AVCO Corporation

HONEYCOMBED PROTECTOR—The more than 370,000 cells in this honeycomb matrix of the Apollo Command Module will be filled with ablative material after examination by technicians of the Avco Corporation at Lowell, Mass. The heat shield will protect astronauts inside from temperatures up to 5,000 degrees F.

SPACE

After the Moon, What?

➤ THE MOON is in our grasp. Within five or six years, man will have landed on the lunar surface, carried out a series of experiments, gathered some samples and come home. But then what? Every step further into space will cost more than the one before it, despite the technological breakthroughs that are bound to occur.

The decade or decade-and-a-half following man's arrival on the moon is already the subject of almost as much research and development as the Apollo moon flight program itself.

But man will not stop there. Just as he feels compelled to go to the moon, he will know that he must visit Mars, the outer planets, and someday perhaps even other solar systems.

Mariner 4, which will pass within a few thousand miles of Mars on July 14, will have taken seven and a half months to get there. The current U.S. crop of booster rockets, including even the huge unfinished Saturn V, which will take three men to the moon, is incapable of handling enough weight to supply even one man during such a journey, if enough scientific equipment is to be included to make the trip worthwhile.

One solution often suggested by scientists at space conferences is the construction of still bigger boosters that are capable of not only carrying bigger payloads but of carrying them faster, in order to cut down the trip time and reduce life support problems.

Meanwhile, the Apollo program's Saturn V is just beginning to have its first-stage engines tested. One such rocket costs so much and takes so long to build and test that the Gemini program, which is nothing more than practice for Apollo, can not even use the same launch vehicle.

Even if it were possible to go directly on a straight line to any planet when it is at its nearest point to earth, the journeys would be prohibitively long at present speeds. Mars never comes nearer than about 35 million miles. And Jupiter is more than 10 times that distance when it is closest. Beyond Jupiter is Saturn, and its nearest pass is at about 746 million miles, 21 times that of Mars.

In addition, the closest pass of a planet is usually not the best launch time. Mariner 4 is following a highly round-about route that covers some 350 million miles.

The most expensive item in Project Apollo is the background of research and development that precedes the flight. While much of the Apollo booster technology can be applied to interplanetary flights, research must still be done on the long-term effects of exposure to cosmic rays and weightlessness.

Unmanned space probes are a relatively simple matter, with the main problem for long-distance missions being durability. If a man is going to go along, however, the difficulties mount rapidly.

First, there is the obvious problem of life support. Food, water, exercise, and even something to do with his time are all areas that must be completely reinvestigated for the years-long flights to the other planets.

After all those kinks are straightened out comes what may prove to be the most crippling problem of all: safety. A standard rule-of-thumb in engineering is Murphy's Law, which says, essentially: "If something can go wrong, it will." Because of this, double, triple and quadruple safety systems must be built to cover each other's tracks in the event of even the most unlikely accident.

• Science News Letter, 88:18 July 10, 1965

SPACE

New Navigation System Developed for Apollo

➤ THE ODDS for a successful manned round trip to the moon have been increased substantially by several major improvements in Project Apollo's guidance-navigation system.

The improved "Block II" system has evolved from a year of tests run on its predecessor, Block I. Massachusetts Institute of Technology engineers in Cambridge, in charge of designing the system, do not rule out still further changes, but as of now Block II will guide the astronauts to the moon and back. The test unit is expected to be completed within a few months.

Specifically, Block II is faster and smaller than Block I, two important considerations for a ride in space. In addition it has twice the memory capacity of the earlier model.

Another significant change is the scaling down of the inertial measurement unit. This is a package of gyroscopes and accelerometers that automatically sense and control orientation in space.

A major improvement in the navigation instrumentation is the incorporation of a built-in horizon sensor and star tracker. This will enable the astronauts to locate and use fixed points on the earth's horizon for navigational measurements. To the naked eye, the horizon looks like a fuzzy band of light.

Milton B. Trageser, director of MIT's Instrumentation Laboratory, discussed the changes at a meeting of the International Federation of Automatic Control, Stavanger, Norway.

• Science News Letter, 88:18 July 10, 1965

TECHNOLOGY

Gun Shoots Glass Bullets To Simulate Meteorites

➤ A SPACE-AGE GUN that shoots tiny glass "bullets" more than 43,000 miles per hour is being used to measure the damage done to spacecraft when speeding meteoroids strike them.

Synthetic micrometeoroids, one five-hundredth of an inch in diameter, are being fired at various metal alloys, plastics and glasses to help engineers design more rugged spacecraft.

A bank of seven capacitors generates and stores electrical energy, providing a charge of 30,000 volts to fire the gun. Developed at North American Aviation's Space and Information Systems Division, Downey, Calif., it is believed to have the highest velocity of any gun known.

• Science News Letter, 88:18 July 10, 1965