Lunar Exploration (2)
Lunar Exploration (4) (4)

Author: Dr. Rafail Murtazin
Rocket Space Corporation Energia, Russian Federation, Rafail.Murtazin@rsce.ru

Mrs. Ekaterina Belyaeva
Rocket Space Corporation Energia, Russian Federation, Gnezdova_EK@mail.ru
Prof.Dr. Vladimir Soloviev
Korolev RSC Energia, Russian Federation, Vladimir.soloviev@rsce.ru

# RETURN OF A MANNED SPACECRAFT TO EARTH IN CASE OF A CONTINGENCY DURING A FLIGHT TO THE POLAR LUNAR ORBIT

**Abstract**

In missions with landing on Moon the preliminary insertion of spacecraft into a circular lunar orbit is necessary, that requires performing of a braking burn in the periapsis of the arrival orbit. In the Apollo Program, the inclinations of lunar orbits were close to equatorial and in case of a braking burn failure for transfer to a lunar orbit, it was provided a flight of the crew via Free Return Trajectory (FRT). The lunar programs that are being developed today suppose insertion of a spacecraft into polar orbits which would allow landing at the lunar pole area. In flight to polar lunar orbits, it is impossible to realize Free Return Trajectory, so it is raised the problem about ways of parrying such contingency. In the developed method, it is proposed to transfer the spacecraft to an intermediate high-elliptical polar lunar orbit. In this orbit, the spacecraft is waiting for opportunity to return to Earth about four days and then the Trans-Earth injection burn is performed using own energy capability of the spacecraft. The paper contains a historical overview of ways of parrying described contingency on the example of the Apollo program and calculating the energy costs for the chosen cyclogram of the flight plan, which confirms the correctness of the proposed method.