

AVIATIONWEEK

& SPACE TECHNOLOGY

VTOL Startup Takes Scheduled-Airline Approach to Short-Haul Market

> TURBINE TILTWING VTOL OFFERS DOOR-TO-DOOR SPEED

> DESIGNED FROM OUTSET AROUND SCHEDULED SERVICES

Graham Warwick Washington

A startup team with experience in vertical-takeoff-and-landing (VTOL) design and air-taxi operations believes it can develop both an aircraft and an airline that will enable scheduled intercity service over short but busy routes such as New York-Boston and Los Angeles-San Francisco.

Together, they are trying to turn aviation's "build it and they will come" paradigm on its head by defining the business case for a short-haul scheduled airline then developing a unique aircraft, the tiltwing Vy 400, able to deliver intercity service affordably and profitably from the outset.



TRANSCEND AIR

Two one-fifth-scale models are being flown to evaluate transition aerodynamics and begin flight-control development.

Boston-based Transcend Air is led by CEO Gregory Bruell, who was co-founder of VTOL developer Elytron Aircraft, and Chief Operating Officer (COO) Peter Schmidt, former president and COO of air-taxi operator Linear Air. The team includes people from flying-car developer Terrafugia as well as from NASA.

In an era where startups with wild ideas pop up almost daily, Transcend's proposal seems both ambitious and conservative at the same time. The aircraft is an unconventional configuration that will require costly development and certification, but it is aimed at a narrow mission that reduces some of the design complexities normally associated with VTOL aircraft.

Schmidt says he joined Linear Air as COO "in a turnaround situation—it was the only Eclipse [very light jet or VLJ] operator left standing after the

2008 economic crisis." Now providing low-cost charter services using a range of aircraft, Linear is the inspiration for Transcend's planned operating model.

At Elytron, meanwhile, Bruell worked with designer Oliver Garrow on a unique VTOL configuration that combined a box wing and a tilt-wing. The team built almost a dozen subscale prototypes, but the full-scale manned Elytron 2S prototype crashed on its first flight in March 2016.

The result, says Bruell, was a pivot away from targeting traditional VTOL markets such as oil and gas to focusing on air taxi and working backward to the type of aircraft required. The "big insight," he says, came when they compared air taxi operations with other possible types of commercial service.

"With charter, you always pay for two legs but fly on only one," he says. "You have to reposition the aircraft one way or the other, so there is an inbuilt overhead cost." Extensive analysis of flight schedules led them to conclude there is a market for "scheduled service with an aircraft scaled down to the bottom end of VTOL—half the size of the Leonardo AW609 tiltrotor—and tailored to scheduled service for an airline customer.

"This is not an air taxi, not on-demand. We want to run a scheduled service with price points impossible under any other scenario," says Bruell. "Pete [Schmidt] has firsthand economic experience that has allowed us to define a complete business model down to crewing requirements."

Bruell is skeptical about the on-demand model behind urban air mobility and the thousands of flights a day required to make it economically viable. "The numbers are unachievable," he says. "We have built up our business model from the bottom, using commercial fuel prices, certification costs and no pixie dust. We both rode the VLJ hype cycle and it informed our process."

Transcend then set out to design an aircraft "starting with an airline economic model essentially unique at this scale of aircraft," says Schmidt. Intended to be certified under the Part 23 commuter category, the Vy 400 is a single-turboshaft aircraft with a maxi-

mum takeoff weight of 6,990 lb., useful load of 2,200 lb. and range of 450 mi. at 405 mph.

The tilting will be faster than competing helicopters, but the challenge facing Transcend is “there is no price on saving time, so it is essentially valueless,” says Schmidt. This is because business travel costs are corporate expenses, and the key performance indicator (KPI) for companies is to minimize expenses. “There is no KPI for saving time,” he says.

So a key to success for Transcend is being able to show corporate chief financial officers (CFO) that the door-to-door cost is less than the combined cost of ground and air transport via existing airports and airlines. “We can get to that point with our aircraft and operating model,” says Schmidt. “We can show a CFO that we can save 5-10% in hard-dollar travel costs between cities on an annual basis.”

Speed is part of the equation. At a projected \$3.5 million, the Vy 400 is comparable in price to the Bell 407GXP light helicopter. Hourly costs are 50% higher, but the tilting is three times faster, “so our per-mile operating costs are less than half,” he says. At \$10 million, a larger, higher-performance Airbus AS365N3+ helicopter is too expensive, and too slow, to make the model work, he adds.

Another design driver related to the airline business model is cabin size. A high-performance turboprop single such as the TBM 930 is too small, Schmidt says, explaining that the Vy 400 has 23-in.-wide seats and enough leg room for 6-ft.-tall passengers to comfortably occupy facing seats.

Another design example is the landing gear, which has pads instead of wheels. “This is not a general-purpose aircraft. It’s a very focused requirement,” he says. “We did not start with a GA [general aviation] mindset. The aircraft is optimized for one mission, although it can be reapplied to others.

“The aircraft in one sense is stripped down, and in one sense it is luxury. But it is not designed for cross-country travel,” says Schmidt. “We can put five 200-lb. passengers and their overnight bags in the aircraft and fly New York-Boston at 353 kt. You can’t do that on any of Linear Air’s GA aircraft.”

The Vy 400 preliminary design has been produced for Transcend by aircraft design services company DAR



Corp. The goal is to certify the aircraft under the latest Part 23 regulations, which have been rewritten to enable industry standards to be used for compliance, with elements of Part 27 rules for helicopters.

“We want to have as many parts as possible that are off-the-shelf and high technology-readiness level,” says Schmidt. The planned engine is a 1,700-shp PT6A-67F, already certified in the Air Tractor AT-802. The turboshaft is mounted in the rear fuselage, driving wingtip propellers via gearboxes and shafts. The engine also powers a 40-hp electric motor driving a tail fan for stability and control.

Transcend is flying two one-fifth-scale prototypes to evaluate aerodynamics, particularly during transition between vertical and forward flight. The next step is to build a half-scale prototype powered by a smaller PT6 to demonstrate the drive train. Where the one-fifth-scale models are electric-powered, the larger prototype will use propeller collective for flight control, as planned for the Vy 400.

The company is using the subscale models to begin development of the fly-by-wire flight-control system, which will have electric actuators and incorporate envelope protection to enforce a safe transition corridor.

Transcend is an early-stage startup, raising funding as it goes along. “We are sufficiently funded to continue one-fifth-scale flying to develop the control laws,” says Schmidt. The company is raising additional funding to begin work on the half-scale prototype and is putting together a Series A investment round to build a full-scale manned prototype, which would fly 18-

The aircraft is designed for short-haul, high-speed intercity services between downtown vertiports based on river barges.

24 months after financing is in place. “If we close the Series A round early in 2019, we could be certified by the end of 2023,” he says.

After flying this proof-of-concept aircraft to demonstrate performance and economics, Transcend is planning to begin selling delivery positions and to complete a joint venture to certify the Vy 400. Certification is projected to cost \$350-500 million. The company is not planning on being the manufacturer. Instead, Transcend wants to find a partner to certify and produce the aircraft while it transitions to being a customer and operator.

In Transcend’s model, aircraft would shuttle between city centers, operating from specially equipped “float-by-wire” barges positioned in rivers downtown and flying steep approaches and departures to minimize noise and airspace issues. The company has identified 46 cities where routes make sense, says Schmidt, among them San Francisco-San Diego, Montreal-Toronto and Boston-Washington.

A key requirement for the scheduled services to be profitable, Schmidt says, is to identify routes with symmetrical movement in both directions, rather than the one-way commuting demand behind urban air mobility. This is needed to ensure aircraft have profitable load factors in both directions, and is just one aspect of Transcend’s VTOL concept that sets it apart from the startup horde in this nascent market. ☛