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The P2 Xcursion

High-performance hybrid

BY BETH E. STANTON

Industrial design couples product design and aesthetics with science and technology. Few industrial designers actually design aircraft. – Tomas Brødreskift

TRAINING FOR HIS PRIVATE PILOT CERTIFICATE while simultaneously studying industrial design at the Oslo School of Architecture and Design (AHO) in Oslo, Norway, led Tomas Brødreskift to look at the old airplanes he was flying in a new way.

"As an industrial designer, I was learning how to criticize products and saw immediately how much could be done in the aviation industry," Tomas said. Shifting the paradigm of light airplanes from hobby to personal transportation could incentivize more people to fly. He always dreamed of a seaplane, but seaplanes typically have 30-40 percent less performance than the best LSA.

"I like going long distances on trips and would love to have the ability to fly with little use of fuel and to land on water. I'd also like to bring gear for outdoor activities like a bicycle or canoe," he said. Tomas envisioned a true sport utility airplane. "A plane is not utilitarian if you are bound to an airport. Utilitarian for me has to do with expanding the areas you can go."

Tomas saw a vacuum between aircraft today and the flying cars of tomorrow: a cost-effective and user-friendly light-sport seaplane could fill the niche in the interim. "The dream airplane that would fit my profile wasn't out there," he said. "I'm in this to make a business, but also to make an airplane for myself." The P2 Xcursion concept became his university diploma project.

After graduating with a five-year master's degree from AHO in 2010, Tomas decided to build his portfolio by publishing his project online. He created a website, and right away enthusiastic people from around the globe asked if they could help. Since Tomas had no formal training in aircraft design, he welcomed the input. He shared his data with engineers, designers, and pilots. He received guidance for the wings, lifting surfaces, hull design, stability, and aerodynamics. The P2 project became an open-source cooperative collaboration. Tomas founded Equator Aircraft Norway SA in 2012. "People all over the world have contributed with details I didn't know much about," he said. A critical part was the aerodynamics. Tomas could make shapes but didn't know how to analyze them. In an iterative process, he'd send 3-D data for analysis and get reports back. Through this back and forth process, the outside shape of the airplane was set over a period of two years. "The cool thing is that this is possible today because of the internet," he said. "It would have been impossible without it."

Want more P2?
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ILLUSTRATIONS COURTESY OF **EQUATOR AIRCRAFT**

TRIAL AND ERROR

This was an experiment from the beginning. – Tomas Brødreskift

Tomas, his father, Knut, and neighbor Jon Fossen have been the main builders of the P2 prototype. Knut, an engineer who completed a Long-EZ in 1983 when Tomas was 2 years old, does the calculations. Everything is designed in a CAD 3-D environment, and the infinite possibilities have presented interesting challenges. "I've got lots of ideas, and my father and I fight, then finally come up with something that works," Tomas said. "I'm the designer that comes in with all the weird ideas and difficult shape, and he complains, then agrees. I've built an undercarriage, he tests it, breaks it, and I reinforce it based on his recommendations."

Trial and error has been the process with many parts of the plane. "It's been a hard learning process mostly through failure," he said. "It's like we've built the plane three times."

Tomas saw a link between physics and aesthetics and has designed a smooth, clean droplet shape for his plane that is both aerodynamically efficient and beautiful. All the edges are smooth, round, and laminar. The canopy shape and curvature was a big challenge with many frustrations to get it to work. The body and wings are reminiscent of a glider, and the engine is mounted on the sleek tail. This proof-of-concept vehicle will prove that the integrated systems work and can eventually be put into production. The all-composite prototype was built entirely by hand (not using molds) to keep costs as low as possible.

HYBRID ENGINE

An efficient seaplane has always been an oxymoron. Seaplane configurations with combustion engines outside the fuselage, propellers behind the cabin, and floats reduce efficiency and create drag. To make a seaplane with the efficiency and endurance of the best LSA landplanes depended upon propulsion technology that didn't yet exist. Tomas applied for more than two dozen grants to no avail. "You can imagine when a 28-year-old comes into a room and says he's going to build an electric hybrid seaplane," Tomas said, "nobody believes you."

In 2012, Equator Aircraft was awarded a $400,000 government grant from Transnova to develop a propulsion system using environmentally friendly fuels. The German company Engiro has been developing the Equator Hybrid Propulsion System (EHPS). The custom electric engine/generator hybrid is designed specifically for the P2. The hybrid solution is a bridging technology providing green flight with a 5-6 hour range capability. Power out from the prop is 100 kW (134 hp). A generator will produce 57-60 kW of power charging the lithium-ion batteries. The Wankel combustion engine is capable of burning biodiesel or jet fuel.

EASY TO FLY

Ease of flying is a key aim of the overall design. The P2 uses information technology platforms to create a simplified user interface, employing electronics to minimize pilot workload. The intuitive cockpit has a clean, non-cluttered aesthetic. The cockpit is waterproof, comfortable, and spacious (61 inches wide). The plane was designed without rudder pedals. A novel fly-by-wire feature achieves yaw control by twisting the stick around the vertical axis. Non-differential braking is also located on the stick. Tomas theorizes that it might be easier for new pilots to learn just hand coordination, rather than hand and foot coordination since fine motor skills are located in the hands. The plane will fly fast and land slow. Performance is estimated to be 130-knot cruise with a 48-knot stall speed.

FUTURE

After working full time in his parent's garage for seven years, Tomas is ready to display the P2 Xcursion prototype in April at AERO Friedrichshafen, Europe's general aviation trade show held in Germany. Flight testing will begin this summer. He has a goal to sell 10 experimental category beta kits by 2020. Experienced builders will be eligible to participate in a program to receive a kit at cost and build it in one year with support from Equator. This program will be a fast way to get flight hours on the airplane and assess the design.

Now 35 years old, Tomas is glad he made his leap of faith. "Getting started as early as possible is important. I have learned so much by taking the risk and trusting that this is something I want to do. The challenges along the way will make you confident. Believe in yourself. If you have a good idea, there are people out there who will help you." EAA

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The intuitive cockpit features an MGL iEFIS and iPad running the nav and hybrid propulsion parameters.

The Equator Hybrid Propulsion System is designed specifically for the P2.