

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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THE MISSION AND SYSTEM DESIGN OF THE FIRST TURKISH LUNAR MISSION

Abstract

Acknowledging its potential resources and strategic importance as a stepping-stone for both human and robotic exploration of Mars, asteroids and beyond, many governmental and commercial entities are establishing capabilities, developing programs and support actors for Lunar exploration and develop infrastructures on and around the Moon. Among these, Türkiye envisions itself to be one of the future spacefaring nations that exists on the Moon and has started the Lunar Research Program (AYAP) through its Turkish Space Agency (TUA). In the first phase of the program, it is aimed to realize the first contact with the Moon by hard landing method (AYAP-1) and in second phase it is aimed to reach the Lunar surface (AYAP-2) by soft landing method. With the AYAP-1 project, Türkiye will realize its first Lunar mission and become one of the few countries that can carry out scientific activities on the Moon.

For the first Turkish Lunar Mission (AYAP-1), a spacecraft is designed with combined features of orbiter and lander to maximize both the Lunar exploration outcomes and operational experience for soft landing on the Lunar surface. The mission is designed such that the spacecraft will be launched to a Supersynchronous GTO and will follow a series of transfer orbits until Lunar transfer orbit injection. Then, it will be placed into a polar circular orbit at 100 km altitude. Here, the mission duration in orbit is expected to be several months. Finally, a de-orbit maneuver will be initiated and the spacecraft will be impacted to a target area on the Lunar surface. In the last part of the mission, a guided deceleration will also be attempted before the impact to gain operational experience for the AYAP-2 soft landing mission.

In this paper, the mission and system design of the first Turkish Lunar Mission are presented. Firstly, the results of mission design and analyses are introduced together with the concept of operations. Here, the imaging, scientific and technology demonstration payloads are also summarized. Secondly, the main functionalities of the AYAP-1 spacecraft are defined and several system design parameters are specified based on the results of system analyses. Thirdly, the layout of the spacecraft and a brief description of spacecraft systems are provided. Collaborations with national and international institutions are explained. Finally, program management and systems engineering challenges are provided with a roadmap to realize the mission.