



1968



Fielding B. Hills



James M. Weaver



Ed Brady

Karl F. Wenz, Jr., formerly Manager of Instrumentation Support Engineering, has been appointed Engineering Manager



1969 Ray Walter



D.L. Hill



1969

Donald N. Partyka



1968

Ron Blackburn



Andrew J. Roy



Leon M. Hayes



Paul D. Birdwell



1970 Drafting

R.L. Cumberland



J. A. Castanes



F. C. Minning



Russell K. Forsyth

1970



Eugene Kociuba



1971

James J. Kibling

## Data Processing On The Range

When testing was started at the Air Force Missile Center there was no computer operation. Data obtained during the early tests was forwarded to Washington, D. C. where a SEAC (Southwestern Automatic Computer) at the National Bureau of Standards performed data reduction.

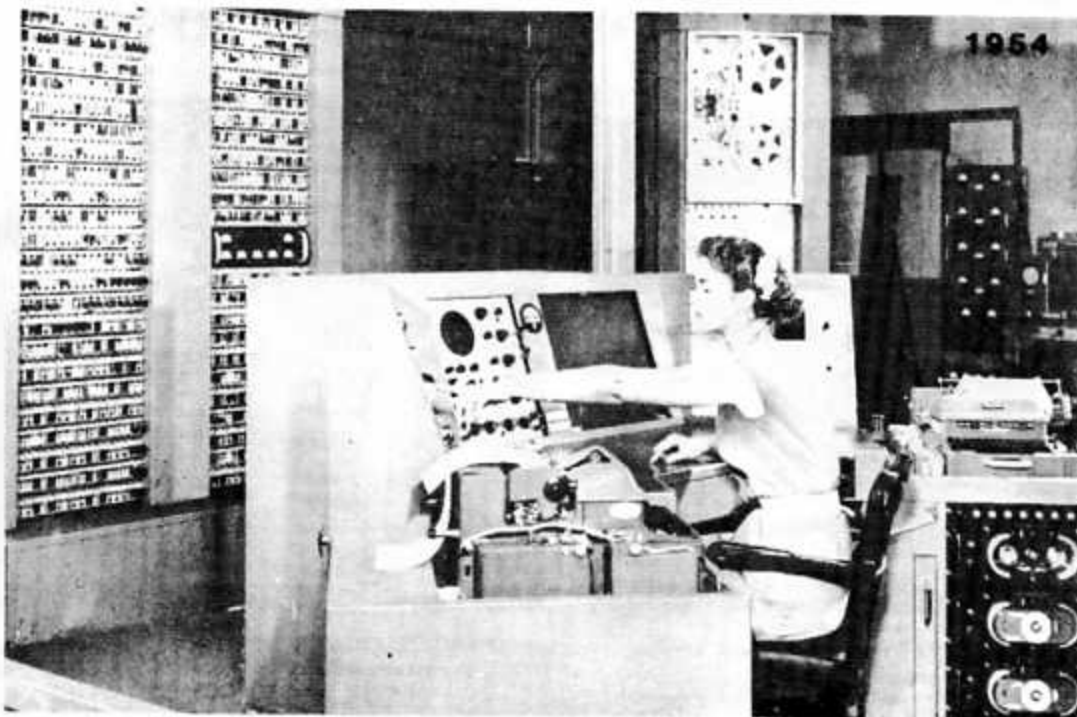
When it was found that there was no computer on the market that could provide the data reduction required at AFMTC, Air Force engineers designed the FLAC I (Florida Automatic Computer). The FLAC I began operations in 1954 with a second FLAC II computer added in 1956. Each had a 512 word acoustic delay memory. In 1957 RCA MTP Engineering personnel enlarged the memory to almost 5000 words in order to accommodate the increased volume of missile data from range activities.

The computers were used during flight operations for impact prediction and to collect all data during flight and covert it into standard units of metric measurement.

During the data reduction process, all camera film records and tape records from radar and telemetry are forwarded to data reduction for interpretation by trained personnel. Skilled film readers and mathematicians analyze and develop requirement solutions and routines for reduction.

After the data has been reduced to usable form, tabulations and graphs of precise position, velocity, acceleration and attitude of the missile's flight are presented to the Air Force and the missile manufacturer as a flight test report for use in the continued development, design and testing of future missiles.

The FLAC I and II computers were replaced by an IBM 709 computer in the late 50's that had a larger memory, computed much faster and was more compatible with other missile contractor computing systems. A big 7094 and three smaller 1401's were added later.



THE FLORIDA AUTOMATIC COMPUTER (FLAC)

A milestone of such was reached in the early 60's when raw data obtained at Ascension Island, 5000 miles downrange, was transmitted in code to Cape Canaveral, fed into a computer, reduced and retransmitted via commercial teletype and then received at the Air Research and Development Command's National Space and Surveillance Control Center, in Cambridge, Mass. All this within a period of thirty seconds.

This was all accomplished by CODIT (Computer Direct To Telegraph) a transceiver system designed and developed by RCA MTP engineers for direct connection to the high speed computer that eliminated the need for punching paper tapes or converting paper tapes to cards or other computer form.

Every piece of instrumentation on the Range and Ships relies on mathematics to transform its raw data into vital questions and answers. Skilled mathematicians and programmers create programs or routines to reduce this raw data to usable information. In writing a program, the programmer must include every step and command in an operation. Instructions must be specific or the machine won't perform.

In the 60's still more sophisticated equipment was introduced to meet the ever increasing data acquisition and data processing requirements imposed by the inexorable progress of ETR missions from relatively simple flights to interplanetary voyages embracing almost inconceivably intricate maneuvers. In late 1964 the RTCS Facility was introduced on the ETR in response to the Range's needs.

Prime use of the RTCS was for the vital Range Safety function, replacing the impact prediction system introduced in the early years of the Range. However it was to be used also in final impact designation, orbital determination and orbital support.

The RTCS still in use today operates in the same fashion as the old impact predictor, where it takes instrumentation inputs, then processes and displays the data for Range Safety Officers in central control within a instant of when the information was gathered. But the RTCS is faster and has a larger memory that can accept inputs from all ETR's radars, both pulsed and CW.



MATHEMATICIANS ANALYZE requirements and develop solutions and routines for reduction.

1954



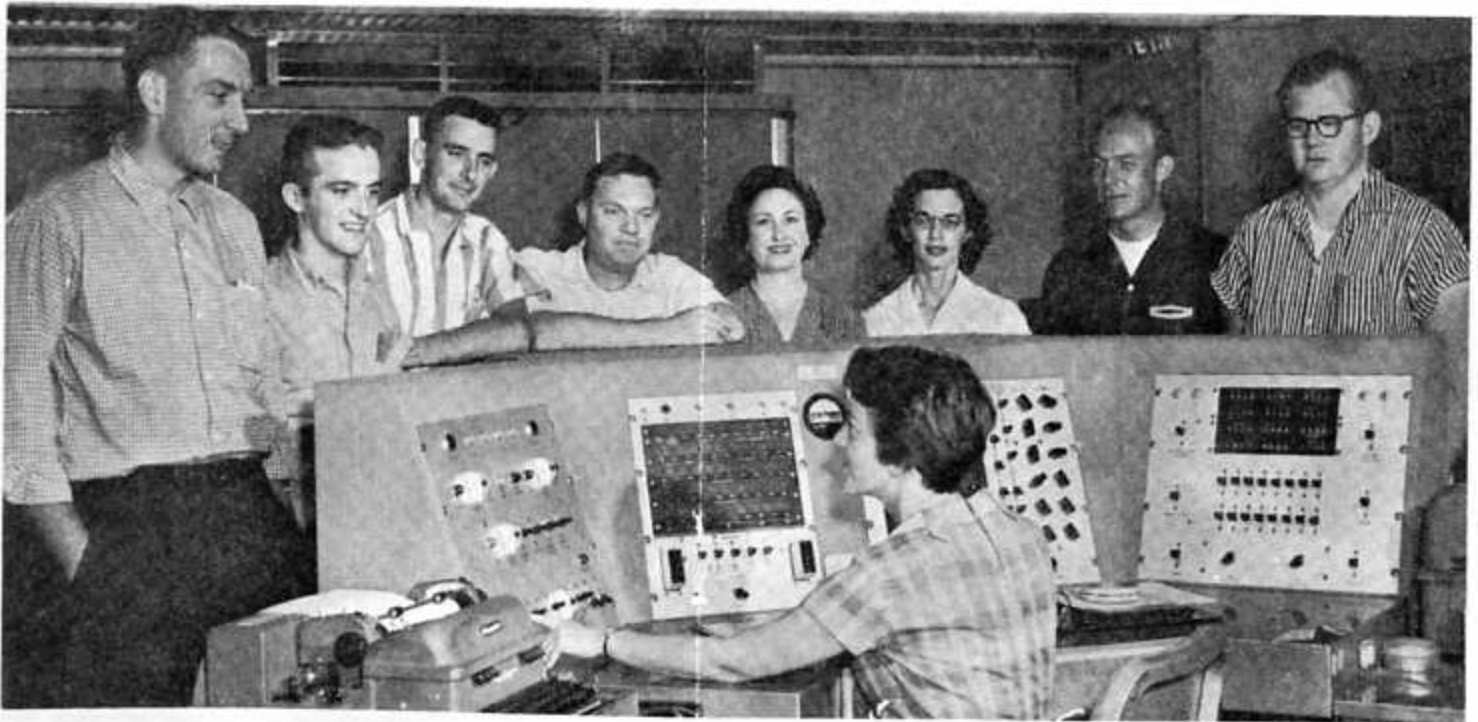
SKILLED FILM READERS use precision reading equipment to extract and record data from optical film records.



H.N. MORRIS



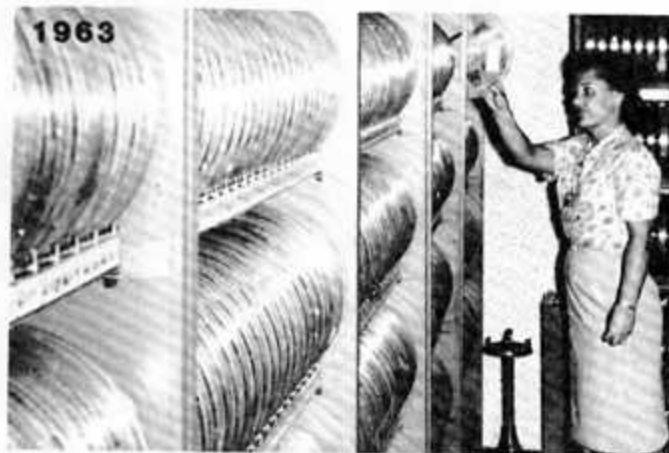
1959  
FLAC operators Earl Finley (left) and James Ayres



Nell Hathaway, Leader, Computer Operators, operates the FLAC II on its last mission, as other FLAC personnel watch. Left to right (standing): Bruce Flickinger, Leader, Computer Operators; Jackie Saunders, Data Preparation Clerk; Earl Finley, Computer Operator; Richard Arnett, Computer Operator; Dorothy Clark, Leader, Data Processing and Reports; Lee Moore, Data Preparation Clerk; and James Ayres.



CHARLES R. SCOTT



Computer Operator Danese Sledge selects a data-filled magnetic tape from Mathematical Services' library.



Secretaries Hilda Cobb (left) and Helen Corley. 1965



Joe Warren, Ed Duff and Bill Sparger.



Johnnie Sharpe, Kathy Stutts and Donna Greiner.

1965



The managers of MTP's RTCS units: (left to right) Gary Spears, In-Flight Analysis and Programming; John Stephenson, Real Time Computations; and Bruce Flickinger, Cape Computer Facility.



Tom Jowanowitch



Mr. Henry

1966



LEFT - Mark Auerback (seated) and Dave Frank at the RC A-401 Computer. CENTER - Down Range Programming Leader Marshall Kitchen (left) and Paul Johnson during an operation. RIGHT - Hugh Romine (seated) and Rudy Lichti.

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MISSING FROM

ORIGINAL DOCUMENT

SORRY

PAGES 21-22  
MISSING FROM  
ORIGINAL DOCUMENT  
SORRY

## Range Ships Systems

Instrumentation Ships were first introduced on the Range in 1957 to fill the "gaps" between downrange stations.

The first vessels used were converted inter-island freighters called FS-Class Telemetry Ships. Operating out of the Navy bases in Recife, Brazil and Trinidad, they were spaced at 800-mile intervals where land based instrumentation was not available. With a RCA maintenance and operation crew of five and with limited telemetry, HF comm and timing equipment, these small (176 feet) ships tracked the Snark missile during its twelve hour flight from the Cape to Ascension. There were six FS-Class Telemetry Ships in operation from 1957 to 1961 using the designations Golf, Hotel, India, Juliett, Kilo and Lima.

Six C1-MAV-1 telemetry and command ships were put into operation in 1958 and were active until 1969. Bigger (337 feet) and considerably more sophisticated, these ships were used in support of the first manned space flights of Mercury and Gemini and other missile and space programs and roamed the oceans from Durban, South Africa to Jacksonville and from Sasebo, Japan to Tahiti. The six C1-MAV-1 ships were: Timber Hitch, Sampan Hitch, Coastal Crusader, Sword Knot, Rose Knot and Coastal Sentry.





During the period of 1959 through 1964, six new instrumentation ships were put into operation on the Range to support the heavy schedule of the manned space programs of Mercury, Gemini and Apollo, the satellite launches, and other launches that were to follow during the next decade and beyond.

First to appear was the American Mariner in 1959 with advanced instrumentation and computers that would be used in the first tracking of re-entering IRBM and ICBM launches and the first measurements of nuclear testing during Project Fishbowl.

In 1960 the Twin Falls was put into operation with its precision tracking radar, inertial navigation system, computers and real-time data transmission. This converted freighter victory ship was active on the Range through the Apollo launches of 1971 and was the first instrumentation ship to combine precision radar with a digital computer and ships inertial navigation system to produce high accuracy, long range, real-time missile and spacecraft trajectory data.

The two famous advanced range instrumentation ships (Aris) Gen. H. H. Arnold and Gen. H. S. Vandenberg were activated in 1962 and would see "action" for the next 20 years. Sailing out of Port Canaveral and Pearl Harbor loaded with radar, telemetry, optics and computer instrumentation, they were used in the Atlantic and Pacific oceans supporting the manned launches, Minuteman, MK-12 reentry vehicle launches and collecting re-entry data on foreign launches.

In use during 1964-66 were the two converted tankers USNS Vanguard and USNS Mercury. Almost 600 feet long with precision tracking radar, auto-track telemetry, digital command control computers and displays they were relied heavily upon during the Apollo man flights.

There are just two ships active today. The Fleet ballistic Missile (FBM) support ship USNS Redstone has operated in the North and South Atlantic and the Caribbean since 1970. Equipped with "state of the art" radar, four telemetry systems, MK-3 SINS, five computers range safety display and command, the Redstone has proven itself during the launches of Apollo, Skylab, Trident, Poseidon and the historic Shuttle flights.



The USNS Redstone Departs Cape Canaveral



USNS Observation Island

Operating out of its home port of Pearl Harbor for special foreign launch missions in the Pacific Ocean, the USNS Observation Island (Cobra Judy) was commissioned in 1981, replacing the USNS Vandenberg. Equipped with S-band phased array radar, Cyber 175 computer and special advanced telemetry, it cruises from Adak, Alaska to Yokosuka, Japan to Kwajalein Island collecting missile re-entry data on foreign launches.

Through the years, the size of the ships and crews, along with the sophistication of the instrumentation, have grown with the advances in the state of the art electronics instrumentation and the Air Force requirements for gathering, storing and transmission of missile flight data.

And through the years since the first FS-class telemetry ships in 1957, RCA and its team of engineers, technicians and shops specialists have operated, maintained, advanced and "fine tuned" the mechanical and electronic ships instrumentation to such a high degree that the ships of today are equipped with instrumentation systems that in capacity are equal to or surpass those of the land-based tracking systems.

**MTP NEWS 1959**    SHIPS



Leo Feldmeier



Jerry Simpkins



Leonard Moldovan



Charles De Christopher



Cary Tucker



William Downey