ICAO

ENVIRONMENT

Report on

Emerging Trends in Aviation:

Community Engagement Practices and Considerations

Deliverable of ICAO Committee on Aviation Environmental Protection (CAEP)

2025

Notes

This report was produced by ICAO Committee on Aviation Environmental Protection (CAEP) Working Group 2 on Airport and Operations during the CAEP/12 cycle. Following the review by subsidiary bodies, the ICAO Council approved the technical recommendation made by CAEP and approved the publication of this report during the 235th Session, which took place from 9 June to 4 July 2025.

Disclaimer

Executive Summary

Purpose: This research paper is intended for States and aviation stakeholders such as airport operators, air navigation service providers, aircraft operators, environmental agencies and other government bodies, and other interested parties.

It provides community engagement considerations, including key trends, insights, and potential challenges and opportunities for three thematic areas of emerging trends in aviation – noise versus emissions, new aircraft technologies, and post pandemic dynamics. Together, the three sections highlight a common theme – that change is continuing at a rapid pace, that interests are diverse, that many of the longstanding principles for community engagement stand, but that there are also new expectations within our communities.

It also brings an important awareness of the risks and opportunities facing the aviation industry from emerging trends in the context of community engagement.

Methodology: A common methodology was applied to three thematic areas of research including literature reviews using templates and a list of specified questions to ensure consistent outputs.

In addition to the literature review conducted in common with the other thematic areas, a questionnaire aimed at airports was used to further explore post-pandemic dynamics to identify changes in noise concerns and noise issues during the pandemic.

Noise Versus Emissions: The work of this section investigates the interplay between noise and emissions in aviation operations, in relation to community engagement.

While climate protection enjoys strong support from large sections of the population, the noise impacts of adjusted routes to achieve lower emissions affect growing populations living close to airports. At the same time, research shows that overall community sensitivity to noise is increasing.

Resolving the conflict between noise and emissions requires broad consensus-building efforts. Community engagement is crucial in navigating the trade-offs between noise and emissions, particularly when implementing procedural changes that affect noise exposure for new and existing communities.

New Aircraft Technology: Emerging aircraft technologies have significant transformational potential to deliver new services and benefits to the communities they serve.

Emerging technology aircraft come with new sets of community concerns such as privacy, public safety, social equity, and loss of employment, along with more traditional concerns in the areas of noise and environmental impacts. Although these aircraft may be quieter compared to traditional aircraft, the aircraft will be operating in much closer proximity to individuals and homes than with traditional aviation. Meaningful work is being undertaken to advance social acceptance, and public facing efforts are growing. However, formal frameworks for community engagement do not yet exist, which may affect social acceptance.

Yet another challenge is accountability for community engagement relating to emerging technology aircraft. A solely responsible party, such as an airport or air navigation service provider, may not be readily

identifiable for these new technologies, raising the fundamental question of who exactly will be responsible for community engagement. In other cases, community engagement may occur in the establishment of operating rules, but once those rules are established, operators may be free to operate without further approvals, so long as they operate within those rules. If the national aviation authority and/or air navigation service provider do not have a formal ongoing community engagement role, the engagement may be left to regional authorities and/or operators who may not yet have well-established processes or community presence.

There may be an opportunity to leverage the aviation industry's collective expertise to enable accountability for community engagement and build community engagement frameworks and resources for emerging aircraft technology proponents. ICAO principles such as the "balanced approach" could also apply to emerging aircraft technologies.

The potential of emerging aircraft technologies must be enabled in a responsible and collaborative manner that is ultimately sensitive and beneficial to the needs of communities around the world.

Post Pandemic Dynamics: The pandemic had a profound impact on all parts of the aviation system and required innovative ways to ensure continued business operations. This included the accelerated use of online tools to support continued community engagement.

The effectiveness and strengths of online engagement during the pandemic can be applied to the post-pandemic environment. Augmenting in-person engagement with online methods can lead to a more robust and far-reaching consultations and new ways of soliciting input, which is ultimately the objective of most consultation plans.

Airports will also likely need to address emerging topics in the context of community engagement, especially related to climate change mitigation measures, including non-CO_2 emissions, and the integration of clean energy into the air transport system.

Conclusion: The aviation sector around the world has long recognized the importance of community engagement in addressing aircraft noise and annoyance, but many – such as airports – are increasingly facing the need to address topics such as climate change, the emergence of new technologies such as new entrants and the adoption of sustainable aviation technologies.

The pandemic posed further challenges to engagement that were overcome through innovation including digital tools and methodology allowing the work to continue, including large scale projects. It also provided an opportunity to learn more about community behaviour related to changing traffic levels and response to the use of engagement tools.

While this report provides a valuable update related to community engagement at a critical point in time for the aviation industry, strategies must continue to adapt to the needs of communities in the context of a paradigm shift in the aviation industry.

Together, the three sections highlight a common theme – that change is continuing at a rapid pace, that interests are diverse, that many of the longstanding principles for community engagement stand, but that there are also new expectations within our communities.

Introduction

Having completed the report on Understanding Aviation Stakeholder Community Engagement Needs in the Context of Delivering ATM Change, CAEP WG2 – Airports and Operations, decided to conduct a task covering engagement more broadly. The scope of this new task included emerging trends in aviation, with a focus on the following three work areas:

- Risks and opportunities related to the growing focus on climate change and the effects and interdependencies of that on local noise issues and mitigation;
- Recent, new and emerging airspace users, such as Remotely Piloted Aircraft System (RPAS), Urban Air Mobility (UAM), hydrogen-fuelled aviation, space ports, and associated considerations in developing a potential framework for community engagement if required, as well as considerations for broader stakeholder engagement; and,
- Environment scan/literature review of the impact of COVID-19 on community engagement strategies following low traffic levels and community responses to noise as operations return.

The document is structured into three main sections, one for each work area:

- Topic 1: Noise Versus Emissions
- Topic 2: Emerging Technology Aircraft
- Topic 3: Post-Pandemic Dynamics

Each work area has a different scope and explores distinct aspects of community engagement within the aviation sector. A common methodology to all work areas was, however, applied to develop this report.

Methodology

Following the identification of scope and the development of key lines of inquiry, which are listed in the *Scope* section of each of the three work areas, three subgroups of TG1 were established to conduct a literature review for each topic. To supplement this, authors leveraged web search tools to identify academic and white papers available online. This resulted in a library of documents, including formal white and academic papers, industry web information and presentations. This activity was repeated over three intake windows during the CAEP cycle, recognizing that information in this area is rapidly changing and that new materials were likely to be made available over the course of the two-year intake period. The last opportunity to add to the document list was in November 2023.

To support common assessment of documents and consistency of outputs, a literature review template was developed to ensure inclusion of relevant information in a standardized format. The literature review summaries can be found in Appendix 1 of the report.

Following this, the task group leads reviewed summaries and leveraged the information they contained, as well as additional direct document reviews, to develop the following sections. In the CAEP cycle, community engagement considerations were reviewed during workshops where further input was received, in many cases further supporting or illustrating community response and engagement concepts.

For the third work area on the impact of COVID-19 on community engagement strategies, in addition to the literature review conducted in common with the other thematic areas, a questionnaire aimed at airports to further explore the scope of the thematic area on post-pandemic dynamics and hopefully gain high level insights into changes in noise concerns and noise issues during the pandemic was developed.

The questionnaire was made up of eight questions and was created with the assistance of airport members participating in TG01. The questionnaire was distributed to a select number of ACI World Environment Standing Committee Noise Task Force airport members in early December 2023, with a requested completion date of 9 January 2024. This extra step was taken in order to try and address the paucity of existing literature on the topic.

In total, six responses were received from the following: Toronto Pearson International Airport (Canada); Queen Alia International Airport (Jordan); Direction Générale de l'aviation Civile (France); DFS Deutsche Flugsicherung GmbH (Germany); Vancouver International Airport (Canada); and, London Heathrow (UK). The summary of responses can be found in Appendix 2.

1. Section Introduction: Noise Versus Emissions

ICAO CAEP has long recognized the existence of interdependencies between noise and emissions; in some operating scenarios noise may be increased where emissions reductions are sought and vice versa. CAEP WG2 airport and operations noise and emissions experts have identified examples where community groups are recognizing these interdependencies. This theme has been investigated by means of a literature review to explore any risks and opportunities related to the growing focus on climate change and the effects and interdependencies of that on local noise issues and mitigation.

1.1 Scope

The scope of this work includes the drive towards net zero and effects of that prioritization on the mitigation of noise around airports. The following set of questions further helped to refine the extent of the topic area to be covered.

Does the focus on climate change affect or create new stakeholders/community groups that must be engaged?
Do the interests and demographics of these groups compare/overlap/differ with noise-interested stakeholders?
What are the characteristics of each group (climate and noise) and how they can best be engaged?
What practices are being used today/will be needed tomorrow to ensure communities are engaged?
What opportunities are there to leverage best practices across various environmental interested stakeholder groups?

What/are there different stakeholder groups should be leveraged/can support in engagement?
What differences do we expect regionally based on the industry's respective ecosystem/regional interests?
How can the industry engage and capture the views across all demographics in their communities
What is local community/how wide should this engagement be?
What is the industry view on prioritization?

1.2 Trends and Insights

This section of the report outlines the trends and insights identified as a result of the literature review. More details from the review can be found at Appendix 1.

One anti-noise community group in the European region, which traditionally had prioritized and campaigned against noise pollution, has increasingly added climate change to its reasoning for opposing aviation, claiming that the airport's growth plans are incompatible with their Government's climate crisis declarations. Another study in Europe found an airspace modernization activity that sought to engage communities on a Required Navigation Performance (RNP)-based procedure to shorten flight paths to save CO_2 emissions and to bypass densely populated areas to improve noise abatement. The proposal to test the procedures led to the division of the surrounding communities into separate groups of self-assumed noise winners and losers. Community groups were almost unanimously focused on noise outcomes rather than emissions, the prospect of reducing CO_2 emissions had practically no effect on the willingness to even accept the testing of the new procedures.

The European project ANIMA (Aviation Noise Impact Management through Novel Approaches) considered the interdependencies between noise and emissions around airports but concluded that more research was needed into these interdependencies, how they should be resolved and what the role of different stakeholders should be in potential solutions. The study did note that priorities among stakeholders are diverse, typically aviation players like airlines and ANSPs are focused on safety and efficiency, while airports are frequently trying to balance safety and efficiency with noise impacts. The study found that community groups around airports rarely consider much other than noise or local air quality impacts as the priority. ANIMA points to the Collaborative Environmental Management (CEM) concept as a route to all actors at an airport to find collective environment solutions that take account of all the interdependencies between them to realize the maximum potential for the sustainable growth of the airport. CEM promotes a collaborative approach between aviation and community stakeholders.

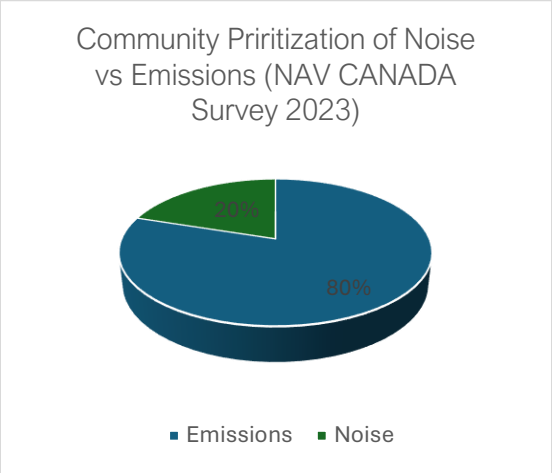
The UK Department for Transport (DfT) and Civil Aviation Authority (CAA) in a publication 'Clarifying Altitude Based Priorities during airspace changes' sought to set out guidance on where noise should be prioritized over emissions and vice versa. Policy had been set by DfT that 'noise should be the 'focus' up to 7,000 feet, although notes the CAA in making decisions about airspace designs may 'balance' this requirement between 4,000 and 7,000 feet with the need to ensure an 'efficient use of airspace and expeditious flow of traffic that minimizes emissions. Over time, local Government officers and community noise groups expressed concern that noise was not being prioritized up to 7,000 feet and asked for the guidance to be updated to ensure this. It was perceived by the community groups that the guidance was being interpreted to prioritize carbon impacts between 4,000 and 7,000ft.

The DfT in consulting aviation stakeholders said that they believed that all could see the vital importance of effective community engagement in order to ensure that their airspace change proposals have a chance of being approved and understand that noise was the overwhelming concern. The DfT believed that all recognized that noise considerations must be at or near the forefront of their proposals in the airspace up to 7000 feet, as otherwise the chances of a successful outcome were low.

The DfT noted that a World Health Organization (WHO) assessment of literature linked long-term exposure to high levels of noise to health conditions including heart attacks, strokes and dementia as well as UK studies pointing to general community annoyance – suggesting people are becoming more sensitive to noise farther away from airports, and to the frequency of aircraft overflight above 4,000 feet. While the global community and aviation sector have raised questions in regard to the study's methodology, the assessment was viewed by the DfT to further pointed to priority for noise (as opposed to emissions) up to 7,000 feet.

The DfT contends that the benefits to the industry of prioritizing noise up to 7,000 feet would be increased community acceptance of airspace change, necessary to deliver the overall benefits of airspace modernization.

The DfT reported that their informal discussions with airports and ANSPs reflected that there was a realization that a sub optimal airspace design – from an efficiency perspective – may be a price worth paying for securing the significant overall benefits of airspace modernization (e.g. additional capacity, better airport resilience, improved fuel efficiency, as well as the possibility of reducing noise impacts).



In their studies the DfT sought to quantify the illustrative cost impact on the industry (additional fuel burn cost) of the prioritization of noise over emissions below 7,000 feet. Noting that the analysis contains large assumptions and uncertainties, it shows an annual average of (UK) £4.6 million additional fuel costs versus the current guidance; low and high estimates are £2.2 million and £7.9 million in additional fuel costs from prioritizing noise.

On emissions, the analysis estimated an average of 37,000 additional tonnes relating to prioritising noise over emissions below 7,000ft (subject to a wide degree of uncertainty) but noted that this figure is small compared to the UK aviation sector's contribution of 34 million tonnes in 2014 and would have little impact on the UK's carbon budget. However, if this principle were to be applied on a global scale, the total increase in emissions may not be considered insignificant despite being proportionately low. Additionally, the concept does not weigh the risk of greater groundswell from displacing flight paths from communities currently exposed to noise to potentially less populous areas who may perceive the change as more impactful.

Some research indicates the prioritization of noise may differ within the population and suggests that existing exposure to aircraft noise may meaningfully and understandably influence prioritization of noise versus emissions, despite being a smaller subset of the population. In public opinion polling conducted by NAV CANADA in early 2024, respondents were asked which environmental concern should be prioritized between noise and emissions; 80% of respondents indicated emissions should be the top priority while 20% favoured noise as the top priority. Respondents were also asked if flight paths should be adjusted to minimize emissions

even if it meant that more people would be affected by noise; 43% of respondents supported prioritization of emissions while 27% were neutral and 30% opposed prioritization of emissions that would result in more people impacted by noise. Nationally, polling revealed that 5% of respondents felt they were impacted by aircraft noise to a high extent while 10% felt that they were impacted to a moderate extent.

A study looking at Aviation Noise Impact Management Technologies, Regulations, and Societal Well-being in Europe considered how land use planning could be used to avoid or minimize noise impact but that there is considerable inconsistency in the utilization of land use planning provision. A key explanation for the range of outcomes is the need to reconcile many, at times competing, demands, such as those of conservation, agricultural, highways and railways, recreation, municipal utilities, commercial, industrial, residential and institutional developments. The research noted that the ICAO balanced approach predated sustainability (emissions) as one of the factors, but the researchers believed that it could easily be added as one of the competing factors in achieving a balance with noise. It was noted in the study that despite very significant technological improvements over the past twenty years and with attention being paid to other environmental impacts, aviation noise remains a major problem in Europe.

The researchers conclude that while noise reduction at source has generally been progressing by leaps, in particular by the evolution of engine concepts, mistrust, negative attitudes and the expectation of not having any voice against airport authorities can considerably impact on the perception of aircraft noise exposure, leading to increased annoyance in lower noise situations. The researchers further consider that when considering the balance with sustainability (emissions), those affected by noise are not the same population group as those affected by sustainability alone. Thus, the willingness of accepting a trade-off between improving noise and improving sustainability is often considered inherently unfair.

1.3 Community Engagement Considerations

There are a few examples of community concerns regarding the trade-offs and interdependencies between noise and emissions; however, they tend to be focused on specific geographical locations, typically in the European region. Where these concerns exist, there tends to be a differentiation between communities close to airports, for whom noise is an absolute priority over emissions and those living away from airports that would prioritize emissions reductions as they are not affected by noise. A number of large-scale research projects have looked at the dynamics of noise vs. emissions trade-offs and community perspectives providing the following insights and trends:

- Noise emissions from aircraft have reduced significantly over the last few decades, but annoyance is increasing. At the same time, the emissions performance of the global fleet has improved but aircraft movement numbers have increased and there is some evidence that could be causing increased annoyance.
- There are competing priorities around airports, covering land use needs as well as community vs. aviation stakeholder requirements that can focus on balancing operational efficiency with improved noise performance.
- One study found that the cost impact of prioritizing noise over emissions below 7,000 feet could lead to a relatively minor fuel cost penalty from a proportional perspective, although uncertainties in the analysis were significant and did not reflect the views of aircraft operators.

- In one case a proposal to improve the emissions performance of aircraft and divert flight paths away from significant population centers met with strong opposition from community groups.
- Public opinion polling shows that a greater portion of the population supports achieving emissions reductions over noise reductions, though this viewpoint will shift based on existing exposure to aircraft noise.
- A number of studies cite the power of non-acoustic factors as an important contributor to aircraft noise annoyance; it is not clear whether a perception of a trade-off between noise and emissions being made could be classed as a 'non acoustic factor'.

Aircraft are becoming ever quieter and lower in emissions with each new generation, the noise vs. emissions conflict remains and requires a solution

1.4 Section Conclusion

While climate protection enjoys strong support from large sections of the population…CO_2 emissions can take a back seat to noise impacts for communities near airports

The findings from the literature review are summarized below and describe the current state of the discussion and conclusions.

While aircraft are becoming ever quieter and lower in emissions with each new generation, the noise vs. emissions conflict remains and requires a solution. This is because both settlement growth is moving ever closer to airports and the subjective sensitivity of the population to noise is increasing, while with generally accepted net-zero targets the logical consequence of improving the efficiency of routes would be at the expense of noise protection. For the foreseeable future, this trade-off will create a permanent conflict that can only be resolved in the form of compromises. While climate protection enjoys strong support from large sections of the population, the more abstract aspects of CO_2 emissions can take a back seat to noise impacts for communities near airports.

More research to capture broader community perspectives would help to establish priorities and better understand health impacts of noise annoyance

These compromises must be reached on a broad population basis in order to achieve viable decisions. Community Engagement can be an organizational and moderating element in this consensus-building process. Newly affected people who are suddenly exposed to aircraft noise due to procedural changes are a particular challenge.

In summary, efforts to harmonize subjective noise problems, medical requirements (e.g. cardiovascular disorders) as well as economic requirements, legal requirements and voluntary commitments to reduce CO_2 emissions should continue to be pursued. In concrete terms, this may be expressed as an altitude-oriented decision process to either avoid noise over short routes or to avoid emissions. According to current limited research and experience in the UK, this threshold is typically but locally differing between 4000 and 7000 feet above ground. However, there is limited evidence of appropriateness and feasibility of this approach on a more global scale and more research to capture broader community perspectives would help to establish priorities and better understand health impacts of noise annoyance.

2. Section Introduction: Emerging Technology Aircraft

Community engagement is a critical part of the change process in aviation as it relates to the impact of aircraft operations on communities, in terms of both noise and emissions. ICAO has developed and supported guidance and resources that have aided the air transport sector in ensuring that it is well equipped to inform and consult communities in support of achieving social license and mitigating, to the extent possible, opposition to airspace modernization and efficient operations.

The current aircraft technology landscape is rapidly changing, bringing with it new technological innovation and new types of airspace users. For example, amongst the more mature but rapidly evolving platforms are Remotely Piloted Aircraft Systems, which have proliferated in use and are employed commercially in a range of sectors as well as recreationally.

Current aircraft technology landscape is rapidly changing, bringing with it new technological innovation and new types of airspace users

As the presence of new aircraft technology platforms continues to grow within our airspace, this report seeks to increase understanding of community engagement needs and considerations. Indeed, some recent and emerging technologies and their users may not fall under existing guidance, protocols or governance structures. Additionally, some organizations that are proponents of emerging technology aircraft may not yet have well-established processes or community presence. These new technologies can operate differently to aircraft associated with conventional commercial aviation, with significantly different acoustic characteristics and operating in locations where communities may not be used to experiencing overflight. They may introduce new considerations or concerns as to their relative impact and benefit to communities and society in areas such as privacy, visual environment, community wellbeing and perceived safety risks.

In doing so, this literature review report seeks to provide a high-level understanding of what factors may differ in considering community engagement for a cross section of emerging aircraft technologies.

Based on available literature, the research attempts to identify which engagement mechanisms and good practices used by the aviation industry can be transferred to new segments, where new ones may be warranted, where deficiencies are evident and where key questions remain. The paper considers some basic operating aspects beyond pure “communication and engagement” factors; this is due to the reality that the operational concept – how it is designed and operated will generate community concern and barriers and is therefore intrinsically linked to any potential communication processes and real impacts/benefits being experienced by communities.

2.1 Scope

The scope of this study is to identify – to the extent literature and industry discussion is known and available – how community/stakeholder engagement will need to adapt to respond to stakeholder needs in the context of new/emerging entrants/technologies, and how this may be different from past engagement efforts within the aviation sector. In doing so, some technical aspects or potential operating factors (where and how an

aircraft flies) that make each technology unique or different were considered to infer potential considerations that could impact community engagement.

A fairly large net was cast, intending to capture Advance Air Mobility (AAM), including both Urban Air Mobility (UAM) and Remotely Piloted Aircraft Systems (RPAS); supersonic transportation (SST); spacecraft/rocket launches; and hydrogen and electrification of aircraft operations. It is worth noting in this early stage that varying quantities of literature were available for each topic, and that the review gleans greater insight into areas where a body of work exists while drawing insight or questions from areas that do not have any consistent literature.

The following set of questions further helped to refine the extent of the topic area to be covered.

What are the key potential community concerns for new entrant/emerging aircraft technologies type?
What is the nature of new concerns that will need to be addressed (privacy, new types of noise, etc.)
What are the unique community needs for various emerging technologies/entrants, etc?
Where may there be competing priorities?
What does the industry think the differences will be?

2.2 Trends and Insights

This section approaches trends and insights from a number of angles, considering the availability of information on community engagement for each emerging technology type, potential areas of community interest (with a focus on impacts) as well as any key insights or good practices presented by the literature. The section ends with a summary of common issues and opportunities related to community engagement. For the purposes of this document, the RPAS section refers to operations that use smaller aircraft with no passengers onboard while AAM/UAM refers to larger aircraft that have the potential to carry passengers.

Space/Rocket Launches

There are a number of magazines and news reports, organizational information and some academic content showing that there are numerous topics that may be of interest to society and communities when considering the proliferation of space/rocket launches. Areas of potential impact that could generate community interest include air pollution, noise impacts, resource consumption, impact on ecosystems and debris. This topic may also generate some concerns with ground infrastructure which often differs from the airports and aerodromes utilized by conventional fixed wing and rotor aircraft.

There is some evidence of consultative and educational efforts for this segment. Beyond public-facing educational content, NASA undertakes public-facing consultation through a variety of channels, including in the context of the US National Environmental Policy Act (NEPA) as well as directly with Tribal leaders and designated representatives to solicit feedback in areas of shared interest (following a 2020 Executive Order).

Maritime Launch Services, which is in the process of establishing new launch services to Nova Scotia, Canada, was required to establish a Community Liaison Committee (CLC) under the provincial environmental act with a mandate of "receiving community views and sharing information with the community".

It is important to note that the limited literature on community engagement in this area does not necessarily mean that engagement does not occur – there is evidence that it takes place under environmental impact assessment requirements or is undertaken by specific organizations regionally. However, the limited material on the topic suggests that common good practices have not been explicitly defined.

Supersonic Aircraft

Much research is being conducted by a small number of innovators to bring commercial supersonic aircraft back into the global airspace which could greatly reduce travel times. A key challenge these organizations have shared is designing a supersonic aircraft with a quieter sonic boom as the impact of sonic boom presents a major hurdle for social acceptance.

In fact, concern for the development of this technology has the attention of the global industry, including ICAO and ACI, which have put forward expectations that it is critical that the impact and approach to this technology not erode the significant efforts and achievements made in social acceptance of conventional passenger aviation.

In light of this, the pursuit of a "quieter" boom is a key focus of research and development efforts. As part of this, NASA has planned work to undertake community trials to, in part, gauge the response to these aircraft. This trial approach will provide key opportunities to inform the public about these new aircraft while garnering critical data for both industry and those within industry responsible for long term community engagement should this technology become more common.

A key challenge…is designing a supersonic aircraft with a quieter sonic boom as the impact of sonic boom presents a major hurdle for social acceptance

The concept of trialing technology and associated community response is one that is not always possible when considering aircraft noise from conventional aircraft operations, and as such may provide an opportunity for supersonic aircraft as well as other new entrants.

Despite this acute awareness of potential impacts of this aircraft type and efforts to better understand these impacts through community engagement, there exists – understandably – few resources on community engagement good practices.

Remotely Pilot Aircraft Systems (RPAS)

The literature review found a meaningful amount of literature review artefacts to assist with understanding potential sources of community concern and potential community engagement considerations.

A number of states have recently undertaken public consultations in support of developing national policy and regulatory frameworks, including regulations for Beyond Visual Line of Sight (BVLOS) operations.

The UK, Canada, Australia and the United States were identified as states that have undertaken these types of public consultations, and it is expected that many more countries have done so or will soon do so.

These consultations have helped garner initial public views on drone operations. As is suggested for other emerging aircraft technologies featured in this literature review, potential noise impacts feature as a concern. Additionally, broader impacts on the environment and ecosystem may generate community concern. Impacts on jobs or employment may also be a concern, where there is an impression that drone delivery could reduce the requirement for delivery drivers and impact the livelihood of individuals that garner their income from the delivery sector. At the same time, the literature recognizes that there are many use cases, such as the delivery of emergency aid and use by first responders, that communities will view positively.

A key point raised is that typical aircraft noise metrics and impact assumptions may not be applicable to RPAS due to the unique nature of their noise emissions. While this is not mentioned in the context of community engagement, noise metrics are typically an important tool to increase understanding of impacts.

Typical aircraft noise metrics…may not be applicable to RPAS due to the unique nature of their noise emissions

However, it should be noted that these consultations are focused on future operational concepts and do not specifically focus on identifying consultation practices that could be used by proponents and operators. Beyond government led consultations, there is indication that the industry is undertaking public engagement. For example, the Aerial Evolution Association of Canada has held "Drone Safety Days" that are open to the public and have a dual purpose of educating new users on safe operations while also creating opportunities for the broader public to learn about safety measures, use cases and benefits. In doing so, they have leveraged webinars as well as twitter (now X) chat capabilities to reach a broader audience. These examples showcase how the RPAS segment is different from some of the other emerging technology aircraft in that there are fewer barriers to acquiring the technology and becoming a user, resulting in public facing engagement including information for future users.

There is also literature content that speaks to effective engagement opportunities more broadly, including the idea of hosting drone "pop up shops" as an opportunity to bring the technology to communities. Other opportunities identified include hosting topical webinars, panels and presentations with identified stakeholder groups such as indigenous groups or environmental groups who may not be aware of the potential of the technology in achieving shared goals.

It is also suggested in a paper considering social acceptance of drones that "all public messaging, emphasis should be placed on positive applications for drones that promote public good" and that improving messaging strategies, specifically incorporating "drones within broader, established narratives that are popular worldwide" such as commitments to the Sustainable Development Goals.

In Canada, the Federal transportation regulator chairs the Canadian Drone Advisory Council (CanaDAC), which maintains a social acceptance task group. The task group identified six key areas to be addressed to support social acceptance of RPAS including enforcement of applicable regulations, concerns for safety, trust in drone operators, threat to privacy, understanding of the drone industry and drones as a source of disturbance. To address these the task group identified four thematic areas for advancement: safety and benefits of drone systems; education of the general public and drone operators alike; protection of the general public and existing aviation; and, promotion of equity and diversity.

In light of the above, many of the recommended activities focus on safety and supportive education to pilots on safe operations; testing, certification, regulatory and enforcement frameworks and their publicization, and operational considerations that reduce public concern (such as creation of drone "zones"). A number of concepts may be considered as applicable to broader public engagement. These include engaging municipal governments, creating educational materials for use by the public, developing a videos series that outlines the use of drones for social good, and launching RPAS use case competitions with high schools.

Some traditional aviation organizations have also engaged in public education activities. Airports provide good examples of this through various trials that evaluate the potential for integration of RPAS into the airspace or detection capabilities to protect aircraft as well as specific use cases such as "the last mile" in delivery from an airport.

Looking at how existing regulatory processes have been levered, the FAA has published numerous environmental reviews for advanced drone operations. One example is an environmental assessment for proposed drone delivery services from Dallas-Fort Worth Airport. The assessment highlights a number of areas that may be of interest including application of existing metrics such as DNL in its assessment, while also indicating that that a Notice of Assessment was published in local papers and offered an opportunity for public comment over a 30-day period.

Overall, given the reality that this segment is amongst the more prevalent or visible in the marketplace and in our communities, it is possible that many lessons will be learned as it continues to proliferate, and more widespread commercial applications occur at a greater volume.

Urban Air Mobility / Advanced Air Mobility

This subject was by far the area which had the most artefacts, due to both the availability of literature, the prevalence of the topic at industry events and the interest of members of the Working Group. While many documents did not pertain specifically to community engagement, there was a sufficient quantity of industry thought to provide insight into community engagement considerations. Overall, a good understanding of potential community concerns and barriers can be gleaned, and this across a mix of potential use cases such as air metro and air taxi.

Additionally, the topic of building community acceptance was not only addressed within a number of papers as something that can be addressed through effective engagement but is also discussed as a consideration towards building an operating ecosystem that prevents negative impacts (e.g. considering sensitive areas of operation, altitude minimums, limit quantity of overflights, consolidation over existing noise corridors, etc).

A number of artefacts touched on community acceptance challenges and mitigation strategies as the industry transitions to the next stage in its evolution. Topics in many areas touched on potential impacts from noise and visual pollution and expanded into societal concepts of equality (equal access) and personal safety while many authors generally acknowledged that the importance of keeping the public in mind and the need for associated strategies. Pragmatically, the literature points to the need for operational and business model mitigations in some cases by expanding access through special pricing models, operational considerations to avoid sensitive areas and restricting the use of photographic devices around communities – amongst others. At the greater extreme, at least one artefact considers how the creation of skyports could be done in a manner that provides additional societal value such as through the creation of spaces and facilities that can be used by the community (beyond the core UAM role of a skyport).

Considering artefacts that more actively discuss community engagement, some good practices are identified (which are not unlike practices used by conventional aviation), including:

- Understanding the existing soundscape and situating a potential new operation acoustically in the context of this environment;
- Discussing new facilities and operations early with community and local government leaders and the business community;
- Consider opportunities to co-create, partner or involve communities in service considerations and in solutions to concerns where possible;
- Leveraging a suite of communication tools such as webinars; and,
- Ensuring there is a clear point person or point of contact that the community can reach out to.

The Community Air Mobility Initiative (CAMI)—a nonprofit organization supporting the implementation AAM—has made available a number of resources outlining steps and strategies for stakeholder education, communication, and collaboration. This includes a toolkit with step-by-step

Information available from organizations that are conducting research and development in the UAM space is also insightful. For instance, an overview of the NASA Advanced Air Mobility National Campaign shows that NASA has been conducting tests together with Advanced Air Mobility (AAM) stakeholders under the National Campaign program. One goal of the testing campaigns is to promote public confidence in AAM safety, facilitate community-wide learning, and to collaborate with stakeholders on development of critical enabling systems. The work being undertaken suggests that demonstrations of new technologies offer an opportunity to engage the public on safety, applicability, and noise of AAM vehicles. Taking this a step further NASA's Langley Research Centre held an Urban Air Mobility Noise Working Group Panel regarding community engagement to bring industry experts together to discuss a range of community engagement topics.

NASA's Langley Research Centre held an Urban Air Mobility Noise Working Group Panel regarding community engagement to bring industry experts together to discuss a range of community engagement topics

Looking at other innovators, such as Joby Aviation, one can deduce that proactive communication of the benefits of emerging aircraft technology is a key facet of garnering buy in. Joby Aviation's web homepage features key benefits such as zero operating emissions, low aircraft noise profile in addition to range and information robustness of trials and development work. Additionally, Joby has recently produced its first Environmental, Social and Governance report, a clear signal on how seriously the organization values a lens that is beyond economic or profit goals, reaching into areas of social good. In addition to information of efforts around noise reduction, the report shows that Joby established workforce development programs in local communities to reskill and upskill underrepresented groups. From an engagement perspective, the organization hosted community tours of its facilities, including with academic institutions, sponsors community events, engages in a supportive way in the innovation spaces and has developed videos demonstrating sound differences between their aircraft and other aircraft being flown today. While these initiatives perhaps do not constitute community consultation per say, they do represent ways that organizations can get a foot in the door at the community level.

In summary, this segment which is at the leading edge of innovation in several areas, highlights important and new opportunities to engage communities and significant work is being done to discuss and develop good community engagement processes in some jurisdictions.

Use of Hydrogen

The literature review captured limited information on use of hydrogen in aviation in the context of community engagement. Most of the literature surrounding hydrogen as an energy source for aviation is focused on its operational feasibility. Areas where community considerations are featured were typically not specific to aviation, but rather the broader use of hydrogen in society. Academic research indicates that hydrogen acceptance hinges on a number of areas, including public perception, social impacts and concepts of social fairness.

2.3 Community Engagement Considerations

Potential Community Engagement Challenges of Emerging Aircraft Technologies

This section provides an overview of potential challenges to community acceptance and engagement across new aircraft technologies gleaned from literature artefacts, both in terms of stated challenges and areas where significant questions remain.

a) There are a range of potential community concerns beyond noise.

The literature review suggests that – depending on the aircraft technology in question – noise may only be one of many sources of negative community sentiment. Conversely, concern from some technologies do focus primarily on noise considerations, as is the case for supersonic aircraft. However, the review shows that concern for safety, mistrust of automation, lack of a visible human "pilot", visual disruption, impact on environment (waste build up, safe disposal of energy waste, wildlife and ecological impacts), concern for privacy, impacts to employment, lack of community access or benefits, and ground infrastructure may all be sources of apprehension or opposition. Combined with the different operating characteristic of new aircraft technologies compared to conventional aviation (at lower altitudes, closer to the community, greater frequency of overflight) may result in fundamentally different initial attitudes towards emerging technologies. For instance, whereas traditional aviation operations are widely accepted as very safe, there may be a lack of understanding of the research, rigorous testing, certification activities, safety reviews and regulator oversight involved in bringing new technologies to market. How these are effectively addressed will be critical to social acceptance, mitigating organized opposition and preventing policy instruments that could ultimately limit their potential applications.

Noise may only be one of many sources of negative community sentiment

b) There are few precedents and limited guidance on community engagement.

For the most part, community knowledge and exposure to new aircraft technologies identified in this document are far from ubiquitous. While measurable characteristics of their operation and their potential use cases provide meaningful insight into how they will be received by communities, the full scope of operations is not known and many facets of community impact have yet to be experienced.

The aviation industry benefits from a well-established regulatory environment, which in most cases include requirements related to noise management and impact analyses and are further supported by community engagement frameworks developed by ICAO, nation states or key players such as airport authorities and ANSPs. In the case of certain new aircraft technologies, these frameworks may not exist or may not be at a sufficient phase of maturity. Participants in the workshop highlighted that due to the range of operating characteristics that standardized guidelines may be challenging and frameworks for engagement may become highly regionalized.

> Currently, there is no consistent framework for community engagement across technologies

The literature review showed that there is not currently a consistent framework for community engagement across technologies, though some operations may fall under existing regulatory structures such as those required for environmental impact assessments. However, over the course of developing this paper, continued attention on developing stakeholder engagement guidance by industry organizations could be observed for some ETA – such as in AAM/UAM segment though publishing of papers on the topic by the Community Air Mobility Initiative (CAMI) in the US.

Our existing knowledge of conventional aviation indicates that community acceptance should not be taken for granted and one can expect various degrees of community reaction to aircraft technologies – ranging from cautious apprehension that may be addressed through education, to organized opposition that will require elaborate community engagement processes, structures and spaces.

c) It is not always clear who will be responsible for community engagement.

Continuing on the previous point, the context on accountability for engagement may be blurry compared to situations where operations may easily be associated with airports, or air navigation service providers. New entrants and new aircraft technology proponents may not be aware of the need for, or be incentivized to, pursue community engagement.

Community engagement may be conducted in the establishment of operating rules, but once those rules are established, operators may be free to operate without further approvals, so long as they operate within those rules. Many operators may operate outside of the sphere of influence of traditional industry if, for example, they do not operate to and from airports or utilize airspace under the control of air navigation services. This raises questions as to whom exactly is responsible for community engagement, and how community engagement will occur with any degree of consistency across a potential fragmented range of organizations providing distinct services.

Additionally, the risk that new entrants face economically, with potential significant amounts of capital at risk, may serve as a disincentive to undertaking time-consuming engagement activities – particularly in the absence of any clear frameworks. A current working group in the US including more than 22 agencies anticipates that guidance will be developed targeting municipalities versus ANSPs and airports, signalling a potential for change in accountability or players within the engagement space. Participants during the workshop highlighted that the role of industry in setting expectations on what noise should or will be is being discussed in a number of spaces, with the Uber Elevate Conference of 2017 and 2018 being highlighted as an example.

d) Standards are likely to continue to lag behind operations.

Understanding the acoustical characteristics of a range of new aircraft technology is an important focus of regulators, international bodies and new aircraft technology proponents. However, the literature review did not provide any clarity on how acoustical metrics, and which acoustical metrics, may be applied in regulatory or standards frameworks, community impact analysis, noise mitigation and community engagement. It is unclear if or how they will fit into existing frameworks such as Canada's Noise Exposure Forecast (NEF) used to support land use planning around airports or sound insulation programs in the United States that are based on Day Night Level (DNL).

The competitive nature and pressure to realize commercial potential of innovative aircraft technologies may result in some reactive standards setting. To draw on an analogy in the ground transportation sector, the proliferation of ride sharing apps occurred outside of the standards and licensing frameworks of traditional taxi services and governments were required to react well after these new services were garnering significant market share. Additionally, there may be some risk that communities that are concerned with new aircraft technologies point to lack of standards as a wedge to oppose their use.

e) Communities may feel disconnected from social benefits.

Some literature review artefacts refer to aspects of social justice (or potential lack thereof), potential cost barriers to individuals benefiting from these aircraft technologies or the risk that members of some communities may not have a direct relationship or be consumers of the services provided. For instance, there is presence of narratives that passenger UAM or Supersonic Aircraft will be reserved for the wealthy who can afford the advantages of these modes of travel. In the case of drone delivery, there may also be concerns for loss of employment where a human may have been a more visible part of deliveries. This may present a challenge to social acceptance when members of the community feel that they are impacted by noise or other outcomes but are not in a position to participate in associated services or economic benefits.

While it is possible that these concerns would be secondary to measurable environmental impacts (noise, emissions, visual landscape, privacy) or economic impacts (loss of employment), they could serve as important amplifiers to opposition. Additionally, during the workshop, it was highlighted that some uses that may be more widely accessible may still be viewed as non-critical or superfluous, such as with food delivery.

f) Consideration should also be given to ground infrastructure.

> The location and physical make up of this [ground] infrastructure may be of interest to communities – not only because they imply a certain frequency of operations in the nearby skies, but due to the spaces they occupy, additional ground traffic, power source and storage, the adjacent land use, visual impact on the landscape and impact on the local ecosystem.

While many new aircraft technologies will operate from existing aviation infrastructure locations such as airports or helipads, the nature of some technologies means that they will no longer be bound by traditional ground infrastructure and bases of operation. This implies the potential for new ground infrastructure or bases of operation to support rocket launches, UAM and RPAS operations. Similarly, the storage and transport of hydrogen may be of interest to communities from a safety and ground infrastructure perspective. The location and physical make up of this infrastructure may be of interest to communities – not only because they imply a certain frequency of operations in the nearby skies, but due to the spaces they occupy, additional ground traffic, power source and storage, the adjacent land use, visual impact on the landscape and impact on the local ecosystem. Consideration should be given to how this ground infrastructure should fit into community engagement activities. It is noted, however, that some of this infrastructure would be subject to regional land use planning requirements and associated notice and consultation provisions. Finally, workshop participants identified that there may be a security or public safety aspect of ground infrastructure which may raise the interest of communities, with new processes for boarding as well as time and cost considerations.

Potential Community Engagement Opportunities for Emerging Aircraft Technologies

While the above section outlines a number of challenges in the lead up to or execution of community engagement, a range of potential good practices were able to be deduced by the literature review. Many of these concepts reflect good community engagement practices used by the aviation industry today, while also considering the novelty of technologies and, as a result, unique opportunities to engage communities in new ways.

a) Early and regular engagement is ideal.

ICAO has put forward a significant body of work on good community engagement processes related to airspace change and aircraft operations. A reoccurring theme within this documentation is the importance of early and sustained community engagement to ensure communities have an opportunity to understand change and provide feedback prior to that change occurring. These principles are also featured in literature as opportunities to increase community buy in.

b) Existing industry good practices may be useful to new entrants.

Building on the previous point, the literature review suggested that many similar community engagement practices or processes were either being used or should be considered. Examples include concepts related to community consultative committees, elected official engagement and varied consultation spaces including webinars or in-community events, and mechanisms that allow airports to provide input. It is

highly likely that the types of engagement vehicles used by aviation today can be used by proponents of emerging aircraft technologies, though these will likely need to be adapted to reach appropriate audiences and include appropriate industry stakeholders. Another opportunity exists in the area of benefits quantification.

c) Identify stakeholders and build engagement spaces.

Whereas the current aviation sector is served by a range of established and evolving stakeholder engagement channels – from association events and industry committees to public engagement protocols and community consultative committees, proponents of emerging aircraft technologies have a unique opportunity to define and build these spaces proactively. Undertaking stakeholder mapping and identifying both industry and community stakeholders and their representatives will support proponents in anticipating who may have both supporting and opposing views, or who may need to be a partner and who may be impacted by new use cases. While some emerging aircraft segments may not benefit from established spaces, there may be engagement opportunities that exist already. Additionally, proponents can proactively consider who and how they will engage stakeholders, what the goals and rules of engagement are, and build their own processes and spaces in the absence of clear guidance. Effective and proactive approaches could form the basis for future good practices and guidance and may help avoid overly burdensome engagement requirements being established by regulatory authorities in the future.

d) Consider underrepresented or underserved communities.

Although disparity in access and benefits amongst communities from traditional aviation has evolved over a long and complex history and many organizations are continuing work to address differences, the emerging nature of new technologies provides an opportunity to potentially address socio-economic disparity upfront. This can potentially start by explicitly considering how to include the underserved and underrepresented in community engagement activities, minimizing impacts on communities that today already experience a greater impact from transportation and evaluating how these communities can access new services. There is a unique opportunity to consider how various segments can be built out to address community needs early.

Demonstrations provide an opportunity for communities to have a firsthand experience and greater understanding of emerging aircraft technologies. Where operationally feasible, this exchange can occur within the community to bring the message to them and provide greater access.

e) Leverage trials and demonstrations in community engagement.

A number of literature review documents highlight trials and demonstrations as vehicles to inform, educate and engage the community. Demonstrations provide an opportunity for communities to have a firsthand experience and greater understanding of emerging aircraft technologies. Where operationally feasible, this exchange can occur within the community to bring the message to them and provide greater access. Conversely, open house type events can also be considered where an operational demonstration is simply not feasible, to allow residents to meet the people and faces behind the work and view the hardware. In the case of trials, these can be multifaceted in that they allow proponents measure impacts and gauge community response while simultaneously providing a platform for community involvement and education.

Given the greater risk that communities will not be familiar with these new technologies and their benefits, demonstrations and trials can help increase awareness.

f) Highlight the new benefits these technologies provide to communities.

There is a significant range of benefits across the range of technologies outlined in this paper. An important enabler of social acceptance will be quantification of benefits. This includes potential examples such as reductions in emissions compared to other forms of transportation, benefits of electrification and reduced energy consumption, employment and job creation, reduction in supply chain costs that may be passed on to consumers, ability to broaden the geographic horizon or timeliness of services, broader economic impact, increases in safety, noise reductions compared to other forms of transport and reductions in surface traffic congestion – to name a few. Beyond quantification, several use cases bring with them important stories.

For instance, life-saving delivery of organs or blood using drones within the medical system and certain emergency response activities are examples of a use cases that are easy to support. Telling these stories and telling them early will help prevent less favorable or misinformed narratives from becoming commonplace. An example approach was raised by workshop participants, highlight ATAG's Aviation Benefits Beyond Borders initiative, which actively promotes the economic growth, social development and environmental efficiency contributions being made by aviation; a similar approach by emerging aircraft technology proponents could provide an opportunity to deliver information clearly and succinctly.

g) Safety should be front and center.

While aviation today benefits from high levels of trust in safety, the industry as a whole maintains an ongoing focus on safety and continues to communicate improvements while addressing risks. For emerging aircraft technologies, the safety history and journey are in their infancy and less known by layperson audiences, and the literature review confirms that safety concerns are a potential hurdle to community acceptance. Finding ways to communicate their safety journey in an easy-to-understand manner – including research and development, testing and trials, certification and safety data – represents an opportunity to reduce mistrust, unfounded fears and reassure communities that safety is at the heart of operations.

2.4 Section Conclusion

Emerging aircraft technologies have significant transformational potential to deliver new services and benefits to the communities they serve. Meaningful work is being undertaken to advance their social acceptance and public facing efforts are growing. However, this literature review suggests that – with the exception of certain environmental impact assessment and regulatory development focused primarily on safety – that formal frameworks for community engagement are either lacking or in their relative early stages of consideration. The limited frameworks may result in reduced social acceptance or the creation of reactive frameworks that could be more burdensome than necessary.

One key line of questioning that should be explored in further detail is the role of the proponent in stakeholder consultation. Some segments of new aircraft technologies are likely to see many service providers in the marketplace, and therefore a sole identifiable responsible party such as an airport or air navigation service provider may not be readily identifiable. While it is likely that regulators and ANSPs

will be involved in the creation of operating requirements/limitations and supportive airspace structures, their role in day-to-day operation will be potentially limited. This raises a fundamental question of who exactly will be responsible for public consultation.

At a time where interest in social outcomes is growing, proponents have a unique opportunity to build in consideration for communities in their endeavours

The literature review shows that there are a number of unique challenges to community engagement that are likely less prevalent in aviation today. Some of the sources of apprehension to these new operations are fundamentally different and reach well beyond aircraft noise and emissions. Of utmost importance will be establishing strong trust amongst communities of the safety of operations.

Overcoming these through novel engagement activities, thoughtful messaging that addresses the value they create for society and the creation of effective community spaces will be essential. At the same time, many of the learnings of aviation are transferable – concepts of early and frequent engagement are prime amongst them. In doing so, proponents should consider their linkages to current aviation industry stakeholders to understand where there are shared or complementary goals and how they can collectively move forward with one another.

There are positive signals and examples from existing innovators as well as through academic thought leaders on how this can be done. At a time where interest in social outcomes is growing, proponents have a unique opportunity to build in consideration for communities in their endeavors while leveraging the distinct technologies through trials and demonstrations to increase understanding of how they work.

Looking ahead, there may be opportunity to leverage the aviation industry's collective expertise to enable accountability for community engagement and build community engagement frameworks and resources for emerging aircraft technology proponents.

From a bigger picture perspective, exploration of how cornerstone ICAO principles such as the "balanced approach" will apply to emerging aircraft technologies may be a useful exercise.

There are a number of unique challenges to community engagement that are likely less prevalent in aviation today

The potential of emerging aircraft technologies must be enabled in a responsible and collaborative manner that is ultimately sensitive and beneficial to the needs of communities around the world.

3. Section Introduction: Post-Pandemic Dynamics

The focus for this subtask is to assess the impact of COVID-19 on community engagement strategies following low traffic levels and community responses to noise as operations return, in consideration of insights that can be extrapolated to future engagement by industry organizations.

Like all other industry sectors, the pandemic forced many in the aviation industry to pivot from in-person engagement to adopt online engagement strategies to conduct regular business or progress large scale projects that required an element of community involvement.

This shift required organizations to rethink how they engaged communities, what channels they used as well as adapting their message while also considering increasing expectations in the areas of corporate responsibility and social equity.

3.1 Scope

The scope of this work includes how techniques for community engagement were used during the pandemic, what can be learned from this for post-pandemic strategies, and how this may influence engagement once pandemic restrictions are relaxed. It also includes assessing whether some changes were identified in terms of engagement, for instance in terms of demographics, of annoyance dynamics, of perception of the airport's importance and value to communities' wellbeing, or of the perception of aviation's impact on communities' quality of life.

The following set of questions further helped to refine the extent of the topic area to be covered.

How has engagement changed and what techniques are used in engaging with new communities & stakeholders (new hybrid/remote work realities/demographics/priorities)?
What are the trends in terms of new concerns and handling complaints from new sources?
How can we address different/competing priorities and target the right audience(s), including: Improving messaging (changing demographics, transparency, etc.); virtual/hybrid reality (opportunities and drawbacks); adapting community engagement to uncertainties.
What/are there different stakeholder groups should be leveraged/can support in engagement?
What differences do we expect regionally based on the industry's respective ecosystem/regional interests?
How do airports contribute to local community's quality of life and how can they improve that?
What policy direction can be recommended to support the communities?

3.2 Trends and Insights

From the Literature Review

This section summarizes general themes and insights from the nine reference documents, based on the following five general themes:

a) Community Engagement – Digital Tools

Four documents were related to the use of digital tools in community engagement. While these documents were written for a broad spectrum of public engagement practices and not specifically for aviation, the information and general principles are universal and is useful for the aviation industry who tended to use

more in-person engagement practices prior to the pandemic and have had to rapidly transition to online formats for supporting major airport and airspace projects during the pandemic.

Some of the key aspects of using digital tools in community engagement exercises are:

- Recognizing that digital tools evolve quickly and there are many tools available.
- Understanding which tool your audience is most comfortable using and seeking to incorporate this tool into your engagement strategy where possible.
- Understanding that digital tools become more sophisticated as you progress through the engagement spectrum, and you need to select the right tool for the specific type of engagement you are undertaking.
- Creating an overall engagement strategy including its objectives, desired outcomes, and success criteria before choosing a digital tool as this will help identify the most effective tool.

Online community meetings can support large scale projects and can provide a good alternative to conducting in-person public outreach

While all the documents highlighted the positive aspects and virtues of online engagement, two important issues were identified:

1. Recognizing that the fundamentals of good quality engagement follow the same principles whether it is online or offline, and that digital tools serve to enhance techniques already in use to engage communities and should not be a replacement.
2. Accounting for the "digital divide" - often defined as the gap between people with effective access to digital and information technology, and those with poor access – and factor how this may limit the effectiveness of engagement by precluding segments of the community from participating or allow technical savvy groups or individuals to drive the conversation at the expense of others.

b) Case Studies – Online Engagement to Support Airspace Changes

Two of the documents summarized case studies of actual online community outreach efforts by aviation agencies to support major airspace change projects during the pandemic. These two case studies highlighted the benefit of online engagement and how it was used to reach a large audience.

Overall, the two case studies highlight that online community meetings can support large scale projects and can provide a good alternative to conducting in-person public outreach. The advantages are that it is easier to control messages, it is possible to get broader participation, and it is easier to allows subject matter experts from other locations and who may not be able to travel to in-person events to participate in the discussions.

However, as public health restrictions around public gatherings continue to relax, the aviation industry may need to consider augmenting online engagement with in-person engagement as there will likely be a continued expectation from the community and elected officials for in-person type engagement sessions.

c) Hosting In-Person Events Safely

One document was related to practices for hosting in-person events during and post pandemic, with the overall goal of promoting public health safety and making people feel comfortable in cases where community members may be anxious about attending in-person events.

The practices described include setting and communicating rules and expectations around public health measures before the meeting, and practical measures to ensure the cleanliness of the venue.

While these practices may become less relevant as health authorities relax public health measures around gatherings, we should recognize that segments of the population will remain uncomfortable in these settings, and we will need to accommodate to ensure fair representation in any community engagement process.

Many organizations continue to offer virtual options to accommodate diverse schedules and preferences, allowing for increased inclusivity and broader participation. They also often combine online and offline engagement participation, a strategy that allows them to reach a wider audience while still fostering meaningful connections. Hybrid models offer flexibility and adaptability to changing circumstances.

d) Community Survey

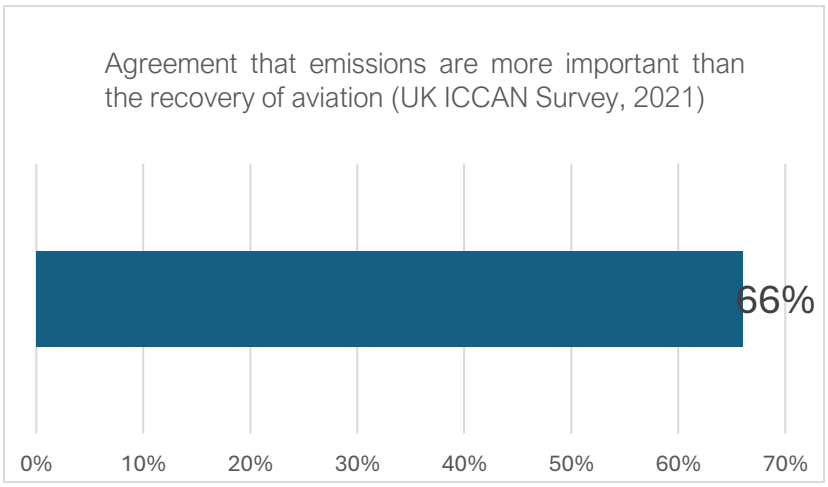
One document summarizes the results of a community survey of residents living close to five airports in the UK about their experiences of aviation noise during the pandemic and reduced air traffic volumes. This survey was conducted by the UK Independent Commission on Civil Aviation Noise (ICCAN – dissolved in September 2021).

While the document does not directly discuss community engagement strategies, some interesting findings from the survey include:

- The survey showed that older age groups were more likely to hear aircraft noise than younger age groups.
- 48% of respondents agreed they do not mind if aviation noise goes back to pre-pandemic level, while 38% disagreed.
- 66% agreed that the environment should be given priority over the recovery of aviation – those in the younger age group were more likely to agree with this statement.

Organizations continue to offer virtual options to accommodate diverse schedules and preferences, allowing for increased inclusivity and broader participation

While providing interesting insights, one should be cautious about drawing broad conclusions from the survey as community responses at other airports are likely to vary due to difference in the community's values, beliefs, sensitivities to aircraft noise, and the local nature of operations at the airport.



In addition to this study, the University of Windsor (Ontario, Canada) has also conducted research during the pandemic in partnership with the Greater Toronto Airports Authority, into the social acoustic metrics for aircraft noise annoyance.

In time, the results from these types of studies may provide interesting insight and understanding of acoustical and non-acoustical factors in the community's response to aircraft noise, which may then be used to enhance noise management strategies.

e) Focus on Non-Acoustic Factors in Communications

One document was an open access book that focused mainly on the achievements by the ANIMA project (Aviation Noise Impact Management through Novel Approaches). While the book contains broad information about community engagement practices, there is reference to proactive communication plans to provide timely information about traffic levels at the airport to ensure the community is aware of current and expected noise exposure.

To address non-acoustic factors associated with annoyance and to help build community acceptance as air traffic levels return to pre-pandemic levels, proactive communication should also focus on the airport's important role in the economy, and the airport's role in supporting the economic and social recovery after the pandemic. However, this communication strategy is not universal, as many external factors such as local media coverage and the airport's standing and reputation in the community will often drive communication plans.

From the Questionnaire Responses Overview

This section provides a short summary of the findings from the questionnaire. The verbatim responses can be found in Appendix 2.

A summary of the questions is provided below. As a general observation, each airport was impacted differently during the pandemic, and all faced unique challenges with their respective communities. As a result, drawing broad universal conclusions is difficult and given the small sample size provided by the questionnaire, the summary is qualitative in nature.

a) Engagement with community stakeholders on noise and airport issues during and after the COVID-19 pandemic

Respondents advised of their continued efforts to engage the community during and after the pandemic. Some respondents cited adopting online tools to continue engagement with communities and other stakeholder groups. While in-person meetings were restricted during the pandemic, online methods were used for community engagement; however, as pandemic and public health restrictions were relaxed, in-person engagements, or a blend of in-person and online engagements, are now considered.

b) Implementation of different techniques to respond to noise complaints during and after the COVID-19 pandemic.

Most respondents cited no change to engagement priorities or changes to how they handle complaints

While most airports advised of no significant changes in the way they responded to complaints, it was observed that one airport was effectively able to change the way they responded to complaints received by telephone (moving away from answering calls directly, and having people leave a message for later follow-up), thereby providing residents with an overall heightened level of service and information provided, while making more efficient use of staff resources.

c) Changes in priorities in community engagement and/or ways to respond to noise complaints change during and since the end of the pandemic.

Most respondents cited no change to engagement priorities or changes to how they handle complaints. One respondent did cite that during the pandemic and as traffic levels returned to normal, they have had to use a long-standing policy more often of not responding to individuals that submit multiple complaints about the same subject and only responding if the individual asks a new question or if there is new information to provide.

One respondent cited that they are experiencing challenges communicating the effects of returning air traffic due to the use of new PBN routes and procedures that were recently implemented. This has created confusion in the community and has made responding to questions and concerns very challenging when trying to differentiate and communicate the impacts of the new procedures vs. the returning level and new air traffic.

d) Changes or general trends in the demographic groups in community engagement activities during the pandemic.

One respondent noted residents that purchased their homes during the pandemic when traffic levels were low and were then surprised to find that their new home is under the flightpath or are exposed to high traffic and noise levels when traffic returned.

e) Changes or general trends in the complaints/annoyance profile.

Respondents noted no observable change in complainant profile, but one respondent mentioned anecdotally observing a greater number of first-time complainers during the pandemic. After responding and providing information to these complainers, many did not submit subsequent complaints afterwards.

f) Change in the perspective of airport's importance/value to the community wellbeing since the pandemic.

While many airports worked to highlight the importance of aviation to support the economic and social recovery from the pandemic, it is difficult to quantify if these messages were effective in increasing the community's positive perception of the airport. One respondent advised they are doing additional work to track community sentiment, but this data is not yet available.

g) New trends or requirements that have emerged from the pandemic.

Nothing specific to the pandemic was identified by the respondents. While ongoing issues from before the pandemic, such as land use planning/encroachment and health impacts from noise exposure, continue to be a challenge for airports, one respondent did cite the growing discussion on climate change impacts due to aviation.

h) Change in government relations stemming from community pressures and expectations.

In Germany, the government tried but failed to include "effective noise protection" in the official duties of Air Traffic Control.

In Canada, the government has proposed Bill C-52 that if passed could lead to significant changes to how airports assess and consult on temporary changes to airport operations – such as changes to runway use to accommodate airfield maintenance. The Bill will pose stringent requirements that may be difficult to meet in a dynamic airport environment. While the proposal of this Bill was not necessarily created because of pandemic conditions, it does highlight the need for closer coordination between regulators and industry to ensure proposed regulations are effective.

Other trends

Beyond the increasing use of social media, online forums, community platforms, and chatbots, to bring communities together for discussion or to engage virtually, community engagement is seeing several trends on the rise. Some of these are summarized below.

a) Data-Driven Engagement

Organizations are using data analytics to understand their communities better and tailor engagement strategies accordingly. By analyzing demographics, behaviors, and preferences, they can personalize outreach efforts and deliver more relevant content.

b) Collaborative Partnerships

Collaboration between different organizations, businesses, and community groups is becoming increasingly common. By pooling resources and expertise, these partnerships can address complex issues more effectively and create a more unified community experience.

c) Focus on Social Inclusion (Diversity, Equity, and Inclusion (DEI))

There's a growing emphasis on ensuring that community engagement efforts are inclusive and representative of all demographics within a community. Organizations are prioritizing social inclusion initiatives to create spaces where everyone feels valued and heard.

d) Community-Led Initiatives

Empowering community members to take ownership of projects and initiatives fosters a sense of belonging and pride. Airports are not new to this, but they are increasingly involving community members in decision-making processes and co-creating solutions to local challenges.

e) Storytelling and Visual Content

Effective community engagement often relies on compelling storytelling and visual content. Social media platforms like Instagram, TikTok, and YouTube are popular for sharing stories, experiences, and perspectives in engaging ways.

f) Sustainability and Social Responsibility

Airports are well aware of the fact that communities are becoming more conscious of environmental and social issues, leading to increased engagement around sustainability initiatives and social responsibility campaigns. Organizations that demonstrate a commitment to these values often garner stronger community support. As mentioned in the section related to emerging technology entrants, the use of cleaner energy such as green hydrogen/battery-powered powered aircraft, or the presence of advanced air mobility, will require airports to maintain open communication channels with the community and provide regular updates on sustainability initiatives, integration efforts, and progress towards adopting these new technologies, in order to build trust and credibility.

Organizing public forums and town hall meetings to discuss the potential benefits and challenges of clean energy can provide opportunities for community members to ask questions, voice their opinions, and participate in shaping the future of aviation in their area.

g) Empowerment through Education

Providing educational resources and opportunities for skill-building empowers community members to participate more actively in decision-making processes and take on leadership roles within their communities.

h) Aircraft noise exposure and health effects

One issue that has been observed at some airports in Canada is an increased interest by communities in the topic of aircraft noise exposure and health effects. While there is evolving research on this topic, some national health authorities still provide little guidance for industry.

Many residents reference the noise guidelines released by the World Health Organization (WHO) European Region in 2018, which provides recommendations for aircraft noise exposure based on a review of results from available studies. While there is significant literature available questioning the WHO's study methodology and recommendations, these are often from stakeholders in the aviation industry and are likely

looked at skeptically by the community, and it remains a challenge for airports to rebut the WHO's findings without looking defensive or unaccepting of the results.

With ongoing research into the impacts on health from aviation, including impacts from exposure to high sound levels and air quality (including nanoparticles), the aviation industry needs to remain active in monitoring these studies to ensure recommendations are based on sound scientific methods and data, are balanced, and develop coordinated strategies on how best to respond.

3.3 Community Engagement Considerations

As illustrated through the literature reviews, online engagement can be used successfully by the aviation sector to host community consultations in support of major changes.

With the relaxation of pandemic restrictions, the expectation of hosting in-person engagement as the "standard" way of consulting is changing. Due to the wide range of tools available and the varying scope of communication plans, careful consideration must be given to structuring and executing online engagement based on the desired outcome of consultations.

> Although we see a return [to in-person engagement] from the community and elected officials, virtual and hybrid formats are now likely to stay; the use of on-line engagement to augment in-person meetings can be just as effective, more efficient and cost effective, and reach a much larger and broader audience, if it is done well and the right tools are used.

Given that the use of online engagement is not exclusive to one industrial sector, the aviation community can benefit from broad lessons learned and can leverage these into building a robust online engagement strategy.

While community engagement trends have been evolving with advancements in technology, changes in social dynamics, and shifts in the way people connect and communicate, new factors may also come into play, influencing the efforts airports must dedicate to community engagement activities:

- More and new people working from home (either full time or hybrid)
- Raising cargo traffic can mean new hours of operations and new routes
- Online meetings give participants an opportunity to use chat functions

Airports around the world have long recognized the importance of community engagement, but beyond the more traditional topics of noise and annoyance, or construction and expansion projects, for instance, they are increasingly facing the need to address emerging topics such as climate change, the introduction of advanced air mobility, or the adoption of sustainable aviation technologies like sustainable aviation fuels (SAF), hydrogen, and electricity-powered aircraft. Communities will also likely have more and more questions on the non-CO_2 effects of aviation emissions and how aviation - and airports – are tackling this issue.

3.4 Section Conclusion

The pandemic had a profound impact on all parts of the aviation system and required innovative ways to ensure continued business operations. Instead of suspending large scale projects due to the inability for in person consultations session, the industry was able to pivot and use online engagement to support continued work on these projects.

With the return to "normal" and relaxation of pandemic restrictions worldwide, there will likely to be push from residents in the community and elected officials for in-person consultations. It will be important for the aviation industry to ensure the lessons learned about the effectiveness and strengths of online engagement are factored into the communication plans for future projects. Augmenting in-person engagement with online methods can lead to a more robust and far-reaching consultations and new ways of soliciting input, which is ultimately the objective of most consultation plans.

Airports will also likely need to address emerging topics in the context of community engagement, especially related to climate change mitigation measures, including for non-CO_2 emissions, and the integration of clean energy into the air transport system.

Despite a **significant lack of literature** on this sub-topic, we can anticipate that community engagement activities are likely to evolve in the future, to address societal transformation and new community concerns towards sustainability (climate change impacts and mitigation measures, social responsibility and equity, etc.)

CLOSING SYNOPSYS

This report and the research behind it provide community engagement considerations, including key trends, insights, and potential challenges and opportunities for three thematic areas of emerging trends in aviation – the trade-offs between noise and emissions, new aircraft technologies, and post pandemic dynamics. This report provides States and aviation stakeholders such as airport operators, air navigation service providers, aircraft operators, environmental agencies and other government bodies, and other interested parties with awareness of the risks and opportunities facing the aviation industry from emerging trends in the context of community engagement.

> Where there is conflict between noise and emissions reductions activities resolution requires broad consensus-building efforts; community engagement is crucial in this consensus building

To ensure consistency across thematic areas a common methodology was applied to each thematic area of research including literature reviews and workshops with ICAO CAEP Working Group 2 aviation sustainability experts. In the case of the post pandemic area of study to augment literature review conducted a questionnaire aimed at airports was used to further explore post-pandemic dynamics to identify changes in noise concerns and noise issues during the pandemic.

> These new technologies have significant transformational potential to deliver new services and benefits to the communities they serve. But these technologies also come with new sets of community concerns such as privacy, public safety, social equity, and changes to employment, alongside more traditional concerns in the areas of noise and environmental

This research has shown that while climate change is a significant and growing concern across large sections of the global population, the noise impacts of adjusted routes, say, to achieve lower emissions often causes even greater concern among populations living close to airports; communities around airports at the same time are increasingly sensitive to noise. Where there is conflict between noise and emissions reductions activities resolution requires broad consensus-building efforts; community engagement is crucial in this consensus building.

Innovation and problem solving has always been a core feature of the development of aviation. The pace and scale of this innovation and change is increasing, with emerging aviation technologies such as urban air mobility, alternatively powered air transport, supersonic aircraft and spaceflight. This research found meaningful work being undertaken to advance social acceptance, but at this stage formal frameworks for community engagement often do not yet exist, which may affect social acceptance. For many new aviation technologies, it can be difficult for communities and other stakeholders to identify a sole responsible user, such as an airport or air navigation service provider, to contact when they have concerns or questions about operations. This is likely to be a barrier to effective community engagement and social acceptance of these new aviation entrants as they grow operations. At risk in this situation is access to users and society to the positive economic and social potential of the new technologies. Many existing community engagement principles (such as the ICAO "balanced approach") remain relevant to these new technologies, but new techniques are likely to be needed tailored to different operational characteristics.

> This research found meaningful work being undertaken to advance social acceptance, but at this stage formal frameworks for community engagement often do not yet exist

The authors note that the body of work around emerging technology aircraft is evolving quickly, with new content being produced and operational trials/learnings being garnered by industry regularly, including on the topic of stakeholder engagement; this is a promising signal in regard to equipping the sector for effective engagement in the future, while also highlighting the importance of future reviews in this area to support guidance.

The pandemic had a profound impact on all parts of the aviation system and required innovative ways to ensure continued business operations including the accelerated use of online tools to support continued community engagement. These online engagement methods can and are being used to augment traditional in-person engagement after the pandemic restrictions have been raised. Aviation stakeholders responsible for community engagement will likely need to address emerging topics with communities, especially related to climate change mitigation measures, including non-CO_2 emissions, and the integration of clean energy into the air transport system. Lessons learned from engagement techniques used during the pandemic restriction periods will be valuable in connecting with communities in these subject areas.

This report provides a valuable update related to community engagement at a critical point in time for the aviation industry as it continues to innovate and deliver improved economic and societal benefits. However, engagement strategies must continue to adapt to the needs of communities in the context of a activity shifts in the aviation industry.

APPENDICES

1. Literature Review Summaries

TOPIC #1: Risks and opportunities related to the growing focus on climate change and the effects and interdependencies of that on local noise issues and mitigation.

Gatwick airport anti-noise group claiming that the airport's growth plans are incompatible with climate crisis declaration in UK. (1970-present)

This website sets out how Gatwick Area Conservation Campaign (https://www.gacc.org.uk) had traditionally run extensive campaigns against aircraft noise pollution but has increasingly added the impact of aviation on climate change to its reasoning for opposing aviation operations. Both groups (climate and noise) are constituted in a single one that identifies itself as the group that occupies and is concerned about the territorial aspects of the airport's area of influence. The group requests to be consulted at different stages of progress of airport's projects and proposals. In the case addressed, the discussion is around the process of bringing the current Northern Runway into routine use.

UK Government Impact Assessment of policy to prioritize noise over emissions impacts below 7,000ft in airspace change. (2017)

This document sets out to clarify altitude based priorities during airspace changes, UK policy set by DfT was 'noise should be the 'focus' up to 7,000 feet, although the CAA may 'balance' this requirement between 4,000 and 7,000 feet with the need to minimize emissions. The research used modelling (with significant assumptions) to quantify the illustrative cost impact on the industry (additional fuel burn) of the prioritization of noise over emissions below 7,000ft. Noting that the analysis contains large assumptions and uncertainties, it showed an annual average of £4.6 million fuel costs additionally versus the current guidance; low and high estimates are £2.2 million and £7.9 million in additional fuel costs from prioritizing noise. These costs to prioritize noise were thought to be relatively low.

The Trade-Off between Optimizing Flight Patterns and Human Health: A Case Study of Aircraft Noise in Queens, NY, USA https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6121545/. Int J Environ Res Public Health. (2018)

Despite having a title that potentially seemed of relevance to this noise vs. emissions trade-offs this research doesn't really fit within the context of the noise vs. emissions subtask effort. The paper attempts to quantify the cost of an aircraft operation procedure that is used a limited amount of the time to the same procedure being used all of the time. The research estimated the monetary benefits relative to health losses associated with one significant change in flight patterns at LaGuardia airport, year-round use of TNNIS Climb, which happened in 2012 as a result of flight automation in New York City. Prior to that the TNNIS Climb was limited to times the U.S. Open tennis matches occurred. The researchers the increased noise exposure of residents living under the TNNIS Climb procedure route as the basis for estimating ground-level health

impacts and associated costs. They compared the health costs to the cost reduction achieved as a result of using the TNNIS Climb procedure year-round.

DFS/Lufthansa Case Study (Stuttgart) RNP allows for new flight procedure designs at Stuttgart airport and an additional SID was created to shorten flights departing from runway 07 with a southern or southwestern located destination. (2020-2023)

This review covers a DFS and Lufthansa created this RNP-based procedure to either shorten flight paths to save fuel and CO_2 emissions and to bypass densely populated areas to improve noise abatement. The point of contention was that the overall noise situation would improve significantly, but few communities would be affected by higher noise values by calculation regardless of the still low absolute values. The prospect of saving CO_2 had practically no effect on the willingness among communities to even accept the testing of the new procedure.

Aviation Noise Impact Management - Technologies, Regulations, and Societal Well-being in Europe. Editors: Laurent Leylekian, Alexandra Covrig, Alena Maximova. (2022)

The chapters in this title that were reviewed were: Competing Agendas for Land-Use Around Airports; Perspective on 25 Years of European Aircraft Noise Reduction Technology Efforts and Shift Towards Global Research Aimed at Quieter Air Transport; Engaging Communities in the Hard Quest for Consensus. The research found that in the desire to tailor to local conditions and only apply controls where necessary to avoid/minimize noise impact—there is considerable inconsistency in the utilization of Land Use Planning (LUP) provision. A key explanation for the range of LUP outcomes is that at the heart of the decision-making process is the need to reconcile many, at times competing, demands, such as those of conservation, agricultural, highways and railways, recreation, municipal utilities, commercial, industrial, residential and institutional developments. They study notes that despite very significant technology improvements over the past twenty years and, despite the attention being paid to other environmental impacts, aviation noise remains a major problem in Europe. Further, it finds specifically on noise vs. emissions trade-offs, those affected by noise are not the same population group (noise is a subset of the overall population affected by sustainability). Thus, the willingness of accepting a trade-off between improving noise and improving sustainability is often considered inherently unfair. The authors cite the EU 'Green Deal' as reducing the European priority for aviation noise annoyance reduction given the changing focus on climate change, claiming that when funding is provided for a wider "environmental" scope stakeholders tend to apply a limited part of it towards noise reduction.

European Aviation Noise Impact Management through Novel Approaches (ANIMA) project reports. (2018-2022)

Interdependencies between noise and emissions in the aviation sector are presented in ANIMA platform as multifaceted issue which should be considered in 3 aspects: 1) technological, 2) operational and 3) policy decision-making. An objective of ANIMA is to also consider such interdependencies and seek out insights into how airports or airlines address these potentially competing issues. However, ANIMA concluded that more work is needed on interdependencies. The study mapped different stakeholders in terms of how they weigh operational and environmental aspects differently. For communities around airports limiting or decreasing the impact of both noise and exhaust emissions related to air quality (NOx and PM) is important. Airlines focus on operational costs/revenues and sustainability goals. Authorities/regulators seek that

airport and airline operations are safe, along with ANSPs. Airports tend to look for a balanced operation in accommodating the airlines and the needs of the community around the airports, working together with regulators and ANSPs, and - last but not least - serving their own interests in being a viable, responsible and responsive entity.

TOPIC #2 - Emerging Technology Aircraft

Urban Air Mobility: History, Ecosystem, Market Potential, and Challenges (2021); Cohen, Adam Phd; Shaheen, Susan A, PhD; Farrar, Emily M

The first few sections of these papers provided significant insight into the evolution of industry. One of the important findings that can be extrapolated from this background research is the barriers to entry. The most obvious is the cost associated with these technologies. However, over the last several decades these costs have started to decrease as the industry determines ways to reduce costs.

The paper provides a good overview of community acceptance challenges and mitigation strategies as the industry transitions to the next stage in its evolution. By providing mitigation strategies to reduce the impacts of noise and visual pollution and provide equal access and personal safety, the authors cover a range of strategies to keep the public in mind as other stakeholders move forward. These mitigation strategies include, expanding access through special pricing models, operational considerations to avoid sensitive areas and restricting the use of photographic devices around communities – amongst others.

Advanced Air Mobility: Demand Analysis and Market Potential of the Airport Shuttle and Air Taxi Markets (2021), Goyal, Rohit; Reiche, Colleen; Fernando, Chris; Cohen, Adam

Although this paper does not focus on traditional community concerns surrounding AAM, it does address some of the economic considerations made by the community. As mentioned in the summary above, the authors found that "AAM could replace non-discretionary trips greater than 45 min; however, demand for discretionary trips would be limited by consumer willingness to pay." Furthermore, in the author's conservative estimates the AAM industry would serve 82,000 passengers daily.

Mobility on Demand Planning and Implementation: Current Practices, Innovations, and Emerging Mobility Futures (2020); Shaheen, Susan A.; Cohen, Adam P.; Broader, Jacquelyn; Davis, Richard; Brown, Les; Neelakantan, Radha; Gopalakrishna, Deepak

As a guide to UAM, this paper outlines what constitutes UAM and provides a range of definitions and common terms. It also provides a list of conditions to be considered when classifying an operation as UAM. Beyond that the paper also provides some baseline insight into the airspace classification used by FAA.

Even if a significant amount of time is not spent on elaborating on potential concerns with UAM, the look into skyports and the ways to improve community usage of them is an important insight from this paper. This guide provides different facilities that can be incorporated into skyport design to engage the community. From athletic facilities to community event space, this paper highlights an important need to keep the community in mind when building and designing UAM infrastructure.

Urban Air Mobility: Opportunities and Obstacles (2021); Cohen, Adam; Shaheen, Susan

After a brief introduction on the history of UAM, this paper moves into an exploration of the potential barriers/challenges to UAM and the potential UAM use cases. The authors identify research gaps in regard to environmental, travel behavior and surface transportation network effects and believe that looking further

into these topics could "help to address many UAM concerns." Additionally, they identify the need for research on emission impacts and land use/societal equity impacts of UAM on communities.

Amongst the concerns listed by the authors several are derived from the community. Passenger mobility, affordability, social equity, visual/noise pollution, activity over residential areas and range anxiety are all listed. Despite this lengthy list, there is little in the way proposed mitigation efforts to address these concerns. Instead, the authors weigh these against potential benefits of increasing UAM operations.

Implementing Mitigations for Improving Societal Acceptance of Urban Air Mobility* (2022)*; Ender Çetin; Alicia Cano ; Robin Deransy;,Sergi Tres; Cristina Barrado

This paper addresses public perception of drones and provides mitigation efforts to address those concerns. Safety ranks the highest amongst public perception of drones followed by noise pollution. However, environmental impacts on humans, fauna, and flora as well as privacy concerns are also addressed in the paper. Ultimately it provides a framework for regulators to use when identifying measures to address public concerns about drone operations.

Using a range of surveys from 2015 to 2021, which address public perception of drones and/or UAM, the authors determined that "between half and three-fourths of the public accepts the deployment of business-related drone operations." Regardless, survey participants mentioned Safety, environment, privacy and noise concerns all as concerns. Additionally, At the CORUS-XUAM workshop, which consisted of professionals in the aviation sector, 59% listed safety/security as the primary concern with drone operations, followed by environmental impacts at 33% and Privacy at 9%.

Based on this information the authors identified a list of mitigation efforts and assigned a difficulty of implementation rank to each of the efforts (Easy, medium, difficult). From there, the mitigation efforts were assigned a score and ranked. Each of the top 10 mitigation efforts also include a list of the concerns addressed by the effort. For example, the mitigation effort to limit minimum altitude, which ranked 1st amongst proposed mitigation efforts, addresses, noise impact, impacts on animals, safety concerns, security concerns and privacy.

To summarize, "Social acceptance can be facilitated by ensuring mitigation measures that prevent the negative impact of drones on citizens and on the environment. Public concerns are identified, and actions that mitigate them shall be implemented well in advance of urban air mobility widespread deployment." The authors conclude, "Social concerns need to be anticipated and mitigated in advance if urban air mobility is to become an accepted part of a modern, efficient, environmentally friendly, and competitive future mobility."

Urban Air Mobility Market Study (2018); NASA; Crown Consulting Inc.; Ascension Global; Georgia Tech Aerospace Systems Design Lab; McKinsey & Company

The presentation provides an overview of the UAM Market Study which had three deliverables, one of which is an overview of potential public acceptance landscape and possible solutions and barriers to widespread UAM adoption. The study focused on three main use cases: Last-mile delivery, Air metro and Air taxi.

The document provided key insights into public concerns when it comes to UAM

- Safety: Consumers distrust autonomous technology and are not aware of safety systems in place
- Privacy: civil liberties groups have privacy concerns with widespread UAM adoption but may misunderstand how camera equipment is used in sensing system technology
- Job security: there is concern that autonomous technology will render jobs obsolete across multiple industries
- Environmental threats: waste build up from batteries, impact on wildlife, and energy usage concern younger consumers
- Noise and visual disruption: Auditory and visual disturbances in residential neighborhoods are likely to create strong, localized pushback as the market expands

The document also recommends a comprehensive strategy to address public concerns to counteract misinformation and have a proactive engagement with interest groups in the areas of R&D, unified messaging from industry, and proactive engagement with concerned groups.

Urban Air Mobility Noise: Current Practice, Gaps, and Recommendations (2020); NASA

The document mainly covers the current practice, gaps in the current practice when applied to UAM noise, and recommendations to address the gaps. The document provides detailed technical information about noise and noise assessment, and how to measure noise annoyance and human exposure to noise. Community engagement is not in the scope of this document.

AAM Project National Campaign Overview (2020); NASA

The overview of the NASA Advanced Air Mobility National Campaign is less of one document, but more of a collection of websites and news articles highlighting the campaign goals and progress. Starting a few years ago NASA has been conducting tests together with Advanced Air Mobility (AAM stakeholders under the National Campaign program. The first stage of the campaign (NC-1) is focused on low-density safety scenario, including beyond visual line of sight (BVLOS) operations, two-way network flight plan communications, and noise. The goal of the testing campaigns is to promote public confidence in AAM safety, facilitate community-wide learning, and to collaborate with stakeholders on development of critical enabling systems.

Although the websites suggest that demonstrations of new technologies are the main way to engage the public on safety, applicability, and noise of AAM vehicles, no specific detail is given into how to best interact with communities on the data gathered.

Requirements for Drone Operations to Minimize Community Noise (2022); Carlos Ramos-Romero; Nathan Green; Seth Roberts; Charlotte Clark; Antonio J. Torija

A key point that the paper acknowledges but sets aside for this particular study is that typical aircraft noise metrics and impact assumptions may not be applicable to drones due to the unique nature of their noise emissions. Further research is needed to be able to derive suitable limits for either the number of drone flyover events above a certain maximum level, or an average noise metric that can be shown to correlate with mean annoyance. Uncertainty about sound transmission through building partitions may differ for the

higher frequency broadband noise associated with drones. This could have implications on existing or future sound insulation programs.

Strategies to improve the social acceptability of drones (2021); Raphaela Chakravarti, Seira Iwai, Suhara Wijewardane

The report included several recommendations on community outreach, including:

- Bringing drone technology to new users and communities through "drone pop up shops", "as an opportunity to take the technology to communities, giving TC the chance to show locals how the technology is used, speak about its registration/safety processes, the benefits to that community, and to give locals a chance to fly them."
- Organizing "a series of topical webinars – as information sessions, panels, or presentations which could be themed on an identified stakeholder group, on a key thematic issue, or done in partnership with a specialized group. For example, a session on drones for Indigenous communities could be done together with the First Nations Technological Council, or a session on how Next Gen drones support decarbonization could be done with the Canadian Environmental Network. This helps to reach new audiences and connect the benefits of drones with established networks and issues. In all public messaging, emphasis should be placed on positive applications for drones that promote public good."
- Improving messaging strategies, specifically incorporating "drones within broader, established narratives that are popular worldwide, particularly in the context of Canada's commitment to the Sustainable Development Goals. Given the previously outlined direct ways that drones are contributing to the realization of these goals, TC could promote and publicize these applications as a good way to gain acceptability, while supporting meaningful action towards their achievement."
- Finally, the authors identified "a number of novel applications for drones, particularly those with public good/social equity implications which we felt were under-communicated and would perhaps go a long way to improving public acceptability. The reason we emphasize "public good" is because public opinion research has shown the highest approval for drone services and applications that support a public good rather than commercial services that do not have the same public dimension. Therefore it appears to be important to highlight these social equity implications, as a way to help prime the public in terms of social acceptability, and to build the trust needed to facilitate support for more complex, next generation applications. For example, the disability applications, benefits for Indigenous land defense, and rural and remote applications reflect more of a public benefit."

An Assessment of Public Perception of Urban Air Mobility (Year TBC); Airbus

The paper provides results of am attitudinal survey conducted in four countries (US, Mexico, Switzerland, New Zealand) concerning factors addressing acceptability of UAM operations. It does not address stakeholder engagement per se, but focuses on acceptability of operations and makes recommendations for demographics that would find UAM operations more acceptable; i.e., wealthy, urban, educated.

Community Benefits of Urban Air Mobility (2020); CAMI

This is a brief (2-page) brochure that describes community air mobility and lays out challenges and steps communities should take to begin planning for UAM operations. The brochure identifies steps communities should be taking to prepare for UAM operations, including gathering data about today's transportation patterns, ambient noise landscapes, and weather; understand current airspace usage in their jurisdictions; review existing heliport and airport facilities for UAM suitability; begin identifying new vertiport location

opportunities, both through new development and through partnership with existing infrastructure; begin stakeholder conversations (e.g., community leaders, business community) to provide information on UAM as well as understand their concerns; explore potential public/private partnership structures and opportunities for UAM; understand electric grid capacity and what needs to be done to facilitate broader transportation electrification, including UAM; identify their point person to lead the UAM conversation and open a dialogue with industry and the associations that are here to assist in this process.

Fast-Forwarding to a Future of On-Demand Urban Air Transportation (2016); Uber

This is an older document that posed some early thoughts on challenges of implementing UAM in communities. Addressing noise will require planning around and close coordination between vehicle design, landing site and route planning, and dynamic scheduling of each flight. Siting of infrastructure and planning of VTOL operational patterns will rely on ensuring that flight patterns can be accomplished without exceeding the target noise level at the endpoints and over the route to be flown, based on actual acoustic monitoring. Measuring physiological loudness and annoyance terms in real time can enable dynamic operational planning to address the community noise standards that are developed.

Dynamic noise measurement and operational planning could enable operators to direct traffic to locations - distances being equal - that have a higher acoustic reserve (having handled fewer recent flights or having a higher background level) over the quieter one. Visual pollution concerns can be addressed via trip route modifications to avoid particularly sensitive vistas or consolidating traffic to existing commute corridors such as above highways. Regarding privacy, operators will need to dynamically and precisely route each flight over less sensitive areas, maintaining appropriate clearance above private property.

Advanced Air Mobility: Integration into the Airport Environment (Year TBC); ACI

This policy brief mainly focuses on considerations for airport operators in anticipation of the arrival of AAM and its impacts. As AAM moves from concept to reality, it states that the aviation industry needs to address challenges around the new or different propulsion types, fuel requirements and capacities, aircraft and operational certification, societal acceptance, noise management, infrastructure equipment, and regulatory developments.

It suggests that airport operators should consult and coordinate with local communities, businesses, cities, and authorities to identify possible local needs and demands for AAM to allow adequate planning and coordination to support economic growth and efficient mobility in the surrounding communities. This can help airport operators better facilitate AAM integration into the airport's master planning activities and sustainability strategies. Understanding potential local needs for AAM can also help develop community engagement strategies as public acceptance is a critical success factor of AAM deployment.

In terms of community engagement, the policy brief recommends an early and extensive community engagement. The management of noise or perceived noise, such as noise level, frequency, and duration, as well as the non-acoustic factors will need to be addressed during the engagement.

The Potential Societal Barriers of Urban Air Mobility (2022); Shaheen, Susan, PhD; Cohen, Adam; Farrar, Emily

The report focuses on passengers willingness to fly in UAMs. It provides a literature review of previous research on willingness to fly in fully automated vs automated but with pilot or piloted aircraft. The review also covers how various biases such as gender bias affect willingness to fly. From a non-user perspective, concerns were expressed about privacy with it suggested that there should either be minimum heights for UAMs to fly, or that they should have to fly over existing road infrastructure rather than point to point.

From a non-user perspective, concerns were expressed about privacy with it suggested that there should either be minimum heights for UAMs to fly, or that they should have to fly over existing road infrastructure rather than point to point. Research also showed that preference was expressed for flights overhead to have a pilot, or at least a flight attendant, due to safety concerns. In addition, the report states that "existing noise concerns focus on traffic noise during the night and early morning; noise from UAM could pose a more notable obstacle in the future as electric vehicles become more mainstream (potentially causing a reduction in overall ambient noise making UAM more noticeable."

Future Aircraft and the Future of Aircraft Noise (2020); Knobloch, K. et al.

This chapter address the potential differences in noise associated with various future aircraft concepts. These aircraft concepts are essentially future variations to current commercial aircraft that would operate similar to current aircraft and from current airports. They would replace the current fleet of aircraft. The chapter contained very detailed technical descriptions of 4 different aircraft design technologies.

The chapter did not address completely new modes of transportation such as Urban Air Mobility and Advanced Air Mobility that have very different acoustic and operational characteristics. This chapter did evaluate new Supersonic aircraft. These supersonic aircraft would operate similar to current aircraft in the airport terminal area. But would have a sonic boom during the enroute phase of flight that is significantly less then old technology, but still creates some level of audible noise.

The information on the supersonic aircraft is based upon the information available at the time of the report research (2020). Given the quickly changing environment, other documents may have more recent up to date information. For example, this document assumed that these aircraft would not fly supersonic over land. Which is not the current expectation.

Advanced Air Mobility and Community Outreach: A Primer for Successful Stakeholder Engagement (2024); National Academies of Sciences, Engineering, and Medicine

This document available on the Community Air Mobility Initiative (CAMI) website provides an overview of the basics of AAM and an excellent overview of stakeholder and community engagement considerations, including how to prepare an engagement plan. It includes case study interviews and lessons learned by industry players and a range of content on concerns for airport neighbours, equity consideration and land use compatibility to name a few. The document also includes a stakeholder engagement toolkit encompassing fact sheets, presentation decks and event templates. Overall, its content touches on a number of relevant topics covered in this ICAO paper. While it was published and identified at a late phase in the literature review, it represents a useful resource and example of a framework that can be applied in consideration of AAM. Future work on this topic should consider the resources, publications and content being put forward by CAMI.

Additional Artefacts reviewed in the development of the section related to ETA:

- *Sustainable technology acceptability: Mapping technological, contextual, and social-psychological determinants of EU stakeholders' biofuel acceptance; Dessi, F et al*
- *Perspectives on advanced air mobility: Navigating the emerging passenger urban and regional air-mobility industry (2022); McKinsey & Company*
- *NASA Advanced Air Mobility Portal: Tribal Consultation and Coordination (accessed 2024) NASA Tribal Consultation and Coordination | NASA*
- *Terms of Reference for Spaceport Nova Scotia Community Liaison Committee (2021); Maritime Launch Services*
- *EASA Drone Consultation Web site (accessed 2024) Public consultation launched - Drone Strategy 2.0 - for a smart and sustainable unmanned aircraft eco-system in Europe | EASA (europa.eu)*
- *Presentation on Community Testing with Quiet Supersonic Aircraft (2023); NASA Langley Research Centre*
- *Beyond the triangle of renewable energy acceptance: The five dimensions of domestic hydrogen acceptance (2022); Gordon, J. et al*
- *Australian Government consultation on drone delivery (accessed 2024)*
- *Canadian Government consultation on drone delivery (accessed 2024)*
- *Joby Aviation Environmental and Social Governance Report (accessed 2024)*
- *FAA web content on NEPA and Drones (accessed 2024)*
- *Recording of Urban Air Mobility Noise Working Group Panel: Community Engagement for Advanced Air Mobility (accessed 2024); NASA Langley Research Centre*

TOPIC #3 – Post-Pandemic Dynamics

Digital Community Engagement Toolkit (2020) Presentation; Kirkman, Ann-Marie; Papachristos, Mary; Mueller, Stacy

This document is provided in presentation format and identifies various digital tools for use in each stage of the engagement spectrum defined by the International Association of Public Participation (IAP2): inform; consult; involve; collaborate; and empower. As there are a wide range of digital tools available each with its own strengths and weakness, this document provides helpful information on which tools to consider based on the engagement outcome you are seeking to achieve.

While this document is not specific to the aviation industry, the concepts and digital tools identified may be useful to the industry as it looks to incorporate elements of digital engagement with the community during and post pandemic.

Community Engagement During the COV-19 Pandemic and Beyond (2020); Fedorowicz, Martha; Arena, Olivia; Burrowes, Kimberly

This document serves as a reference guide and was written to help organizations conduct community engagement in an online remote environment. While the guide was developed as a guide specifically for engagement under pandemic conditions where in-person gatherings were restricted due to public health orders, the concepts and practices outlined in the guide can be used to structure any type of online remote engagement.

Community engagement during COVID: A field report from seven Clinical and Translational Science Awards (2021); Marsh, Erica; Kappelman, Michael; Kost, Rhonda; Mudd-Martin, Gia; Shannon, Jackilen

This document servers as a case study of how university researchers were able to pivot from in-person to remote interaction during the pandemic to support ongoing community engagement and research. The case study looked at seven universities in the US and summarized how researchers were able to successfully adopt virtual approaches to engagement during the pandemic to sustain ongoing and new research and highlighted the fundamental principles of meaningful and authentic stakeholder engagement being of paramount importance to success.

The Event Safety Alliance Reopening Guide (2020); Multiple Contributors

This guide provides a collection of industry practices for organizers hosting in-person events during the pandemic with the goal of promoting life and health safety throughout all phases of the event. The practices identified in this guide may also be useful post-pandemic to address concerns from some community members that may be anxious or reluctant to attend in-person events due to health and safety concerns. The guide provides a wide range of "best practices" as each event is unique given its size, venue, spectrum of public health orders, etc., and identifies foreseeable health risks for each stage of the event process and suggested mitigation options.

Digital Engagement, Social Media & Public Participation (2017); Lyons, Susanna

This document applies to any type of digital public engagement process, and the ideas and concepts are relevant to the aviation industry – especially with the industry's past focus on in-person face-to-face type of engagement strategies. During the pandemic, the aviation industry had to adopt digital engagement strategies and there will likely remain a place for some form of digital engagement post-pandemic.

As this paper was written before the pandemic, it may not reflect current social attitudes, reactions, and potential increased acceptance for online engagement. Nevertheless, it still provides helpful considerations for the aviation industry when deciding when and how to use digital tools to support a well-defined public engagement process that has clear goals and objectives.

While examples of digital tools are referenced in this document, it acknowledges that technology changes very rapidly and one needs to keep abreast of which tools are most appropriate for the type and objectives of the engagement.

Community Engagement – South Central Florida Metroplex (2022); US Federal Aviation Administration Website

The material on this website serves as a case study of how the US FAA conducted virtual community engagement to support a major airspace change project during the pandemic when in-person meetings were restricted.

The project, referred to as the South-Central Florida Metroplex initiative, went live in 2022 and optimized arrival and departure procedures for twenty-one airports. As community involvement was a critical part of the environmental assessment, the FAA hosted a series of virtual workshops to provide information on the draft environmental assessment and answer questions from the community.

The virtual workshops included live question and answer sessions with environmental and air traffic control experts. Overall, the workshops received more than 119,000 views across the state. The virtual workshops allowed the project to remain on track and proved successful for engaging with many people and fulfilling the requirement for community engagement.

Aviation Noise Impact Management - Technologies, Regulations, and Societal Well-being in Europe (2022); Open Access Book

This book focuses on the achievements of the ANIMA project (Aviation Noise Impact Management through Novel Approaches) and provides information on aviation noise with a focus on reducing annoyance.

While the book contains broad and general information about community engagement, there were a few references relevant to community engagement during the pandemic. These include recognizing the importance of communication especially when there is a change in the noise exposure condition, understanding the differences in annoyance in cases of changing versus stable noise exposure situations due the changes in the volume of air traffic, and seeking to leverage digital technology in post-pandemic noise management and community engagement exercises.

Luton Airport/NATS – Virtual Consultation on New Flight Paths (2020); Luton Airport and NAT UK Websites

The materials on these websites provide a case study on the use of virtual meetings and digital information as a good alternative and primary means of conducting public outreach during the pandemic to support proposed changes to arrival procedures for Luton Airport.

This was the first airport in the United Kingdom to conduct consultation in a fully virtual setting. The meetings were well attended and considered a success in fulfilling the regulatory requirements for community outreach.

Survey on People's Experience of Aviation Noise during Lockdown (2020); UK Independent Commission on Civil Aviation Noise (ICCAN) Summary Report

The document summarizes the findings from community surveys, conducted on behalf of ICCAN, on experiences of aviation noise during the pandemic by people living close to five airports in the UK.

The goal of the survey was to gather people's view on aviation noise from reduced air traffic volumes with the aim of understanding how this might change as the aviation industry recovers. Unfortunately, only the summary notes are available online, and the full report could not be accessed.

While the summary notes do not directly discuss community engagement strategies, it has useful information on the community's response to aviation noise as well as their thoughts on recovery. However, as each community is unique, the results of a similar survey would likely yield different results for each airport, and it is likely a challenge to project the ICCAN results across all airports.

ICCAN noted their plans to repeat the survey in the future when air traffic has recovered to provide comparative results. Future surveys of this type could provide useful insights into post-pandemic community engagement and noise management strategies.

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2. Airport Community Engagement During/Post-COVID-19 Pandemic: Verbatim Responses to Questionnaire

QUESTION	Toronto Pearson International Airport (Canada)	Queen Alia International Airport (Jordan)	Direction Générale de l'aviation Civile (France)	DFS Deutsche Flugsicherung GmbH (Germany	Vancouver International Airport (Canada)	London Heathrow International Airport (UK)
1. How have you engaged with community stakeholders on noise and airport issues during and after the COVID-19 pandemic?	Throughout the pandemic, Toronto Pearson engaged with community stakeholders virtually. We do continue to mainly engage in this way. We did hold some in person community open houses in Spring 2023.	Yes	DSNA have a generic email address for environmental complaints and requests. For Paris airports (Roissy, Orly, Le Bourget), information about the traffic, QFU in use, altitude of interception of finals, etc. are uploaded on the ministry of transport website every month.	Noise abatement commission consultations continued during the pandemic. Noise complaints reduced. It seems that communities considered traffic decline as the natural reaction to their demands.	During the pandemic, the Vancouver Airport Authority ("Airport Authority") supported NAV CANADA's work on the Vancouver Airspace Modernization Project which involves restructuring the IFR arrival routes for YVR and for other areas in the south-west region of the Province. Work on this multi-year project continued during the pandemic. While the planning for community consultations occurred during the pandemic, the actual consultations occurred in December 2022 – February 2023, during a time-period when public health restrictions on meetings and gatherings were being relaxed. As such, a hybrid approach of on-line and in-person community engagement sessions were hosted. The consultation plan was jointly created by NAV CANADA and the Airport Authority, and our staff attended to support NAV	During the Covid Pandemic many staff were initially placed on furlough meaning that community engagement forums were largely stopped with communications managed through website and social media channels. As restrictions relaxed online "TEAMS" forums were used to reconnect with Community Group Forums.

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						CANADA at the information sessions.	
2. Did you implement different techniques to respond to noise complaints during and after the COVID-19 pandemic?	**a. If so, can you list/describe them?**	For the majority of the period since the pandemic, we have not taken 'live' calls as we were working remotely. The majority of our contacts came through online complaints through our form and WebTrak. For phone complaints, we now rely on voicemail only.	We have annual meeting with local community, that received their feedback, in addition, we have representative from local community attending our quarter airport environment committee meeting.	DSNA is developing a website that will allow anybody to access precise statistical information of overflight: numbers, altitudes, comparison up to 5 years. The project was launched before the pandemic.	Techniques haven't changed. People have to get explained that increasing noise is not new noise but returning traffic volume.	We relied on our regular methods of email and telephone to respond to complaints. While we would also normally offer to meet with complainants in person at our office to review and discuss their concerns, we offered to host these meetings online instead. Only one individual accepted our offer to met online.	The Covid period was used to undertake a review of our Forum structure and TORS, hybrid meeting are now a common feature and most 121 dialogue is conducted this way rather than in person. Complaints were largely managed in the same way.
	b. What can be learnt from these strategies?	We have had few complaints about not taking 'live' calls anymore. This strategy (due to circumstance of remote working) demonstrated that taking live calls was no longer critical for us. As mentioned above, most contacts are made through online platforms, so a lower proportion of complainants are expecting someone to answer their call. We also aim to have a quick turnaround so residents aren't waiting too long for an answer. As a result we do not receive much criticism for not taking live calls. Relying more on voicemail allows us to better prepare for a call – we can understand the nature of the complaint, type of operation, and individual's history with our office. We are also able to respond with one					

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	phone call when several calls are made by the same individual over a short period of time. This cuts down on our overall time on phone calls.					
3. Did your priorities in terms of community engagement or how you respond to noise complaints change during and since the end of the pandemic?	Please see note above regarding live calls versus voicemail only. With the influx of complaints as traffic returned, we did implement a no callback approach for individuals we'd spoken with multiple times on the same issue. This has been referenced in our Complaints process document for a few years, however we have applied this option more regularly over the last year. We always explain to an individual that we will continue to accept their complaint, but will no longer respond unless there is a change in impact or information.	NO	No change	We are facing a trifold challenge in community engagement: 1. returning traffic; 2. new procedures combined with new traffic where old effects (regrowing traffic) and new effects (new flight paths) are being mixed up; 3. PBN: all new procedures are designed to meet PBN criteria which sometimes alters flight paths or procedure dep. This causes confusion about a) returning traffic, b) returning traffic on new flight paths., c) new traffic.	No change to priorities.	No change to priorities but structure of Forums changed.
4. Did you notice any changes or general trends in the demographic groups in community engagement activities during the pandemic?	Operations are not as they were prior to the Pandemic despite returning traffic. We are therefore engaging with communities that were less impacted prior to the Pandemic than they are now. We have also found that some residents purchased their homes	NO	No information on a possible change in demographics	No. Still well educated mostly retired people.	We observed no general trends in changes in complainant demographics; however, privacy policies prevent us from asking questions	Not significantly although as the recovery continued "new" complainants emerged.

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		during the Pandemic and so are surprised to find that they are living under a flightpath and/or are exposed to high traffic and noise levels.				to determine demographics.	
5. Did you notice any changes or general trends in the complaints/annoyance profile (please describe), i.e.:	**a. Demographic changes**	Different communities, but similar demographics as in the past.	NO				No
	b. Subject of complaints/concerns	Amount of traffic due to reduced use of runways leading to higher concentration of traffic over specific areas. There seems to be more mention of air quality and health impacts than there were pre-Pandemic.	NO				no – night flights still primary issue along with individual noise levels (too loud/too low)
	c. Frequency of complaints	Similar to the past, high volume complaints are made by just a few people.	NO	One noticeable change is the number of people arguing after a first response, sometimes with multiple requests and even aggressive one.			Not particularly
	d. Other	People are joining together at our online meetings. They are sharing their contact details and cc'ing each other on emails. They are writing to us very frequently in addition to submitting noise complaints.	NO		In certain cases, communities are organised very well and produce complaint samples to promote mass complaints.	We observed a greater percentage of first-time complainers during the pandemic; however, we have not done a detailed analysis of historical data to determine if this trend was observed in past years. For people that contact us for the first time, we do spend extra time to investigate and ensure a thorough response with supporting data and information. While this results in	

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					additional workload and resources on staff, we do observer that many of these individuals do not submit further complaints after receiving a comprehensive response.	
6. Do you believe there has been a change in the perspective of airport's importance/value to the community wellbeing since the pandemic?	I don't know at this point, but we are doing some more tracking on sentiment to airport.	Yes, more engagement and considering community feedback.	Yes, more people are referring to climate change impacts. But mostly, effects of noise on general health are mentioned.	No. But there is a growing gap between an increasing standing for climate protection and continuing flying (officially critical about aviation but continuing flying.	Difficult to quantify this. We did include general messages highlighting the importance of 24/7 airport operations to economic recovery in our responses to complainants. These messages were drafted in collaboration with our communications team to ensure consistent messaging was used.	Difficult to form an objective view without independent data but feedback from community groups supportive of the airport was forthcoming and responses to the latest round of Noise Action Planning was higher than any other round
7. Are there any new trends or requirements you think have emerged from the pandemic, e.g., new/different stakeholder groups that should be leveraged government involvement, need for government policy, etc.?	Land use planning issues has become a common concern among Canadian airports. We do need more support from all levels of government and perhaps new policy to protect lands from development that could restrict airport operations.	NO	Yes, the law "Climate and resilience" has been edited. But it is a result of climate change adaptation and decarbonisation objectives rather than due to the pandemic episode.	It sometimes seems that communities consider the reduced traffic during the pandemic as the logic reaction to their demands. Secondly there is hardly any consciousness about the reduction of short	No – nothing specific related to the pandemic.	Not related to the pandemic.

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				haul flight. For any reasons airlines are very reserved about this.		
8. Have you experienced a change in government relations stemming from community pressures and expectations?	The Canadian government has introduced Bill C-52 that if introduced could lead to significant changes to how we assess and consult on temporary impacts. It will be very difficult to meet the stringent requirements in a dynamic airport environment. Local MPs have indicated support for the Bill, so we need to influence its content to something that is realistic for airports, particularly as there are enforcement actions that can be taken against the airport and ANSP, and permanent projects can be put on hold until community complaints around the consultation process are assessed.	NO	Technical services are increasingly in demand, an increasing number of acoustic measurement campaigns have been organized to have elements of answers, as we have noticed a stronger feeling after the pandemic with a feeling of higher traffic than before the pandemic.	The present German government tried to include "effective noise protection" in the official duty (safe, orderly expeditious) of ATC in Germany with some priority, but finally failed.	Due to the ongoing NAV CANADA Vancouver Airspace Modernization Project and the supporting community consultations, there is heightened community and political awareness and interest in noise issues (including health impacts), particularly from communities located further away from the airport where the new proposed arrival routes would impact. This has resulted in us expanding our government relations outreach to these communities to ensure they are supported with accurate information about the project. The increased focus on noise was not exacerbated or influenced by the pandemic.	Noise policy is under review in the UK partly in response to community noise group pressures and emerging research.