

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. The causes for the variation of dynamic pressure at the nozzle exit, which was observed in the experiments, were investigated numerically. Two factors were predicted as a candidate of the cause. One is the wall temperature upstream of the cooled nozzle throat block, as shown in Fig.1. The other is the inflow from the downstream of the settling chamber, as shown in Fig.2. The magnitude of the dynamic pressure variation was comparable between experiment and CFD.

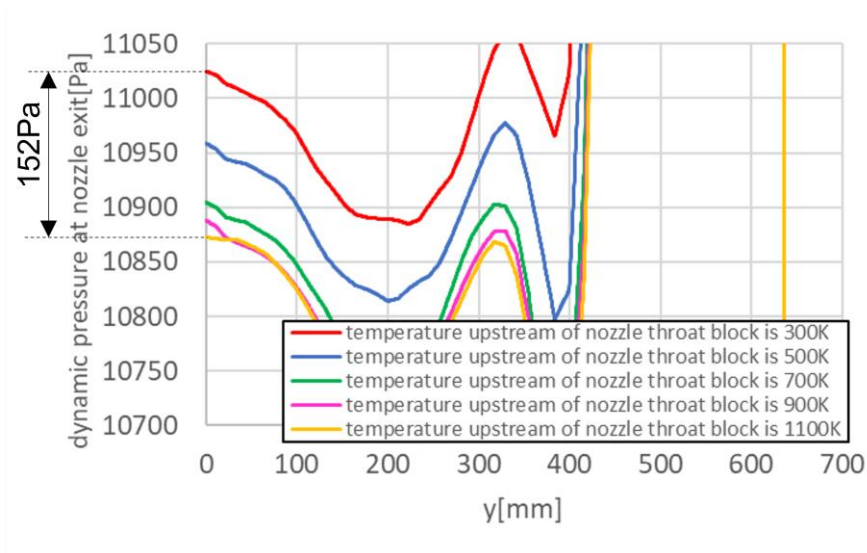


Fig. 1: The effect of non-cooled block temperature on the dynamic pressure at the nozzle exit

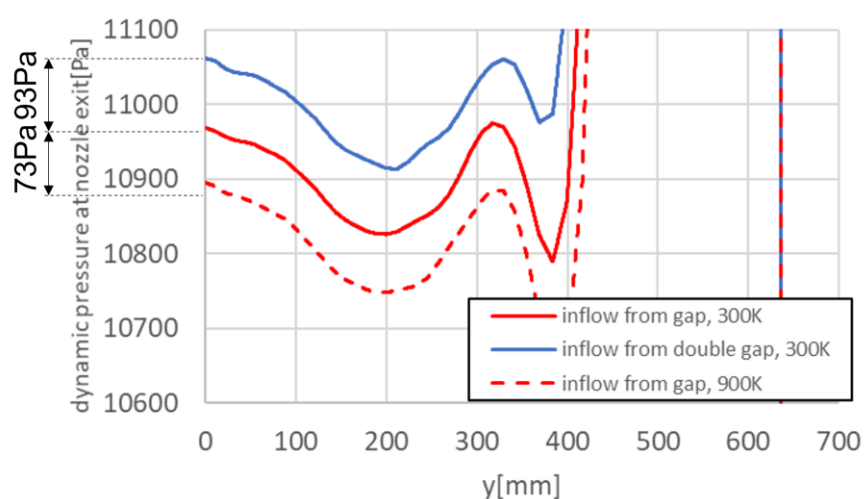


Fig. 2: The effect of the inflow from the gap on the dynamic pressure at the nozzle exit

● Publications

N/A

● Usage of JSS

● Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	48 - 144
Elapsed Time per Case	24 Hour(s)

● **JSS3 Resources Used**

Fraction of Usage in Total Resources^{*1}(%): 0.08

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage ^{*2} (%)
TOKI-SORA	1,799,921.68	0.09
TOKI-ST	10,632.36	0.01
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	18.72	0.00
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	137.91	0.14
/data and /data2	3,589.32	0.04
/ssd	128.33	0.03

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage ^{*2} (%)
J-SPACE	5.82	0.04

^{*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)	646.36	0.45

^{*2}: Fraction of Usage : Percentage of usage relative to each resource used in one year.