

SYSTEMS DIVISION

II. Systems Analysis

A. Trajectory Analysis

V. C. Clarke

1. Interplanetary Trajectories

As reported in RS 36-8, a computer study is in progress to determine the characteristics of ballistic interplanetary trajectories from Earth to Mars, Venus, Mercury, and Jupiter. The computations for Venus from 1962 to 1970, for Mars from 1962 to 1977, for Mercury from October 1967 to January 1969, and for Jupiter from December 1969 to February 1970 are now complete. A table of minimum energy transfers was published in RS 36-8. Final additions to that table are given in Table 1. These trajectories have been computed using actual planet positions obtained from an ephemeris tape. Thus, inaccuracies arising from assuming coplanar, circular motions of the planets are nonexistent.

Selected parameters of the trajectories have been saved on magnetic tapes. These tapes are being used to generate graphs of the parameters on an automatic plotting machine. The results of this study, with about 200 graphs,

will be reported in Reference 7. Publication target date is September 1961.

A second phase of the study has begun with the computation of return ballistic trajectories from Mars and Venus to Earth. The results of these computations will also be saved on magnetic tape, and graphs will be prepared. In addition, the return trajectories will be combined with the Earth-to-target planet trajectories in a merging program to obtain round trip transfers. These transfers will include both ballistic flyby and stopovers of various duration at the planet. Completion of this phase of the study is projected to November 1961.

2. Out-of-Ecliptic Trajectories

A study is nearing completion of a special class of trajectories in which a space probe is launched from Earth in a direction perpendicular to the ecliptic plane, flies above (or below) the plane for a period up to 6 months, and finally returns to Earth. A cursory look at such trajectories from two-body (Sun-probe) mechanics indicates that the distance above the ecliptic that can be