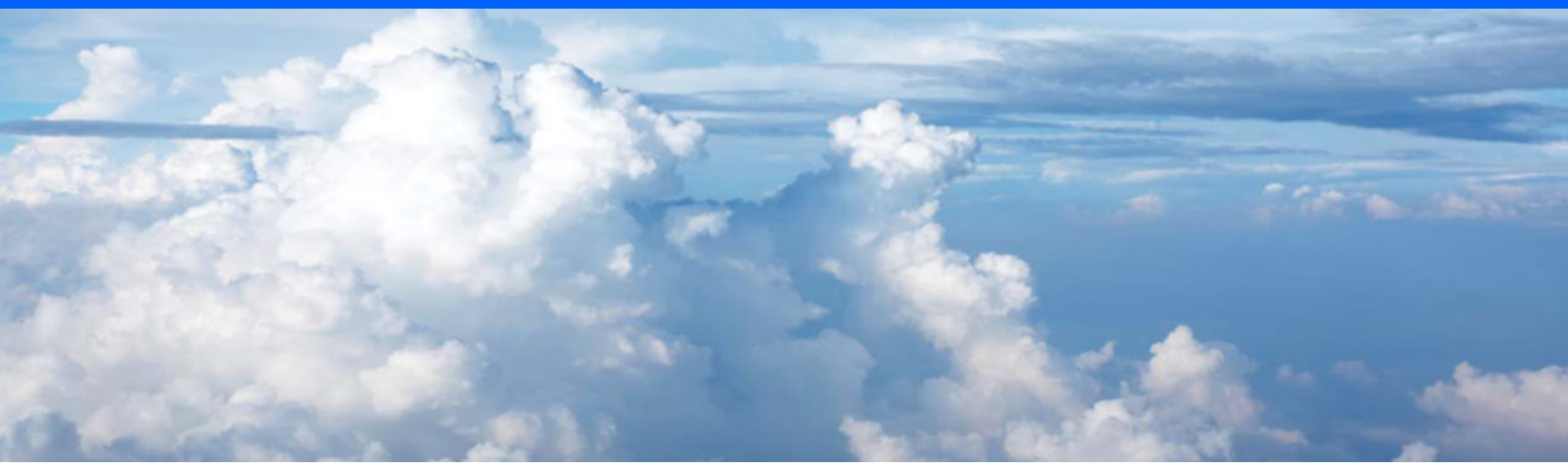
ICAO

ENVIRONMENT

Environmental Community Engagement for Performance-based Navigation



2019

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1 Introduction

1.1 Background

Community engagement is an important aspect of aviation projects such as Performance-based Navigation (PBN). ICAO recently published Circular 351, *Community Engagement for Aviation Environmental Management*, that examines general industry practices.[1] This report, tasked by the Committee on Aviation Environmental Protection (CAEP) summarizes good practices used by Member States to engage communities on the deployment of Performance-based Navigation.

1.2 Approach

This report gathers information on PBN implementation challenges, needs and potential solutions, including methods for cross-industry collaboration and structured community engagement; and includes information from States, ANSPs, airports, and aircraft operators.
The report includes:

- a compilation of a body of information on issues with PBN implementation;
- identification of any gaps/needs and recommended next steps to supplement the recently published ICAO Circular 351 on community engagement and the appropriate format; and
- development of proposals on how to disseminate the deliverables.

2 Methodology

A three-phased approach was undertaken to develop this report: developing a plan for the work; collecting data; and documenting the results of the work.

In Phase 1, the task objective was reviewed and four methods for data collection and analysis were defined:

i. A CAEP memorandum and survey was developed for States and CAEP Observers to provide information on current PBN activities, related approaches to community engagement, and areas where further ICAO guidance or assistance would be beneficial.

ii. A review of ICAO Circular 351, *Community Engagement for Aviation Environmental Management*, to identify how it might be supplemented to support PBN implementation.

[1] See: https://www.icao.int/environmental-protection/Pages/Community-engagement-for-aviation-environmental-management.aspx

iii. A review of State PBN Implementation Plans to identify information regarding plans/processes for community engagement, community concerns or benefits.

iv. A literature review.

Data collection and analysis in the areas defined above was conducted as follows:

i. A CAEP memorandum and survey were sent to CAEP Members and Observers in May 2017 inquiring about their experiences with community engagement for PBN. A total of 33 responses (update as needed) to the survey questionnaire were received. Responses came from several types of organizations including ANSPs, airport operators, State/Regulator/CAAs, manufacturers, NGOs, and procedure designers. The survey generated detailed information with which to characterize different community engagement experiences (see section 5).

ii. ICAO Circular 351 *Community Engagement for Aviation Environmental Managemen*" was reviewed for information that might specifically relate to PBN (see section 6).

iii. ICAO State PBN Implementation Plans that outline State goals and progress in implementing PBN into national airspace were reviewed. Ninety-nine of these documents were reviewed to gather information about good practices relating to PBN implementation and community engagement (see section 7).

iv. A review of documents relevant to PBN and community engagement was carried out (see section 8).

In Phase 3, the findings from the previous two phases were documented leading to this report. The following sections provide details of the information gathered and assessment of their implications and, where relevant, gaps in knowledge, guidance or understanding that may exist.

3 Definition of Performance-based Navigation (PBN)

Performance-based navigation (PBN) is an advanced form of air navigation which primarily leverages the accuracy provided by satellite-based positioning and the navigation capabilities of modern aircraft flight management systems (FMS). ICAO defines PBN as 'Area navigation based on performance requirements for aircraft operating along an air traffic service (ATS) route, on an instrument approach procedure, or in a designated airspace.' ICAO further explains that 'PBN[3] specifies that PBN performance requirements are expressed in navigation specifications, in terms of accuracy, integrity, availability, continuity and functionality required for the proposed operations in the context of a particular airspace concept'. Navigation specifications set out performance requirements and are defined to a sufficient level of detail to facilitate global harmonization by providing specific guidance for States and operators.

Aircraft using PBN can navigate along a defined path with much greater precision and accuracy than with legacy navigational systems. While the benefits of PBN enable the safe improvement of flight efficiency, its implementation to deliver these efficiencies can result in airspace changes affecting aircraft flows.

More information on PBN can be found in ICAO's *Performance-based Navigation (PBN) Manual* (Doc 9613).[2]

ICAO's PBN concept, introduced in 2008, is not a means in itself but it is an enabler for new airspace and instrument procedure changes which in turn produce improvements in safety, efficiency, capacity and environmental impacts. The PBN concept aims to:

- Ensure global interoperability through standardization of PBN performance requirements through internationally agreed are navigation (RNAV) and required navigation performance (RNP) specifications; and
- Limit the proliferation of non-standard RNAV applications in use worldwide.

The use of precise tracks is often cited as beneficial to noise and emissions, however, such a focusing [3] of aircraft over a smaller area may result in an increase in noise events for some, while reducing it for others. Some communities in close vicinity to concentrated PBN flight paths have concerns with how PBN is implemented. As the aviation industry moves forward with modernization of air navigation systems, collaboration among operational stakeholders (e.g., ANSPs, aircraft operators) in the process of deploying new technologies such as PBN is essential to address community concerns.

Potential benefits of PBN include reduced track miles to destination and associated reductions in flight time, fuel consumption and emissions. PBN can improve overall sequencing and airspace efficiency while reducing air traffic control and aircrew workload as well as frequency congestion. Good airspace design utilizing PBN capabilities can enable the use of continuous climb and continuous descent operations (CCO/CDO). CDO is quieter as a result of reduced aircraft thrust and flap settings compared to a conventional step-down approach; aircraft may also be at higher altitudes for some segments of the approach. Another advantage of PBN is a reduction in the need to rely on ground-based navigational aids, which in turn provides more flexibility in terms of route placement. Despite this added flexibility, other constraints related to State-adopted design criteria, safety, aircraft equipage and capacity may limit options for route placement.

4 PBN Interest to Communities

Sustainable aviation is fundamental to the global economy and social mobility. To enable continued access to aviation services in a safe and environmentally responsible manner, airspace must be modernized to cope with increased demand. For this reason, communities have a stake in airspace modernization as this is the route to their continued access to sustainable aviation.

Communities increasingly expect government transparency, responsiveness, and inclusivity in the processes associated with airspace changes, including PBN procedure development and implementation. When their concerns are not adequately addressed, communities may submit complaints, and influence policymakers and regulators against airspace activities. This has the potential to constrain development and limit the benefits of airspace changes, such as PBN.

Any action taken to modify airspace (including PBN) may generate community concerns about the consequences of such changes. In particular, environmental concerns (e.g. aircraft noise) have been prevalent recently when initiating airspace changes. These concerns can have a range of effects on airspace projects (e.g. delays, changes, cancellations). While community environmental concerns

[2] ICAO Doc 9613, *Performance-based Navigation (PBN) Manual*, Order Number: 9613 Edition 4 ISBN 978-92-9231-198-8

[3] It is possible that there may be some regional variations in this definition, for the purposes of this document the ICAO definition is being used

[3] In some States the term 'concentration' is used instead of 'focusing'

frequently focus on aircraft noise, communities may also be interested in other areas ranging from air quality, greenhouse gas emissions, safety, perceived impact on real estate values, or increased visibility of aircraft.

Whereas many community interests and concerns are not unique to PBN, there are some PBN-unique factors and considerations. Some communities were initially interested in PBN because they hoped it would be used to reduce community impacts, since PBN allows more flexibility in procedure design. In some instances, the location of non-residential land around an airport provides opportunities to systematically keep aircraft away from residentially populated areas through a PBN-enhanced airspace structure, but the land use makeup around many airports does not offer the same opportunities. In these cases, PBN can increase regularity of overflight over specific neighbourhoods due to track precision. PBN can reduce emissions and reduce the number of people exposed to noise; other consequences inherent in PBN can cause community concerns, primarily related to the focusing of operations over specific areas due to increased track precision. The good practices identified in ICAO Circular 351, *Community Engagement for Aviation Environmental Management* are useful in all types of aviation community engagement, including PBN-related projects.

5 Summary of Questionnaire and Responses

To provide context on how aviation stakeholders currently approach community engagement for PBN projects, a survey of CAEP Members and Observers was conducted and communicated via a CAEP memo. The survey covered a wide range of questions, including some focused on the status of current PBN projects, the expected benefits of current PBN projects, community engagement procedures, and other topics. An analysis of the survey responses is found below.

5.1 Who responded

A total of 33 responses to the survey were received from a mix of organizations, including aircraft operators, States, airports, airport groups, procedure designers, manufacturers, NGOs, and regulators, as described in Figure 1.

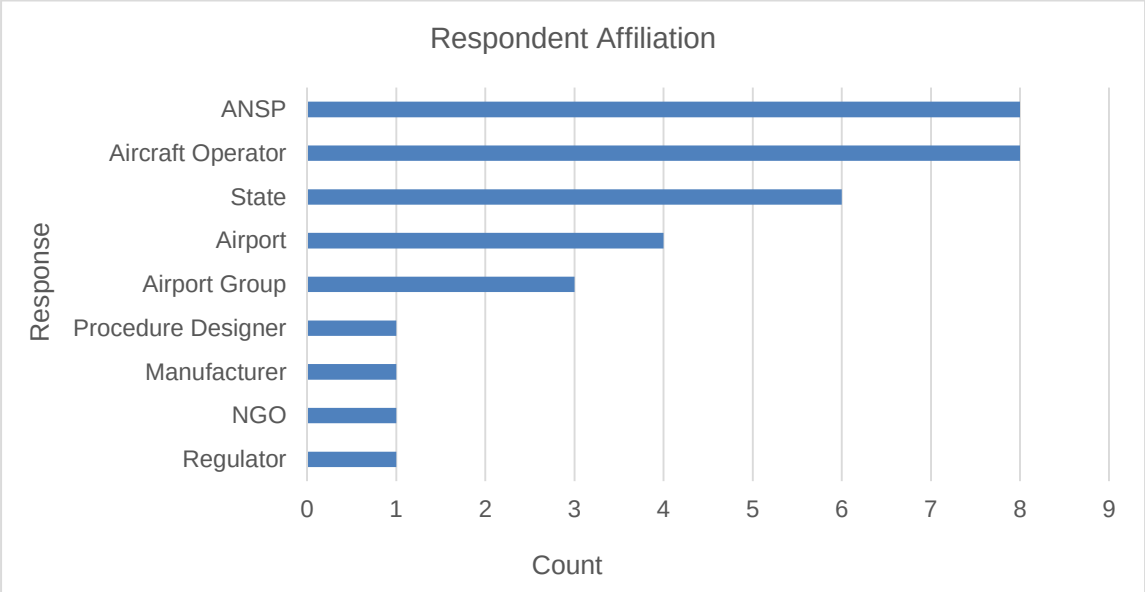

Figure 1. Survey respondent affiliation

The survey respondents reflected good regional coverage, including input from organizations in five ICAO regions, and one civil society organization, as depicted in Figure 2.

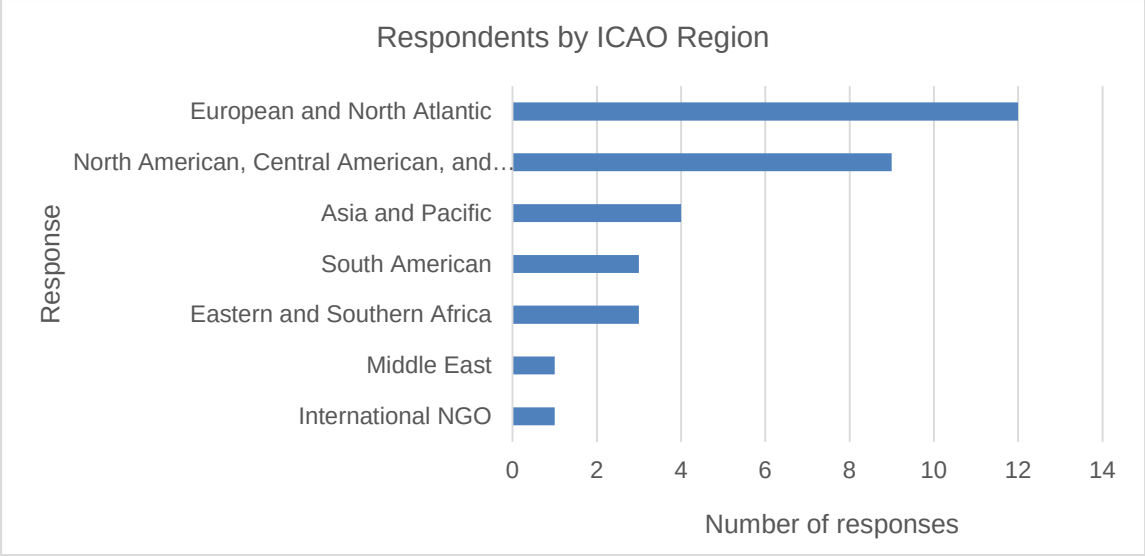

Figure 2. Survey respondent by region

Survey responses were received from respondents with experience of all stages of PBN project implementation, as presented in Figure 3. Respondents also reported a range of timescales for PBN project implementation, which tended to range from less than one year up to several years for more complex PBN projects.

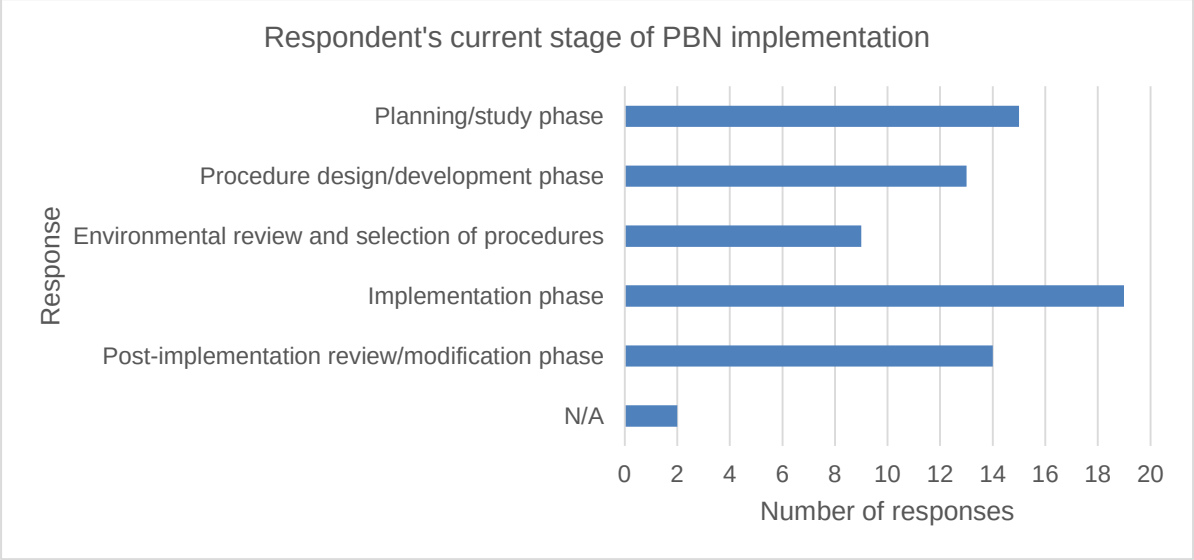

Figure 3. Respondent's current stage of PBN implementation.

(Note.— Responses add to more than 33 because respondents were able to select multiple answers.)

5.2 Key themes

Types of PBN projects

Survey respondents that had implemented, or planned to implement, PBN reported that the vast majority of their PBN projects (79 percent) were in terminal airspace (i.e., arrival routes, departure routes, or instrument approaches), which could be relevant to local communities; the remaining number of respondents' PBN projects occur in en-route airspace, as reflected in Figure 3.

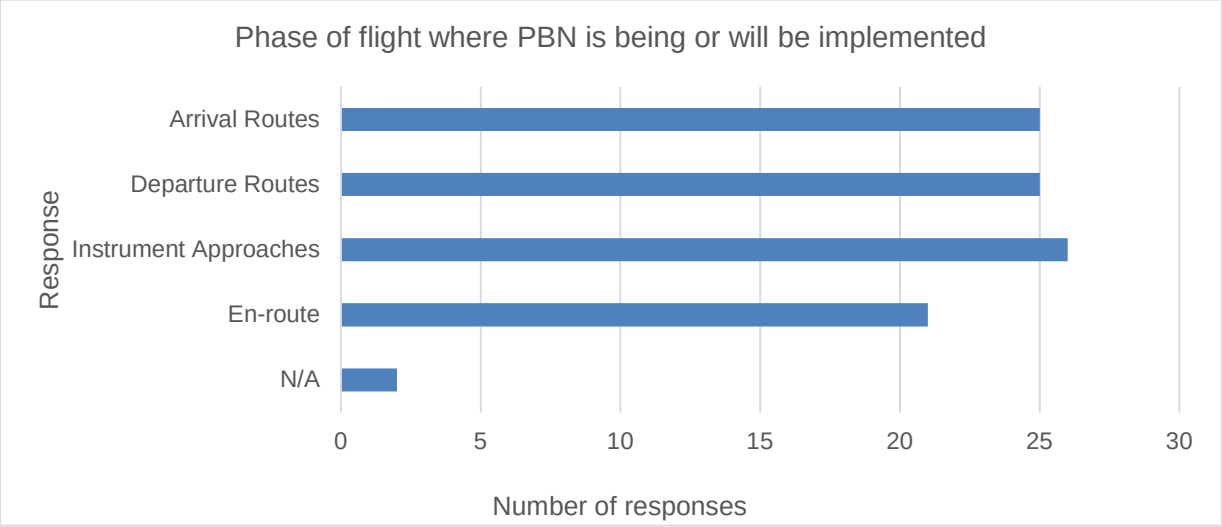

Figure 3. Phase of flight where PBN is being or will be implemented.

(Note.— The response count adds to more than 33 because respondents were able to select multiple answers).

PBN processes

The majority (73 per cent) of survey respondents said that there was a standard development or deployment process that their organization must follow when pursuing PBN projects, as reflected in Figure 4.

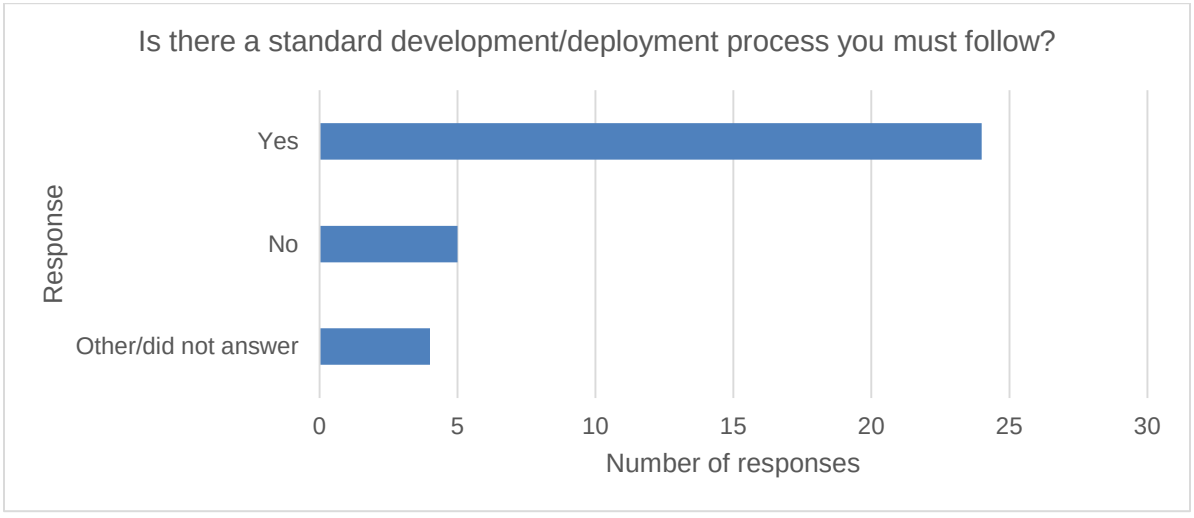

Figure 4. Respondents that do or do not have a standard development or deployment process to follow when pursuing PBN projects

One third of respondents reported that they are required to conduct an environmental review or impact assessment for PBN projects, as reflected in Figure 5.

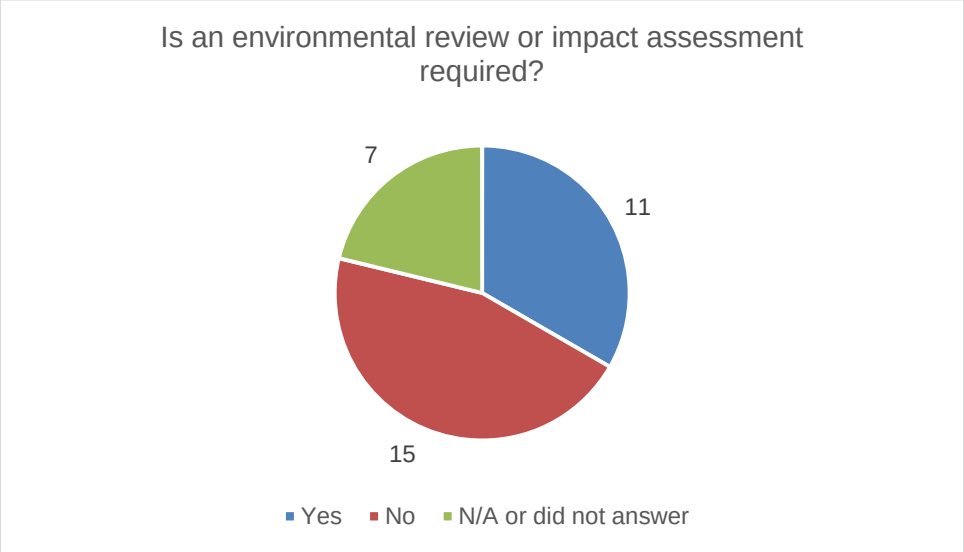

Figure 5. Respondents that are required to conduct an environmental review or impact assessment for PBN projects.
(Note.— Some respondents were not from organizations that implement PBN projects).

Approximately half of respondents (55 per cent) intended to do, or had already done, an environment review or impact assessment of their PBN projects (Note: some respondents were not from organizations that implement PBN projects and/or may have had to accept PBN procedures developed by another organization), regardless of whether they were required, as reflected in Figure 6.

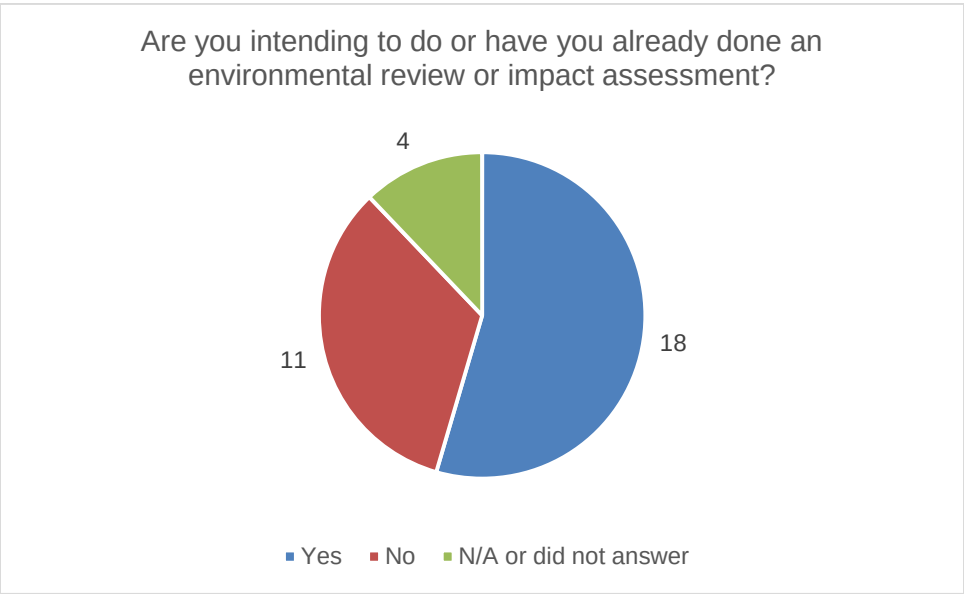

Figure 6. Respondents that intend to do, or have already done, environmental reviews or impact assessments of PBN projects

The vast majority of respondents (85 percent) have a programme of stakeholder engagement for PBN projects, as reflected in Figure 7.

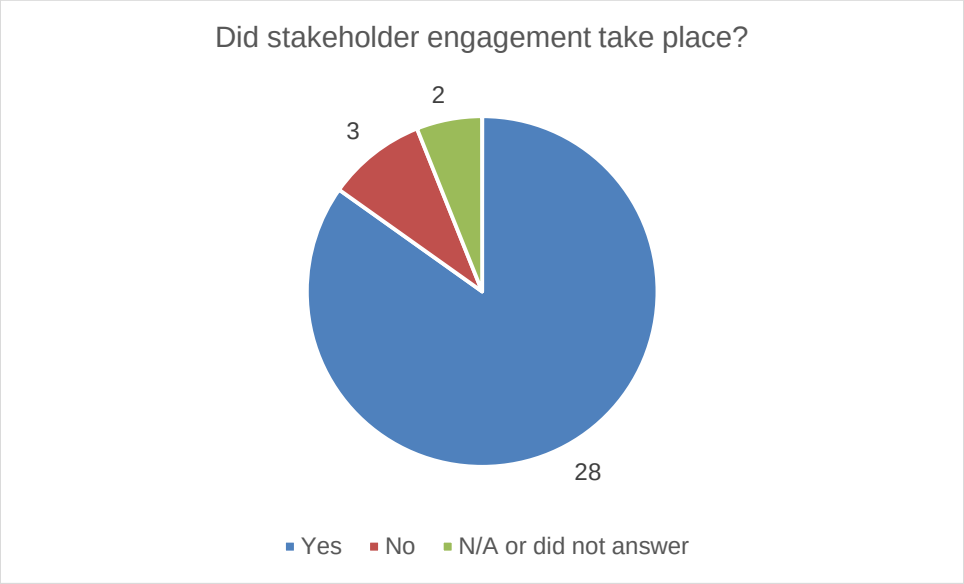

Figure 7. Respondents that have a programme of stakeholder engagement for PBN projects

5.3 Expected benefits

Overall, less than half of respondents (40 per cent) expected dis-benefits from the implementation of PBN projects, as reflected in Figure 8. Notably, while only approximately one third of respondents were required to conduct an environmental review, approximately half intended to conduct one, while almost all respondents intended to conduct community engagement.

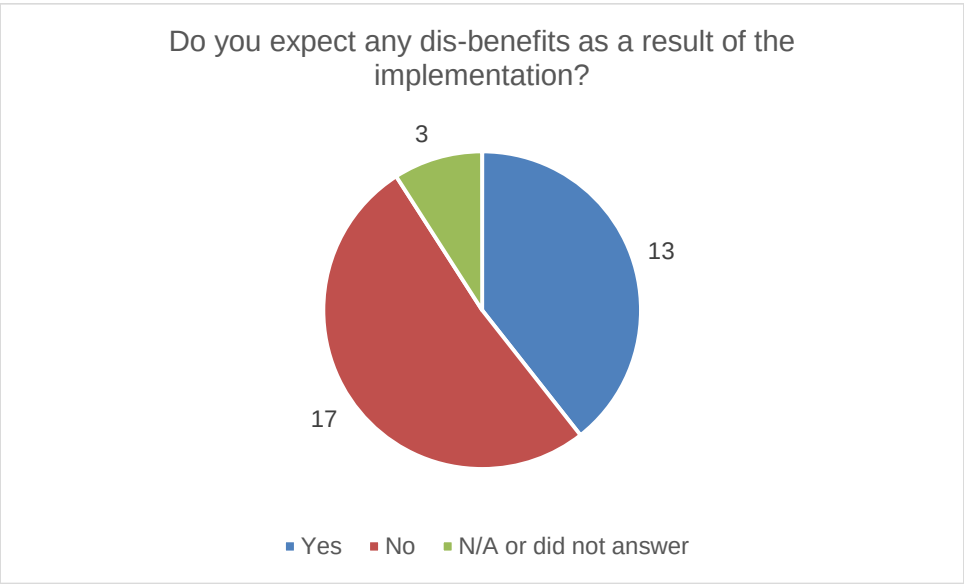

Figure 8. Respondents expecting dis-benefits or benefits of PBN implementation

Respondents were asked whether they expected benefits (or dis-benefits/trade-offs) from PBN for a series of variables, according to a scale that included options to select “Most Important”, “Important”, “Not

Important", "Not Considered or Not Applicable", and/or "Dis-benefit or trade-off?". Respondents considered flight safety, operational efficiency, and fuel burn to be the three most important benefits of PBN implementation (i.e., classed them "Most important" or "Important" when responding to the survey). Some respondents (i.e., one or more) considered flight safety, increased predictability, delay reduction, capacity, local air quality, resilience, or third-party risk to be important to PBN implementation. Some respondents (i.e., one or more) considered noise or local air quality to be a dis-benefit for trade-off to PBN implementation, as reflected in Figure 8. Compared to the respondents' perceived benefits of PBN, the perceived dis-benefits or trade-offs appear small.

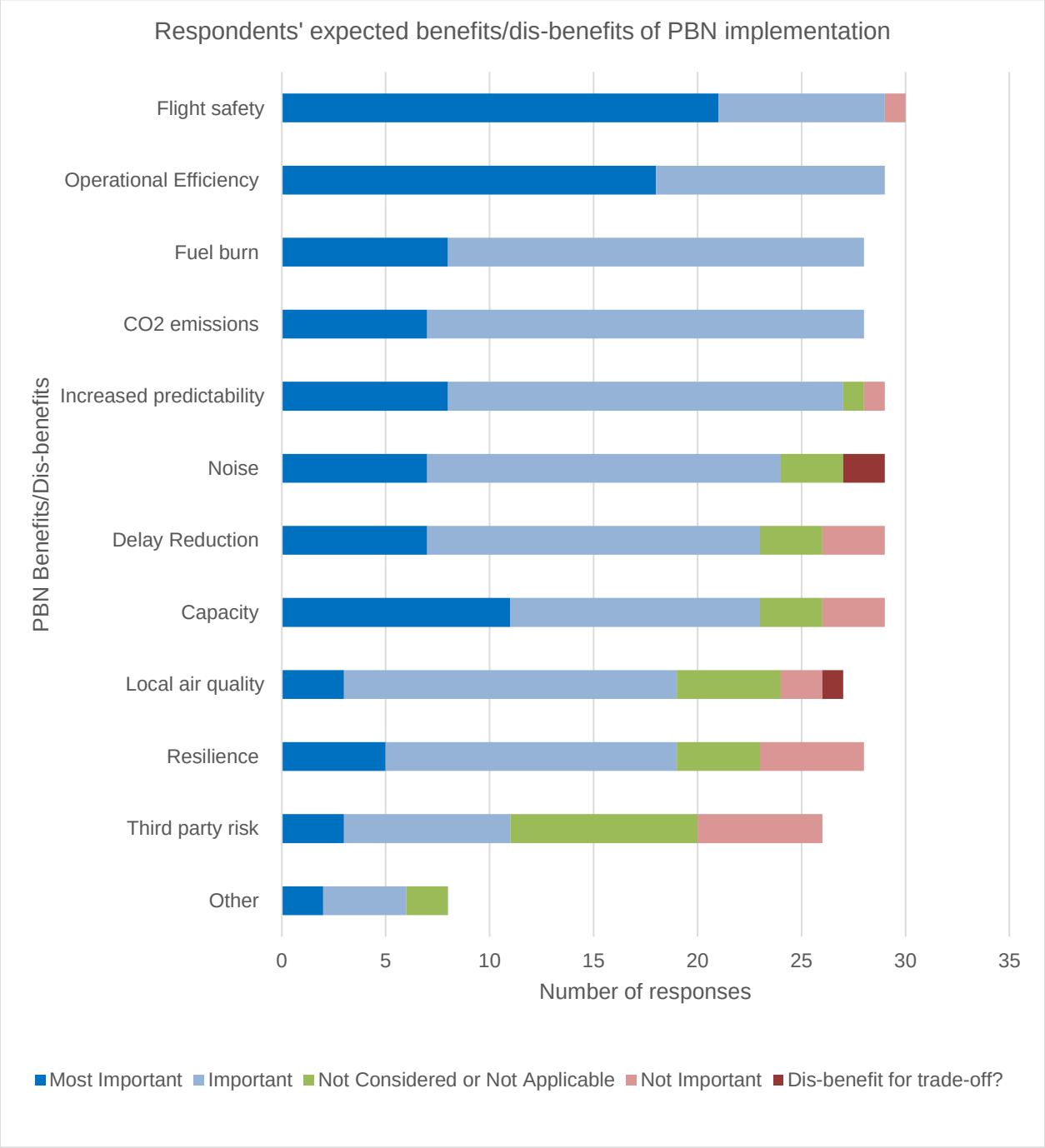

Figure 8. Respondents' expected benefits or dis-benefits of PBN implementation.

(Note.— The response count adds to more or less than 33 because respondents were able to select multiple answers or chose to select no answer at all.)

5.4 Engagement strategies

Respondents that planned to mitigate potential negative impacts from PBN implementation pursued several strategies, as described in Figure 9.

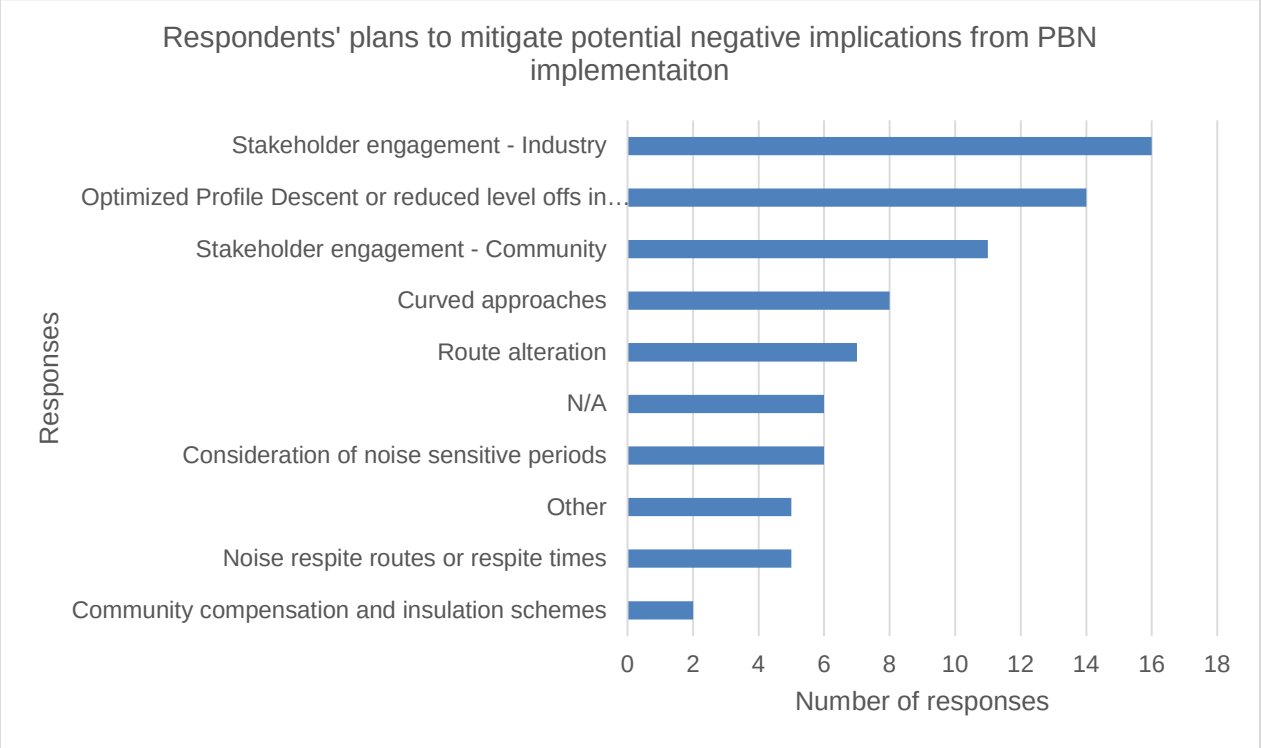

Figure 9. Respondents' plans to mitigate potential negative implications from PBN implementation.
(Note.— The response count adds to more or less than 33 because respondents were able to select multiple answers or chose to select no answer at all.)

5.5 Lessons learned

In general, respondents that shared information on community reaction to PBN projects said that they received a positive reaction from communities that were relieved of previous flight paths, while communities that saw flight paths change due to PBN projects became more likely to organize and voice concerns, or in some cases, pursue legal intervention. In terms of lessons learned, many respondents found community engagement for PBN projects was very similar to community engagement for other airspace projects, but saw challenges when communicating unique PBN characteristics because discussions would refocus on different issues, like aircraft noise and overflights. Respondents also reported that communities should be involved early; community engagement needed to be extensive, consistent, and factual; and that there should be clear areas of responsibility and lines of communication from aviation stakeholders.

5.6 Survey findings

In general, respondents found it important to provide communities with different types of information about potential impacts (e.g., noise contour maps, flight track depictions, etc.), but care should be taken to

ensure that the volume and complexity of the information provided does not overwhelm the audience. It is very important that, where possible, information should be tailored and location specific for the audience it is aimed at. It should be communicated at a level that accords with the audiences' technical understanding. Respondents also noted that more specific, smaller-scale information, presented in smaller groups might help better inform communities. Some respondents said it was important to improve feedback to communities, particularly on technical reasons why community input could not always be addressed.

In general, several respondents also felt that some States already had mature processes for stakeholder and community engagement, and that more robust sharing of their best practices, either via published documents or in-person workshops, could benefit other States. Several respondents also said that the publication of better educational materials on the distinct technical aspects of PBN and ATC modernization could help explain why PBN projects are being pursued generally, and what potential noise or emissions benefits projects could have on a community. Many respondents said that collaborative education and outreach to communities from all relevant stakeholders (e.g., ANSPs, regulators, airport operators, etc.), particularly when started early and conducted often, were most likely to mitigate community concerns and produce positive outcomes. These findings from the survey responses have been valuable in informing those sections of this document that consider the opportunities to address community concerns.

In response to a question regarding how ICAO can provide support regarding community engagement for PBN implementation, most respondents did not offer a response or indicated ICAO support was not needed for PBN community engagement. However, several airline and airport respondents indicated that ICAO could share information and best practices, such as by hosting workshops and publishing case studies and educational materials.

6 ICAO Circular 351, *Community Engagement for Aviation Environmental Management*

This section provides an overview of the circular, findings in the circular, seeks to identify any gaps/needs and recommended next steps to supplement the recently published community engagement circular

6.1 Overview of the circular

ICAO Circular 351, *Community Engagement for Aviation Environmental Management*, provides an overview of current and recent practices in the work of aviation stakeholders[4] in engaging with communities[5] near airports (local community)[6], with the broader community[7] and with action groups[8].

[4] Per the circular "The aviation sector includes a broad spectrum of stakeholder groups. There are those related to the industry itself, such as airport operators, airspace users, ANSPs and manufacturers. In addition, the sector interacts with a wide range of other business and government entities."

[5] Circular 351 acknowledges that for the purpose of the circular three categories of communities have been identified: local community, broader community and action groups. The list is acknowledged to be not exhaustive and that it may vary depending on location. In addition, the groupings are recognized to not be mutually exclusive; some individuals may belong to some or all of the groups.

[6] Circular 351 defined local community as "…those living or working in the immediate vicinity of the airport. In many countries, these local communities have grown as cities have expanded and urban development has begun to encroach on the airport boundary. In general, the primary environmental concern of these communities is aircraft noise and overflights, and the majority are usually located within or near traditional airport noise contours maps."

[7] Circular 351 defines broader community as "…generally located further away from the airport and can include the members of the general public who have an interest in environmental topics associated with aviation. The primary environmental concern of these communities tends to be growth and in some areas, GHG emissions."

[8] According to Circular 351, "this category includes organized groups such as non-governmental organizations (NGOs) that are established to reduce specific aviation environmental issues; for instance, noise. These groups may focus on a specific

The circular was developed to share community engagement lessons learned and good practices to assist States and the aviation industry, in particular airports, aircraft operators and air navigation service providers (ANSPs), in engaging communities and in addressing environmental issues. Thus, it is applicable for different types of aviation projects, which could range from small landside projects to large airspace redesign projects. It was produced based on a survey and case studies with the aim of providing information on lessons learned and good practices in community engagement. The respondents of the survey were primarily international airports (63 per cent), but also included aircraft operators, an airframe manufacturer, an engine manufacturer, ANSPs, government bodies and a NGO.

The targeted audience for the circular includes States and aviation stakeholders such as airport operators, ANSPs, aircraft operators, environmental agencies, other government bodies, and other interested parties. This circular provides a snapshot of lessons learned and good practices drawn from recent case studies on community engagement by aviation stakeholders. It was developed mainly to address community involvement regarding environmental matters, but the lessons learned can apply to other aviation community involvement issues as well. The primary "good practices" discussed in the circular can be broadly applicable to all aviation projects: start consultation early; provide for open and transparent exchange of information; be as inclusive and collaborative as possible.

6.2 Findings of the circular

The circular begins with an outline of the background to community engagement and how a methodical approach, using a survey questionnaire to collect case studies, was taken to develop the circular. Section 2 describes the different communities and aviation stakeholders, and provides some information on the responses to the questionnaire. Section 3 describes the kinds of community engagement activities that took place and the main issues of concern. Sections 4 and 5 discuss the lessons learned and good practices as gleaned from the case studies. Appendix 1 contains a full list of the case studies collected and a very short description of each, including a link to a website or report, when available. Appendix 2 summarizes the main statistics on the data collected. Appendix 3 contains a brief summary of a selection of 15 case studies that provides more information on the scope of submissions.

The circular found that the most common form of community engagement consists of the aviation industry (e.g., ANSPs, airports) providing information to community groups and individuals on aviation operations and development plans, and communicating the current and future environmental, social, and economic benefits and impacts. It was found that community members may provide feedback and express their views by means such as mail, telephone, email, websites, and meetings. Public consultation is often required as part of the process to gain consent or approval for infrastructure development including both on airport projects and airspace changes. The process of community engagement can both ensure that communities are informed of proposed changes and that their views are taken into consideration during the decision-making processes.

Good practices in the circular include strategic approaches that many of the respondents take in addressing community concerns including being systematic (e.g., importance of developing plans), being proactive in engagement, collaborating and building trust. It outlines the technological approaches that can be taken such as visualization and simulation. It also discusses the importance of face-to-face meetings, print and other media, and community relationship building.

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organization or, region, or nationally, responding to where they believe the greatest priority to be. Focus groups might address issues such as wildlife, new airspace flight tracks, or airport growth in general."

As each project is unique, engagement should be tailored to each individual circumstance. Below are some common elements identified in the circular that may be considered for any community involvement initiative:

- start engaging early;
- proactive approaches;
- good planning and preparation;
- on-going engagement;
- being inclusive;
- transparency and trust building;
- community understanding of needs, benefits and potential impacts of any proposal;
- technology, audio-visual aids, computer graphics and social media can assist communications; and
- managing community expectations.

The circular notes that environmental matters usually dominate community engagement and found that the impact of aircraft noise was the issue of most concern, followed by land use around airports, greenhouse gas emissions and climate change, local air quality and visual intrusion.

Many airport operators and other aviation stakeholders have taken their community engagement efforts beyond communications and consultations on environmental topics. Recognizing that the three pillars of sustainability are commonly considered to be environmental, social, and economic, aviation stakeholders are increasingly implementing social programmes, often as a part of their corporate social responsibility or similar initiatives.

6.3 Observations on the circular

The circular collected information on community engagement relating to aviation operations and development plans, and as such did not focus specifically on any one topic such as PBN. Because of the above-mentioned general nature of the circular, there are some PBN-unique elements that could merit additional consideration on how to engage communities involved in PBN implementation. For instance, one PBN-unique element that is discussed regularly is the focusing of aircraft tracks and associated noise over the same area, including farther away from the airport, which have made some communities more aware of aviation activities and its impacts.

The principles and lessons learned from the circular remain valid for community engagement in PBN cases. That said, the increased interest in PBN-unique elements give the industry the opportunity to engage more proactively with farther out communities (who previously tended to be more concerned about aviation growth and GHG emissions, rather than noise and visual intrusion). Thus the industry can explore additional ideas on how to engage with them, including awareness and education about potential benefits and impacts of PBN.

There is therefore an opportunity to provide further information to States wishing to engage communities on PBN implementation about how to describe the good practices available in this regard. The generic principles in the circular (e.g. starting engagement early, having a plan, building trust, etc.) are useful but PBN implementations may require additional information to communicate specific impacts and potential benefits.

7 Review of State PBN Implementation Plans

7.1 Overview of State PBN Implementation Plans

A total of 99 ICAO State PBN Implementation Plans were reviewed. The implementation plans ranged from a handful of pages or PowerPoint slides to very comprehensive documents in excess of 40 or 50 pages.

The vast majority of plans only used 'community' and 'consultation' in the context of the aviation, State or regulatory community. Most plans made passing mention of noise and all made mention of fuel burn and/or emissions but there tended to be little detail on this other than reference to improvements to, or solving noise problems, but this was not generally in the context of community engagement. However, some plans did make mention of environmental impacts in the context of community engagement and some points of note from specific implementation plans are discussed below.

There was little reference in the plans to the fact that the successful introduction of PBN could be facilitated by engaging communities around airports. But it should also be noted that the guidance provided to States by ICAO on their PBN implementation plans did not explicitly require States to include reference to community engagement.

The United Kingdom's Implementation Plan states that all new procedures should aim to apply CDO and CCO and no change to operating procedures will be made without an assessment of environmental impact as required by national policy and procedures. The plan notes that there should be an appropriate level of consultation with those affected in recognition that the concentration of environmental effects, especially for those living close to major United Kingdom airports. The United Kingdom plan also outlines environmental policy, consultation requirements and recognizes that decisions need to be made about where the impacts of PBN implementation should lie, i.e. town versus country, focused tracks versus dispersed tracks.

The Swedish Implementation Plan cites environment as one of the two primary drivers for implementation of PBN, with communities benefitting from reduced noise, emissions, less infrastructure and more predictability. 'Unnecessary noise' was listed as one of the key costs of delaying PBN implementation.

Implementation Plans for Guyana, Malawi, Myanmar, The Gambia and Ukraine cited protection of the environment as one of the strategic objectives of their PBN implementation activities through reducing fuel burn, emissions and noise pollution over sensitive areas. However, these plans did not mention community engagement specifically in this context.

7.2 Analysis of State PBN Implementation Plans

Because ICAO did not require State PBN Implementation Plans to include it, reference to community engagement in the plans is limited, and the majority of States do not elaborate on the need to engage communities in their PBN deployment plans. But the review identified that two States (Sweden and the United Kingdom) do conduct community engagement as part of their PBN plans and there are good practices therein that could be disseminated more widely. In other PBN Implementation Plans, although there was no specific mention of community engagement, this does not necessarily mean that community engagement is not being considered during PBN implementation.

8 Literature Review

In addition to the review of the CAEP memo and survey, ICAO Circular 351 covering community engagement, and ICAO State PBN Implementation Plans, a literature review of documents relevant to PBN and community engagement was carried out. This literature review is not necessarily exhaustive or an endorsement of individual documents, but has been conducted to inform the development of this document. There is a significant body of literature on PBN, with references to community engagement. The result of this review has been part of the information used to inform the discussion of strategies on how to address community concerns set out below. The literature review is attached at Appendix A.

9 Potential Strategies to Address Community Concerns

As a result of the survey responses, the review of State PBN Implementation Plans and the literature review it is clear that proactive management of community concerns regarding PBN implementation is a way to remove any potential barriers. In order to address these concerns a number of strategies have been identified as a result of the work of this task. These possible strategies are outlined below (it should be noted that these strategies can also be useful to situations other than PBN).

The analysis of survey responses showed that it can be useful to:

- provide communities with different types of information about potential impacts (e.g., noise contour maps, flight track depictions, etc.);
- ensure that the volume and complexity of the information provided does not overwhelm the audience;
- tailor information and make it location specific for the audience it is aimed at;
- information should be communicated at a level that accords with the audiences' technical understanding;
- publish better educational materials on the distinct technical aspects of PBN and ATC modernization to help explain why PBN projects are being pursued;
- provide better information on potential noise or emissions benefits projects could have on a community; and
- collaborative education and outreach to communities from all relevant stakeholders (e.g., ANSPs, regulators, airport operators, etc.), particularly when started early and conducted often, were most likely to mitigate community concerns and produce positive outcomes.

A number of respondents acknowledged that some States already had mature processes for stakeholder and community engagement, and that more robust sharing of their best practices could benefit other States. Some respondents said it was important to improve feedback to communities, particularly on technical reasons why community input could not always be addressed. As a result of the survey analysis, there could be a role for the ICAO PBN Programme Office or ICAO more generally to improve the material that it provides to States to support them in the community engagement aspects of PBN implementation. A review of PBN relevant literature showed that there is a large body of information on PBN, some of it having relevance for community engagement activities. The literature review also identified the following five key principles to consider when planning PBN deployment and community engagement:

1. Start early

   A running theme in the literature is to start community engagement as soon as possible. Opposition is usually based on misinformation or misunderstanding so education at the beginning of the design

process can help to avoid this and bring disparate groups of stakeholders together (CANSO, 2015; RTCA, 2014; FAA, 2016).

2. Know the community

   There is a need to have a good understanding of the political, social and community environment in which the changes are taking place. For instance this will facilitate an understanding of community wants, needs and concerns.

   There is strong agreement across the literature that knowing the community is vital to gaining community support. There is also a strong emphasis on using the airport's own knowledge to achieve this. This is a reflection of their long history of working with communities and their unique position in understanding the interests of the community, with established relationships (RTCA, 2014; Airports Council International, 2013; ACRP, 2016; FAA, 2016).

3. Recognize that every case is different

   As RTCA (2014) states "one size does not fit all" and project scope, complexity and size will determine which stakeholders to include and which strategies to employ. This is particularly relevant when it comes to respite (or temporary relief) as there is no single definition for this concept; it is likely to mean different things to different people. Therefore strategies must be tailored to specific areas and it is essential to clearly define the type and respite (or temporary relief) required (Airports Commission, n.d).

4. Develop an outreach/community engagement plan

   Unsurprisingly, a key theme that appears across the literature is to develop a stakeholder engagement plan and best practices tailored to the scope and scale of the PBN project (CANSO, 2015; RTCA, 2014).

   An effective plan should have several components. Education is needed to ensure that opposition based on misinformation or misunderstanding is avoided. Transparency here can help to build trust amongst the public. There have been examples of where this has not happened, resulting in distrust that takes time and effort to overcome (ACRP, 2016; Airports Commission, n.d.; RTCA, 2014).

   Community engagement helps to incorporate local concerns into PBN planning and design, potentially leading to a feedback loop to address those concerns. Again it is important that the flight procedure implementation process is transparent (ACRP, 2016; RTCA, 2014). As JDA (2015) highlighted there are new opportunities for information and engagement with the development of new tools.

5. Consider going beyond minimum requirements

   Community engagement should be tailored to the scope and scale of the PBN project and the potentially impacted community. Perception of impacts is also highly individual. Thus, there may be a need in some circumstances to conduct more community engagement than legally required For example, where environmental policy requirements are minimal there may be a case for going further than minimum requirements (ACRP, 2016; RTCA, 2014).

   Airports' strong background in working with their communities can be of help to both industry and community stakeholders in understanding the collective interests and managing expectations on both sides. It is recognized that no other entity involved in PBN development has more local presence or level of responsibility to the community than the airport operator.

   Circular 351 noted that communities increasingly expect aviation industry and government transparency, responsiveness, and inclusivity in the processes associated with airspace changes,

including PBN procedure development and implementation. When their concerns are not adequately addressed, communities may submit complaints, and influence policymakers and regulators against airspace change activities. This has the potential to constrain development and limit the benefits of airspace changes, such as PBN. This transparency will require collaboration among operational stakeholders (e.g., ANSPs, aircraft operators) in the process of deploying new technologies such as PBN, and is essential to addressing community concerns.

6. Use lessons learned from community engagement (while managing community expectations).

   During the community engagement process the change sponsor may learn of feedback that could be addressed through technical measures (e.g. operations, design, respite or temporary relief options). The sponsors of a change should remain open to exploring such changes, whilst managing community expectations – as changes need to be safe and operationally feasible.

10 Observations

PBN is a technology that can enable innovative and flexible use of airspace and procedures to reduce the impacts of noise on local communities. Some examples of different ways of using PBN depending on local circumstances are given below:

- Using a single PBN route to minimize the *total* number of people overflown;
- Using a single PBN route to minimize the number of people *newly* overflown, keeping routes or portions of routes close to where they are today where possible subject to limitations of procedure design and safety constraints;
- Sharing routes over a wider area with multiple PBN routes although this might increase the total number of people overflown;
- Prioritizing routing aircraft accurately over urban areas, recognizing that urban areas have higher general noise levels; or prioritizing accurately routing aircraft over rural areas where fewer people live;
- When designing airspace in urban areas, using PBN to protect parks and other quiet spaces by routing aircraft over built up areas or vice versa;
- Using PBN routes designed to prioritize noise over CO_2 emissions in low level airspace and reversing that prioritization in areas where noise has less impact;
- Using multiple PBN routes to alternate flights over different areas, possibly on a planned basis to give community predictable periods of respite or temporary relief from aircraft noise; and
- Changing PBN routes at particular times of day to manage noise impacts.

In some cases it may be a local regulatory requirement to focus impact assessment on a single metric, but supplementary metrics (single event, average etc.) can assist in clearly communicating the impacts of PBN. Where it is available, it may be helpful to independently verify noise data to explain noise impacts in order to build trust with communities.

11 Conclusions and Options for Dissemination

12.1 This report has identified a large body of information about PBN implementation and community engagement through:

- reviews of ICAO PBN Implementation Plans;
- a review of the CAEP Circular 351, *Community Engagement for Aviation Environmental Management*;
- analysis of responses to a survey; and
- a literature review of PBN-relevant material.

Given that the implementation of PBN is a core tenet of the ICAO Global Air Navigation Plan it is recommended that the information in this report is disseminated to States so they can understand the good practices that can be employed in the process of implementing PBN. Options for such dissemination are discussed below.

12.2 Any dissemination decisions should consider the need for general capacity building and improving information accessibility on community engagement. In addition, dissemination on PBN-unique elements of community engagement should be coupled with more general information on community engagement.

12.3 In the survey, a question was asked in regard to how ICAO can provide support on community engagement for PBN implementation. Most respondents did not offer a comment or indicated ICAO support was not needed for PBN community engagement. However, several airline and airport respondents indicated that ICAO could share information and best practices, such as by hosting workshops and publishing case studies and educational materials.

APPENDIX A: LITERATURE REVIEW

In addition to the review of the ICAO State PBN Implementation Plans, the CAEP memo and survey plus the review of ICAO Circular 351 covering community engagement, the task group also carried out a literature review of documents relevant to PBN and community engagement. This literature review is not necessarily exhaustive or an endorsement of individual documents, but has been conducted to inform the development of this document and it was reviewed by WG2.

Overview of Papers

Civil Air Navigation Services Organisation (CANSO) – Performance-based Navigation Best Practice Guide for ANSPs (2015)

This paper acknowledges that community concerns can be mitigated through consultation and either procedural design that spreads out the noise, therefore sharing the burden across different paths or providing flight paths that avoid residential areas.

However, it is found that noise sharing leads to mixed results and can result in flow management issues without a fairly complex arrivals manager and a fleet able to handle multiple paths.

It is recognized that community involvement should be included from an early stage as accommodating the needs and wants of a disparate group of stakeholders is the real challenge of implementing PBN. The obvious community outcome is to minimize the number of people exposed to the noise footprint associated with the procedure, however other outcomes sought might be visual amenity, avoidance of culturally or environmentally sensitive areas and satisfying political agendas.

It is also stated that before 'going public' there is a need to try and have a good understanding of the political, social and community environment in which you are working with a documented stakeholder engagement plan or consultation protocol to ensure consistent delivery of messaging and management of stakeholder expectations.

Radio Technical Commission for Aeronautics (Radio Technical Commission for Aeronautics (RTCA) tasked by FAA - Blueprint for Success to Implement PBN (2014)

This paper analyses lessons learned from prior PBN implementations, with the aim of developing a blueprint for future success. Recommendations include:

- All PBN efforts should identify and effectively engage all stakeholder groups, both technical and non-technical.
- Establishment of a non-technical stakeholder community outreach effort to parallel development and implementation effort and develop best practices tailored to scope and scale of the PBN effort.
- Airport stakeholders should provide advice and information on noise sensitive communities and prior commitments and agreements; previous or on-going facility and operational planning studies; and existing infrastructure and constraints.

- Contacts within the public sphere should include residents or communities which will be (or likely perceived to be) impacted by the project. Impacted is defined by the individual and often goes beyond statutory impacts as defined by federal regulations.
- Residents or communities who will benefit should also be engaged. Public opinion should be driven not only by those who oppose the projects but also those neutral or who support it.
- Community groups and NGOs are key entities to include as they are organized and have established tools to engage larger groups within the community. These may be based on geography (e.g. neighbourhood or homeowners association) or special interest (e.g. airport-noise or community livability).
- Government officials need to be informed of projects and impacts on the community.
- One size does not fit all and project scope, complexity and size will determine which stakeholders to include and which strategies to employ.
- Proposed PBN implementation should be evaluated from the outset including populations and political jurisdictions affected by anticipated changes in flight tracks, aircraft dispersion around tracks and anticipated changes in runway use at the affected airport.

The paper suggests a number of outreach strategies for non-technical stakeholders as follows:

- Education: this is important as it is often found that opposition is based on misinformation and misunderstanding. Therefore this should start early in the PBN procedure development. It also has the benefit of providing a commitment to transparency which can help with building trust and public acceptance. This should help reduce project delays and increased costs. The media is also important here and they have a sensitive role in how information is presented to the general public.
- Engagement: this includes outreach, communication and collaboration in an effort to incorporate non-technical stakeholders' expertise, local concerns, interests and potential impacts. Some PBN projects need specific public engagement, but even where there is no regulatory requirement to do so it should be recognized that communities are critical non-technical stakeholders.
    - Outreach to public should include a communications plan that provides a consistent message, which ideally is incorporated into project planning, design and implementation.
    - Proactive engagement in the initial phase offers the project team the opportunity to demonstrate a commitment to the community and provides the opportunity to educate local leaders on PBN, gain a better understanding of local interests and potential concerns that can be integrated into PBN planning and design.
    - If community groups are well established within the community they can be helpful in gaining public support for the project by serving as ambassadors.
- Advocacy: this incorporates an understanding of collective stakeholder interests and ensures those interests are considered during the design and implementation. Demonstrating this effort to consider community perspective with the intent of accommodating it encourages trust and can reduce opposition.

Airports Council International North America NextGen Working Group - Airports' Role in the Development and Implementation of Performance-Based Navigation (PBN) Flight Procedures (2013)

- This paper is part of a NextGen working group effort to provide benefits to all stakeholders where PBN is being implemented. It acknowledges the importance of airport operators, who have a long history of working with their communities to establish balanced and cost effective ways of

reducing impacts. Experience has shown that changes are likely to be met with resistance unless there is outreach to explain the changes.

- Airport operators are in a unique position in that they understand and can address the interests of stakeholders, whose interests may diverge based on expectations or communication/outreach. Many have existing relationships with surrounding communities and are therefore in a good position to participate in outreach. Industry stakeholders at some locations have implemented PBN procedures without airport operators' involvement being requested, as well as any community involvement. In many cases the proposed PBN was not expected to result in adverse effects, but not including stakeholders has led to distrust, taking time and effort to overcome.
- Airports have much to lose if community support disintegrates leading to controversy and possibly legal actions. Airports need to help the industry stakeholders and community stakeholders in understanding the collective interests and managing expectations on both sides.
- No other entity involved in PBN development has local presence or level of responsibility to the community than the airport operator. Involvement in the concept stage bringing all insights to the table helps to ensure that PBN development efforts will be directed properly.

Airports Commission's Senior Delivery Group – Implementation of Performance-Based Navigation in the UK (n.d.)

- This paper provides a high level exploration of PBN routes and the effect they are expected to have as part of a wider programme to modernize the United Kingdom's airspace and air transport network.
- In terms of community engagement it states that it is important to ensure understanding and to allow contribution of ideas and experiences for proposed changes.
- The rest of the paper discusses respite for communities although points out that there is no single definition for this as it is likely to mean different things to different people. This means that respite should not only be tailored to specific areas, but also it is essential to clearly define the type of respite required.

UK Civil Aviation Authority (UK CAA) – Performance-Based Navigation Airspace Design Guidance: Noise mitigation considerations when designing PBN departure and arrival procedures (2016)

- This paper provides guidance on a range of design options for PBN procedures with the intention of offering options for different kinds of noise mitigation guidance. It is recognized that the greater focusing of flight tracks can provide significant benefits to local communities owing to the reduction in the number of people affected by noise, but for those in close vicinity to the PBN flight path there are negative impacts.
- The paper highlights that relief can be provided through dispersion by planned variation in areas impacted e.g. different runways being used at different times of day. Currently there is no agreed minimum distance between routes that would result in what is considered to be acceptable levels of relief from aircraft noise.
- In addition, the design of PBN offers more flexibility than historic conventional alternatives allowing tracks and associated noise to be moved away from noise sensitive areas but this assumes that the adjacent area is less sensitive to noise. As noise sensitivity is a subjective

concept, the relative noise sensitivity of an area must be carefully considered where distribution is the aim.

- Guidance makes no distinction between populations already exposed to noise and those that are newly exposed. However anecdotal evidence shows that communities not previously overflown will be particularly sensitive when it comes to change in airspace.

Joe DelBalzo Associates – Best Practices and Tools to Provide Noise Information to Communities (2015)

- This paper takes a more technical approach to community engagement and explores the range of noise impact information available globally. It is stated the "airports belong to the communities that they serve" and noise is becoming a leading variable in determining the balance between air transport benefit and burden.
- Airport's effectiveness at promoting communication, presenting facts clearly and honestly and reducing noise impacts determines their community dynamic.
- Noise management system technology advancements have increased engagement by airports and empower communities around them. An example of this is Gatwick, tailoring noise reporting systems to meet community needs and even varying the reporting community as required to address unique needs and community interests.
- Airport noise reporting evolution can be voluntary or forced by community pressure. Two software systems are cited as standing out – Casper's Noise Lab and Bruel and Kjaer's Web Track. Both systems have similar capabilities, combining noise data collected through traditional noise monitoring systems with flight track data. This allows near real time display of noise monitor levels associated with each flight track.
- Airports differ in their use of the systems with some showing flight tracks and noise monitor measurements, and some going as far as to display flight tracks, noise monitor measurements and current noise contours.

Transportation Research Board (TRB) Airport Cooperative Research Program (ACRP) Report 150: NextGen for Airports, Volume I: Understanding the Airport's Role in Performance-Based Navigation (2016)

- This is a guide to airports providing comprehensive information with an emphasis on working with stakeholders and communities with a United States focus.

- The FAA environmental review process is described for new and revised procedures including noise. Above 10 000 feet noise screening is generally not required. Between 3 000 and 10 000 feet noise screening is required and certain increases may require an environmental assessment, but changes can be made with a categorical exclusion (CatEx), however, there has been significant controversy in some cases and special care should be taken to understand impacts and reaction of communities. Below 3 000 feet an environmental assessment is typically required and a CatEx can only be used over non-noise sensitive areas or part of a legislative CatEx.

Input from community representatives is valuable in helping to ensure that the needs of communities are understood and considered in the procedural design. Communities can address concerns by being aware of and understanding procedure development and having options to voice their concerns. It is important

that the flight procedure implementation process is transparent to the community to allow them to feel they have a stake in implementation.

It is stated that it is better to have the community represented through representative bodies such as noise forums, city councils, planning divisions or other organizations rather than in an ad hoc manner. These bodies are informed about land use and noise sensitive areas within communities and can therefore offer education regarding PBN, airport operations and other matters, which is more difficult than with ad hoc or general public.

Consultation with community representatives is valuable to ensure the needs of the community are met in the procedure design and is typically more valuable in the early stages. Input may also be valuable in post-implementation assessment of procedures to validate the planned results.

Whilst the United States National Environmental Policy Act (NEPA) provides a framework for community engagement as part of the Environmental Assessment process, it is advised that outreach efforts should go beyond satisfying these requirements.

Challenges in outreach include community opposition and resources. Opposition may be due to limited knowledge and understanding and can hamper implementation. Outreach to communities prior to and throughout the procedure process can help to obtain their understanding and approval. This may require significant resources depending on the project and level of interest and concern from the community. However, educating the community on the benefits to PBN is paramount – airports typically have outreach programmes and procedures in place which can be leveraged to support PBN.

Airport Representatives should be knowledgeable of PBN and have relationships with local community and government. Airport and local representatives involved in the PBN process should possess a comprehensive understanding of the local airspace structure and flight procedures. They should have thorough knowledge of the community, particularly as it relates to local environment and noise considerations and have established relationships with local community and political leadership.

Throughout the process personnel can provide important local and environmental information which may supplement the procedural design, identify procedural design considerations, conduct community outreach and coordinate between the airport, FAA, aircraft operators, community and action groups. Such knowledge and relationships ensure the airport and local representatives can meaningfully engage with the FAA throughout the design process and ensure PBN procedures meet the objectives and constraints of FAA air traffic operations, aircraft operators and surrounding communities.

The paper suggests potential contributions of the airport to procedural development in terms of community engagement as follows:

- Phase 1: preliminary analysis
  - Translate concerns of the community and other stakeholders in design objectives and constraints for the procedures.
  - Communicate the concerns of the community and other stakeholders in design considerations.
  - Propose refinements to the objectives and constraints of procedure design to address the concerns of the community and other stakeholders.
- Phase 2: development Work
  - Brief the community on the evolving design in scoping sessions or other outreach forums and obtain their feedback.
  - Brief the community on the resulting design in scoping sessions or other outreach forums to educate them regarding the design objectives and constraints, design approach and trade-offs

anticipated impacts on the airport, airlines, FAA and other stakeholders, the community and the environment.

- Phase 3: Operational preparations
  - Conduct or support completing any final environmental review, community outreach or other activities in preparation for implementation.
- Phase 4: Implementation
  - Review published procedures to ensure they comply with the requirements of the airport operator, community and other stakeholders.
- Phase 5: Post-implementation
  - Monitoring and evaluation - obtain feedback from the community regarding their perceptions of the impact of the procedures.

A number of lessons learned and best practice are also provided. A successful outcome is defined as a project in which the designed flight procedures were implemented and consistently utilized, without significant and consistent opposition from the community.

Six case studies found that reasons for success/failure of PBN varied for different airports. At Hartsfield Jackson Atlanta International airport (ATL) and Denver International (DEN) projects were successful due to the level of coordination and participation of the airport and community.

Procedure design is unique to each airport and surrounding airspace which requires balancing multiple, sometimes competing objectives:

- At ATL the initial leg of one departure procedure was extended to avoid exposing a school in the local community to noise and another was rerouted slightly north to avoid another segment of the community.
- At Minneapolis (MSP) the majority of the land use is residential and the surrounding communities pay close attention to the operations of the airport so design to minimize noise exposure can be challenging.
- At the Houston metroplex the area around IAH is industrial therefore design challenges to avoid noise sensitive areas are not necessarily significant.

Operations below 3 000 ft can result in significant public opposition so consideration of community concerns should be part of the process as with any PBN process. Early outreach to the community and other stakeholders is critical to the success of PBN initiatives. Waiting until procedures are complete, or nearly complete, before briefing interested stakeholders may be met with resistance and could lead to the need to redesign procedures and delay projects. Community outreach, with full explanation and disclosure, engenders community understanding.

The community must have sufficient time to review and understand the proposed changes, provide feedback, and engage in a discussion with the airport operator. The duration required will vary with location and procedures. An adequate public outreach campaign may include a web site, briefings to city council and other local government representatives, open houses, broadcast media coverage, newspaper articles, periodic (e.g., quarterly) meetings with the public, and distribution packets with all relevant project information. For example:

- At DEN, a level of outreach similar to that described above was proposed, and was successful in educating local government officials and the community and garnering their support.
- At MSP, a level of outreach similar to that described above was proposed, however, the time frame was limited to 60 days. This proved to be insufficient time to brief the communities and allow them to understand the proposed airspace redesign, and to earn their approval.
- At the Houston Metroplex, the FAA Metroplex team met with the HAS three times during the

design process and attended noise round table public meetings held by the HAS. Other meetings were held by HAS to brief the public and respond to their questions.

The impacts of the procedure changes need to be explained in terms understandable to the community. For example, at SEA, detailed technical descriptions of the impacts of the proposed procedures, such as incremental changes in the decibel level of the DNL, were confusing to the community members.

FAA – Performance-Based Navigation (PBN) National Airspace System Navigation Strategy (2016)

This report sets out an updated PBN NAS strategy, providing the context for defining and refining implementation plans and resource requirements. Whilst the primary focus is on the more technical elements of implementing, airport and community outreach is highlighted as an essential element in the PBN strategy.

The importance of this is stated owing to recent PBN implementation efforts and the need to ensure community concerns are adequately addressed so projects can progress on schedule. The FAA's approach is to incorporate recommendations from the Blueprint for Success in Implementing Performance Based Navigation.

Early, active and sustained outreach by the FAA on PBN procedure design and implementation are emphasized as requirements for continued success. The importance of the involvement of airport operators who understand local interests, sensitivities and expectations for effective outreach is also stated.

Result of the Literature Review

There is a significant body of literature on PBN, with references to community engagement. The result of this review has been part of the information used to inform the discussion of opportunities on how to address community concerns set out above.

— END —