Research project meeting summary: Trajectory Module for Launcher MDAO

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September 4, 2020

Plan:

Review of previous work

- I extended the Us Atmosphere from 50 km to 600 km with 600 data points to allow heat flux calculation at high altitude.
- I grouped 5 components into the Aero Group and implemented class inheritance to reduce repetition of code.
- Dynamic pressure and heat flux are now calculated in the Aero Group and can be used to set up path constraints.
- Created the TSTO class and got the data for Falcon9.

Key points discussed

- For the instantaneous changes in mass due to stage jettison, I haven't been able to create the discontinuity in the state variable. I can't find any examples.
- m_{p_1} and m_{p_2} are both design parameters? if m_{p_2} is fixed I can fixed the value of mass of the initial guess.
- Discuss Python script for orbital elements
- **Guidance program for TSTO**
    1. Lift-off
    2. Pitch over (Linear and exponential)
    3. Gravity turn: Finishes when there's no fuel left in stage 1 and above 50km. I could also limit dynamic pressure at 1 *kPa*.
    4. Stage separation happens here. No coast phase.
    5. Exoatmospheric command (BLTL): It divides into 2 phases because of fairing jettison that happens at heat flux threshold. This phase finishes when 2 of the elliptical orbit parameters are reached.
- new release of Dymos
- Updated report due on monday 09/07

- **Correction of guidance program for TSTO**
  1. Lift-off
  2. Pitch over (Linear and exponential)
  3. Gravity turn: Finishes with limit dynamic pressure at 1 *kPa*.
  4. Exoatmospheric command (BLTL): It divides into 3 phases because of stage separation and fairing jettison that happens at heat flux threshold. This phase finishes when the apoapsis of the actual orbit is equal to the target apoapsis.

- The elliptical transfer orbit is not fully determined. Only its apoapsis is defined and its periapsis is constrained at 145km.

- The circularization burn is not included in the numerical optimization but calculated with analytic equations for Hohmann transfer.

- work on corrected version of report due on 2020/09/07.
- continue optimization process by fixing m_{p_2}