# space sciences

## Gathered at the Manned Spacecraft Center in Houston during the flight of Apollo 9

NAVIGATION

### Apollo 8's remarkable numbers

As space officials analyze the data from the Apollo 9 test flight of the lunar module, a check reveals the remarkable standard set by the previous mission, Apollo 8's round-trip to the moon.

Apollo 8 began in style by lifting off the pad less than two-thirds of a second late, and it splashed down in the Pacific a mere 11 seconds behind time. During its ascent to earth orbit, every one of the engine ignitions and cutoffs of the three Saturn 5 booster stages was within four seconds or less of the flight plan. The S-4B third stage reignited only 0.9 seconds late to send the spacecraft toward the moon, and shut down exactly on time, having pushed the three astronauts to a speed scarcely one-fifth of one percent off target.

On the outbound leg, four midcourse corrections were scheduled, but so accurate was the trajectory that the first was not deemed necessary until more than two hours past its set time, and the second and third corrections were not needed at all. Correction No. 4 was used to provide a trivial change of two feet per second, though officials said it, too, could have been dispensed with.

The spacecraft's Service Propulsion System was fired three times around the moon—first to get into lunar orbit, then to circularize the orbit, and finally to get out again—and each burn was accurate to the second. The latter two of the three planned homebound midcourse corrections were not needed at all; reentry speed was precisely as planned.

SELENOLOGY

### Mineral separation facility

To ensure the best conservation and distribution of the lunar rock samples to be brought back by Apollo astronauts, a mineral-separation facility is being added to the lunar receiving laboratory at the Manned Spacecraft Center in Houston.

Equipment will be provided—some of it just now being developed—for crushing, sieving, magnetic separation and encapsulation of samples. Some of the separation workbenches will have continuous flows of inert gas across their surfaces to keep dust from collecting on the samples.

Mineral-separation technicians are being trained by the U.S. Geological Survey in Washington, D.C., and California before they begin work at Houston.

COMMUNICATIONS

### NASA gets lunar walkie-talkies

While Apollo 9 was in space sorting out communications difficulties with the lunar module, the Manned Spacecraft Center in Houston was being delivered the first production models of the walkie-talkies that the Apollo moon explorers will use to communicate with earth.

These extra-vehicular communications systems are designed to keep lunar-surface-walking astronauts in touch with one another, with the spacecraft and with mission control on earth. For conversations with earth, signals from the EVCS will be relayed through the lunar module's more powerful equipment. To talk with the command module, orbiting the moon overhead, signals will have to go to the LM, to earth and finally back to the CM.

The 6.5 pound, very high frequency (VHF) units are each about the size of a cigar box. Each RCA-designed unit contains two AM receivers, two AM transmitters, either an FM receiver or an FM transmitter and telemetry instrumentation to transmit biomedical data and information on the condition of the moon-walker's spacesuit.

ROCKETRY

### First of the slimmer Saturns

The second stage of the Saturn 5 booster that carried Apollo 9 into orbit was the first of a new, lightweight variety designed to carry more fuel for flights that are higher, faster, longer or all three. In addition, the S-2 second stage was the first to carry engines uprated from 225,000 to 230,000 pounds of thrust.

There are 15 S-2's being built under the present contract by North American Rockwell Corp.'s Space Division in Seal Beach, Calif. Apollo 9's stage was No. 4. That one, and all subsequent ones, are the lightweight models. The booster stage is 81.5 feet tall and 33 feet in diameter. Its five engines now produce a total of 1,150,000 pounds of thrust.

The major weight reduction came from 3,250 pounds trimmed off the vehicle structure. About half of this came from a 16 percent reduction in the thickness of the tank sidewall.

The result is a stage weighing 84,600 pounds, down from 88,500. Similar changes in other parts of the booster brought the total dry Apollo 9 booster weight down from 304,000 to 295,600 pounds.

PROPULSION

### Nuclear rocket begins new test series

An experimental nuclear rocket engine, planned to aid in development of the Nerva nuclear upper-stage booster, has begun new test firings in Jackass Flats, Nev.

The tests, run by the Space Nuclear Propulsion Office administered jointly by the National Aeronautics and Space Administration and the Atomic Energy Commission, are to reach the engine's full design thrust level of 50,000 pounds. This corresponds to about 200 megawatts of power and a chamber temperature of 2,000 degrees F.

The main test objectives are to gather data on the engine during simulated high-altitude, low-pressure operation and to evaluate control concepts being considered for the future flight version, for major space missions after the Apollo program.