

## First In-Flight Studies Of Metabolism

As the President's science advisers (see right) try to chart the future of the nation's space program, scientists are beginning to develop data—not just supposition—on the effects on man of time in space.

The first comprehensive study to obtain data on metabolic and hormonal changes in man in space was made on Astronauts Frank Borman and James Lovell; the pair orbited the earth for 14 days in Gemini VII in 1965. A team of scientists headed by Dr. G. D. Whedon of the National Institutes of Health measured, among other things, the input and output of calcium, nitrogen and phosphorus as well as levels of hormones such as aldosterone and corticosteroids.

Measurements were made on the excretions in the urine, stool and skin.

**Borman and Lovell participated** in control studies on the ground as well as tests in space in what are believed to be the only such evaluations of in-flight metabolic function and endocrine activity made by any country.

Final data of this research was reported in Texas last week by Dr. Leo Lutwak of Cornell University. Calcium loss, he feels, is not a significant threat on short term flights. His evaluations do not bear out flight surgeons' concern with the effects of immobilization in space. On the Gemini VII trip, one astronaut showed no meaningful increase in calcium excretion and the other an increase of only 15-20 percent which was made up quickly upon re-entry. However, calcium loss may still be of greater concern on long-term flights, already planned to last two and three months or more, he stresses.

An increase of urinary phosphorus, was noted, however. Phosphorus is used with calcium in the calcification of bone.

Hormonal assays showed both astronauts excreted greater amounts of aldosterone in space than on the ground. Aldosterone, secreted by the adrenal gland, helps the body rid itself of excess fluid, so the rise of this hormone indicated everything was going well on that score.

Drs. Whedon and Lutwak emphasize that the data is preliminary. They point out the need for considerably more in-flight study of this kind before long-term flights are undertaken.

However, NASA has scrapped plans for any further tests at the moment, apparently because budget cuts limit them to tests that are more immediately essential to astronaut safety.

## Science Advisers Report

**A national goal such as the moon by 1970 may get the job done, but it leaves everything else behind.**

The Apollo moon program gets not nearly so great a push from its mighty booster rockets as from its status as a national goal.

Whatever else is going on, Apollo comes first. Maddeningly tight schedules, starvation budgets for unrelated projects and recently the feeling by some that "now that we've sunk all that money in it we're in too deep to slow down," have caused a number of second thoughts about whether national goals are the way to do things.

**Now those thoughts** have some heavy official weight behind them. The President's Science Advisory Committee, looking far beyond the Apollo program, has reported to President Johnson that it rejects the idea of a "single new dominating goal" in space. PSAC, while not the last word, is at least an influential voice.

While setting a national goal does have a "focusing and galvanizing effect on the program," said Dr. Franklin A. Long of Cornell University, chairman of the Committee's Space Science and Space Technology Panels, "there is a tendency to freeze technology at the point at which you start your program."

Instead, the Committee panels recommended, in a 99-page report that could provide the base of debate on where next in space, a broadly accented effort, which while covering most of the same ground as that trod by National Aeronautics and Space Administration planners, has some pointed differences. The plan outlined by the Committee extends almost 20 years into the future, but the space agency could soon start feeling its effects.

The areas covered in the report include an extension of Apollo for lunar exploration; unmanned and manned planetary exploration; practical applications of space; and scientific research in earth orbit. No trouble there, for NASA, at least on the surface.

**But NASA** would like to go gung ho for Mars. PSAC recommends equally high priority (and thus a share of the money) for Venus. One committee proposal, in fact, is already in disagreement with the administration's present space plans. An unmanned flyby through the atmosphere of Venus in 1970 should be given "particular consideration as the next new planetary mission," the report says, and no such item is listed in the fiscal 1968 budget.

Such a long-lead project would have to be started this year to take place in 1970, and Presidential science adviser Dr. Donald Hornig reports "no discussion" of a supplementary budget item to pay for it.

Spreading out even farther, the committee said that science in orbit, particularly astronomy, "can well serve as the major scientific focus of the U.S. space program in the 1970's." While such a major focus would not bode well for a national goal of Mars, this recommendation ought to sit better with NASA, which has gone all out to push space science as the end of Apollo looms into view.

**PSAC's wide-ranging** scheme leaves a lot of room for variation. In order to give some indication of the commitment required by space programs at different levels, the committee projected three "illustrative" space budgets for 1972:

- The smallest would total only \$3.5 billion, a third smaller than NASA's present allotment, and would require an "indefinite" delay of manned interplanetary flights.

- A slightly increased level of spending, \$5.8 billion, would enable development to begin toward manned flights to other planets, without being pushed toward a specific goal. This is the closest to being a "PSAC budget."

- If a national goal were established, such as a manned flight to Mars by 1985, the budget "certainly could" swell to huge proportions. The Committee envisions an awesome budget of some \$7 billion in that event, roughly equivalent to tacking on the present appropriation of four entire National Science Foundations to the existing space allocation. Such a goldmine would permit such luxuries as a "Grand Tour" space probe, to visit both Mars and Jupiter on the same flight by 1977.

**Dr. Hornig**, as the chief scientific voice in the President's ear, said of the report, made public on Sunday, that while he did not necessarily agree with every detail in it, he would strongly support it in general. The committee's negative attitude toward an all-consuming national goal was hardly a mere detail, and the result may be that the space program will become a tight, cohesive scientific effort, instead of bounding from headline to headline, picking up research along the way.