For Network Personnel Only

TECHNICAL INFORMATION BULLETIN

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New Site Gets New Radar

Installation of a new precision tracking radar—the RCA-developed FPQ-6—is scheduled to begin at the Carnarvon, Western Australia site this fall to support Gemini and other NASA programs. This C-band radar is capable of providing continuous spherical coordinate information on appropriate targets at ranges out to 32,000 nautical miles with a range accuracy of ±2 yards. As a comparison, the FPS-16 tracks to 500 miles with an accuracy of 5 yards. (The FPS-16 can be modified to track to 5000 miles.) The FPQ-6 is capable of acquiring and accurately tracking space vehicles (with or without beacon transmitters) and providing trajectory data in real time.

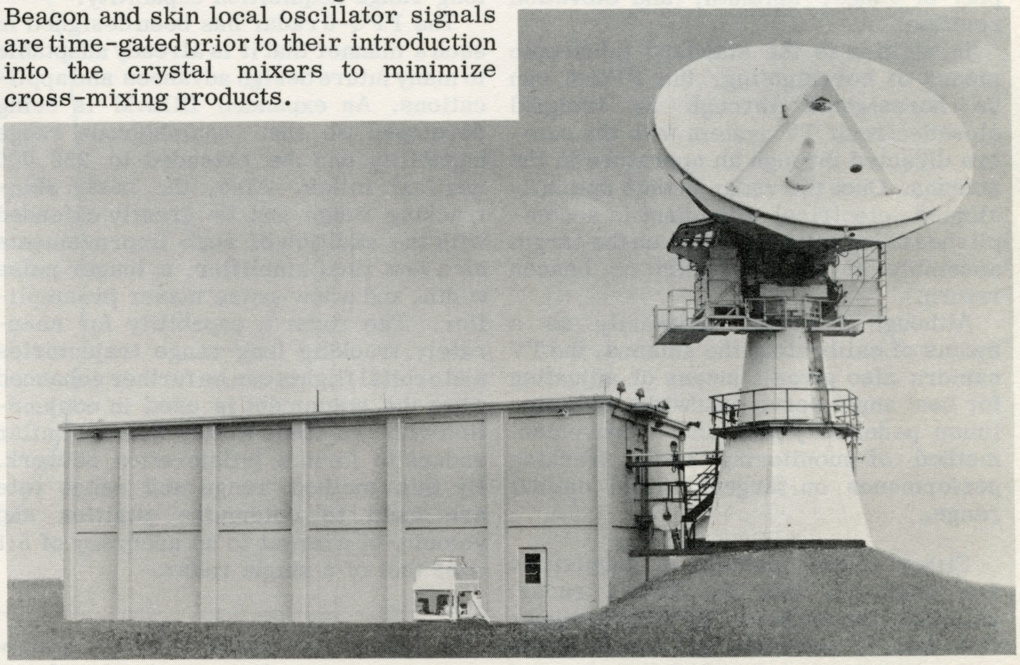
The radar employs a 2.8-megawatt peak power (4.8 KW average), broadbanded (5400 to 5900 MC) transmitter with frequency stability of 1 part in 10^8. The 29-foot diameter antenna dish uses a Cassegrainian feed and has a 51 DB gain with a 0.4-degree beamwidth. Its monopulse, 5-horn feed system permits the reference and error antenna patterns to have their gains independently established as well as the slope of the error patterns optimized while supplying target return signals to the receiving system with a minimum of feed insertion loss. This design has advantages over conventional monopulse feeds and reduces the possibility of sidelobe lock-on. The three-channel signal outputs of the antenna feed system are supplied directly to the receiving system without undergoing any additional, loss-inducing, signal manipulation. The three-channel monopulse receiving system has its bandwidths optimized for the specified pulse widths of 0.5, 0.75, 1.0, and 2.4 microseconds, and the receiver noise figure of 7.5 DB has been improved to 3.5 DB through the addition of closed-cycle, parametric RF amplifiers.

The combination of RF power programming, bypassing the parametric amplifiers, and receiver IF AGC ensures a signal dynamic range in excess of 120 DB. The receiving system provides simultaneous presentation of the skin and beacon returns to the console operator so that skin track can be used in the event that the beacon signal is lost. Beacon and skin local oscillator signals are time-gated prior to their introduction into the crystal mixers to minimize cross-mixing products.

The antenna pedestal is a high-precision, two-axis mount that uses a hydrostatic bearing in azimuth and phased roller bearings in elevation to provide mobility and support to the counter-balanced, solid-surface antenna system. The antenna is positioned through anti-backlash dual-drive pedestal gearing, via a high torque-to-inertia electrohydraulic valve motor system. An important design criterion of the system is structural stiffness to realize the attainment of the widest possible servo bandwidth. A viscous coupler (similar to the FPS-16) located between the valve motor and the pedestal drive gearing damps out undesired mechanical resonances.

A two-story building houses the electronic and auxiliary equipment. The first floor contains the equipment load center; data input junction box; air conditioning systems; transmitter heat exchanger controls, tank, and filter (the heat exchanger is located outside the building); and ancillary equipment. Space is available for future expansion.

The second floor holds the eight banks of equipment racks, the console, and the



FPQ-6 HAS TRACKING POTENTIAL FOR LUNAR RANGES . . . .
The FPQ-6 precision tracker for advanced space missions is going into service at Carnarvon. With three million watts peak power, it can now track spacecraft to 32,000 miles, and with slight modification could track targets to the moon.

CQ

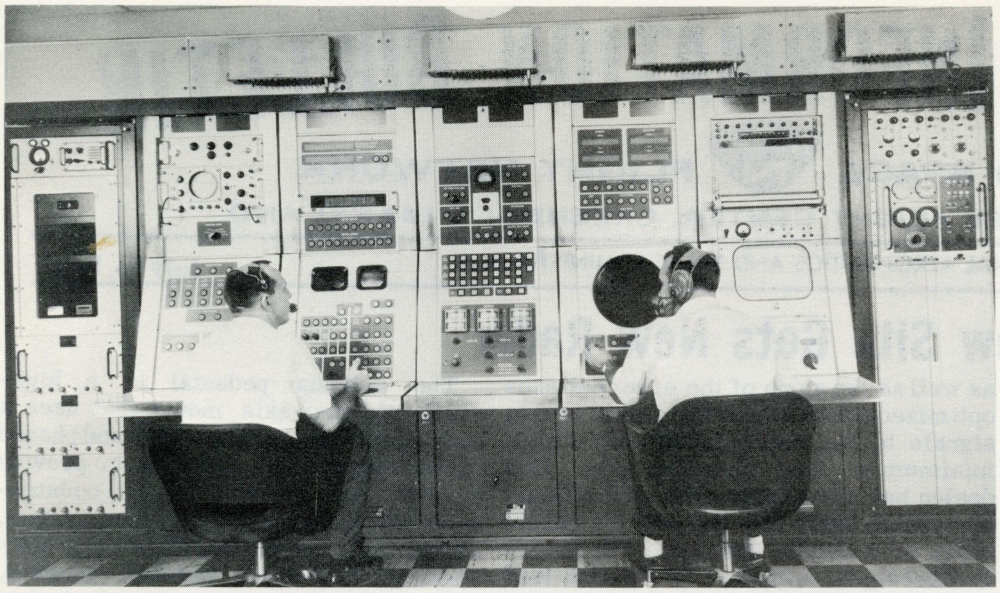
TIB suggested in its June 14th issue that those amateur radio operators who wished to establish contact with fellow operators at other sites send appropriate information to TIB. The following operators have responded so far:

XE2EX — Rafael
Guaymas, Sonora, Mexico
15, 20, and 40 meters; AM
Mon. thru Fri.: 0100Z to 0500Z
Sun.: 1700Z to 2400Z

VP5BB — Bert
Grand Turk Island, BWI
10 and 15 meters; phone
Mon. thru Sun.: after 2130Z

W3AAE — Jim
Mt. Rainier, Maryland, U.S.A.
2 and 6 meters during summer
After 2300Z (when skip is on)

If response continues, pertinent information will be published in this new column, CQ.



NEW TRACKING RADAR CONSOLE CAN BE OPERATED BY TWO MEN..........
Ease of operation is a feature of the FPQ-6 monopulse tracking radar, developed by RCA Missile and Surface Radar Division.

3-megawatt transmitter. Equipment units dealing with related functions are kept together, wherever possible, to reduce the number of interconnecting cables and to simplify servicing procedures.

The FPQ-6 is the only operational radar with a self-contained general purpose digital computer (RCA FC-4101). Its primary purpose is to correct dynamic lag in the angular output data. The computer corrects for errors in range rate and for static errors such as out-of-level (precluding the need for a leveling arrangement on pedestal), mechanical warp, null shift, and droop. It also provides conversion for direct decimal display of range, azimuth, and elevation position.

In addition to the standard telescopic means of boresighting, the FPQ-6 can be boresighted through an integral closed-circuit TV system with the camera directed through an aperature in the antenna. Once the radar is thus optically aligned, electrical alignment is accomplished using a transponder on the target assembly to simulate skin or beacon return.

Although installed primarily as a means of calibrating the antenna, the TV camera also gives a means of adjusting for best angle servo bandwidth and minimum pedestal jitter, and a convenient method of monitoring radar tracking performance on targets within optical range.

Either of two methods of acquisition are employed with the FPQ-6 radar: automatic target detection when designation data is available and the target is within 10,000 yards of the designated range, or manual lock-on when designation information is not available. As an example of the acquisition effectiveness of this equipment, the automatic tracking unit is said to have a 99.5% probability of locking-on in 0.2 seconds with a target providing a S/N ratio of 10 DB or greater.

The digital range machine (DIRAM)—which uses all electronic, transistorized modules with high density packaging—is capable of measuring range unambiguously to 32,000 miles. It is an extended-range version of the range unit (5,000 nautical miles) employed in later models of the FPS-16. The extended range of the DIRAM is due to its utilization of the Nth-time-round measuring technique that enables operation at a high PRF, which, in turn, ensures high performance and long-range acquisition capability.

The FPQ-6 radar has been designed in such a manner that it is already adaptable to many future design advances and applications. An expanded DIRAM is being developed so that unambiguous range capability can be extended to 256,000 nautical miles. Also, the basic skin-tracking range can be greatly extended with the addition of such improvements as a new final amplifier, a longer pulse width, and a low-noise maser preamplifier. The radar's capability for accurately tracking long-range trajectories and orbital flights can be further enhanced when the equipment is used in conjunction with two other widely spaced similar radars to form a trilateration network. By this method, range and range rate are used to determine position and velocity of a target to an accuracy of 5:1 over that of a single radar.

Revised Index of Manuals Being Published

The equipment documentation group in the Network Operations Branch at GSFC report they are now completing issue 3 of Index of MSFN Instruction Manuals and expect to have it printed and distributed within a few days. The new issue, besides being up to date as of this week, will differ from the last previous issue in that it will have an added section to show the sites to which each manual applies. Altogether, the new issue will comprise three parts:

- Numerical Listing — gives control number, title, equipment manufacturer, and dates of changes.
- Alphabetical Listing — gives all the manuals in alphabetical order of the equipment manufacturer's name.
- Site Applicability — shows sites to which each manual applies.

With the publication of this issue of the index, the network sites will have for the first time a convenient means of verifying that they have copies of all applicable manuals and that each manual on site has the latest revisions in it.

Site personnel and other users of MSFN manuals should find the index very helpful in maintaining their libraries and files in an up-to-date condition.

About Documentation

During the past 2 weeks, revisions to the following manuals were completed and distributed to applicable sites:

ME-104 X-Y Recorder Model 3010, Revision June 28, 1963

ME-105 P/C Coordinate Converter Model 4004, Revision June 24, 1963

ME-130 Sanborn Recorder Assembly, Revision June 28, 1963

ME-239 Verlort Radar System Pacific Missile Range Mod Kit, Revision July 1, 1963

ME-706 Dual-Diversity Receiver Terminal DDR-6E, Revision July 1, 1963.

ME-1005 Single and Dual Bandwidth IFM Demodulators Modules, Revision July 15, 1963

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