

Numerical Simulations for H3 Rocket Development

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Subject Category: Space Technology

URL: <https://www.jss.jaxa.jp/en/ar/e2021/18123/>

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● Abstract

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

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● 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 JSS3. In FY2021, 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) |

● JSS3 Resources Used

Fraction of Usage in Total Resources*1(%): 14.03

Details

| Computational Resources | | |
|-------------------------|--------------------------------------|------------------------|
| System Name | CPU Resources Used (core x hours) | Fraction of Usage*2(%) |
| TOKI-SORA | 323,981,464.75 | 15.76 |
| TOKI-ST | 1,177,976.71 | 1.45 |
| TOKI-GP | 189.74 | 0.13 |
| TOKI-XM | 37,779.58 | 27.22 |
| TOKI-LM | 21,481.42 | 1.60 |
| TOKI-TST | 2,076,545.45 | 43.57 |
| TOKI-TGP | 0.00 | 0.00 |
| TOKI-TLM | 6,456.52 | 19.85 |

| File System Resources | | |
|-----------------------|------------------------|------------------------|
| File System Name | Storage Assigned (GiB) | Fraction of Usage*2(%) |
| /home | 4,281.66 | 4.26 |
| /data and /data2 | 232,478.04 | 2.48 |
| /ssd | 5,155.69 | 1.33 |

| Archiver Resources | | |
|--------------------|--------------------|------------------------|
| Archiver Name | Storage Used (TiB) | Fraction of Usage*2(%) |
| J-SPACE | 228.84 | 1.55 |

*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) | 4,371.85 | 3.06 |

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