Paper ID: 88197
student

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

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DEVELOPMENT OF A LOW-COST REUSABLE ROBOTIC LANDER PROTOTYPE WITH COLD GAS PROPULSION SYSTEM

Abstract

Space technologies have become an indispensable field in today's world, and space missions are becoming more successful and frequent day by day. Space missions, which are long-lasting projects, have many active elements such as rockets, landers, payloads and rovers. Landers, which undertake the final stage of the discovery of many other environments waiting to be discovered by human beings, such as the Moon and Mars, have an important place among the mentioned elements. However, these landers consist of components that are quite expensive and difficult to find and produce. In other words, landers are expensive systems and it is necessary to make sure that all systems are working perfectly before sending the landers on a mission. Therefore, landers must go through qualified RD and testing stages until they are ready for the mission, and each of these processes causes serious increases in the project cost. During RD and Testing processes, fuel, wasted system components, materials and many other expenses occur. In this case, various solution needs arise in order to carry out the relevant processes more efficiently. The CLPS (Commercial Lunar Payload Services) program, recently announced by NASA, also adopts an approach consistent with the understanding of carrying out landing missions at more affordable costs. The fact that NASA, which is a stakeholder in a significant part of space studies, has developed such a program proves that most of the international organizations working in this field are focusing on this issue. This article is about a lander prototype developed as a solution to these needs, designed at low costs and working with a cold gas propulsion system. If we consider the fuel consumption during the test phases, even the fuel used during the test phase, which is carried out only to observe the structural behavior of a lander that uses unique fuels to meet the mission requirements, causes serious costs. In addition to cost, these fuels often make testing processes dangerous. Cold gas propulsion systems are an important solution in this regard. Cold gas propulsion systems are generally included in the reaction control systems of spacecraft and rockets. However, in the project subject to this article, the cold gas propulsion system also constitutes the main propulsion system of a lander. Factors such as cheap labor, appropriate material choices, less costly test methods and applications, geographical location and etc. also make less costly work possible.