Aerodynamic testing technology for reentering capsules

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Abstract

To enhance hypersonic aerodynamic testing technology especially for reentering vehicles through developing understanding about the hypersonic wind tunnel nozzle flow which affects a lot estimation error to the flight characteristics and through defining the ability in predicting RCS jet interaction.

Reasons and benefits of using JAXA Supercomputer System

Since it perfectly suits the requirement in calculating heavy RCS jet interaction flow field and the hypersonic nozzle flow. Useful tools such as FaSTAR is another.

Achievements of the Year

Flow inside JAXA 1.27m hypersonic wind tunnel was solved numerically. One standard deviation of change rate of the freestream dynamic pressure in the expriments was 1.3 %. CFD results required 300-700K of the uncooled block temperature (Fig.1), or 0.7-1.4mm of the gap with 300 K of the inflow temperature (Fig.2). In the future, the gap may be filled in, and the effect was investigated by CFD. The present p02/p0 variation was 0.026%. When the gap was filled in, p02/p0 variation was 0.017%. It concluded that the gap could be filled in.

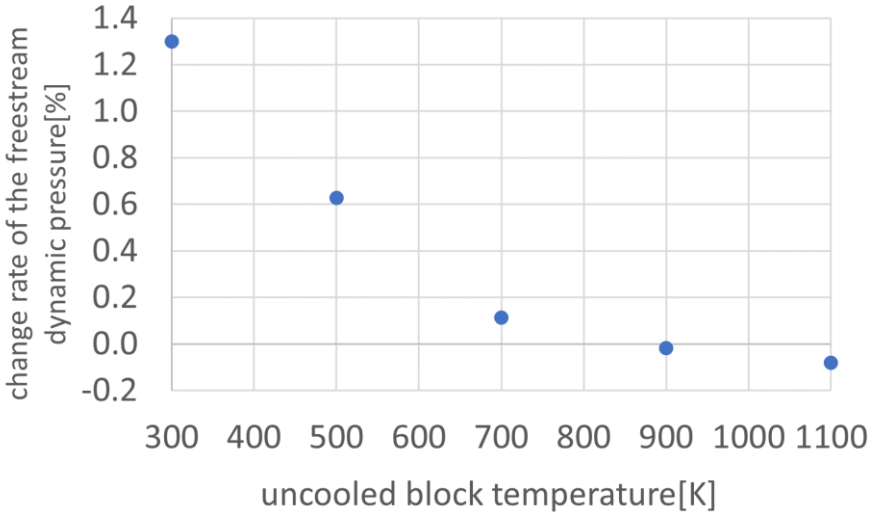

Fig. 1: The effect of uncooled block temperature on change rate of the freestream dynamic pressure

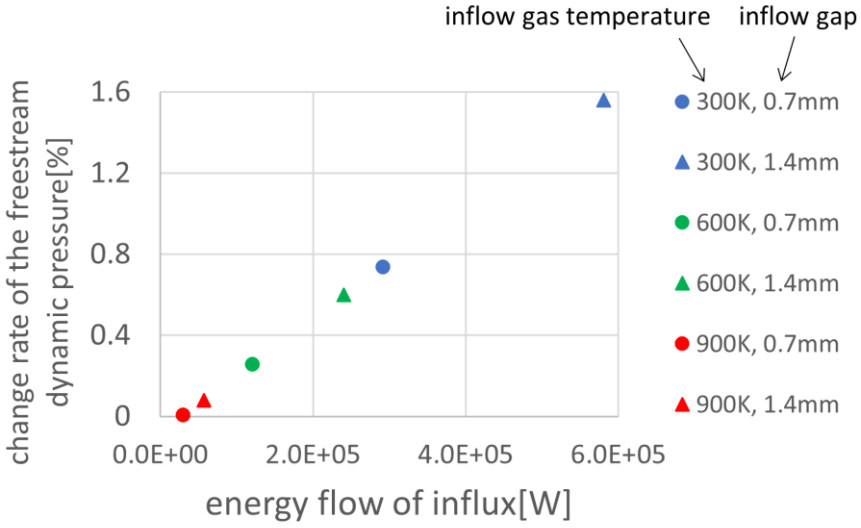

Fig. 2: The effect of energy flow of inflow on change rate of the freestream dynamic pressure

- **Publications**

  N/A

- **Usage of JSS**

- **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	48
Elapsed Time per Case	40 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.06

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	1,685,202.00	0.07
TOKI-ST	8,906.91	0.01
TOKI-GP	0.00	0.00
TOKI-XM	18.37	0.01
TOKI-LM	2,002.66	0.13
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2] (%)
/home	244.46	0.22
/data and /data2	3,534.82	0.03
/ssd	416.65	0.06

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2] (%)
J-SPACE	5.60	0.02

[*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.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage[*2] (%)
ISV Software Licenses (Total)	322.53	0.22

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