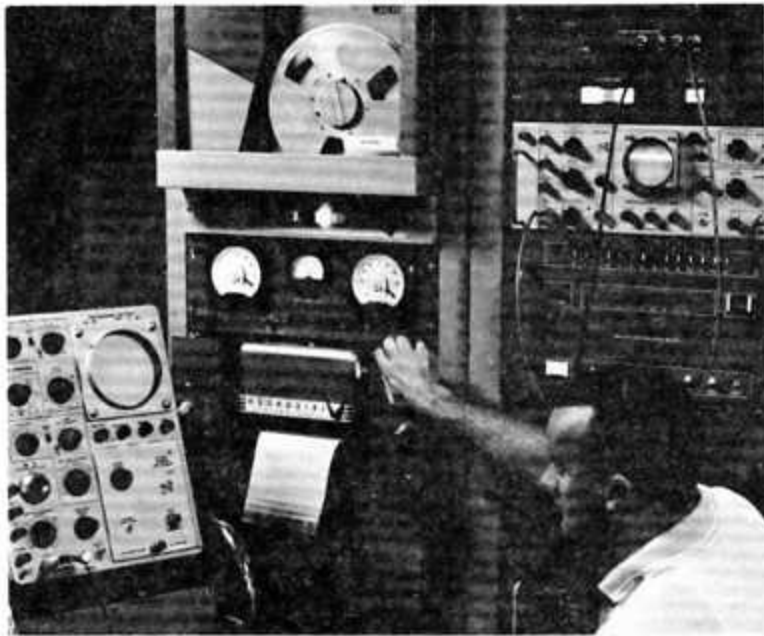


1962



Technician Paul Karreck operates an altimeter surface station on the ship Twin Falls Victory

1963



Graham Walker at the telemetry control console of the General Arnold.



Manning the radar console on the General Arnold are (left to right) Charles Demming, Charles Whitetree and James Fennell.

1963



ABOVE — ARIS I Ship's Instrumentation Manager (SIM) Samuel L. Candler is shown working at the radar console during a test. BELOW — Don L. Ely, ARIS II SIM, checks the target trajectory plotter. Candler and Ely head up RCA personnel aboard the two ARIS vessels.



Ernie Gagne (foreground) and Don Crawford.



Meal time on the General Vandenberg.

1965

Coastal Crusader & Sword Knot



Charlie Brown, Dix Compton at communications console.



Terry Hood (standing), Bill Cooksey in receiving room.



Dwight A. Collier with the Redstone in the background.

1967

Reunion At Alameda

The USNS Arnold joins the Vandenberg at dockside, the first meeting of the two ships in almost three years. Exchanging greetings from the rails, (in photo below) are MTP crew members.



Twin Falls

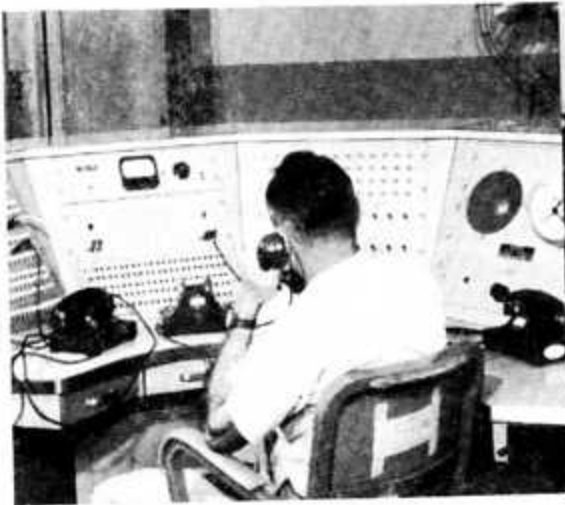
MTP technicians stand by to support a Polaris test. Chief Technician, Henry Janicki (center), checks out telemetry receivers. Technicians Dan Chapman (left) and Henry Bishop follow countdown

Communications

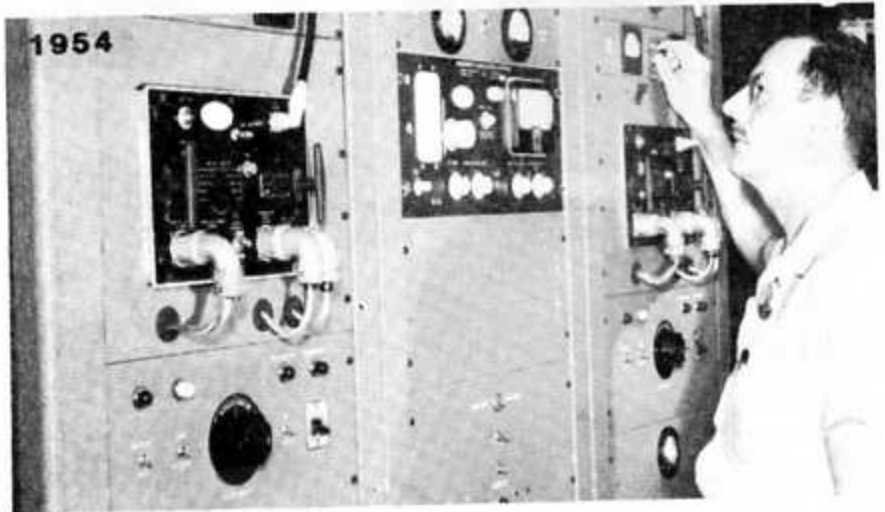
In 1919, when the original charter of the Radio Corporation of America was adopted, the document stressed the company's emphasis on communications.

Today that fulfillment of the original charter is nowhere better exemplified than at Cape Canaveral and the Eastern Test Range.

In 1953, with only a few personnel, RCA assumed responsibility for operating and maintaining communications on the Atlantic Missile Range. Contact between Cape Canaveral and the only downrange station at GBI was solely dependent upon high frequency radio. A green phone system was in operation, but the submarine cable, MOPS system, HF sideband and VHF/UHF were to come later with RCA providing the engineering and expertise that made them possible.



MONITORING AND NET CONTROL CONSOLE



VHF GROUND RADIO EQUIPMENT for missile destruction and control.

The lifeline of the Range is its extensive and complex communications system. This system ranges from a 5000 line automatic dial telephone system at Cape Canaveral to a complex intercommunication network comprising over 4000 stations.

Downrange, as far as Antigua, the backbone of communications is the submarine cable system. This cable network between tracking stations provides multiple voice channels as well as channels for transmission of teletype, tracking and timing data. Ground/air and shore/ship contact is provided from each station over high-frequency, very-high-frequency and ultra-high-frequency radio systems. Ten 45-kilowatt single-sideband terminals, utilizing high-gain rhombic antennas, provide highly reliable communications over the long hops to Antigua and Ascension.

An extensive interstation communications network connects each range station with each other and the outside world. A high degree of flexibility and reliability is achieved by using undersea cable, high frequency and microwave radio, communications satellites and various landline links.

RCA communications personnel maintain and provide a net control for all stations during operations, guard designated frequencies, operate a central tape recording system that can record 100 channels for up to 24 hours, provide on-site technical support during missile tests and operate a 24 hour comm center that provides continuous teletype and cryptographic communications by submarine cable and radio to all range stations and other selected agencies.

Today, point-to-point radio links between major stations primarily use the 45-kW transmitters and antennas. The tri-nested rhombic antennas are designed for directional radiation in specific frequency bands and fixed in azimuth. Line-of-sight uhf and vhf radio is normally used in ground-to-air, air-to-air, air-to-ground, ship-to-air, and air-to-ship communication. Transmissions normally consist of administrative/operational test support coordination, using simplex voice channels. Transmissions are either unified S-band (2200-2300 MHz) or vhf. The vhf capability is simplex up- or down-link using one AN/ARC-34, 100-W transceiver and four vhf crossed-dipoles mounted in the telemetry dome. For unmanned launch operations, uhf, vhf, or hf is used. Ships can be configured to obtain secure communications. For manned launch operations, the unified S-band system is also used. Low-power hf single sideband transceivers are located at each station for contingency communications during disasters such as hurricanes.

The USNS Redstone and CCAFS have installed WSC-3 UHF satellite terminals, used in conjunction with the WSC-3 terminal installed aboard the USNS Range Sentinel and at Norfolk.

The Range's Ascension Island station is equipped with an AN/GSC-39 Defense Satellite Communications System satellite terminal. The CONUS end of the satellite circuit terminates at Northwest, near Norfolk. Four voice plus two data circuits are extended by landline to CCAFS.

CCAFS is the communications focal point for all Range circuits, Range User nets, and domestic commercial carrier interconnect to all other Government agencies. Antigua is the nodal point for the Caribbean area. Ascension is the net control station for ship and aircraft operations in the Atlantic, Africa, and Indian Ocean areas. Antigua and Ascension have complete manual and semiautomatic Range communication control center capabilities. One digital microwave system interconnects CCAFS and PAFB with 504 voice channels; 120 channels of the 504 are extended from CCAFS to Malabar and there are 72 channels between Malabar and CCAFS. Audio recorders at CCAFS and downrange stations record selected voice channels during operation support. CCAFS can now record 160 voice channels simultaneously at 15 to 16 inches/second. The Digital Network Switch (DNS) located at CCAFS provides a store and forward processing capability. Several intercommunications systems extend through the mainland and downrange instrumentation and operational control sites. The primary systems are the Green Phone and the Transistorized Operations Phone System (TOPS). The Green Phone system is a direct line ringdown system that allows rapid communication between instrumentation supervisors (or Range Users) and operating personnel.



A. H. McDowell (standing), Leader, Cape Canaveral Communications Center, observes teletype operators C. E. Park, E. H. Conz, and W. M. Johnson as they send messages to down range areas.

1961



Range station wire technicians W. L. Andrus (left) and G. R. Wisman splice cable at the Cape Canaveral North Terminal Cable Building.



John Blalock (left) and Billy Morefield



John T. McCabe
Cape Wire Communications



Cecil Nelin (foreground), RCA's Communications Manager at San Sal makes an entry in the log during an operation as N. C. Tucker, Manager of RCA Instrumentation, leans forward to watch the missile's progress



MTP's electronic shops are also constructing some of the equipment that will be used on Gemini. Here technician M. D. Hernandez assembles a Gemini communications switching panel. Looking on is Al Waits, who designed the device, of Communications Engineering.



Bill Seay



John Varn, Arthur Hensley, Joe Falgione, Larry Mims in Cape Center



Patrick Leader Melba Backus



Gene Smith mans Osborne console.



Technicians at their stations in Transmitter Bldg.



Vic DeRosa inspects the Microwave



Jay P. Morgan (seated), R. F. Ferguson set-up equipment.

35 Years Of Radars At The ETR

When MTP was put in charge of the Range Instrumentation in January 1954, it dealt not only with the operational aspects of this responsibility but also started an unexpectedly long era of progress and creative developments for the benefit of the Range and its customers. In the radar part of the instrumentation, these efforts have culminated in the most advanced Test Range radar chain of the U. S. and a reputation for top capabilities and data quality.

MTP's accomplishments in this area were made possible by the competence of its team, the motivation and dedication of many individuals, and the cooperation with the agencies managing and utilizing the ETR. The expertise of the MTP/Pan Am teams in performing major "in-house" modernizations throughout the years produced substantial improvements of capabilities while achieving enormous cost savings to the taxpayer.

By the start of MTP at the ETR, there were a series of Mod I S-Band radars - slightly modified WW II SCR-584's with a poor-man's data system, the WLAMC Data Box. The targets tracked were Matadors, Bomarcs, Snarks and the first ballistic missiles, the Redstones. Data were processed manually on Monroe and Friden calculators, with boresight camera films helping to achieve acceptable angle data quality. The first digital electronic computer - the FLAC - was in a phase of trials and checkout. Beginning in 1955, the MOD I's were replaced by the Reeves - developed MOD II radars which were an outgrowth of the MSQ-1 guidance radar for the Matador missile and incorporated many innovations peculiar to Test Range missile tracking as well as an "operator-friendly" console, the layout of which employed various MTP suggestions. Initiated by MTP, mobile Mod I and Mod II radars explored the utility of the PAFB, Vero Beach and Jupiter sites as a means for reducing flame attenuation/interference effects through less sensitive radar-to-missile aspect angles. The Mod IIs participated heavily well into the 60's and were, together with the Reeves Verloort radars at other sites, major supporters of the Mercury and Gemini manned spaceflight programs. MTP contributed various innovations, including solutions for the teething problems of the Giannini punch tape data recording system, the beacon sequencing technique allowing uninterrupted station-to-station handover operation, calibration methods for improved accuracy, and the first evaluations of target radar cross-section.



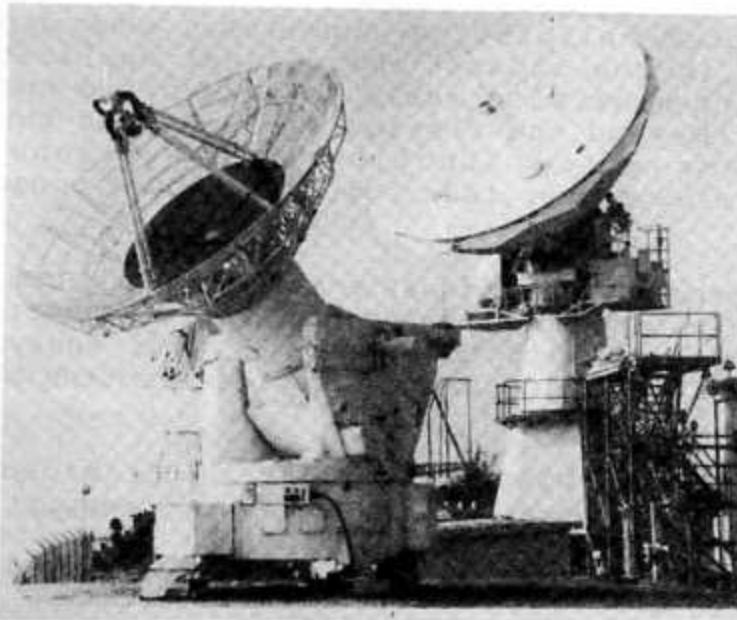
1954

Mod II S-Band Radar
atop Central Control
(The CPS-5 Search Radar
in background).



A dramatic step forward took place in 1957 when RCA placed the first C-Band monopulse instrumentation radar, the FPS-16 XN-1, at Patrick AFB for support of the Navy's Vanguard program. The more than 10-fold improvement in angle performance and other features quickly raised the importance of this radar so that launch agencies in several cases would rather postpone a missile launch than to forego the FPS-16 support! This prototype and its brother, the XN-2 at GBI, were the first Test Range sets which accomplished skin track of the Sputnik II satellite in December 1958. It was only logical that FPS-16 radars were installed at the major ETR stations and other Test Ranges in the following years and also became part of the Spaceflight tracking network.

The progress of the U.S. missile programs led in 1962 to the RCA development of the high-performance FPQ-6/TPQ-18 (MIPIR) radar which as expressly designed to satisfy the tracking and metric demand of long range missile and space vehicle support operations. The first system was accepted at PAFB with the turnkey ceremony on 5 June 1963. These radars replaced the FPS-16s (except at CCAFS) in the following years and remained the backbone of the Range's radar instrumentation to this day.



FPS-16 XN-1 and FPQ-6
at the PAFB Beach Site, 1962
before removal of the XN-1.

As early as 1965 the ETR MIPIRs debuted as part of the ADCOM Spacetrack Network because of their outstanding data quality, and are still in this 24-hour service at Antigua and Ascension Island.

The years since introduction of the MIPIRs brought about two major milestones leading to extensive modifications and modernizations:

1. The advances in solid-state technology led to conversion of all tube-equipped radar subsystems - except the transmitter - to solid state circuitry, reducing equipment size, power and cooling requirements, and failure rates. These conversions, including the engineering of the new digital range tracker, receiver, and electric antenna drive were designed and performed as part of the radar modernization program at the ETR by the Range Contractor's Engineering Team.

