

## Research on the Future Transportation Technology ( Integrated Design of Airframe and Engine)

Report Number : R17EG3103

Subject Category : Research and Development

URL : <https://www.jss.jaxa.jp/ar/e2017/4436/>

### ● Responsible Representative

Kouichi Okita Research and Development Directorate, Unit IV

### ● Contact Information

Susumu Hasegawa hasegawa.susumu@jaxa.jp

### ● Members

Susumu Hasegawa

### ● Abstract

The establishment of technologies for airframe/engine integration of the spaceplane for the realization of future space transportation technology.

### ● Reasons for using of JSS2

The comparison between the experimental data obtained by wind tunnel tests and the numerical results were conducted and verified. After the verifications of numerical results, various aerodynamic data which are difficult to obtain by experiments are computed and analyzed by CFD for the realization of the spaceplane.

### ● Achievements of the Year

Correspondent numerical calculations of spaceplane performed by wind tunnel experiment were carried out. Comparing the experimental results with the numerical calculation results, computational results obtained by CFD are in good agreement with experimental results. Furthermore, in order to improve the spaceplane configuration, the configuration where flow separation was likely to occur was identified in each flight Mach number. We changed the spaceplane configuration of the second phase spaceplane and conducted the wind tunnel tests in December, 2017. Moreover, the analysis of ejector experiments was carried out using CFD.

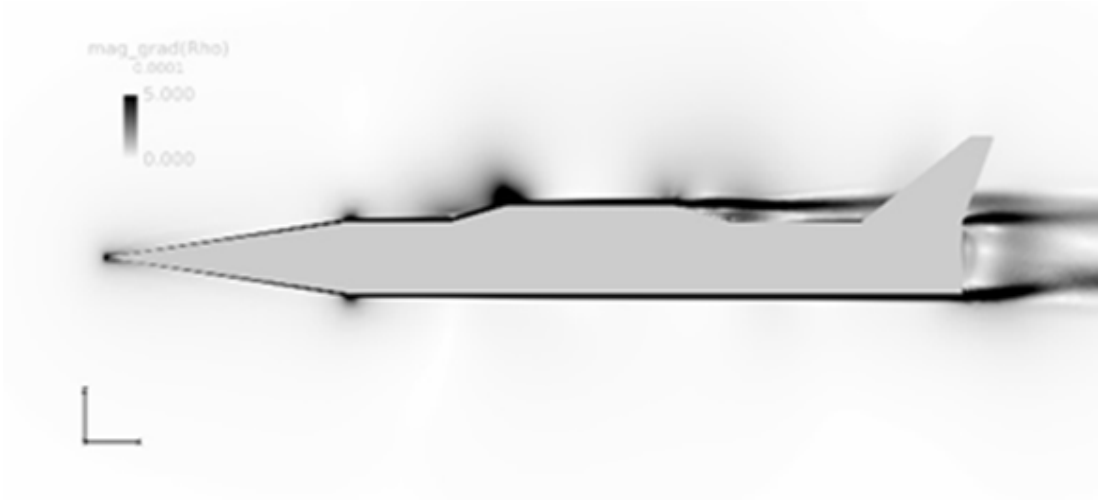


Fig.1 Numerical Schlieren around the splpaceplane for the flight condition of Mach 0.7

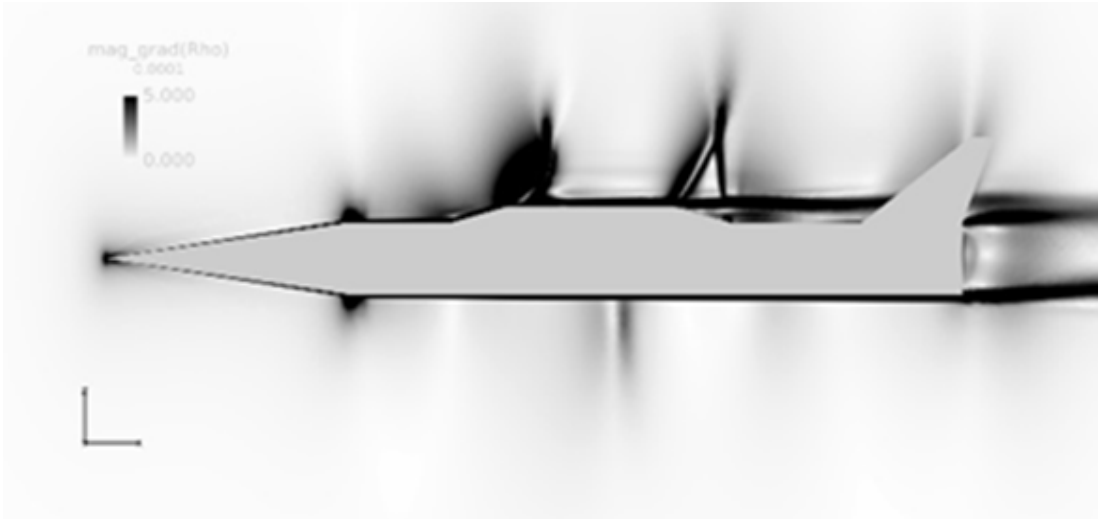


Fig.2 Numerical Schlieren around the splpaceplane for the flight condition of Mach 0.9

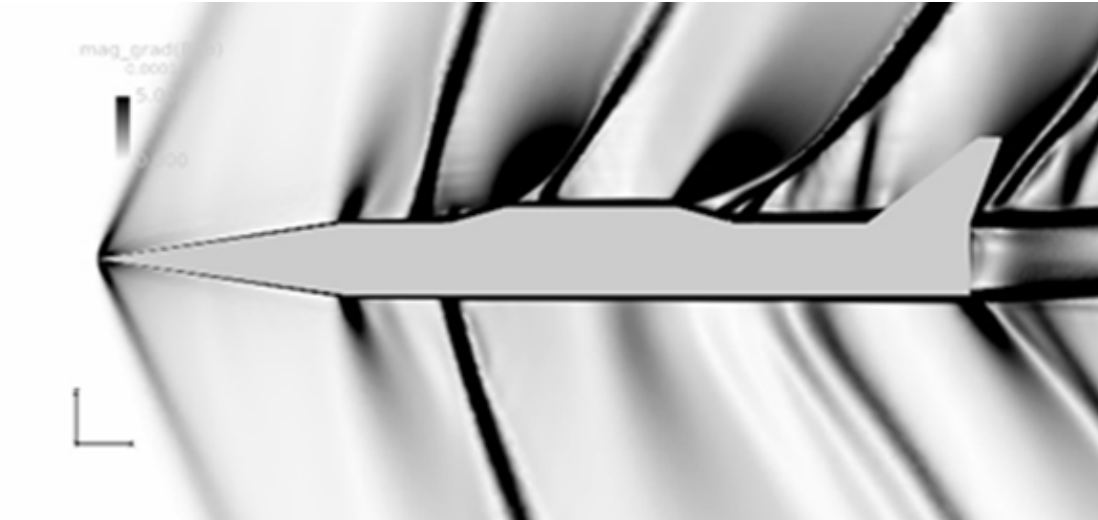


Fig.3 Numerical Schlieren around the splpaceplane for the flight condition of Mach 1.1

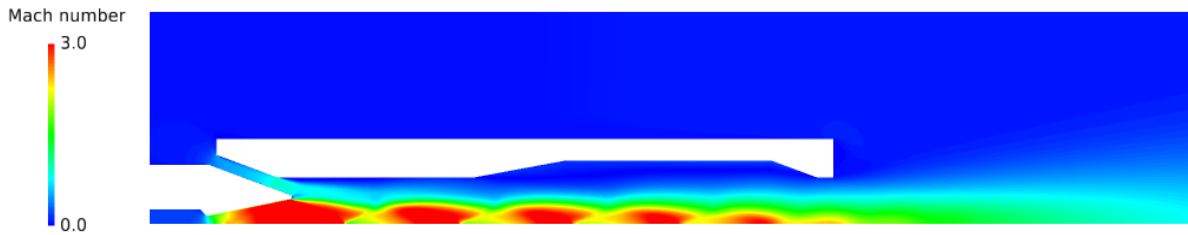


Fig.4 Mach number distribution around the ejector (The chamber pressure was 3.0MPa)

## ● Publications

### ● Peer-reviewed papers

- 1) Susumu Hasegawa, Takeshi Kanda: "Preliminary Numerical Simulation of Flow around Spaceplane for Airframe Engine Integration", Transactions of JSASS, Aerospace Technology Japan.

### ● Non peer-reviewed papers

- 1) Kanenori Kato, Kouichi Takasaki, Kouichiro Tani, Susumu Hasegawa, Kazuhide Mizobata, and Takeshi Kanda, "Coupled Aerodynamic Characteristics of Airframe and Engine of Space Plane", 31st ISTS, 2017-a-41, Matsuyama, Ehime, Japan. Jun. 2017.
- 2) Susumu Hasegawa, Kanda Takeshi : Numerical analysis of the flowfield around the spaceplane tested in the transonic wind tunnel, JSASS Northern Branch 2018 Annual Meeting, Sendai, May. 2018.

### ● Presentations

- 1) Susumu Hasegawa, Takeshi Kanda: "Preliminary Numerical Simulation of Flow around Spaceplane for Airframe Engine Integration ", 31st ISTS, 2017-a-40, Matsuyama, Ehime, Japan. Jun. 2017.
- 2) Kanenori Kato, , Kouichi Takasaki, Kouichiro Tani, Susumu Hasegawa, Kazuhide Mizobata, and Takeshi Kanda, "Coupled Aerodynamic Characteristics of Airframe and Engine of Space Plane", 31st ISTS, 2017-a-41, Matsuyama, Ehime, Japan. Jun. 2017.
- 3) Susumu Hasegawa, Kanda Takeshi : Numerical analysis of the flowfield around the spaceplane tested in the transonic wind tunnel, JSASS Northern Branch 2018 Annual Meeting, Sendai, May. 2018.

● Usage of JSS2

● Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	32 - 256
Elapsed Time per Case	3.00 hours

● Resources Used

Fraction of Usage in Total Resources\*1 (%): 0.04

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	279,219.58	0.04
SORA-PP	105.87	0.00
SORA-LM	0.00	0.00
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage assigned(GiB)	Fraction of Usage*2 (%)
/home	004.45	0.00
/data	4,231.77	0.08
/ltmp	651.04	0.05

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	0.57	0.02

\*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