment, it will furnish display of identification signals.

II. DESCRIPTION

A. MAIN COMPONENTS. The AN/APS-4 consists of the following pieces of equipment, plus interconnecting cables:

1. Transmitter-receiver.
2. Control box.
3. Indicator (two indicators for multiplace aircraft).
4. Indicator-amplifier (two indicator-amplifiers for multiplace aircraft).
5. Cable junction box.

1. The antenna scanner, transmitter, receiver, and rectifier power supply are mounted in a laired, pressurized bombshell similar to the Mark 17 bomb. This entire unit is supported in a bomb rack for either wing, or under-the-fuse-lage mounting. In an emergency situation during flight where the security of the radar equipment is endangered by the possibility of its falling into enemy possession, the entire bomblike container may be jettisoned.

2. Only the control unit, indicator scopes, indicator amplifiers, and junction box are mounted within the aircraft.

B. ANTENNA SCAN AND SCOPE PRESENTATION. 1. *Beam coverage.--a.* The antenna beam is a 6° cone and may be tilted by manual control from 10° above, to 30° below the longitudinal axis of the aircraft in which it is installed.

b. On search, the 6° conical antenna beam scans through 150° in azimuth and executes a two-line scan, with a 4° nod, to cause the beam to cover 10° in a vertical plane.

C. On intercept, the beam executes a four-line scan, with 6° between lines, to cover a vertical plane of 24°. See figure [2-54](#).



Figure 2-55.--A scope presentation of the APS-4 when set for the 20-mile range. The dark area represents a bay while the light area represents the land on either side. Note the surface ship targets in the convoy proceeding up the bay.

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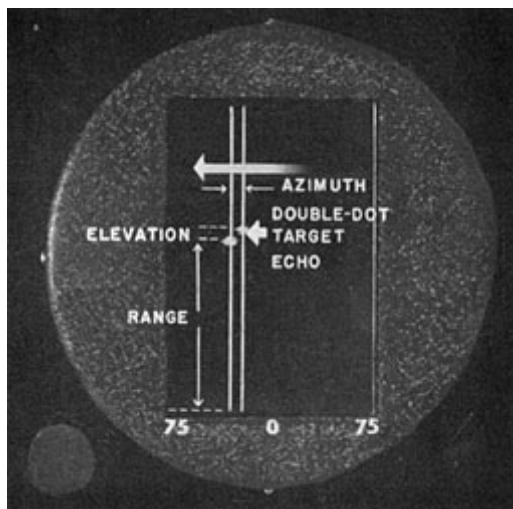


Figure 2-56.--The APS-4, when set for intercept, produces a double, laterally moving trace. An aircraft target is shown as a double dot.

2. *Type of scan.--a. B-scan.--*When set for search, the B-type scan presents target images on a rectangular (3-inch) screen. Single targets are displayed as single spots of light. Land masses, coast lines, islands, etc., are displayed as relatively large patches of light having the general contour of the actual area being scanned. The distortion typical of B-type scans is present in the AN/APS-4 scope display. See figure [2-55](#).

A plexiglass filter located over the face of the indicator cathode-ray tube contains scribed vertical lines at intervals of 25° either side of the zero-degree or lubber line, to assist in judging target bearing. The position of the search aircraft is considered to be at the bottom of the central (zero degree) scribed line.

When set for beacon reception the AN/APS-4 indicators display the range-coded beacon signals to indicate the identity, range, and relative bearing of the beacon transmitter.

b. H-scan.--On intercept, the scope display, figure 2-56, is of the H-type scan. A target within the field of the antenna beam (150° in azimuth and 24° in the vertical plane) will produce an echo which appears on the indicator screen as two dots of light. The left dot is termed the echo pip, the right dot is termed the shadow pip. The position of the echo pip on the screen indicates the target's range and relative bearing. The position of the shadow pip relative to the echo pip shows the target's elevation. The intercept function of AN/APS-4 permits the interceptor aircraft to be maneuvered so as to put the target aircraft dead ahead and in the line of fire.

3. *Range settings.*--AN/APS-4 has four operating ranges which are identical for both search and beacon operation--4, 20, 50, and 100 miles. Range marks, instead of being horizontal lines of light as in other B-type scans, are a series of brilliant light spots which appear only at the extreme right vertical edge of the scope screen each time the antenna scanner reaches the limit of its sweep to the right. See figure 2-57.

Range (nautical miles)	Number of range marks	Range mark interval
4	4	1
20	2	10
50	5	10
100	10	10

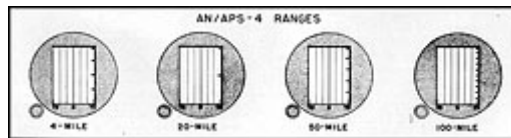


Figure 2-57.--APS-4 has four operating ranges of 4, 20, 50, and 100 miles. The range marks produced by each of the ranges are shown above.

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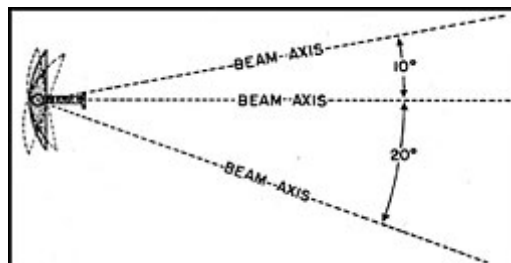


Figure 2-58.--The fill of the APS-4 transmitted beam can be controlled manually from 10° above the horizontal to 20° below the horizontal.

C. SPECIAL FEATURES. 1. *Antenna tilt.*--By means of a control located on the panel of the control box, the antenna reflector may be tilted so as to cause the 6° beam to tilt from 10° above to 20° below the aircraft's line of flight. See figure 2-58. The nodding action of the

antenna is independent of any setting of tilt. In other words, for any setting of antenna tilt, the antenna will execute a two-line, 4° nod on search, and a four-line 6° nod on intercept.

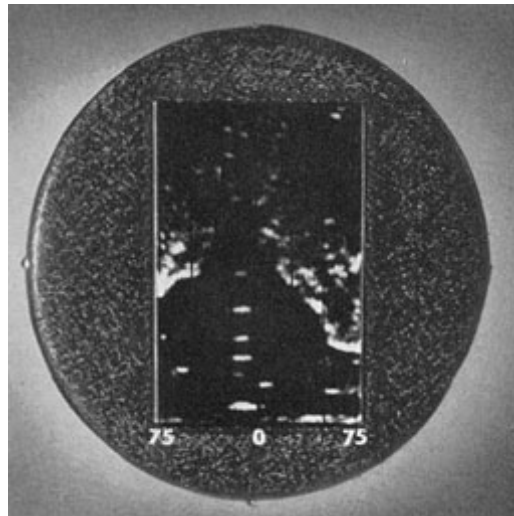


Figure 2-59.--Another view of the convoy proceeding up the bay as shown on the APS-4. Here the antenna has been tilted downward so as to focus the beam on the ship targets. As a result the land mass pattern loses some of its definition.

2. *Warning light.*--A warning light located on the control box may be set so as to flash when a target echo appears on the screen. During those periods when the operator may be unable to devote his entire attention to the indicator screen, the warning light may be set to indicate the presence of targets.

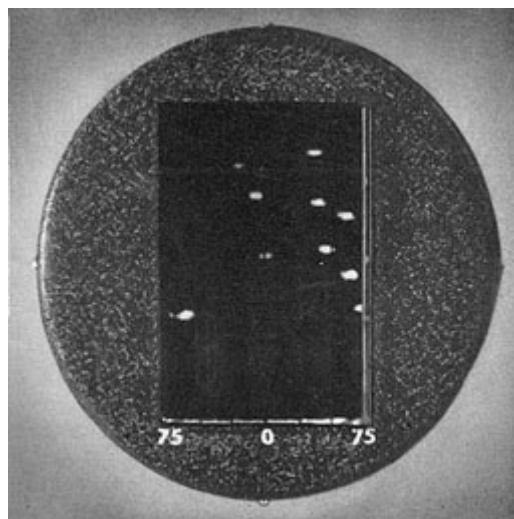


Figure 2-60.--Ships in convoy as seen on the 4-mile range setting of the APS-4.

III. TACTICAL EMPLOYMENT

A. SEARCH; B. NAVIGATION; C. BOMBING. Tactically, the AN/APS-4 may be employed in the same way and for the same purpose as the AN/APS-3 (see p. 55) with the exception that the additional feature of intercept is provided.

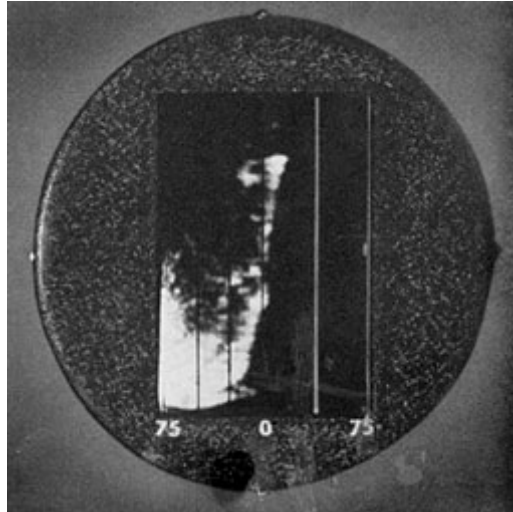


Figure 2-61.--Coast line as it appears on the 20-mile range setting of the APS-4.

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D. INTERCEPT. On intercept, the interceptor aircraft is maneuvered so as to get the target or echo pip on the central (zero-degree) lubber line with the shadow pip horizontally aligned with the echo pip. So long as the target aircraft remains in the field of the antenna beam the target pips will appear, regardless of evasive tactics employed. As the range is closed, both pips will move downward on the screen until visual contact can be made with the target aircraft.

Except under ideal conditions where the target aircraft is retained within the beam scan of 24° in elevation, the intercept feature of AN/ APS-4 is limited in its use and as a rule is never employed for long periods of operation.
