

# Project Title: International Joint Research and Development of Airflow Control Devices for High Efficiency and Performance of Aircraft (2023—2026)

Entrusted Parties: Toyota Technological Institute (TTI), Aichi Institute of Technology (AIT), National Institute of Advanced Industrial Science and Technology (AIST), Tokai National Higher Education and Research System Nagoya University (NU), Waseda University (WU)



## Outline of the Project

### • Background

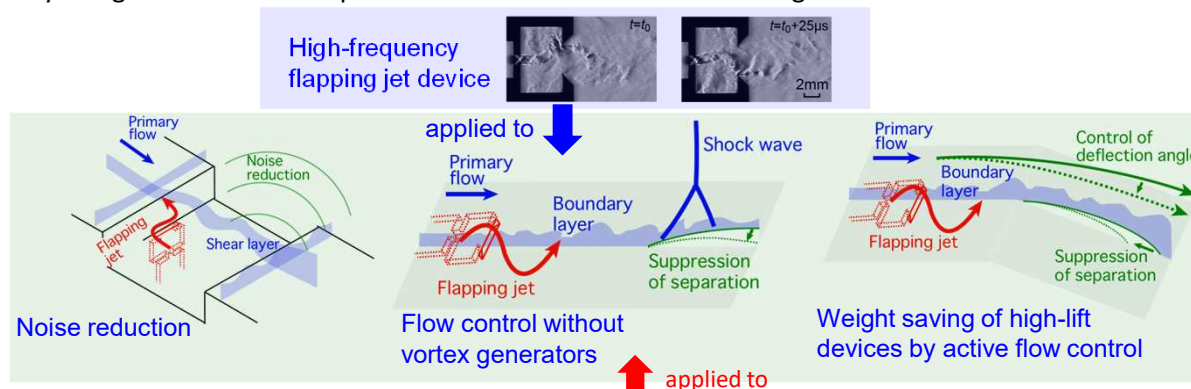
For the realization of a low-carbon and sustainable society, it is necessary to significantly improve the efficiency of reduction in aerodynamic drag and reduce the weight of high-lift devices as well as reducing the noise of aircraft that are subject to compressible high-speed flows around them.

### • Objective

The aim of this project is to develop aerodynamic flow control methods that lead to higher efficiency and lower noise for electric and hydrogen aircrafts by using new high-frequency flapping jet generation devices (operating frequency: several tens of kHz).

### • Research strategy

Advanced flow diagnostic systems will clarify the phenomena appearing in high-speed flows around the aircraft, which cause noise and aerodynamic drag force, to be controlled by new devices. High-efficiency and high-performance airflow control methods will then be established by using state-of-the-art optimization methods with an annealing machine.

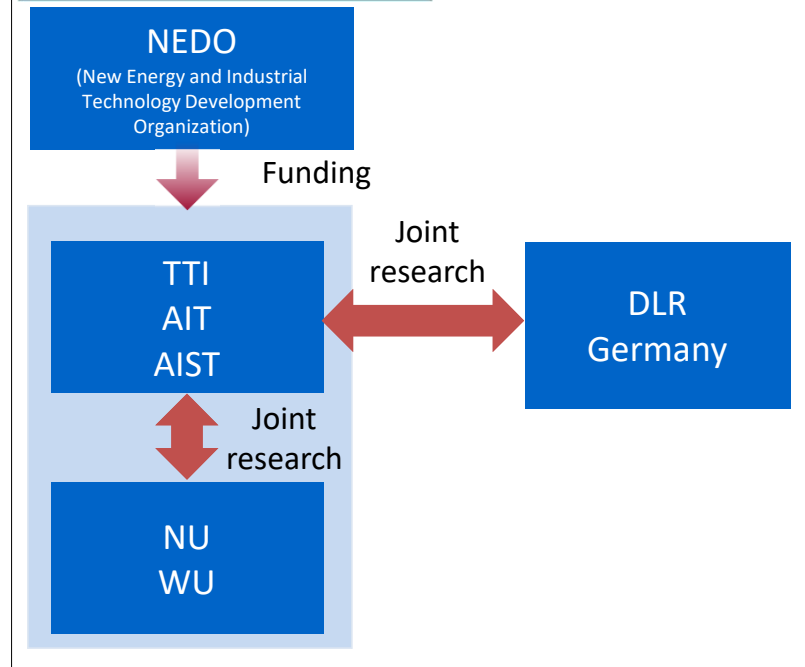


- Pressure/temperature-sensitive paint, super resolution particle image velocimetry
- State-of-the art optimization method using an annealing machine

## Significance of International R&D

In collaboration with the German Aerospace Center (DLR), verification tests will be carried out using DLR's full-scale Reynolds number wind tunnel (cryogenic Ludwieg tube) for verifying methods to control new devices developed and optimized by a domestic research group.

## Project Scheme



## Expected Outcomes

- Social impact
  - Replacing vortex generators with the new device  
→ 1 to 2% reduction in aerodynamic drag
  - Weight saving of high-lift device by flow control  
→ Aircraft weight reduced by 1%
- CO<sub>2</sub> reduction
  - 8 to 12 million tons CO<sub>2</sub> per year
- Economic impact
  - 420 to 640 billion JPY per year