Basic research for system integration of silent supersonic airplane technologies

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Abstract

The system integration design technologies for achieving low sonic-boom, low aerodynamic drag, low landing and take-off noise, and light weight simultaneously are the key technologies for future supersonic airplanes. JAXA is promoting the R&D for these technologies based on our experiences of demonstrating the advanced low-drag and low-boom design concepts.

Ref. URL: http://www.aero.jaxa.jp/eng/research/frontier/sst/

Reasons and benefits of using JAXA Supercomputer System

To achieve low sonic-boom, low aerodynamic drag, low landing and take-off noise, and light weight simultaneously, the multi-objective optimization tools are utilized in the design study. The super computer is necessary to obtain the multiple objective function efficiently with many numerical simulations.

Achievements of the Year

Buzz, the biggest issue in the operation of inlets for supersonic aircraft, is caused by the inflow of shear layers generated in the external compression region of the inlet. In order to prevent unsteady pressure fluctuation caused by buzz, it is necessary to clarify the mechanism of buzz generation. In this study, the process from the inflow of shear layer to the onset of buzz was investigated in detail by using FaSTAR (Fig. 1). As a result, it was found that the buzz occurs when the vortex generated by the shear layer inflow significantly restricts the flow rate into the intake (Fig. 2).

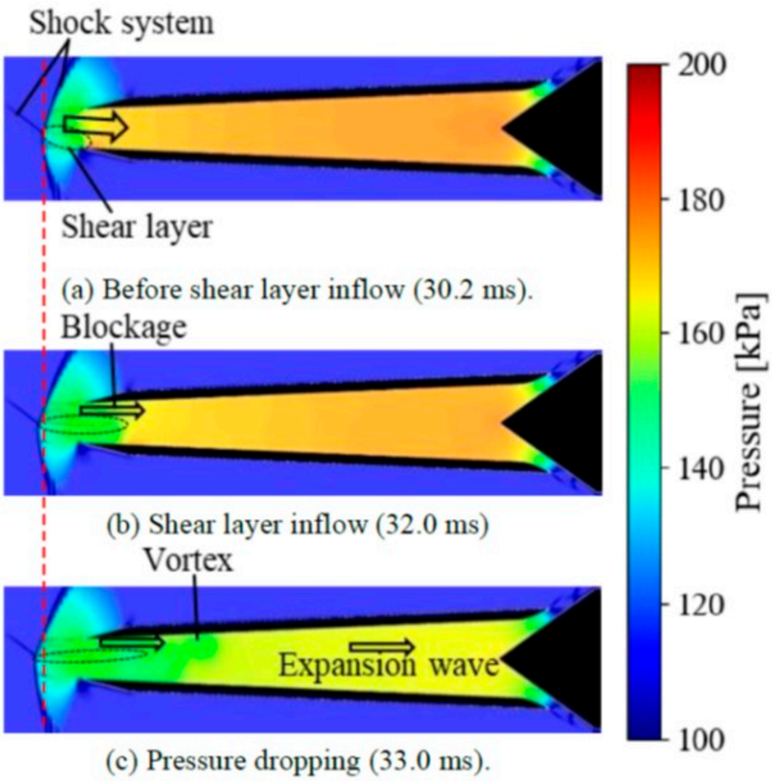

Fig. 1: Flow field

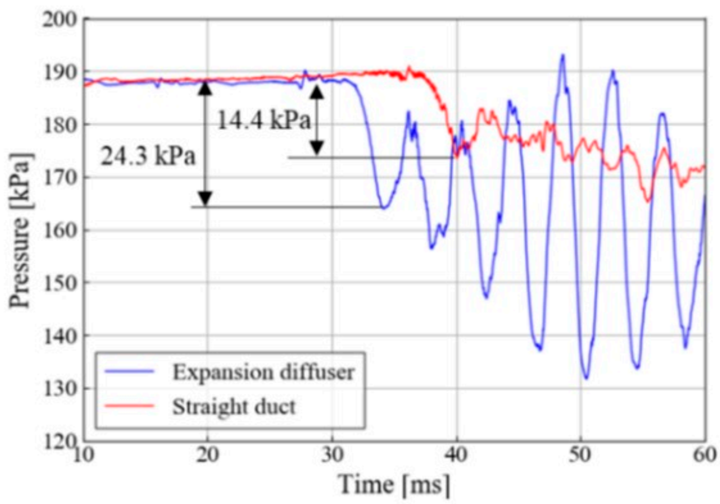

Fig. 2: Pressure time history

Publications

N/A

Usage of JSS

- **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelization
Number of Processes	128
Elapsed Time per Case	5.3 Hour(s)

- **Resources Used(JSS2)**

Fraction of Usage in Total Resources*1(%): 0.66

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2(%)
SORA-MA	3,012,904.94	0.57
SORA-PP	88,001.71	0.69
SORA-LM	4,661.88	2.74
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	1,148.81	1.05
/data	47,673.49	0.92
/ltmp	10,695.69	0.91

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	3.41	0.11

*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](%): 0.05

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	8.00	0.00
TOKI-RURI	7,282.04	0.04
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	940.96	0.64
/data	56,271.58	0.94
/ssd	413.26	0.22

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	3.41	0.11

[*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.