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“Report on first/mid-term workshop”

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The EU DJINN project is a collaborative effort between CFD-Berlin (coordinator), Airbus SAS, Dassault Aviation, Safran Aircraft Engines, Rolls-Royce Deutschland, ONERA, DLR, University of Southampton, CERFACS, Imperial College London, von Karman Institute, CNRS, and Queen Mary University of London.

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Table of Contents

Page

1	The first DJINN CONFERENCE – Preparing the conference.....	4
2	The first DJINN CONFERENCE – During the conference	7
3	The first DJINN CONFERENCE – After the conference.....	10



1 The first DJINN CONFERENCE – Preparing the conference

Early in 2021 it was decided to go for a conference rather than a workshop. The main reason was that holding a conference would be more attractive to researchers from outside the consortium. To support this idea, two well-known scientists have been invited for presenting keynote lectures:

H. Xia (Loughborough University):

“Developing modelling and simulation techniques for high St jet noise.”

M. Azarpeyvand (University of Bristol):

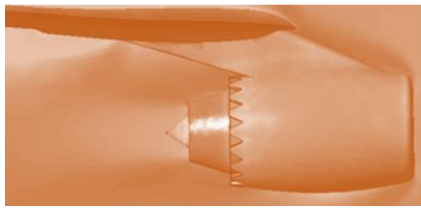
‘An overview of jet noise research at the University of Bristol’

The announcement of the conference was distributed by use of a flyer, which was updated and adjusted during the time of the preparation of the conference. The last version is exhibited on the two pages below.

Because the conference was held online, no fees applied, those who have been collected by the organiser, VKI, have been reimbursed in the meantime.

All information with respect to the conference details have been provided on the public part of the DJINN website, including information about the two openly available test cases, provided by CNRS and SOTON - for both as isolated and installed applications. A special website tab has been added with a description of the test cases - in a comprehensive manner.

The final version of the conference flyer is given below:



Taking place ONLINE

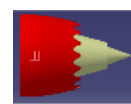
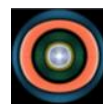
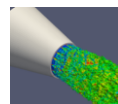


CONFERENCE

Industrially Oriented Jet Noise Reduction Technologies

1-2-3 December 2021 at the VKI, Brussels, Belgium

From noon to noon



The DJINN (Decrease Jet Installation Noise) initiative is an EU H2020 project coordinated by CFD-Berlin

Conference objectives

With the aim of reducing the environmental impact of noise caused by aircraft during take-off, the prediction and mitigation of jet-airframe interaction noise sources remains a significant challenge for integrated propulsion-airframe architectures. The ambition of the DJINN (**D**ecrease **J**et **I**nstallation **N**oise) project is therefore to develop a new generation of reliable computational fluid dynamics (CFD) methods, most of them belonging to the field of hybrid methods, for assessing promising noise-reduction technologies, with support and validation from reduced-scale experiments.

This key ambition of the DJINN CONFERENCE is tied to the provision of advanced tools for coupled aerodynamics-aeroacoustics to enable design optimisation in future industrial environments and to reach a new level of noise reduction through a highly collaborative effort – with the main innovative objectives targeting at industrial needs:

- Increase the frequency range of simulations, whilst maintaining affordability and ability to capture the complex geometries representing the two aircraft configurations selected.
- Predict under-wing jet-airframe interaction noise to within 1 dB accuracy.
- Demonstrate a reduction of jet-airframe interaction noise peak level at low frequencies.
- Reduce the turn-around time of high-order (CFD) approaches – like h-p refinement techniques for approaches such as Spectral Difference Methods (SDM) (mesh + simulation + post-processing).
- Evaluate innovative high-fidelity simulation-method components (accelerators, alternatives to FWH, improved numerical schemes) including optimisation aspects.

Call for (numerical and experimental) contributions

Contributions by participants are expected according to the listed topics:

- Innovative noise reduction technologies including **optimisation of designs**.
- **'Design-to-noise' capabilities** for jet-airframe interaction noise of under-wing and rear-fuselage mounted engines at various flight regimes.
- Near-field acoustic loads due to **jet-airframe interactions**
- Jet-airframe interaction noise technologies including **flow-control techniques** for commercial aircraft.
- **Improved solvers, highly adapted meshes** for complex geometries, improved **processing of data** ('co-processing'), high-performance computing (HPC) to reduce wall-clock times.
- **Advanced low-fidelity modelling** approaches to compare with high-fidelity CFD tools for 'rapid-design'.



Invited Speakers

H. Xia (Loughborough University):

“Developing modelling and simulation techniques for high St jet noise.”

M. Azarpeyvand (University of Bristol):

‘An overview of jet noise research at the University of Bristol’

Test cases for conference participants

It is of importance for the DJINN project to interact with colleagues from outside the DJINN consortium. Therefore, at the DJINN CONFERENCE two test cases (both isolated and installed nozzle geometries) will be made available including comprehensive data sets for computation.

All obtained results will be gathered well before the second DJINN CONFERENCE - close to the end of the DJINN project, i.e. about 1.5 to 2 years after this first conference.

Please note that **running a test case is NOT mandatory for registration.**

Date of DJINN CONFERENCE

1st to 3rd December 2021 – starting around noon on 1st December 2021 and terminating around noon on the 3rd of December 2021.

Location/Venue

The workshop will be hosted by the von Karman Institute for Fluid Dynamics, VKI, Waterlooosteenweg 72, B-1640 Sint-Genesius-Rode, Belgium. **All information regarding location and hotel accommodation can be taken from the djinn website.**

Conference fees

The workshop fee is 350 € - and will cover the book-of-abstracts, all coffee breaks and lunches, and a workshop dinner. Moreover, all presentation files will be made available to all conference participants as on the DJINN web site (‘DJINN CONFERENCE’ tab) as PDF versions.

Please note the following:

*Payment can be delayed until beginning of November at the latest - just to make provisions for any change in the COVID-19 pandemic. Nevertheless, the organisers would encourage everybody to **register now** (and pay later). Note also, that in case the pandemic will not allow for a face-to-face meeting, no fees apply. We will then go online.*

Deadline for registration / abstracts

The deadline for registration is **21 November 2021** with no further extension possible.

Please note the following: **When considering a presentation** at the conference, an **abstract (1-2 page(s) max.)** is requested by **15 November 2021** at the (very) latest.

Further information

do not hesitate to contact: W. Haase, werner.haase@cfd-berlin.com and/or visit <https://djinn.online> ... or use the QR-Code directly → and click on the ‘DJINN CONFERENCE’ tab



Organising and Scientific Committee

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2 The first DJINN CONFERENCE – During the conference

As mentioned above, two test cases have been identified (by CNRS and SOTON), that can be run both as isolated and installed applications. These cases have been presented during the conference by two special presentations at the beginning of the conference

The mentioned test cases have been made available right at/after the conference. They can be found on the website under the ‘1st DJINN CONFERENCE’ tab.

The key topics of the DJINN project were presented at the conference in an introductory presentation by the coordinator. The conference itself ran under the broader title: “*Industrially Oriented Jet Noise Reduction Technologies*”.

Unfortunately, the planned face-to-face meeting had to be replaced by a virtual/online conference, handled by the VKI. During the time of the conference, VKI supported the online presentations by the continuous presence of Elena Grof, providing immediate help when problems arose – which was very much appreciated.

The conference programme had been made available via the DJINN web site, and all registered participants received a file containing all submitted abstracts. In total, 23 conference presentations, including the mentioned concise overview about the DJINN project, have been presented.

More than 60 colleagues from more than 10 countries did participate.

A few days before the conference, a book-of-abstracts was distributed amongst the participants – together with the conference programme, listed below:



Afternoon Sessions (Wednesday, 1 December 2021)	
12:00 – 13:00	Registration
13:00 – 13:10	Welcome – Opening by <u>W. Haase</u> (CFD-Berlin, Germany)
13:10 – 13:45	<u>W. Haase</u> (CFD-Berlin, Germany) An Introduction to the EU DJINN project
13:45 – 14:55	Session 1 (Chairperson: <u>H. Siller</u>, DLR, Germany)
13:45 – 14:20	<u>P. Jordan</u> (CNRS – Université de Poitiers, France) Flow and acoustic fields of round turbulent jets
14:20 – 14:55	<u>J. L. T. Lawrence</u> (University of Southampton, UK) SOTON Generic Isolated and Installed Jet Test Cases
14:55 – 15:30	<i>Coffee break</i>
15:30 – 17:15	Session 2 (Chairperson: <u>H. Xia</u>, Loughborough University, UK)
15:30 – 16:05	<u>L. A. Maia</u> ¹ , <u>D. Eysseric</u> ¹ , <u>G. Brès</u> ² , <u>L. Lesshafft</u> ³ , <u>P. Jordan</u> ¹ (¹ Institut Pprime, CNRS-Université de Poitiers-ENSMA, France, ² Cascade Technologies Inc., USA, ³ Laboratoire d'Hydrodynamique, CNRS-Ecole Polytechnique, France) Instability mechanisms in jets with flight effects
16:05 – 16:40	<u>F. Gand</u> and <u>M. Huet</u> (ONERA, France) Zonal Detached Eddy Simulations of installed jet noise on unstructured grids with the elsA software
16:40 – 17:15	<u>U. Michel</u> ¹ , <u>M. Schwalbach</u> ¹ , <u>F. Thiele</u> ¹ , <u>H. Xia</u> ² , <u>Ch. Ellis</u> ² (¹ CFD-Berlin, Germany, ² Loughborough University, UK) Evaluation of a low dissipation and low dispersion finite volume scheme for turbulent jet noise prediction
17:15	<i>End of day 1</i>



Sessions on Thursday, 2 December 2021	
09:00 – 09:50	Invited Lecture I (Chairperson: <u>R. Ewert</u>, DLR, Germany) M. Azarpeyvand (<i>University of Bristol, UK</i>) An overview of jet noise research at the University of Bristol
09:50 – 10:25	Session 3 (Chairperson: <u>J. Lawrence</u>, Southampton University, UK)
09:50 – 10:25	<u>C. Jente</u> (<i>DLR, Germany</i>) Steady aerodynamics flow analysis for determining the necessary build space of an isolated jet shear layer
10:25 – 11:00	<i>Coffee break</i>
11:00 – 12:45	Session 3 cont.
11:00 – 11:35	<u>M. Mancinelli</u> , <u>U. Karban</u> , <u>I. Albuquerque Maia</u> , <u>P. Jordan</u> (<i>CNRS-Université de Poitiers-ENSMA, France</i>) Linear reactive control of jet-plate interaction noise
11:35 – 12:10	<u>C. Jente</u> (<i>DLR, Germany</i>) Jet-flap interaction noise in model scale and full scale - and the implications for evaluating noise reduction technologies
12:10 – 12:45	<u>C. Jente</u> , <u>J. Schmidt</u> (<i>DLR, Germany</i>) Noise reduction of Jet-Flap-Interaction using porous trailing edges, perforated and slotted plates
12:45 – 14:00	<i>Lunch break</i>
14:00 – 14:50	Invited Lecture II (Chairperson: <u>F. Clero</u>, ONERA, France) H. Xia (<i>Loughborough University, UK</i>) Towards prediction of high Strouhal number spectra of single-stream jet noise
14:50 – 16:00	Session 4 (Chairperson: <u>F. Clero</u>, ONERA, France)
14:50 – 15:25	<u>A.P. Markesteijn</u> , <u>V. Gryazev</u> , <u>S.A. Karabasov</u> (<i>Queen Mary University of London, UK</i>) GPU CABARET solutions for the SOTON benchmark jet noise problem
15:25 – 16:00	<u>H.A. Abid</u> ¹ , <u>A.P. Markesteijn</u> ¹ , <u>V. Gryazev</u> ¹ , <u>S.A. Karabasov</u> ¹ , <u>H.K. Jawara</u> ² , <u>M. Azarpeyvand</u> ² (<i>¹Queen Mary University of London, UK, ²University of Bristol, UK</i>) Jet Installation Noise Modelling Informed by GPU LES
16:00 – 16:20	<i>Coffee break</i>
16:20 – 18:05	Session 4 cont.
16:20 – 16:55	<u>D. Lindblad</u> , <u>S. Sherwin</u> , <u>Ch. Cantwell</u> (<i>Imperial College London, UK</i>) Jet Noise Predictions using the High-Order Discontinuous Galerkin Method
16:55 – 17:30	<u>F. Basile</u> ^{1,2} , <u>J.-B. Chapelier</u> ¹ , <u>R. Laraufie</u> ² , <u>P. Frey</u> ³ (<i>¹ONERA, ²Airbus SAS, ³Sorbonne Universités</i>) hp-adaptive hybrid RANS-LES simulations and aeroacoustic analysis of jet flows using a high-order Discontinuous Galerkin method
17:30 – 18:05	<u>U. Karban</u> ¹ , <u>P. Jordan</u> ² (<i>¹Middle East Technical University, Turkey, ²CNRS-Université de Poitiers-ENSMA, France</i>) Modeling closed-loop control of jet-flap interaction using Ginzburg-Landau equation
18:05	<i>End of day 2</i>



Morning Sessions (Friday, 3 December 2021)	
09:00 – 10:45	Session 5 (Chairperson: <u>S. Lemaire</u>, Dassault-Aviation, France)
09:00 – 09:35	<u>U. Michel, M. Höchel, F. Thiele</u> (CFD-Berlin, Germany) Jet-wing interaction noise based on simulated surface pressure signals
09:35 – 10:10	<u>V.B. Ananthan, J. Dierke, R. Ewert</u> (DLR, Germany) Evaluation of Low Noise Technologies for Jet-Flap Interaction Noise
10:10 – 10:45	<u>C. Jente</u> (DLR, Germany) Acoustic Mach number, jet Mach number or jet speed – what is the optimal control property for jet noise experiments at AWB
10:45 – 11:15	<i>Coffee break</i>
11:15 – 13:00	Session 6 (Chairperson: <u>S. Sherwin</u>, Imperial College London, UK)
11:15 – 11:50	<u>H. Siller, Ch. Jente, J. Schmidt, J.-B. Mansoux, W. Hage</u> (DLR, Germany) Jet-noise experiments in the small-scale jet facility JEXTRA
11:50 – 12:25	<u>J. L.T. Lawrence</u> ¹ , <u>A. R. Proença</u> ² (¹ University of Southampton, UK, ² Cranfield University, UK) Experimental Far-field Noise Results from Subsonic Single-Stream Isolated and Installed Chevron Nozzles
12:25 – 13:00	<u>C. Jente</u> (DLR, Germany) Drivers of Jet-flap interaction noise: The thrust vs. shear layer difference velocity experiment
13:00 – 13:05	Closing of the conference by <u>W. Haase</u> (CFD-Berlin, Germany)

3 The first DJINN CONFERENCE – After the conference

As mentioned, right after the conference the open test cases have been made available via the website.

All presentations are available for the participants via the website, but it should be noted that this page will be closed by the end of January 2022 because of data security reasons. Nevertheless, all participants have been informed that in case of later interest in a certain publication, the DJINN coordinator needs to be informed. He will send the corresponding ad requested paper.

We are now looking forward for the 2nd DJINN CONFERENCE in 2023 ...