

Research on Airframe Noise Reduction Design (FQUROH+)

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● Abstract

This research is being carried out as part of the FQUROH (Flight Demonstration of Quiet Technology to Reduce Noise from High-Lift Configurations) project aimed 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, large-scale computational simulations based on Large/Detached Eddy Simulations (LES/DES).

Ref. URL: <https://www.aero.jaxa.jp/eng/research/ecat/fquroh/>

● Reasons and benefits of using JAXA Supercomputer System

The JSS2 was used to understand detailed physics of noise generation, and to optimize noise reduction designs. The FQUROH project aims to accelerate technology maturity of airframe noise reduction methods using advanced large-scale, high-fidelity computational simulations on the JSS2's high performance computing platform and to demonstrate the high-fidelity design technologies through flight tests. Computational simulations using the JSS2 made it possible to design low-noise devices by understanding detailed physical phenomena, which was difficult to obtain only with wind tunnel tests.

● Achievements of the Year

Unsteady flow simulations have been conducted to understand flow characteristics around slats including slat

track rails that have been found to be major noise sources for airframe noise during landing. A representative part of a main wing was modeled with a periodic boundary condition in the spanwise direction so that highly-resolved flow field can be achieved using a dense mesh. Based on findings obtained by these simulations, noise reduction concepts for the slats have been proposed and the shape design of the noise reduction devices for a civil aircraft has been implemented.

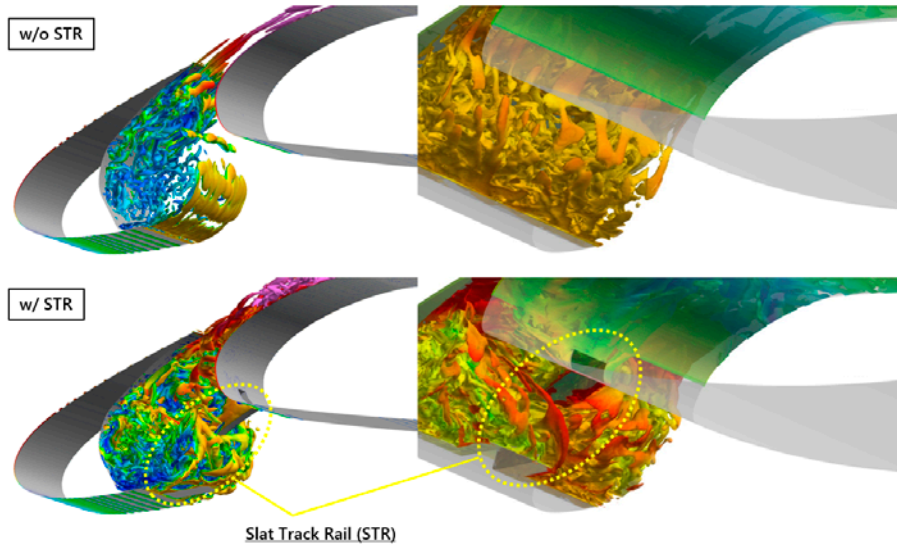


Fig. 1: Isosurfaces of Q-criterion colored by Mach number (left) and density (right) around a slat including a slat track rail from an unsteady flow simulation result for the representative part of the main wing.

● **Publications**

N/A

● **Usage of JSS**

● **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	1728 - 3456
Elapsed Time per Case	130 Hour(s)

- **Resources Used(JSS2)**

Fraction of Usage in Total Resources^{*1}(%): 0.81

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage ^{*2} (%)
SORA-MA	4,527,735.40	0.86
SORA-PP	85,621.17	0.67
SORA-LM	6,249.90	3.67
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage ^{*2} (%)
/home	48.66	0.04
/data	15,308.11	0.30
/ltmp	1,552.32	0.13

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage ^{*2} (%)
J-SPACE	280.06	9.27

^{*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.

- **Resources Used(JSS3)**

Fraction of Usage in Total Resources*1(%): 0.01

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2(%)
TOKI-SORA	16.07	0.00
TOKI-RURI	184.68	0.00
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	73.05	0.05
/data	17,238.08	0.29
/ssd	101.63	0.05

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	280.06	9.27

*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.