AERO DESIGN PROJECT

Notes on dual payload mission idea

**DUAL PAYLOAD MISSION PROPOSAL:**

A dual payload launcher is proposed to achieve significant cost savings by addressing two orbital requirements in one mission, hence increasing the efficiency significantly. It would be specifically designed to deliver the first payload to LEO and then use its upper stage to execute a Hohmann transfer, in order to deliver the second payload, enabling it to reach GEO.

* **ADVANTAGES**:
* Efficiency: Delivering two payloads (one to LEO and one to GEO) in a single launch can increases the efficiency of the vehicle capabilities.
* Cost: Similarly, this can reduce the cost significantly compared to launching them separately.
* Fuel: By utilising the Hohmann transfer, reaching GEO from LEO can be done with a minimal ΔV value, saving fuel.
* **DISADVANTAGES**:
* Complexity: LEO and GEO have different performance requirements, which increases the complexity of the mission (timing, control, separation mechanisms etc)
* **Increased propellant and mass:** The extra burns required go from LEO to GEO need more propellant, which could limit the capacity of payload or increase the launcher size.
* Mission duration: Hohmann transfer requires more time to be executed

**EXISTING EXAMPLES OF DUAL ORBIT APPROACH:**

The following rockets are designed to execute multiple burns and adjust their trajectory:

**Rocket Lab Electron Rocket:**

<https://www.rocketlabusa.com/updates/rocket-lab-successfully-deploys-satellites-500km-apart-to-separate-orbits-for-kaist-and-nasa/#:~:text=NASA%20%7C%20Rocket%20Lab-,Rocket%20Lab%20Successfully%20Deploys%20Satellites%20~500km%20Apart%20to,Orbits%20For%20KAIST%20and%20NASA&text=Following%20payload%20deployment%20to%20two,to%20help%20reduce%20space%20junk>**.**

**Fregat Upper Stage:**

* Typically used with Soyuz launchers, the Fregat stage
* Liquid propellant
* 2 hypergolic propellants

|  |  |  |
| --- | --- | --- |
| Propellant mass | Max thrust | Spec impulse |
| 5,307 kg | 19.85 kN (high) 13.93 kN (low) | 333.2 s (high) 320 s (low) |

**Briz‑M Upper Stage:**,

* Typically used with Proton rockets
* Hypergolic propellant.
* Powered by a pump-fed gimballed main engine

|  |  |  |
| --- | --- | --- |
| Propellant mass | Max thrust | Spec impulse |
| 5,055 kg | 19.6 kN | 326 s |