

## Numerical Simulations for H3 Rocket Development

Report Number: R20EK2302

Subject Category: Space Technology

URL: <https://www.jss.jaxa.jp/en/ar/e2020/14367/>

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### ● Abstract

Please refer to the following URL: <http://global.jaxa.jp/projects/rockets/h3/>

### ● Reasons and benefits of using JAXA Supercomputer System

Risk management is the key to make a success of a large-scale development project like H3 rocket. This is because its development schedule and cost could be significantly influenced by the face of imminent risks when new technologies are under system-level verification and validation. In order to complete the project under defined period and cost, a variety of efforts are essential for planning and process of technology development itself in terms of efficiency and certainty. In that context, numerical simulation technologies and JSS2 have been playing one of major roles to make the H3 project success.

### ● Achievements of the Year

With regard to the booster engine, 'LE-9', under detailed design phase, evaluation of design and risks as well as studies for improvement were carried out by making full use of JSS2. In FY2020, numerical simulations of the combustion chamber and turbopump design were performed to improve their designs and contributed to the LE-9 engine development.

### ● Publications

N/A

## ● Usage of JSS

### ● Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	FLAT
Number of Processes	128 - 16000
Elapsed Time per Case	300 Hour(s)

### ● Resources Used(JSS2)

Fraction of Usage in Total Resources<sup>\*1</sup>(%): 19.94

#### Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage <sup>*2</sup> (%)
SORA-MA	121,029,899.97	22.90
SORA-PP	26,087.25	0.20
SORA-LM	1,671.35	0.98
SORA-TPP	39,869.40	3.76

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage <sup>*2</sup> (%)
/home	10,114.56	9.27
/data	94,775.12	1.83
/ltmp	5,030.67	0.43

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage <sup>*2</sup> (%)
J-SPACE	137.54	4.55

<sup>\*1</sup>: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

<sup>\*2</sup>: Fraction of Usage : Percentage of usage relative to each resource used in one year.

- **Resources Used(JSS3)**

Fraction of Usage in Total Resources<sup>\*1</sup>(%): 5.59

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage <sup>*2</sup> (%)
TOKI-SORA	29,499,285.00	6.35
TOKI-RURI	62,324.00	0.36
TOKI-TRURI	278,038.81	22.41

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage <sup>*2</sup> (%)
/home	16,536.22	11.33
/data	173,852.76	2.91
/ssd	2,897.57	1.51

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage <sup>*2</sup> (%)
J-SPACE	137.54	4.55

<sup>\*1</sup>: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

<sup>\*2</sup>: Fraction of Usage : Percentage of usage relative to each resource used in one year.