Noise Monitoring Systems Good Practices

By Athanasios Synodinos (ICCAIA) and Oleksandr Zaporozhets (Ukraine) [1]

Noise Monitoring Systems are an essential element of noise management at and around airport

Noise Monitoring Systems (NMS) exist since the 1960s and, in their simplest form, measure in real-time aircraft noise in the vicinity of airports. NMS feature numerous monitoring stations (portable, or fixed), strategically positioned around the airport. Figure 1 shows a typical NMS measuring station. Today`s technologies boost a wide range of NMS features, functionalities, and possibilities for integrating into other airport planning and sustainability tools. Consequently, combined with the ICAO Balanced Approach (BA), NMS tend to play an increasingly important role in airports' action plans to control noise from aircraft operations. In fact, NMS providers envisage NMS being part of integrated environmental management systems and becoming a crucial component for meeting increasing public expectations and supporting strategies for a better quality of life. Furthermore, there is a growing need for airport authorities to be transparent and provide the public with robust information (e.g. noise data) and tools (e.g. NMS public website) for impartially contributing to local land use planning decisions.

Various national and international standards are available for installing NMS around airports (for example, ISO-1996, SAE ARP4721), as well as for defining requirements for reliable measurements (ISO 20906). However, there is a notable lack of guidance on using these systems comprehensively, i.e. sharing good practices on making the most out of an NMS. Indeed, literature reviews, surveys, and case studies conducted at ICAO revealed cases where airports have either been using NMS non-comprehensively,

FIGURE 1: NMS monitoring station in Athens International Airport "Eleftherios Venizelos", Greece.

or stopped using it, due to various reasons; ranging from unreasonable public expectations (e.g. due to data/metrics misinterpretation), to misjudged planning and unexpected costs, resulting from underestimating NMS complexities.

About the ICAO initiative

In the CAEP/13 cycle, WG2 addressed the lack of NMS guidance by developing a report on NMS good practices. Aiming at providing relevant stakeholders, such as airport authorities, with reference material for using NMS to ultimately balance the airports' need to operate effectively, with the community's need to understand how noise exposure is measured and how that relates to their real-life experiences.

Although ICAO work on NMS practices at airports began about 20 years ago, the document on NMS good

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practices is the first official ICAO document on this topic; filling a notable and long-lived gap, i.e. the lack of guidance on comprehensively use of NMS. Aviation noise management is increasingly becoming part of a multi-disciplinary problem, and integrated systems, such as NMS, are becoming essential in shaping airports sustainability programs.

NMS and the Balanced Approach (BA) to Aircraft Noise Management

The main overarching ICAO policy on aircraft noise is the BA to Aircraft Noise Management, which consists of identifying the noise problem at an airport using objective and measurable criteria, and then analysing the various measures available to reduce noise through the exploration of four principal elements, namely reduction at source, land-use planning and management, noise abatement operational procedures and operating restrictions (see also: ICAO Resolution A41-20). Aiming at selecting noise-related measures that achieve environmental benefits in the most cost-effective manner.

Identifying a noise problem at an airport, and adopting effective mitigation measures, requires availability of adequate objective data describing the noise environment (and its changes), with respect to the surrounding housing development. NMS provide objective means, not only to promptly collect such data and therefore appraise the benefit from the different BA elements, but also to support noise models for forecasting and comparing noise exposure levels for different future scenarios. Hence contributing towards improving the ICAO BA implementation and enhancing airport ecosystem with day-to-day data.

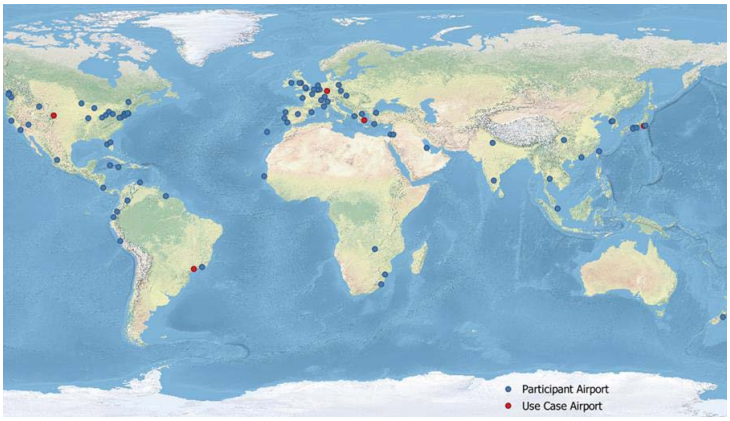

FIGURE 2: Map indicating locations of airports that responded to the survey and airports used as case studies.

What is ICAO doing on NMS?

A. Gaining understanding on current NMS practices

A necessary first step toward identifying NMS good practices required attaining a clear and holistic understanding of current practices and use cases of NMS from the point of view of different stakeholders, aiming to avoid bias due to approaching the task from specific stakeholders' perspectives. Therefore, multiple different approaches were explored and developed to acquire an understanding to deliver good practice reference material, namely, a survey to airports and interviews with NMS providers, literature review and review of use cases.

101 airports of various sizes and operational capacities and from different regions of the world participated in the survey to airports, which was web-based and consisted of open and multiple-choice questions. A more in-depth review of NMS at five 'use case' airports (namely Athens International Airport, Denver International Airport, Frankfurt International Airport, Sao Paulo Congonhas Airport, and Tokyo International Airport) was undertaken to gain additional insight into why airport implement NMS, what challenges are encountered, and identifying unique practices that contribute to successful NMS implementation. Figure 2 shows a graphical representation of the location of airports that responded to the survey.

In addition, four interviews with NMS providers were conducted; interviews were 'open', to allow NMS providers to provide unbiased responses and advice.

Data collected was analysed qualitatively and quantitatively to allow identification of trends and patterns that could lead to extraction of good practices. Figure 3 highlights the challenges of using the full capabilities of NMS. Data analysis also aimed at capturing indirect relationships, for example, on how factors such as local regulations or community engagement practices influenced not only the implementation of NMS, but

also its perceived performance (e.g., its contribution in reducing complaints). Overall, the survey results provided a valuable snapshot of the current state of NMS practices at airports worldwide and a basis, not only for further research, but also for policy development, and collaboration within and beyond the aviation industry.

FIGURE 3: Reasons Cited for not using all NMS functions.

B. Main takeaways from the data collected

The main takeaways from the data collected are outlined below:

- The results of the airport survey indicate that main motivation for NMS installation at airports included:
  - meeting legal or regulatory requirements;
  - taking proactive action; and,
  - responding to community request or public pressure.

- The majority of respondents also indicated that the role of NMS in the overall aircraft noise management process is to support noise calculation and noise mapping, verify noise predictions, as well as simplify complaints management.

- The majority of respondents expressed their satisfaction with the NMS and its use as a means to communicate with regulators and the general public.

- Airports indicated challenges related to processing, verifying, and analyzing NMS data.

- Major benefits of an NMS cited by airports included improved trust, compliance support, transparency and improved stakeholder/community engagement. Effective information dissemination/disclosure was another major benefit reported by the majority of airports.

- Negative impacts of operating the NMS mainly included unreasonable expectations by the public, confusion related to data interpretation, malicious use of NMS data, (e.g., for supporting political or litigation arguments), but also the dedicated additional resources needed to operate the NMS.

- From the NMS providers perspective, NMS is regarded as a tool that goes far beyond the management of airport noise impacts. It is viewed as a comprehensive mechanism integrated with an airport's sustainability programs and as a dynamic means for supporting effective and strategic communication and engagement.

- In the future, NMS providers envisage the NMS to evolve into integrated environmental management systems (e.g., alongside air quality pollution emission tracking) and to become a crucial component for meeting increasing expectations, not only from the communities' perspectives, but also for supporting strategies for a better quality of life.

Summary of NMS Good Practices

Table 1 summarises good practices. Their applicability (and value) may vary between airports, depending on local situations, but for practical implementation, the good practices have been organized into three broad categories:

- Planning for an NMS;
- Using and Maintaining NMS; and,
- Dissemination of NMS information.

TABLE 1: NMS good practices identified by the Task Group, organized into 3 main categories

1. PLANNING FOR A NOISE MONITORING SYSTEM
• Identify the motivations for implementing. • Proactively implement an NMS. • Use NMS platforms, that are thoroughly tested. • Plan for the training needs of the personnel operating the NMS. • Comprehensively understand the NMS potential and the functionalities needed to support the airport's noise management goals. Accordingly employ full time NMS processional(s) for its efficient operation. • Consider appropriate number and location(s) for the noise monitoring stations when planning for implementation of an NMS. • Consider NMS programs that allow the NMS user to obtain radar data. • Consult with relevant stakeholders such as the ANSP, community representatives, airline and airport operators before implementing an NMS.
2. USING AND MAINTAINING A NOISE MONITORING SYSTEM
• Conduct maintenance of the NMS at least once a year, or as per the NMS providers advice. • Understand that the full breadth of benefits can only be realized after operating an NMS for several years. • Track trends and fluency of noise abatement departure procedure (NADP) use • Conduct education and information efforts.
3. DISSEMINATING NOISE MONITORING SYSTEM INFORMATION
• Determine which entities should receive NMS data based on the goals of implementing the NMS, and resources constraints. • Determine the type of information that should be displayed on a public website and whether the data should be refined before it is made publicly available. • Educate communities on noise data, metrics, thresholds and how an NMS works. • Be transparent when the NMS is not functioning correctly.

Conclusion

The potential benefits of NMS are recognised and the CAEP WG2 literature review and surveys imply that their implementation has been increasing globally, often in a more integrated manner (i.e. integrated within wider environmental platforms). Nevertheless, their use has remained incomprehensive, due to a perceived lack of guidance, unique airport needs, as well as technical complexities.

ICAO has identified and outlined NMS good practices with the aim to guide airport authorities into using their NMS more efficiently and effectively, so that they ultimately get the most benefit for their airport management and impacted communities.

ICAO believes that, in combination with the ICAO's Balanced Approach, NMS maintains a high potential in supporting airports to achieve the maximum environmental benefit in a cost-effective manner. Good practices identified thus far are not exhaustive and they should evolve along with NMS evolutions. In that context, an envisaged next step is to create means for online dissemination of the good practices, which would also allow regular reviews of the contents, based on new evidence, such as new data and use cases.