APOLLO 15
PRESS INFORMATION

GENERAL ELECTRIC

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press information
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SD-71-15A

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GENERAL ELECTRIC'S ROLE IN APOLLO

CAPE KENNEDY, FLA.--General Electric is one of the largest and most diversified of the 20,000 separate contractors involved in the Apollo Program.

More than 6,000 General Electric employees in 26 locations have provided support ranging from checkout of the spacecraft, booster and launch facilities to illuminating the instrument panels in the command and lunar modules and color TV transmission of the Apollo splashdown.

Pre-launch checkout systems, built by a GE Space Division component in Daytona Beach, Fla., already have conducted thousands of tests on the Apollo spacecraft, its Saturn launch vehicle and on the launch facilities themselves.

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"Fourteen Apollo Systems acceptance checkout equipment (ACE) stations have tested the Apollo 15 spacecraft from factory to launch," G.T. Smiley, General Manager of Apollo and Ground Systems, said. "Each three-room ACE station comprises racks of equipment which conduct critical tests, acquire data, analyze findings and report on those findings. They are capable of checking all of the spacecraft's more than 3,000 test points automatically, receiving data at the rate of 200,000 bits per second."

Similar GE equipment inspects all of the thousands of checkpoints on Saturn V's three stages; conducts all switching operations in the final three minutes of countdown; checks fueling of the Saturn stages; and controls communications, telemetry, water control and launch complex operations.

Another GE Space Division component, the Technical Operations and Services Department, operated and maintained the 25-square-mile NASA Mississippi Test Facility (MTF) near Bay St. Louis. Services provided NASA at MTF, proving ground for the first and second stages of the Apollo/Saturn V space vehicles, included range maintenance, systems modifications, central control and the transport, storage and transfer of cryogenic propellants and high-pressure gases.

The department also operated high-pressure water systems on the test stands, performed test and range data acquisition and processing, and operated the laboratories which provided electronics, instrumentation, materials, calibration, photographic, acoustic, and video services.

The Valley Forge, Pa.-based GE Space Systems has made two principal contributions to the Apollo Program. Lee Farnham, General Manager, Space Systems, said that a color TV transmission system, built and operated by GE for Western Union International, Inc., provides live color television coverage

of all Apollo recoveries via satellite from the recovery carrier. A radioisotope thermoelectric power system, called SNAP-27, will provide electricity to power lunar surface experiments to be left on the Moon by Apollo 15.

Neutrography service, a non-destructive testing technique similar to X-ray but which reveals details which cannot be seen in X-rays, is being used by contractors who supply components to the Apollo project. This service is provided by the General Electric Irradiation Processing Operation in Pleasanton, Calif. Neutrography is used principally to inspect pyrotechnic devices, such as the tension tie cutters, which must separate the command module from the command service module prior to re-entry. The service is especially useful for inspecting explosive devices which contain high quantities of hydrogen but which appear transparent when X-rayed.

Instrument panels aboard NASA's Apollo command module and its piggy-back Lunar Module will glow with "moonlight" lamps manufactured by the General Electric Miniature Lamp Department in Cleveland, Ohio. The low-brightness electroluminescent (EL) light sources are wafer-thin and produce a brightness approximating moonglow. They were chosen for the job because they provide more visual comfort for the astronauts and because of their extreme ruggedness.

CONTRIBUTIONS OF OTHER GE COMPONENTS

Other General Electric components, their locations and contributions were:

Component	Location	Contribution
Aerospace Electrical Equipment Department	Syracuse, N.Y.	Electrical control assemblies for LM
	Erie, Pa.	Hydraulic pump motor on Saturn II first stage
Aircraft Engine Group	Lynn, Mass.	Engines for Apollo recovery helicopters; and engines for Lunar Landing Training Vehicles.
	Evendale, Ohio	Ullage rocket motor cases for second stage of Saturn
Apparatus Service Shops Department	Chamblee, Ga.	Instrumentation repair
Capacitor Department	Irmo, S. C.	Capacitors used in Lunar and Command modules
Communications and Control Devices Department	Waynesboro, Va.	About 500 relays for use in Apollo Spacecraft.
Distribution Assemblies Department	Plainville, Conn.	Switchboards and panelboards used in ground support equipment
Distribution Protective Equipment Department	Pittsfield, Mass.	Emergency substation at Cape Kennedy
Distribution Transformer Department	Oakland, Calif.	Transformers aboard Essex provided power for TV coverage of Apollo 8 recovery.
Electronics Laboratory	Syracuse, N.Y.	Computer Display developed for NASA simulates space docking
Industry Control Department	Salem, Va.	Controls for hoist systems at Redstone Arsenal, KSC Complex 39 and MTF

Component	Location	Contribution
Industry Sales and Engineering Operation	Schenectady, N.Y.	Engineered hoist systems at Redstone, KSC and MTF
Industrument Department	West Lynn, Mass.	Instrumentation and control for launch pad cooling system
Insulating Materials Department	Schenectady, N.Y.	Insulating materials used in variety of applications at Kennedy Space Center.
Lamp Glass Department	Cleveland, Ohio	Meteor shield built for first Apollo mission
Lamp Metals and Components	Cleveland, Ohio	Raw tungsten supplied for Apollo control jets
Large DC Motor Business Section	Schenectady, N.Y.	Traction drives in crawler transporters at Cape Kennedy
Lighting Systems Department	Hendersonville, N.C.	Interior lighting of Vertical Assembly Building (VAB) at Cape Kennedy
Magnetic Materials Business Section	Edmore, Mich.	Thermistors for use in automatic exposure controls
Marine Turbine and Gear Department	West Lynn, Mass.	Marine steam turbines and gears for Apollo 7 recovery ship, USS Essex
Mechanical Drive Turbine Department	Fitchburg, Mass.	Generators for power on all Apollo instrumentation ships
Medium AC Motor Department	Schenectady, N.Y.	Motor used in derrick at Redstone.
Mobile Radio Department	Lynchburg, Va.	Radios used by security and maintenance personnel at Kennedy Space Center

Component	Location	Contribution
Plastics Department	Pittsfield, Mass.	Lexan polycarbonate used in helmets worn by Apollo astronauts
Power Transformer Department	Pittsfield, Mass.	Lightning protection studies at Cape Kennedy
Semiconductor Products Department	Syracuse, N.Y.	Semiconductors used in Apollo spacecraft
Silicone Products Department	Waterford, N.Y.	Silicone compounds for overshoe soles and glove finger tips
Small AC Motor and Generator Department	Schenectady, N.Y.	Motors in use at Redstone, Cape Kennedy, and MTF.
Speed Variator Department	Erie, Pa.	56 Max speed drive systems for derricks and cranes at Redstone, KSC and MTF
Tempo	Santa Barbara, Calif.	Twelve Apollo related studies.
Tube Department	Owensboro, Ky.	Video display devices in use at Houston Manned Space Flight Center, Bethpage, N.Y. and Downey, Calif.
Visual Communication Products Department	Syracuse, N.Y.	Color TV cameras used by network crews on Apollo 8
Wire and Cable Department	Bridgeport, Conn.	Electronic and power cable in three launch towers and VAB at Cape Kennedy

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"ATOMIC BATTERY" TO AGAIN POWER LUNAR EXPERIMENTS

VALLEY FORGE, PA.--Power for the Apollo 15 Lunar Surface Experiment Package (ALSEP) will be provided by a General Electric-developed "atomic battery" similar to ones that continue to power instrument packages left behind by Apollo missions 12 and 14.

Called SNAP-27, the 43-pound radioisotope thermoelectric generator (RTG) was designed by the GE Space Division here. The SNAP-27 provides a minimum of 63.5 watts of electrical power for more than a year. The generator, developed for the Atomic Energy Commission, operates continuously throughout the lunar day and night under temperature extremes which range from +170°F to -280°F. A previous SNAP-27 generator left on the moon over a year and a half ago by Apollo 12, continues to provide more than 70 watts of power to the experiment as does the SNAP unit deployed on the Apollo 14 mission in February, 1971.

The Apollo 15 experiment package will measure moonquakes and meteorite impacts; the lunar magnetic field; variations in the moon's atmosphere; heat from the lunar surface and other areas of interest.

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SNAP-27 is a total system that includes flight hardware and all necessary ground support and checkout equipment. The system has no moving parts. Flight hardware consists of the SNAP-27 power generator, called an integrated power unit (IPU), a flight handling tool, and a graphite lunar module fuel cask.

The Integrated Power Unit is an assembly of two basic components--a fuel capsule and a generator assembly, which are carried separately on the lunar module. The inert generator assembly is fitted into the scientific equipment bay of the lunar module with the Apollo Lunar Surface Experiment Package (ALSEP), while the fuel capsule is attached to the exterior of the module in the graphite fuel cask.

After lunar landing, the astronaut will remove the generator assembly and the ALSEP from the equipment bay. He then will pull a lanyard, which releases the fuel cask, allowing it to swing to a horizontal position. Using the flight handling tool, he will remove the fuel capsule from the cask and place it into the center of the generator assembly. The activated SNAP-27 then will be carried with the experiment package for placement on the lunar surface.

Associated SNAP-27 ground support and checkout equipment includes shipping containers for storing the generator assembly and fuel capsule, ground handling tools, and test consoles for generator voltage, current and power readouts.

Electric power is produced by applying a heat source utilizing plutonium 238 to a thermopile composed of lead telluride thermocouples. The thermocouples produce electricity when a temperature difference is maintained across their length. Beryllium is the main structural material due to its

high strength--and its light weight.

"As successful as SNAP-27 has been, it really is the forerunner of more powerful, longer duration radioisotope thermoelectric generators," forecasts A.J. Arker, Manager of GE's Isotope Power Systems Operation. "Work is already underway," says Arker, "on the Multi-Hundred Watt RTG" (MHW-RTG). This generator is being designed to provide 100-200 watts of power for up to 12 years. With its modular construction, the MHW-RTG could be the basis for space power systems of up to 1000 watts.

"On future space flights, the MHW-RTG might power advanced satellites as well as spacecraft on interplanetary missions,"Arker indicated.

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SNAP-27 SYSTEM FACT SHEET

GENERATOR PERFORMANCE

Design Output Power (Min)	63.5 watts (end of mission)
Expected Output Power (Actual)	67.0 watts (end of mission)
Output Voltage (controlled by ALSEP)	16.0 volts dc
Current (nominal)	4 amps
Max. Hot Junction Temp	1080°F (lunar day)
Max. Cold Junction Temp	525°F (lunar day)

GENERATOR DESIGN CHARACTERISTICS

Over Generator Dia. (over fins)	15.7 in.
Overall Generator Length	18.1 in.
No. of Fins	8
Fin Radial Length	5.0 in.

HEAT SOURCE CHARACTERISTICS

No. of Fuel Capsules	1
Capsule O.D.	2.50 in.
Capsule Length	15.6 in.
Thermal Output (nominal)	1480 watts

WEIGHT

Generator Assembly (includes Cable, Connector & Instrumentation)	28.2 pounds
Fuel Capsule Assembly	14.8 pounds
Total IPU Weight	43 pounds

FLIGHT HARDWARE

Generator Assembly (GA)	Thermopile, hermetic seal enclosure, heat rejection system, and wiring harness assembly.
Fuel Capsule Assembly (FCA)	Fuel, fuel encapsulation and end plate latch assembly.
Graphite Lunar Module Fuel Cask (GLFC)	Transport device for FCA on Lunar Module.
Flight Handling Tool (FHT)	Used to remove FCA from the GLFC and to insert it in the GA.

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MILLIONS TO VIEW APOLLO 15 SPLASHDOWN VIA "EMMY" AWARD-WINNING TRANSMISSION SYSTEM

VALLEY FORGE, PA.--General Electric's "EMMY" award-winning TRANSATEL TV transmission system is scheduled to bring another Apollo recovery scene to millions of people throughout the world this month.

This portable system is mounted on the deck of the recovery ship, USS Okinawa. The system will transmit via satellite the splashdown and recovery of the Apollo 15 crew back to the United States and the world from the Pacific, in less than one-quarter of a second. Working in conjunction with Western Union International, TRANSATEL has been used for TV transmission of all Apollo recovery missions since Apollo 7.

Developed by GE's Space Division, it utilizes a light-weight, 15-foot collapsible parabolic antenna which can be assembled quickly. The antenna and other transmission equipment can be air-transported by cargo jet and set up within 24 hours at almost any site in the world, where TV, radio, photographs, or printed material can be transmitted via satellite globally.

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TRANSATEL was awarded a special "EMMY" earlier this year by the National Academy of Television Arts and Sciences "in recognition of outstanding achievement in engineering development." The citation was based upon the outstanding transmission of signals from earlier Apollo recoveries. During a previous Apollo TRANSATEL mission, the picture quality received by ABC's International Control Center in New York for retransmission overseas prompted a representative of the European Broadcasting Union to radio that they were the best pictures ever relayed from the U.S.

Commenting on the "EMMY" award, Daniel J. Fink, Vice President and General Manager of the General Electric Space Division, said, "We're very proud to be honored for this significant technological achievement." He predicted that the use of space for global communications will expand in the 1970's and that by 1980 almost all nations will be utilizing satellites for worldwide communications.

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FACT SHEET

TRANSATEL CAN PROVIDE THE FOLLOWING SERVICE:

ELECTRICAL CHARACTERISTICS

Operating Frequencies-Transmit	6.2-6.3 GHz
-Receive	4.1-4.2 GHz
Transmitter Output Power	Up to 14 KW CW
Transmit Capability	1 Color Video Channel 1 Program Audio Channel 6-4 KHz Voice Channels
Receive Capability (Dependent on Satellite EIRP)	Up to 6-4 KHz Voice Channels (1) 1 Color Video (2) 1 Program and 6 Audio (2)
Antenna	15-foot Diameter Parabolic Reflector with Prime Focus Feed. 18, 21, 28, and 30-foot Options Available for Land-Based Operation
Prime Power	440V 3ϕ 60 Hz

(1) When used with a parametric amplifier and 15-foot antenna

(2) When used with a parametric amplifier and fixed 28-foot reflector

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MECHANICAL CHARACTERISTICS

Weight

Antenna.....150 lbs.

Tracking Pedestal.....2500 lbs.

Radome.....1000 lbs.

Electronics Shelter.....10,000 lbs.

Generator.....5700 lbs.

Size (Packed for Shipping)

Antenna.....10' long x 3' deep x 3' high

Tracking Pedestal.....6' long x 6' deep x 5' high
(2 pieces each)

Radome.....7' long x 5' deep x 4' high

Electronics Shelter.....10' long x 8' deep x 8' high

Generator.....12' long x 4' deep x 7' high