

IAF SPACE EXPLORATION SYMPOSIUM (A3)
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KARI, Korea, Republic ofEARTH TO MARS INTERPLANETARY TRANSFER TRAJECTORY DESIGN FOR LAUNCH OF A
KOREAN MARS ORBITER**Abstract**

In November 2022, South Korea announced a space economy roadmap to “plant the Korean flag on the surface of Mars by 2045,” and announced the 4th Korean national space development basic plan in December 2022, with the vision of becoming a space economy powerhouse by 2045. Three specific goals were presented: expanding the space exploration area, expanding investment in space development, and creating a private space industry. South Korea plans to expand its space territory by pursuing its own space exploration plan, and plans to launch a Mars orbiter in 2035 and land on Mars by 2045. In this study, the Earth-Mars interplanetary transfer trajectory design was performed for Korean Mars orbiter to be launched in 2035. The synodic period between Earth and Mars is 779.935 days, meaning that their relative positions are the same every 2.14 years, so the launch period that can be launched from Earth must be determined by considering the synodic period. Porkchop plot is an ‘interplanetary fuel efficiency map’ according to launch date and arrival date, and the possible launch period is determined through the porkchop plot. There are two types of interplanetary transfer trajectories from Earth to Mars which are Type 1 and Type 2 depending on the angle of Earth-Sun-Mars. Two types of interplanetary transfer trajectories were designed and the results were compared and analyzed to finally select the trajectory that requires less energy. A Korean Mars orbiter is scheduled to be launched by KSLV-3 from Naro Space Center in Korea in 2035 and the total mass of the Korean Mars orbiter is assumed to be 1,500 kg. After the Korean Mars orbiter is launched, it reaches a circular orbit at an altitude of 200 km and performs a short thrust-free flight, and after TMI (Trans-Mars – Injection), it leaves the Earth’s gravitational sphere influence and heads to Mars. The Korean Mars orbiter arrives at Mars after approximately 6 to 8 months of interplanetary space flight. When the Korean Mars orbiter arrives at the periapsis of Mars, it decelerates about 3 to 4 times through engine ignition and then finally settles in the Mars target orbit. The target orbit of Mars was assumed to be a circular orbit of 400x400 km with an orbital inclination angle of 90 degrees. Through simulation, it was possible to confirm the optimal Earth-Mars transfer trajectory for Korean Mars orbiter, which will be launched in 2035.