Aeroelasticity Branch
NASA Langley Research Center

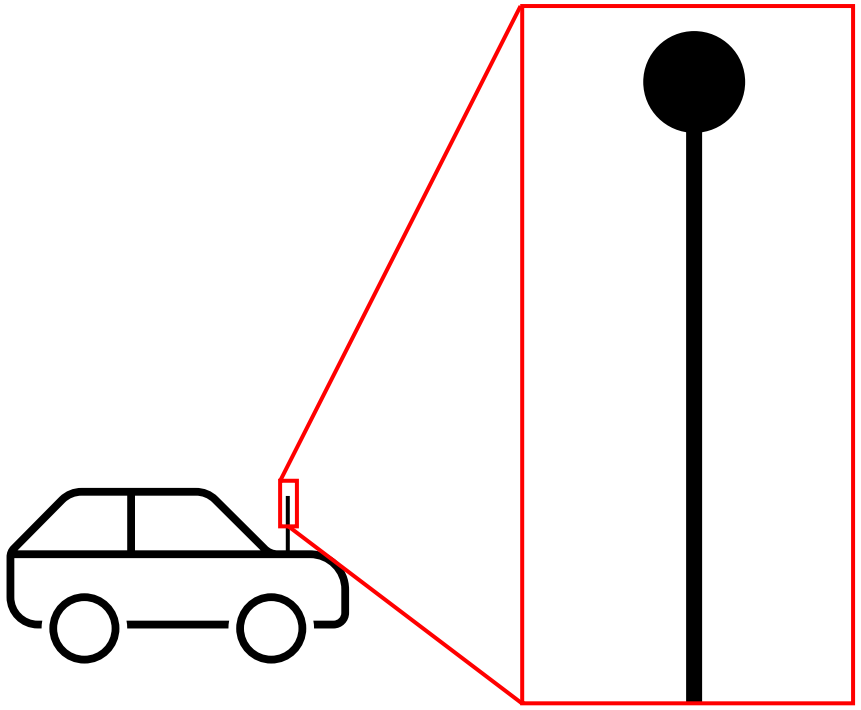
Aeroelasticity at NASA Langley

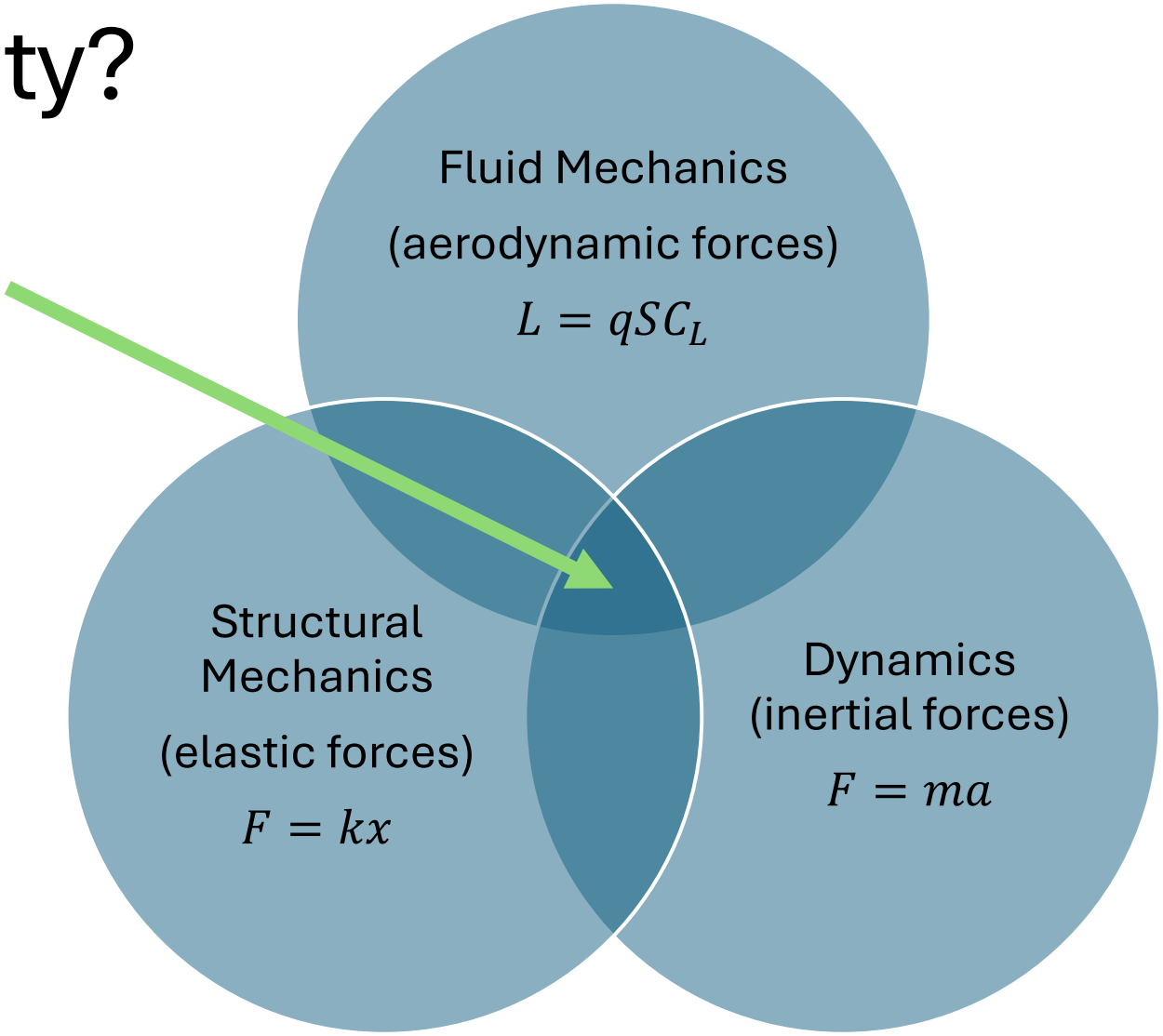
Josiah Waite

NASA Langley Research Center

What is aeroelasticity?

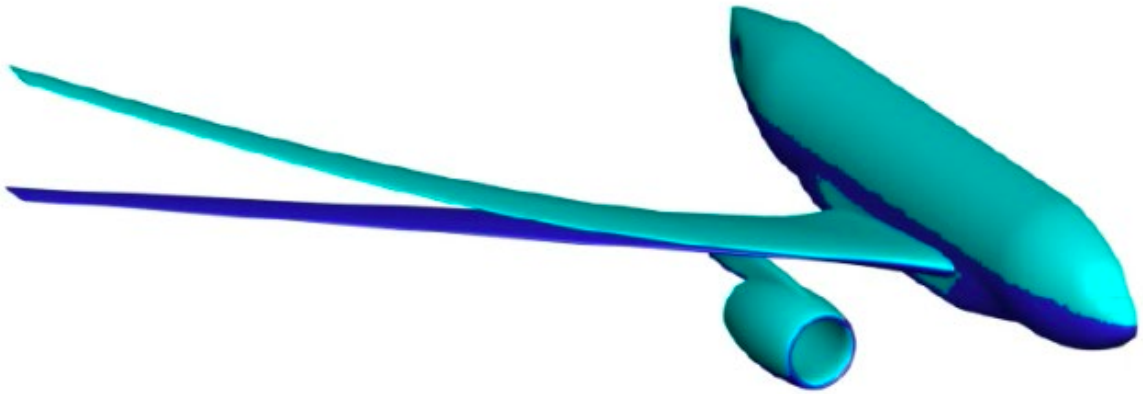
Aeroelasticity: coupling of aerodynamic, elastic, and inertial forces



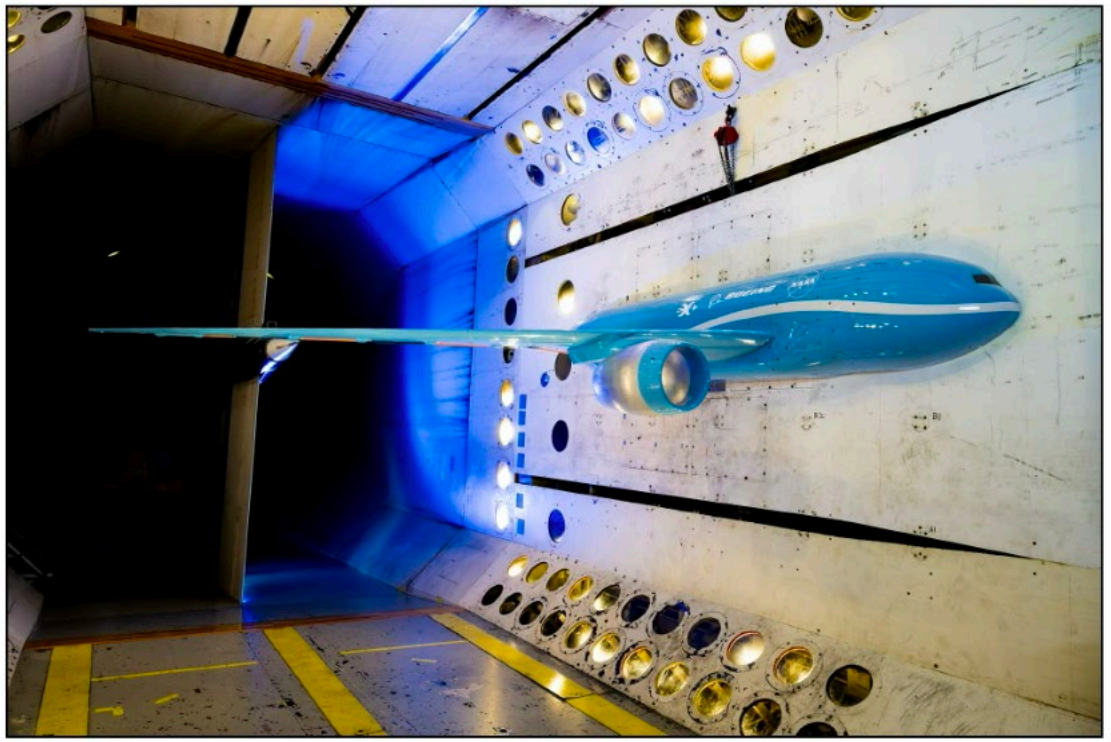


How do we study aeroelasticity?

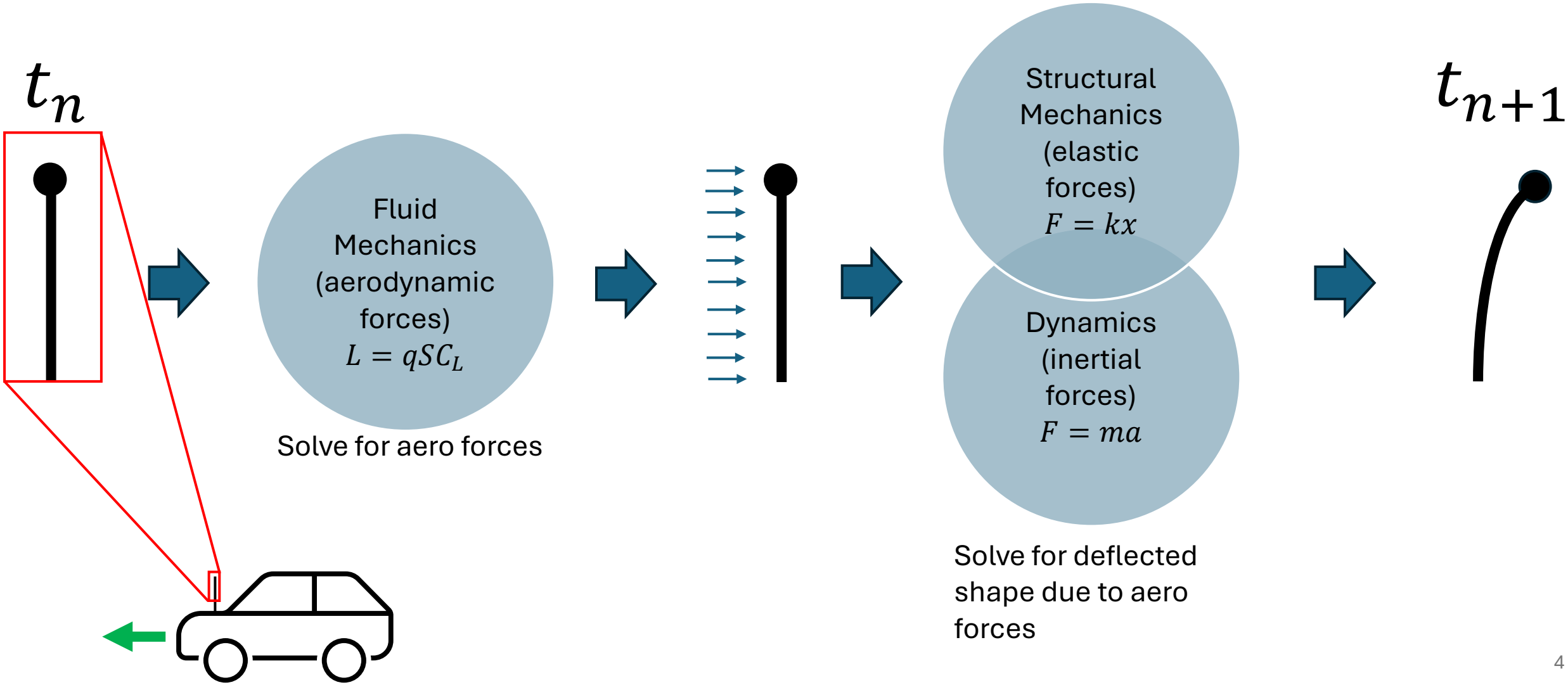
Computational



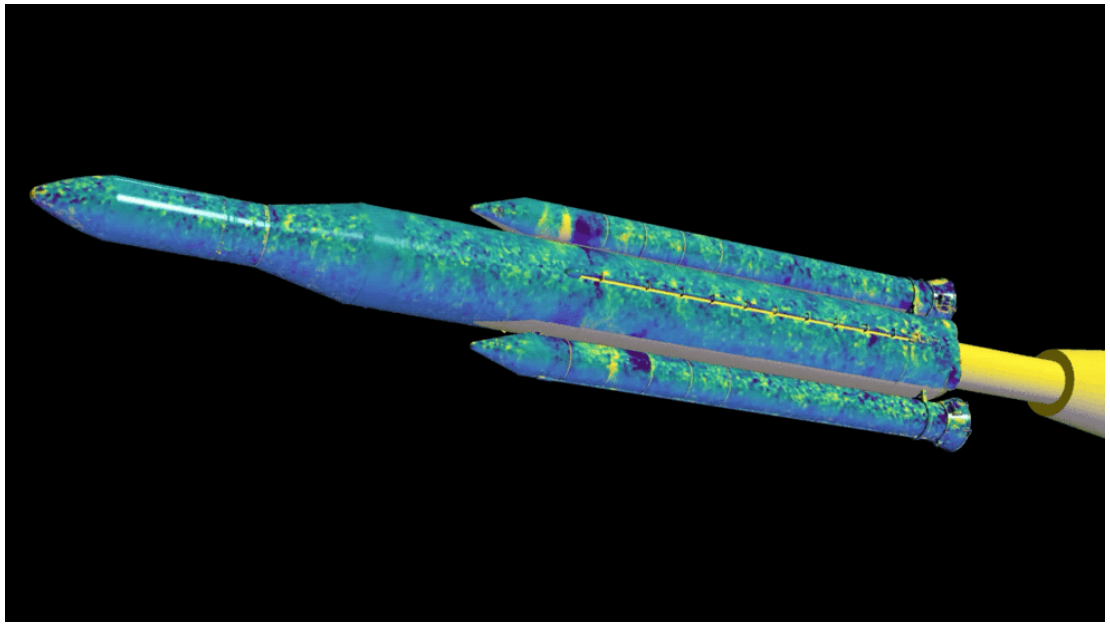
Experimental

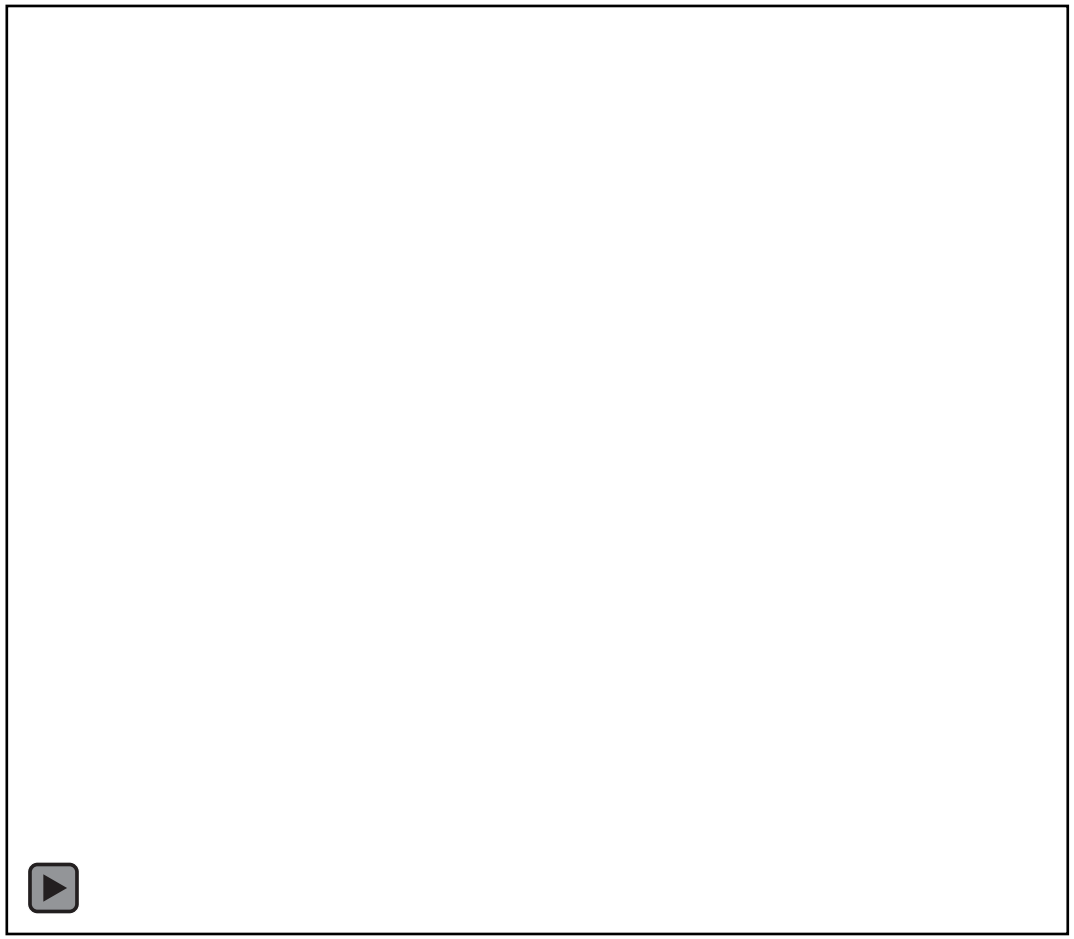


Computational Aeroelasticity



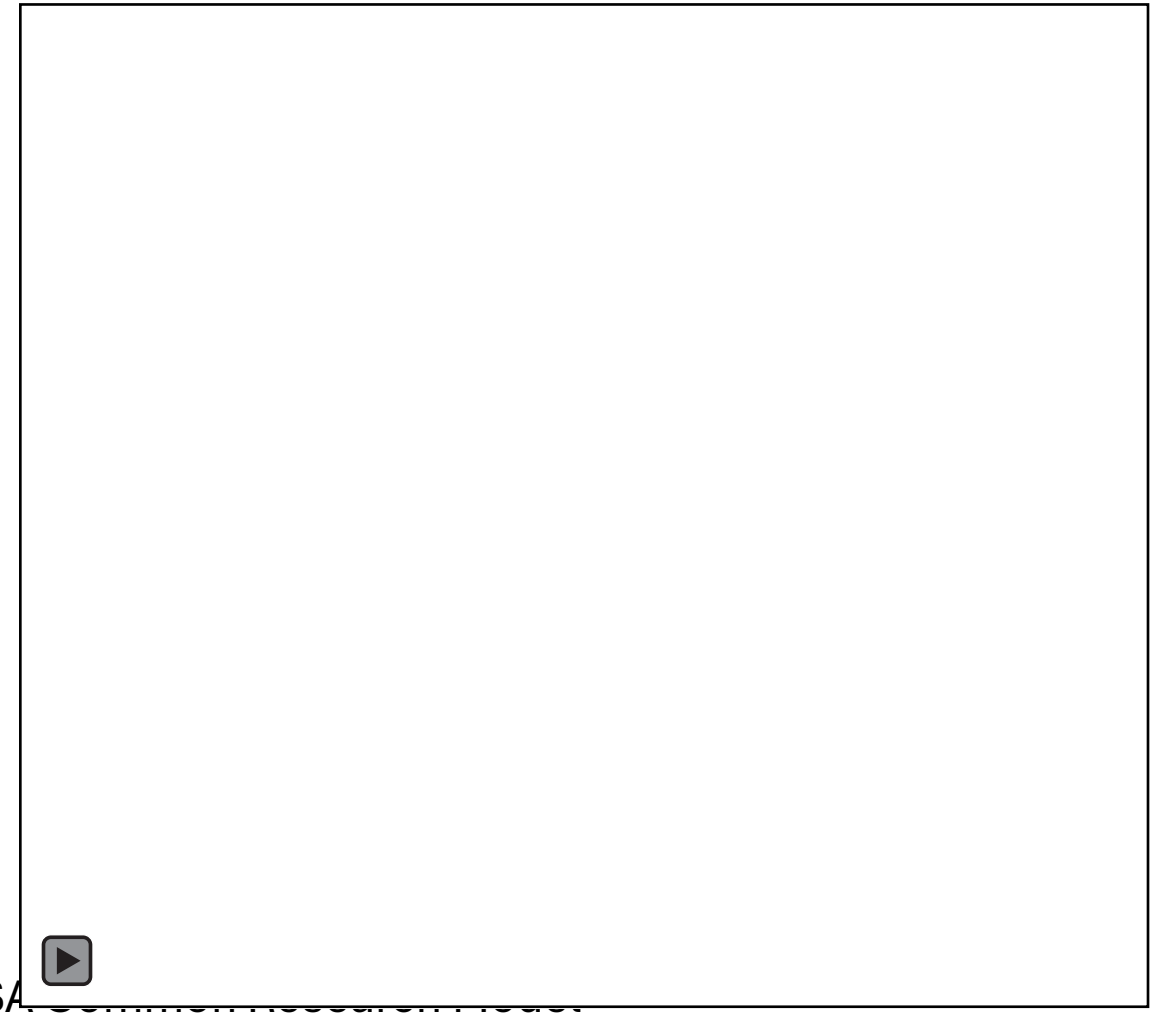
Computational Aeroelasticity





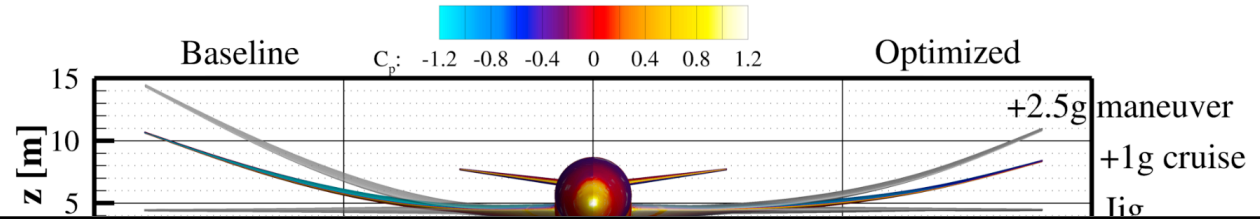
Space Launch System (SLS)

Computational Aeroelasticity

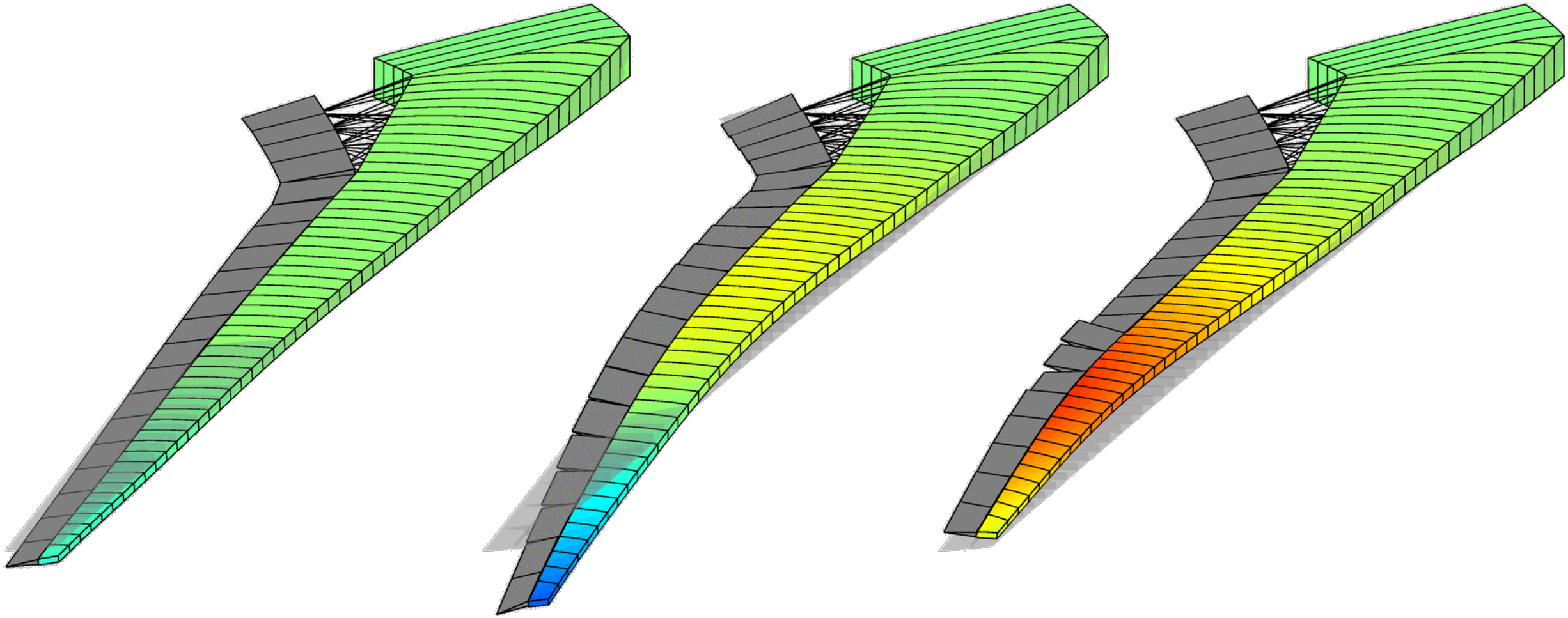




Computational Aeroelasticity



Computational Aeroelasticity



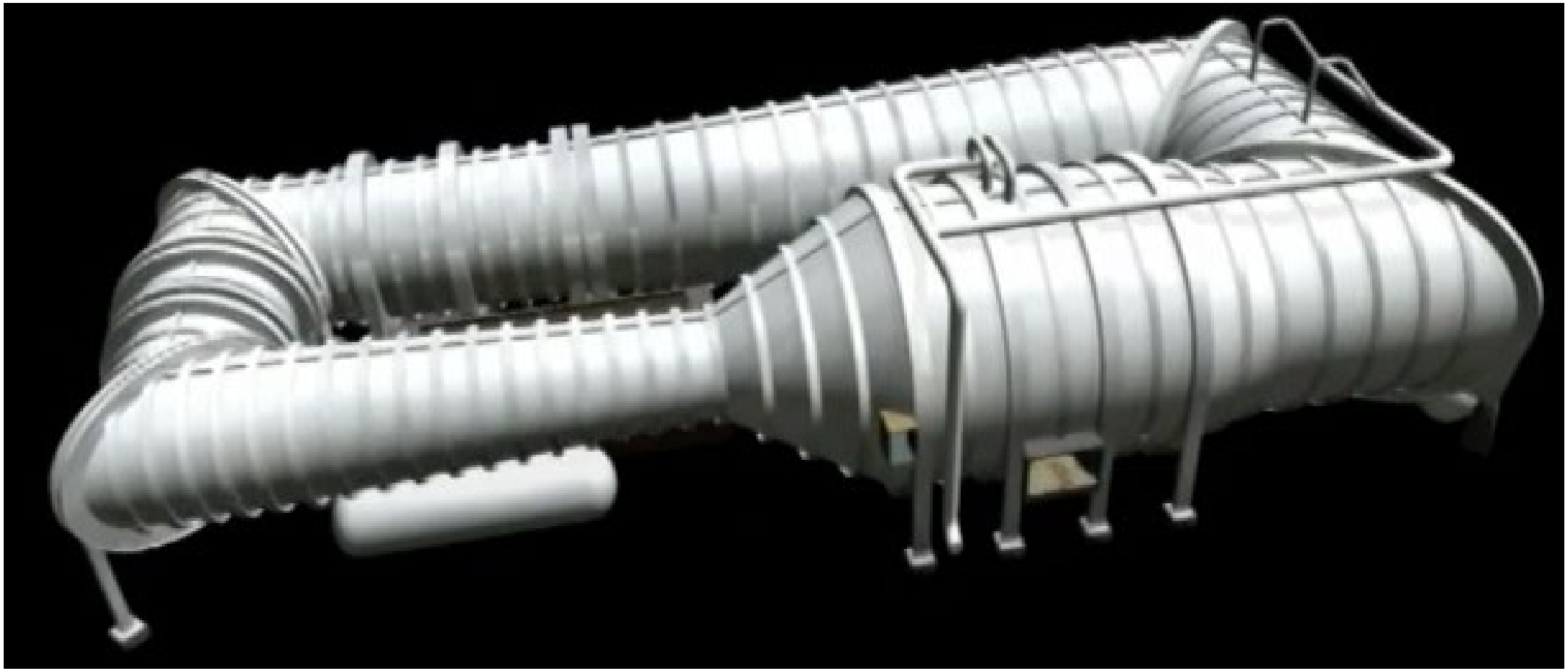
NASA Common Research Model

Experimental Aeroelasticity

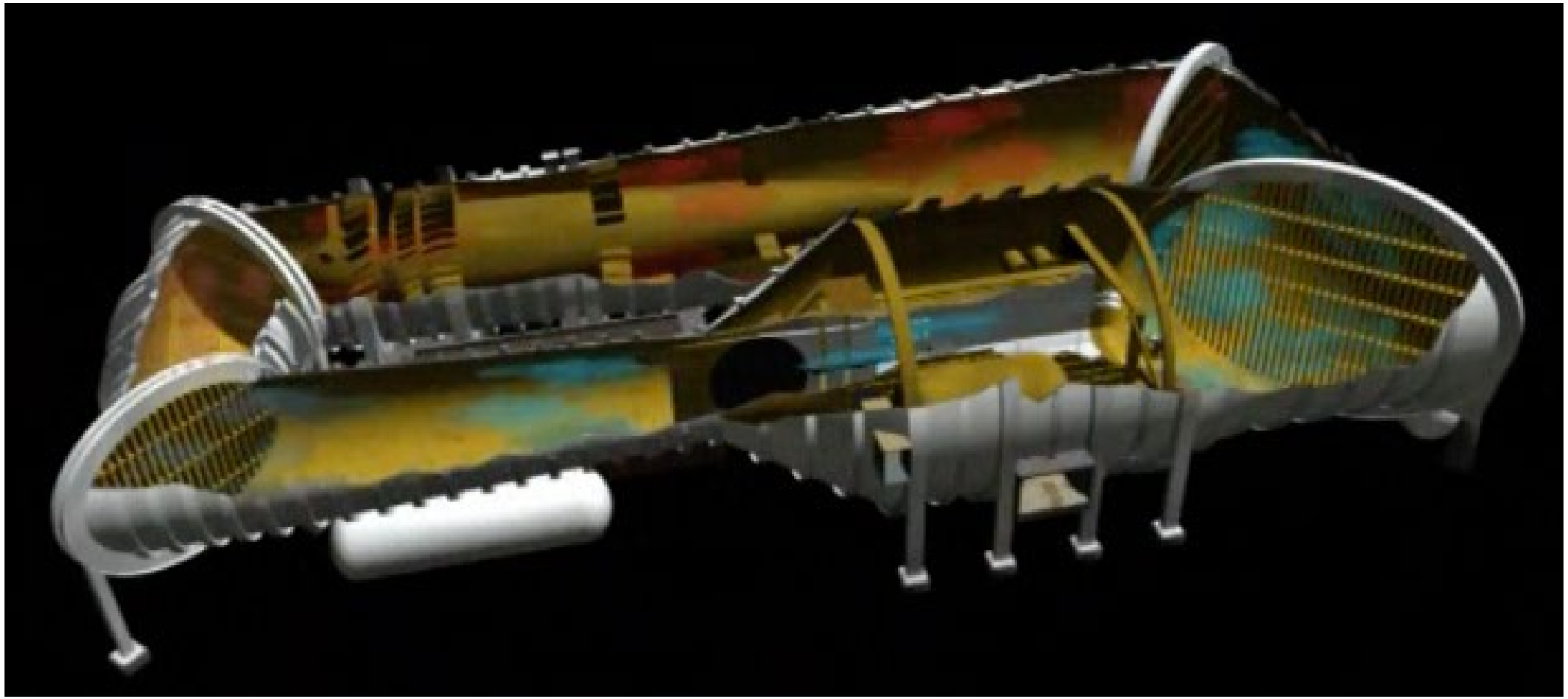


Transonic Dynamics Tunnel (TDT)
NASA Langley Research Center
Hampton, VA

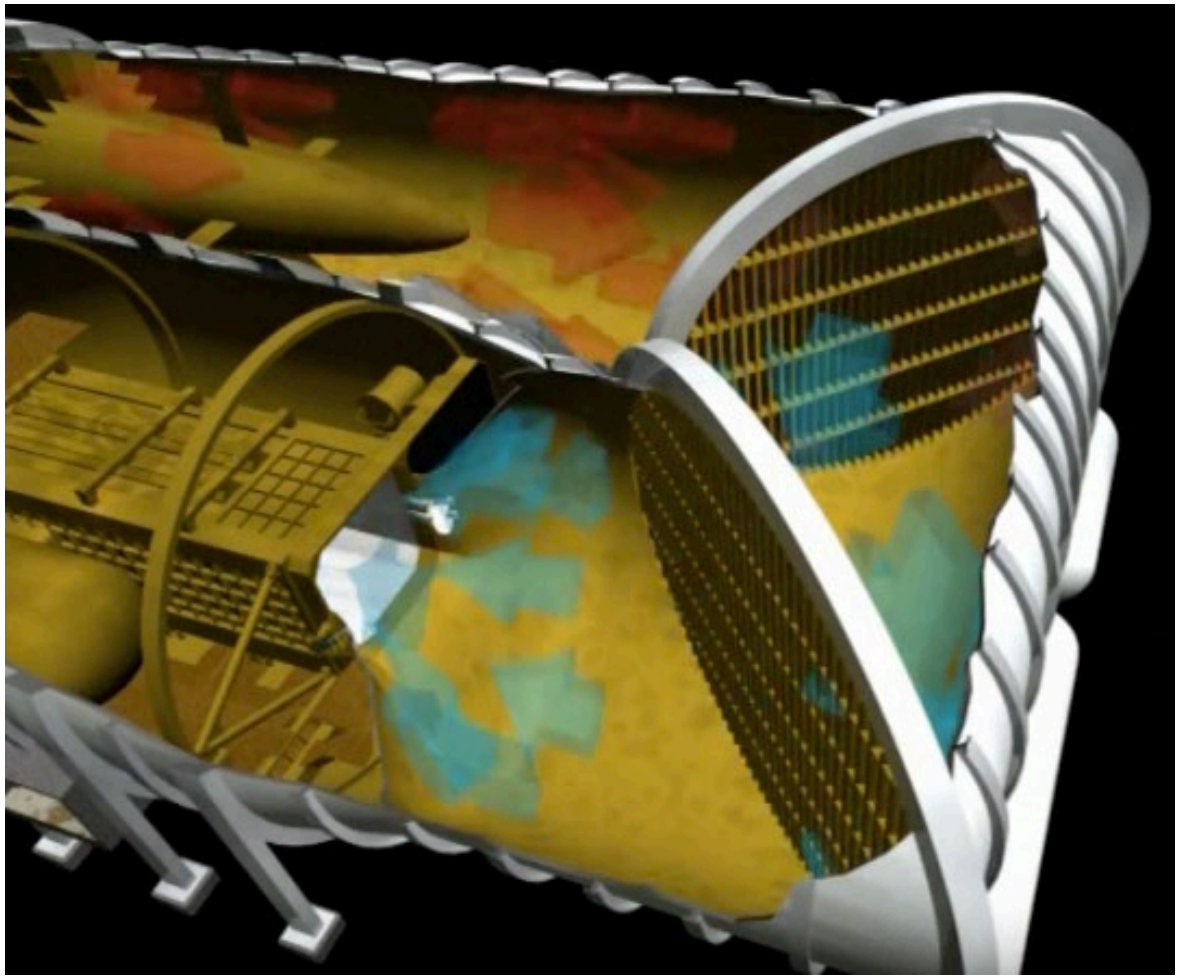
Transonic Dynamics Tunnel (TDT)



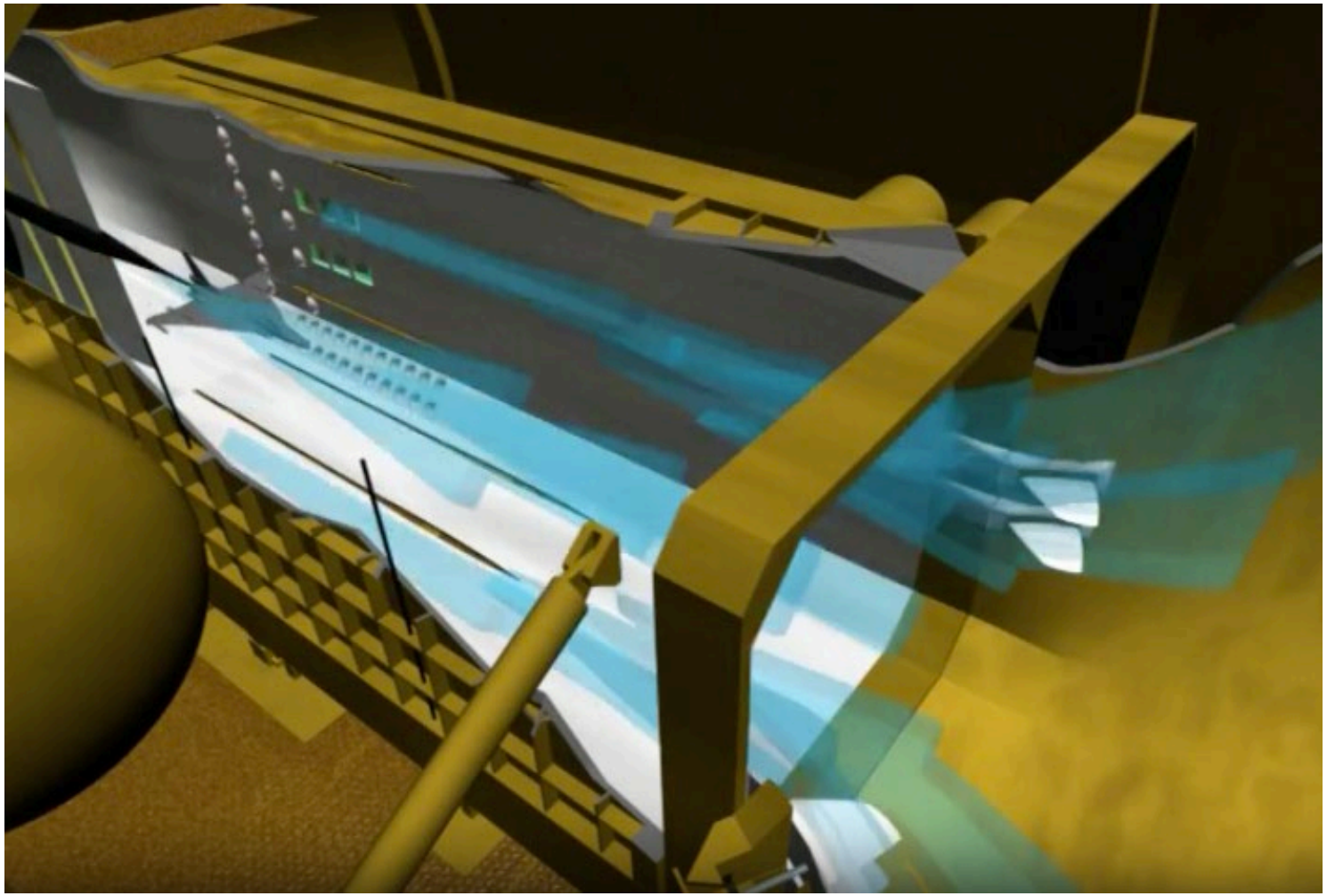
Transonic Dynamics Tunnel (TDT)



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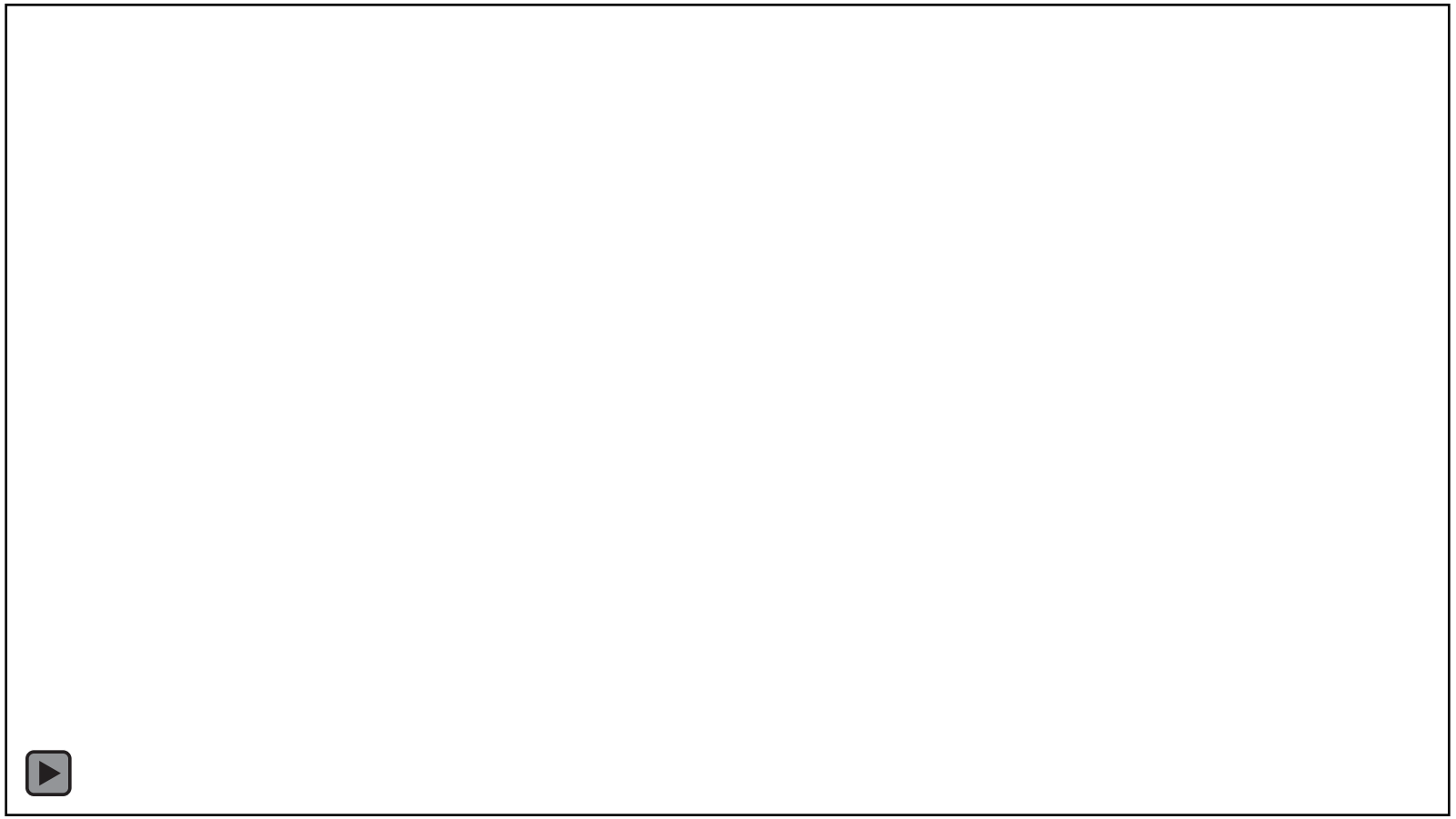
Flutter

According to Johns Hopkins University's Flow Physics and Computation Lab*, flutter is "an unstable, self-excited structural oscillation at a definite frequency where energy is extracted from the airstream by the motion of the structure".

Flutter is among the most dangerous of all aeroelastic phenomena.

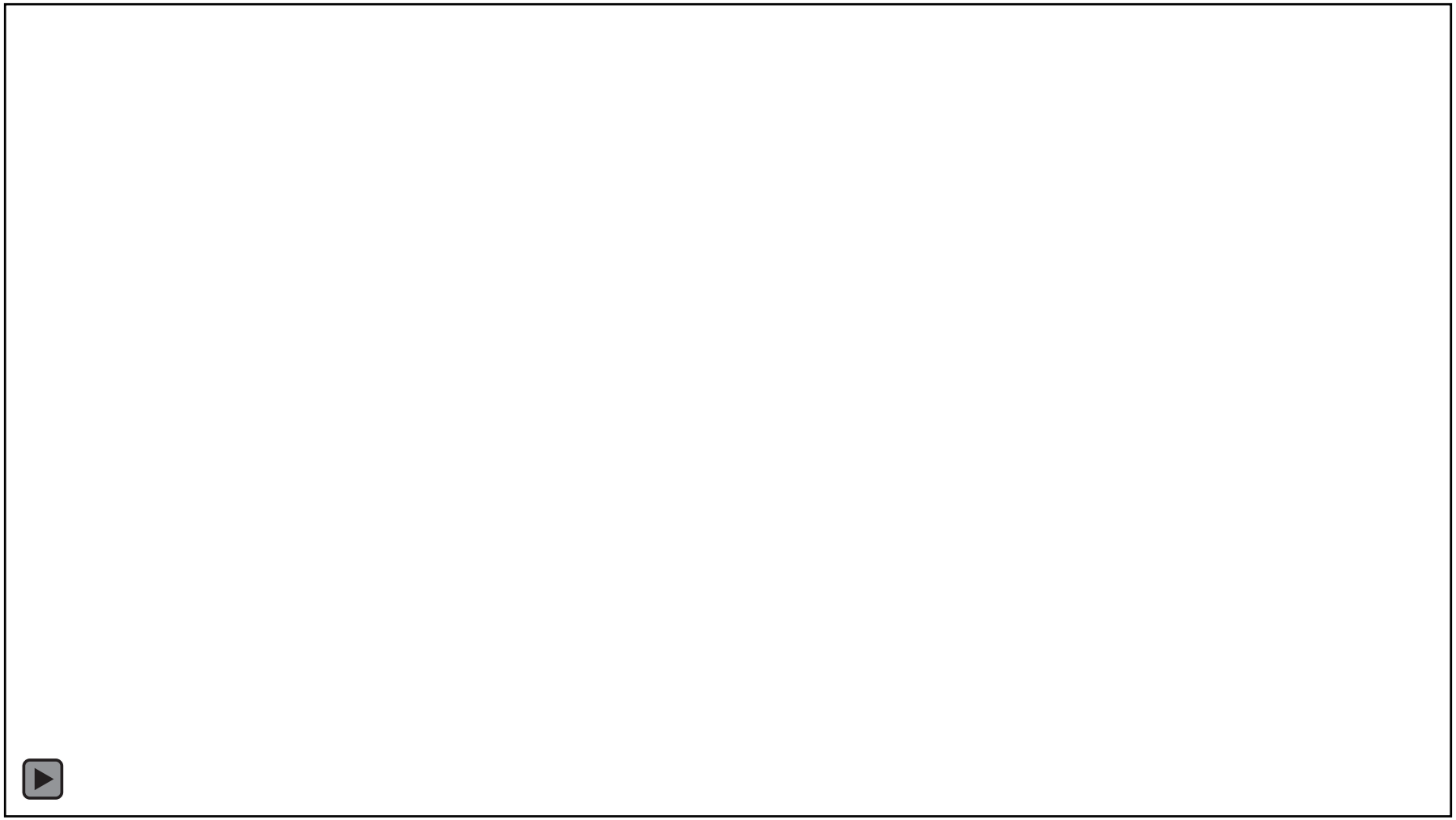
* https://engineering.jhu.edu/fsag/research/aeroelastic-flutter/

Flutter



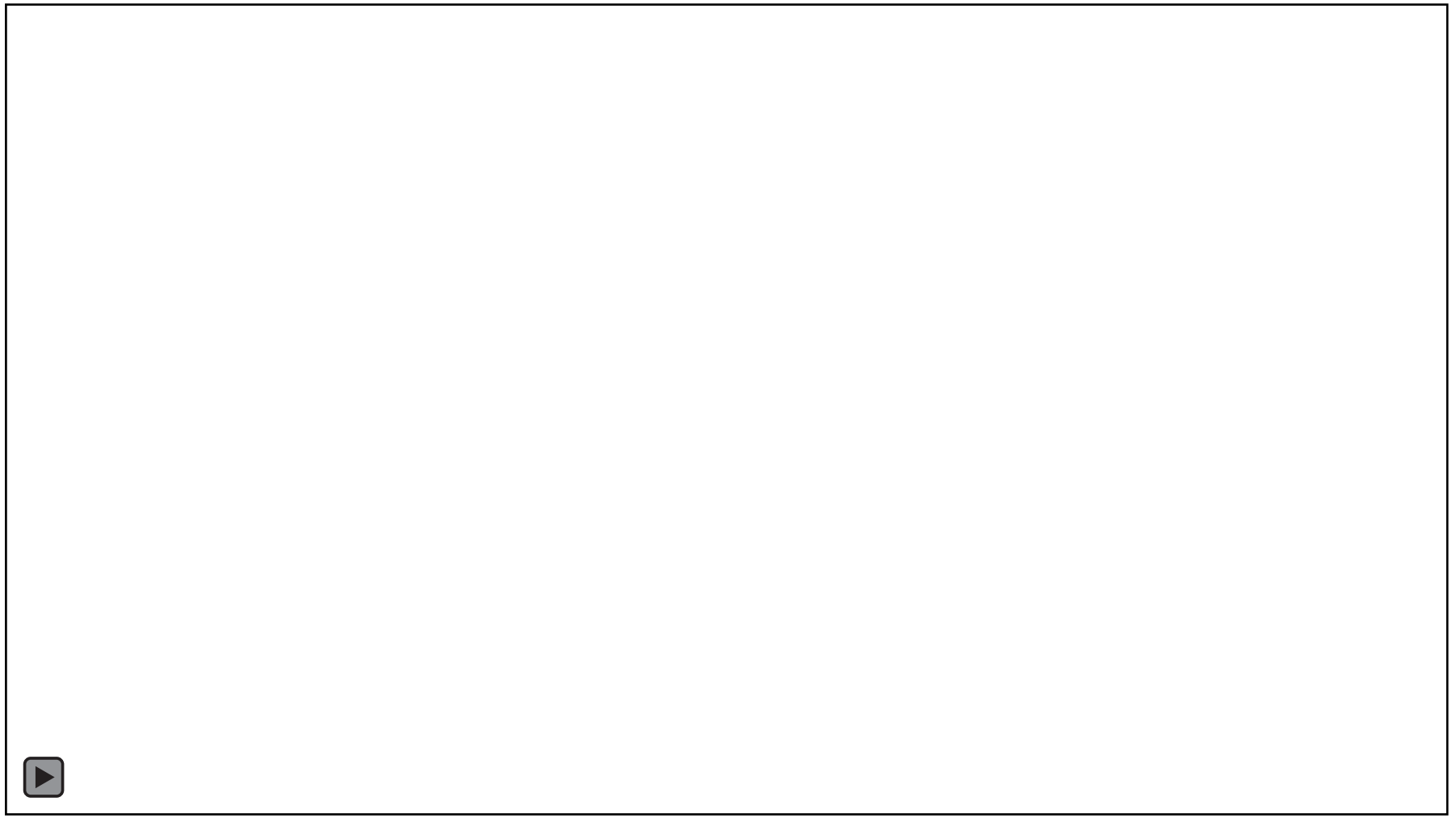
KTH generic fighter configuration

Flutter



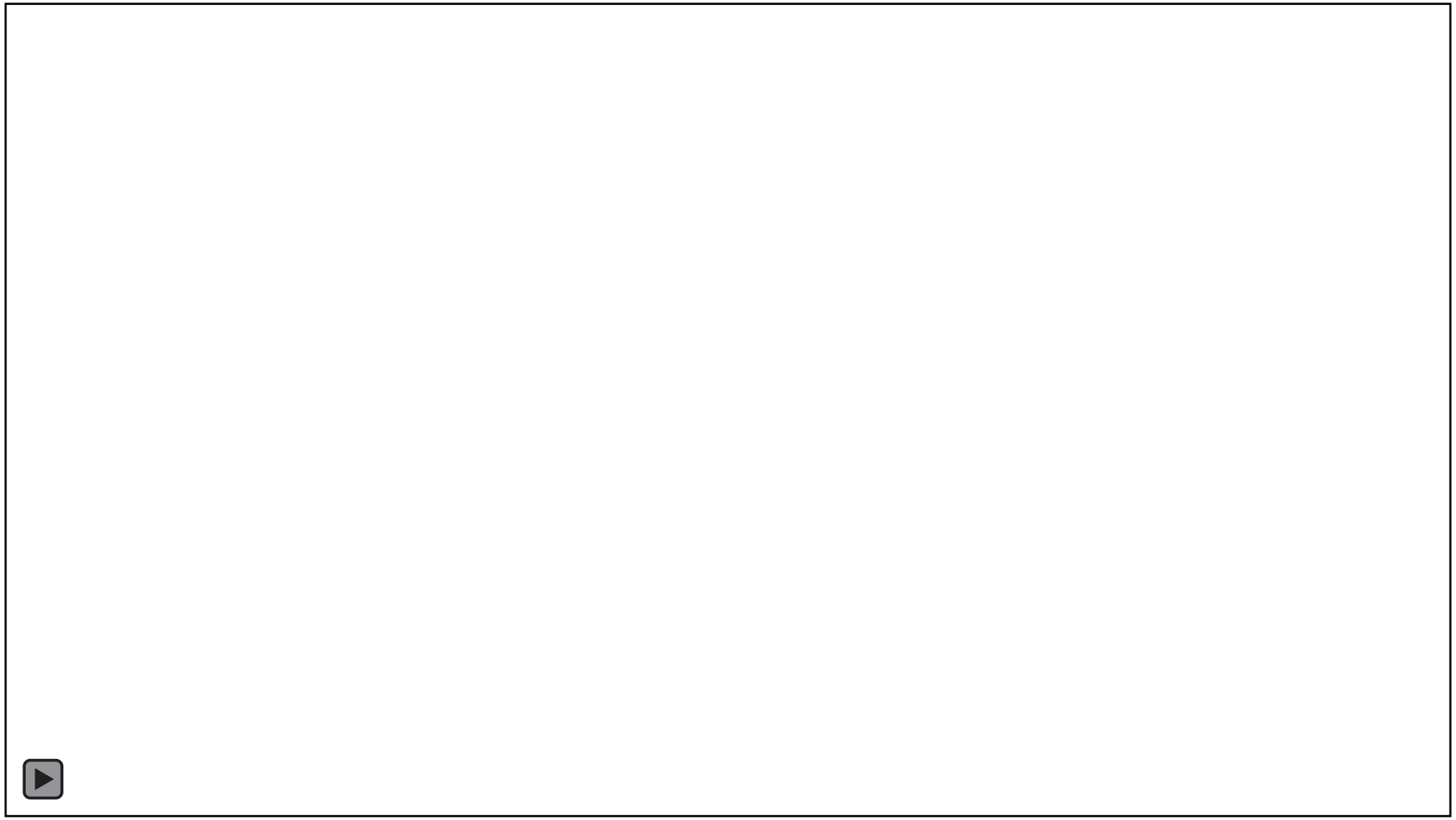
Gulfstream Empennage Flexible Model

Flutter



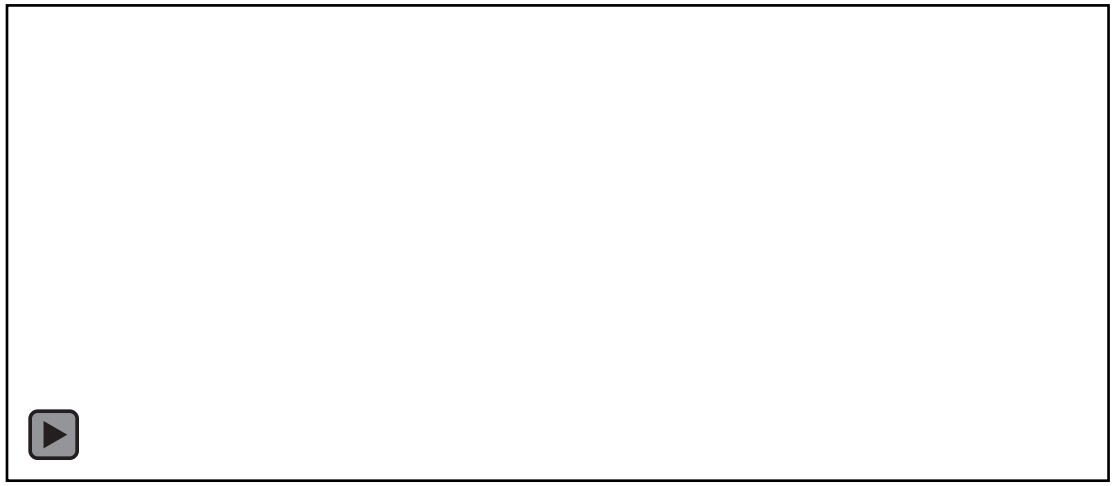
Transonic Truss-braced Wing (TTBW), X-66A

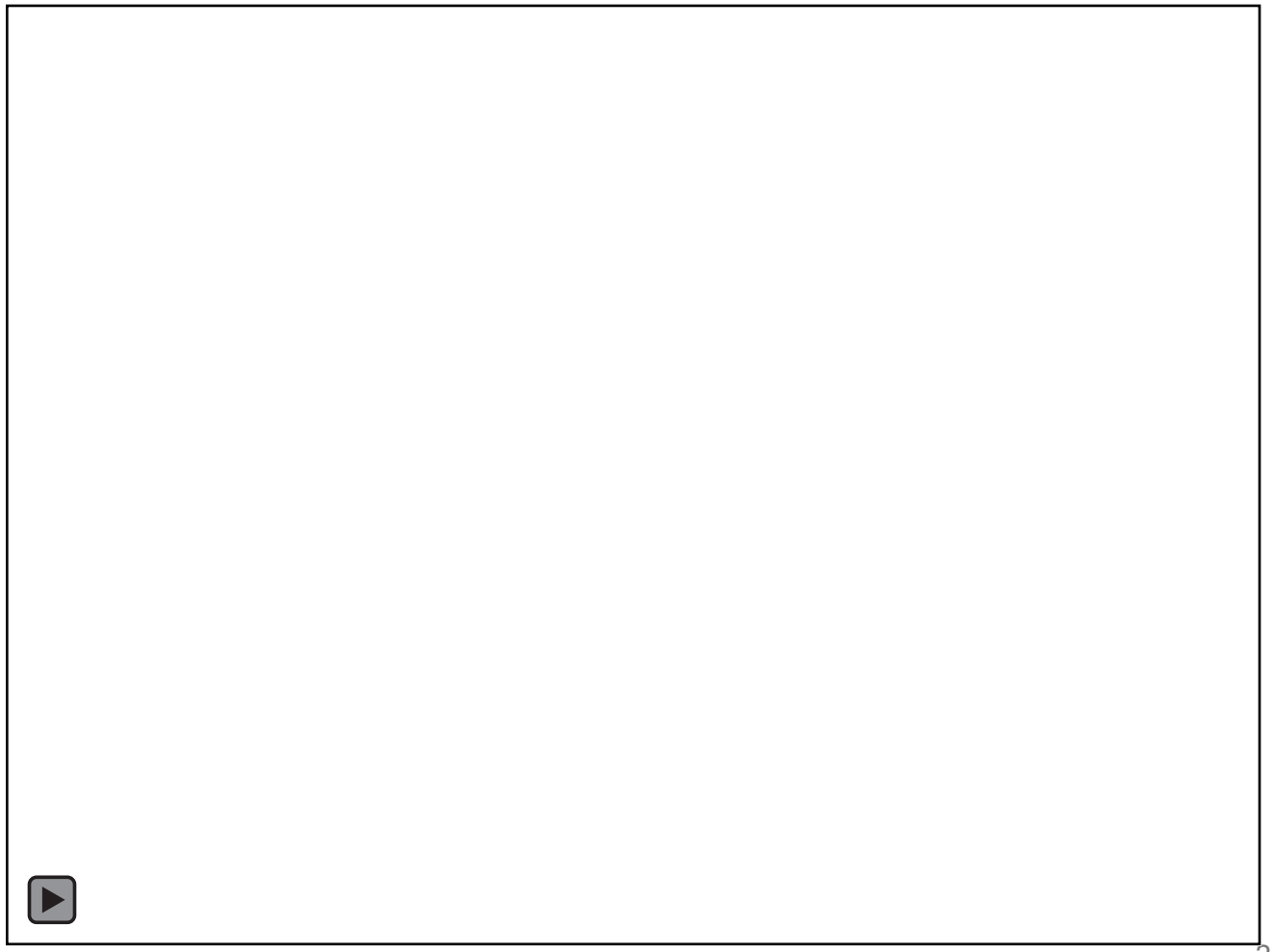
Flutter



Transonic Truss-braced Wing (TTBW), X-66A

Whirl Flutter





Other TDT Tests

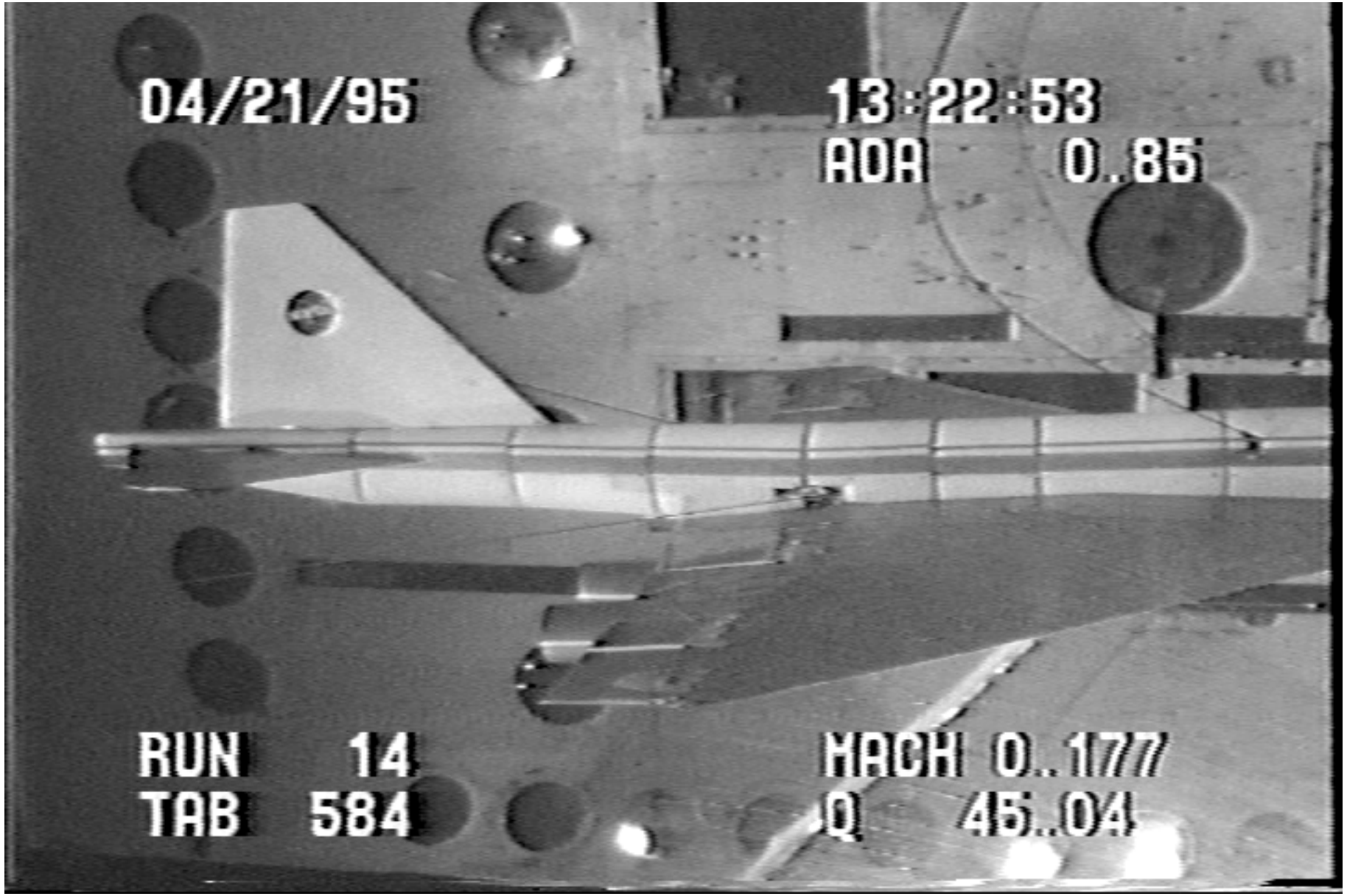


Summary

- Aeroelasticity is the study of coupled aerodynamic, elastic, and inertial forces
- Computational and experimental approaches are used, often in parallel, to study aeroelasticity
- The Transonic Dynamics Tunnel (TDT) is a NASA facility dedicated to studying aeroelasticity
- Flutter is a dangerous aeroelastic phenomenon where parts of an aircraft oscillate with growing amplitudes
- NASA strives to develop tools to predict aeroelastic behaviors to make aircraft safe

Thank you!

Backup Slides



Supersonic Transport

Dragonfly Capsule



Human-scale Mars Lander



Human-scale Mars Lander