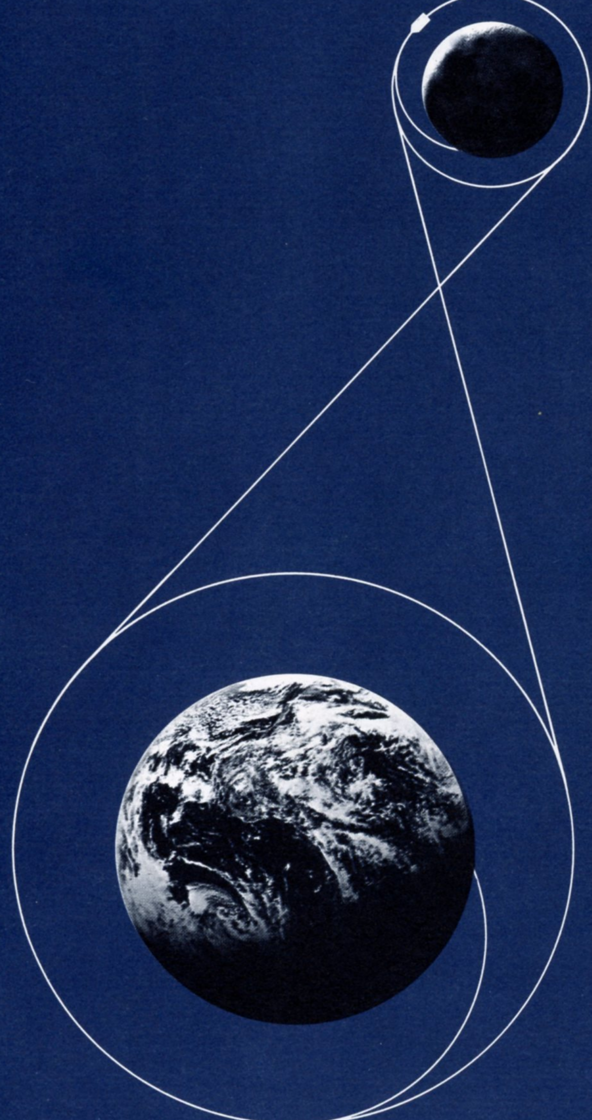
Apollo
# COMMUNICATIONS
*And Information Handling Equipment*



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*Electronics Group*

HARRIS-INTERTYPE CORPORATION

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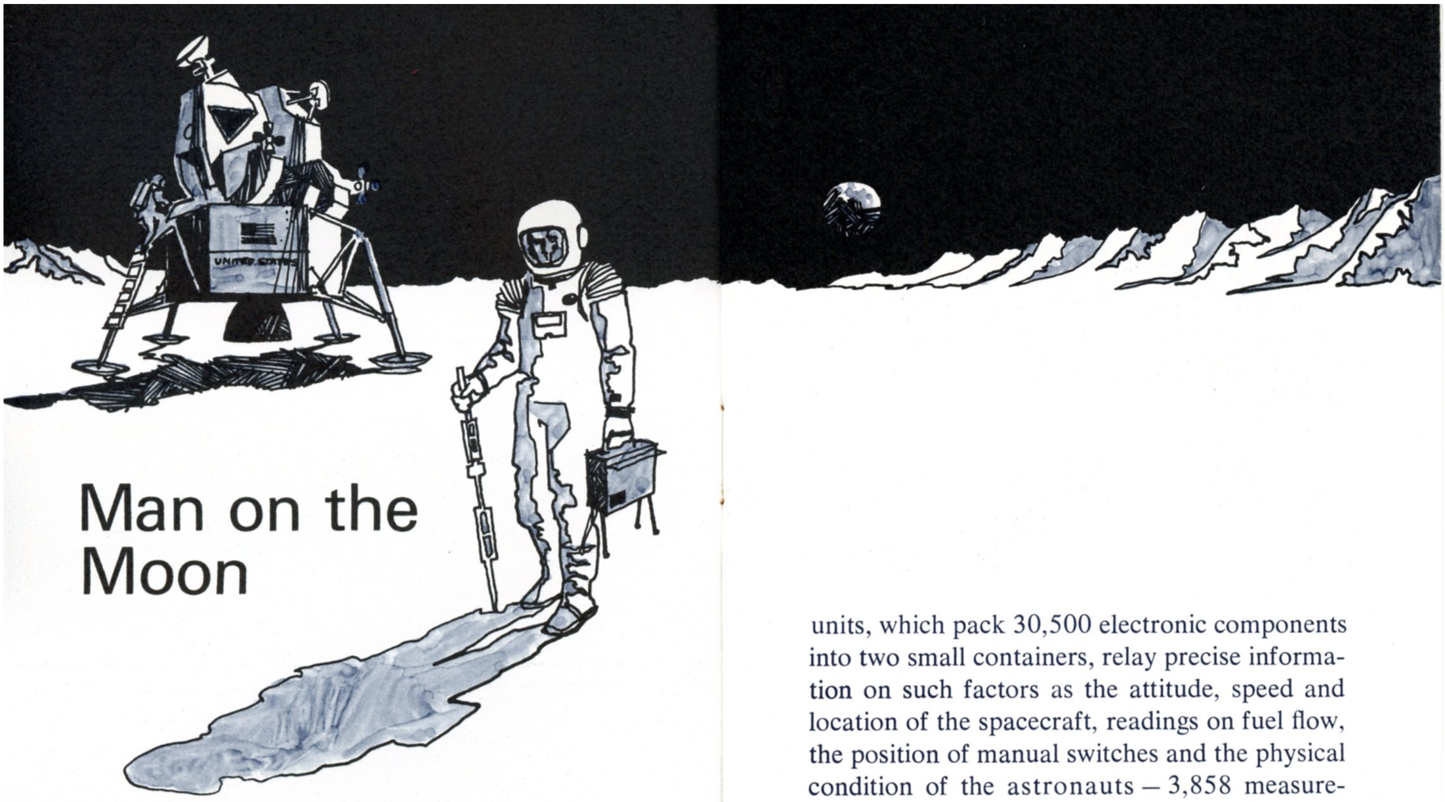


# Man on the Moon

As the culmination of America's national goal of a manned lunar landing, Apollo 11 symbolizes the great team effort put forth by some 500,000 Americans in government, industry and education during the past eight years.

Harris-Intertype Corporation, through its Electronics Group, has been a major supplier of electronic systems and equipment for the Apollo Command and Lunar Modules and the Saturn V rocket.

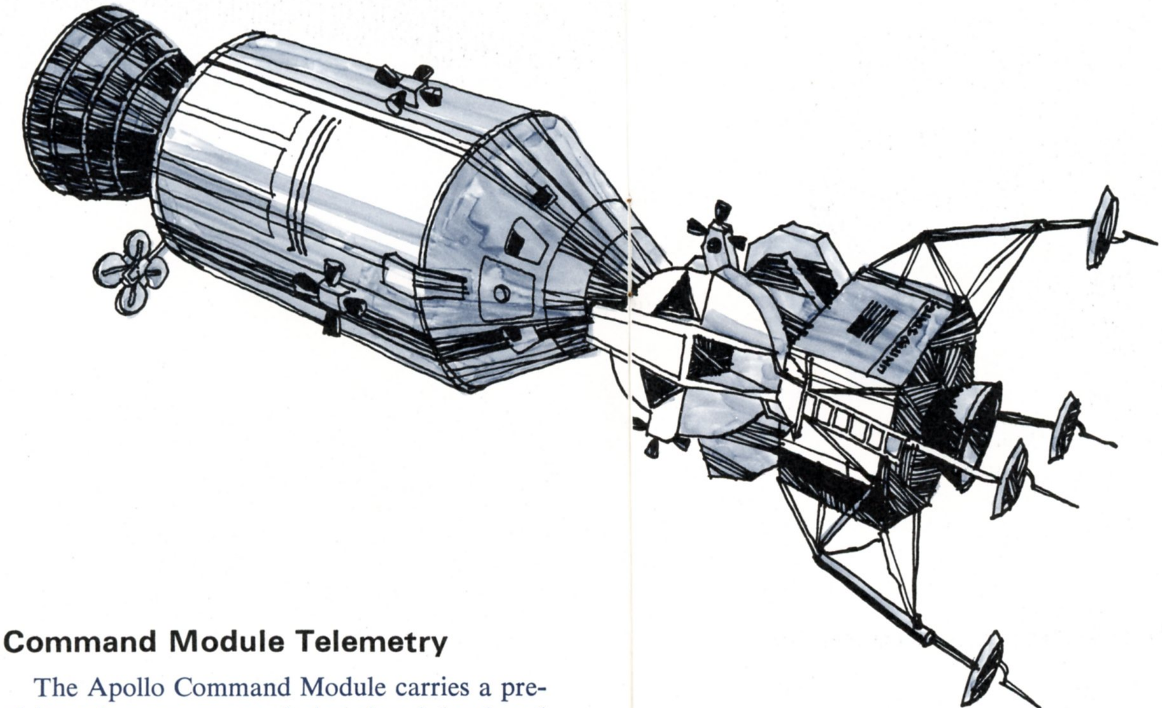
The company has designed and manufactured both ground-support and on-board equipment for Apollo, primarily in the field of communications and information handling. These advanced products include on-board telemetry units, and ground-based data acquisition and processing systems, simulation and test equipment and tracking and communications antennas.

The on-board telemetry systems, for example, permit the men at NASA control centers to monitor instruments and other sensing devices located throughout the space vehicles. These units, which pack 30,500 electronic components into two small containers, relay precise information on such factors as the attitude, speed and location of the spacecraft, readings on fuel flow, the position of manual switches and the physical condition of the astronauts – 3,858 measurements in all, coded and condensed into a single radio signal and beamed to antennas on earth. Here they are unscrambled, decoded and displayed for engineers, technicians and physicians. This information, received as it is happening, gives skilled ground teams a comprehensive picture of second-by-second conditions aboard the space vehicles.

These on-board systems were produced by Radiation Incorporated of Melbourne, Florida, a Harris subsidiary with some 4,500 employees about 30 miles from Cape Kennedy. Radiation also supplied ground-support systems for Apollo, including communication, data-processing, simulation and testing equipment.

Although the company's contributions to the Apollo program were carried out primarily by Radiation, other divisions and subsidiaries in the Harris Electronics Group were involved. Gates Radio Company, Quincy, Illinois, provided broadcasting equipment. RF Communications Inc., Rochester, New York, supplied two-way radio systems. And PRD Electronics, Syosset, Long Island, produced the Lunar Module descent and ascent simulator.

# ON-BOARD SYSTEMS



## Command Module Telemetry

The Apollo Command Module carries a precision telemetry system designed and developed by Harris. The complex package, which contains 21,400 electronic components, measures less than one cubic foot and weighs only 45 pounds. Operating without supervision or adjustment from lift-off through recovery, it collects information on the status of the spacecraft, the equipment on board and the physical condition of the astronauts.

This information is coded by the telemetry system and condensed into a single radio signal for transmission to the earth. Among the data handled by the unit are temperature of the heat shield, flow rate of water and oxygen to fuel cells, status of the guidance computer, and even which of the two fans in each astronaut's suit is operating at a particular time.

The Command Module telemetry package incorporates standby components and circuits which are automatically brought into play if needed.

## Lunar Module Telemetry

The Lunar Module, in which astronauts Armstrong and Aldrin will land on the moon, also carries a telemetry and timing system manufactured by the company. The unit packs 9,100 components into a space 20 inches long, 5 inches wide and 6 inches high. It weighs 23 pounds.

During the lunar landing phase, the system serves as the primary communications link between the LM and the orbiting Command Module, processing and relaying vital data on all aspects of the craft and its crew. Information processed by the unit includes attitude of the vehicle – its pitch, roll and yaw – temperature readings from the outside skin, cabin and engine, and data on the descent/ascent propulsion system, such as engine gimbal position and fuel quantity, temperature and pressure.

# GROUND-SUPPORT SYSTEMS

## Data Acquisition and Processing

Performance of the Apollo Command Module, as well as the Saturn rocket, is evaluated during ground checkouts by computer-controlled data acquisition and processing systems developed by Harris.

Two separate systems were produced, each containing 65 cabinets of equipment. One was designed to handle telemetry data from the Command Module, the other tailored to process data from the second stage of the Saturn rocket. Four computers – two for each system – provide high-speed handling of the information.

In addition to pre-launch checkouts, the systems are employed for post-mission analysis of recorded data.

## Decommutation System

The company produced eleven decommutation systems, located at various sites in NASA's Space Tracking and Data Acquisition Network, and at Automatic Checkout Equipment sites. These computer auxiliaries receive radio telemetry signals in different "space talk" languages, unscramble and route them to computers or display consoles. They also record data for future playback.

## Digital-to-Tone Converter

A specialized unit to study digital command communications techniques was developed by Harris for the Apollo program. Called the Apollo Digital-to-Tone Converter (ADTOC), its function is to receive coded commands (converted telemetry signals) at extremely high speed, check them for accuracy and decode them. It then provides separate outputs of the information—sending it to computers, print-out units, visual display consoles or tone encoders. The new techniques developed with the aid of ADTOC enable scientists to receive from space the complete and accurate information they need during conduct of the missions and for post-flight analysis.

## Lunar Module Simulator

The safety of the astronauts is of prime consideration in the Apollo program. Testing of mission equipment is continuous, repetitive, rigorous and thorough. The astronauts devoted hundreds of hours to familiarizing themselves with their craft, practicing maneuvers with facsimilies of the actual Command Module and the Lunar Module. Part of the complex testing system was supplied by Harris. Called the Descent and Ascent Stage Simulator, the intricate electronic system simulates signals similar to those which will be transmitted between the Lunar Module and the moon-orbiting Command Module during the manned lunar landing.

## Lunar Module Test Equipment

Exhaustive pre-launch testing of the network of sensors on the Lunar Module was conducted under simulated space conditions.

Sensors are located in the fuel cells, where they measure the amount of fuel aboard; in navigation panels, where they sense attitude of the spacecraft; in the electrical power pack, where they detect the electrical charge available; in the life support system and in scores of other important locations.

Each sensor sends its information to the telemetry package for processing and radio transmission to earth. Precise measurements by the sensors and maximum reliability of the system are required.

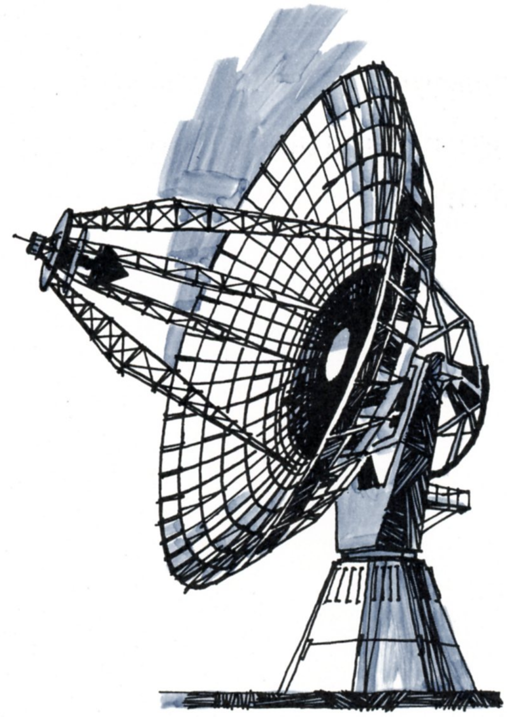
So important are the sensors and so precise their function that a special computer system was required to perform the pre-launch tests. The system and its auxiliaries, collectively known as the LM Automatic Test Station, were produced by Harris.

## Antennas

More than 50 antennas built by Harris for civilian and military space programs are in operation throughout the world. These antennas, and other units modified by the company for improved performance, range in size up to a "big-dish" antenna 150 feet in diameter. Several of these antennas will track the Saturn V rocket and its space voyagers during the early moments following lift-off. Other units stand ready to support NASA's tracking and command network. These antennas handle voice, television and telemetry communications. Land-line and microwave relays link them to mission control centers and support sites.

## Broadcasting Equipment

The splash-down of the Apollo 11 astronauts upon their return to earth will be reported to the outside world by means of a compact mobile radio transmitter anchored to the deck of the prime recovery vessel, the aircraft carrier U.S.S. Hornet. This equipment transmits all voice signals for the television and radio network pool, supplying stations and systems which carry the various Apollo newscasts around the earth. The special transmitter for this commercial broadcasting link was manufactured by Harris.



## Two-Way Radio Equipment

The U.S. Navy supports NASA with tracking and recovery vessels deployed around the world. In addition to the prime recovery ship waiting in the Pacific for Apollo 11, back-up vessels in other oceans are ready to move into position at a moment's notice.

More than 1,200 Navy vessels have been fitted with Harris-developed two-way radio systems. Using the single sideband (SSB) technique, this equipment provides efficient voice and data communications over distances of from 25 to 10,000 miles.

## "A new type of communications equipment company..."

Paralleling the worldwide information explosion of recent years has been a corresponding development in communications equipment and technology.

A striking feature of this development has been a growing convergence of the printed and electronic forms of communication.

Harris-Intertype Corporation, uniquely established in both printing equipment and electronic equipment, has evolved into a new type of company with a special concept. It is the concept of merging graphic and electronic technology to produce advanced systems and equipment for the vast communications industry of tomorrow.

The company has a long-established commercial base in equipment for printed communications: printing presses of many kinds, typesetting systems, bookbinding and paper-converting equipment. To this it has added electronic sophistication: broadcasting and point-to-point communications equipment, digital communication and information handling systems, electro-optical technology, computer-controlled testing and microelectronic circuitry.

From this broad foundation, Harris is moving into the new world of communications dramatized by the Apollo program—a world of integrated systems for gathering, processing, displaying, editing, printing and transmitting a wide variety of business and scientific data, news, entertainment and other information.

## Harris-Intertype Corporation

### *Electronics Group*

**Radiation Incorporated**
electronic communications, control & information handling systems

**Gates Radio Company**
broadcasting & other communications equipment

**RF Communications, Inc.**
two-way radio communications equipment

**PRD Electronics, Inc.**
avionic checkout systems & electronic instruments

### *Graphics Group*

**Harris-Seybold Company**
offset printing presses & supplies; bindery equipment

**Intertype Company**
typesetting equipment & type matrices

**The Cottrell Company**
web offset, magazine & other web printing presses

**The Sheridan Company**
book & magazine bindery equipment

**The Langston Company**
corrugated container machinery & paper industry equipment

**The Schriber Company**
business forms presses & related equipment

### *International Group*

**OMCSA • Milan**
sheet-fed offset printing presses

**Harris-Intertype Ltd. • London**
typesetting equipment & matrices; offset presses & bindery equipment

**Marinoni, S.A. • Paris**
web & sheet-fed offset presses; newspaper and banknote presses

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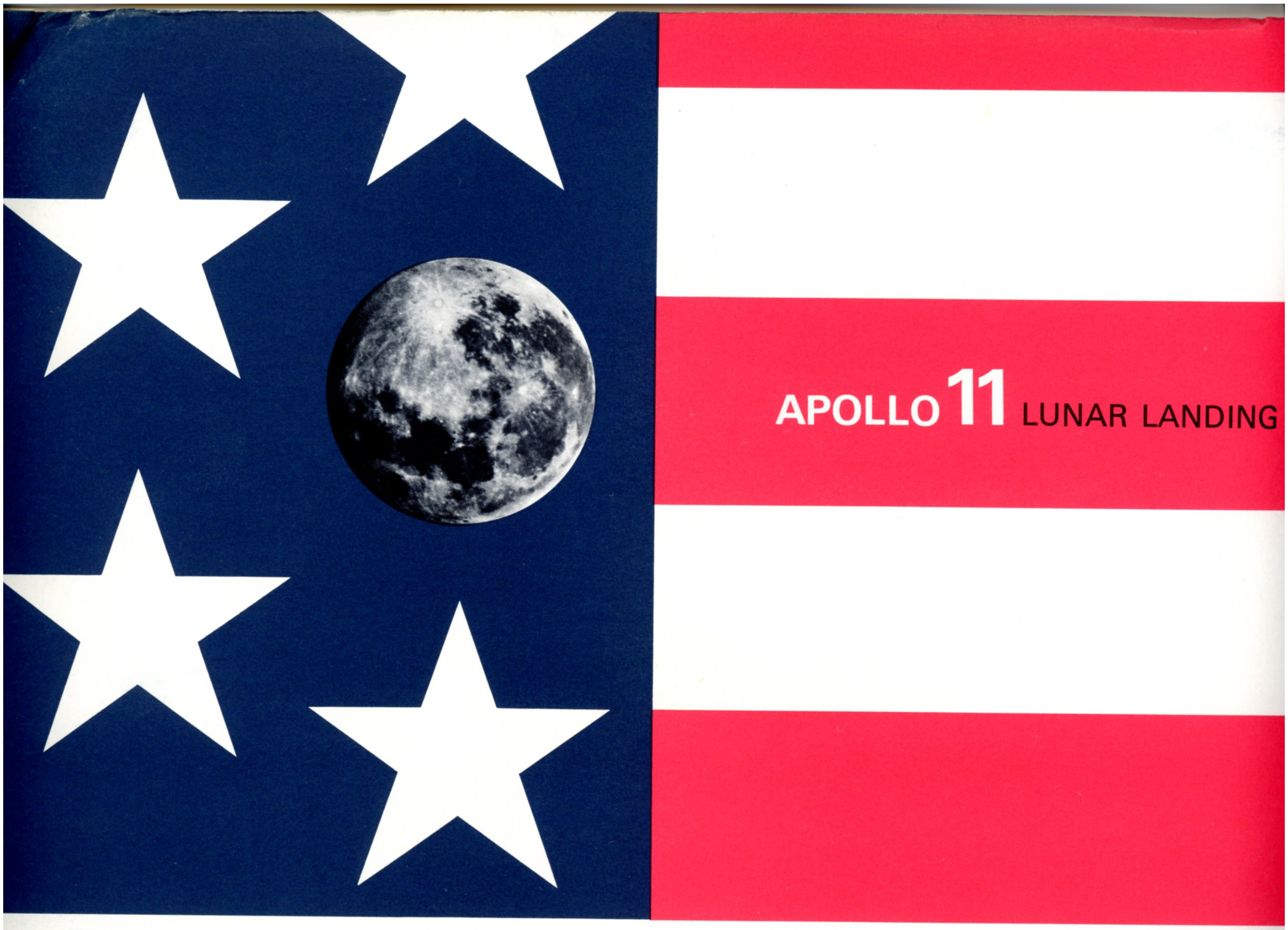


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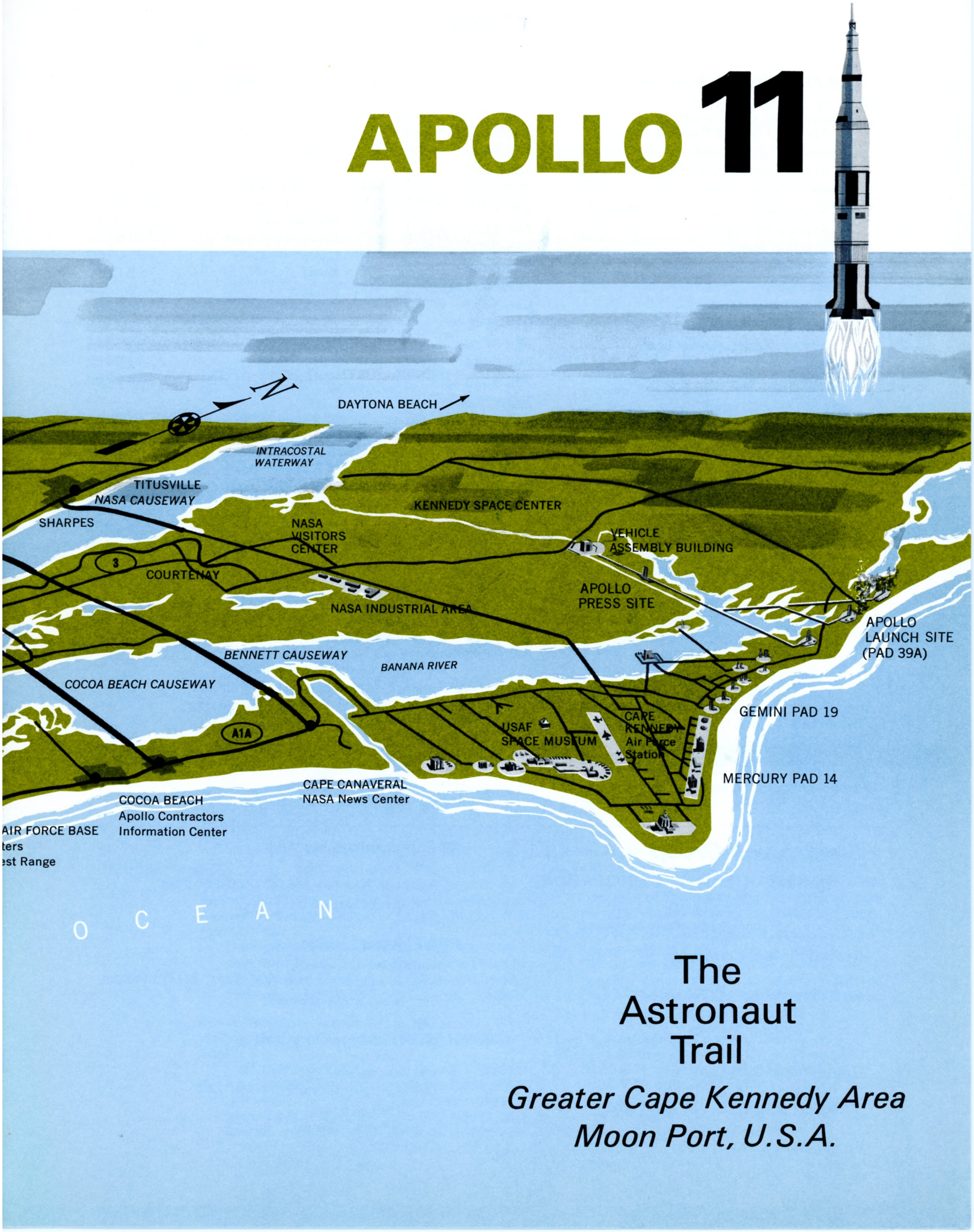
# APOLLO 11




# The Astronaut Trail

*Greater Cape Kennedy Area*
*Moon Port, U.S.A.*

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## Cape Kennedy Telephone Index (Area Code 305)

| | |
|---|---|
| Apollo 11 Status Reports | 784-2380 |
| Harris Public Relations | 783-0679 |
| Apollo Contractors Information Center | 784-1260 |
| NASA News Center | 783-7781 |
| USAF Public Information Office | 494-7731 |
| Associated Press | 783-2120 |
| Aviation Week | 783-0400 |
| Fairchild Publications | 783-6388 |
| Melbourne Times | 723-7661 |
| Orlando Sentinel | 636-5331 |
| Today | 636-2641 |
| United Press International | 783-3784 |
| ABC | 783-5464 |
| CBS | 783-8093 |
| NBC | 783-2340 |

## Car Rentals

| | |
|---|---|
| Airways | 783-5057 |
| Avis | 783-3643 |
| Budget | 783-1641 |
| Cape Car | 783-2226 |
| Chevway | 636-2021 |
| Continental | 784-1884 |
| Hertz | 783-7771 |
| King Car | 783-4090 |
| National | 783-7007 |
| Olins | 783-3074 |
| Ross | 783-7733 |

## Cocoa Beach Motels

| | |
|---|---|
| Bal-Ray Resort | 783-9958 |
| Cape Kennedy Hilton | 783-0361 |
| Caravelle | 783-1300 |
| Crossway Inn | 783-2221 |
| Gulfstream | 783-4114 |
| Holiday Inn | 783-2271 |
| Howard Johnson's | 783-9481 |
| Imperial "400" | 783-0500 |
| Koko | 783-0890 |
| Polaris | 783-7621 |
| Quality Courts | 783-9430 |
| Ramada Inn | 783-9441 |
| Sea Breeze | 783-7344 |
| Sea Missile | 783-2442 |
| Sheraton | 783-2252 |

## Airlines

| | |
|---|---|
| Delta | 636-3144 |
| Eastern | 632-3110 |
| National | 784-1653 |
| Airport Limousine | 783-7800 |

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HARRIS-INTERTYPE CORPORATION

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Edward S. Gagnon

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*Rochester, New York 14610   (716) 244-5830*

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*6801 Jericho Turnpike*
*Syosset, Long Island, New York 11791   (516) 364-0400*

Wallace A. Weissman

**Harris-Intertype Corporation**
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Fred W. Baker
William B. Sheil

# Manned Space Log

## Project Mercury

**Alan B. Shepard, Jr.—May 5, 1961—Freedom 7**
*America's first manned space flight; suborbital; 15 min. 22 sec.*

**Virgil I. Grissom—July 21, 1961—Liberty Bell 7**
*Evaluated spacecraft functions. Suborbital; 15 min. 37 sec.*

**John H. Glenn, Jr.—February 20, 1962—Friendship 7**
*America's first manned orbital space flight; three revolutions; 4 hrs. 55 min. 23 sec.*

**M. Scott Carpenter—May 24, 1962—Aurora 7**
*Initiated research experiments to further future space efforts. Three revolutions; 4 hrs. 56 min. 5 sec.*

**Walter M. Schirra, Jr.—October 3, 1962—Sigma 7**
*Developed techniques and procedures applicable to extended time in space. Six revolutions; 9 hrs. 13 min. 11 sec.*

**L. Gordon Cooper, Jr.—May 15-16, 1963—Faith 7**
*Met the final objective of the Mercury program—spending one day in space; 22 revolutions, 34 hrs. 19 min. 49 sec.*

## Project Gemini

**Virgil I. Grissom—John W. Young—March 23, 1965—Gemini III**
*America's first two-man space flight; three revolutions; 4 hrs. 52 min. 31 sec.*

**James A. McDivitt—Edward H. White, II—June 3-7, 1965—Gemini IV**
*First "walk in space" by an American astronaut. First extensive maneuver of spacecraft by pilot; 62 revolutions; 97 hrs. 56 min. 12 sec.*

**L. Gordon Cooper, Jr.—Charles Conrad, Jr.—August 21-29, 1965—Gemini V**
*Eight-day flight proved man's capacity for sustained functioning in space environment; 120 revolutions; 190 hrs. 55 min. 14 sec.*

**Walter M. Schirra, Jr.—Thomas P. Stafford—December 15-16, 1965—Gemini VI**
*World's first successful space rendezvous. 16 revolutions; 25 hrs. 51 min. 24 sec.*

**Frank Borman—James A. Lovell, Jr.—December 4-18, 1965—Gemini VII**
*World's longest manned orbital flight; 206 revolutions; 330 hrs. 35 min. 1 sec.*

**Neil A. Armstrong—David R. Scott—March 16-17, 1966—Gemini VIII**
*First docking of two vehicles in space; 6.5 revolutions; 10 hrs. 41 min. 26 sec.*

**Thomas P. Stafford—Eugene A. Cernan—June 3-6, 1966—Gemini IX**
*Three rendezvous of a spacecraft and a target vehicle. Extravehicular activity—2 hrs. 7 min.; 45 revolutions; 72 hrs. 20 min. 50 sec.*

**John W. Young—Michael Collins—July 18-21, 1966—Gemini X**
*First use of target vehicle as source of propellant power after docking. New altitude record — 475 miles; 43 revolutions; 70 hrs. 46 min. 39 sec.*

**Charles Conrad, Jr.—Richard F. Gordon, Jr.—September 12-15, 1966—Gemini XI**
*First rendezvous and docking in initial orbit. First multiple docking in space. First information flight of two space vehicles joined by a tether. Highest manned orbit — apogee about 853 miles; 44 revolutions; 71 hrs. 17 min. 8 sec.*

**James A. Lovell, Jr.—Edwin E. Aldrin, Jr.—November 11-15, 1966—Gemini XII**
*Astronaut walked and worked outside of orbiting spacecraft for more than 5½ hrs.—a record proving that a properly equipped and prepared man can function effectively outside of his space vehicle. First photograph of a solar eclipse from space; 59 revolutions; 94 hrs. 34 min. 31 sec.*

## Project Apollo

**Walter M. Schirra, Jr.—R.Walter Cunningham—Donn F. Eisele—October 11-22, 1968—Apollo 7**
*First manned Apollo flight. First live television from space. Schirra became first man to pilot Mercury, Gemini and Apollo spacecraft; 164 revolutions; 260 hrs. 8 min. 45 sec.*

**Frank Borman—James A. Lovell, Jr.—William Anders—December 21-27, 1968—Apollo 8**
*First manned flight of the Saturn V rocket. Lovell joined Schirra as only other three-flight astronaut. First manned lunar orbit; greatest speed by humans (nearly 25,000 MPH); and longest distance from earth for a manned flight (approx. 233,000 miles). 10 lunar orbits; 147 hrs. 11 sec.*

**James A. McDivitt—David R. Scott—Russell L. Schweickart—March 3-13, 1969—Apollo 9**
*First manned flight of Lunar Module. Two dockings of Command and Service Modules. First EVA in Apollo program. 241 hrs. 53 sec.*

**Thomas P. Stafford—Eugene A. Cernan—John W. Young—May 18-26, 1969—Apollo 10**
*Cernan and Stafford descend to within eight nautical miles of lunar surface, the closest man has ever been to another celestial body. 192 hrs. 3 min. 25 secs.*

**Neil A. Armstrong—Edwin E. Aldrin, Jr.—Michael Collins—Apollo 11 Flight Plan**
*9:32 A.M. July 16—Apollo 11 Liftoff*
*4:23 P.M. July 20—LM Lunar Landing*
*2:17 A.M. July 21—Astronaut Armstrong sets foot on moon; Aldrin follows minutes later.*
*1:50 P.M. LM Lunar Liftoff*
*12:49 P.M. July 24—CM Splashdown mid-Pacific*

(All times EDT)

# APOLLO 11 SIDEBAR NEWS

IMMEDIATE RELEASE

PRETTY JANET HINKSON poses with what will be the central nervous system of the Apollo 11 Command Module. The system, a precision telemetry unit, collects data from tiny sensors, then codes and condenses the data for radio transmission back to earth. The information collected includes everything from the speed of the spacecraft to the space traveler's heart rate. Over 21,000 electronic components are packed into this pressurized unit, the size of a hatbox. It was designed and developed by the Electronics Group of Harris-Intertype Corporation.

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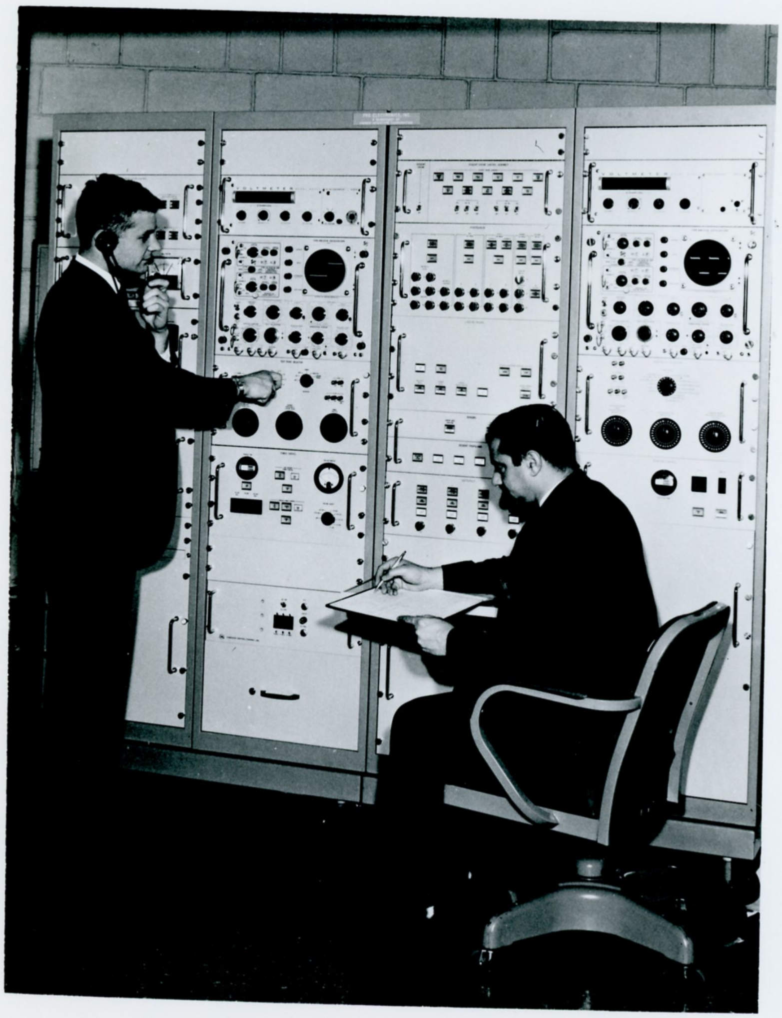
# APOLLO 11 SIDEBAR NEWS



IMMEDIATE RELEASE

HARRIS TECHNICIANS check out part of the Descent and Ascent Lunar Module Simulator. This intricate electronic system simulates signals similar to those which will be transmitted between the Lunar Module and Apollo 11 Command Module during landing and takeoff from the Moon.

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# APOLLO 11 SIDEBAR NEWS

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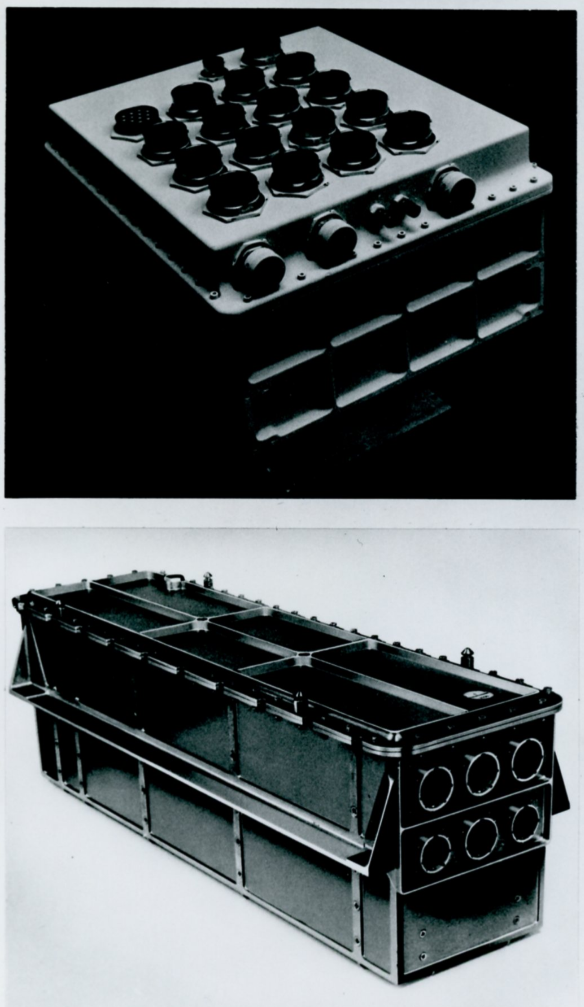

APOLLO 11 TELEMETRY SYSTEMS, precision on-board units packing 30,500 components in two small containers, report continuously on the condition of the spacecraft and its crew. Information on heart rates, temperature, fuel, pressure, and other statistics are fed into these packages in the form of electronic pulses. They are converted into a numerical code and condensed for radio transmission over a single link to engineers, technicians and physicians at mission control centers on earth. The telemetry system for the Command Module (top) weighs 45 lbs.; the Lunar Module (bottom) weighs 23 lbs.

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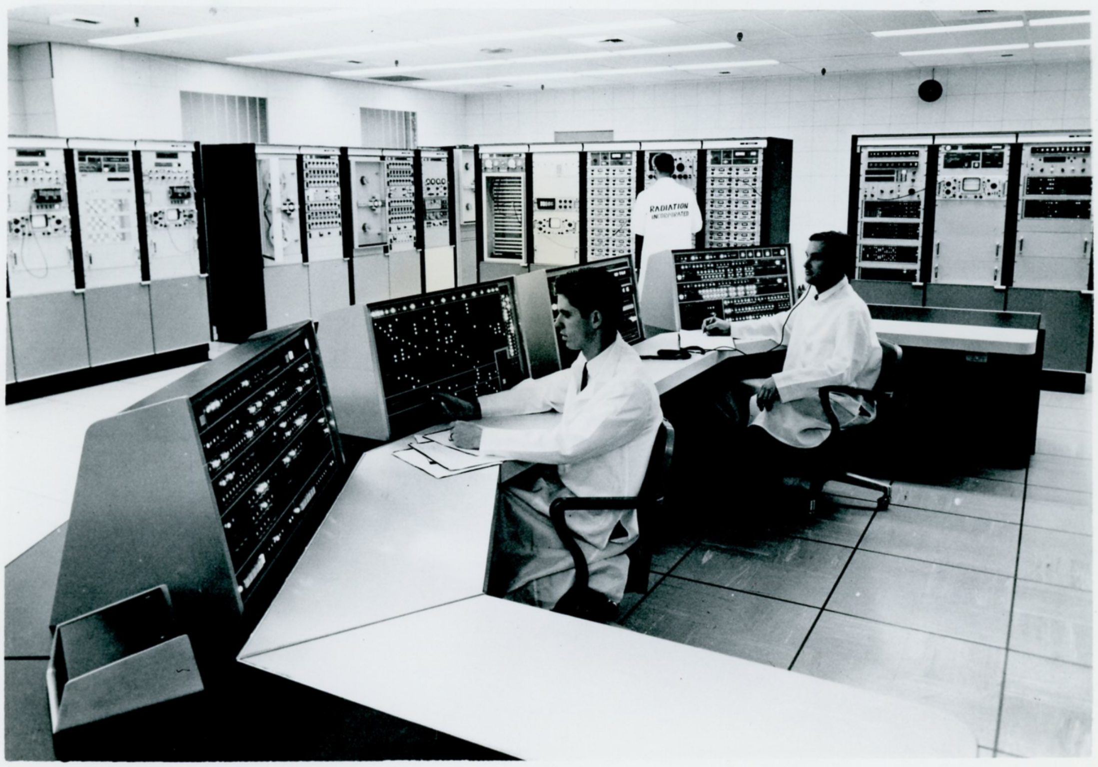


DATA ACQUISITION AND PROCESSING SYSTEM used to checkout Apollo 11 Command Module during manufacturing. An identical 65-cabinet system also was supplied by the Electronics Group of Harris-Intertype Corporation for processing telemetry data from the second stage of the Saturn moon rocket.

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# APOLLO 11 SIDEBAR NEWS

IMMEDIATE RELEASE

ANTENNAS AROUND THE WORLD will receive both voice and data communications from Apollo 11. This "big-dish" antenna, 85' in diameter, is on Grand Bahama Island. It is one of more than 50 specialized antennas built for civilian and military space programs by the Electronics Group of Harris-Intertype Corporation

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# APOLLO 11 SIDEBAR NEWS

IMMEDIATE RELEASE

TECHNICIAN PREPARES Apollo 11 Command Module telemetry system for packaging. The precision unit, manufactured by the Electronics Group of Harris-Intertype Corporation, collects information on the status of equipment aboard the spacecraft and the physical condition of the astronauts for transmission to Mission Control.



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# APOLLO 11 SIDEBAR NEWS

IMMEDIATE RELEASE

COMPLEX GROUND SYSTEMS, called decommutators, will unscramble data received from the Apollo 11 spacecraft and route it to computers or display consoles. Eleven of these high-speed ground units were built by the Electronics Group of Harris-Intertype Corporation for use at NASA installations.

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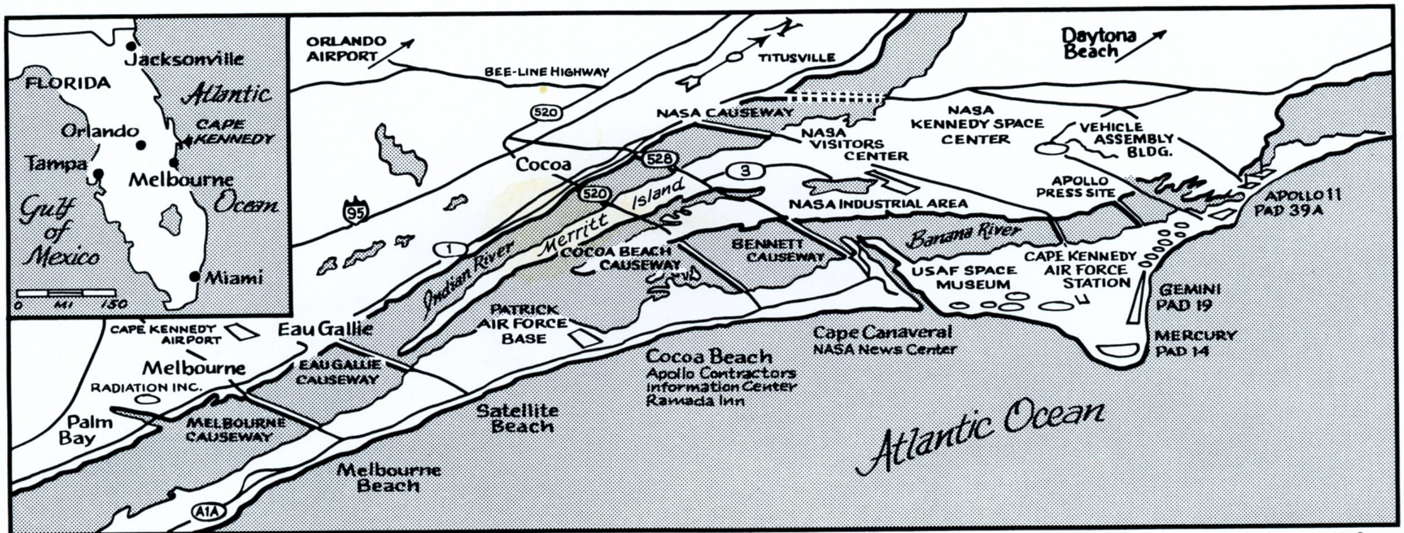


©Map by Electronics Group, Harris-Intertype Corp.

VIEW OF CAPE KENNEDY AREA - BREVARD COUNTY, FLA. - More than 250,000 people live here along the "Astronaut Trail" with its 66 miles of ocean coastline. Brevard covers 1,310 square miles, 299 square miles of which is water, including the Banana and Indian Rivers. Radiation Incorporated, a subsidiary of Harris-Intertype Corporation, is located near Melbourne (lower left). Radiation is Florida's seventh largest industrial firm, employing 4,500 persons. It manufactures electronic communications and information handling equipment.



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# APOLLO 11 SIDEBAR NEWS

IMMEDIATE RELEASE


Air tra nilitary's AN/TSC-54 will provide Alaskans with live television of the Apollo 11 moon landing July 20, the first major news event to be seen on Alaskan TV as it happens. The antenna, which was airlifted to Anchorage on July 11, was built by Radiation Incorporated, subsidiary of Harris-Intertype Corporation, located near the starting point of Apollo 11 at Cape Kennedy.

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# APOLLO 11 SIDEBAR NEWS

For Immediate Release

TECHNICAL DATA

Engineering Information on Systems and Equipment Produced for the Apollo Program by the Electronics Group of Harris-Intertype Corporation

COMMAND MODULE PCM TELEMETRY: The pulse code modulation (PCM) telemetry system used in earlier Apollo missions also will be aboard Apollo 11. The system contains more than half of the electronic components required for the complete CM's communication and data network. The system receives analog and digital data from spacecraft sensors, samples it at selected rates, and converts it to a single serial PCM format. It can process 365 high-level 0-5 volts analog inputs at a rate of one to 200 samples per second. It also can process 304 parallel digital-bit inputs plus one serial 40-bit word. The system was built to a factor of mission reliability which allows the loss of not more than five analog channels and eight digital bits. The package employs two types of internal redundancy. Four resistors -- two in series and two in parallel -- perform the function of one resistor. There also is a duplicate circuit arrangement known as "block redundancy" which includes automatic switchover to a standby circuit in the event of primary circuit failure.

LUNAR MODULE PCM TELEMETRY: The LM PCM telemetry and timing system accepts four types of data input signals -- high-level and low-level analog, and parallel and serial digital. Each parallel digital input contains a group of eight parallel bits. The serial digital input is a return-to-zero (RZ) signal, 40-bits per word in length, with a rate of 50 words per second. The high-level analog signals are unipolar, 0-5 volts full scale. Low-level analog inputs are differential, 0-40 millivolts full scale.

The sampling rate of each channel covers a range from one to 200 sps (expandable to 800 sps by reducing the number of inputs, and cross-strapping). Low-level channels may be sampled to 500 sps or combinations of lesser rates with 500 sps as maximum. An internal timing source with an accuracy of two parts per million for 136 hours (launch through lunar liftoff, rendezvous and docking), serves as standby to the normal external timing source. System bit-rate is 51.2 kbs

(more)

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with an inherent capability of up to 64 kbs in the normal format mode. The system can also be operated in a remotely selected reduced format mode at a rate of 1.6 kbs. The system's accuracy of 1.5 per cent peak is held over a temperature range of zero to 160$^{o}$F.

540 PCM SYSTEM: The series 540 PCM acquisition and stored program decommutation system provides decommutated data outputs for computer output and entry equipment. It combines the flexibility of a random access 8192 x 40-bit, 5-microsecond memory with a high-performance signal conditioner and bit synchronizer. The system accepts all major PCM coding forms, including serial PCM/NRZ, serial PCM/split-phase, and serial RZ; with continuous coverage of bit rate ranges from one-million bits/sec NRZ and 0.5 to 500,000 bits/sec split phase and RZ. PCM formats and bit rates can be selected automatically by the stored program processor, or manually. In addition, continuous outputs are available for data formatted into parallel words and truncated words. For each serial word entering the system, output words are available in binary or BCD. Both most-significant and least-significant bit binary outputs are provided for either MSB or LSB input.

DIGITAL-TO-TONE CONVERTER: The DTOC accepts either data bit or 5 sub-bit/bit encoding at either 1 $KH_z$ or 2 $KH_z$, checks the data for correct sub-bit and data bit coding and either stores or forwards the data to the correct output. Either of two modes of operation are automatically selected by the coding in the system address (SA). When the SA is decoded, either the printer mode or computer mode is selected and the remaining data is outputted. The printer output is a serial output and no further processing is done. The computer output is a broadside dump and the data are temporarily stored until end-of-word is received and word length checked. If correct, the data are transferred to the computer. Data words of 12-bits receive special handling. The 3-bits of vehicle address and the next 3-bits of SA are stored and checked for validity. The remaining 6-bits are stored and on receipt of end-of-word, if the word length converter is at 12, the 6-bits are summed to a unitary 0-63 number, latching a relay. Each of the 64 relays are patchable to 20 additional relays with contacts which, while they can be used for other purposes, usually lead to a tone encoder.

LUNAR MODULE SIMULATOR: The LM's descent and ascent stage simulator provides test stimuli and manual control of selected signals to the stage under test during de-mated stage checkout. It also monitors response signals received from the stage under test and identifies faults or malfunctions in the stage.

(more)

LUNAR MODULE TRANSDUCERS: The transducers or sensors aboard the LM are interfaced to the PCM telemetry package by a signal-conditioning electronics assembly, which contains a variety of precision signal-conditioning modules including buffer amplifiers, AC/DC converters, low-level amplifiers, thermo couple reference junctions, etc. The LM automatic test station checks out these modules -- individually and as a complete electronics assembly. It performs state-of-the-art measurements and issues Go/No-Go decisions. The station, which has the inherent advantage of digital technique accuracy, consists of a set of stimuli to excite the signal conditioner, equipment to measure the conditioner's response, and a supervisory control unit to command all equipment operations in response to stored program instructions. It also includes a general purpose computer to provide stored program system control, perform calculations and interpret the quality of measured response.

ANTENNAS: Two 85-foot diameter TAA-2 telemetry antenna systems stand ready to support Apollo missions. These are high gain, wideband automatic-tracking systems which provide general telemetry support in the collection of data during launch and re-entry. Two shipboard S-Band telemetry antennas -- one 12-feet and one 24-feet in diameter; the 60-foot TLM-18 ARM telemetry tracking and receiving station and a 60-foot TLM-18-1 experimental tracker . . . also are available for the program. In addition, the company provided extensive modification gear to up-date other antennas and to increase their effective range. These antennas are the AN/FPS-16, the ANFPQ-6 and the TPQ-18.

# # #

July, 1969

APOLLO 11 SIDEBAR NEWS

IMMEDIATE RELEASE

Apollo 11 Mission

ALASKA TO GET LIVE TV

The Army and Air Force are combining forces to bring live TV coverage of the Apollo 11 Mission to Alaska.

To enable residents of the northernmost state to view the historic moon landing as it happens, the Army's Satellite Communications Agency (SATCOM) airlifted to Anchorage on Friday, July 11, a mini-weight antenna terminal, known as the AN/TSC-54, where it will receive television signals relayed by the Air Force's TACSAT I satellite. This marks the first time that Alaskans will be able to watch live television of a major news event. If not for this unique relay system, Alaska would have to wait for video tapes of Apollo 11 events.

Here's how it will be done: TV signals will travel from the Apollo 11 Command Module to NASA ground stations in California. They will then be amplified and routed through commerical TV facilities to SATCOM's Engineering and Test facilities at Fort Monmouth, New Jersey. A fixed antenna at the military post, which is the headquarters of the SATCOM Agency, will

-morebeam the signals to the TACSAT I satellite hovering over the Pacific Ocean for relay to the waiting TSC-54 in Anchorage.

The air transportable TSC-54, which was built by Radiation Incorporated, a subsidiary of Harris-Intertype Corporation located near Cape Kennedy, includes a four-dish "cloverleaf" antenna, an electronics shelter, and a mobile generator. The complete system, and a six-man SATCOM crew, was airlifted on a single C-130 transport plane.

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IMMEDIATE RELEASE

## SENSORS TELL IT LIKE IT IS!

A network of sensors, tiny electronic and mechanical devices that report on the status of on-board equipment, and the physical condition of the astronauts, tell it as it happens during the mission of Apollo 11.

The sensors are placed in the fuel cells, where they measure the amount of fuel aboard; in the electrical power pack, where they detect the electrical charge available; in the life support system, and hundreds of other locations. In fact, 3,858 individual measurements and readings are made on the Lunar Module, and in the three stages of the Saturn rocket.

Each sensor sends its information to a telemetry package for processing and transmission to earth. So important are the sensors and so precise their function, that a special computer system was required to perform exhaustive pre-launch tests under simulated space conditions. The system, and its auxiliaries, collectively known as the Lunar Module Automatic Test Station, were produced by the Electronics Group of Harris-Intertype Corporation.

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# APOLLO 11 SIDEBAR NEWS

IMMEDIATE RELEASE

WHAT IS LM's TEMPERATURE?

Is the temperature inside the Lunar Module holding steady? Has the command pilot's heart speeded up?

Engineers and physicians on the Apollo ground team need to know -- and quickly. Special electronic systems have been devised to feed them such information smoothly and continuously during the flight of Apollo 11. Only during the communications blackout on the far side of the moon and the short moments of fiery re-entry is this reception of data halted.

To provide a second-by-second report on conditions aboard the Apollo/Saturn V, and on the Astronauts themselves, tiny sensors make 3,858 individual measurements and readings. Not too long ago, it would have taken hundreds of communications channels to transmit the readings back to earth. However, both the Command and Lunar Modules are equipped with precision telemetry packages that funnel all the data into a single radio signal. These small units, which pack 30,500 components - in containers the size of a hatbox - were designed and built by the Electronics Group of Harris-Intertype Corporation.

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In addition to monitoring fuel flow, pressure, acceleration, valve and switch positions and related information on the spacecraft, the telemetry units relay readings on biomedical data of the astronauts.

Whatever the measurement, it is handled in much the same way -- a sensor, called a transducer, is placed in a fuel cell, or positioned against the wall of the spacecraft, or attached to the skin of an astronaut. At a constant value (for an astronaut's temperature that would be 98.6F), a single steady tone is emitted by the transducer. If his temperature rises, the tone rises; if his temperature falls, it drops - much like moving up and down the scale of a piano.

The telemetry package monitoring the transducer signals combines or "multiplexes" hundreds of them in a numerical code and transmits them on one radio channel to antennas on earth. When they are received, another system re-sorts them and translates them to display the original values for engineers, scientists and doctors at Mission Control in Houston. Received as it is happening, this information permits personnel at Space Flight Operations to "sit-in" on the eight-day flight.

IMMEDIATE RELEASE

Columbus and Apollo -

TWO HISTORIC VOYAGES - BUT WITH A DIFFERENCE

We often hear the trip of our Apollo astronauts compared to the voyage and discovery made by Columbus back in 1492. In some ways, the comparison is an apt one; we are certainly taking the first step toward vast new horizons and a new world. But any further comparison simply does not hold. Our voyage of discovery and investigation of the moon is unlike any ever attempted by man. The big difference is communications.

Columbus set out in three pitifully small ships, and at sea the only ones involved in the voyage were the crew members. Apollo is even a smaller craft with a crew of only three. But literally thousands of others are leaning over their shoulders -- in essence, making the trip with them. To learn just how this is done, let's take a look at a small package aboard the spacecraft that allows ground control to virtually go along with the astronauts.

The hatbox-size package, which weighs 45 pounds, is a precision telemetry system manufactured by the Electronics Group of Harris-Intertype Corporation. It is really a "collector" and "translator" of information to be sent to the ground. From hundreds of points in the spacecraft, information about heart rates,

-more-temperature, fuel, position, and other vital statistics, is fed into this package in the form of electronic pulses. Here they are combined into a single coded form for radio transmission to the ground. Translated and displayed, this information puts Mission Control "in space" with the Apollo 11 crew.

Let's look at it from Columbus' viewpoint. If Columbus had had even a remotely similar system, Queen Isabella would have known not only the amount of moisture and strain on every piece of wood on the Santa Maria, but would also have known the stress and temperature of every nail on the ship, and the physical condition of the crew!

Harris-Intertype has a similar package aboard the Lunar Module, too, (about half the size of the command module unit) that operates through the Command Module system. And that, in Columbus' terms, would take care of the Nina and Pinta.

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APOLLO 11 SIDEBAR NEWS

IMMEDIATE RELEASE

## RADIO AND TV COVERAGE FROM U.S.S. HORNET

The re-entry, splashdown and recovery of the Apollo 11 crew in the mid-Pacific July 24 will be reported to the world by means of a compact mobile radio transmitter built by Harris-Intertype Corporation, and anchored to the deck of the prime recovery ship, the U.S.S. Hornet.

ABC News has been charged with providing an international pool coverage of this historic event. The pool is formed by three major U.S. television networks and four radio networks. It will mark the first time that world broadcasters who use the Pacific and Atlantic communications satellites will receive direct pictures and sound of recovery operations as they occur.

It is estimated that some 225 million people will watch the Apollo 11 Mission on television in Europe, 60 million in Asia and Asia Minor, and 20 million in South and Central America. People around the world will be able to see and hear the Astronauts in their first greetings following their return from the Moon. The audio portion of the news programs -- all the voice and sound -- will be transmitted by the Harris equipment.

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Producer of the pool coverage aboard the Hornet is ABC's Ron Ogle, who will administer operations of 25 camera, lighting, sound and video tape men, as well as other engineers and production officials.

A team of four correspondents -- ABC's Keith McBee, Dallas Townsend of CBS, Ron Nessen of NBC, and Don Blair of Mutual -- will report for the four radio networks.

Because of precautions against contamination taken by NASA, the three Astronauts -- Neil Armstrong, Edwin Aldrin and Michael Collins -- will be restricted from contact with anyone but Space Agency physicians and technicians until three weeks after their return to earth. Consequently, there will be no flight deck ceremonies to welcome the men home.

Once the spacecraft splashes down, the Astronauts will don special contamination-proof suits before being picked up by a helicopter provided with a special panel constructed to separate them from the helicopter crew. Ogle's difficult job will be to televise glimpses of the Astronauts through windows as they come aboard the aircraft carrier.

Once aboard the ship, the Astronauts will remain in the helicopter, which will be towed by tractor to an elevator that will bring the craft down to the hangar deck of the Hornet. On this deck will be a mobile quarantine

- more -

facility that will be the home of the Astronauts until they return to Houston. This facility will be some 10 to 14 feet from where the helicopter is parked. When the men take that short walk, it may be the only good look at them until after their preliminary physical examination.

Following the first physical examination, the Astronauts will appear at a photo window, where with hand-held TV cameras and a microphone constructed into the facility, ABC will be able to provide coverage of the Astronauts' first public words.

To help accomplish this coverage, ABC will have three vans of equipment aboard the Hornet. Six television cameras will be employed, two of them the hand-held type to permit flexibility. The equipment will also include a complete control room, video tape facilities, video and audio control facilities and portable (wireless) microphones.

The Harris transmitter on the flight deck relays all voice and sound signals for the television and radio network pool. It was designed and developed by the Gates Radio Company, Quincy, Illinois, a division of Harris-Intertype Corporation.

# APOLLO 11 SIDEBAR NEWS

IMMEDIATE RELEASE

SPACE CAPSULES

There have been 20 U.S. manned space flights. Six were Mercury missions, ten Gemini launches and four Apollo flights. Twenty-three American astronauts have been launched on those 20 flights. Four astronauts -- Schirra, Young, Lovell and Stafford -- each made three flights. Seven -- Borman, Cernan, Conrad, Grissom, McDivitt, Scott and Cooper -- made two trips. Twelve others have made one.

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Information on the status of equipment on board the Apollo Command Module and Lunar Module -- and on the physical condition of the astronauts -- is relayed to earth via two telemetry systems designed and manufactured by the Electronics Group of Harris-Intertype Corporation. Data from the moon is back here in about 1.3 seconds!

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Twenty-three American astronauts have logged more than 1,860 hours in space. The longest flight was Gemini 7 (December 4-18, 1965), Borman and Lovell were up for 330 hours, 35 minutes and one second. The shortest: Shepard's Mercury mission of May 5, 1961 -- 15 minutes, 22 seconds.

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The Electronics Group of Harris-Intertype Corporation is now larger than the entire company was five years ago. This year corporate sales will exceed $330 million, compared with $101 million in fiscal 1964. And over $125 million, or about 40% of this year's total, will come from sales of electronic communications and information handling equipment made by the Electronics Group. The Cleveland-headquartered company also is a world leader in equipment for the printing and publishing industry.

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The three Apollo 11 crew members each made a Gemini space flight:

Neil Armstrong -- Gemini 8 with David Scott, March 16-17, 1966
Edwin Aldrin -- Gemini 12 with James Lovell, November 11-15, 1966
Michael Collins -- Gemini 10 with John Young, July 18-21, 1966

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Scientific advances spurred by the space program have helped some companies in long-established industries. Harris-Intertype Corporation, for example, pioneered the application of electronics to equipment for printing and publishing industry. Twelve years ago -- the year of Sputnik 1 -- the company also started moving into electronic communications equipment. Corporate sales have increased 550% since then -- and electronic products now account for 40% of total volume.

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