Intermodal-container Air Cargo Concepts Attract Interest

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Can an unproven market bring success to unproven aviation concepts?

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To the lone inventor in aviation, the chance to have serious engineering horsepower applied to your idea is rare. For Pat Peebles and his FanWing concept, that opportunity has come in the form of a European Union (EU)-funded program led by German aerospace center DLR.

The project is relatively small—two years and €783,000 ($1.05 million), including EU funding—but if the optimization work and feasibility study by DLR, the Von Karman Institute for Fluid Dynamics (VKI) and the University of Saarland substantiates claims for the idea it will be a welcome boost for Peebles.

The FanWing is one of the more eyebrow-raising concepts in aviation, and involves a horizontal-axis rotor mounted in the wing leading edge that accelerates airflow over the wing to provide both distributed propulsion and augmented lift at low airspeed. The goal is to provide short-field performance close to that of a helicopter or tiltrotor with operating costs approaching those of a conventional aircraft.

Peebles has been developing his idea the way most lone inventors do, by flying small radio-controlled models of increasing scale and complexity. The next step, if funding can be found, was to be a two-seat ultralight demonstrator. Then along came DLR and the EU-funded SOAR (distributed open-rotor aircraft) project to optimize the rotor and wing and explore the feasibility of a FanWing cargo aircraft (see concept).

The SOAR project is aimed at a perceived gap in the global logistics infrastructure—an aircraft able to carry the ISO-standard intermodal shipping containers now moved by ship, rail and road, but not by air because of their size and weight. Today containerized loads are broken up for air transport either as bulk cargo or in lightweight airfreight containers that are not compatible with the other modes.

Proponents of the "container-plane" concept argue that the ability to transport the 20-ft.-long ISO containers by air would be valuable in underdeveloped countries lacking road and rail infrastructure, while enabling "door-to-door" deliveries in developed nations and providing flexibility for military cargo operations. The attraction of the FanWing is its potential for cost-effective ultra-short-takeoff-and-landing operations.

SOAR has begun with wind-tunnel tests at VKI in Belgium to optimize the cross-flow fan and wing shape. The 1.5-meter (5-ft.)-span wing section, with 50-cm-dia. rotor, will allow researchers to test different blade airfoils and angles of attack, rotor angles and speeds, entrance and exit heights, and

trailing-edge angles, says Peebles. Tests will include flow visualization, particularly of the trapped vortex that creates a low-pressure region within the rotor and contributes a large part of the lift.

DLR's feasibility study will define takeoff and landing distances, speeds, fuel consumption and through-life costs for a 10-ton-payload cargo FanWing. Peebles and SOAR project consultant George Seyfang estimate the aircraft will have a takeoff run of 300 ft. and cruise at 150 kt. at 18,000 ft.

FanWing is not alone in aiming at the container-carrying mission, if such a market exists. Another U.K. company, 4X4 Aviation, is developing an unusual unmanned-aircraft concept, the Versatile Vehicle (VV), with backing from a Singapore-based investor in the logistics industry, says founder Torsten Rheinhardt. The design uses gimbaled electric turbines, or ducted fans, for vertical takeoff and landing (VTOL).

Power comes from a combined-cycle engine in which energy from combustion of fuel and recovery of waste heat as steam are combined to drive a generator via sinus discs that convert linear piston motion to rotary shaft drive. If that was not unusual enough, the VV also uses lightweight pressure vessels to store energy as compressed gas to rapidly provide the additional electrical power needed for VTOL.

Rheinhardt has built subscale models to test control software and is working to raise the major funding required for a three-year project to build a prototype of a 10-ton-payload vehicle. While the ability of lone inventors to get their concepts off the ground is highly questionable in today's investment environment, Rheinhardt has his eye on markets other than aerospace for the power-generation and energy storage elements of his design.