Basic research for system integration of silent supersonic airplane technologies

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Abstract

The system integration design technologies for achieving low sonic-boom, low aerodynamic drag, low landing and take-off noise, and light weight simultaneously are the key technologies for future supersonic airplanes. JAXA is promoting the R&D for these technologies based on our experiences of demonstrating the advanced low-drag and low-boom design concepts.

http://www.aero.jaxa.jp/eng/research/frontier/sst/

Reasons for using of JSS2

To achieve low sonic-boom, low aerodynamic drag, low landing and take-off noise, and light weight simultaneously, the multi-objective optimization tools are utilized in the design study. The super computer is necessary to obtain the multiple objective function efficiently with many numerical simulations.

Achievements of the Year

The planform dependency for supersonic airfoil was investigated. In results, it was found that, in airfoil design, the shape of the forward camber and the twisted angle have the largest influence on drag reduction.

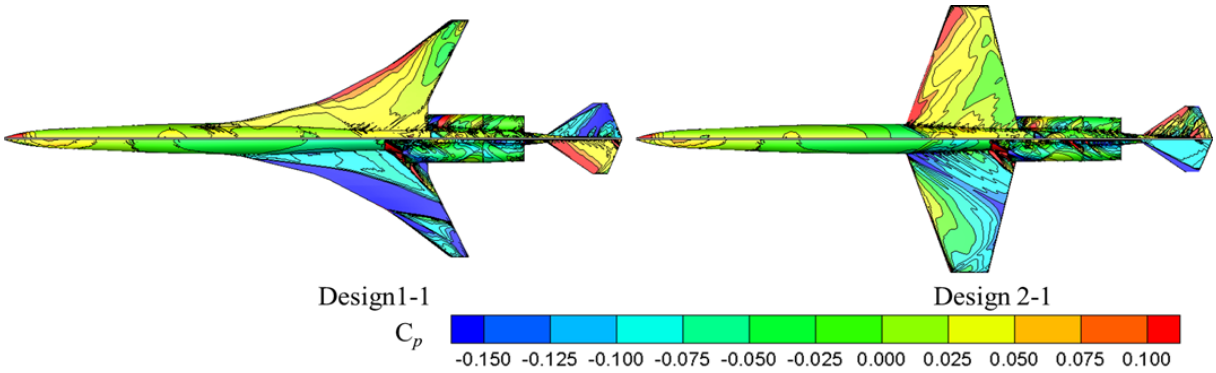

Fig.1 Surface pressure distribution on high and low swept back wing.

Publications

- Peer-reviewed papers

1) Y. Kishi, M. Kanazaki, Y. Makino and K. Matsushima, Wing planform dependency on optimum supersonic airfoil, Transactions of the JSME (in Japanese), Vol.83, (2017), p.16-00454.

- Non peer-reviewed papers

1) Y. Kishi, S. Kitazaki, A. Ariyarit, Y. Makino and M. Kanazaki, Planform Dependency of Optimum Supersonic Airfoil for Wing-Body-Nacelle Configuration using Multi-Fidelity Design Optimization, AIAA 2017-4468, (2017).

- Presentations

1) Y. Kishi, M. Kanazaki and Y. Makino, Investigation of supersonic forward-swept wing for simultaneous reduction of sonic boom and aerodynamic drag, 49th Fluid Dynamics Conference/35th Aerospace Numerical Simulation Symposium, 1A09, (2017).
2) J. Akatsuka, N. Ogura, T. Homma, Y. Watanabe and M. Kameda, Experimental Evaluation of Acoustic and Thrust Characteristics, 49th Fluid Dynamics Conference/35th Aerospace Numerical Simulation Symposium, 1B11, (2017).
3) Y. Kishi, M. Kanazaki and Y. Makino, Study on SST with Forward Swept Wing for Simultaneous Reduction of Low Drag and Low Boom, 55th Aircraft symposium, 3A02, (2017).
4) G. Iwamoto, Y. Kasuga, H. Ishikawa and N. Tokugawa, An Approach to Fully Natural Laminar Flow Wing Design of NEXST-1, 55th Aircraft symposium, 3A08, (2017).

Usage of JSS2

Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelizatio
Number of Processes	4 - 128
Elapsed Time per Case	12,000.00 seconds

Resources Used

Fraction of Usage in Total Resources*1 (%): 0.35

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	1,789,166.76	0.24
SORA-PP	83,621.32	1.05
SORA-LM	1,104.56	0.57
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage assigned(GiB)	Fraction of Usage*2 (%)
/home	2,969.57	2.06
/data	73,850.95	1.37
/ltmp	16,927.09	1.28

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	75.21	3.23

*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