SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations (IP)

Author: Mr. Grégor Vindry
ISAE-Supaero University of Toulouse, France, gregor.vindry@student.isae-supaero.fr

Ms. Yulia Akisheva
ISAE-Supaero University of Toulouse, France, yulia.akisheva@student.isae-supaero.fr
Mr. Lyès Badaoui
ISAE-Supaero University of Toulouse, France, lyes.badaoui@student.isae-supaero.fr
Mr. Paul Compagnon
ISAE-Supaero University of Toulouse, France, paul.compagnon@student.isae-supaero.fr
Mr. Yves De Léotard
ISAE-Supaero University of Toulouse, France, yves.de-leotard@student.isae-supaero.fr
Mr. Louis Dutheil
ISAE-Supaero University of Toulouse, France, louis.dutheil@student.isae-supaero.fr
Mr. Jiahuan Wan
ISAE-Supaero University of Toulouse, France, jiahuan.wan@student.isae-supaero.fr
Mr. Stanislas Wasier
ISAE-Supaero University of Toulouse, France, stanislas.wasier@student.isae-supaero.fr

DESIGN OF A LUNAR TAXI CREW-LANDER

Abstract

The Moon Village project studies the possibilities and measures to be taken in order to prepare and maintain a space mission for the period of 2030s, in which 5-10 international astronauts stay permanently on the Moon. The aim of this report is to propose a lander- crew taxi that will serve the astronauts as a mean of getting from/to the orbit around the Moon to its surface. The orbit is considered circular at the altitude of 100 km. The main objectives are to assure safety and precision of the taxing and landing on Moon for at least 4 astronauts on board, minimizing the energy costs.

To achieve the main goals of the lander this report will address the following areas: structural design of the craft, automatic control, energy budget and safety and comfort for the people on board. The structural design includes the choice of the type and size of lander to assure that its capability to bring at least 4 astronauts with additional weight. The case of emergency, when the maximum of 10 astronauts needs to be taken to the orbit, is also considered. The choice of the team is to design a lander of type shuttle. The part of the automatic control studies the processes of piloting, approach and docking to propose a completely human-independent system. The model of the energy budget will be estimated as a function which depends on the weight of the shuttle. An important element to consider is the propulsion method. The team initially chose chemical propulsion, and studied the possibility of electrical propulsion. The possibility of a device set up on the surface of the Moon and providing an initial thrust to put the shuttle in orbit around the Moon will be investigated. Any decision made will be analyzed to make sure that the main objective of safety is satisfied. To assure safety, the team will consider the time spent onboard, the correction of the orientation of the shuttle once in space, soft landing and the level of vibrations. Furthermore, the effect of collisions with space debris will be taken into account.

There are two major factors: safety and cost. Despite the fact that it is important to minimize the costs, the safety measures prevail. Therefore, the biggest difficulty will be to balance out the costs while maintaining the highest safety standards.

This paper is a part of a study conducted at ISAE-SUPAERO.