

## Aerodynamics of Re-entry Capsule with Hyperbolic Contours

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### ● Abstract

For develeopment of future sample return capsule, we applied the hyperbolic contours to design the front shape of the capsue. To find the optimal shape of the capsule, we perfomed CFD analyses.

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

There have been many shapes depending on the parameter for hyperbolic curves with various flight conditions such as Mach number and AoA.

### ● Achievements of the Year

This year, aerodynamic characteristics of a hyperbolic re-entry capsule in the supersonic region were investigated by wind tunnel experiments and CFD analysis. For the analysis, the JSS version of FaSTAR was used, and HexaGrid v1.2.1 was used for grid generation. A thin-shelled capsule with a 60 degree semi-apical angle was used as the reference capsule shape. As a result, it was confirmed that the local pressure drop could be improved by using a hyperbolic shape as in the HAYABUSA capsule.

### ● Publications

N/A

### ● Usage of JSS

#### ● Computational Information

|                                 |              |
|---------------------------------|--------------|
| Process Parallelization Methods | MPI          |
| Thread Parallelization Methods  | N/A          |
| Number of Processes             | 36 - 72      |
| Elapsed Time per Case           | 60 Minute(s) |

# ● JSS3 Resources Used

Fraction of Usage in Total Resources\*1(%): 0.00

Details

| Computational Resources |                                      |                        |
|-------------------------|--------------------------------------|------------------------|
| System Name             | CPU Resources Used<br>(core x hours) | Fraction of Usage*2(%) |
| TOKI-SORA               | 19.36                                | 0.00                   |
| TOKI-ST                 | 3,714.83                             | 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                 | 0.00                   | 0.00                    |
| /data and /data2      | 0.00                   | 0.00                    |
| /ssd                  | 0.00                   | 0.00                    |

| Archiver Resources |                    |                         |
|--------------------|--------------------|-------------------------|
| Archiver Name      | Storage Used (TiB) | Fraction of Usage*2 (%) |
| J-SPACE            | 0.00               | 0.00                    |

\*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<br>(Hours) | Fraction of Usage <sup>*2</sup> (%) |
| ISV Software Licenses<br>(Total) | 0.00                                  | 0.00                                |

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