

Research on advanced rocket engines

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● Abstract

The objective of our work is to accelerate ongoing projects such as RV-X and CALLISTO, which are R&D of small reusable rockets, and future researches on reusable and advanced rocket engines through numerical simulations.

● Reasons and benefits of using JAXA Supercomputer System

It is very useful for researchers who make R&D of advanced rocket engines that various softwares such as CFD and FEM are available.

● Achievements of the Year

1. The effect of engine plumes of the RV-X engine at flight tests on ground facilities are examined using CFD simulations (Fig.1).

2. Aerodynamic forces acting on the vehicle of CALLISTO during its descending phase are investigated using CFD simulations.

3. In order to establish a low-cost manufacturing method for a small liquid rocket engine being conducted in J-SPARC, the strength of the combustion chamber and nozzle against pressure and thrust was investigated using FEM analysis code (Fig. 2).

4. Regarding the electric pump for supplying liquid rocket engine propellant, the stress generated in the rotor of the axial-gap-motor and the critical speeds of the LOX-electric-pump were investigated using FEM analysis.

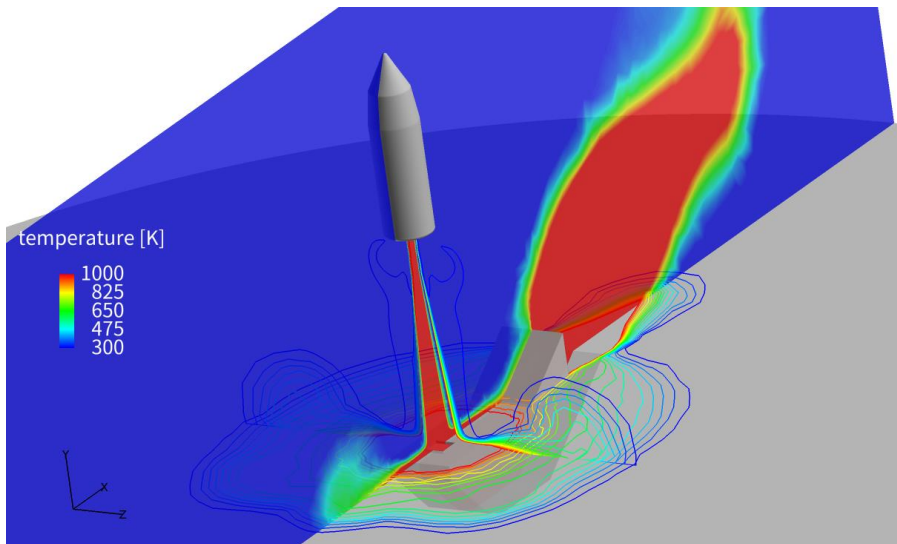


Fig. 1: The temperature distribution of engine plume gas of RV-X vehicle when the vehicle is above its launch pad.

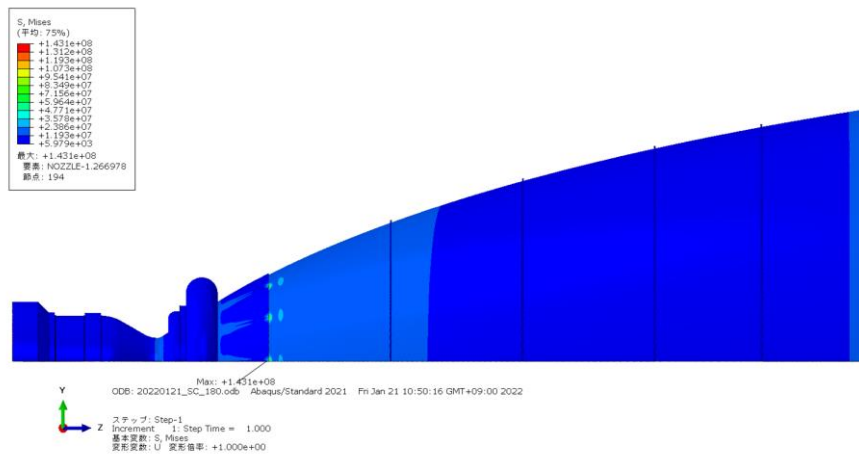


Fig. 2: An example of analysis result that evaluated the integrity of the regeneratively cooled combustion chamber and nozzle for pressure and thrust.

● **Publications**

N/A

● **Usage of JSS**

● **Computational Information**

Process Parallelization Methods	N/A
Thread Parallelization Methods	N/A
Number of Processes	1
Elapsed Time per Case	0 Second(s)

● **JSS3 Resources Used**

Fraction of Usage in Total Resources*¹(%): 0.10

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage* ² (%)
TOKI-SORA	0.00	0.00
TOKI-ST	1,441.33	0.00
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	0.00	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	133.15	0.13
/data and /data2	324.00	0.00
/ssd	170.00	0.04

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage* ² (%)
J-SPACE	0.83	0.01

*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)	8,022.41	5.62

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