Taking Off with Simulation

New airborne solutions are being developed to accommodate one or more persons for air travel. Explorations including large drones, small helicopters, airplanes, and flying cars will enable companies to respond to the demand for Personal Air Mobility (PAM). The team at Talaria was founded by students at the Delft University of Technology. They believe more people will soon be able to fly without having to undergo expensive and lengthy pilot training. The idea for Talaria's Individual Air Mobility project began at the end of 2017. Founder Philipp Essle heard about the Boeing GoFly competition which rewarded the best designs for a one-person aircraft. Soon after, Essle won over fifteen fellow students and jointly founded the Talaria startup. Talaria's mission is to develop an electrically driven PAM that can take-off and land vertically in urban environments. Today, the Talaria team has around 18 students from Delft Technical University and is supported by many sponsors invested in the potential of this revolutionary project.

The Key to Air Mobility

When considering air mobility, safety and weight are the main focus areas for development. The weight of all components has a considerable impact on flight performance and the flying range, so Talaria optimized the hubs of four rotor blades to reduce the overall weight of the device. The challenge was to reduce the weight and number of unique components, while ensuring feasibility and safety in a quicker production process.

The chosen manufacturing method of this project was 3D printing, which presented a unique challenge because this is not common practice in the aviation industry for critical components. Searching for a way to meet their needs, the team discovered Altair through their sponsor, Additive Industries. Realizing Altair Inspire™ could quickly help the team to find new solutions, Essle began to solve the challenges of the project.

TALARIA

Industry
Aerospace

Challenge
Weight reduction and speeding up production process

Altair Solution
Optimization with Altair Inspire

Benefits
- 1.5 kilograms weight reduction
- 50% saving on the number of unique components and volume
- Simplifying and speeding up the production process with 3D printing

"We are currently working on the first prototype of our one-person flight solution for urban environments. "In terms of performance, it is important that our solution is strong, safe, and lightweight. That's why we're optimizing several critical components using the Altair Inspire simulation software," said Essle.

Our Solution

Talaria first designed the basic geometry of all the components with a 3D CAD program. Using Altair Inspire, they checked whether material and weight could be reduced through topology optimization. This approach resulted in a significant 1.5-kilogram weight reduction of the rotor hubs.

"Thanks to topology optimization with Altair Inspire, we reduced the number of unique components by about 50 percent. This resulted in a weight reduction of around 1.5 kilograms which is almost 30 percent of the total weight. As we are going to manufacture the hubs using heavy metal titanium, the weight saving is less than the volume saving (about 50 percent). In the final step, the optimal topology was fine-tuned for additive manufacturing," said Essle.

In close cooperation with Additive Industries and Altair, Talaria explored the applications of 3D printing. This manufacturing method is the key to lean production, especially when combined with simulation technology.

"3D printing significantly shortens our production process. In the original design, each rotor hub consisted of three components, 12 total, all of which required post-production treatment following waterjet cutting. The total lead time for the production process would have been about two to three weeks, depending on the supplier. When using 3D printing, only four parts require post-production treatment, which significantly shortens turnaround time. Our rotor hubs are made from expensive and strong titanium, so we considered the required support structures using topology optimization," said Essle.

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>
> Philipp Essle
> Founder

Results

The intuitive user experience of Altair Inspire made it easy for Talaria to apply the software to solve its challenges and to design the product. The Talaria engineers carried out several simulations using Altair Inspire to optimize the geometry, weight, and strength of the rotor hubs. As a result, they were able to reduce the weight by 1.5 kilograms and save 50 percent on the volume and number of unique components. This also simplified and sped up the design and production process with 3D printing. Happy with the results, Essle will continue to use Altair Inspire in future projects and the software solution will play a major role in helping Talaria reach new heights.

"Altair Inspire runs seamlessly with third-party 3D CAD applications. Moving forward, we will optimize various components including our battery pack cooling in order to prepare everything for the "Certificate of Airworthiness." Subsequently, our helicopter will be transported to the United States to participate in Boeing's GoFly fly-off finals on February 29, 2020. Whether we win or not, our goal is to make flying accessible for many people with innovative PAM solutions."

Altair Inspire screenshot of optimized parts. The number of unique components could be significantly reduced.

Talaria's PAM device Hermes can take-off and land vertically in urban environments.

The topology optimization of the rotor hubs resulted in a weight reduction of almost 30%.

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