



Lockheed

RENDEZVOUS—The way in which Gemini spacecraft rendezvous and dock is illustrated in this drawing. At top right, the Agena Target Vehicle is stationary as the two-man spacecraft moves toward it. At left, the two vehicles are joined.

SPACE

Gemini 8 Launched

Another milestone in space flight history was reached when Gemini 8 astronauts completed docking maneuvers with an Agena vehicle—By Jonathan Eberhart

► **THE MOST** complicated maneuvers in man's first flight to the moon will be the various couplings, uncouplings, dockings and rendezvous performed at the two ends of the journey. Now, after several malfunctions, an aborted launch attempt and some compromises, practice has started.

At 11:41 a.m. on March 16, Astronauts Neil Armstrong and David Scott shot spaceward, pursuing their target, an Agena spacecraft launched an hour and 41 minutes earlier. Their attempt to nose Gemini 8 into a mechanical "docking collar" attached to the Agena was successful—another milestone in space flight.

However, less than half an hour after docking, while Gemini 8 was still coupled to the Agena, Armstrong reported engine trouble. The two vehicles were rolling and yawing out of control. The astronauts backed their spacecraft away from the Agena target and then stabilized by switching from their maneuvering power system to the one used for reentry into the atmosphere. But it was considered risky to continue the operation on fuel intended for the return trip. Because of this, and because no one was entirely sure what caused the trouble, Gemini Control in Houston cancelled the remainder of the flight. Late in the evening of their launch day the two astronauts landed safely in a recovery area in the Pacific.

Had the three-day mission been completed other experiments would have been carried out.

Co-pilot Scott was equipped with a

long, cable-and-air-hose-filled "umbilical cord," so that he could leave his cramped position in the spacecraft and spend one-and-a-half orbits of the earth walking in space. Spacewalking, although vitally important to orbiting space stations and any other missions that require outside repairs, will not be a part of the lunar flight.

The shirtsleeves environment in the Apollo will prevent any of the three-man crew from stepping out into space, although two of them will step out on reaching the surface of the moon. However, Gemini flights between now and then may do away with the need for umbilical cords.

Docking was the most important. While adjusting their orbit to match that of the Agena, the astronauts traveled some 107,000 miles, while keeping track of the roundness of their orbit, and the relative angle between the Gemini and the target, among other things.

Rendezvous and docking are not the same thing. The former consists of getting from, say, 100 miles away to within about 100 feet at the proper angle, speed and orbit. Computers do all the heavy mathematics, and the pilot follows their instructions.

Docking on the other hand, is done largely by eye. On the nose of the Gemini is a small "sighting post," just like a sight on a rifle. At the rear of the Agena, inside the collar, is another sight, in the form of a notch. Neil Armstrong's job as pilot was to center the post in the notch.

When two spacecraft are close enough for this, the operation becomes a matter of repeated slow nudges with the thrusters until the two vehicles touch. The collar then automatically locks them together.

Similar maneuvers, with somewhat different equipment, will occur several times during the moon journey. At one point, the spacecraft will detach from its booster, turn around 180 degrees, and dock nose-on.

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SPACE

On the Moon 18 Days But Still on Earth

► **AFTER SPENDING** 18 days in a tiny chamber too small even to stand up in, two "testronauts" emerged feeling just fine, if a little grimy.

Their home had been a mock-up of a vehicle that might someday carry explorers over the surface of the moon. The vehicle was scarcely 10 feet long, the ceiling was only five feet high.

Michael J. Vaccaro and Haydon Y. Grubbs Jr. of the National Aeronautics and Space Administration's Marshall Space Flight Center, Alabama, worked 14-hour days in the Lunex II, with telemetry electrodes relaying permanent records of their physical condition to the outside world.

From time to time, they were allowed to leave their vehicle, in their 20-pound pressure suits and life-support packs, to perform such activities as simulating recovery of an "injured" explorer from outside, or collecting rock samples, supplied by the University of Minnesota.

In the test chamber built by Honeywell Inc., Minneapolis, the testronauts drove Lunex II over an electronically-simulated "road," represented by a screen on their instrument panel.

The National Aeronautics and Space Administration sponsored the project.

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