DARcorporation

Design • Analysis • Research

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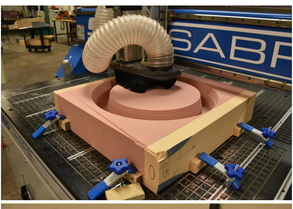
Ducted Fan Manufacturing

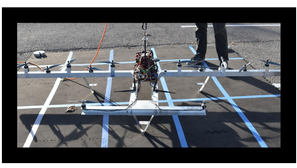
As part of ongoing expansion of the DARcorporation prototype manufacturing capabilities we have recently begun designing, manufacturing and installing ducted fans on our prototype aircraft. The ducts are constructed from three pieces of fiberglass composite attached to the wings via extended wing ribs at the wing/body intersection and at the outer edge of the duct. The extended wing ribs connect to a C-channel duct inner structure. The leading edge and trailing edge duct pieces are then bonded to the C-channel to provide the full aerodynamic shape of the duct.



High density foam molds for the fiberglass components are manufactured with the CNC router. The curing process for the fiberglass components is done in a vacuum. All parts and joints are inspected before and after fitting and assembling. This process allows DARcorporation to control and assure the quality of the airframe components from the design phase all the way through to the installation on the test vehicle.

HTB Tethered Flight

DARcorporation has developed and test flown the Hover Test Bed, or HTB, a distributed electric propulsion (DEP), hover capable, radio-controlled aircraft. The HTB is designed to test the hover characteristics of a DEP eVTOL aircraft, test various motor control schemes as defined through the onboard Pixhawk controller and flight test various autopilot functions. The Hover Test Bed is equipped with 6 electric motors on each wing and a single electric motor on each horizontal tail for a total of 14 electric motors. The HTB is of simple construction, using aluminum extrusion for all of the baseline structure and plywood for mounting the avionics.



The HTB is tethered to a crane for the first flight. This allows for the HTB to hover under its own power if the tether is slack but acts as a safety mechanism if the flight controller and/or autopilot do not act properly. After multiple tethered flights, the HTB will be flown with no safety tether. Future tests will test various avionics and autopilot functions.

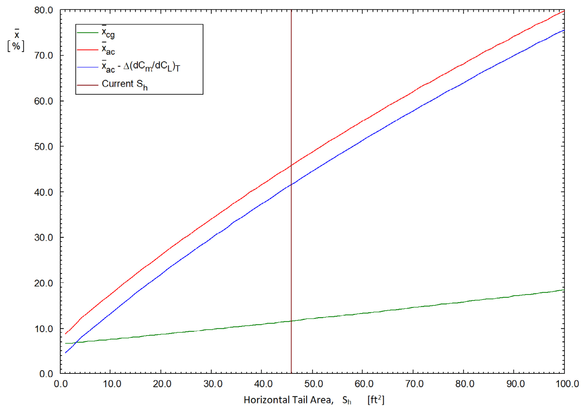
Software News: New Version Release of AAA!

Spring 2022 will see the release of Advanced Aircraft Analysis 5.0, the latest version of the comprehensive aircraft design software that has been in use by customers worldwide since its first release over 30 years ago. AAA 5.0 incorporates over 350 modifications and feature upgrades to allow for greater flexibility in aircraft configurations, while streamlining the design process. What's new in AAA (pdf)

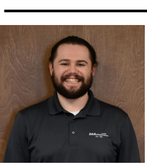
Highlights from the extensive feature upgrade list include:

- AAA 5.0 allows for increased flexibility in the types of configurations that can be designed. While previous versions needed a fuselage to be modeled, methods have been updated so that users can now design a true flying wing. With the current interest in VTOL configurations in mind, AAA 5.0 makes it easier to design aircraft with tilting wings for different flight conditions. The center of gravity of fixed equipment can either be kept constant or variable between different flight conditions to reflect different flight configurations.
- Power effects such as blown wing effects are more accurately calculated, making AAA 5.0 well suited for Distributed Electric Propulsion configurations.
- AAA 5.0 now includes the Inherent Tail Surface Area Sizing module, which calculates the required tail surface area for a given desired static margin. More elaborate than the conventional volume method, the new calculation takes into account changes in center of gravity and aerodynamic center due to the tail surface change. This is compatible with conventional horizontal tails, V-Tails, canards and three-surface aircraft.
- Users have more options for control surfaces such as drag rudders, differential canard and differential elevators.
- The Weight, Aerodynamics and Stability & Control modules have been significantly overhauled to streamline the work flow. Weight, Center of Gravity and Moment of Inertia calculations have been split into different submodules. The Stability & Control module was restructured so the different functionalities are easier to find.

Horizontal Tail Area based on Static Margin



Welcome to the team, Lucas Powell!



Lucas Powell began his relationship with DARcorporation as a student intern in May of 2019 and has recently transitioned into a full time engineer. In his years as a student intern, Mr. Powell utilized his AAA knowledge to develop models of multiple aircraft and participated in the conceptual design of a military trainer aircraft. Mr. Powell's initial task as a full-time employee at DARcorporation is the updating of the AAA User's Manual for Version 5.0.

DARcorporation
910 East 29th Street
Lawrence, Kansas 66046