**A Regional Renaissance; how Electrical-Propulsion Technology is Changing Business Models?**

di **John Halpin**

**REPORT**

We receive, and gladly publish, John Halpin's point of view on the new short to medium term prospects of the air transport following the COVID effects.

John is one of the main analysts in the air transport sector and a careful observer of the Italian aviation industry and Campania region, in particular.

Speaking at Leonardo’s Vergiate helicopter factory 30 January 2018 Chief executive Alessandro Profumo presented the industrial plan to “*restore growth across Leonardo” between* 2018-2022*.* This was after a 2017 marked by a difficult environment for its helicopter division. He said that Leonardo has abandoned a new ATR program extending the product size to 100 seats in favor of investing in the existing ATR 42 and 72 models. The existing ATR product, he stresses, "is so successful, we have to cash in all we can" acquiring resources to reinvest - strengthening our other products.

The ATR program office had released 2018-2037 marketing projections for potential deliveries of 3,200 aircraft during the 2018-2037 period composed of a need to replace 1,200 for aging a/c and a potential fleet growth of 1,800 vehicles. Fleet growth was projected to account for 60% of turboprop deliveries in the next 20 years.

On 24 April 2020, Airbus and Rolls-Royce announced that they had were canceling the flight demonstration but would continue ground test of E-Fan X systems.

Both Leonardo and Airbus now find themselves in territory occupied by startups. When Airbus launched the E-Fan X project in 2017, it entered territory occupied new entrants such as Ampaire and Zunum Aero were taking a bottom-up approach by introducing hybrid-electric propulsion first to smaller aircraft, with 11 passengers or fewer. Airbus’ E-fan and Leonardo’s NGTP were aiming at the top of the regional market aircraft with up to 100 seats. With the demise of the E-Fan X and Leonardo’s NGTP ATR, electric propulsion leadership reverts to the startups.

At this point it is useful to review how airlines are studding the emerging electrical-propulsions technology options and their potential impact on their regional business models.

Andreas Aks, deputy chief operating officer at Wideroe, a regional airline based in Bodoe, Norway was tasked with finding an answer to a pressing question: *What aircraft will be best for the airline in the future for its widespread network of short and thin routes? so?* Wideroe has a large fleet of Bombardier Dash 8-100s, -200s and -300s that it sometimes operates on extremely short sectors in a public service obligation network connecting remote towns and islands with the rest of the country, a *typical business base in the early years of regional aviation.* Wideroe’s oldest Dash 8-100 will hit the limit of 120,000 cycles in the next three years. There is huge pressure in Norway to be environmentally more sustainable. “We are at a tipping point.

In the 1990’s and early 2000’s regional airlines had expected to move to larger, more powerful vehicles with advanced gas turbines, it now appears the next generation will be smaller aircraft powered by a new wave of hybrid-electric propulsion systems. Andreas Aks observed, “Scale does not matter that much with electric aircraft. We are flying many empty seats on some of our routes anyway.”

An aircraft with dramatically lower operating costs that can compete with other modes of short-range transport—such as cars, buses and for island systems ferry boats is required. The new startups have settled on electric propulsion and its ability to lower energy costs, as the key to **recreating a regional market** that large turboprops and regional jets have priced out of existence. Most are looking at hybrid-electric for the ranges required, as well as an evolution to all-electric options. They are looking at aircraft in the 9-12-seat class for now - Cessna Caravan and Pilatus PC-12 territory - because of the opportunity to reopen networks of short and thin routes is compatible with current limits on battery technology.

Embraer, with origins in regional turboprops, has been studying reentry into the lower end of the sector for some time but Embraer Commercial Aviation President/CEO John Slattery says they are not close to a launch decision (partially driven by the collapse of the merger with Boeing).

ATR, as the market leader for turboprops has two aircraft, the ATR 42 and 72, that have been selling for decades with incremental improvements. The ATRs are a nimble short-haul plane, optimized for regional and local flights. It has no interest in hurting sales prospects prematurely. ATR instead is focusing on improving its current aircraft including a reduction of direct maintenance costs for the engine and the propeller as well as the landing gear and other components.

“A new aircraft is a question of investment. It still has to be alive in 30 years,” says Stephane Viala, ATR senior vice president for engineering. “[The company] has a clear product strategy for the coming years,” he says. “The idea is to carry on [modernizing the existing aircraft] while preparing for the future. We are starting to look at what technology could trigger the launch of a new aircraft. We are looking at all the options.” Viala is convinced that going for fully electric propulsion for an aircraft the size of the ATR 42 is “not viable.” Key challenges for electric and hybrid-electric propulsion remain unsolved, Viala points out. He says that even a 19-seater would still be a hybrid aircraft if it entered service in the 2030s, and the electric share of power would be “very low.”

Airbus’ lack of interest in the regional sector surely played a role terminating the NGTP. Viala suggests that the risk of investing in soon-to-be obsolete hybrid-electric technology was key discounting the with incremental technology evolution.

Where is the market for short-range aircraft, when the trend in regional aviation has been to grow bigger and fly farther? Ampaire and VoltAero sees electric aviation opening up additional secondary routes and then expanding as technology and evolving business cases permits.

A U.S. startup Ampaire is using a Skymaster as the testbed for its hybrid-electric system, but its business plan is to work with small operators to convert their existing aircraft to electric propulsion. Target platforms include the Caravan and Beechcraft King Air. Later this year, Ampaire plans to fly its experimental aircraft on routes flown by Hawaiian regional Mokulele Airlines.

Several electric-propulsion startups are also targeting the opportunity to reengine aircraft, such as the Caravan and King Air, powered by the popular Pratt & Whitney Canada PT6 turboprop. Electric-motor developer MagniX wants to reengine a Caravan with its 560-kW (750-shp) Magni500 motor, although its first application is to repower the de Havilland Canada DHC-2 Beaver for North American seaplane operator Harbour Air.

Harbour Air, North America’s largest seaplane airline, has partnered with motor developer MagniX to convert its fleet to electric propulsion. The companies plan to replace the radial piston engine in one of the airline’s de Havilland Canada DHC-2 Beavers with the startup’s 750-hp electric motor. The “remotored” aircraft is expected to accomplish a supplemental type certification (STC) of the conversion. Harbour Air plans commercial service converting its entire fleet of almost 35 seaplanes, including the larger DHC-3 Otter and DHC-6 Twin Otter. The Vancouver-based airline operates 12 routes to islands and other locations in the

Pacific Northwest.

VoltAero’s Botti cites France, where north-south traffic is well served with airline routes and high-speed rail, but traveling east-west is harder, potentially creating a market for small-aircraft transportation. Another example is Norway, an environmentally conscious country that has committed to electrify all domestic aviation by 2040. Ampaire has a letter of intent in place with Norwegian regional operator Wideroe, also collaborating with Norway’s Avinor as the airport operator commits to incorporate electrical charging infrastructure into airports before 2040.

In Scotland, where the geography of the islands and short distances are an ideal testing ground for electric aviation, Loganair is working with Cranfield Aerospace Solutions on an island-hopping electric aircraft for the Orkney Islands, with a long-term aim of transforming the airline’s fleet of Britten-Norman Islanders to electric propulsion and a demonstrator set to fly by 2021.

Wright Electric entered into a partnership with Dubai’s Jetex in 2018 that will see the two companies collaborate on producing the first electric aircraft for the Middle East and North Africa (MENA) region. Jetex a fixed-base operator (FBO) wants to install ground charging infrastructure for electric plane technologies at up to 30 airports throughout their network in Europe, the States.

Susan Ying, Ampaire senior vice president for global partnerships, sees the Scottish islands—with their short travel distances and enlightened energy policies encouraging innovation—as a region with a high potential for electric aviation to make its mark. “These will be ideal places for us to start,” she says. “Over there, continental US and EU, they’re still operating with a hub-and-spoke model, but what about flights between the islands or between secondary cities on the mainland and secondary cities and the islands? This opens up a lot of opportunities and will really enable the smaller operators.”

Ying also believes electric aircraft may have an important role to play in connecting smaller airports and cities, as well as in making airline networks denser as lower fuel costs make more routes economically feasible for airlines. She cites FAA figures and a 2017 airport report on European aviation that show 2,250 airports in the European Union and 5,314 in the U.S. are open to the public, but just 438 in the EU and 434 in the U.S. operate regular scheduled flights—leaving the potential for as many as four and 11 times more services, respectively, if the economics make sense, which electric aviation could help with. “If you can open up secondary city pairs, you can open up new routes. It opens up the possibility of a dense net kind of operation,”. A comparison and discussion of the Mokulele Hawaii and a potential business model is available in the jchalpin blogspot cited below. Some aging ATR’s and Q400s are expected to be replaced with hybrid-electric vehicles.

Aks of Wideroe has no issue with short ranges—many of his airline’s routes are even shorter. And it has larger aircraft, even jets, for the trunk sectors. He points out that at up to 19 seats, even current Part 23 regulations allow electrification. One important coincidental element is that single-pilot operations are also allowed for aircraft up to 19 seats, although not for commercial services. Aks believes changing the regulation to include commercial flights will ultimately be possible.

Scotland’s Loganair is another carrier seeking electric aircraft for short routes. The airline wants to electrify the Britten-Norman Islander, with which it makes the world’s shortest commercial flight—1.7 mi.—between Westray and Papa Westray in the Orkneys. Ampaire is planning to work with the Orkney Islands Council, which has a sustainable energy strategy in place and is in charge of airport infrastructure. It is also working on a proposal to the Scottish government for a flight-test program similar to the one it is running in Hawaii with Mokulele Airlines. The State of Hawaii is focusing on the impact of ground infrastructure and charging stations availability at Hawaiian airports. Hawaii has no natural fuel resources – energy conservation and economic development of the diverse islands is the motivation for their investments. Several other operators with similar route profiles have also signed letters of interest with Ampaire; Seattle’s Kenmore Air, Guernsey’s Aurigny and Puerto Rico’s Vieques Air Link.

Scandinavian Airlines and Airbus have also signed a memorandum of understanding for research into hybrid and electric aircraft ecosystem and infrastructure requirements. They are working together to better understand the operational and infrastructure challenges involved charging availability and charging time at airports required for introducing hybrid-and full-electric aircraft to airlines’ operations.

UK-based budget carrier EasyJet is investing in electric, with a partnership in place with U.S.-based startup Wright Electric, whose long-term aim is a 150-seat electric aircraft. Work is currently underway on a nine-seat technology demonstrator, and the company plans to fly a 50-seat intermediate aircraft around 2022-23 as a steppingstone toward its goal. EasyJet’s director of operations transformation, Gary Smith, believes electric aviation will soon move out of the realms of fantasy. “In the last couple of years, opinions have been changing quite quickly to seeing electric aviation as a reality and something that is technically feasible. With Wright, there’s a road map to get to an aircraft that’s at the smaller end of what we operate today. It’s about playing with range and payload, trying to find the sweet spot between the two, which we think would be 150-160 passengers initially, with a range probably able to cover London-Paris or London-Amsterdam. That would still be a significant part of our operations.”

While an electric aircraft will have completely different economics—lower fuel costs but perhaps more expensive manufacturing of propulsion units— Gary Smith expects the costs to work out as competitive. “As we go through the years, airlines will have to make decisions about replacing aircraft in their fleet,” he says. “At a certain point, electric aircraft will become available, and at that point in time, those electric aircraft will be measured in terms of their overall economics and viability against the other aircraft available at that time.”

The arrival of electric aircraft, whenever that may be, could also change the shape of the air transport industry. Smith says, “I think we have to be open to the fact that the market could change, and we may have to adapt to that. We may be back to flying shorter routes, with smaller aircraft," he says. “We are willing to disrupt our own markets.”

New entrants and local governments face their own COVID-19-induced funding challenges. That may slow them down but is unlikely to derail them as they are not targeting a traditional regional and long-haul aviation markets, that will be struggling to recover through 2035. By using electric propulsion to dramatically reduce the operating cost of aircraft, they are instead aiming to compete with automobiles to provide regional mobility. This is a changed business case for the giant OEM’s that have focuses on larger vehicles in a search to reduce overhead cost per available seat mile, CASM.

A shift toward shorter routes to and among secondary destinations will have a structural impact on the industry with a wave of new entrants followed by a later consolidation phase in which established carriers will alter their business models by acquiring those new operators focusing electric aviation.

Returning to the Lernardo2 Industrial plan, the potential deliveries of 3,200 aircraft during the 2018-2037 period composed of a need to replace 1,200 aging a/c and a potential fleet growth of 1,800 vehicles for the legacy ATR appears unrealistic. There will be about 1/3 reduction in expected deliveries by 2035 with a significant replacement delivers for regional vehicles flying shorter routes with smaller, not larger aircraft. Leonardo’s Industrial strategy is not a Low-risk strategy for the next 20 years!

Zunum’s struggle to raise money may be a warning sign for the many other startups in the embryonic stages of developing electric and hybrid aircraft. Getting a few million in seed capital is one thing, but aerospace is an extremely capital-intensive business with long development times. Others also likely won’t find it easy to secure investors with the patience to wait for four or five years until the company gets its aircraft through certification and starts earning any revenue.

Due to COVID, there is a risk that governments will reduce or hesitate supporting electric Innovation projects and the infrastructure investments, cited above. Instead, they should see it as an opportunity to reshape/refresh their industrial base to catch up with the technology leaders - preparing them to compete when the time comes. Now is the time for investments so as to be prepared for a return to market growth led by these structural changes. Industrial policies need to address how OEM’s, Tier 2 and 3 campiness are addressing the question “Are we willing to disrupt our own legacy markets.” If the answer is NO what will be the consequences?

ACKNOLAGEMENTS; This discussion has used data and verbiage from the following articles:

https://jchalpin.blogspot.com/p/version-7.html, see UAM & ATR Strategic Risks presentations

https://aviationweek.com/aerospace/aircraft-propulsion/end-airbusrolls-e-fan-x-not-end-hybridelectric-propulsion

<https://aviationweek.com/air-transport/hybrids-considered-regional-market-incumbents-look-options>

<https://aviationweek.com/air-transport/aircraft-propulsion/airlines-study-how-all-electric-aircraft-will-impact-business>

<https://aviationweek.com/aerospace/are-seaplanes-electric-harbour-air-thinks-so>