

fort, as Dr. Welsh seems to interpret the report, the board may simply be reefing its sails to ride out the budget blow.

The members view what they've done as an effort to keep some missions flying over the next decade. In the next few years, the configurations of the planets will provide opportunities for gathering information that will not return for many years.

In 1973 and 1975 it will be possible to use the gravitational field of Venus to assist a joint Venus-Mercury flyby. This opportunity will not repeat until 1980, and to study Mercury otherwise would need a much larger booster.

In 1977-1978 the same kind of gravitational assist can be gained for a grand tour of the major planets: Jupiter, Saturn, Uranus and Neptune—again without the need for extraordinarily powerful boosters. This opportunity will not repeat for 100 years.

The report also recommends learning as much as possible about planets from the ground. Radar astronomy has done particularly well lately with its studies of the nearer planets, especially Venus (SN: 8/24, p. 179).

The study group believes that the radar people, who have put up "a continuing battle" for recognition, in the words of one observer, should be encouraged by NASA support for a radar astronomy installation 1,000 times more sensitive than existing ones, at an estimated \$30 million capital cost.

An optical telescope for planetary studies at some location in the Southern Hemisphere and one in orbit around the earth are also recommended.

Finally the board members seem to feel that so little national prestige is really involved in the space race that they recommend renewed efforts at cooperative planning with the Soviet Union so that the two countries do not duplicate each other's efforts. The U.S. Government has had feelers out to this end for years with very little success.

Now, as Dr. Eshleman puts it, the scientists ask for a change of emphasis that they feel could lead to success: "Let's make overtures at the scientific level, not through diplomatic channels," he says.

Support for U.S.-Soviet cooperative planning was expressed by several Congressmen during last winter's hearings on the NASA budget, but some Administration officials are not sure the space race is that far over. Dr. Russell C. Drew of the White House's Office of Science and Technology points out that the Russians haven't flown a manned flight in two years and public reaction has become dull. What would happen if things started up again is difficult to assess.

HIJACKING

Airlines seek a breakthrough

Have gun, will travel . . . to Cuba.

On the average of once a month, a U.S. airliner lands at Havana, Cuba, and discharges a pistol-packing hijacker. During the last year, 13 such unscheduled flights were made at the behest of hijackers.

The frequency with which airliners are being hijacked has stirred up wide concern in the aviation industry and Congress. But the prevention of hijacking is a problem so fraught with technical, legal, economic and public relations problems as to almost defy solution.

One quick remedy, which no one favors, at least not yet, would be to



search every passenger before he boards the plane.

Another strong-arm measure, actually proposed as national legislation last month by Senator Warren G. Magnuson (D-Wash.), would empower the Federal Aviation Administration to place armed guards on all passenger aircraft. But the airlines are completely opposed, fearing this will lead to gun fights. A bullet puncturing the pressure skin of a jet airliner flying at cruising altitudes can result in an explosive release of pressure—and disaster.

The airlines point out that so far no passenger has been harmed, and not one hijacked airliner lost or even damaged. This explains the prevailing attitude among airline executives: "If you don't get the hijacker at the gate, take him wherever he wants to go," says one. Pilots on several airlines have been instructed to do just that if faced with a hijacker.

Still another approach to the problem would be to lead passengers past some sort of gun detection devices be-

fore boarding. Presumably, the device would be located at the boarding gate through which passengers must pass single file.

The difficulty here is that there is no known device that can distinguish reliably between a gun and a harmless piece of metal, such as a penknife. Various types of electronic devices have been tried, but none of them can tell one metal object from another. To use detection devices presently available would result in a plethora of false alarms.

There is one device that may offer some promise: a magnetometer just developed by Lockheed Aircraft Corp., Burbank, Calif., and under consideration by the Air Transport Association.

The Lockheed device senses disturbances within its immediate segment of the earth's magnetic field. When magnetic lines of force are interrupted by a metal object containing iron, the device causes an alarm to go off. It detects only ferrous metal objects above a certain preset length. This rules out false alarms from key chains, penknives and other objects below the size of a small pistol, plus all nonferrous objects. One slight problem: a portable radio's loudspeaker magnet would set it off.

Next step for Lockheed is to test the device at an actual boarding gate to see what sets it off and how reliable it is at detecting pistols. Says Lockheed R&D manager Don Galbrath, "Neither we nor the airlines know at this time what kinds of objects the flying public carries in its pockets or pocketbooks. About all we know is that ladies carry aerosol cans in their purses and these would set off the magnetometer. We've got to find out what other objects in the same size range as pistols are being carried and if these will set off the device. We'll also run a few planted pistols past the device to make sure it picks them up."

Galbrath predicts, with some caution, that based on these studies Lockheed may be able to develop the device to the point where it will distinguish guns from other objects of a similar length with a sufficient reliability to be of value to the airlines. The low cost of Lockheed's present magnetometer—approximately \$100 per gate position—makes it highly feasible from a cost standpoint.

But even if the Lockheed device proves to be reliable enough for the airlines, the use of it would raise all sorts of legal problems. Says FAA lawyer Barclay Webber, "We don't know if it's constitutional for the airlines to

search a person or even his luggage without a warrant." And some people are licensed to carry weapons, although they are required by law to check them with the flight crew.

Then there's the ticklish problem of what to do when a passenger walks past a device and the alarm goes off. Since the ticket agent cannot be authorized to take the passenger aside and search him, this means an armed guard at every gate.

The airlines could get around the searching problem by asking an individual who sets off the alarm to empty his pockets voluntarily and then walk past the device again to make sure the gun isn't hidden in his clothing. Any suspect passenger who refused could legally be kept off the aircraft. But false alarms would cause a nightmarish customer relations problem for the airlines. And if the passenger is in fact planning a hijacking, he is liable to be highly dangerous.

Finally, there is the problem of economics. Since one detection device would have to be installed at every boarding gate, cost is a major consideration. "If money were no object," says FAA engineer Max Collins, "it might be possible to develop a reliable device with several sensors, an image recognition unit and a computer. But you could hardly afford to put one at every boarding gate."

One way to circumvent the cost problem would be to put detection devices at every fifth or tenth gate, and then to post signs at all boarding gates to the effect that passengers are being searched for weapons by hidden electronic devices. This approach would be similar to the use of "speed checked by radar" signs posted along certain highways.

In spite of all the obstacles, the FAA and the ATA are continuing to look for solutions, primarily for more reliable detection devices. Until such time as an inexpensive, almost foolproof gun detection device is available to the airlines, their present policy of accommodating hijackers will no doubt continue. For the immediate future, the best hope for the hijacking problem is still that it will simply go away, perhaps by the resumption of normal relations with Cuba.

Castro, meanwhile, has made it known that he strongly disapproves of the hijackers who have been diverting planes to Cuba. In fact, several of the hijackers have been jailed, according to Moises Pérez, an official of Cuba's Ministry of the Interior. Pérez adds, however, that "some of the hijackers have been released after showing the proper revolutionary attitude." Pérez says it is unlikely that hijackers would ever be regarded as revolutionary heroes.

MASCONS

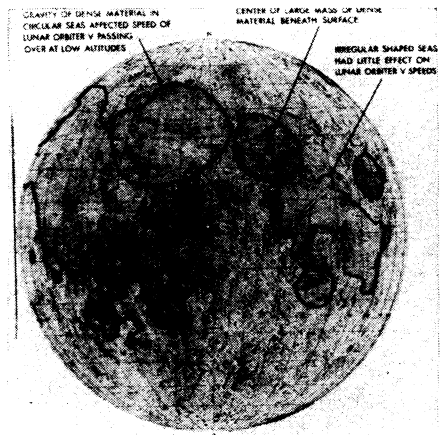
Lumps beneath the maria

The moon may have relics of ancient collisions with heavy bodies buried beneath the surface of its maria. So conclude Drs. P. M. Muller and W. L. Sjogren of the Jet Propulsion Laboratory of California Institute of Technology, who have used lunar orbiter tracking data to make a gravimetric map of the near side of the moon.

The force of gravity is not uniform over the surface of the moon—or the earth for that matter—but varies slightly according to the density of the matter below a particular spot. As it moves across the face of the moon, the orbiter responds to these changes in force by slight variations of its motion. Analysis yields the gravimetric data.

There appear to be concentrations of dense matter—or mascons, as the observers abbreviate mass concentrations—under six of the nearside maria—Imbrium, Serenitatis, Crisium, Nectaris, Humorum and Orientale—and in the area between Sinus Aestuum and Sinus Medii.

The maria are flat areas sometimes ringed with ridges, and their appearance has led some observers to suggest that they may have been caused by collisions with heavy bodies. It could be, say Drs. Muller and Sjogren, that the mascons are the impacting bodies



NASA

Mass concentrations on the moon.

buried beneath the lunar surface—the one in Mare Imbrium, for example, would roughly equal a nickel-iron sphere 100 kilometers in diameter.

Whether the mascons actually are asteroidal-sized bodies that caused the associated maria by impact is a question the Caltech researchers present for future study. If the mascons are not simply the original impactors, they say in the Aug. 16 SCIENCE, then one must find out how they were formed in the lunar interior. Another question is whether the mascons are consistent with the notion that the moon has a molten interior.

SPECIES DIFFERENCES

Chimp study shakes theory

Rhesus monkeys reared in isolation never learn to copulate. Chimpanzees reared in isolation do.

Although the chimp never becomes quite normal, given time with an experienced partner, a chimp can at least learn the techniques of becoming a parent, while a rhesus monkey, except for the rare female, remains completely inadequate.

Human psychologists, extrapolating from animal behavior, consistently fail to appreciate the magnitude of species differences. In this case, the classic experiments on the long-term effects of isolation on rhesus monkeys, by Dr. Harry F. Harlow in Wisconsin in the 1950's, have influenced a generation of psychologists.

Dr. Harlow's monkeys were permanently impaired socially and sexually by their early isolation in wire cages. The males would attempt copulation, but without success. The females retreated from bigger experienced males and, in rage, attacked the smaller ones. When four females were eventually impregnated by patient partners, they became terrible mothers, abusing their

offspring and refusing to let them nurse.

The behavior of the rhesus monkeys ranged from cowering fear, to stereotyped motion, aggression and self-mutilation.

Animal behaviorists reacted to this information with: "Well, isolation certainly ruins a rhesus monkey." But to the public and many psychologists, jumping further than the animal behaviorists would, the parallels to human behavior were provocative.

New results on chimpanzees from Yerkes Primate Center in Atlanta, Ga., leaves untouched the basic theory that social isolation damages behavior. But it shows the extent of that damage and the form it takes to be quite specific to the species involved.

Of 12 chimpanzees reared for three years in closed boxes, eight later learned sexual behavior from wild-born animals.

This represents considerable recovery, although the animals are still abnormal in duration and frequency of sexual activity. Often their copulation is interrupted by a sudden access of stereotyped repetitive motion, says Dr. Charles M. Rogers, co-author of the