Aerodynamic Simulations on Airframe Noise Reduction Technology (FQUROH+)

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● **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**

Aerodynamic simulations by RANS CFD have been conducted for a civil aircraft model in a high-lift configuration as shown in Fig.1. Sensitivities of the fidelity of model geometries and a wall interference effect of

its half-span wind tunnel model have been investigated to improve the prediction accuracy of the aerodynamic performance of the aircraft. During the design process of the noise reduction devices, these simulations have been utilized to investigate flowfields associated with the noise generation from high-lift devices, such as slats and flaps. Computational simulations have been also conducted to evaluate the impact of the low-noise devices on flowfields and aerodynamic performance of the aircraft to ensure that the devices are effective in noise reduction and have a negligible impact on aerodynamics.
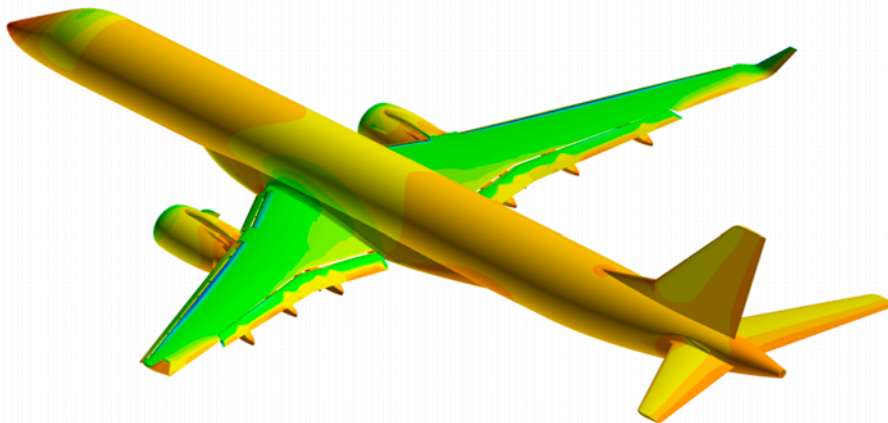

Fig. 1: Surface Cp distribution of a civil aircraft model with the high-lift devices deployed

● **Publications**

  N/A

● **Usage of JSS**

● **Computational Information**

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

- **Resources Used(JSS2)**

Fraction of Usage in Total Resources[1](%): 0.59

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[2](%)
SORA-MA	3,583,387.74	0.68
SORA-PP	2,907.97	0.02
SORA-LM	11.10	0.01
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	6,519.05	0.13
/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](%): 0.60

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[2](%)
TOKI-SORA	3,274,312.53	0.70
TOKI-RURI	63.48	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	8,449.02	0.14
/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.