

far reaches of the galaxy and others that have their origin nearby. There should be a "substantial number of sources only a few hundred parsecs (less than 1,000 light years) from us," he says.

Dr. Simpson suggests these sources may be flare stars, of which there are a good number nearby, but not enough is known about flare stars to be sure. "Flare star observation is now one of the things that's in the backwaters of astronomy," says Dr. Simpson. ◇

## TRANSPLANTS

### So well for so long

On Nov. 21, Dr. Norman E. Shumway transplanted a heart into Darrell Hammarley, a 56-year-old retired airline pilot. Six hours later, it became apparent that the heart was not working well. Dr. Shumway sewed in a second heart replacement in the first such operation in history. At midweek, the patient was in good condition at Stanford University Medical Center, Palo Alto, Calif.

**Following** Dr. Shumway's double transplant by only a few hours, Dr. Denton Cooley of St. Luke's Hospital, Houston, gave another heart to Everett Thomas, a 47-year-old accountant who received his first new heart last May 3. Thomas, who lived longer with a borrowed heart than any other person in the United States, was rejecting that heart and failing to respond to anti-rejection drugs when Dr. Cooley made his second attempt to save him. But Thomas died less than two days after the operation.

"Denton was really shaken by Thomas' death," a colleague said. "Thomas had done so well for so long."

In some cases, a second transplant may have less chance of surviving than the first, if a patient develops new anti-heart antibodies. This phenomenon, known as myocardopathy, afflicts about five percent of persons with heart disease and is itself an incurable disease in which the patient rejects even his own heart. When this condition is not present, surgeons believe that a second transplant could work as well as a first. This has proved true with kidney patients who have had two, and even three, new kidneys. These individuals stand a good chance of living at least two years with their new organs. Some are alive after eight years. At this time, however, the prognosis for heart patients is not as hopeful.

"I'm pleased but surprised that our patients are doing as well as they are," says Dr. Christiaan Barnard. "We subject very sick people to a major, and new, operation and have had very encouraging results, all considered."

## THE MOON RACE

### Apollo, Zond and LM

Charting and timing a space flight like the coming Apollo 8 moon-orbiting mission is a mathematician's nightmare.

Besides judging the moon's swing around the earth, flight planners must plan the launch at an angle that will not carry it over heavily populated areas. The launch must be timed so that several hours of daylight remain in the abort area, so that recovery teams will be able to pick up the crew if it is necessary to abandon the mission in its early minutes. The length of the mission must also be considered, so that there will be adequate lighting in the recovery area.

Apollo 8 also poses certain special problems. A major goal of the flight is for the astronauts to check out landing sites, although they will not touch down. Thus the launch must be timed so that the sun will shine on the landing sites at the same angle as it would for an actual landing attempt, so that surface features—boulders, crevasses and slopes—will appear as they would then.

**Apollo landing** requirements at present are that the sun must be at an angle of between 7 and 21 degrees above the horizon. Because the sun crosses the lunar sky at some 12.5 degrees per day, it is at a permissible angle for little more than a day over each landing site. There are five possible landing sites, however, stretched out across almost the entire width of the moon, so Apollo 8 will have a launch window of almost six days, from Dec. 21 to 26. The future landing mission will have the same leeway.

The Soviet Union could conceivably beat the U.S. to the punch. Four of Russia's six unmanned Luna craft, however (including both successes), touched down in the same area—the Ocean of Storms near the moon's western edge—which may mean that Russia is banking on a single site selection for its first manned landing.

This in turn would mean that Russia has only a day or two during any of the moon's 28-day trips around the earth to launch preliminary flights that will see the moon under the same lighting conditions. Zond 5 and Zond 6, launched Sept. 14 and Nov. 10 respectively, were spaced 57 days apart, just one day more than two exact lunar months. The next likely day is Dec. 8, the following one Jan. 6.

Whether the Soviet Union will take advantage of one of these opportunities for a manned moon flight is an open question.

Two facts argue against a cosmonaut going to the moon this month or next.

One is the rugged winter weather in the Soviet Union, which could expose a returning spaceman to hours of sub-zero blizzard; no cosmonaut has ever flown later than October or earlier than March. Also, only one Russian has been in space since the massive spacecraft redesign believed to have taken place since Cosmonaut Vladimir Komarov was killed in the crash of Soyuz 1 on April 24, 1967.

**On the other** hand, the prestige value of, at least, flying a man around the moon before Apollo 8 could be a strong inducement to try. Soviet scientists could be planning to get around the weather problem by landing in the comfortable Indian Ocean. Zond 5 did that.

In the U.S., moon plans have taken another step with the selection of the Apollo 10 crew, which could conceivably land on the moon. Command pilot will be veteran Thomas P. Stafford, who has logged almost 100 hours in space. Second in command will be John W. Young, who filled the same role on the first manned Gemini mission and later commanded Gemini 10. Perhaps the trickiest job, however, will be that of former Gemini 9 commander Eugene A. Cernan, who will pilot the spidery lunar module—which may be the item that will keep Apollo 10 from landing on the moon.

**In the first** place, Apollo 10 will be only the second manned flight of the lunar module, which has the job of ferrying the astronauts down from a lunar orbit to the moon's surface and back.

Another difficulty is weight. The LM has grown some five tons from its original design weight of 22,000 pounds. Increases in booster strength have enabled a new weight ceiling of 32,000 pounds, but engineers at the Grumman Aircraft Engineering Corp. in Bethpage, N.Y., have still had to struggle to save every possible ounce. The first Apollo mission now scheduled to get a LM with the full weight-saving treatment—"the first one that could be landed on the moon," says a space agency official—is Apollo 11.

The other obstacle between Apollo 10's LM and the moon is electronics—the black boxes that are custom-tailored for each mission. "Some of the electronic components aboard the LM 4 vehicle (the one now assigned to Apollo 10) were not designed and installed with a lunar landing in mind," says a Grumman official. The appropriate boxes could be transferred from Apollo 11's LM, but the change would probably cause another delay in the Apollo lunar timetable.