

OHB's Current Challenges and Future Solutions in LEO EOL

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Key Challenge for LEO: Controlled vs. Uncontrolled



• How to best fulfil mission requirements for each case?



OHB A Trade-off Space S/C dry mass Launcher: Vega-C • For some missions, the choice is clear Chemical Uncontrolled For the others, there are many factors Propulsion reentry Controlled reentry No Yes Uncontrolled reentry Compliance to casualt risk of 10^-4? **Drivers:** Yes Launcher performance No Yes Launcher performance Type of Mission sufficient for full chemical sufficient for full chemical solution? Hybrid: Launcher Change to EP and use CP only for Mission Concept: Mission Concept: final burn Chemical Propulsion **Chemical Propulsion** Spacecraft mass restrictions Controlled Re-entry Uncontrolled Reentry Hybrid: Add CP for final burn Propulsion System Still compliance to casualty risk of 10^-4? No Chemical vs. Electric Propulsion Yes • Payloads auncher performance auncher performance • Can contain large casualty risk factor contributors sufficient for hybrid sufficient for full electrical solution? Yes Yes Mission Concept: Mission Concept: Hybrid Propulsion Electrical Propulsion Controlled Reentry Uncontrolled Reentry

Iteration

solution?

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solution?

Backup Launcher

Ariane 6.2

or Ariane 6.4



Why Focus on Uncontrolled Re-entry?

- Cost benefits
- Lower mass due to lower propellant
- Less complexity in mission operations
- Higher certainty of maintaining compliance at EoL for potential mission extensions



Model Uncertainty

- No model is perfect
- Uncertainty in the models accuracy and in the modelling accuracy itself can drive results in an unrealistic direction
- Small differences in models can result in big differences for results! CFRP Electronic Cards



D4DBB



Improved Representation of Destructive Spacecraft Re-entry from Analysis of High Enthalpy Wind Tunnel Tests of Spacecraft and Equipment, Beck et al.

Hurdles to Uncontrolled Re-entry



• Early resolution of re-entry type is needed

• Needed to design and size spacecraft appropriately

Hurdles to broader adoption:

- Design adaptation and resultant costs
- More expensive unit solutions
- Heritage of current designs
- Restrictions on selection of units

Outlook for the Future

Better modelling of spacecraft

- Understanding built on ground and flight tests
- Standardisation

Lower kinetic energy options

• Break up into small low mass elements

Further units with increased demisability

- Selecting units for low Casualty Risk impact
- Tailoring selection for spacecraft compliance

Designing spacecraft for better demise

- Payloads designed for demise
- Structures and accommodation to promote earlier demise











What will that look like?

- Bespoke solutions to address critical areas in order to enable uncontrolled re-entry
 - Spacecraft utilising combinations of D4D solutions for low casualty risk
- More certainty for casualty risk compliance at EoL
 - Enabling mission life extension
- Maintaining fulfilment of key requirements for Spacecraft whilst allowing for more uncontrolled re-entry
- Lower and lower casualty risks enabled through uncontrolled reentry



Thanks for listening!

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