For Network Personnel Only K Lee

TECHNICAL INFORMATION BULLETIN

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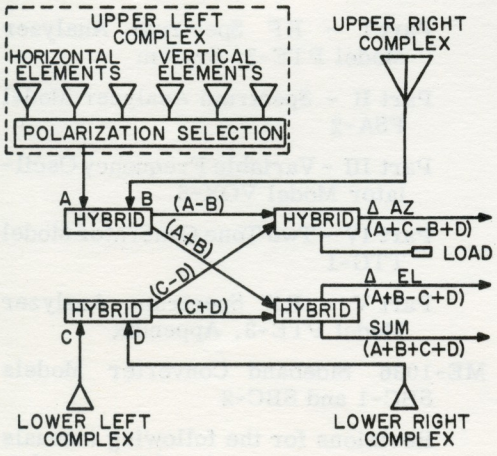
First Gemini Acq Aid System Completed

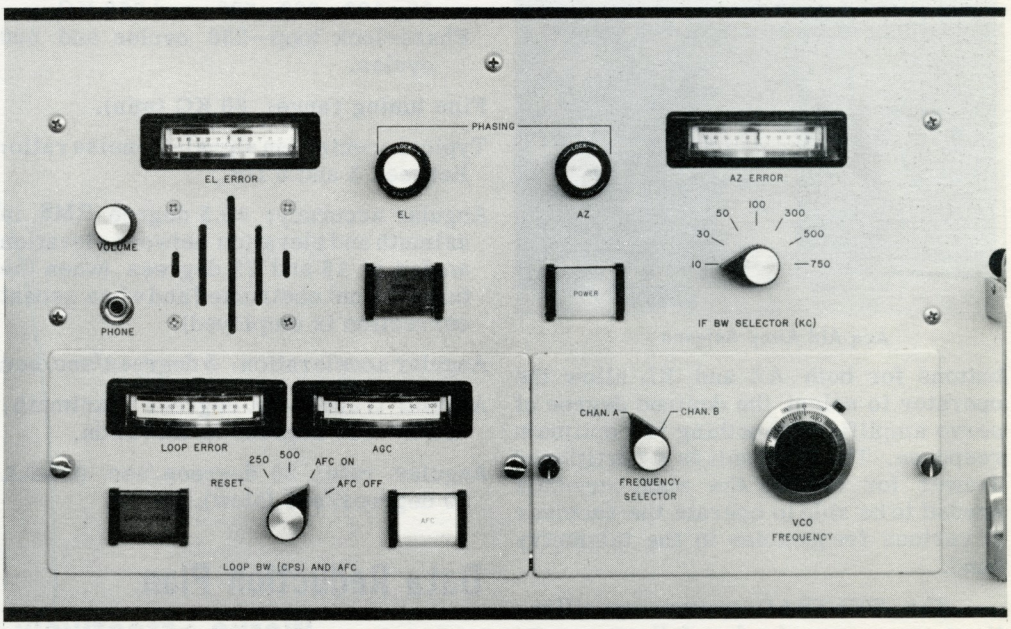
The first of eight Gemini acquisition aid systems is being shipped today from the subcontractor, Canoga Electronics Corporation, Van Nuys, California, to the staging area for later transshipment to Carnarvon. TELTRAC, which is Canoga's nomenclature for the new acq aid, has the following new features that will provide smoother and more accurate tracking than the Mercury AGAVE system: antenna polarization selection, improved hybrids, receiver using phase-lock or cross-correlation modes of detection, wide-band crystal-controlled frequency selection, fine tuning control, and manual smoothing of the servo system for pointing the antenna in elevation and azimuth.



Simplified Block Diagram of Antenna Subsystem

The antenna system (see antenna diagram) uses an 18-element crossed-dipole array antenna (see photo). With this system, vertical, horizontal, or circular polarization can be selected. Side lobes are down more than 18 DB, which will alleviate much of the previous multipath problem in locating the elevation of the spacecraft. As in the previous acq aid, this antenna system provides siganls corresponding to AZ and EL errors, and a sum output for use as a reference signal.

To reduce losses in the RF cables, the RF frequency of the telemetry signal is converted at the pedestal to a 40-MC IF signal and amplified before being sent to the receiver in the main TELTRAC cabinets. In each of three channels in the Teledyne receiver, the signals are amplified in a broadband IF amplifier and then mixed with the voltage-controlled oscillator output to produce a 4.5-MC second IF. The signals are further amplified in a broadband second IF amplifier.

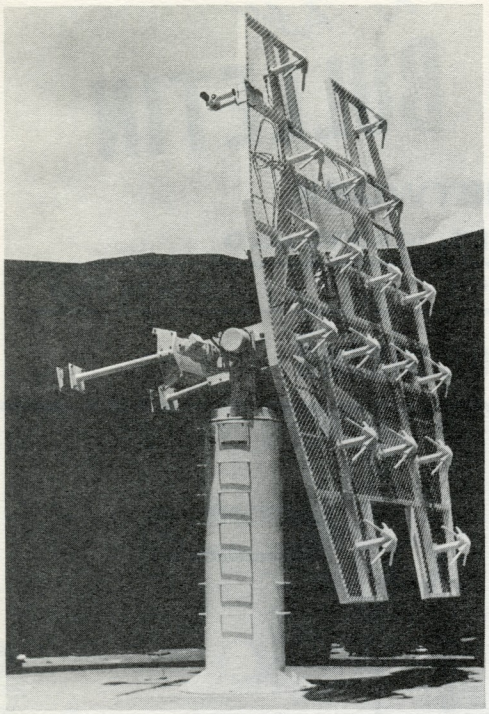


Front Panel of Receiver

In two channels for AZ and EL pointing, IF difference signals are applied to error phase detectors. The servo system scaling factors for the AZ and EL pointing error voltages are set correctly in DC amplifiers. A drive motor positions the antenna towards the direction which produces a null error voltage.

In the third channel, signal frequency is determined with the receiver in the phase-lock mode and bandwidth in the cross-correlation mode. The bandwidth is determined so that the receiver can be adjusted for optimum selectivity. This setting is accomplished by inserting the appropriate IF filter (selected by a panel switch) in the phase-detection loop. The signal frequency is tracked for the purpose of locking the receiver onto carrier frequencies within the 225 to 260-MC band. The same phase detectors are used for either mode of operation, for either a band of frequencies or a single frequency. The reference input for cross-correlation action is the sum signal after it is passed through a limiter, whereas the input for phase-lock action is the 4.5-MC oscillator. Receiver AGC voltage is obtained from a detector and fed back to an earlier stage, and is monitored by an indicator on the front panel. (See picture of receiver panel.)

The antenna, pedestal, and two cabinets (shown in photos) make up the system. The top of the left cabinet contains a panalyzor. Directly under the panalyzor (not shown) will be an acquisition bus control panel. The lowest unit (shown extended) on the left-hand rack is an output converter which furnishes antenna position data in digital form. Additional operating controls are located in the right-hand rack. The top two units contain servo amplifiers and amplidyne controls. The third unit down houses the receiver previously described. Below the receiver are manual antenna controls and antenna position indicators. Plunging or over-the-top elevation operation is possible from -10 to +190 degrees. Four indicators provide coarse and fine EL and AZ information. The fifth panel (shown extended) contains the manual, slave, and auto track buttons. Manual or slave control is provided independently for AZ or EL, and three auto track



Acq Aid Array Antenna

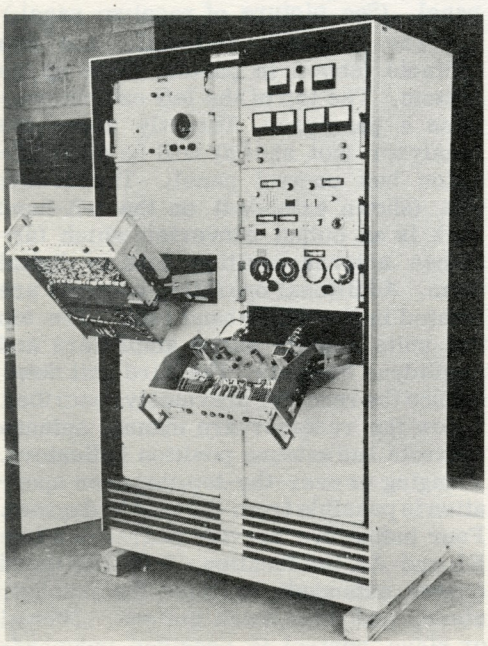
buttons for both AZ and EL allow the operator to select the desired degree of servo amplifier smoothing for optimum response. The sixth unit is a partitioned drawer for storing the many crystals needed to be able to operate the receiver at various frequencies in the telemetry band.

The TELTRAC system specifications are summarized as follows:

Frequency range: 225 - 260 MC, tracking. 280 - 300 MC, voice.

Polarization: Right- or left-hand circular, and linear vertical or horizontal.

Sum channel antenna gain: 18 DB (min).



Acq Aid Rack Equipment

Antenna system outputs: Sum and difference (based on phase sensitive monopulse techniques) for azimuth and elevation errors.

Beamwidth at 3-DB points: approximately 18 degrees AZ, 12 degrees EL.

Side lobes: -16 DB (min) with respect to main lobe in all planes and -18 in principle planes.

Receiver noise figure: 4.5 DB (max).

Acquisition noise bandwidth:
Cross correlation—Switchable 10, 30, 50, 100, 300, 500, and 750 KC.
Phase-lock loop—250 cycles and 500 cycles.

Fine tuning range: 80 KC (min).

Typical acquisition signal-to-noise ratio: Between 3 and 6 DB.

Angular accuracy: ±0.5 degree RMS in azimuth and elevation between elevation angles of 15 and 75 degrees (when the target is not obstructed and when secant correction is employed).

Angular acceleration: 5 degrees/sec/sec.

Angular travel: 700 degrees in azimuth, -10 to +190 degrees in elevation.

Angular rate: 20 degrees/sec (track). 30 degrees/sec (slew).

Data Reduction Plan Works Effectively

Emerging from the details of the postmission analysis of MA-9 network performance are several points concerning the new Network Data Reduction (NDR) plan:

- MSFSD is very much satisfied with the results of the plan and the cooperation received from the sites and from most of the various supporting agencies.
- The Cape data office reported that data records were received in much better condition since the sites began using mailing tubes. A considerable number of mailing tubes have been salvaged and returned for re-use.
- The MSFSD data section will begin revising the NDR for the purpose of reducing the work load at the site and increasing the efficiency of the NDR. At the same time, PLIMS will be reviewed and revised to be more compatible with the NDR.
- A list of standard terminology is being compiled and will be submitted for approval and adoption when completed. The sites will be asked to review and comment on this list before it is submitted.

Timing System Battery Power Increased

It has been suggested that it would be very desirable to have a longer operational capability for the time standard rack when on emergency battery power. To carry out this recommendation, a 12-volt battery with a 200-ampere-hour capacity (increasing the emergency power capability from the present 3 hours to about 20 hours) will be issued when requests for two 6-volt batteries are received. (The 12-volt batteries are not to be ordered unless the 6-volt's require replacement.) A new mounting bracket will be designed and sent out as an EI.

About Documentation

The following new manuals were forwarded to applicable sites during the month of June:

ME-1033 Slow-Scan Monitors Models CSS-5 and CSS-6

ME-1034 Slow-Scan TV to Standard TV Scan Converter Model ED602

ME-1035 RF Spectrum Analyzer Model PTE-3

Part I - RF Spectrum Analyzer Model PTE-3, System

Part II - Spectrum Analyzer Model FSA-2

Part III - Variable Frequency Oscillator Model VOX-5

Part IV - Two Tone Generator Model TTG-1

Part V - RF Spectrum Analyzer Model PTE-3, Appendix

ME-1036 Sideband Converter Models SBC-1 and SBC-2

Revisions for the following manuals are now in process and will be issued in the near future:

ME-131 Voice and Telemetry Antenna System and Voice and Command Antenna System

ME-340 Cardioscope and Cardiophone

ME-706 Dual-Diversity Receiver Terminal DDR-6E

MS-104 Timing System

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