NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (202) 962-4155
WASHINGTON, D.C. 20546 TELS: (202) 963-6925

FOR RELEASE: SUNDAY
July 5, 1970

RELEASE NO: 70- 112

Mariner 10 Computers

ALSO RELEASED AT JPL

MARINER-VENUS '73 FLIGHT GENESIS

The United States' first multi-planet flight--the 1973 Mariner Venus-Mercury project--first took shape nearly a decade ago in the computations of a spacecraft trajectory analyst at the National Aeronautics and Space Administration's Jet Propulsion Laboratory, Pasadena, Calif.

The pioneer pathfinding trajectory studies of Victor C. Clarke, Jr., a senior JPL engineer, were recalled this week as he received a 1970 award from the Gravity Research Foundation of New Boston, N.H.

Clarke, mission analysis and engineering manager for the 1973 project, wrote a prize-winning essay on "The Application and Principle of Gravity-Assist Trajectories for Space Flight." He first demonstrated in 1961 the possibility of bouncing a spacecraft from planet to planet.

-more-

The Mariner Venus-Mercury flight will be the first to use this so-called interplanetary billiard technique. Other multiple-planet missions--the Grand Tours of the outer planets--have been proposed for the late 1970s.

The use of a planet's gravitational field to change spacecraft speed and direction can significantly shorten flight times or make long missions feasible with present launch rockets.

The V-M Mariner will be launched in October or November, 1973, and arrive within 3,300 miles of Venus in February 1974. The closest approach point will be carefully selected by JPL guidance controllers so that the Venusian gravity field will sharply bend the path of the spacecraft and change its velocity 10,000 miles-per-hour on toward Mercury. It will arrive there in late March.

To send the same spacecraft directly to Mercury, Clarke points out, would require a launch vehicle with more than twice the boost capability of the planned Atlas-Centaur vehicle.

Clarke, an engineer-scientist at JPL for 12 years, worked extensively in 1960 and 1961 on computing trajectories from Earth to Venus, Mars, Mercury and Jupiter. Jupiter is the pivotal planet for Grand Tour flights.

Tentatively, JPL has proposed that a 1977 unmanned mission to Jupiter, Saturn and Pluto be followed by a 1979 mission to Jupiter, Uranus and Neptune. The trip to the outermost planets, normally a 30-year venture, would be cut to nine years.

Clarke found that during several days of each launch opportunity Venus, Mars, Mercury and Jupiter can be approached so that the arrival energy of the spacecraft equals the energy which would be required to launch it to the next planet (in or out) in the solar system. He calls this desideratum an "energy match." The 1974 energy match at Venus occurs from Feb. 3 to 7.

And to get the proper bend toward Mercury, the Spacecraft must pass within 3,300 miles, but no closer than 2,500 miles, of Venus. "A one-mile miss at Venus could mean a 1,000-mile miss at Mercury," says Clarke. Controllers will have a post-Venus course correction capability, however, to bring the spacecraft to within 625 miles of Mercury.

The project plans to take the first close-in television pictures of both Venus and Mercury, in addition to measuring atmospheric constituents, surface temperature, magnetic fields, planetary and cosmic radiation.

"Theoretically, the process of diverting a spacecraft from one planet to another might be continued indefinitely, if the planets were in favorable positions," Clarke says. He recalled that his former assistant, Michael A. Minovitch, then a U.C.L.A. graduate student, worked out an "8-ball" gravity-assist trajectory, Earth-Venus-Mars-Earth-Mars-Earth-Venus-Earth.

Such a trip would take five years. In 1963, Minovitch theorized that such a space bus might be the start of "interplanetary transportation networks to support manned bases on Venus and Mars."

However, in 1970, in the harsh reality of Mariner mission findings at both Venus and Mars, Clarke labels Project "8-ball" an "interesting oddity, with little scientific justification."

With the aid of U.C.L.A. and JPL computers, Minovitch worked out possible spacecraft trajectories for a decade of multi-planet missions, including Earth-Venus-Mercury in 1973.

These calculations all were prompted by Clarke's 1961 study showing the feasibility of a simple Earth-to-Venus-and-return mission.

Subsequently, other JPL scientists pursued the problems of trajectories to Jupiter and Saturn and beyond. Gary Flandro, a Caltech graduate student, made the first definitive Grand Tour feasibility study for NASA in 1966 under the direction of Dr. Homer Joe Stewart, then manager of JPL's Advanced Studies Office.

Clarke's paper won fourth place in the Gravity Research Foundation's essay contest. He received a 1969 NASA Exceptional Service Medal for his contribution to the Mariner Mars 1969 mission design.

-end-