Abstract

Urban Air Mobility (UAM) vehicles are intended as a means of rapid transport for people and goods in urban environments where travel times may be long due to high traffic. The All-weather Taxi Pilots E**x**perimental **W**eather aircraft "Blizzard" (ATP-XW Blizzard) is designed for use in Chicago, a market challenging for UAM design, given the cities' low temperatures in winter, high wind speeds, and poor visibility during snow and rain. The ATP-XW Blizzard is therefore designed primarily to operate in the Chicago market, or other similar cold-weather cities. It is designed to carry a pilot and four passengers, and to service Chicago's urban and suburban areas. The aircraft is designed for short flights, and will ferry passengers to and from heliports and rooftops of tall buildings, but is capable of a maximum flight range of at least 80 km.

The aircraft has an expected gross mass of 2200 kg, and uses a coaxial eight-rotor multirotor design, which control the aircraft through varying motor RPM. The eight motors allow the aircraft to remain airborne in the event of a rotor failure, or **O**ne **E**ngine **I**noperable condition (OEI). The aircraft uses a hydrogen fuel cell system to provide power to onboard systems, including propulsion, heating, and avionics. A hydrogen fuel cell power supply provides several advantages over Li-ion in cold weather, due to hydrogen's greater range of temperature tolerance, as Li-ion batteries suffer significant drops in output voltage in cold weather (< 2°C), and extended exposure to low temperatures causes the battery to degrade. Hydrogen also provides a higher specific power and energy density than those of the lithium batteries. The aircraft will be available for $2.9 million dollars MSRP, and will cost $766 dollars per flight hour to operate, for a cost per available seat mile (CASM) of $3.99, making it cost competitive with other UAM concepts and current taxi and ride-share prices.

Many UAM systems are limited in maneuverability, and can only operate under clear and calm weather conditions. The ATP-XW Blizzard will operate under conditions in which competing aircraft cannot, and thereby gain a competitive advantage. To that end, the detailed design for the ATP-XW Blizzard focuses on gust detection and response while navigating wind fields in the open sky, and in the unpredictable micro-climates created by city structures and buildings in the greater Chicago area. The primary focus is making the ATP-XW Blizzard able to quickly stabilize after encountering gusts. This is done with a feed forward control system which determines the magnitude and direction of gusts encountering the aircraft, allowing it to more effectively and efficiently react. This control system is called the **G**ust **R**ejective **S**ystem, or GRS.