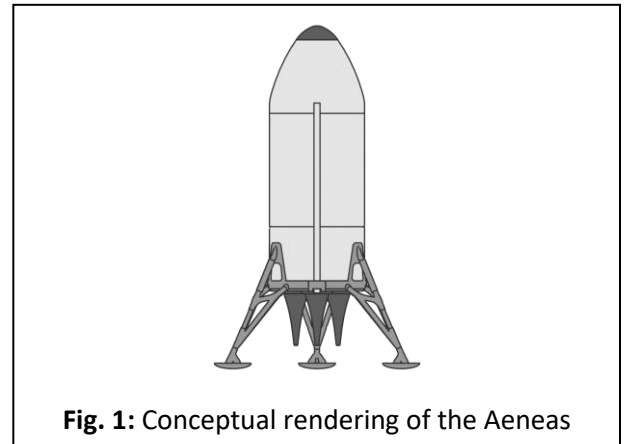


3/19/2021

Project Aeneas: Preliminary Design and Analysis of a Crew-Rated Mars Ascent VehicleDavid Aden^a, Pooja Algikar^b, Alejandro Sosa^c, Richard Tuminello^c, Brendan Ventura^c, Dr. Kevin Shinpaugh^c^a*Department of Materials Science and Engineering, Virginia Polytechnic Institute and State University*^b*Department of Electrical and Computer Engineering, Virginia Polytechnic Institute and State University*^c*Department of Aerospace and Ocean Engineering, Virginia Polytechnic Institute and State University***Abstract**

The National Aeronautics and Space Administration (NASA) plans to begin crewed missions to Mars within twenty years. Inherent in this plan is the need for a new launch vehicle, optimized for operation on Mars and capable of safely transporting crew. Acting through the Revolutionary Aerospace Systems Concepts Academic Linkage (RASC-AL), NASA has issued a request for submissions of innovative designs capable of carrying two astronauts and 100 kg of payload from the surface of Mars into a low-altitude orbit, to be ready to launch by the end of 2034. The Project Aeneas team recently completed initial concept studies and analysis on such a design, and has submitted a proposal paper to RASC-AL. The Aeneas is a next-generation launch vehicle design that leverages aerospike nozzle technology to increase engine efficiency and in-situ resource utilization (ISRU) for propellant production on the surface of Mars. These advancements allow the Aeneas to possess exceptional orbital insertion capability and will assist NASA in expanding its technology portfolio to enable long-term crewed missions and low-mass vehicle designs. The design philosophy depends heavily on the use of cutting-edge model based systems engineering software to fully explore all relevant trade spaces and produce a highly optimized final design. Future work of special interest will include final trade selections, ISRU efficiency prediction, and materials selection for the aerospike cooling system.

**Fig. 1:** Conceptual rendering of the Aeneas**Biography**

David Aden earned his BS degree in Mechanical Engineering from Virginia Tech in the spring of 2020. He began pursuing an MEng degree in Materials Science and Engineering in the fall of 2019 and is expected to graduate in the spring of 2021. His academic focus is launch vehicle development, with a concentration on the design of required support equipment. David has had the opportunity to contribute to the manufacturing process of the ARRW hypersonic missile, as well as providing designs and production support in the SpaceX Starship development campaign. He serves as the leader of the Project Aeneas team.

