SPACE

Tape for Space

The amount of vital magnetic tape used so far during America's space shots would reach from here to the moon and then make three loops around the earth—By Jonathan Eberhart

➤ RED TAPE has been one of the greatest hindrances to the U.S. space program, but without another kind of tape—the magnetic variety—space research would have ground to a halt years ago.

During the first 20 minutes of a typical space shot, for example, three times as many "words" as there are in the entire Encyclopedia Britannica must be recorded on tape.

Actually these are not words as such but their equivalent in digital "bits," the language of electronic computers. The Library of Congress estimates that about 30 bits are the equivalent of an average English word.

The first data from a pilotless flight was recorded by a much more austere system. In 1929, Dr. Robert Goddard, the "father of modern rocketry," built a small rocket in which he mounted a thermometer and a barometer. Facing the "meterological data acquisition system," as it would probably be called today, was a camera. When the rocket had climbed to a height of 100 feet, the camera shutter was automatically tripped. Afterwards the rocket floated back to earth with its prize.

Magnetic tape has given data handling a much more complicated role—in fact, it now has three roles. Briefly, they are monitoring the condition of the spacecraft, giving it operational instructions, and recording the information that it collects on its mission.

As space missions have expanded since Goddard's pioneering experiments, new problems have cropped up, some of them almost unheard of only a few years ago.

One problem, especially with long-distance flights, is that data must be sent back to earth slowly. Since the small power supplies permissible on space vehicles produce only small voltages for the playing back of data, transmissions from spacecraft must be kept to a very narrow band of frequencies. Otherwise the available power would be too "diluted" to do any good.

The result of all this is that only so much data can be pushed through to earth in a given time. This is the reason Mariner 4's photos of Mars took only minutes to record but days to play back.

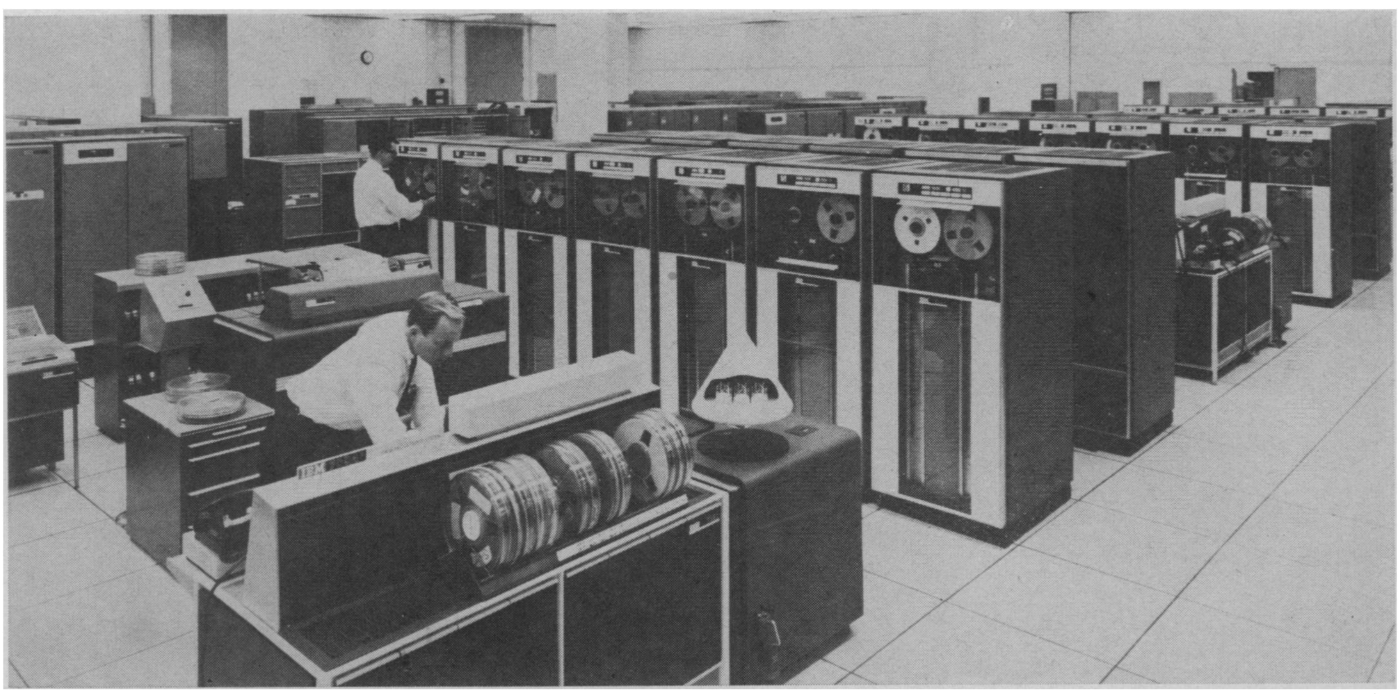
These difficulties beset only one of magnetic tape's three jobs. Back on earth, where millions of dollars worth of electronic computers carry on two-way "data-talks" with their spacecraft, magnetic tape has had no such stumbling blocks. Development has gone on unfettered at a prodigious rate, and the United States' ribbon of tape grows longer, and longer, and longer.

Frequency Response

Expanded frequency response, which in a phonograph simply means the highest and lowest notes the equipment will reproduce, has been one of the biggest gateways to increased data collection.

Whereas a good high fidelity phonograph will reproduce sounds as high as 15,000 or perhaps 20,000 cycles per second, some of today's sophiscated recorders can fit as many as five million c.p.s. on a tape.

However, this does not mean only a clearer sound. Every additional bit of frequency response allows more data to be recorded in the same amount



International Business Machines Corporation

TAPESVILLE—These computers and magnetic tape equipment are being operated by IBM engineers at the computing center of the National Aeronautics and Space Administration's Manned Spacecraft Control Center, Houston. Tape recording and handling devices used during space missions are constantly being improved to keep up with the ever-faster computers they serve.

of time and tape. Medical data on an astronaut, for example, can be sent to earth over the low frequencies, while information about the performance of his space capsule is transmitted at the same time on high-frequency bands.

During the week before an average space shot an average of 1.7 billion words are recorded. And these include virtually nothing but checkout data—nothing about the flight or the space environment.

NASA's total archives of space-tape contain more than six trillion words. To find some idea of its size, it can be compared to the Library of Congress, which estimated in 1963 that it had only about two-thirds as many words on all its miles of shelves.

Space flights are not the only sources of data to be recorded. One recent test of a large rocket engine involved almost 400 continuous measurements. In fact, almost everything NASA tests is documented, at least in part, on tape. Vibration tests, heat tests and pressure tests—all are made easier because tape recorders store the data until it can be analyzed by computers.

U.S. scientists are still learning things they did not know from tapes made more than a year ago. In the future, even more information will be recorded. By the time men actually set foot on the moon, NASA will want to be ready to record every conceivable tidbit, so that hoards of scientists can spend months or even years playing the tapes over and over and over and over. . . .

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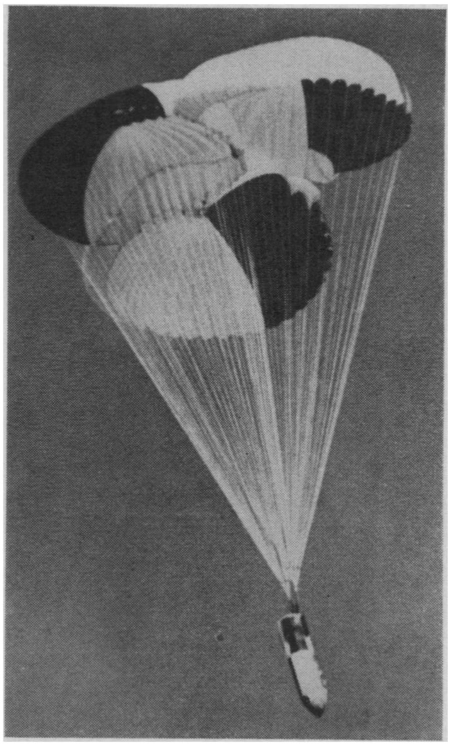

NASA

FLOATING CLOVERLEAF—A cloverleaf parachute is shown fully opened in the final minutes of descent. Future spacecraft may use it for either land or water landings. The Cloverleaf, developed by the Ventura Division of Northrop Corporation for the National Aeronautics and Space Administration, provides a glide range of nearly two feet for each foot of vertical descent.

SPACE

Astronauts Named

➤ ASTRONAUTS have been named to flight crews for the first manned Apollo mission and Gemini 11.

Prime crewmen for the Apollo earth-orbital mission tentatively scheduled in the first quarter of 1967 are USAF Lt. Col. Virgil I. "Gus" Grissom, USAF Lt. Col. Edward H. White II and Navy Lt. Roger B. Chaffee.

Assigned as prime crewmen for the Gemini 11 mission scheduled in the last quarter of this year are Navy Comdr. Charles "Pete" Conrad Jr., command pilot, and Navy Lt. Comdr. Richard R. Gordon Jr., pilot.

Duration of the first manned Apollo mission, as presently conceived, will be determined on an orbit by orbit basis for the first six orbits, then on a day-by-day basis for up to 14 days maximum. Its orbit is to carry as high as 265 miles statute with a perigee of 100 statute miles. Prime goal of the flight will be to verify spacecraft, crew and ground support compatibility.

As presently planned, Gemini 11 will be a rendezvous and docking flight of up to three days duration. Rendezvous is scheduled in the first revolution, with the flight crew using onboard systems to compute their own trajectories and maneuvers. Ground systems will be used as a backup.

Plans call for the spacecraft to rendezvous with the Gemini 11 Agena vehicle, which procedurally will be a passive target the second time. The rendezvous also will be accomplished with the use of onboard systems.

Extravehicular activity is planned, using a hand-held maneuvering unit similar to the one which would have been used on Gemini 8. Duration of EVA and tasks to be performed will be based on experience in Gemini 9 and Gemini 10.

Approximately eight experiments are tentatively scheduled for Gemini 11. All of them will be repeats of experiments flown previously, but a list of specific experiments will not be available until a reevaluation is completed.

The Gemini 11 Agena will be parked in a high orbit for possible use during Gemini 12.

The launch profile and orbital parameters will be essentially the same in Gemini 11 as those in Gemini 8. The Agena will be launched into a 185 statute mile orbit, and rendezvous will be accomplished at that altitude.

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RADIOLOGY

New X-Ray Helps Cure Deafness in One Ear

➤ CHILDREN born deaf in one ear may be cured surgically with the use of a new form of X-ray photography to guide the surgeon to successful repair operations.

Called "thin-section tomography," the technique was described by Dr. Arnold Berrett, assistant clinical professor of radiology, New York Medical College. In effect it isolates in the X-ray photograph a thin slice of ear by blurring out the interfering bones and other structures. This allows the surgeon to view the tiny structures inside the ear and then operate microscopically upon the abnormalities, reconstructing to restore hearing.

"Children may be born deaf in one ear and be otherwise normal," Dr. Berrett explained. "If untreated, it may seriously handicap the child in learning and general development."

There are numerous other areas in which this technique may be employed, Dr. Berrett said.

Conventional diagnostic X-rays produce a two-dimensional presentation of all the structures in the line of X-ray beam and the exposed film. Because of the superimposition of many structures, diagnostic interpretation may at times be difficult. This is true of the skull, which is a complex and involved anatomical structure.

Tomography is an old X-ray technique which makes it possible to select a thin slice of a particular area, and makes interfering structures virtually invisible because of the purposeful blurring.

The new X-ray machines overcome some of the very definite limitations of standard X-ray examinations and meet the demands of modern microscopic surgery. These tomographic machines have been pioneered in France and other European countries.

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GENERAL SCIENCE

Fishing by Helicopter Planned in New Zealand

➤ A HELICOPTER is the latest tool for commerical fishermen in New Zealand.

A new company called Marine Helicopters plans to use an American Hughes aircraft to set as many as 50 miles of fishing line and 50,000 hooks in the water each day.

The helicopter will also lay nets and crayfish pots, and will be armed with harpoons for shark shooting to protect their catch. Lines laid close to shore will be pulled in by a jeep, while those farther out will be retrieved by a man in a small boat.

The haul of fish will be carried in nets slung under the helicopter.

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