City buildings could blow air taxi future off course

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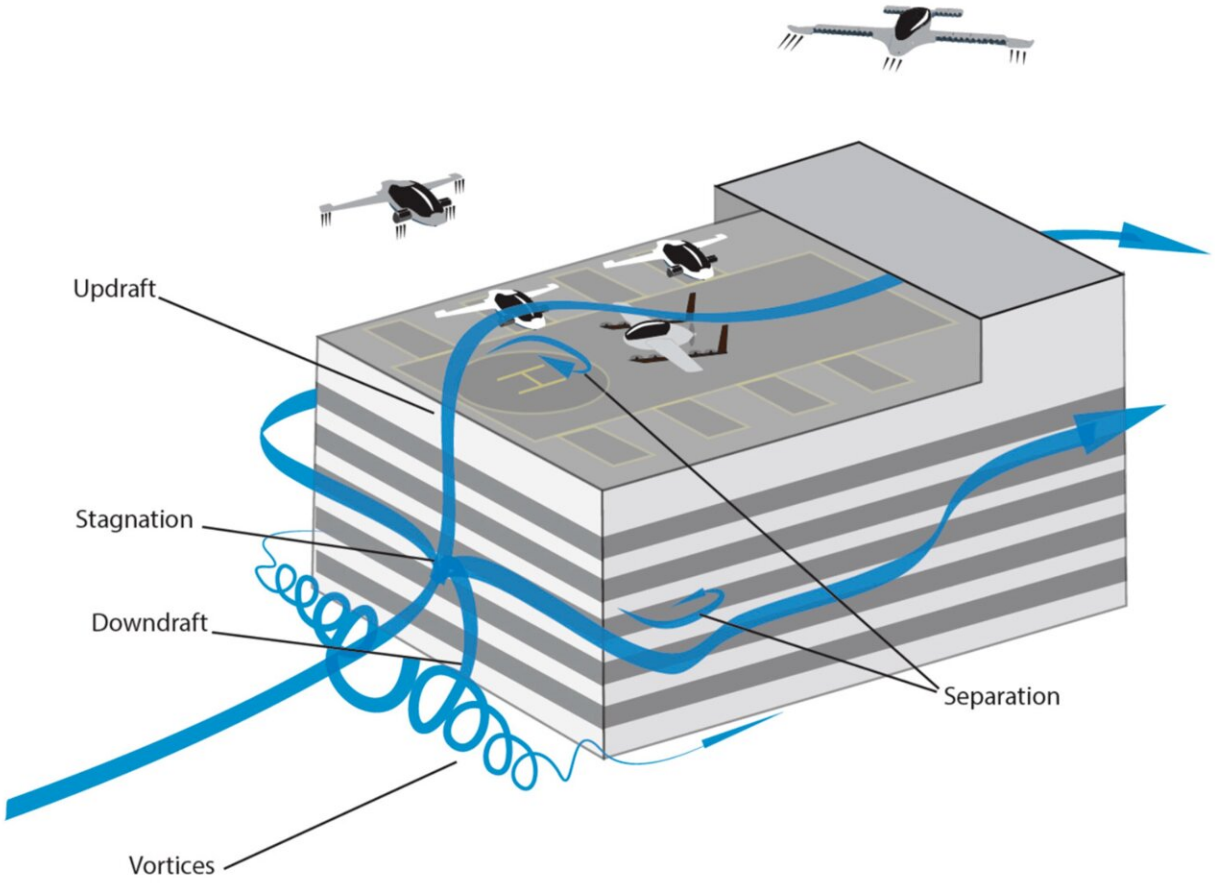

Notional flow field about a building generated by atmospheric winds. Credit: *Drones* (2022). DOI: 10.3390/drones7010022

The air taxi market is almost ready for take off, with companies such as

Boeing, Hyundai, Airbus and Toyota building fleets to have commuters flitting through the sky. Europe and the U.S. have both drafted new rules to pave the way for air taxis to begin operations within the decade, with Australia's Civil Aviation Safety Authority (CASA) to follow suit.

Increasingly sophisticated studies over recent years, including a recent paper by RMIT University's Uncrewed Aircraft Systems (UAS) Research Team, have measured how sudden wind gusts form around city buildings and destabilize aircraft.

Lead researcher and aerospace engineer, Dr. Abdulghani Mohamed, who's studied wind gust dynamics for over a decade, says this aspect needs to be adequately addressed by regulation in Australia and overseas before we fill our city skies with air taxis and other drones.

Strong wind gusts form around city buildings

Low-flying aircraft are at risk from wind gusts because they land and take off at low speed, explained Mohamed, with the RMIT research revealing sudden wind gusts can pose significant safety challenges for air taxis and drones in under a second.

As a result, air taxis and drones will need more power for landing or taking off in cities compared with an airport or an open space, he explained.

"These aircraft need powerful motors that can rapidly change the thrust generated by the propellers to rapidly force the vehicle back on-course, a process which requires more energy," said Mohamed, from the School of Engineering.

Making our city skies safe

Regulations for Advanced Air Mobility (AAM) aircraft, such as future air taxis, are being compiled around the world, including the US and Europe. The RMIT team emphasizes that weather frameworks are needed to ensure this new technology is safe and reliable.

"Regulations and certification need to specifically address safe operation when traversing building flow fields," Mohamed said.

He argues that site-specific wind simulations and measurements are essential to identify hazardous regions.

"As we determine the location of vertiports—where these vehicles will take off and land—we also need to determine hazardous regions to avoid. This will enhance safety and reduce interruption of a fleet due to wind conditions," Mohamed said.

"In Australia, it is not clear yet whether this falls under CASA's jurisdiction or the Bureau of Meteorology, however, air taxis will need to be provided with weather information at much higher resolution and faster rates than currently possible. This is important for flight planning.

"The margin of error will be much lower than at airports, where large aircraft can tolerate much stronger gusts. We won't have that flexibility with air taxis in cities."

Next steps

"Purpose-built vertiports mean we could integrate geometric design features to reduce hazardous flow conditions from occurring, and we are exploring this in our current research," Mohamed said.

"Existing buildings can also be repurposed as vertiports but may require modifications to improve the aerodynamics near the landing pads. The

effectiveness of such design features can be assessed through either scaled experiments in wind tunnels or through full-scale measurements.

"Extensive wind flow mapping at full-scale will no longer be daunting in the future. We are continuing to develop our wind sensing drones—a swarm of drones instrumented with wind anemometers—to very accurately map around large infrastructure."

"Gusts Encountered by Flying Vehicles in Proximity to Buildings" has been published in *Drones*. The recommendations could help shape the regulation of vertiports, flight paths and air taxi requirements in Australia and potentially globally.

The researchers are continuing research into wind gusts around buildings, with further exploration of different building shapes that may minimize adverse effects. They are also continuing to study the sensitivity of vehicles to gusts and turbulence, as well as flight-stability technologies.

More information: Abdulghani Mohamed et al, Gusts Encountered by Flying Vehicles in Proximity to Buildings, *Drones* (2022). DOI: 10.3390/drones7010022

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