AN/FPS-20Q RADAR

OCEANA NAS

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GENERAL DESCRIPTION

The AN/FPS-20Q radar system installed at Oceana NAS is a high powered, dual channel, long range radar. Both channels utilize a common antenna system. This system is a basic FPS-20A with the following additional equipment: each receiver system has an OA-4527/FPS-87 Canadian Arsenals Dicke Fix receiver, the antenna is an AN/FPS-37 system with a circular/linear polarizer. The entire radar system is housed in an arctic tower with a rigid radome covering the antenna. Total tower height is 75 feet above ground level. The geodesic radome is 55 feet in diameter. Tower latitude is 36 degrees 49 minutes 37 seconds north and longitude 76 degrees 00 minutes 51 seconds west.

Characteristics

Primary power- 3-phase, 60 cycle, 120/208 volts.

Antenna gain- 36db horizontally polarized.

Antenna beam- single, cosecant squared pattern.

Antenna beam width- 1.3degrees horizontal, 60 degrees vertical.

Antenna rotation speeds(RPM)- 3.3, 5, 6.6, 10.

Polarization- horizontal or circular.

Transmitter- L-3035 klystron, liquid cooled.

Frequency range- 1280-1350 MHz.

Pulse repitition frequency- 350 per second.

Pulse repitition time- 2858 microseconds.

Transmitter power-	2.5 megawatts peak maximum	
	2.0 megawatts peak minimum	
	6000 watts average maximum	
	4350 watts average minimum	
Receiver sensitivity-	Normal #1-	-112 dbm
	Normal #2-	-113 dbm
	MTI-	-110 dbm
	Dicke-	-108 dbm
	Log-	-110 dbm
	PIE-	-110 dbm

Radar accuracy- ± 1 nautical mile in range

± 1 degree in azimuth

Target resolution- 1000 yards of each other in slant range.

Range- 231 nautical miles theoretical(350 PRF).

Tower- 1 AB-199A/FPS-3 arctic tower

2 AB-305/FPS arctic tower extension

Radome- CW 396A/GPS rigid geodesic radome.

The AN/FPS-20Q radar system installed at Oceana has many receivers and optional features, most of which are not being utilized. In an attempt to acquaint the user with some of these features, a brief description and function of these items will be explained. The use of the different types of receivers under different conditions (refraction, weather, jamming) together with some suggestions as to their use will be discussed below.

I Major Optional Features

A- Polarization Selection: Circular or Linear (Horizontal) may be selected. Linear is the normal mode of operation. This causes the transmitted radar beam wavefront to be in the horizontal plane.

Circular polarization causes the wavefront to continuously change its plane of reference. Circular polarization helps reduce the effects of weather as seen on the PPI scopes. Linear or circular polarization is selected by radar maintenance personnel.

B- Preamplifier Automatic Gain Control (PreAmp AGC)

This selectable feature will automatically control the gain of the receiver preamplifier and as a result, controls the gain of all the radar receivers. The preamp AGC system may be used to counteract noise jamming as seen on the PPI scopes. This feature is selected by radar maintenance personnel.

II Receiver System

Receivers and Videos available to Operations:

Normal Receiver Video	in use
Normal Integrated Video	not used
MTI Receiver Video	in use
Dicke-Fix Receiver Video	not used
LOG Receiver Video	not used
PIE Receiver Video	not used

a- Functions

Normal Receiver- presents in video form to the PPI scopes all radar returns: ground clutter, aircraft, ships, weather, effects of uncancelled ground clutter residue close in to the radar site. Some strong ground clutter returns may not cancel in the MTI receiver and may be presented as moving targets.

III When all of the radar videos become available to operations personnel, the options available at the PPI scopes will be greatly increased. LOG video for example is the most effective against heavy weather returns. Normal Integrated video will enhance weak target returns. Other radar receivers should be used in the presence of jamming. (Covered in detail in section IV). It is hoped that a greater understanding of the capabilities of the Oceana radar will give the operator enough knowledge as to the use of the different radar options in adverse conditions (weather, jamming).

IV Jamming Environment

Jamming of accidental or unintentional origin may result from malfunctioning of the radar equipment, natural atmospheric conditions, or interference from nearby radar sets. Malicious jamming (jamming of intentional origin) results from RF signals directed at the radar set by near-by low-powered radio frequency jammers or distant high-powered RF jammers. The purpose of malicious jamming is to obscure targets or to cause false targets to appear on the PPI scopes so that the operator will be unable to detect aircraft. Jamming and measures taken against jamming come under what has been called ECM/ECCM.

ECM- Electronic Counter Measure. May be defined as a measure taken to counter the effectiveness of electronic devices - in our case, the AN/FPS-20Q radar.

ECCM- Electronic Counter Counter Measures. May be defined as measures taken to counter the effectiveness of ECM.

a- AN/FPS-20Q ECCM

This radar set has a number of different ECCM features. These features can be separated into two groups - Active and Passive.

Elimination- The performance of the LOG receiving system against CW jamming is shown in Figure 9. Although the gain of the LOG receiver is reduced by the CW jamming, the receiver does not saturate its output and many targets are still visible.

6- Clutter

Recognition- several types of clutter may have the characteristics of noise. Some of these are sea, rain cloud, snow cloud, and condensation clutter. The PPI range in Figures 10 and 11 is 50 miles. As shown in Figure 10, MTI has little effect against certain weather conditions.

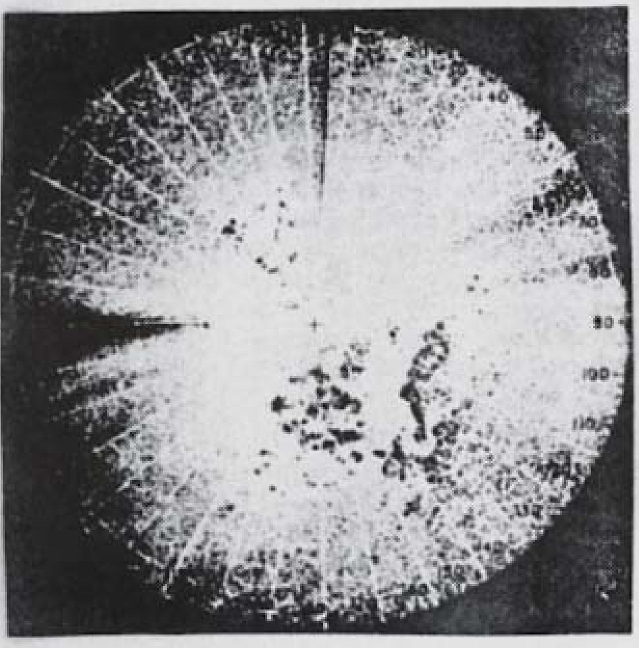


Figure 10

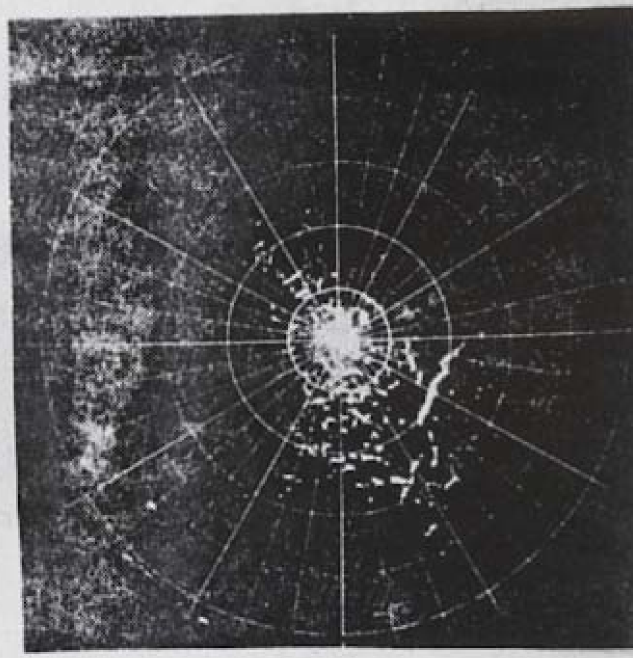
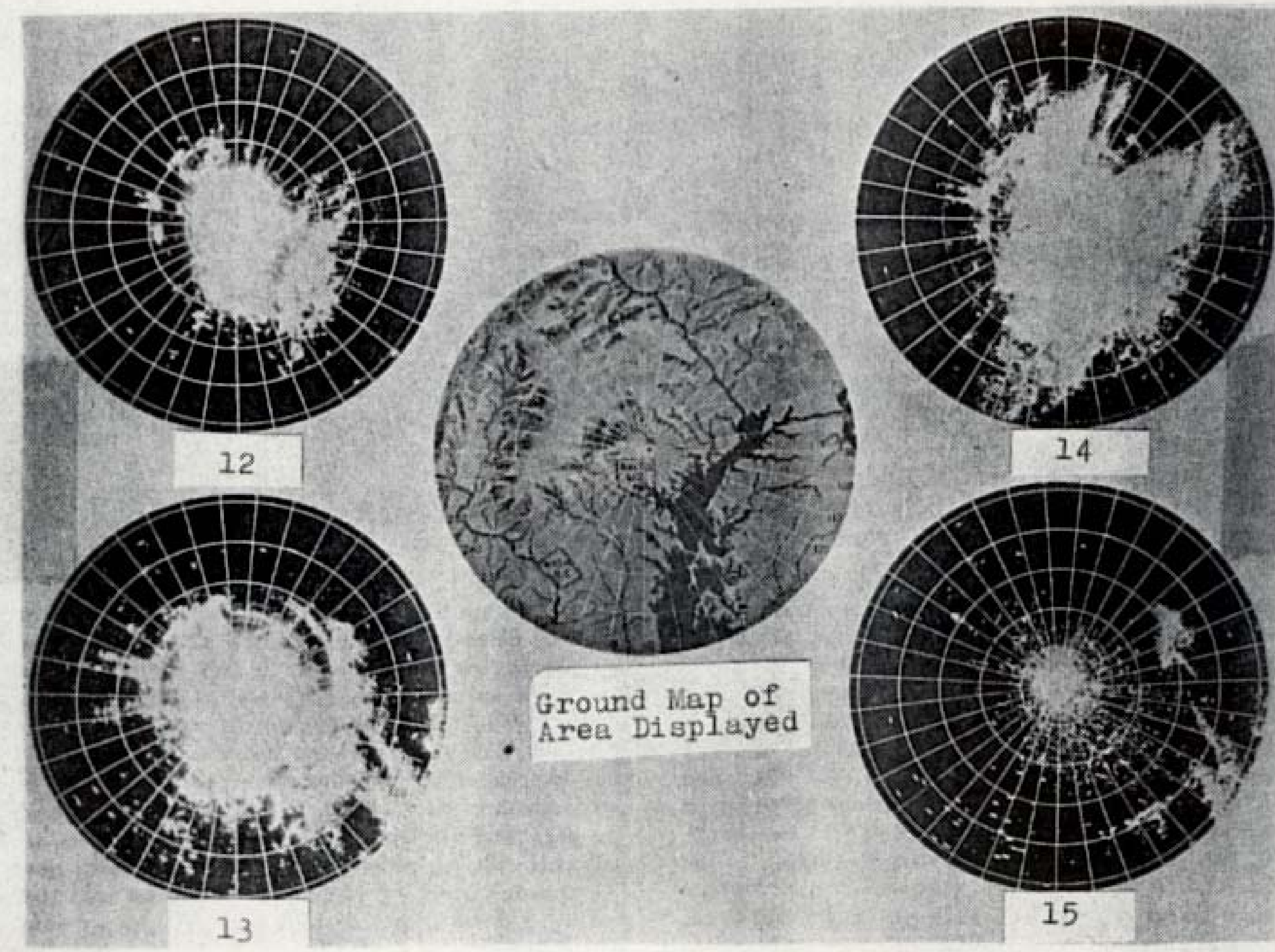


Figure 11

Elimination- The performance of the LOG receiving system is much better (Figure 11). Virtually all noise is eliminated and the ground clutter is broken up by the FTC circuitry, allowing the individual targets to be viewed.

Other weather presentations are presented in Figures 12 thru 15.



GLOSSARY

MTI - a radar receiver which cancells fixed targets and presents on the PPI video containing moving targets only. (Moving Target Indicator)

RF - Radio Frequency.

IF - Intermediate Frequency. Usually the receiver frequency.

AGC - Automatic Gain Control.

FTC - Fast Time Constant.

PPI - Plan Position Indicator.

RAPPI - Random Access PPI.

PIE - Pulse Interference Eliminator. A radar receiver.

CW - Continuous Wave.

MHz - Megahertz. One million cycles.

KHz - Kilohertz. One thousand cycles.

FM - Frequency Modulation.

ECM - Electronic Counter Measure.

ECCM - Electronic Counter Counter Measure.

RADAR - RAdio Detection And Ranging.

PRF - Pulse Recurrence Frequency.

PRT - Pulse Recurrence Time.

dbm - decibels below one milliwatt. Indicates the sensitivity of the radar receiver.

Dicke-Fix - A radar receiver with special ECCM characteristics.

Quick-Fix - A receiving system containing the LOG and PIE receivers. Each having different ECCM characteristics.