



PHOTO CREDIT: ANDREA VIGNAROLI

# TASK 39 REPORT 2020

## Quiet wind turbine technology

Societal acceptance of new technologies is key to their successful adoption. In some jurisdictions, there is concern about the potential impact of wind turbine noise.

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**T**he goal of IEA Wind TCP Task 39 is to accelerate the development and deployment of quiet wind turbine technology and consolidate understanding of wind turbine sound emission, propagation, and ultimately its perception by residents

in term of annoyance, but also acceptance. The Task will convene an international expert panel to identify best practices in the prediction, measurement, and assessment of noise, as well as investigate regulatory aspects.

A first objective is to ensure that the best available information on quiet noise technology is available to consultants, regulators, and developers to contribute to relevant international standards and government regulations. A second objective is to promote



collaborative work between researchers across different countries on selected topics relevant for wind turbine noise related technologies. The collaboration will carry out its work in a series of focused work packages 1) addressing interdisciplinary education and guidance, and support interdisciplinary discussion, 2) addressing technical aspects of design, modelling, assessment, and measurement, including subjective effects, and 3) developing recommended practices.

To date, there has been broad participation in Task meetings, involving experts in a diversity of disciplines in industry, consultancy, and research. Remote participation and presentations in meetings, facilitated through web conferencing, have served to extend participation to a wider group of experts. In addition, there has been in-kind contributions, in terms of active participation to sub-tasks from the Task work programme, from several of the countries involved (formally or not, see below) in the Task activities. However, three countries have officially committed to participate in the Task with agreement from their relevant governmental organizations that grant participation in IEA Wind TCP activities (see Table 1).

In addition to the above countries, a number of countries have expressed their interest in participating to Task 39 and/or have joined Task meetings, but are not fully committed yet. These countries and organizations are (non-exhaustively): Canada (HGC Engineering, Aercoustics), China (Goldwind, CGC), Finland (Poyry), Ireland (SEAI, Trinity College Dublin, RPS Consulting), Norway, Switzerland (Prona SA), UK (ION Acoustics, Hayes McKenzie, Innogy Renewables), USA (CH2M, NREL, UC Davis).

## Progress and achievements

In the Task 39 work programme, three work packages corresponding to key aspects of wind turbine noise are defined, and a number of potential sub-tasks to be addressed are identified.

The first work package focuses on Interdisciplinary Education and Guidance. The corresponding activities have recently concentrated on the writing of two fact sheets: the first one on low-frequency noise and infrasound, the second on tonal noise (following a fact sheet on Amplitude Modulation published earlier).

These are currently being drafted and reviewed by international experts in respective fields. In addition, two technical documents are being considered. A Roadmap for Required Technological Advancements to Further Reduce Onshore Wind Turbine Noise Impact on the Environment has involved major wind turbine manufacturers as well as other participants from the industry, research experts and academics in the field. This document has been reviewed and it is in the process of being disseminated. Furthermore, a Catalogue of International Wind Turbine Noise International Wind Turbine Noise Limits and Regulations is currently being drafted. This should provide a better overview of the many different regulatory approaches used worldwide to tackle the issue of wind turbine noise, as well as provide some guidelines for countries in the process of developing new or more specific policy frameworks. The next step is to publish this information online, so that they can be interactively updated by experts in the field.

The second work package deals with physical and technical aspects of wind turbine noise. Two distinct benchmark exercises have been initiated. The first one is a wind turbine noise simulation codes benchmark conducted in collaboration with Task 29, the latter dealing with validation of aero-elastic wind turbine simulation codes. The first round of comparisons has been completed by four participants (DLR/DTU/IAG/TNO). Additional contributions (from NREL) have been included, and a few other institutes are expected to join this effort in the future (TUDelft, TUMünchen). A second benchmark is concerned with the creation of a database of aerodynamic and noise measurements for the validation of model for serrated airfoil. Improvement of the serration design as a noise mitigation technique can yield to further reduction of wind turbine noise emission. Measurement campaigns have been conducted in five acoustic wind tunnel facility by three different institutions (DTU, DLR, TUDelft). It is expected that UTwente will join this effort. The final goal is to produce a database reliable enough for the validation of numerical models for the prediction of serration noise in order to improve their design.

The third work package is concerned about the psycho-acoustic aspects of wind turbine noise. Unfortunately, there has been no contributions to this part of the Task

TABLE 1. COUNTRIES PARTICIPATING IN TASK

Table 1. Task 39 Participants in 2020		
	Country/Sponsor	Institution(s)
1	Denmark	DTU, SGRE, Vestas, FORCE
2	Germany	DLR, IAG & IFB Stuttgart, GE, Enercon
3	The Netherlands	TNO, TUDelft, Lagerwey



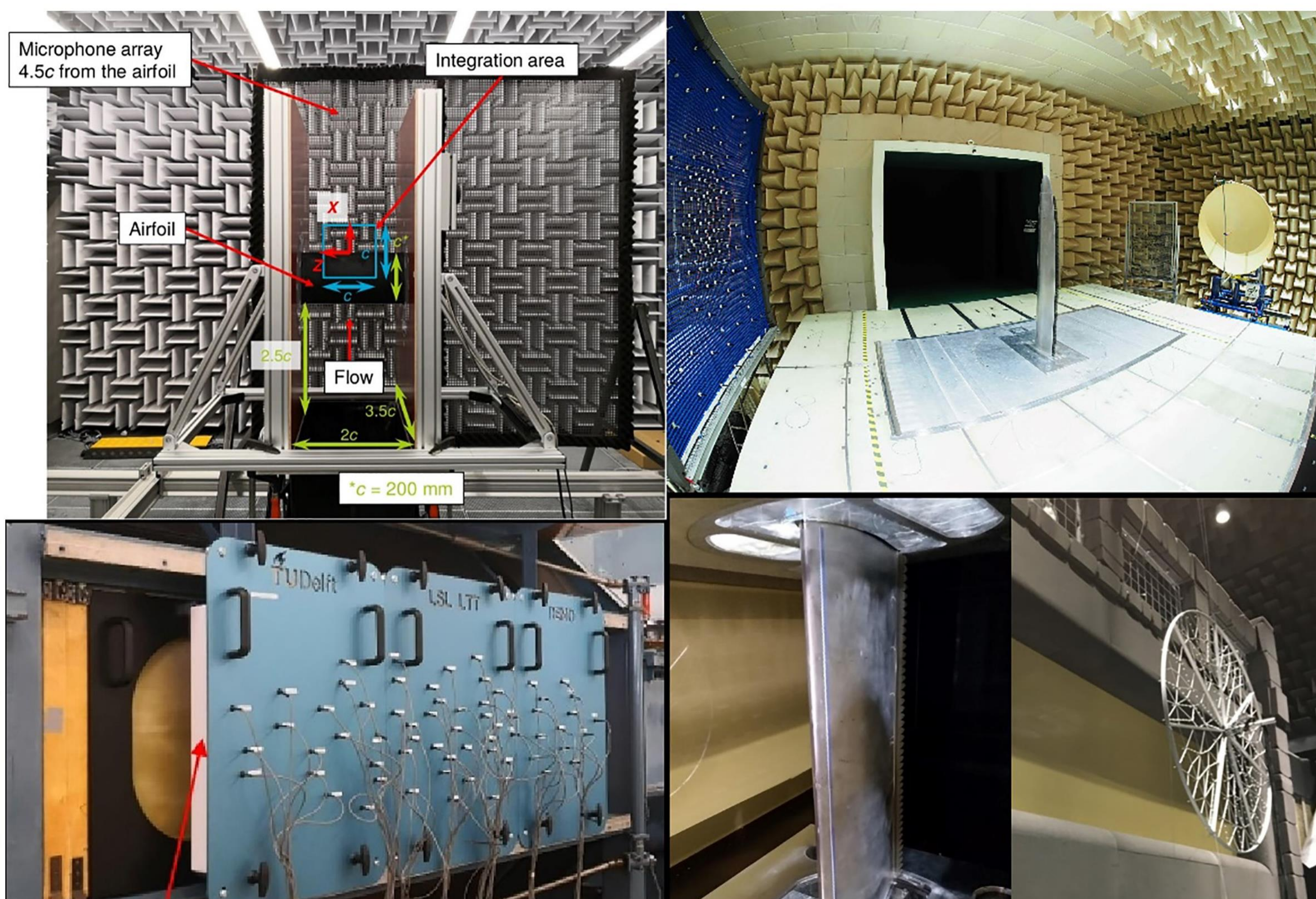


FIG. 1: FOUR OF THE FIVE WIND TUNNEL FACILITIES USED FOR THE SERRATION BENCHMARK (TOP LEFT: TU DELFT A-TUNNEL; BOTTOM LEFT: TU DELFT-LTT; TOP RIGHT: DLR-AWB; BOTTOM RIGHT: DTU-PLC).

from specialists in this domain in this first phase of Task 39. Nevertheless, the planning of the second phase is ongoing, and focus will be set on the psychology of noise, its perception in term of annoyance, but also in relation to other factors.

### Highlight

The serration benchmark was initially meant as a single experiment in an acoustic wind tunnel and the results should be shared among participants to compare and validate their respective simulation codes. However, several institutes have expressed interest to compare their respective acoustic wind tunnel capabilities in an extensive benchmark as a separate initiative. It has been decided that the serration benchmark should be coupled with this larger effort. As a result, measurements of serrated airfoil have been conducted in 2 wind tunnels at Delft University (NL), 2 wind tunnels at DLR (DE) and 1 at DTU (See Fig. 1).

### Outcomes and significance

From a general point of view, developing noise mitigation technologies and recommending best practices for regulatory and siting processes is regarded

as an important step toward public acceptance. This should eventually facilitate the deployment of wind energy. IEA Wind Task 28 has already advanced the potential for enhanced community engagement to address such problems.

On the technical side, the benchmarking and comparisons of models between research institutes and industry contribute to improve the design tools for quiet wind turbines design and their siting. This should also help in developing best practices on how to use these tools. Furthermore, the review report on existing noise regulations worldwide may provide a valuable overview for policy-makers, especially in countries in the early stage of wind energy deployment. Finally, the roadmap document on required technology for further wind turbine noise and environmental impact reduction can provide guidance for decision makers when prioritizing research goals regarding wind turbine technologies.

### Next steps

The first 3-year phase of Task 39 has officially ended at the end of year 2020. A new work programme for the



second phase is being drafted by existing and future participants with a larger focus on the psychology of noise, such as perception and social aspects.

Extension of Task 39 activities to a second phase has been submitted to the ExCo 87 meeting. The proposed new work program has been approved and will be conducted during the period 2021-2024.

### **Task contact**

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