Enhanced Aero-Servo-Elastic (EASE) Model

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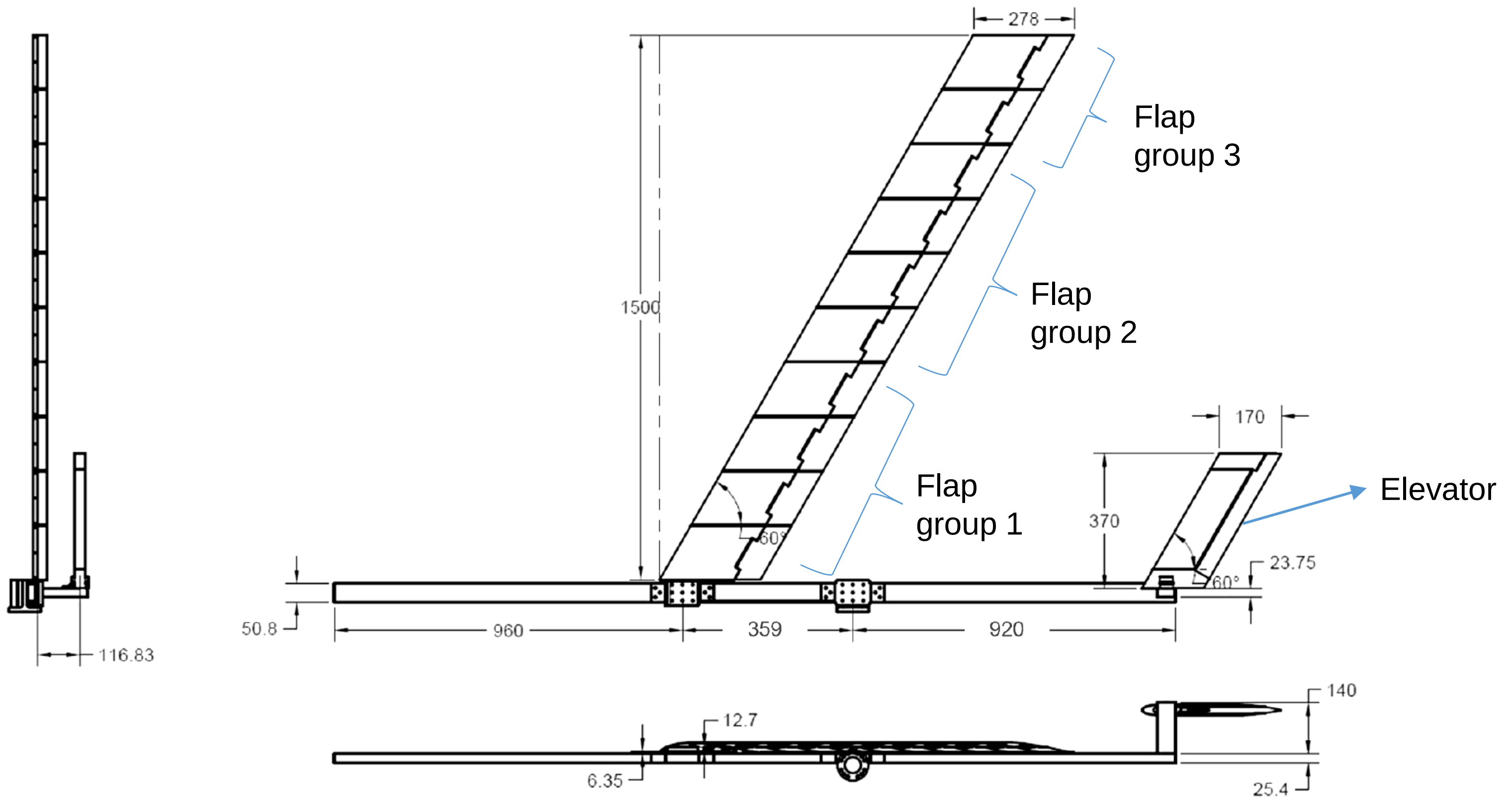
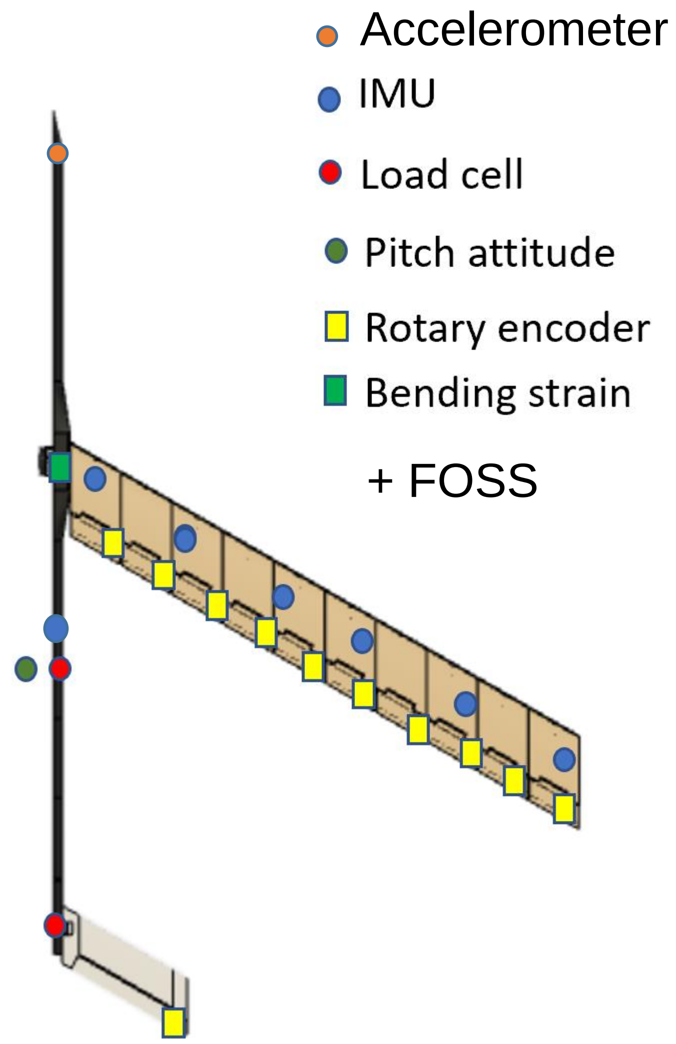
Overview

- Next step from Pazy wing for large deflection workgroup
- Allows for growth
  - Isolated cantilever swept wing
  - Isolated swept wing with pitch and/or plunge motions
  - Swept wing as part of a half aircraft configuration
  - At any point: open and/or closed loop studies

EASE model's dimensions and instrumentation



10 wing TE control surfaces that can be grouped and 1 HTP elevator

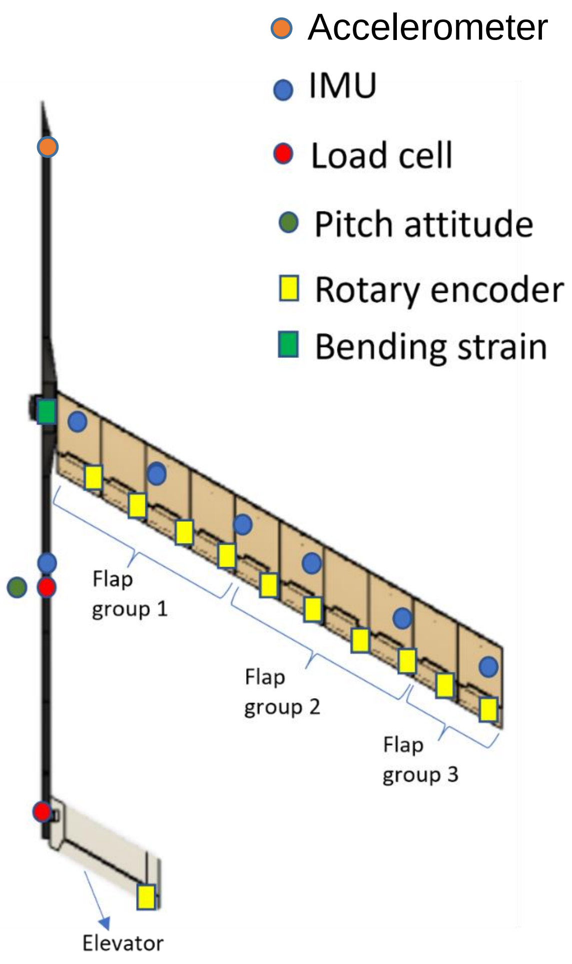


Note: rotation point = aircraft c.g.

Data collected in experiments

The following data was collected from sensors in the experiment:

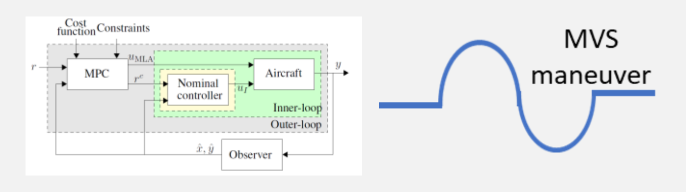
- Accelerations, angular rates and Euler angles from IMU units on wing and fuselage
- Acceleration at fuselage nose
- Pitch angle from encoder at the rotation point
- Forces and moments on tail root and at rotation point from load cells
- Strain at wing root. Can be used to recover moment at that station.
- Spanwise strain variation from **fiber optic system**. Can be used to recover wing shape.
- Control surfaces deflection from encoders



The following control system data was saved:

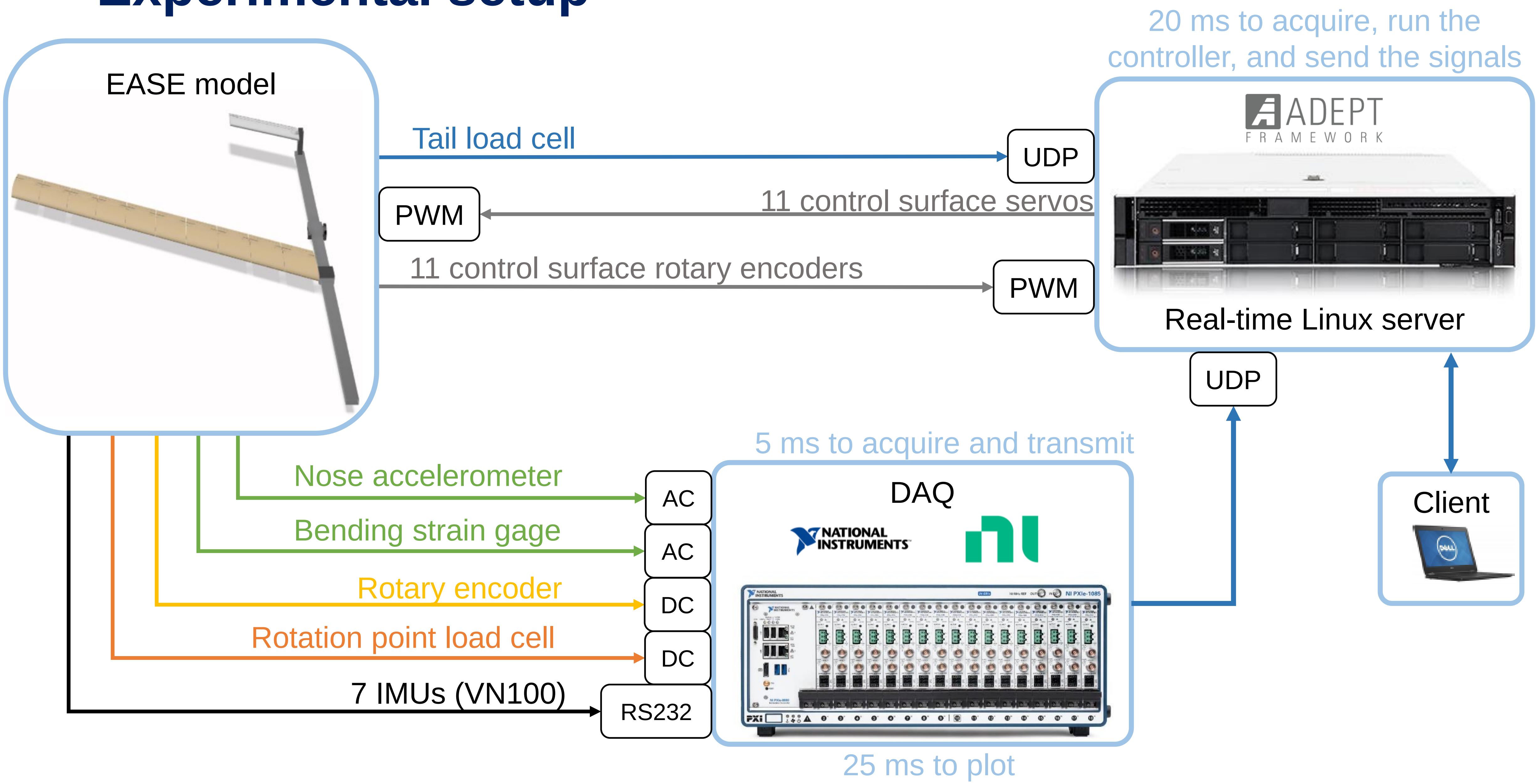
- Frame time
- Commanded control action
- Tracking reference
- Controller flags
- Optimizer performance: time, number of iterations, feasibility status

Configurations for currently available data



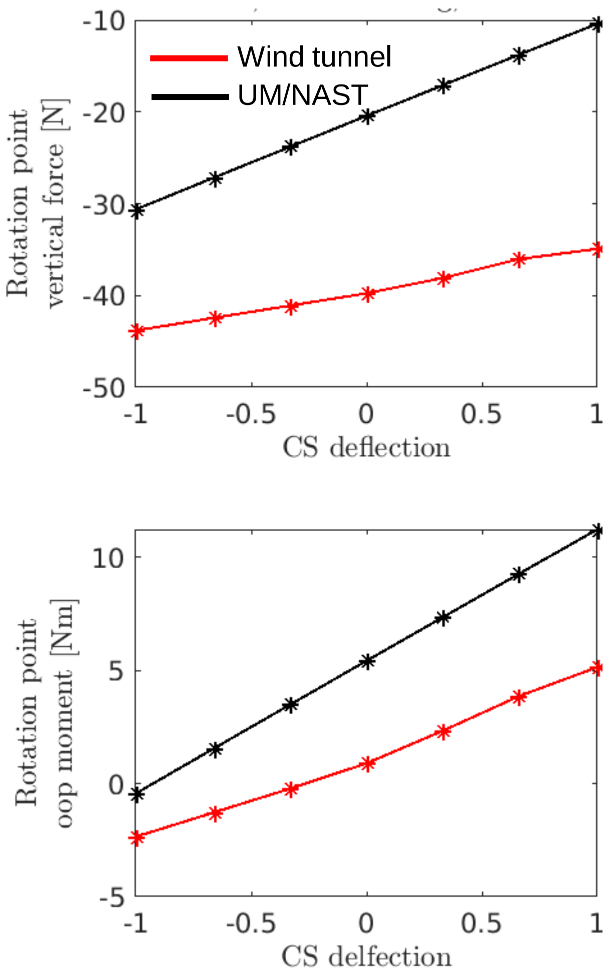
- GVT (lab and/or WT)
  - Isolated wing
  - Isolated fuselage + HTP
  - Half-aircraft model
- Steady aeroelastic characterization at different body pitch angles and speeds
  - Isolated fuselage + HTP
  - Half-aircraft model
- Individual and group control surface characterization
- Maneuver Stretched Vertical (MVS) maneuver in open- and closed-loop (MPC) control

Experimental setup

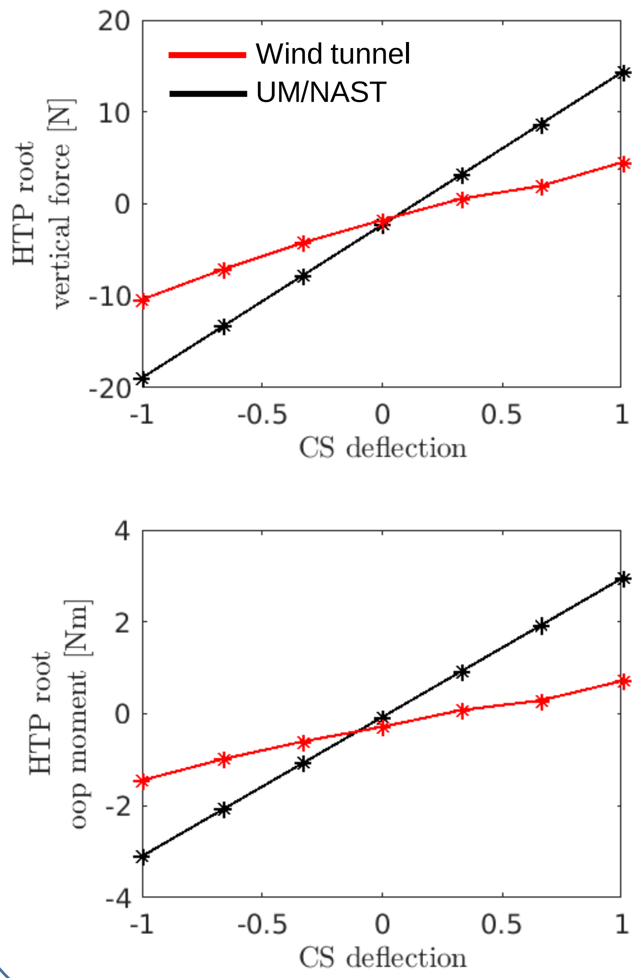


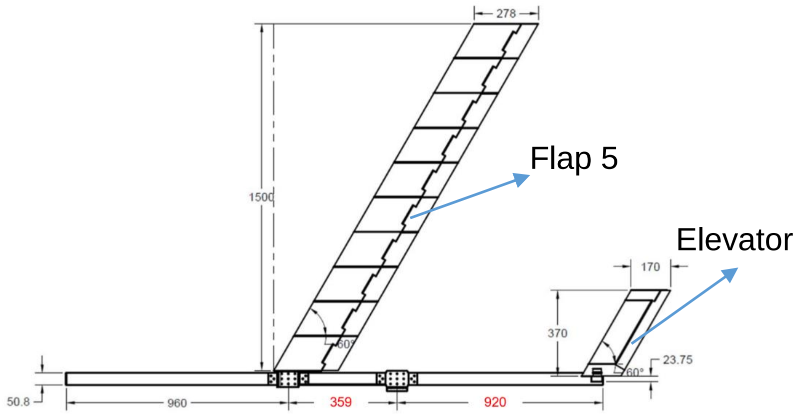
Sample data: open-loop static results (fixed pitch)

Flap 5 deflection



Elevator deflection





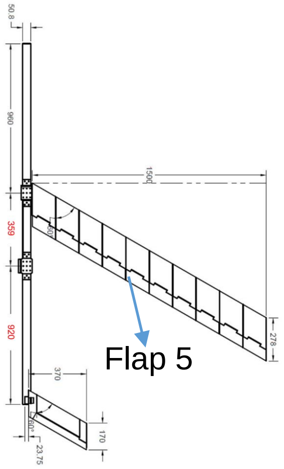
UM/NAST model overestimates loads on wing and tail

Potential reasons

- Effect of pod gaps on wing are not taken into consideration
- Wind tunnel wall interference

Additional data has been collected and mode adjusted for that

Sample data: open-loop dynamic results (fixed pitch)



Frequency sweep 0.5-10 Hz, 20 deg amplitude

Different wing deformed shape leads to different dynamic behavior