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MULTI-DISCIPLINARY ANALYSIS OF SINGLE STAGE TO ORBIT (SSTO):SKYLON SPACEPLANE

Abstract

In the dawn of 21st century, low-cost space access has been one of the major challenges. The scope of having a vehicle which can take-off from designated Earth-based facility, like spaceport or launch pad, deliver the payload into the prescribed orbit and return back to the earth-station, can be envisioned as a profitable business case for replacing a much lesser efficient expendable rocket-based transport. These vehicles, which can be referred to as reusable launch vehicles, have been on the drawing board since the 1960's.

Different concepts have been proposed for reusable spacecraft's over the years and have been researched with the available resource materials. Though having immense potential to become a future Space Access Vehicle (SAV), most concepts have never reached its production phase. One of the concepts which has been pursued over past few decades is single stage to orbit (SSTO).

This paper formulates a Multi-Disciplinary Approach (MDA) as a problem-solving technique to understand the feasibility of spaceplane concepts. For this study SKYLON, a spaceplane by Reaction Engines Limited is considered. There have been several SSTO concepts proposed and tested from 1960's but not a single spaceplane has ever flown. This study is to evaluate one of the recent proposed/being developed concept by Reaction Engines Limited called SKYLON. The vehicle uses a sophisticated, yet highly fuel dominated Synergistic Air-Breathing Reaction Engines (SABRE) concept thereby generating a much larger volume wing-body configuration. The evaluation of the SKYLON spaceplane will be done taking into consideration learnings from past programs. In this study, multi-disciplinary analysis of SKYLON will be carried out to answer critical questions like: with the current proposed design can SKYLON reach the orbit? Is investing in SSTO it a good idea to or is TSTO a better option. Questions are answered based on different phases of the mission. Mission considered is same as proposed by reaction engines as sending the payload of 12 tons to ISS at 380 Km. The results obtained will be compared and analyzed para-metrically with the past successful aircraft or spacecraft to better understand where SKYLON lies in the performance zone.