

## Numerical analysis on fuel injector design

Report Number: R21EBA30201

Subject Category: Aeronautical Technology

URL: <https://www.jss.jaxa.jp/en/ar/e2021/18387/>

### ● Responsible Representative

Takashi Yamane, Aeronautical Technology Directorate, En-Core Project team

### ● Contact Information

Kazuaki Matsuura, Japan Aerospace Exploration Agency, Aeronautical Technology Directorate, En-Core Project team(matsuura.kazuaki@jaxa.jp)

### ● Members

Kazuaki Matsuura, Jun Iino, Takahiro Inagawa, Kinya Saito, Huilai Zhang, Aya Yoshida, Kunihiko Sakata

### ● Abstract

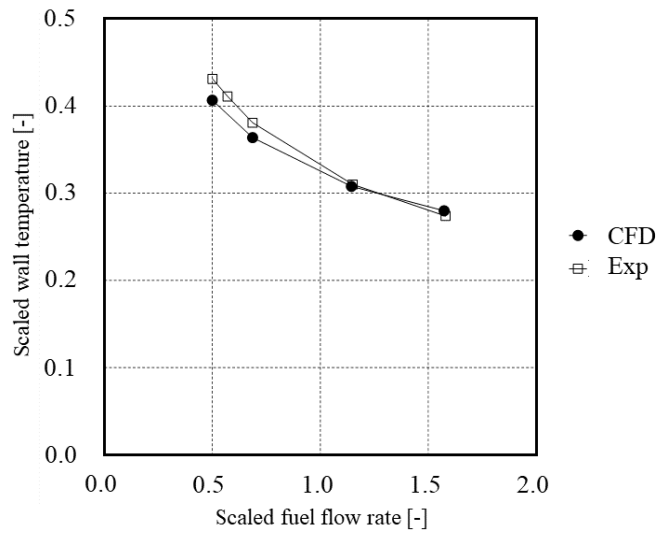
Numerical simulations of thermofluid dynamics are performed to optimize fuel injector design.

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

The use of supercomputer is necessary due to high computational load of thermofluid analysis on fuel injectors in complex design.

### ● Achievements of the Year

In order to avoid fuel coking in fuel circuits of a coaxially-staged lean-burn fuel injector, development cycle of thermal-protection design and of its numerical evaluation was carried out. As a result, thermal-protection performance of the injector was improved (at least in numerical space). Furthermore, the results of CFD and of the corresponding experiment on injector-wall temperature were compared to each other for CFD validation. Both results showed good agreement at a certain airflow condition as shown in the figure below, but the validation should be further conducted at different conditions.



5

Fig. 1: Relationship between fuel flow rate and wall temperature at a monitoring point: Comparison between CFD and experiment.

● **Publications**

N/A

● **Usage of JSS**

● **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	1024
Elapsed Time per Case	165 Hour(s)

● **JSS3 Resources Used**

Fraction of Usage in Total Resources\*<sup>1</sup>(%): 1.01

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage* <sup>2</sup> (%)
TOKI-SORA	24,048,953.55	1.17
TOKI-ST	2,732.71	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* <sup>2</sup> (%)
/home	193.32	0.19
/data and /data2	70,024.00	0.75
/ssd	253.33	0.07

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage* <sup>2</sup> (%)
J-SPACE	0.00	0.00

\*<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.

● **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage*2(%)
ISV Software Licenses (Total)	0.00	0.00

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