

MAE 795/895 – Topics: Mars Aerodynamics

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Overview

This course will be project-based, open-ended, and will rely on small teams to study varied aspects of aerodynamics related to flight through and within the Mars atmosphere. The first part of the course will be a study of past work, which is considerable and dates back many decades. Students will then focus on specific technical challenges and undertake further study. Examples of challenge areas include:

- Entry, Descent and Landing (EDL). Existing missions rely on ballistic entry, but this may not scale well to NASA's stated goal of delivering 20 metric tons to the surface per mission. Entry configurations developing aerodynamic lift may have advantages. Aerodynamic challenges span the hypersonic, supersonic, transonic, and subsonic regimes.
- Flight within the atmosphere. The Ingenuity helicopter is a recent example of a novel approach to wide area exploration. A range of alternatives will be explored, including fixed wing, rotorcraft and lighter-than-atmosphere.
- Terrestrial test and evaluation of vehicle and device concepts. A low density, low Reynolds number, but possibly high Mach number test environment is needed.
- Development of thrust.
 - Propellers and rotors are current technology but are operating in an environment where optimum solutions differ from earth-based vehicles.
 - Although the atmosphere is inert, it can be used as a working fluid if a prime mover other than conventional combustion is used.



Schedule

The course is built around class meetings Tuesday/Thursday 2:00-3:40 p.m., May 18th thru August 6th. The schedule is expected to be flexible, with smaller group meetings supplementing/replacing classes as required.

Delivery

The course will be available online within and outside Virginia. ODU students will register in the usual way. NIA students may register via the NIA course exchange agreement, with approval from the Director of Graduate Education. Non-NIA students may register as non-degree, with subsequent credit transfer to their home school.

Deliverables

Assuming good progress, it is hoped that the class outcomes can be converted into some form of team-authored formal publication; forum to be determined. (A previous NIA class was summarized as AIAA 2019-3466).

