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Case Study

Image Credit: Black Swift Technologies

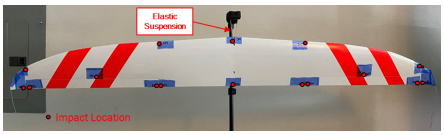
Aeroelastic Assessment of Venus Exploration Vehicle

OVERVIEW

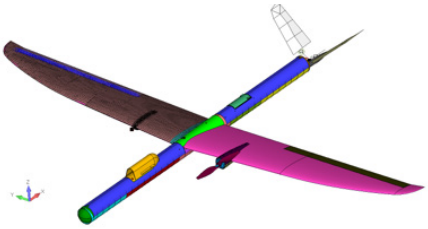
Black Swift Technologies (Black Swift) was awarded a contract from NASA in 2018 to develop an unmanned aerial system (UAS) capable of deployment in the upper atmosphere of Venus, a demanding flight environment consisting of turbulent high-speed wind loads and corrosive particulates. To enable high-altitude, long-duration planetary observations recorded under these harsh atmospheric conditions, Black Swift proposed an unpowered high-performance glider configuration leveraging an energy harvesting technique, dynamic soaring, to power the vehicle and extend its range. Black Swift also explored the use of a folded wing, which would allow for transporting the UAS to Venus within a compact, interplanetary transport system. ATA Engineering supported Black Swift during the development of their UAS by conducting modal surveys and performing aeroelastic and mechanical analyses to validate their designs.

TASKS PERFORMED & KEY OUTCOMES

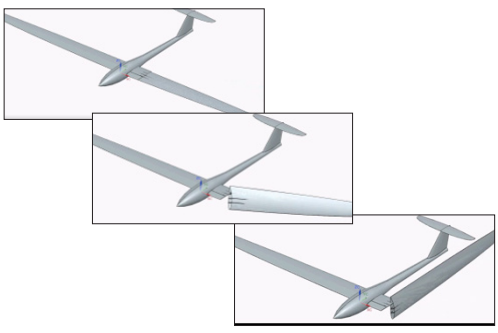
- Modal testing of an Earth demonstrator UAS to develop structural models
- Dimensional analysis to investigate and confirm that low-altitude flight tests of the demonstrator UAS could be used to validate the structural integrity of a high-altitude aircraft deployed in the atmosphere of Venus
- Aeroelastic modeling and analysis for flutter and loads assessment, results of which confirmed satisfactory design
- Mechanical design and analysis of a folding wing hinge to assess its impact on flight performance



Modal Testing



Aeroelastic modeling of UAS



Mechanical design and analysis of folding wing hinge