

Term Project – Updates and Exceptions

- Review of project statement from Lecture #01
- Expectations
- News update: SpaceX Starship IFT-3!

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Term Project - A Fully Reusable Launch System

- A fully reusable launch system is the “holy grail” of space transportation
- SpaceX has reused the Falcon 9 first stage up to 19 times, but upper stages are expendable
- Blue Origin planned for New Glenn to be fully reusable, but recently announced the upper stage will be expendable
- SpaceX is considering starting Starship operations with expendable upper stage
- Upper stage entry from orbital velocities is hard!

Term Project

- Do this individually or in pairs (your choice)
- Perform analytical trade studies to determine optimum configuration (e.g., number of stages, propellants, size)
- All vehicles will be conceptually designed from scratch (no “catalog engineering”!)
- Design process should proceed throughout the term
- Progress reports will be due throughout the term
- Formal design presentations at end of term

Expectations for Term Projects

- Trade studies for launch vehicle(s) – design for minimum cost
 - Number of stages / Δv distribution
 - Choice of propellants
 - Payload mass(es)
 - Reusable vs. expendable
- Launch vehicle design using MERs
- Launch vehicle trajectory
- Revision of required Δv
- Return/landing of first stage



Term Projects – Upper Stage Entry Vehicle

- Trade studies
 - RCS and deorbit propulsion
 - Aerodynamic configuration
 - Heat shield materials and configuration
 - Entry, descent, and landing system
- Vehicle nonrecurring and recurring costs
- Entry trajectory
- Thermal loads



Term Project – Systems Engineering

- Mission model (flights / yr) for creation of economic viability analysis
- Total cost (nonrecurring + recurring)
- Breakeven charge for launches at 10% and 25% discount rates
- Analysis of system resiliency
- CAD images of final vehicle configuration
- Any other targets of opportunity

Starship IFT-3 Launch



Starship IFT-3 Entry

