Flyby Geometry Optimization Tool
Langley Research Center, Hampton, Virginia

The Flyby Geometry Optimization Tool is a computer program for computing trajectories and trajectory-altering impulsive maneuvers for spacecraft used in radio relay of scientific data to Earth from an exploratory airplane flying in the atmosphere of Mars. This program implements a genetic algorithm (GA) to choose trajectories to maximize the volume of data relayed via at least one of three spacecraft: a main spacecraft in a hyperbolic orbit and two alternate spacecraft in elliptical orbits about Mars. [The GA approach is ideal for this type of optimization problem, wherein discrete data-transmission rates lead to discontinuities in data-collection volumes that one seeks to maximize. Such discontinuities are typically problematic for other optimization methods — especially, gradient search methods.]

The GA code is used to calculate a maneuver made by the main spacecraft prior to its periapsis passage, to set up a favorable orbital geometry for communication with the airplane. The maneuver is chosen to maximize the total volume of data (see figure) transmitted from the airplane to the spacecraft. Then the program causes the data to be transmitted from the airplane to whichever spacecraft offers the highest data rate.

This program was written by Christopher D. Karlgaard of Analytical Mechanics Associates, Inc. for Langley Research Center. Further information is contained in a TSP (see page 1). LAR-16884-1.