2.0 PROCEDURE FOR RENDEZVOUS

2.1 Overview

A method of matching the position and velocity of a target satellite was sought. The outline of such a method was given by NASA's Orbital Flight Handbook and forms the basis of this description. A similar method was used by Battelle in studying retrieval of satellites by the STS, and the method is also incorporated in studies funded by ESA/ESTEC on rendezvous in geostationary transfer orbits.

In establishing a procedure to attain a target orbit, an attempt was made to avoid large planar changes due to their high cost in fuel. This cost is well illustrated in Figures 2-1 and 2-2 from the Handbook which show the impulsive velocity required to rotate a satellite's orbital plane, both as a single maneuver and combined with altitude changes. As these are given in non-dimensional form, the velocity table (see Table 2-1) is included to illustrate the magnitudes involved. An impulsive velocity of $\Delta V = 2500$ mps was taken as a reasonable maximum for orbit changes, and the inclination change attainable with this maximum is shown. At low altitudes, no more than an 18° or 19° change would be considered.

The method which reduces the problem to a nearly coplanar orbital transfer, and which does not impose restrictions upon the target orbit, is predicated upon definition of launch times and the use of an intermediate orbit. The procedure consists of launching into the plane of motion of the target at the time the launch site is in this plane, waiting in an intermediate orbit for the desired relative positions of the two vehicles and then performing a planar transfer.

The general assumptions made are that the orbits are ellipses perturbed by earth oblateness, that burns are impulsive, and that no perturbations occur due to other forces. When more detailed planning is done, these effects will have to be included, particularly that of atmospheric drag at low altitudes.

The procedure is outlined in sequential steps, working from the known to the unknown.