

## Numerical Simulations for H3 Rocket Development

Report Number: R18EK2302

Subject Category: Space Technology

URL: <https://www.jss.jaxa.jp/en/ar/e2018/9151/>

### ● Responsible Representative

Masashi Okada, Space Technology Directorate I, H3 Project Team

### ● Contact Information

Hideyo Negishi (negishi.hideyo@jaxa.jp)

### ● Members

Kuniyuki Takekawa, Seiji Tsutsumi, Masashi Kanamori, Masaaki Ino, Hironori Fujiwara, Masaharu Abe, Hiroyuki Ito, Shinji Ohno, Takenori Nakajima, Hideyo Negishi, Yu Daimon, Takanori Haga, Taro Shimizu, Junya Aono, Tetsufumi Ohmaru, Akiko Kotani, Taroh Fukuda

### ● Abstract

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

### ● Reasons for using JSS2

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 FY2018, the turbopump design was upgraded based on parametric study by using numerical simulations and the improvement of turbopump performance was verified by LE-9 engine tests without performing prototype tests.

### ● Publications

- Non peer-reviewed papers

(1) Ogawa, Y., et al., “The latest Development Status of LE-9 Engine Turbopumps,” AIAA Propulsion and Energy Forum, Cincinnati, Ohio, AIAA Paper 2018-4550, July 9-11, 2018.

(2) Kawashima, H., et al., “Progress of LE-9 Engine Development,” AIAA Propulsion and Energy Forum, Cincinnati, Ohio, AIAA Paper 2018-4458, July 9-11, 2018.

- Usage of JSS2

- Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	FLAT
Number of Processes	128 - 6400
Elapsed Time per Case	300 Hour (s)

- Resources Used

Fraction of Usage in Total Resources\*1 (%): 8.38

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	77,957,270.94	9.54
SORA-PP	2,508.19	0.02
SORA-LM	697.60	0.33
SORA-TPP	1.07	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2 (%)
/home	7,779.71	8.05
/data	86,565.32	1.53
/ltmp	2,935.04	0.25

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	116.34	4.07

\*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.