

Numerical Analyses on Hypersonic Experimental Aircraft

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● Abstract

This research aims at the demonstration of the thrust control method of a hypersonic pre-cooled turbojet engine using liquid hydrogen fuel and the aircraft / propulsion integrated control method. We acquire the control characteristics of the hypersonic integrated control experiment aircraft to establish the aircraft / propulsion integrated control method taking into account the mutual interference of hypersonic airframe and hypersonic engines. In addition to defining the required specifications of hypersonic aircraft, we present the design specifications of the hypersonic experimental aircraft for carrying out flight demonstration of hypersonic pre-cooled turbojet engine.

Ref. URL: <http://www.aero.jaxa.jp/eng/research/frontier/hst/>

● Reasons and benefits of using JAXA Supercomputer System

We need a long calculation time to obtain the aerodynamic characteristics of the overall hypersonic experimental aircraft by CFD analyses.

● Achievements of the Year

Aerodynamic performances of the High Mach Integrated Control Experimental Aircraft (HIMICO No.1) was evaluated by CFD analyses. (Fig.1, Fig.2, Fig.3)

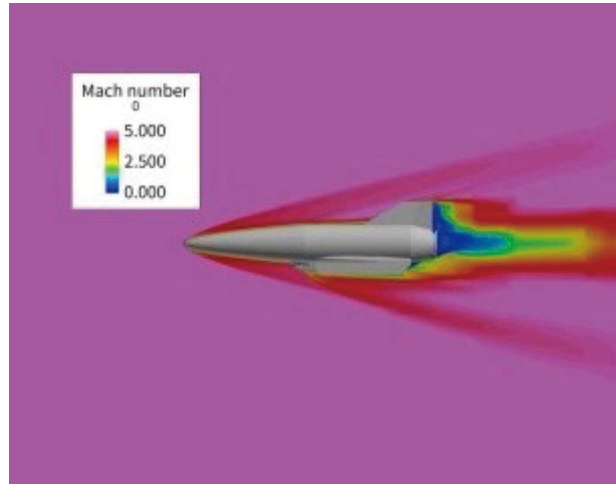


Fig. 1: HIMICO Unit1 Vehicle with Ojive shape (HIMICO Unit1 Mach Contour, Mach5, AoA = 0deg)

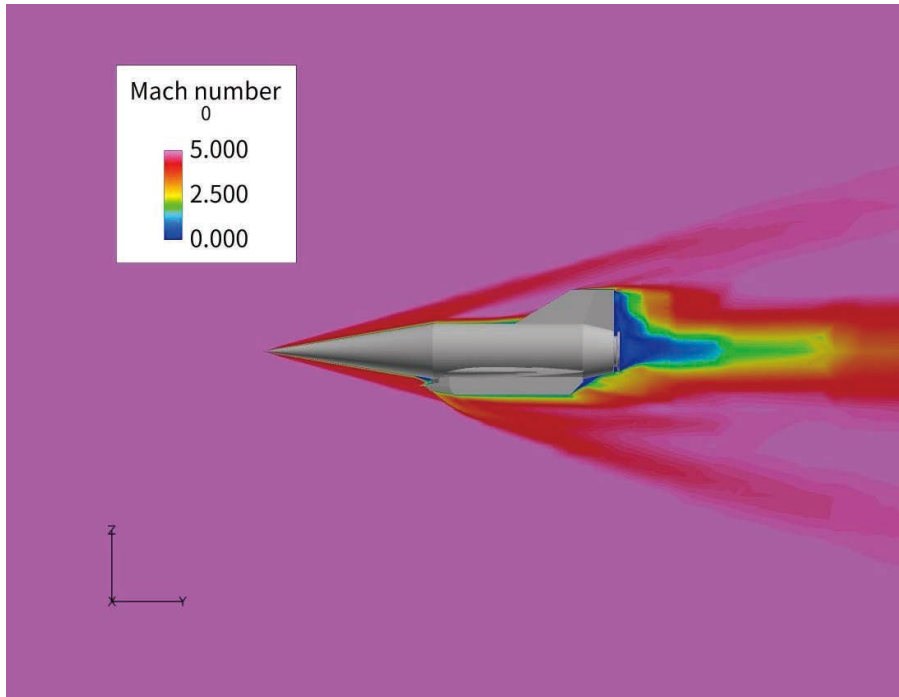


Fig. 2: HIMICO Unit Vehicle (HIMICO Unit1,M Mach Contour, Mach5, AoA = 0deg)

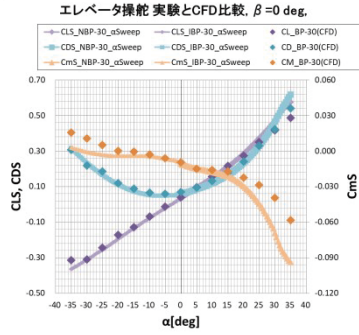


Fig. 3: HIMICO Unit1 Vehicle with -30deg of elevator angle(HIMICO 1, Mach Contour and Streamline, Vertical Three-Component Force Compared with Wind Tunnel Test, Mach5)

● Publications

N/A

● Usage of JSS2

● Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	1 - 2
Elapsed Time per Case	30 Hour(s)

● Resources Used

Fraction of Usage in Total Resources*1(%): 4.96

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2(%)
SORA-MA	44,812,321.74	5.45
SORA-PP	12,343.40	0.08
SORA-LM	8,930.08	3.73
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	2,636.91	2.20
/data	78,220.40	1.34
/ltmp	13,671.88	1.16

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	2.04	0.05

*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.