Increasing Lunar Propellant Delivery Capability with ACES Aerobraking

Nicholas S. Campbell, Brian M. Argrow

Aerospace Engineering Department

University of Colorado

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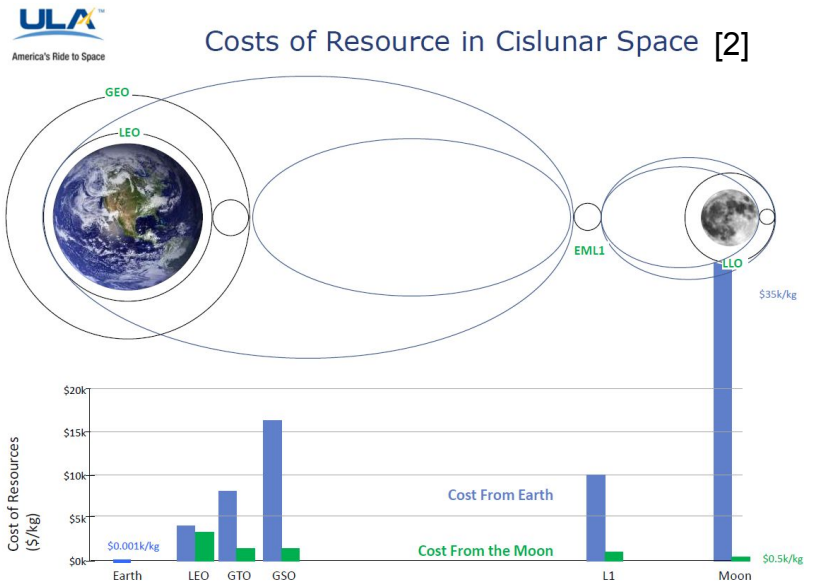
Motivation

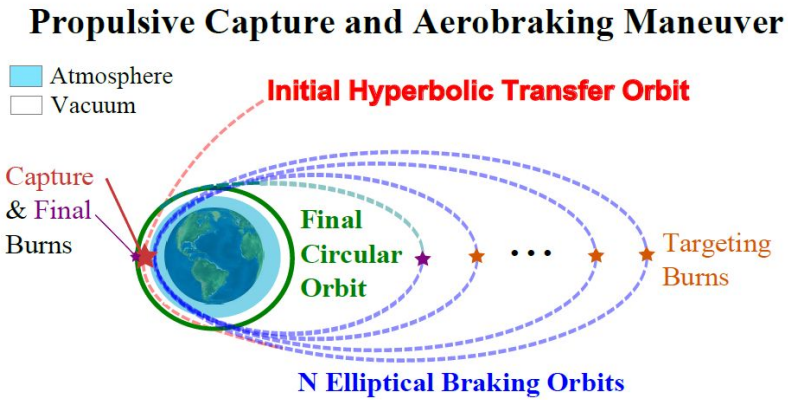
- **Evolving commercial space market**
  - Lunar Propellant fueling EO-ops
- **Long duration spacecraft**
  - The ACES
- **B$'s worth of propellant annually for EML1 → LEO transportation[1]**
  - ***Is this cost necessary?***

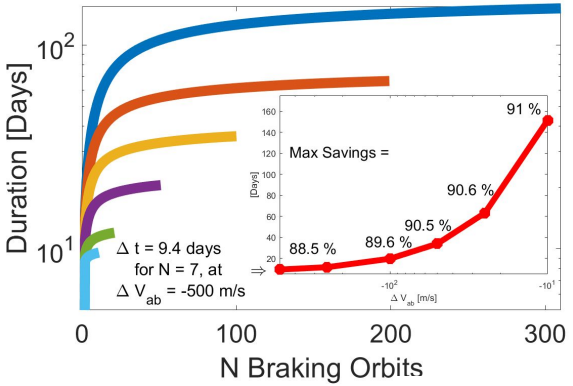


[1] Bennett, T. et al. (2016) *AIAA Space Conf. Long Beach, CA.*
[2]"Transportation Enabling a Robust Cislunar Space Economy," April 9th, 2016, from **ula**launch.com *on 1/9/17*

The Trade-Off

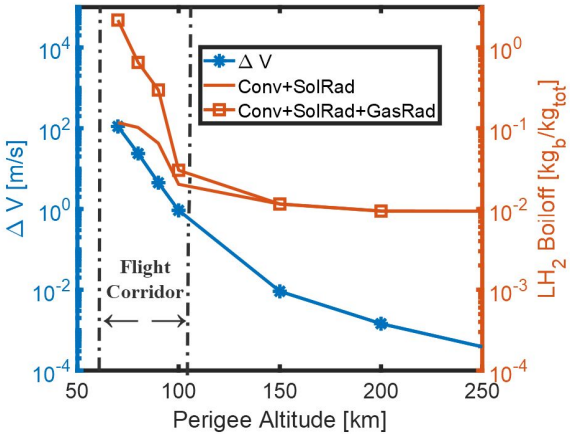
Aerobraking back to LEO





>200% Increase in delivered propellant!

BUT…

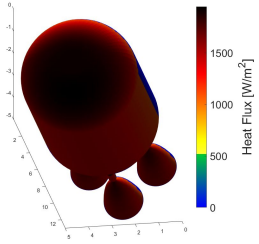


Reasonable durations require added boil-off considerations

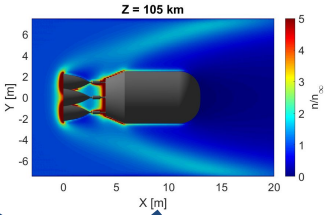
...at the least

Technical Approach

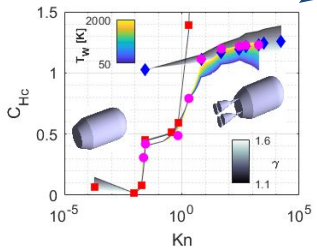
System Identification

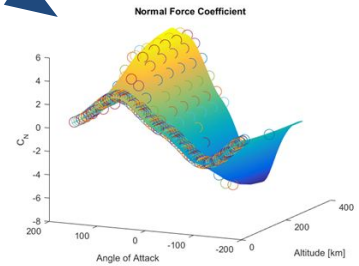


Aerothermodynamic Modeling



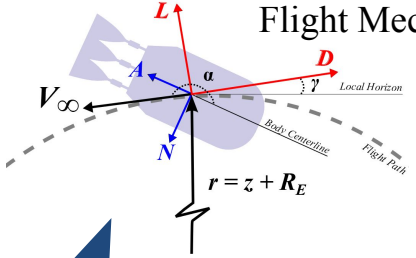
Uncertainty Quantification



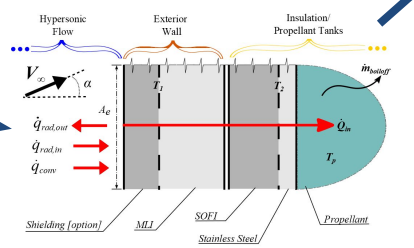


Efficient Databasing

Spacecraft Dynamics



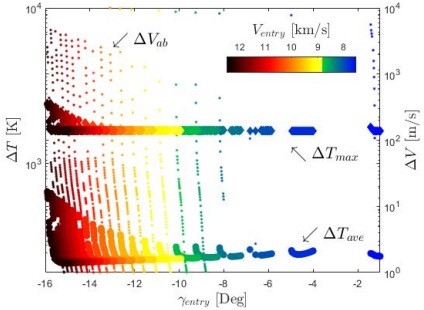
Flight Mechanics



Thermodynamics

Trajectory Analysis

Perigee Targeting Strategies



ΔV = 1 m/s → 1 km/s in Δγ < 0.5° !

Full Maneuver Propagation

Thanks for listening!

Please come visit the poster session for more details