RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité

ONERA
THE FRENCH AEROSPACE LAB

Experimental Structural Dynamics
GVT — Ground Vibration Testing — Methods

@ https://www.onera.fr/en/daaa/contact

Goal : Structural dynamic characterization

- for analytical and numerial model updating
- for aeroelastic (flutter) analysis
- for the design of complex structures subject to dynamics loads

GVT Methods

PRM : Phase Resonance Method

Normal mode testing

1. Approximate selection of the frequency of the target mode
2. Iterative correction of the excitation forces and frequency
3. Recording of the normal mode shape
4. Identification of the modal parameters

Advantages and shortcomings

- ✓ Localized excitation energy
- ✓ Continuous control of the structure
- ✓ Little to no post-processing required after measurement
- ⚠ Time-consuming measurements
- ⚠ Amount of excitation locations
- ⚠ Required measurement know-how

PSM : Phase Separation Method

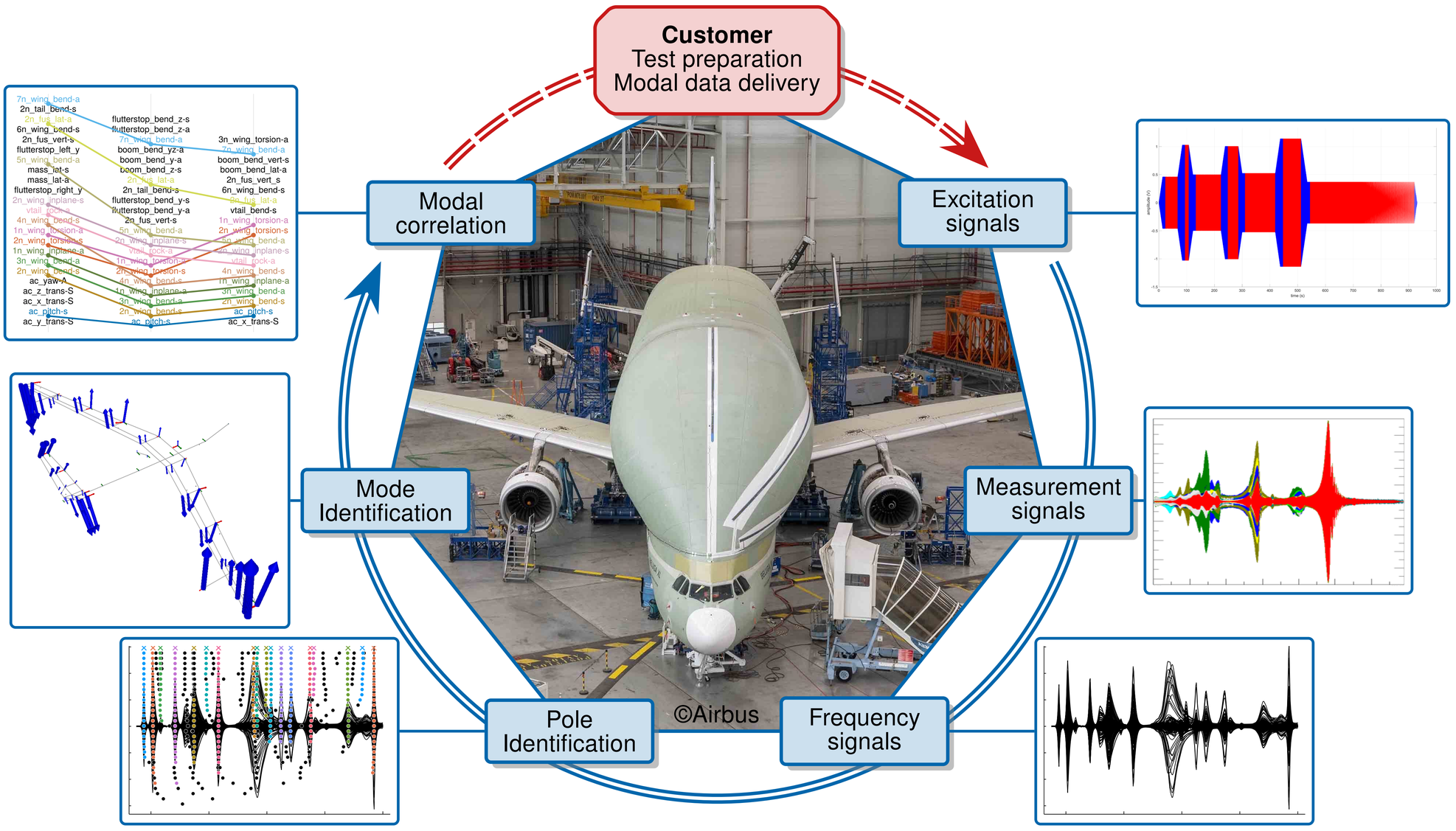
Frequency response function fitting following wideband excitations

1. Definition of the excitation signals over the frequency band of interest
2. Excitation of the structure, measurement of the time response signals
3. Estimation of the frequency domain signals
4. Identification of the poles using stabilization diagrams
5. Identification of the modeshapes

Advantages and shortcomings

- ✓ Wide frequency domain
- ✓ Large data colllection
- ✓ Reduced risk of non-detection of modes
- ⚠ Extensive data post-processing
- ⚠ Fails with very nonlinear structures
- ⚠ Required analysis expertise

GVT data production



GVT data applications

Finite Element Model updating

- Update of the numerical model of the tested structure
- Of utmost importance for the certification process of large aircraft
- **Crucial** to understand the **large amplitude** behavior of the structure

Post-GVT flutter computations

- Coupling with an **aerodynamic model** to predict the **aeroelastic behavior** of the structure
- Computations feasible **during the GVT campaign** to adapt the **test plan**
- The aeroelastic model is **tailored** to the nature and complexity of the airflow (DLM, BEM, CFD)

Partners

DLR — Sopemea

Research Supports and Customers

DGA — dgac — European Commission — AIRBUS — DASSAULT AVIATION