Research and Development on Aircraft Certification DX(Flyability)

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Abstract

This project corresponds to a joint proposal by domestic heavy industry manufacturers and JAXA for "Key and Advanced Technology R&D through Cross Community Collaboration Program / Innovation of aircraft design, certification, production processes and process integration" (hereinafter referred to K Program), which NEDO solicited publicly. The K Program is required to implement four major items from FY2023 to FY2027, one of which is Certification DX for this project.

In order to promote an efficient certification process while ensuring safety, Certification DX will demonstrate highly practical CbA (Certification by Analysis) in cooperation with aircraft manufacturers, certification authority, and international WGs, and establish CbA guidelines. The objective is to integrate the design, certification, and production processes on a digital platform using a system model based on MBSE (Model Based Systems Engineering). Specific activities planned include the establishment of CbA guidelines for structure, flight, and lightning, CbA mock reviews, and the application of MBSE to the CP (Certification Plan).

Reasons and benefits of using JAXA Supercomputer System

In this project, CbA for trim and static stability in longitudinal, lateral and directional directions will be demonstrated through comparison with flight test data, and guidelines for flight CbA will also be developed. JSS is planned to be used for the analysis necessary for these purposes.

In developing guidelines for flight CbA, JSS use is necessary in the following perspectives:

(i)It is necessary to parametrically combine multiple control surfaces and perform a huge number of simulations to compare with flight test data,

(ii)RANS simulation using FaSTAR also requires a large computational cost due to the need to capture turbulent phenomena in detail,

(iii)Grid refinement for takeoff configuration, V&V for RANS simulations, and unsteady flow simulations

increases the number of grid points and requires large computational resources,

(iv)Internal resources must be used to maintain the confidentiality of the geometry data.

- **Achievements of the Year**

To demonstrate CbA for trim and static stability in longitudinal, lateral and directional directions, a large number of parametric combinations of flight conditions and control surfaces were simulated to build an aerodynamic database. The assessment of grid convergence was also conducted as part of the V&V.

- **Publications**

N/A

- **Usage of JSS**

- **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	480
Elapsed Time per Case	60 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.97

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	42,622,288.47	1.92
TOKI-ST	66,176.95	0.07
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	3,762.20	0.29
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	2,617.49	2.17
/data and /data2	314,038.97	1.94
/ssd	3,561.20	0.34

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2] (%)
J-SPACE	69.08	0.25

[*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)	152.86	0.07

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.