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ABSTRACT FOR SUBMISSION TO THE U. S. AUTOMATED RENDEZVOUS & P. 2  
CAPTURE CAPABILITIES REVIEW

IMP, A Performance Code

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ABSTRACT

OVERVIEW

"IMP" (Integrated Mission Program) is a simulation language and code used to model present and future Earth, Moon, or Mars missions. The profile is user controlled through SELECTION from a large menu of events and maneuvers. A Fehlberg 7/13 Runge-Kutta integrator with error and step size control is used to numerically integrate the differential equations of motion (DEQ) of three spacecraft, a main, a target, and an observer. Through selection, the DEQ's include guided thrust, oblate gravity, atmosphere drag, solar pressure, and Moon gravity effects. Guide parameters for thrust events and performance parameters of velocity changes (Delta-V), propellant usage (maximum of five systems) are developed as needed. Print, plot, summary, and debug files are output.

APPLICABILITY

Events of particular interest to Automated Rendezvous are:

- INTERCEPT: The main craft maneuvers to intercept a point with respect to the target.
- FORMATION: The main craft intercepts then maneuvers to be coelliptic, (at the same relative point at a later time).
- PHASE: Checks phase angle between the main and target crafts, coasts until desired value reached.
- SIGHT: Compute line of sight (LOS), main, target, and observer.
- RENDEZVOUS: Seven different rendezvous algorithms are preprogrammed.

## HISTORICALLY

"IMP" was initially coded for "MSFC SE-AERO-G" by the author while employed by Northrop Services Incorporated, Huntsville, AL (1970). In 1981, it was revived by the author, installed on the UNIVAC 1108, then the DEC VAX 11/780 at MSFC. Since then, it has been continuously improved and upgraded. Recently a version was submitted to COSMIC at the University of Georgia for sale to the public. A universal version in Fortran 77 has been debugged and is available to run on most mainframes and PC's with very little modification.

## EXPERIENCE

Mission profiles and performance parameters developed by "IMP" have been used in studies of the following craft or systems.

OMV	Orbital Maneuvering Vehicle
CTV	Cargo Transfer Vehicle
STV	Space Transfer Vehicle
SIRTF	Solar Infrared Telescope Facility
LLT	Lunar Transit Telescope
SSF	Space Station Freedom (assembly and resupply)
HLLV	Heavy Lift Vehicle
SH-C	Shuttle-C
AFE	Aeroassist Flight Experiment
SEI	Space Exploration Initiative

IMP can generate profiles from liftoff to touchdown (soft or hard). Although not an interplanetary code, profiles to the Moon and to the Earth-Moon or Earth-Sun libration points may be obtained. The author will gladly discuss improvements and additions to the code.