

Cost and timetable for approval:

The history of the AW 609 tilt wing aircraft formally called the BA 609 provides little room for optimism regarding the time it might take for an eVTOL to be FAA certified as an air taxi. The BA 609 was the 1st and until recently the only aircraft, prior to the emerging eVTOL (battery powered) air taxi, to seek FAA certification under its “powered lift” category. In 1998 the BA 609 development began and in the following seven years Bell and Augusta spent \$3 billion dollars developing it as a commercial air taxi version of the proven military XV15 that was funded as a smaller version of the Osprey V22. The AW 609 designation occurred when Westland replaced Bell. By 2013, AW 609 had undergone numerous piloted flights. **Despite this success the FAA stated that they expected AW 609 to require another 10 years to achieve certification** ^[1]. Its FAA certification is still ongoing despite an additional \$5 billion investment. AW 609 is now called Leonardo 609 with Augusta leading its FAA certification program.

It should be of concern to investors and potential airline buyers of eVTOL air taxis that the FAA will need to approve an aircraft design that significantly advances state-of-the-art compared to the novel Leonardo 609. For example, the use of batteries as a power source introduces unknowns that will make the FAA particularly cautious since battery life is so dependent on its operating history, including number of charges, depth of discharges and environment during use. Quantifying the effects of these variables impacts the certification timetable which is lengthy without technical unknowns. According to the input from AI (Artificial Intelligence) Chatbot, commercial aircraft carrying more than 19 passengers (FAA part 23) have taken 7 to 10 years to obtain FAA certification, general aviation aircraft utilizing well established guidelines (part 25) have taken 3 to 7 years, while the novel Leonardo 609 (part 21.17b) is still not certified after investing more than \$8 billion over 25 years. The steps to produce a marketable air taxi include design, development, and FAA certification of both the aircraft and its manufacturing and testing facilities.

This could easily exceed \$5 billion for each novel air taxi based on experience with the less novel Leonardo 609, the first air taxi to seek FAA certification under the powered lift category. Joby Aviation, Archer Aviation and Vertical Aerospace completed their first piloted flight in 2025 effectively starting the FAA certification process. Based on the time taken to FAA certify slightly novel designs ^[2], it could take well into the next decade for the very novel 4 to 6 passenger eVTOL air taxis to be approved under part 21.17b (powered lift). One and two passenger air taxis could require far less time to achieve FAA certification under the recently approved Mosaic rules ^[3].

Economic viability in a ride-sharing role:

Archer Aviation has received significant conditional orders for their four passenger “Midnight” air taxi priced at \$5 million. Historically, final aircraft prices have been at least 50% higher than the manufacturers estimated offering price following the first piloted demonstration. The Leonardo 609 had an estimated price in 2004 of \$8 to \$10 million while its current price is \$30 million. With the emerging eVTOL air taxi’s

limited range of 50 to 60 miles between battery charges, trip cost could be higher than the \$8 per passenger mile for ride-sharing flights in a \$7.5 million similar priced helicopter (S76). Trips in a \$2 million helicopter (Bell 206) cost \$3 to \$4 per mile and despite this more modest price, airborne ridesharing has been used mostly by the wealthy.

Convenience of use:

Except for dedicated routes, the use of air taxis could be very inconvenient. For example, if one wishes to fly between San Francisco and San Jose (34 miles), he or she would need to take an Uber trip from his or her home to a Skyport, which due to noise concerns, is likely to be located on top of a high rise. Each air taxi needs an area of nearly 8000 square feet to operate safely or an area the size of a city block to accommodate twenty 4 to 6 passenger air taxis. Following a 20-minute flight, a second Uber trip would be required to reach the rider's destination. Most eVTOL air taxis in development would require the battery to be recharged before making a return flight to San Francisco. A ground-based ridesharing trip would be less expensive and may be more convenient even if it takes longer. The majority of people utilizing ridesharing by air taxi will be travelling on dedicated routes like hotel to airport or the few commuters who are fortunate enough to be working in the same area at the same time. Many advocates argue that the cost of ridesharing in air taxis will substantially reduce as the market matures. This is only true if the market is large enough to benefit from economy of scale. The ridesharing market for battery powered 4 to 6 passenger eVTOL air taxis is inherently limited. Their large size, short range, high trip cost and complicated logistics prevents this size air taxi from providing a meaningful alternative to the present travel status quo.

Possible design alternatives to mitigate present limitations:

- **Range:** Convert to a hybrid version where an engine is used to provide energy during cruise while during VTOL, power comes primarily from battery driven motors. **Power [watt per kilogram] can be very high from a battery, however, the energy [watt-hour per kilogram] from a battery is 3% of the energy per kilogram compared to gasoline or diesel fuels.** This conversion could extend the air taxi range from 60 miles to 500 miles. Achieving even a 100-mile range with batteries alone is unlikely to occur within the next ten years since the energy of lithium polymer (LiPo) batteries increased by only 2% per year over the last 10 years. The use of LiPo batteries is required due to the high discharge rate required during VTOL.
- **Size:** Having the wings fold could potentially reduce the 4 to 6 passenger air taxi size by 66%. However, that requires the powerplants to be mounted on a separate structure from the wings. Embraer and Boeing have designs that could do this by their separation of the lifting powerplants for VTOL from the cruise powerplant. None of the leading start-up air taxi developers (Joby, Archer and Vertical Aerospace), have designs with this inherent ability. **Another option is to pursue a more individual approach to the usage of air taxis.** This would entail one and two passenger air taxis using folding wings to become small enough to operate from an automobile parking space.

The major challenge in this case is reducing their noise signature enough to operate at street level rather than from the top of a high rise.

- **Cost:** If Morgan Stanley is correct in their prediction that the air taxi and drone market will be valued at \$1 trillion by 2040 and \$9 trillion by 2050 ^[4], they have in effect predicted that autonomous air taxis can replace automobiles as our primary travel vehicle while drones will dominate parcel or freight delivery to our homes. The acquisition cost for one and two passenger air taxis could then be closer to that of an automobile due to economy of scale. Uber predicts that future travel by autonomous ground taxis could cost less than \$0.45 per passenger mile or near the cost of automobile ownership ^[5]. Uber further predicts that autonomous air taxi cost per mile could be less.
- **Logistics:** Future one and two passenger autonomous air taxis operating within an integrated three-dimensional personnel and package delivery network should simplify the logistics.

References:

[1] https://en.wikipedia.org/wiki/Leonardo_AW609

[2] Years between first flight and FAA certification for slightly novel 6 passenger very light jets [VLJ]: HondaJet HA-420...12 years, Cirrus Vision SF50...8 years, Eclipse 500...9 years.

[3] <https://www.google.com/search?q=Mosaic+Rule+ChatGPT>

[4] Morgan Shifts its Timeline. at:

<https://www.google.com/search?q=Morgan+Shifts+its+Timeline&oq=Morgan+Shifts+its+Timeline&aqs=chrome..69i57j33i160.16045j0j15&sourceid=chrome&ie=UTF-8>

[5] https://techcrunch.com/2018/05/08/heres-how-much-ubers-flying-taxi-service-will-cost/?utm_source=chatgpt.com