

Innovative Green Aircraft Technology : High Efficiency and Low Noise Aircraft I

Report Number: R21EA0601

Subject Category: Aeronautical Technology

URL: <https://www.jss.jaxa.jp/en/ar/e2021/18159/>

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● Abstract

The purpose of the iGreen research is to develop and mature a bunch of advanced and innovative technologies on aerodynamics, aeroacoustics, and structures to enable airframe design with higher environmental performances, thereby helping the Japanese aviation industry to enhance its share on the global market. In addition to verifying practical application of these technologies, we will also work on the development of elemental and system technologies.

Ref. URL: <https://www.aero.jaxa.jp/eng/research/ecat/igreen/>

● Reasons and benefits of using JAXA Supercomputer System

CFD analysis are used for the understanding of aerodynamic characteristics and evaluation of the performance in the aircraft design phase. Huge calculation resources and costs were required for the high fidelity and quick response CFD analysis for the optimum aerodynamic design process on complex aircraft geometry. JSS3 can achieve those requirements, the cost and time are drastically saved on the CFD analysis.

● Achievements of the Year

The attachment-line transition is one of mechanism which cause the boundary layer transition from laminar to turbulent on the transonic aircraft which has swept wing. Aerodynamic devices installed at wing root region were investigated to prevent attachment-line transition (ACD: Anti attachment-

line Contamination Device). Many ACD concepts were installed on TRA2022 (JAXA Technology Reference Aircraft), aerodynamic characteristics were investigated including preventing boundary layer transition. A streamwise groove type ACD was selected from feasibility study. Parametric studies were performed on the streamwise groove ACD geometry using DNS analysis. A design guideline of the streamwise groove ACD was accumulated which can be prevented the boundary layer transition without significant additional drag increment.

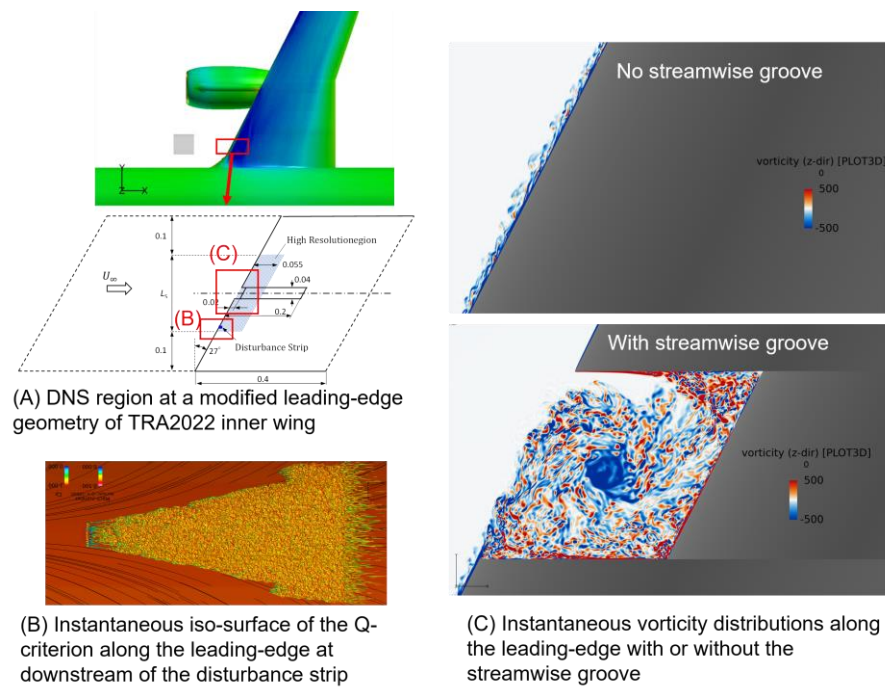


Fig. 1: DNS for an anti-contamination device (streamwise groove) to prevent the attachment-line contamination on TRA2022

● Publications

- Oral Presentations

-Keisuke Ohira, Naoko Tokugawa : On the Characteristics of Anti-Contamination Devices on Attachment-Line of Subsonic Transport Aircraft, 2021 Asia-Pacific International Symposium on Aerospace Technology, Jeju, Korea, 15-17 Nov, 2021

-Takahiro Ishida, Keisuke Ohira, Rio Hosoi, Naoko Tokugawa, Takahiro Tsukahara : Numerical and experimental study on three-dimensional boundary layer transition induced by the isolated cylindrical roughness elements, 2021 Asia-Pacific International Symposium on Aerospace Technology, Jeju, Korea, 15-17 Nov, 2021

● **Usage of JSS**

● **Computational Information**

| | |
|---------------------------------|---------------------------|
| Process Parallelization Methods | MPI |
| Thread Parallelization Methods | Automatic Parallelization |
| Number of Processes | 64 - 28000 |
| Elapsed Time per Case | 300 Hour(s) |

● **JSS3 Resources Used**

Fraction of Usage in Total Resources*¹(%): 2.73

Details

| Computational Resources | | |
|-------------------------|--------------------------------------|-------------------------------------|
| System Name | CPU Resources Used (core x hours) | Fraction of Usage* ² (%) |
| TOKI-SORA | 62,828,832.49 | 3.06 |
| TOKI-ST | 191,706.30 | 0.24 |
| TOKI-GP | 0.00 | 0.00 |
| TOKI-XM | 0.00 | 0.00 |
| TOKI-LM | 60,948.17 | 4.54 |
| 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 | 407.51 | 0.41 |
| /data and /data2 | 85,332.19 | 0.91 |
| /ssd | 3,507.08 | 0.91 |

| Archiver Resources | | |
|--------------------|--------------------|-------------------------------------|
| Archiver Name | Storage Used (TiB) | Fraction of Usage ^{*2} (%) |
| J-SPACE | 76.05 | 0.51 |

^{*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 (Hours) | Fraction of Usage ^{*2} (%) |
| ISV Software Licenses (Total) | 6,921.88 | 4.85 |

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