# Advanced Exploration of Reliable Operation at low Altitudes: meteorology, Simulation, and Technology (AEROcAST)

## Improving Weather Tolerant Operations for AAM

Challenge

- Create a weather sensing, modeling, and reasoning framework for enabling weather tolerant operations
- Improve flight performance in the challenges of the atmospheric boundary layer, requiring:
  - Atmospheric boundary layer wind data with low latency
  - Weather data in extreme conditions
  - New techniques for urban navigation
  - Modeling and display of winds and turbulence
- Understanding the wind environment in urban
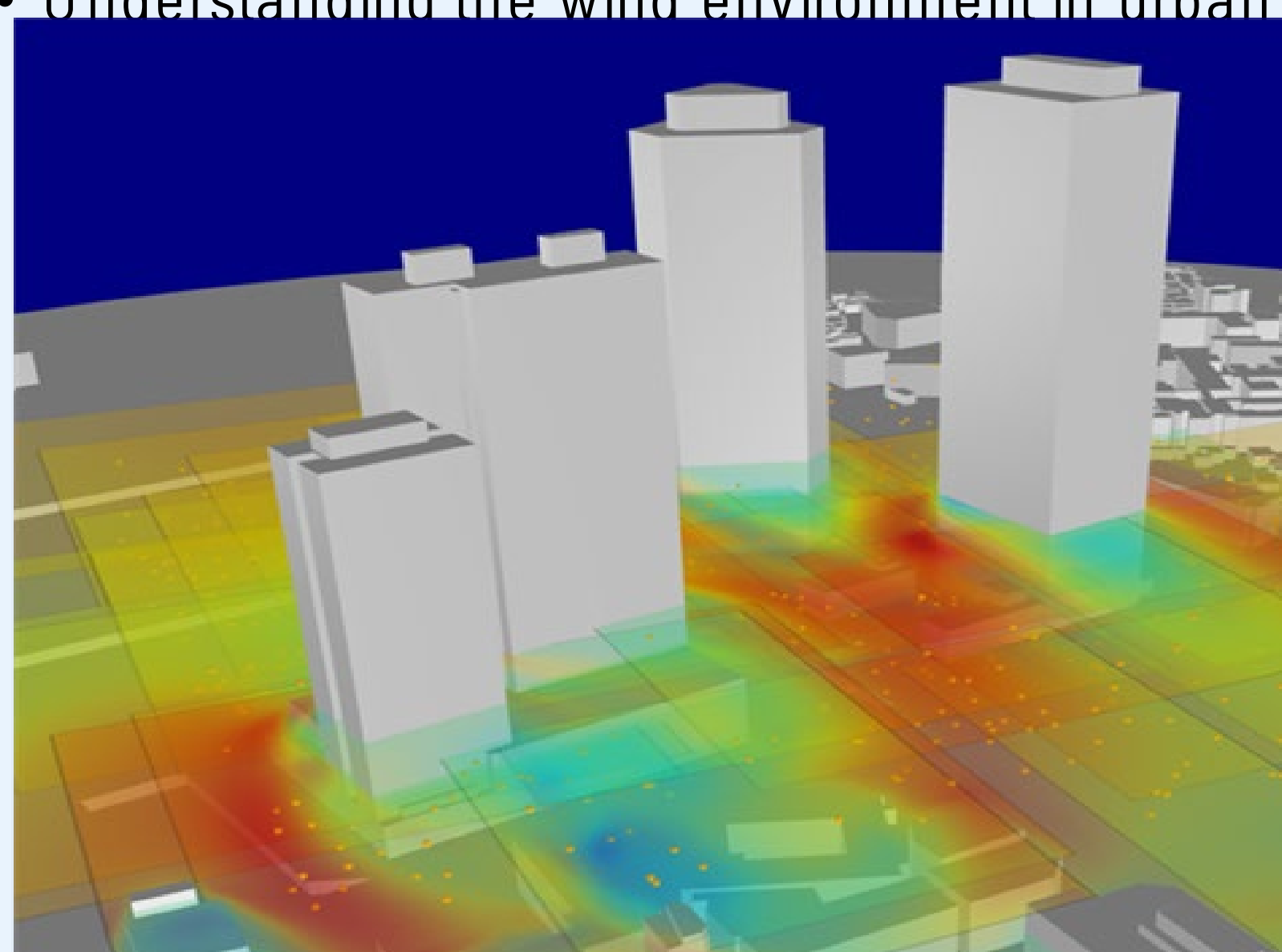
Modeling and visualization allows "seeing" wind

Expected Impacts

- Enhanced safety and efficiency of AAM in adverse weather conditions
- More efficient vertiport operations
- Improved navigation and decreased turbulence in urban environments
- Filling the gap of weather observations in the atmospheric boundary layer and better understanding of wind flows in the urban environment
- Improved weather forecasts for many applications
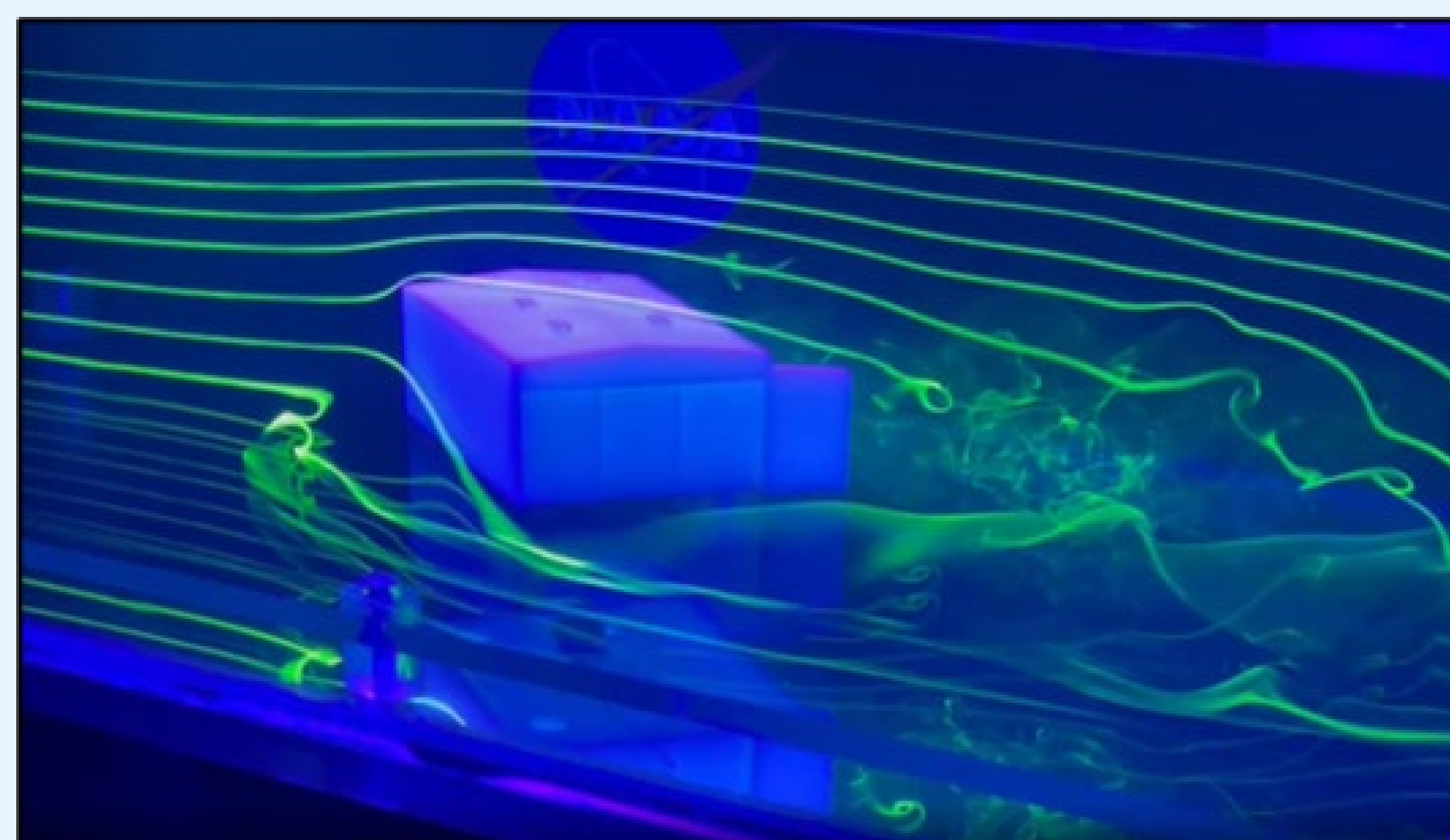
ARC water tunnel model of AFRC Shuttle Hangar

Solution

- UAVs as a sensor platform and better use of existing ground-based sensors
- Sensor implementation for extreme weather
- Advanced lidar techniques for wind measurement
- Data aggregation and low-latency distribution of weather data
- Wind data fed to models and simulation for identifying potential hazards
- Machine learning and computational fluid dynamics (CFD)

Results

- Cost-effective wind and weather sensing from vehicles
- Multiple sensor and data technologies for weather situational awareness
- Solutions for weather-tolerant Advanced Air Mobility (AAM)
- Dataset of atmospheric measurements around a building for UAM stakeholders

Next Steps

- Distribution of wind measurement database
- Publication of modeling results, new sensing techniques, and measurement validation
- Interaction with university research and small business
- Several patents available for licensing of projects technology advancements

Partners

- NASA Convergent Aeronautics Solutions
- Four NASA Centers:
  - AFRC: meteorological research and flight testing
  - ARC: wind modeling, simulation, and visualization
  - GRC: sensing in extreme weather conditions
  - LaRC: wind sensing and data aggregation
- Virginia Tech, vehicle-based wind measurement
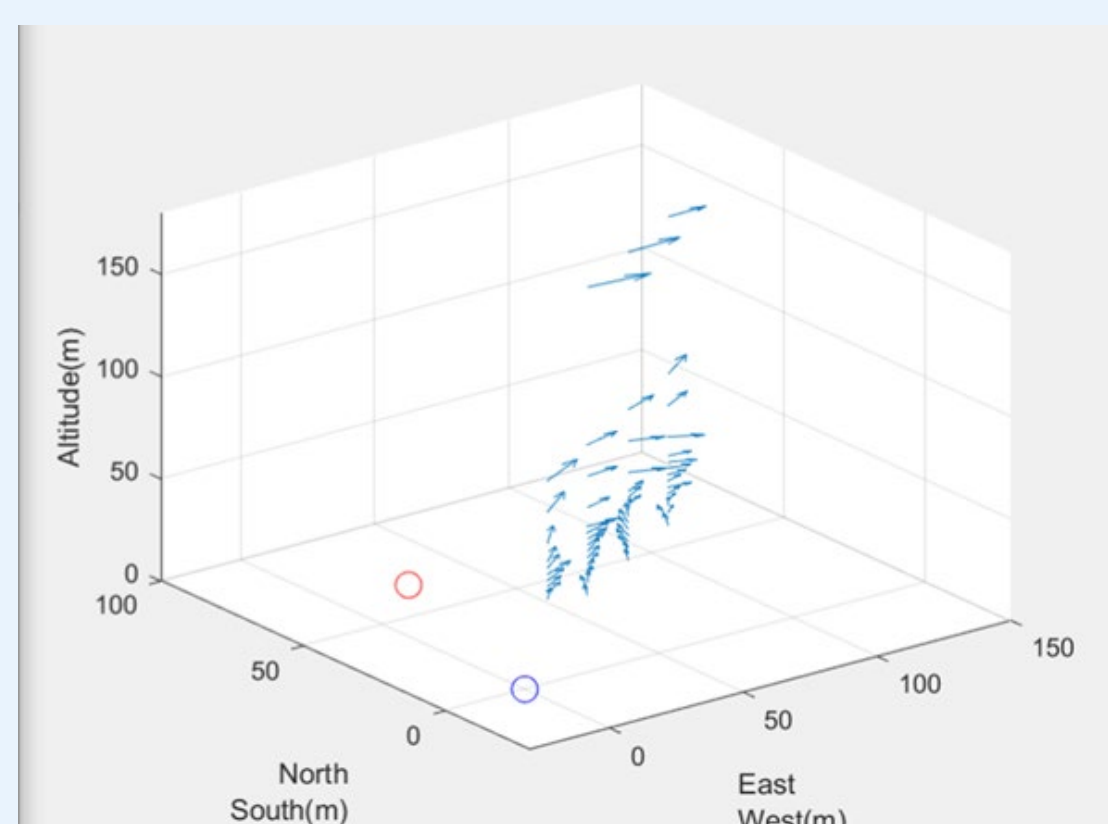
Dual-Doppler wind lidar for measurement validation

Flight testing of vehicle-based wind sensing

Altruistic Weather Scout for severe conditions

IMAGINAVIATION

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