Environmental Impact of Unmanned Operations at and Around Airports

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The International Civil Aviation Organization Committee on Aviation Environmental Protection (ICAO-CAEP) proposed the task of reviewing the current and future environmental impact of unmanned operations at airports globally. During the 3 year CAEP/12 cycle (2019-2022), the task group under Working Group 2- Airports and Operations conducted an extensive literature review, collected information through outreach to industry stakeholders. The task group quickly discovered that this topic was extremely dynamic, with new material on the subject emerging monthly, exacerbated by a wealth of new use cases appearing during the global COVID19 pandemic. Despite these challenges, the task group successfully delivered a State of Play report that will be published under the e-eco-airport toolkit as part of the CAEP/13 cycle.

For years, the primary use of Unmanned Aircraft (UA) was restricted to military purposes. However, over the past five years, the number of UA and their uses has grown exponentially and is expected to continue at that pace – not only for small UA (also referred to as drones), but also for unmanned aircraft that are being developed to transport passengers or cargo at lower altitudes within urban and suburban areas (referred to as Urban Air Mobility (UAM) or Advanced Air Mobility (AAM)).

AAM builds upon the UAM concept by incorporating cases not specific to operations in urban environments, such as commercial inter-city, cargo delivery, public services, and private/recreational vehicles. While many of the planned projects for UAM or AAM will start with a pilot onboard, the long-term vision is to have these aircraft either remotely piloted or controlled through ground automation. Proposed concepts envision these UA operating between 400 ft – 5,000 ft, while small UA are expected to operate below 500 ft.

The ICAO Remotely Piloted Aircraft Systems (RPAS) Panel is working on Standards and Recommended Practices (SARPS) on the technical aspects for certification and integration for international remotely piloted aircraft operating in an Instrument Flight Rules (IFR) environment flying in controlled airspace with no people onboard. However, currently there are no ICAO noise and emissions standards as there are for traditionally manned aircraft.

In October 2020, a National Aeronautics and Space Administration (NASA)-led UAM Noise Working Group released a paper identifying UAM noise needs and recommendations. The paper summarises current practices, gaps, and recommendations to close those gaps and highlights the need for noise measurement and prediction methodologies to support impact assessment, noise mitigation, and regulation. Anticipated UAM vehicles are likely to have novel and complex designs, operating modes, and operating environments for which acoustic data is currently lacking. Flight testing and measurement are critical to acquiring the necessary data to develop and validate modeling tools and noise reduction methods. Acoustic signature data is needed to understand the human response to this new noise, and to develop technologies and procedures that could help mitigate adverse impacts. Regulation and policy also require specific knowledge of noise source characteristics, both for certification and environmental reporting.

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FIGURE 1: Cora, the UA from Wisk. Wisk is a joint venture of The Boeing Company.

The ICAO-CAEP Impact and Science Group (ISG) is developing a report on the state of knowledge on so-called non-acoustic factors. In addition, based on the experience with Chapter 13, CAEP Working Group 1 (Noise) will be gathering measurement data to recommend measurement procedures to define the noise footprint of these new vehicles in order to start laying the groundwork for a new standard. Research is needed to fully understand the unique acoustics effects of UA, how these will impact the public, and how they might be managed.

From an emissions perspective, small UA have the potential to provide a benefit where they can be used as a lower emission alternative for a mission typically carried out by a ground vehicle or traditional aircraft (e.g., runway inspections or calibration of navigational aids). On the other hand, the anticipated large number of larger UA that will be used for UAM/AAM operations raises issues on how these vehicles will be recharged and refueled between flights. While most UAM are expected to be electric, the carbon footprint of generating the additional electricity to charge/recharge these aircraft needs to be accounted for because, in some countries, electricity is still generated using fossil fuel.

eVTOL (Electric Vertical Take-off and Landing) operations are anticipated to operate at airports, for example, at the top of a parking garage or other building. eVTOL mobility may require additional infrastructure to accommodate the additional loads on the electric grid that will be needed to charge/recharge these vehicles between flights. Assessment of the emissions of UA operations will need to be done on a life-cycle basis to account for the different power sources across the different types of UA.

The operations of these new entrants need to be sustainable and not impact the environmental performance of "traditional" aircraft. UAM/AAM may improve connectivity between cities and airports; however, the impact on airport operations, both landside and airside, must be understood and managed before deployment. The integration of manned and unmanned aircraft should support safe and efficient operations for all users of airspace. Any new operational requirements for UA should not have a negative impact on the environmental performance of conventional aviation nor limit conventional aviation's access to airports and airspace.

Public and political opposition to UA operations pose a significant risk to the success and growth of this industry. Community annoyance to UA operations will differ from annoyance to traditional aircraft operations – UAs are unfamiliar in appearance and in noise characteristics; they are flown remotely at low altitudes and within close proximity to communities. This is not just a change, but an entirely new environment for residents that may be impacted by both traditional aircraft and UA operations. Just as new airport arrival and departure procedures can introduce noise to neighborhoods that had not previously experienced that level of activity and raise opposition, airports have discovered that early and extensive community engagement is key to gaining public acceptance for any changes.

Community engagement around UA operations will be complex given that operations extend across municipalities, include airports, and co-exist with traditional aircraft operations. A harmonised approach to engagement is needed to properly convey the overall expectation around the airspace to community stakeholders.

In addition to addressing acoustic factors, a community engagement strategy should be developed that will focus on addressing non-acoustic factors such as fear around safety, concern about intrusion, loss of privacy, sense of unfairness, anger around change in the overall environment, and degradation of nature. This will require transparency around the reasons for the change, how decisions are made, how the system works, safety rules and protocols, and an accurate prediction of impact.

It is also critical to include education on the environmental and economic benefits of UA operations as part of the strategy. Consultation should involve residents, elected officials, municipality representatives, and any other relevant community stakeholder group. For the CAEP/13 cycle, work will continue on a task to understand aviation stakeholder engagement needs for new entrants that will include UA. The goal will be to develop best practices for early community engagement.