



**SCIENCE**  
IN THE AGE OF EXPERIENCE™



From Comfort to Safety

Addressing A&D Industry Processes through Simulation

# Where Do You Want to Go Today?



# Our Vision

“

Dassault Systèmes provides business & people with **3DEXPERIENCE** universes to imagine sustainable innovations capable of harmonizing product, nature and life.

”

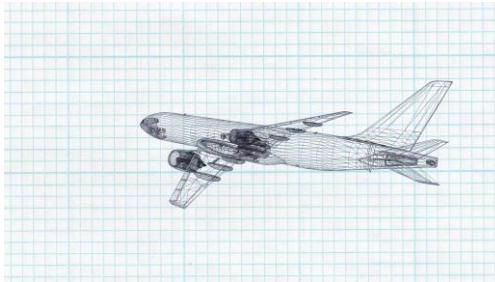
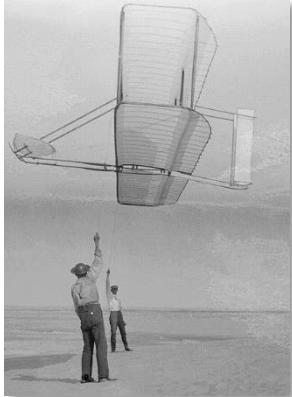


# Aerospace Industry Revolutions

## 1<sup>st</sup> Revolution

World's first successful airplane, invented, built, and flown by the Wright Brothers

**1903**



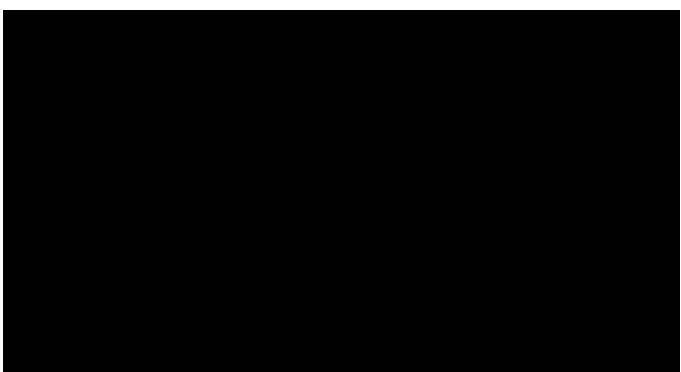
## 3<sup>rd</sup> Revolution

Personal air taxis for on-demand urban transportation

**Today**

## 2<sup>nd</sup> Revolution

Introduction of the jet engine leads to large scale commercial aircraft

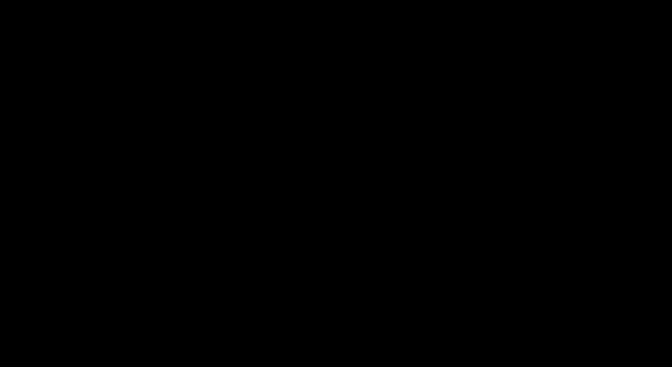


# Challenges

## 3<sup>rd</sup> Revolution

Personal air taxis for  
on-demand urban  
transportation

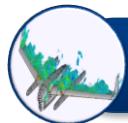
Today



## Feasibility Barriers

- Vehicle Performance
- Certification
- Aircraft Noise
- Vehicle Efficiency
- Cost and Affordability
- Safety

# How Can Simulation Help?



**Aerodynamic Performance**



**Aircraft Noise**



**Airframe Composites**



**Lightweighting**



**Communication Systems**



**Environmental Effects (E3)**

## Feasibility Barriers

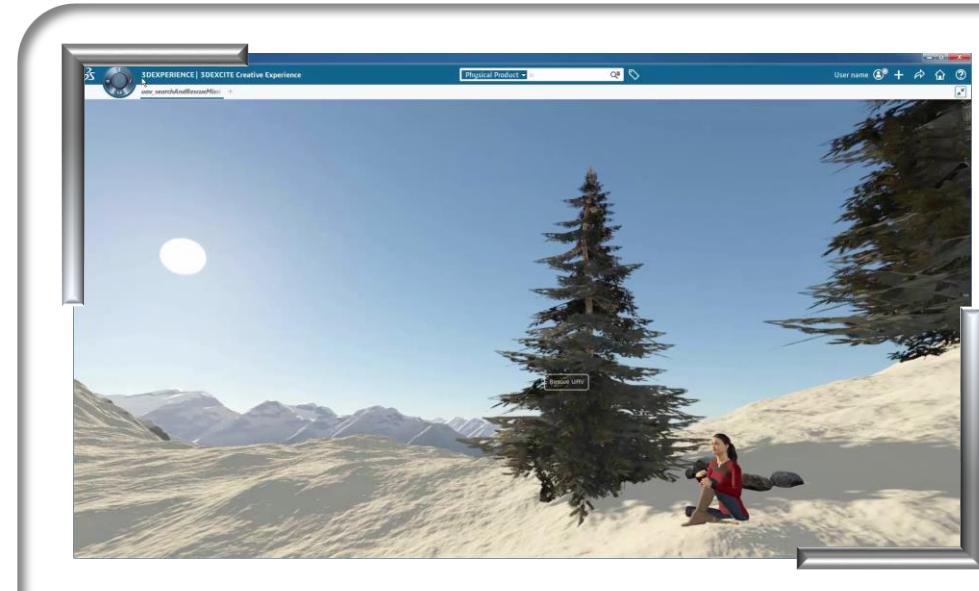
- Vehicle Performance**
- Certification**
- Community Noise**
- Vehicle Efficiency**
- Cost and Affordability**
- Safety**

# Accelerate Innovation in Aerospace

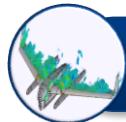
Joint project at Wichita 3DEXPERIENCE Center: Deliver a Search and Rescue UAS in 90 days

**NIAR | WICHITA STATE UNIVERSITY |**

**DASSAULT SYSTEMES** | The 3DEXPERIENCE® Company



# How Can Simulation Help?



Aerodynamic Performance



Aircraft Noise



Airframe Composites



Lightweighting



Communication Systems



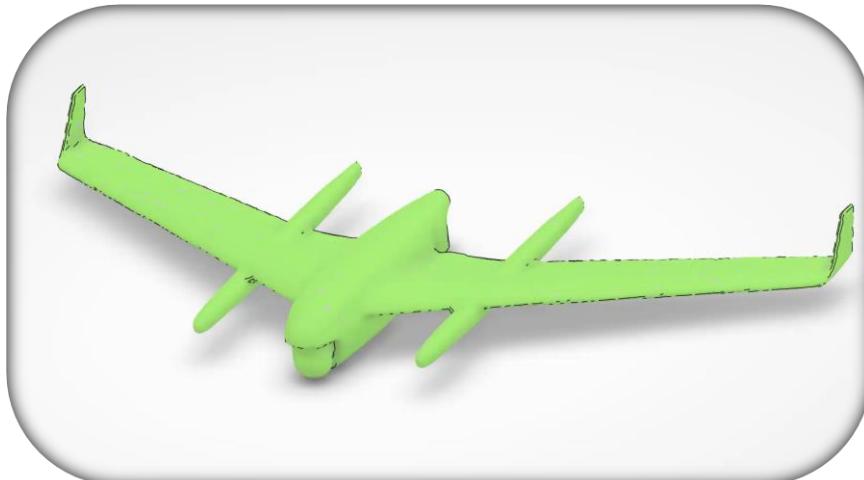
Environmental Effects (E3)

## Feasibility Barriers

### Vehicle Performance

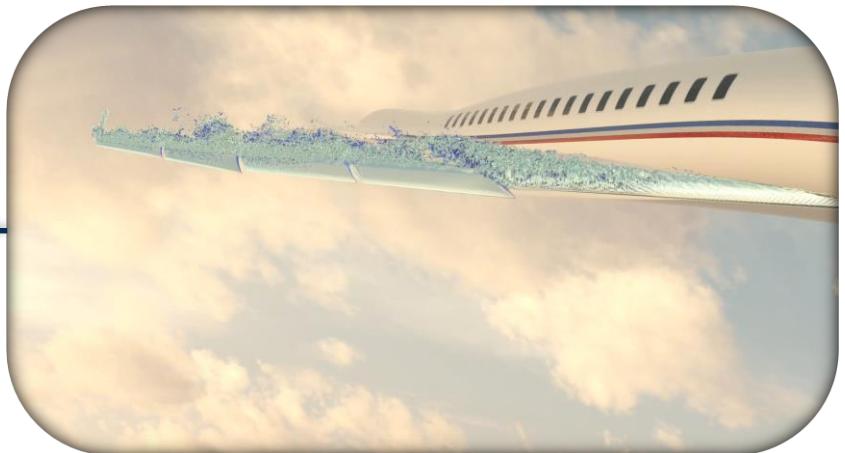


# Aerodynamic Performance | CFD Solutions



Taking CFD from the Center of the Flight Envelope ...

- Steady state simulations
- Smooth geometries



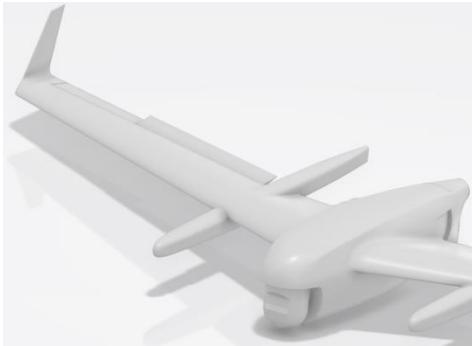
... to exploring the entire Flight Envelope

- Unsteady simulations
- Separated flows
- Fully detailed geometries

# Cruise Conditions | Parametric Model

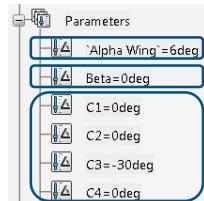
Predict UAS performance through CAD-enabled CFD on the 3DEXPERIENCE platform

Parametric UAS geometry

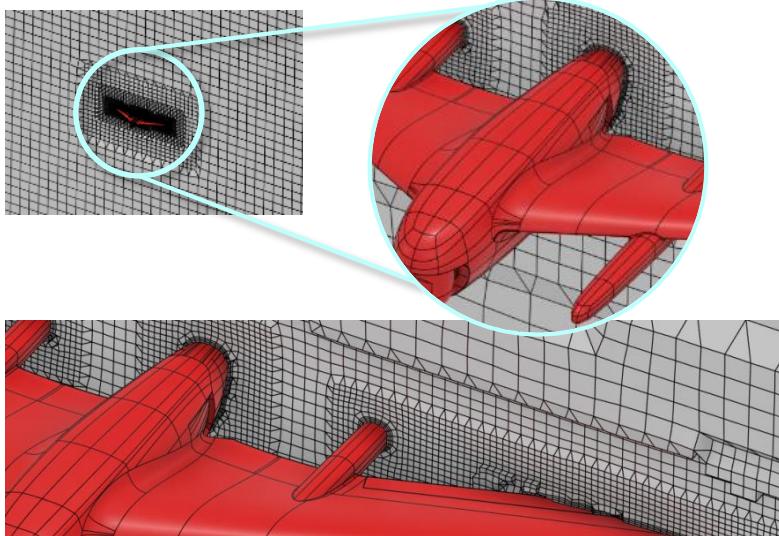


Angle of attack  
Sideslip angle

Flap angles

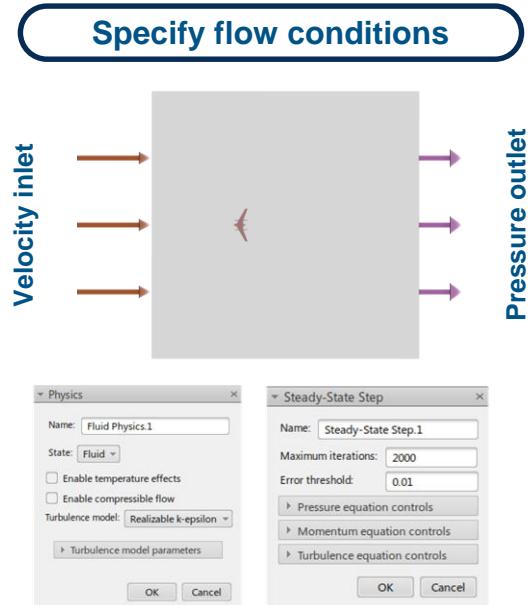


Generation of CFD mesh

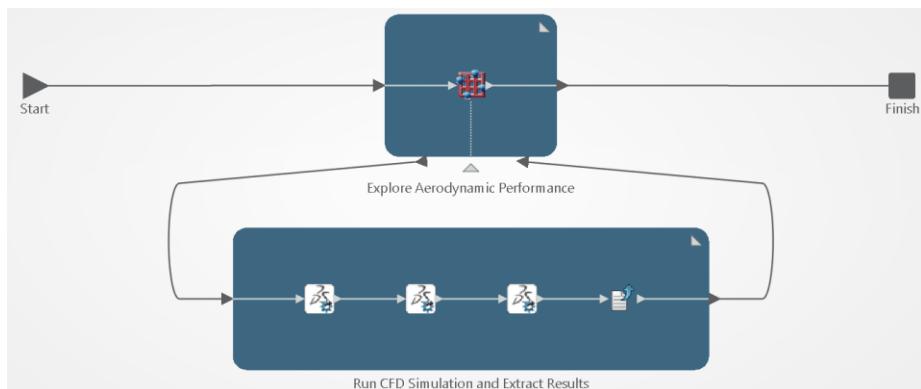


# Cruise Conditions | Automation

Predict UAS performance through CAD-enabled CFD on the 3DEXPERIENCE platform

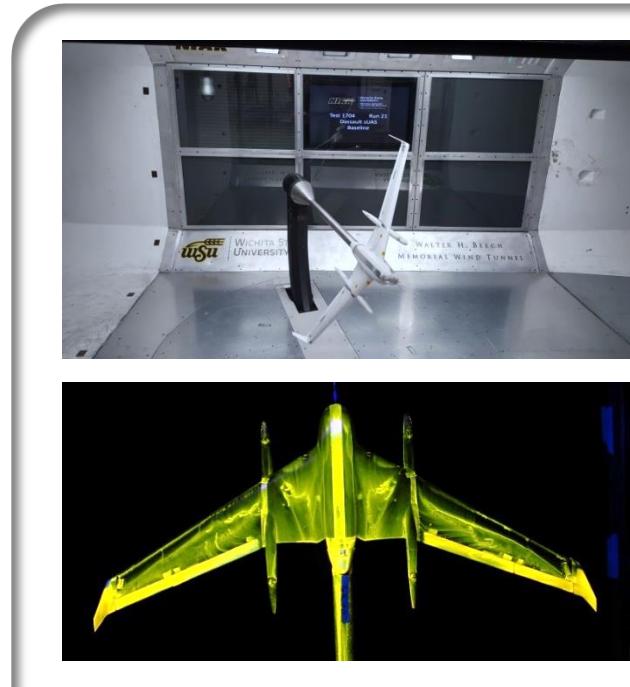
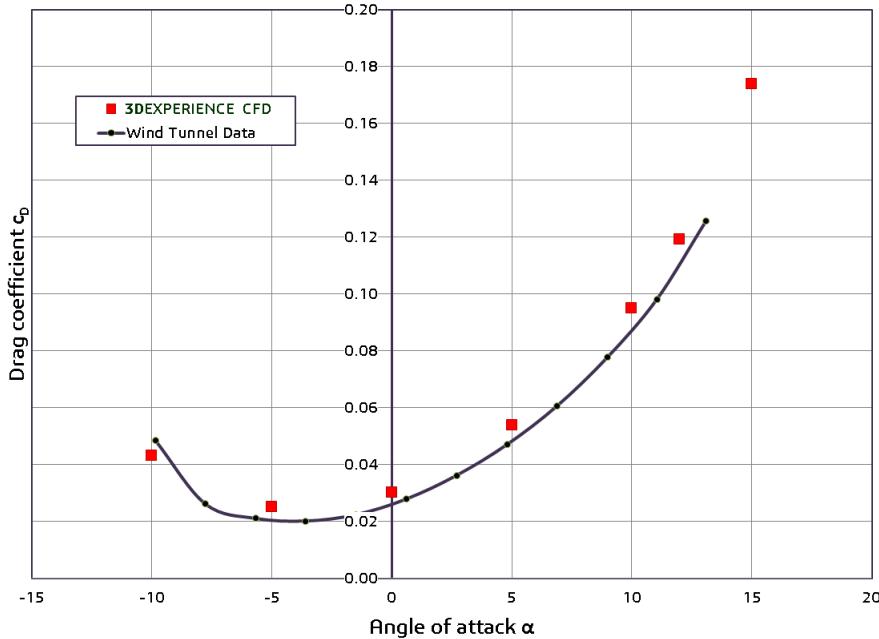


**Use process automation to evaluate aerodynamic performance**

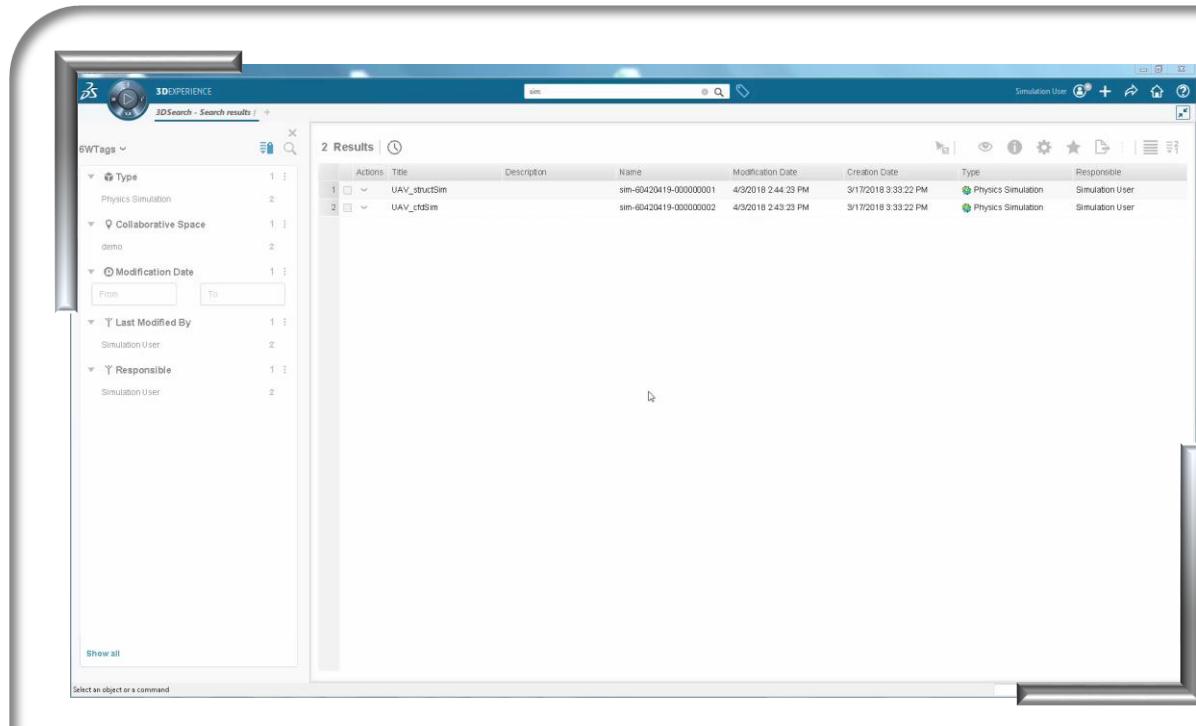
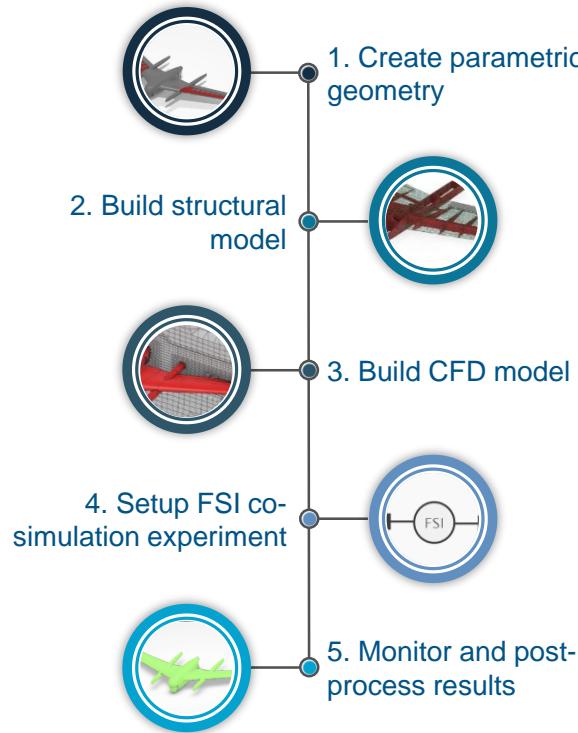


# Cruise Conditions | Verification

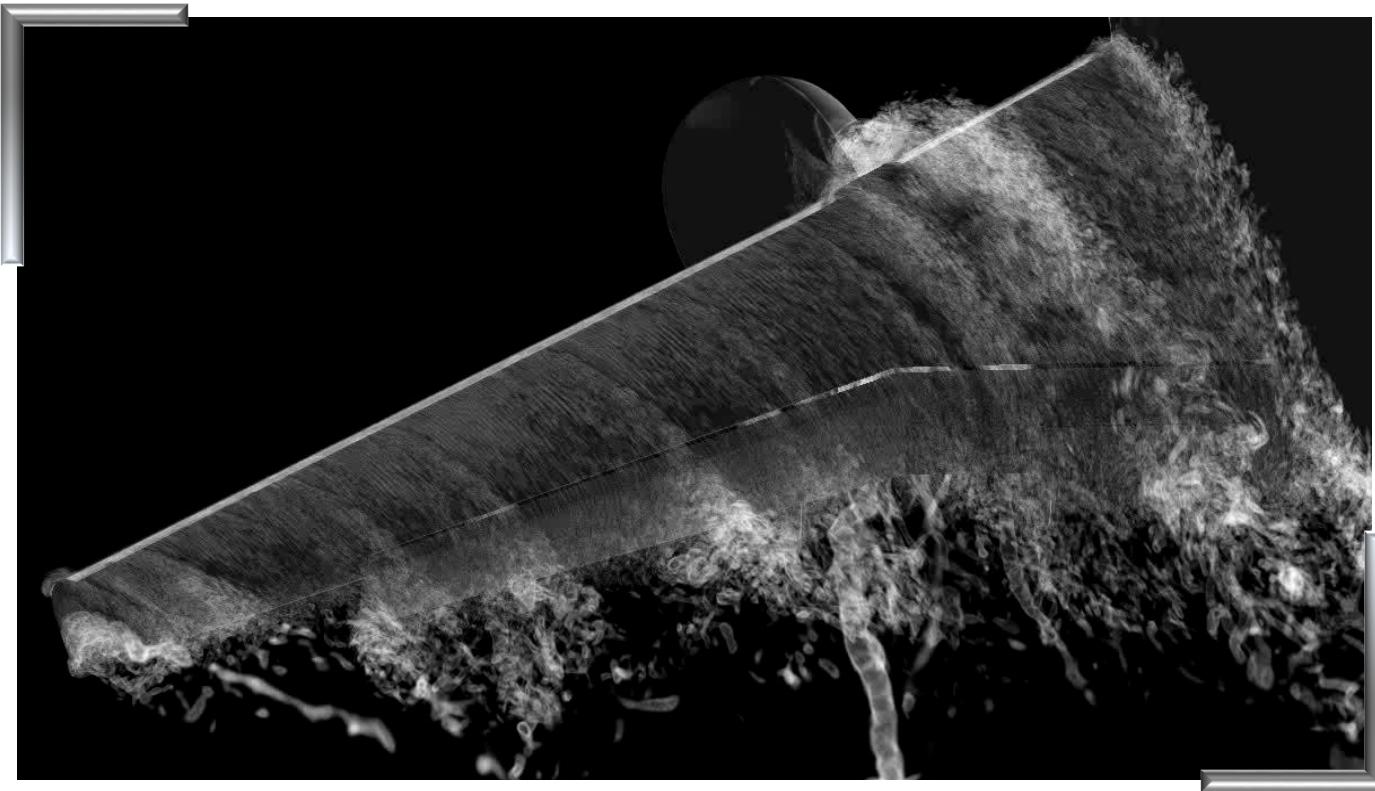
Wind tunnel test data is used for verification of simulation results



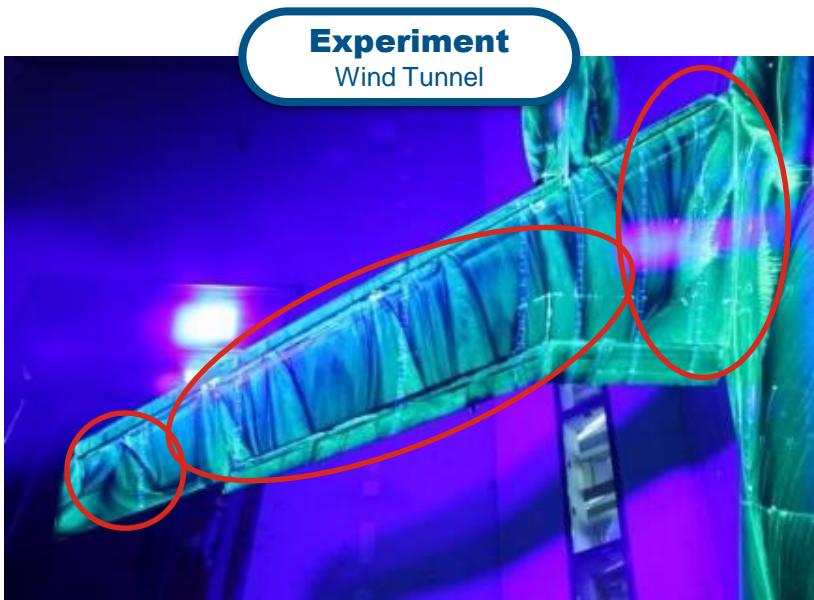
# Cruise Conditions | Fluid Structure Interaction



# Exploring the flight envelope | High-Lift Conditions



# Exploring the flight envelope | High-Lift Conditions

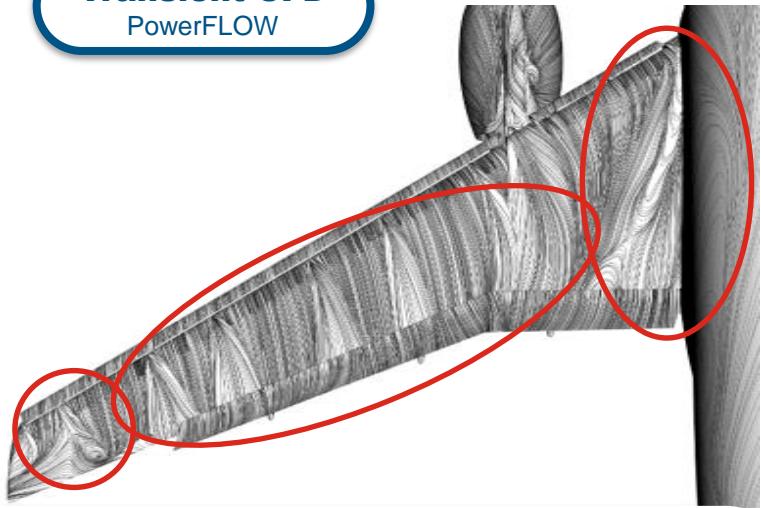


**Experiment**

Wind Tunnel

**Transient CFD**

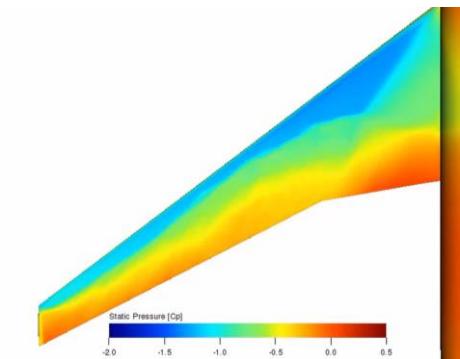
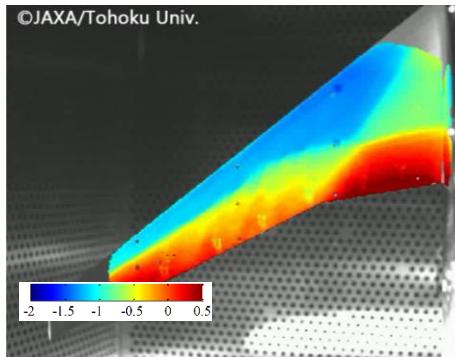
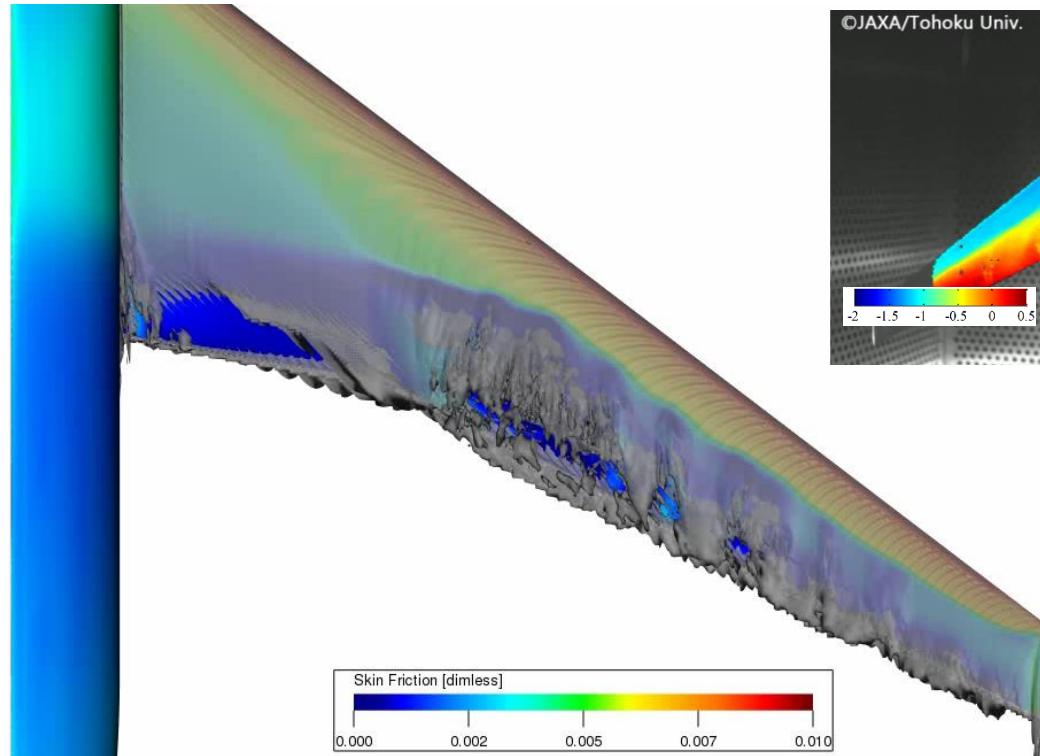
PowerFLOW



## Key Benefits

- Accurate prediction of stall mechanism and maximum lift
- Fast evaluation of multiple designs
- Replace large wind tunnel campaigns

# Exploring the flight envelope | High-Speed Buffet

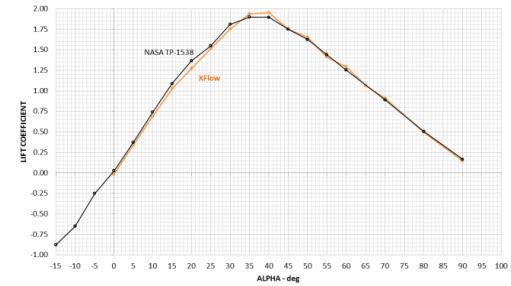


6.00 deg.

## Key Benefits

- Prediction of buffet onset and post-stall regime in conceptual and pre-WT definition status
- Provide aircraft handling information to the aircraft project during early phases

# Exploring the flight envelope | High-Speed Buffet



Accurate simulation of buffet onset and post-stall regime

# How Can Simulation Help?



Aerodynamic Performance



Aircraft Noise



Airframe Composites



Lightweighting



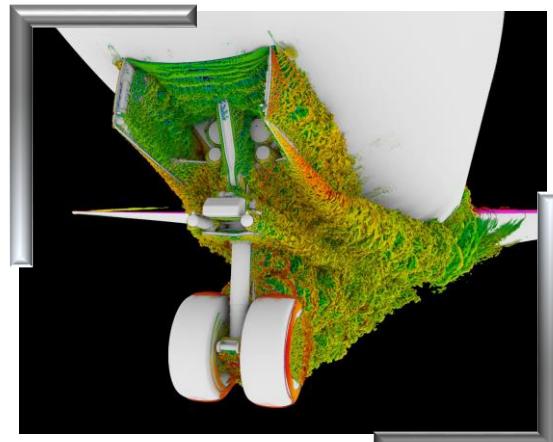
Communication Systems



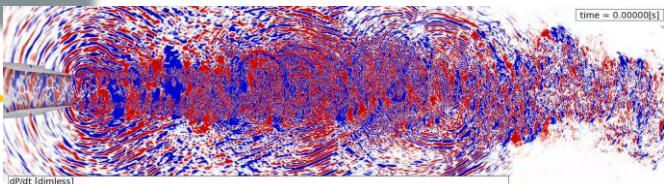
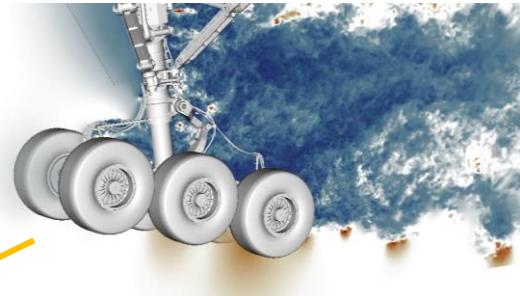
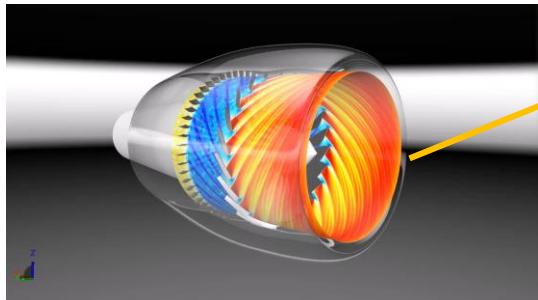
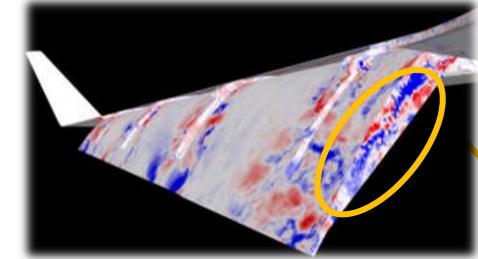
Environmental Effects (E3)

## Feasibility Barriers

- Certification
- Aircraft Noise

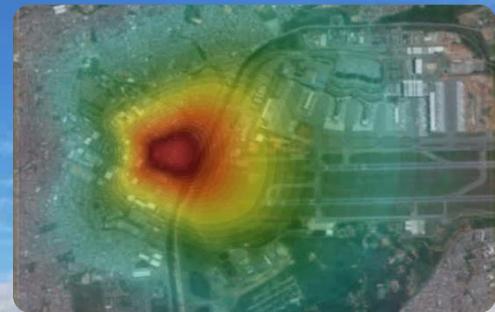


# Aircraft Noise | Community Noise

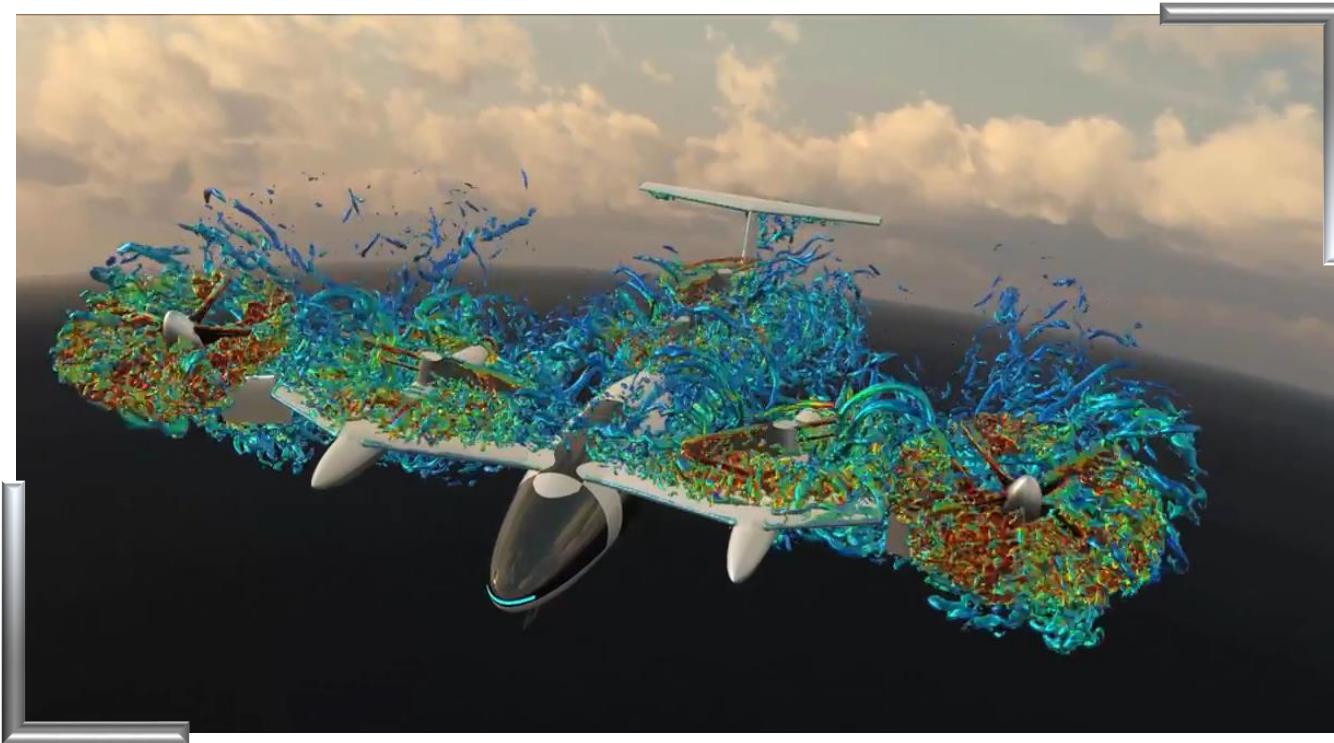


# Aircraft Noise

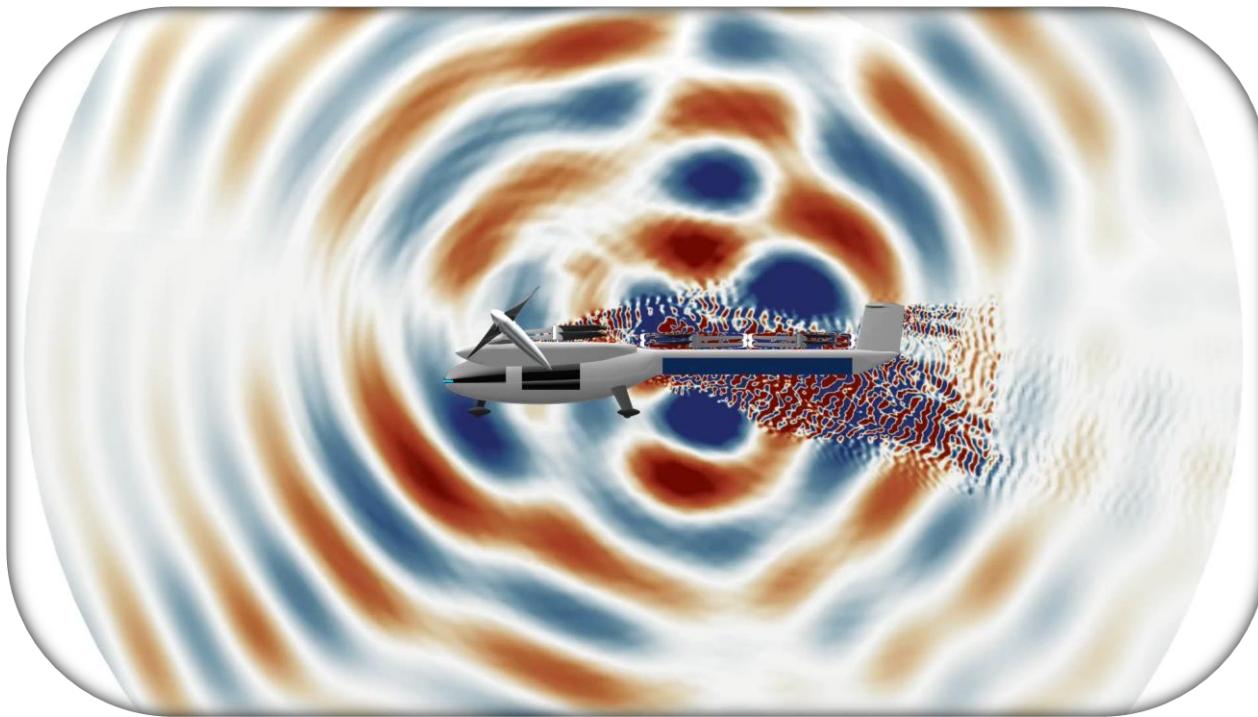
From Component Analysis ..... To full Aircraft Simulation ..... Towards Digital Certification



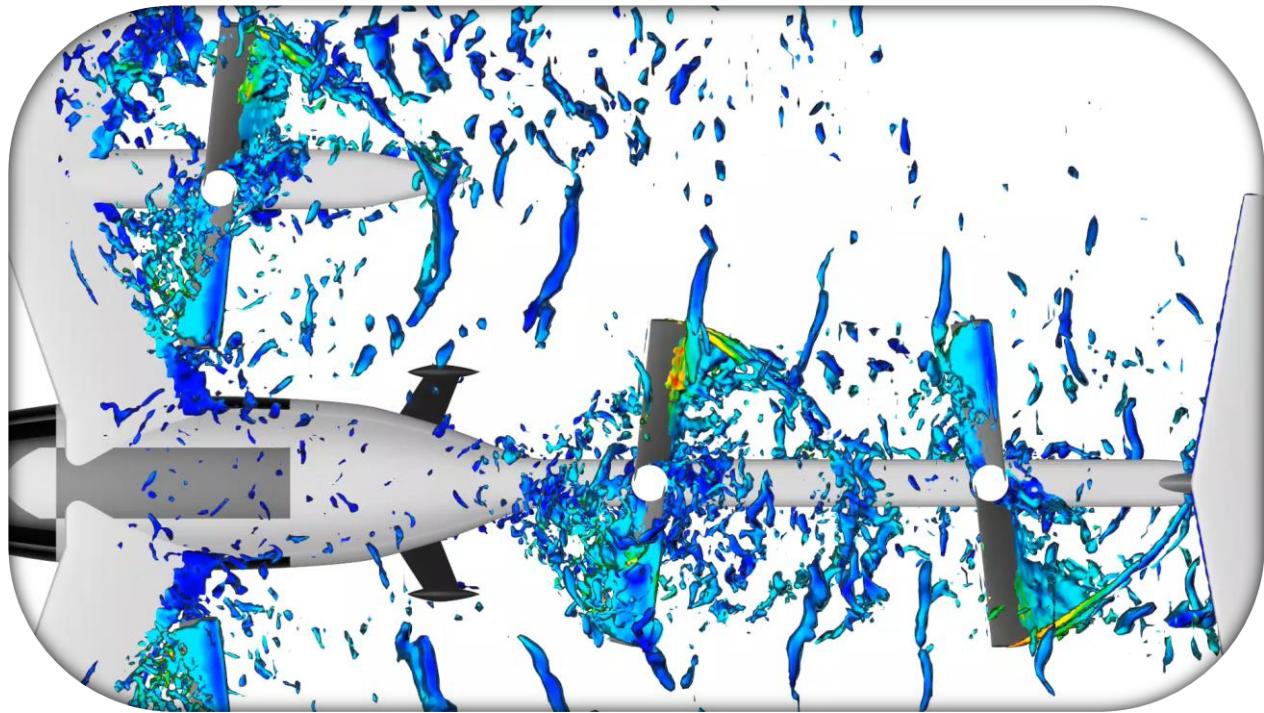
# Aircraft Noise | Air Taxi Community Noise



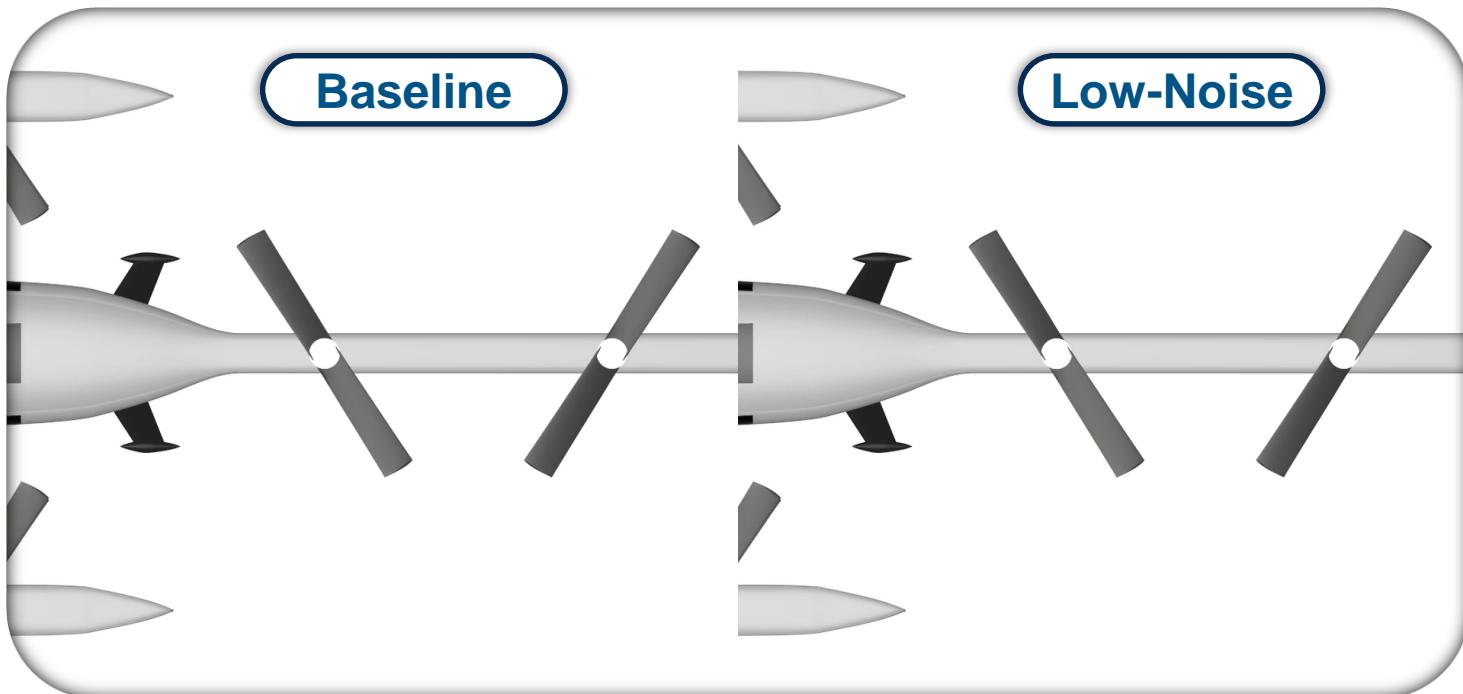
# Aircraft Noise | Air Taxi Community Noise



# Aircraft Noise | Air Taxi Community Noise

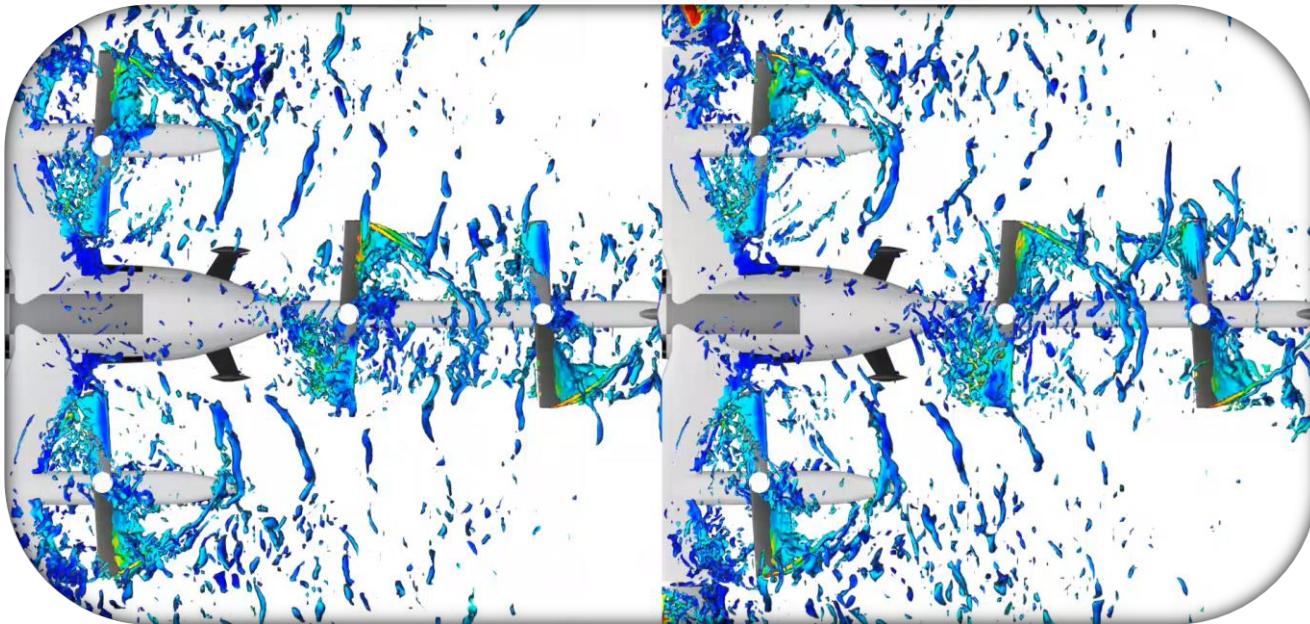


# Community Noise | Geometry Modification



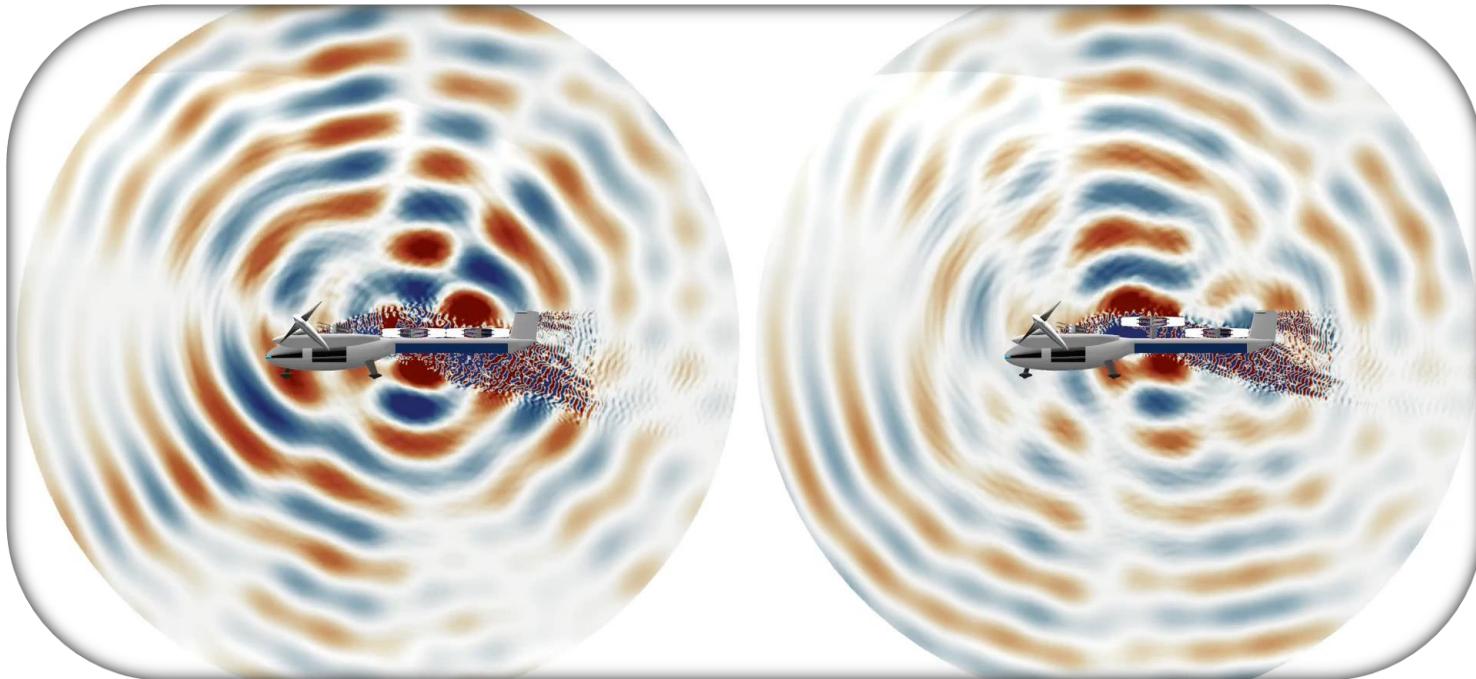
# Community Noise | Geometry-based Noise Reduction

Baseline vs. Low-Noise

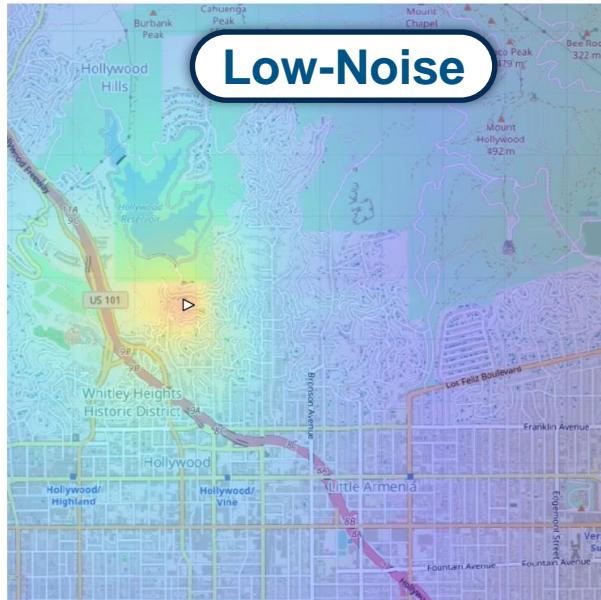
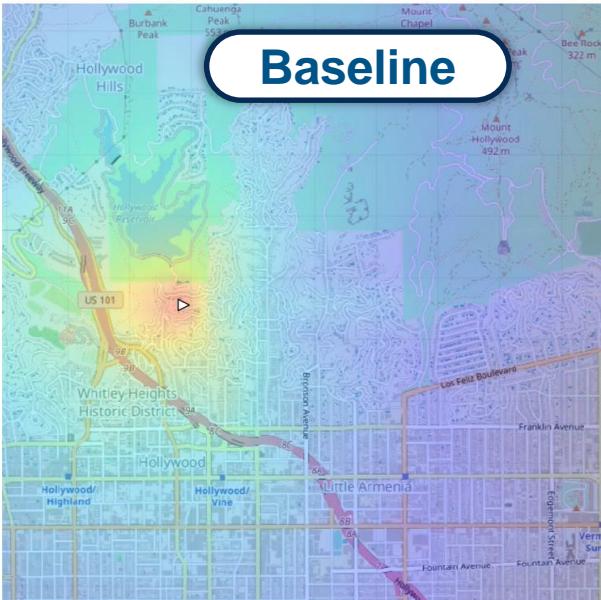


# Community Noise | Geometry-based Noise Reduction

Baseline vs. Low-Noise



# Community Noise | Noise Signature on Ground



... towards true Digital Flight



# How Can Simulation Help?



Aerodynamic Performance



Aircraft Noise



Airframe Composites



Lightweighting



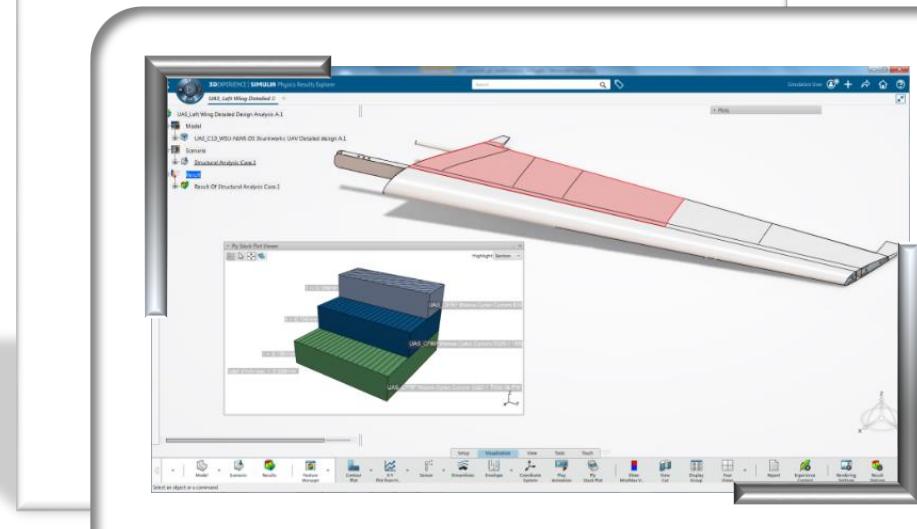
Communication Systems



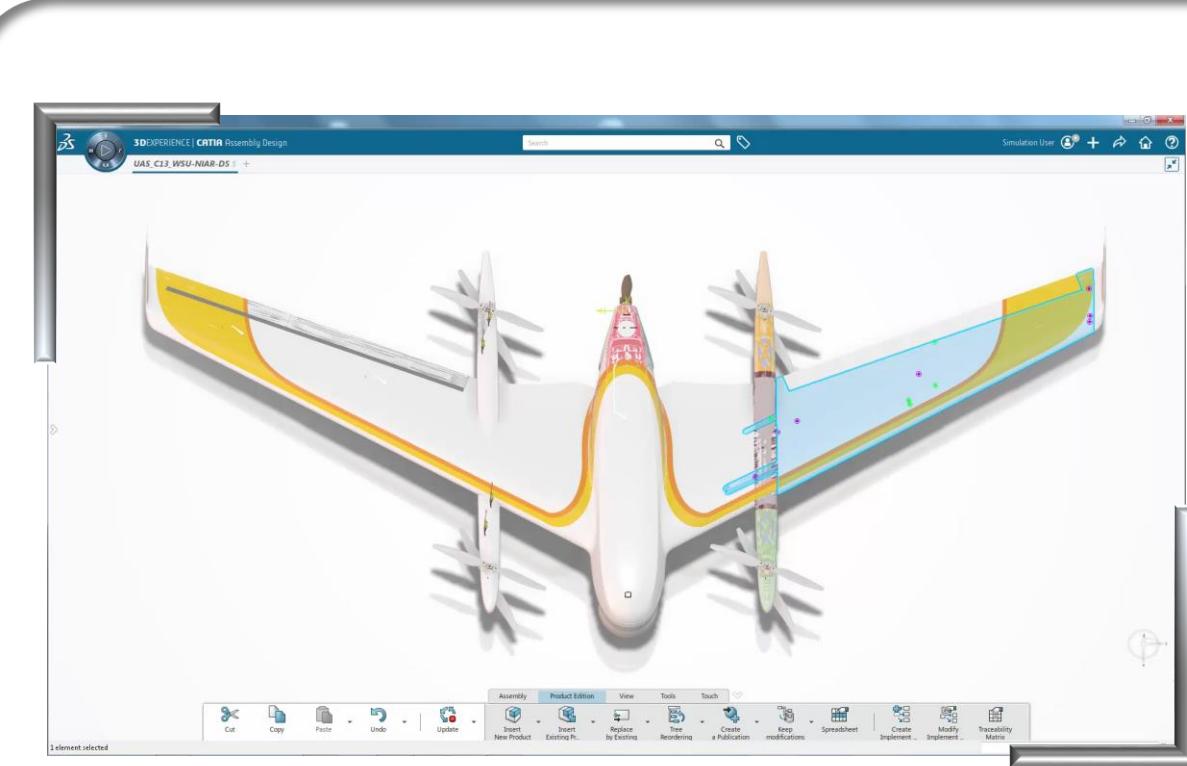
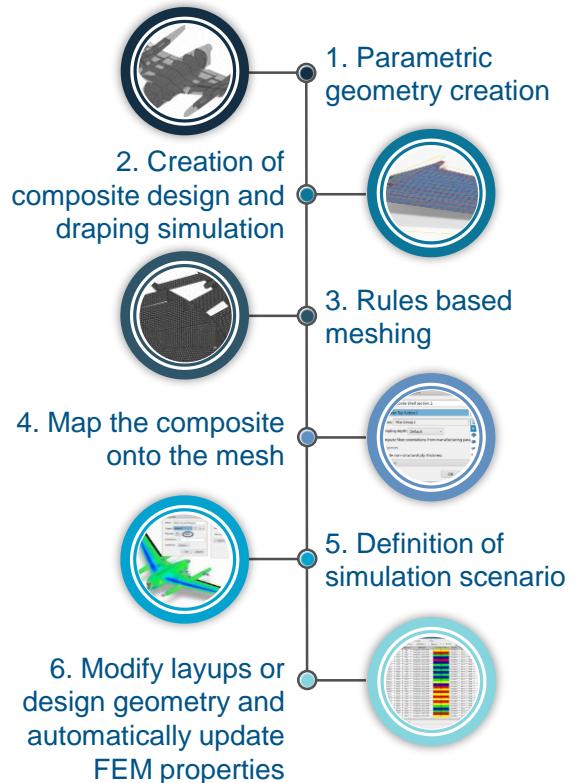
Environmental Effects (E3)

## Feasibility Barriers

- Vehicle Efficiency
- Cost and Affordability



# Airframe Composites



# Airframe Composites | Key Capabilities

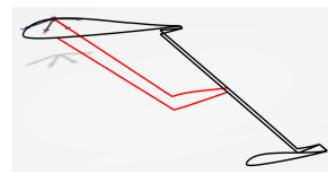
Capabilities of composites solutions on 3DEXPERIENCE platform

Seamless integration  
with CATIA composite  
design tools

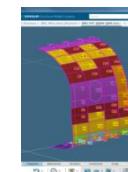


Supports all design methods available in  
CATIA composite design

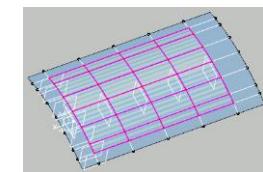
Plies Design



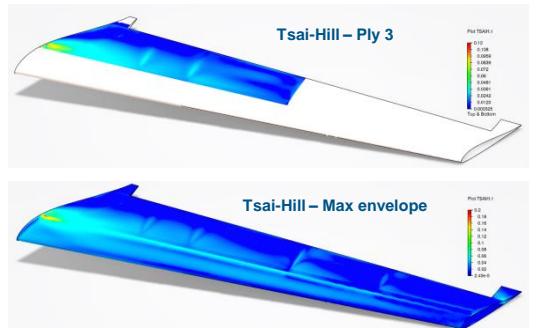
Zones Design



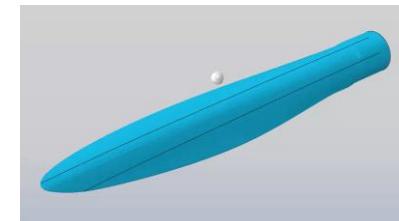
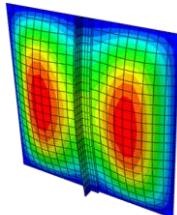
Grid Design



Ply-based post-  
processing tools



Full range of solver capabilities from linear  
analysis to progressive damage analysis



# How Can Simulation Help?



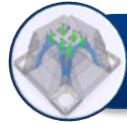
Aerodynamic Performance



Aircraft Noise



Airframe Composites



**Lightweighting**



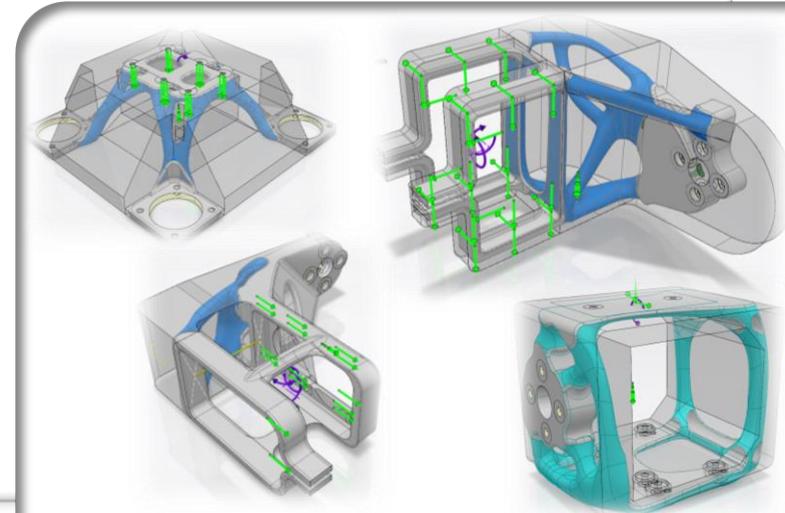
Communication Systems



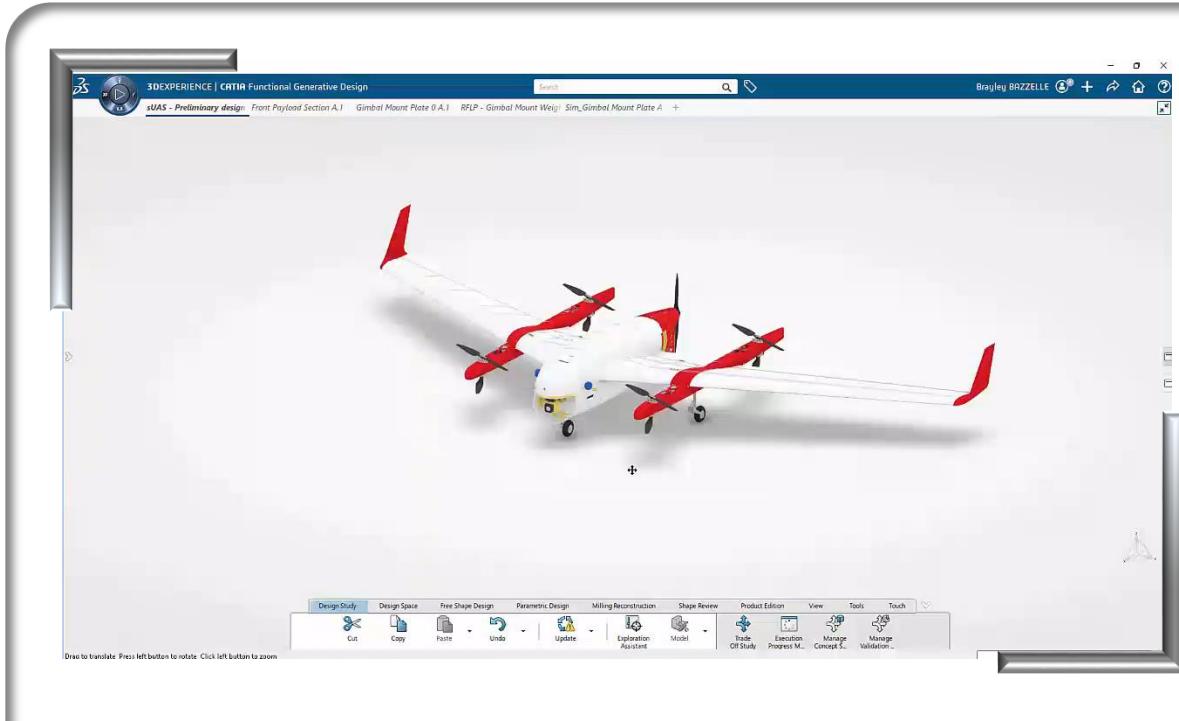
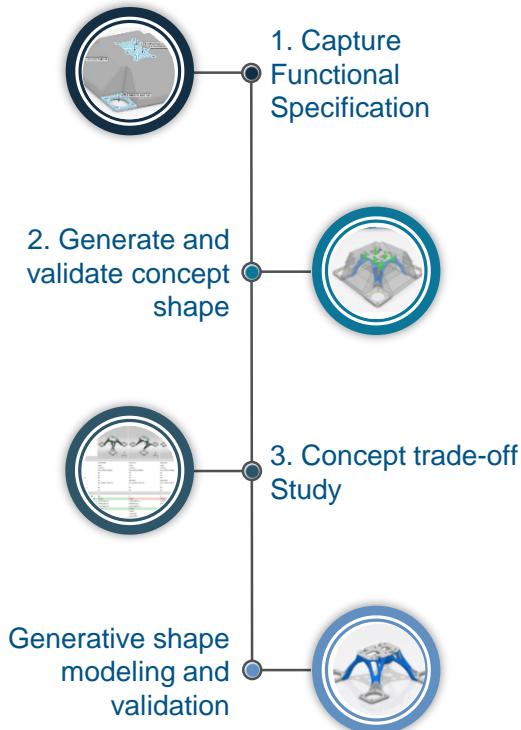
Environmental Effects (E3)

## Feasibility Barriers

- Vehicle Efficiency
- Cost and Affordability

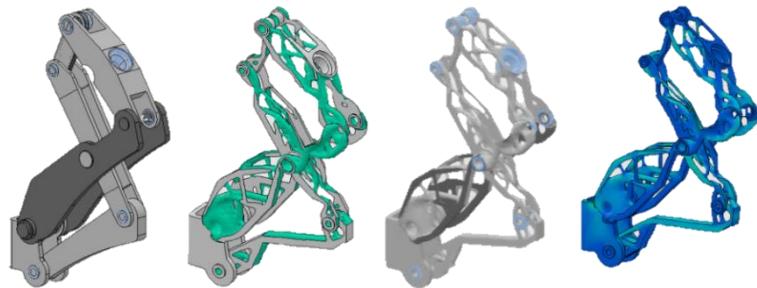


# Lightweighting



# Lightweighting | Key Capabilities

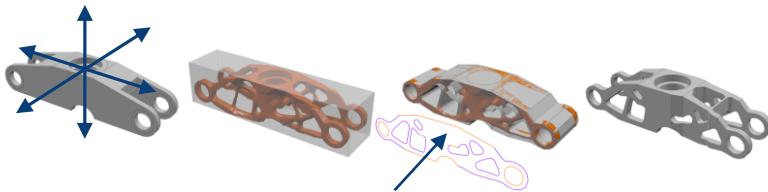
Assembly optimization



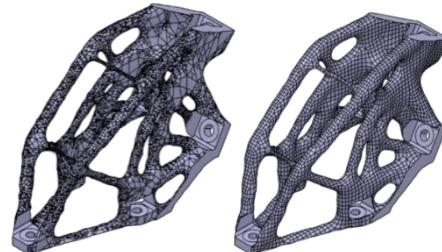
Different manufacturing constraints



Milling reconstruction



Automatic smooth geometry creation



# How Can Simulation Help?



Aerodynamic Performance



Aircraft Noise



Airframe Composites



Lightweighting



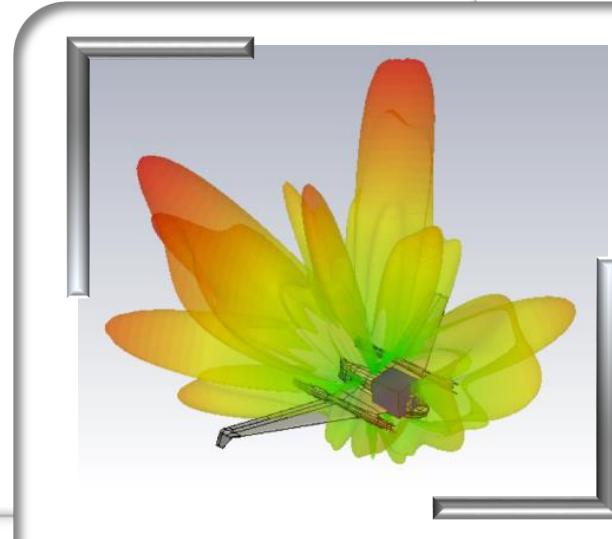
Communication Systems



Environmental Effects (E3)

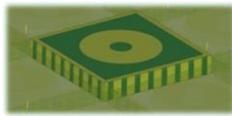
## Feasibility Barriers

### Safety



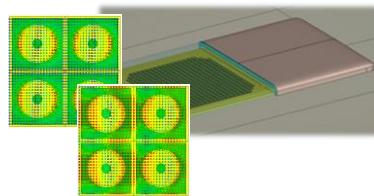
# Antenna and Array System Analysis

Element: Antenna Synthesis



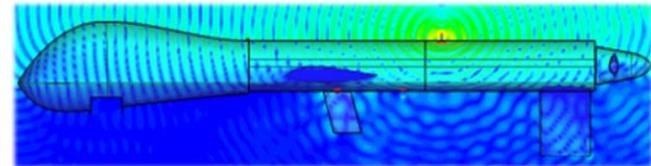
1

Periodic and Finite Array Analysis

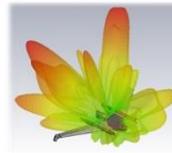


2

Powerful Visualization  
and Post-Processing



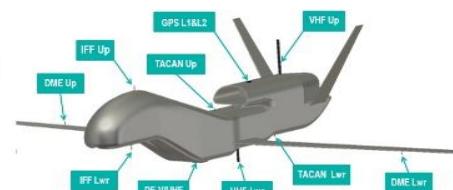
Antenna Installed Performance



3

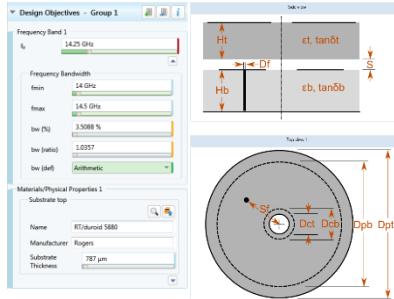
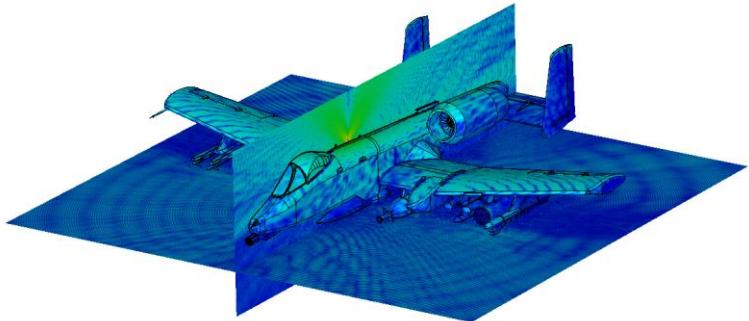
Cosite / Coexistence Analysis  
for multiple Antenna Systems

4



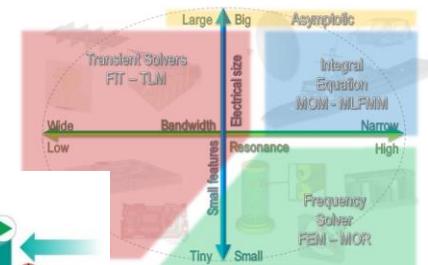
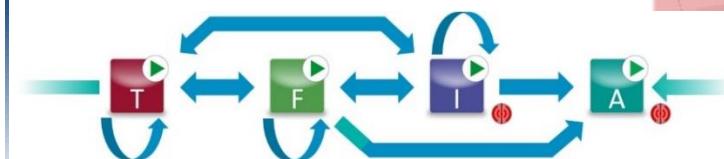
# Antenna Analysis | Key Capabilities

High performance 3D field visualization

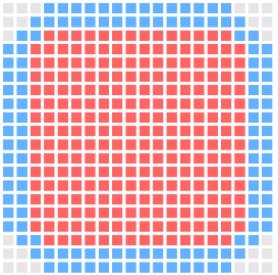


Antenna  
Synthesis

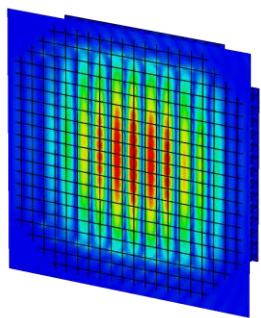
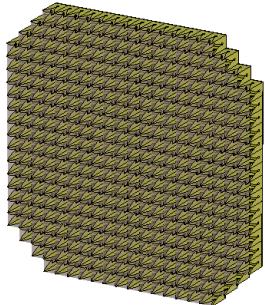
Complete EM solver technology,  
hybrid simulation, single GUI



# Antenna Analysis | Key Capabilities

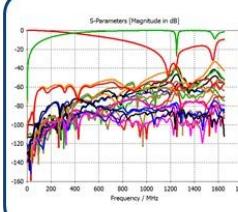


**Array tool,  
setup and  
optimize  
large arrays**

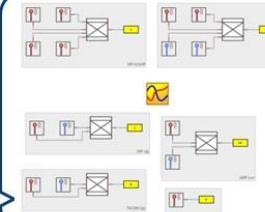


## Interference Task for Co-site / Coexistence

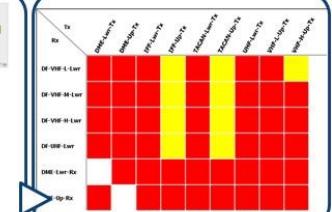
Coupling Matrix



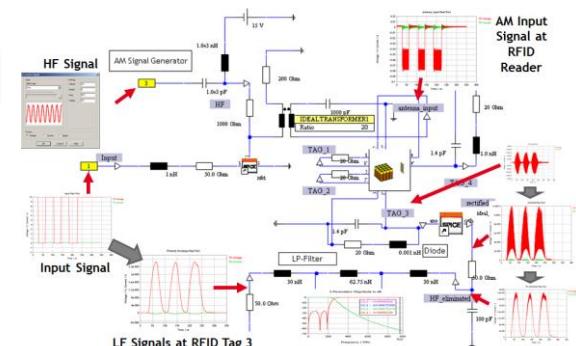
Parametric RF Systems



Violation Matrix



**Circuit system  
integrated with  
3D simulation**



# How Can Simulation Help?



Aerodynamic Performance



Aircraft Noise



Airframe Composites



Lightweighting



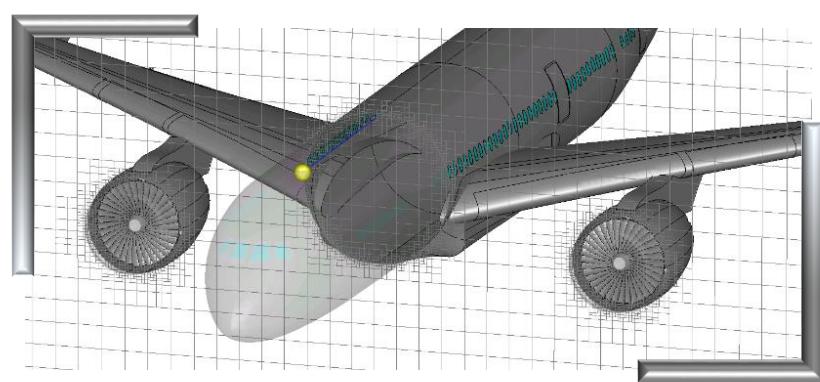
Communication Systems



Environmental Effects (E3)

## Feasibility Barriers

### Safety



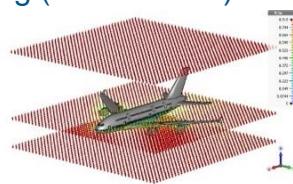
# Lightning Strike Event Analysis

Aircraft Fuselage / Cabin Model



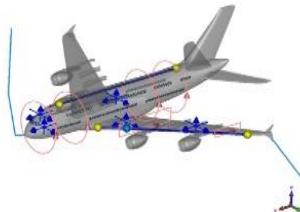
1

Locate strike areas with Aircraft Zoning (static E field)



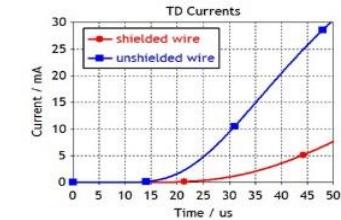
2

High Frequency, Transient Analysis



3

Ensure electrical systems maintain performance to specification

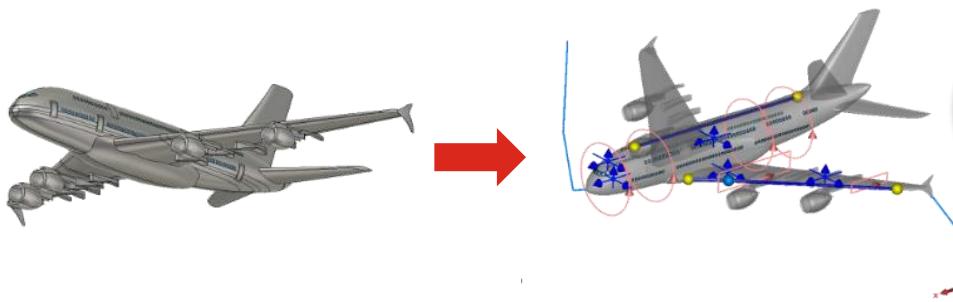


Visualize resulting fields and currents



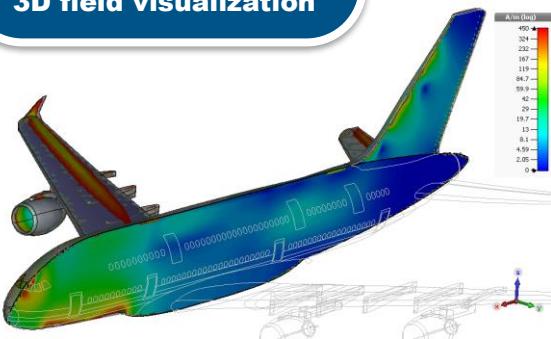
4

# Lightning Strike | Key Capabilities

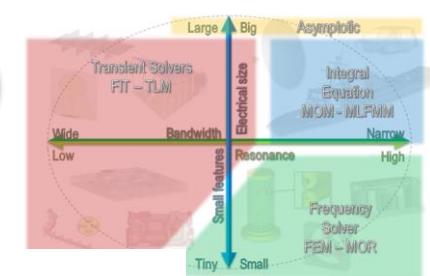


Tight integration between  
Computer Aided Design and  
Computational  
Electromagnetics

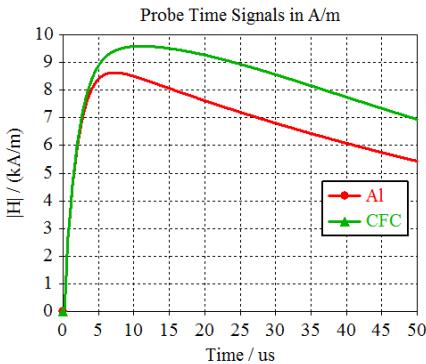
High performance  
3D field visualization



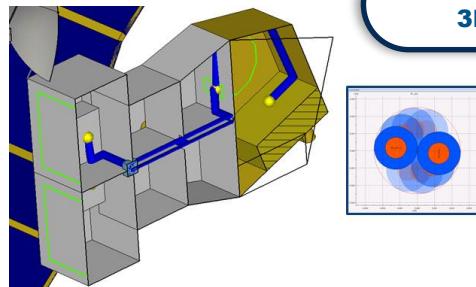
Complete EM solver technology,  
hybrid simulation, single GUI



# Lightning Strike | Key Capabilities

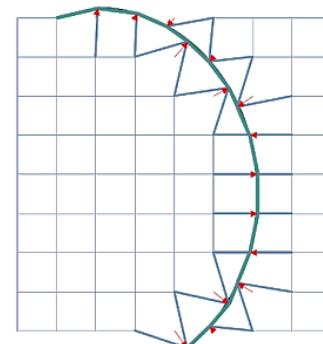
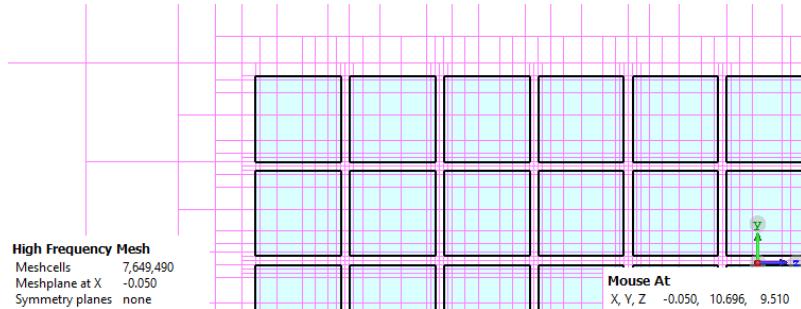


**Native transient analysis, use direct lightning waveform**



**Bidirectional cable harness,  
3DEM cosimulation**

**Perfect boundary approximation (PBA) mesh, octree lumping**



# From Comfort to Safety

