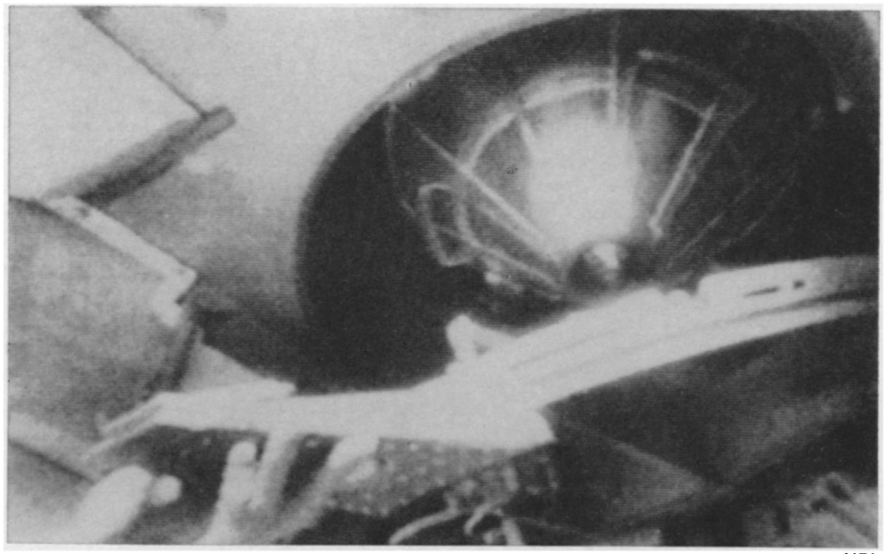
Spider makes its mark

Only moon-landing radar is still unproven as Apollo 9 moves U.S. toward the moon



UPI

Inside the Spider, an astronaut's hand reaches to close the docking tunnel.

Before the launch of Apollo 9 (SN: 3/15, p. 255), space officials were even more cautious about the exhaustive mission than they usually are: "I'll be surprised," said one, "if we really accomplish all the things we've set out to do." Five days later, after Astronauts James McDivitt, David Scott and Russell Schweickart had almost flawlessly demonstrated the spaceworthiness of the lunar module and left its two stages in orbit around the earth, the view of the mission had changed. "In every way," said Apollo director Gen. Samuel Phillips, "it has exceeded even our most optimistic expectations."

In fact, one of the most annoying problems of the flight was an overcautious alarm that kept humming and glowing red when nothing was wrong.

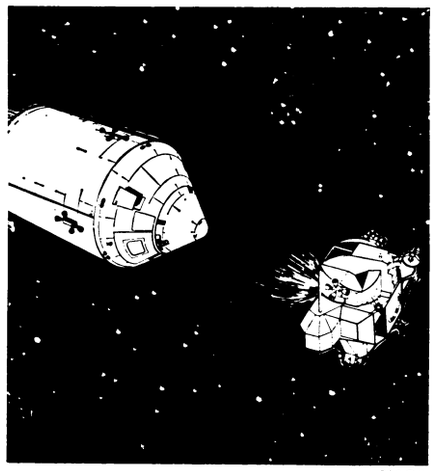
Once the combined command and service modules, christened Gumdrop by the astronauts, had docked with the lunar module about three hours into the flight, most of two days was spent in checking out the LM and maneuvering the coupled spacecraft around as one with Gumdrop's main service propulsion engine. One important goal of this was to measure the strength of the joint between Gumdrop and the LM, alias Spider. "You can feel the whole thing shake and vibrate," radioed Scott, "but it's pretty solid."

Shortly after noon on the mission's third day, however, came Spider's first big test, the firing of its descent engine, Apollo's only throttlable engine. It passed with flying colors, with McDivitt moving the throttle up and down to vary the thrust over a wide range.

The big event of the following day almost didn't happen. Two attacks of nausea had officials worrying that rookie Schweickart might not be up to performing his planned spacewalk, intended to demonstrate among other things that the LM crewmen could return to the command module even if the connecting tunnel was blocked. But with hours to go, Schweickart was fit and ready.

He never did get all the way to the command module during his excursion —officials decided not to overtax him— but that was the least important part of the exercise. The main aims were to get the LM hatch open, so that Spider would be operating in the same airlessness it would face on the moon, and to have Schweickart try out the backpack life-support system that would be necessary on the lunar surface. The hatch was opened, and Schweickart, his backpack working, moved out onto a platform known as the porch. The backpack was the first which permitted extra-vehicular space activity without an oxygen-supplying umbilical cord.

But the fifth day was the most important of the flight. Simulating the lunar landing mission, Spider separated from Gumdrop and used its descent engine to take up a carefully calculated orbit that would move it more than 100 miles from the command module. While on its own, Spider then jettisoned its descent stage, and used its ascent engine to rendezvous again with Gumdrop. This was the first time that the ascent engine had ever been fired with men aboard; it will be the only way home for astronauts on the lunar surface. "It's a sort of a kick in the fanny compared to the DPS (descent propulsion system)," radioed McDivitt, "but it went all right."



NASA

Last of the LM: final ascent burn.

Once the LM ascent stage had rejoined Gumdrop, McDivitt and Schweickart reentered the command module, which had been under Scott's solo control. The last action from Spider, triggered by radio from the ground, was the firing of the ascent engine a second time, to carry the ascent stage away from Gumdrop into a lofty orbit extending more than 4,300 miles above the earth. This again simulated the climb from the lunar surface. Officials predict the ascent stage will not reenter earth's atmosphere for 19 years.

Spider was the last major Apollo component to be checked out, but one of Spider's key systems still remains to be tested in its operating environment. This is the landing radar, designed to report the distance of the LM from the lunar surface, as well as its forward and lateral velocity. Accurate tests on

earth are impossible, its designers say, and Apollo 9 provided only self-tests, in which electronic signals simulating speed and distance information were fed into the radar's analytic circuitry.

Even moonbound Apollo 10, in which the LM will descend to within 50,000 feet of the lunar surface while the command module waits in orbit 60 miles up, will provide only a rough evaluation. The landing radar is designed to report accurate height data from only about 25,000 feet on down, and velocity from about 18,000. Thus, no one will know how good the landing radar is until the LM actually has to use it to land.

Apollo 10 is still scheduled for May 17, first day of that month's launch window, with Apollo 11, the first manned lunar landing mission, aimed at July 15. Apollo 10 is physically incapable of being used for a lunar landing, largely because of the weight of its lunar module ascent stage (SN: 3/1, p. 218), although the minute, and extremely under-doggish possibility exists that Apollo 10 could simply be pushed out of the line-up by an early Apollo 11. This would bank everything, however, on Spider's one manned trial last week. Successful as this was, many high officials in the National Aeronautics and Space Administration feel that the vehicle's complexity and troubled past warrant a second try-out. The decision is due this week or next.

One strong argument in favor of orbiting the moon with Apollo 10 is the chance to study the changes caused in spacecraft orbits, particularly low ones, by varying mass concentrations beneath the lunar surface. These irregularities caused the roundness of Apollo 8's lunar orbit to change by more than five miles, as well as making it lag as much as three miles behind and almost half a mile above or below where computers on earth predicted it would be. Mission planners want to be able to predict at least two orbits in advance exactly where the LM will be when it must start its descent to the surface, so any variations due to the mass concentrations are undesirable, and possibly dangerous.

Apollo 8 astronauts took altitude measurements with both a telescope and a sextant during their 20 hours in lunar orbit, and the two kinds of measurements did not agree. Thus, faced also with the untried landing radar, officials have double grounds for concern about accurate orbital computation. Flight Operations Director Christopher Kraft Jr. has even proposed that Apollo 10's stay-time in lunar orbit be increased from about a day, similar to Apollo 8, to as long as 63 hours to gather more data on orbital perturbations caused by the mass concentrations. ◇

MINE SAFETY

A pair of bills, a brace of problems

Although most mining deaths come from unspectacular mishaps or occupational disease, it usually takes a disaster to get Congress to pass major coal mine legislation. Miners had to lose their lives in an explosion in Centralia, Ill., in 1947 and more had to die in 1951 in West Frankfort, Ill., before the 1952 Federal Coal Mine Safety Act was enacted. It is still the chief legislation regulating coal mine operations. Out of the deaths of 78 miners last November near Farmington, W. Va., will come a new coal mine safety act (SN: 12/7, p. 568).

Bills from both the Nixon and Johnson Administrations are working in the Congress. A tally by Senator Jennings Randolph (D-W.Va.) at a Senate subcommittee hearing last week showed agreement between the Johnson bill, which he introduced last year, and the Nixon bill, on about 16 provisions out of 23.

Most significantly, both bills would vest authority in the Secretary of the Interior to set mandatory health and safety standards. Under the 1952 act this authority belongs to Congress. But to Interior Secretary Walter J. Hickel and others, Congressional decree is an inefficient and cumbersome method to bring about needed health and safety measures in the ever-changing coal industry.

Hickel points out that many suggested revisions have not been enacted because the authority rests with Congress. "It is not practicable," he says, "to expect Congress to enact specific and detailed health and safety standards. The fact that Congress has changed the coal mine safety standards only three times in the last 30 years demonstrates the inadequacy of the legislative route for establishing mine health and safety standards. We must allow sufficient flexibility in the setting of standards so that new technology can be utilized for the benefit of the miners."

In what seems like a case of strange bedfellows, the coal industry and the United Mine Workers of America oppose the transfer of power. The UMW, preferring to work through Congress as in the past, feels that such a transfer could be used to weaken as well as strengthen safety requirements. Representative Ken Hechler (D-W. Va.) has accused the UMW of dragging its feet in the area of mine safety. "Loud talk in public," says Hechler, "cannot cover up the private conspiracy with management which has resulted in high wages, high production, high accident rates, high level of coal dust and high incidences of black lung." Hechler has been a focus for corrective action.

United Mine Workers Journal
Dr. Goldman: coal and black lung.

It is the problem of black lung which constitutes the major difference between the Nixon and Johnson Administration bills. Black lung disease (coal pneumoconiosis) afflicts 125,000 U.S. miners (SN: 6/3/67, p. 521). As described by Dr. I. E. Buff, a Charleston, W. Va., physician who has worked closely with miners and who was a leader in the fight to get workmen's compensation for black lung in the state, coal dust collects around the small arteries of the lungs, eventually choking them off.

The constrictions, make breathing difficult by depriving the lungs of blood and therefore causing lung cells to die. This produces a back pressure on the heart, which is working overtime to bring in oxygen to compensate for the lung tissue that has died. At the same time, carbon dioxide build-up poisons the body. The end results range from heart attack to emphysema to general deterioration of the body.

Additional evidence on black lung was presented by Dr. Joel Goldman of the UMW-supported clinic in Centerville, Pa.

According to Dr. Buff, in practice the compensation laws of the three other states that have them—21 mining states do not—are inadequate because the states presume a miner not to have black lung, and he must prove otherwise. About 80 to 90 percent of the cases of the disease will not show up on the typical X-ray demanded by the states for the miners to be compensated. Even West Virginia's new law, the result of a wildcat strike, is considered an unsatisfactory compromise by the miners because of insufficient medical benefits and restrictive requirements.

The major issue between the Nixon