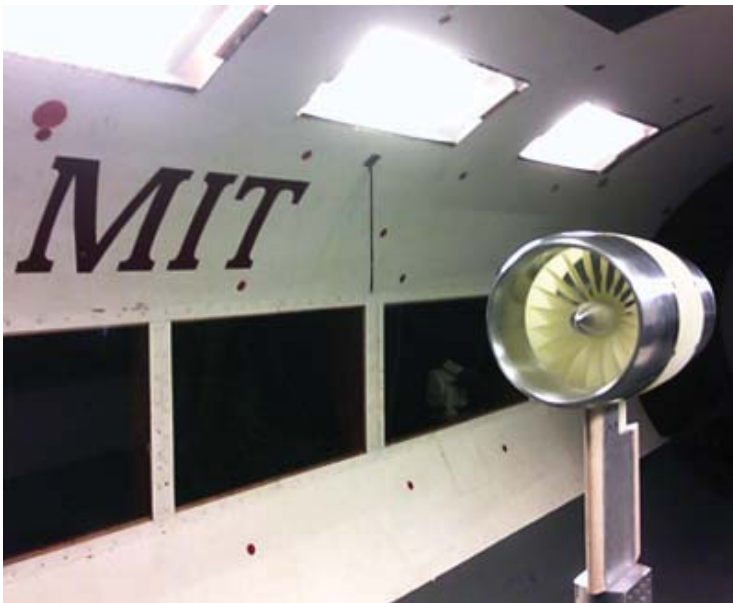


Stereolithography Helps Reduce Drag Noise on Aircraft

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NASA and MIT teamed up to design and test a new method of reducing aircraft noise caused by drag. When an aircraft approaches an airport, the flaps go down and a huge amount of drag is produced. This drag causes vibration and noise inside the aircraft. The NASA and MIT project teams came up with a unique design, which would reduce the noise produced by the drag, that they called a "swirl tube." In order to validate the design, the project teams had to produce prototypes with enough dynamic strength that they could be tested in a wind tunnel.

Darius Mobed, a grad student at MIT explains: "The swirl tube is a ducted set of stationary turning vanes." The vanes do not eliminate the drag – aircraft need drag to



The SLA "Vaned Disk," or "Visk" manufactured by Solid Concepts is shown assembled with other scale-sized parts. The device is being used to simulate a through-flow quiet drag method being researched in a wind tunnel at MIT.

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Extensive wind-tunnel testing was necessary to validate a quiet drag concept. Prototyping the device meant creating exact replicas that could withstand the rigors of testing.

slow them down on landing – instead they redirect the drag so that it does not create the heavy vibration that typically occurs. The application of the concept was to fit current aircraft as well as all future aircraft models. The experiments themselves focused on the proof of the concept's simplest configuration, the swirl tube.

A modular test model was designed in CAD and outsourced to a prototyping service. The centerpieces for the design were interchangeable vaned disks (visks) fabricated using SLA (Stereolithography) by Solid Concepts, Valencia, CA. SLA allows a customer to provide highly accurate models and patterns in a matter of hours. The models are ideal for use as concept models, form and fit studies, and as master patterns for a variety of molding techniques.

Today, many companies and universities are considering 3D desktop printing machines as an alternative to outsourcing, but would need to make a high initial investment to do so. That's why outsourcing has maintained its place in the prototyping market. Many of the 3D printers available, though capable, have inherent limitations on the size of parts produced, as well as the materials and characteristics to choose from.

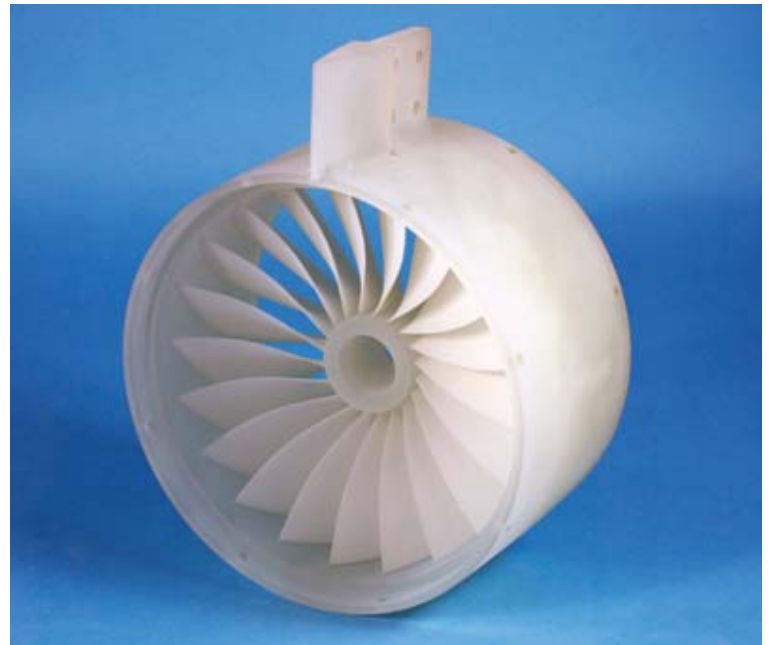
Outsourcing avoids being locked into a single technology. Plus, with Solid Concepts' newly introduced overnight prototyping service, ZoomRP.com, turnaround times have been minimized, allowing customers to receive the part via FedEx Priority Shipping the next business day. This service, then, not only provides a fast prototype but also the benefits of the latest technology and materials without having to buy a new machine every few years.

With this type of outsourcing, SLA models are produced in a very short time. All that is needed is to start with CAD geometry, IGES or STL data.

Even though outsourcing services offer many options for finishing, the MIT visks did not need such fine-tuning for the tests to be performed. In fact, the visks used in the testing were constructed only to account for aerodynamic performance, compatibility with test facilities, construction material, and structural integrity.

Mobed says, "These visks played critical roles in all of our experiments. Most of all, their material strengths were crucial to the structural safety of the model while their surface finishes and build resolutions were important to aerodynamic and acoustic performance." The results from the experiments confirmed that swirling exhaust flows of such a device can indeed generate quiet drag.

The NASA Langley Research Center funded the experiments that assessed the aero-acoustic behavior of the swirling flows developed by the swirl tubes. The team at MIT chose a modular design that allowed nine different



MIT Engineers created 3D CAD models of "Vaned Disks" for their research. Once the CAD data was downloaded into the proper format, the disks were manufactured. Solid Concepts produced the disk using SLA rapid prototyping technology.

SLA visks to alternately be tested in a wind tunnel assembly. The analysis performed after testing proved that swirling flows can generate drag quietly.

Furthermore, some aspects of the practical integration of swirl tubes into aircraft design were assessed as well. Integrating swirl vanes into aircraft engines is suggested to generate effective drag at minimal weight and cost, benefiting from increased mass flow through the device due to fan pumping. These devices are still under test.