# Aerodynamic Simulations on Airframe Noise Reduction Technology (FQUROH+)

Report Number: R19EDA101R20
Subject Category: Aeronautical Technology
URL: https://www.jss.jaxa.jp/en/ar/e2019/11577/

## Responsible Representative

Kazuomi Yamamoto, FQUROH+ Team, Aviation Systems Research Unit, Aeronautical Technology Directorate

## Contact Information

Kazuomi Yamamoto(yamamoto.kazuomi@jaxa.jp)

## Members

Kazuomi Yamamoto, Yasushi Ito, Takehisa Takaishi, Mitsuhiro Murayama, Ryotaro Sakai, Tohru Hirai, Kentaro Tanaka, Kazuhisa Amemiya, Gen Nakano, Takashi Ishida

## Abstract

The FQUROH (Flight Demonstration of Quiet Technology to Reduce Noise from High-Lift Configurations) project aims at raising the technical maturity level of the noise reduction technology for high-lift devices and landing gear, which draws international attention to reduce noise in areas around airports, to a level applicable to future development of aircraft and related equipment. This contributes to reduction of aircraft noise in local communities around the airport and airline operating costs by reducing landing fee. One of the objectives of the FQUROH project is to verify the feasibility of practical noise reduction concepts and design methods based on advanced computational simulations through modification of aircraft. Computational simulations were performed as part of the FQUROH project to investigate Reynolds number effects, wind tunnel wall interference effects, and time-mean flow features around major aeroacoustic noise sources, such as slats.

Ref. URL: http://www.aero.jaxa.jp/eng/research/ecat/fquroh/

## Reasons and benefits of using JAXA Supercomputer System

The JSS2 enabled a large number of high-fidelity Reynolds-averaged Navier-Stokes (RANS) simulations with aerodynamically-important details in several flight configurations in the expected flight envelop to be conducted in a timely manner. The aerodynamic effect of low-noise devices can be evaluated and quantified, which is difficult to obtain only with wind tunnel tests.

## Achievements of the Year

RANS simulations were conducted for the JAXA high-lift configuration standard model (JSM) to improve our computational techniques for half-span wind tunnel models and to deepen our understanding on wind tunnel wall effects (Fig. 1).

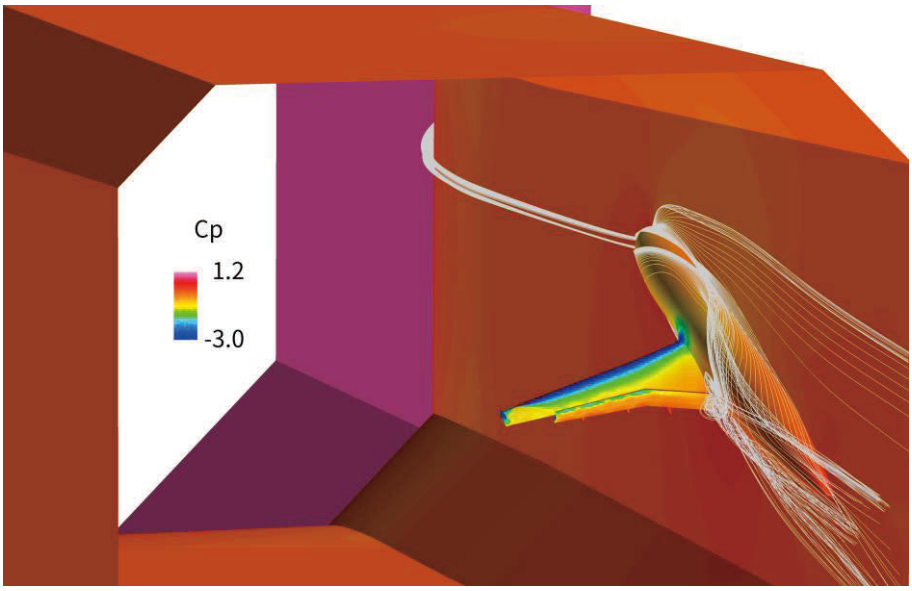


Fig. 1: JSM half-span model at an angle of attack of 20 degrees in the JAXA 6.5 m x 5.5 m Low Speed Wind Tunnel (LWT1)

## Publications

- Peer-reviewed papers

1) Ito, Y., Murayama, M., Yokokawa, Y., Yamamoto, K., Tanaka, K., Hirai, T., Yasuda, H., Tajima, A., and Ochi, A., "JAXA's and KHI's Contribution to the Third High Lift Prediction Workshop," Journal of Aircraft, Vol. 56, No. 3, May-June 2019, pp. 1080-1098, DOI: 10.2514/1.C035131.

- Invited Presentations

1) Ito, Y., "Automatic Local Remeshing Method for High-Fidelity Computational Fluid Dynamics Simulations," 6th Workshop on Grid Generation for Numerical Computations (Tetrahedron Workshop VI), INRIA Saclay Ile-de-France, Palaiseau, France, October 2019.

2) Yamamoto, K., "A Flight Demonstration Project for Airframe Noise Reduction Technologies, FQUROH," Asia Pacific International Symposium on Aerospace Technology (APISAT) 2019, Gold Coast, Australia, December 2019.

## Usage of JSS2

### Computational Information

| | |
|---|---|
| Process Parallelization Methods | MPI |
| Thread Parallelization Methods | Automatic Parallelization |
| Number of Processes | 216 |
| Elapsed Time per Case | 40 Hour(s) |

- **Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.41

Details

| Computational Resources | | |
|---|---|---|
| System Name | Amount of Core Time (core x hours) | Fraction of Usage[*2](%) |
| SORA-MA | 3,456,068.94 | 0.42 |
| SORA-PP | 138.15 | 0.00 |
| SORA-LM | 0.00 | 0.00 |
| SORA-TPP | 0.00 | 0.00 |

| File System Resources | | |
|---|---|---|
| File System Name | Storage Assigned (GiB) | Fraction of Usage*2(%) |
| /home | 66.10 | 0.06 |
| /data | 9,047.16 | 0.15 |
| /ltmp | 2,021.15 | 0.17 |

| Archiver Resources | | |
|---|---|---|
| Archiver Name | Storage Used (TiB) | Fraction of Usage*2(%) |
| J-SPACE | 280.18 | 7.05 |

[*1]: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.