

SHARED Operational REsearch Logistics In the Nearshore Environment (SHORELINE21) Workshop

NHERI WOW EF Overview

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Florida International University

FIU | Wall of Wind
NHERI Experimental Facility

April 26, 2021

The Natural Hazards Engineering Research Infrastructure's (NHERI) Wall of Wind EF is supported by the National Science Foundation awards CMMI 1520853 and 2037899. Any statements in this material are those of the presenter(s) and do not necessarily reflect the views of the National Science Foundation.



NHERI WOW EF: Facility



- Open jet large wind tunnel
- 12 electric fans in an arc-focal arrangement
- Wind field cross-sectional area: 20ftx14ft (WxH)
- Wind speed range: 10mph – 157mph
- Open, Suburban and Uniform exposures
- Turn table diameter: 16ft
- Turn table capacity: 105,000lb static and 52,000lb dynamic
- Rotational speed range: 0.015-0.0014 min/deg

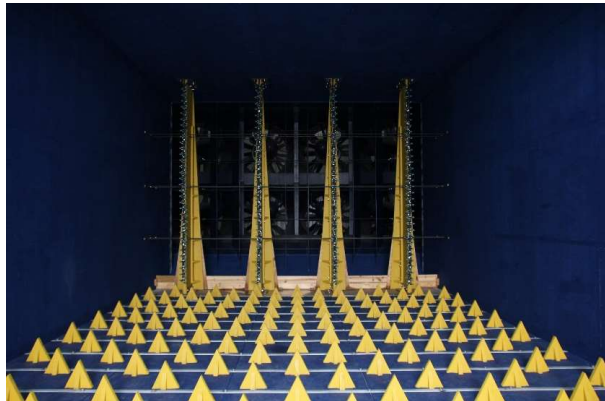
NHERI WOW EF: Facility



Building and Operations and Control Center



Control Room



Flow Management and Rain Nozzles

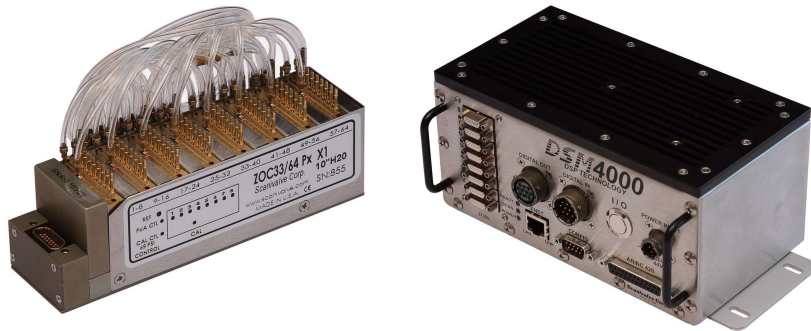


WOW Turntable (16 ft. Diameter)



Staging Area

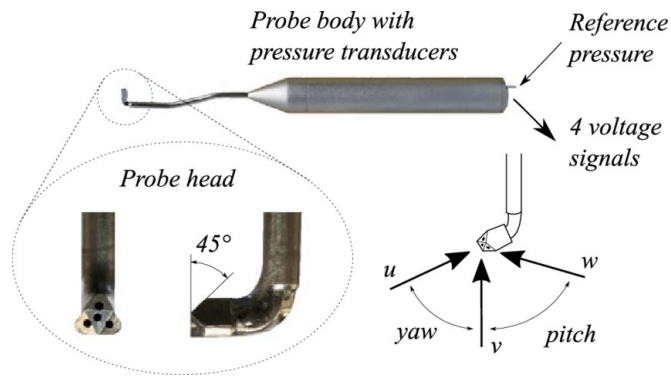
Instrumentation



Scanivalve Pressure Scanner



Strain Gauge



Cobra Probe

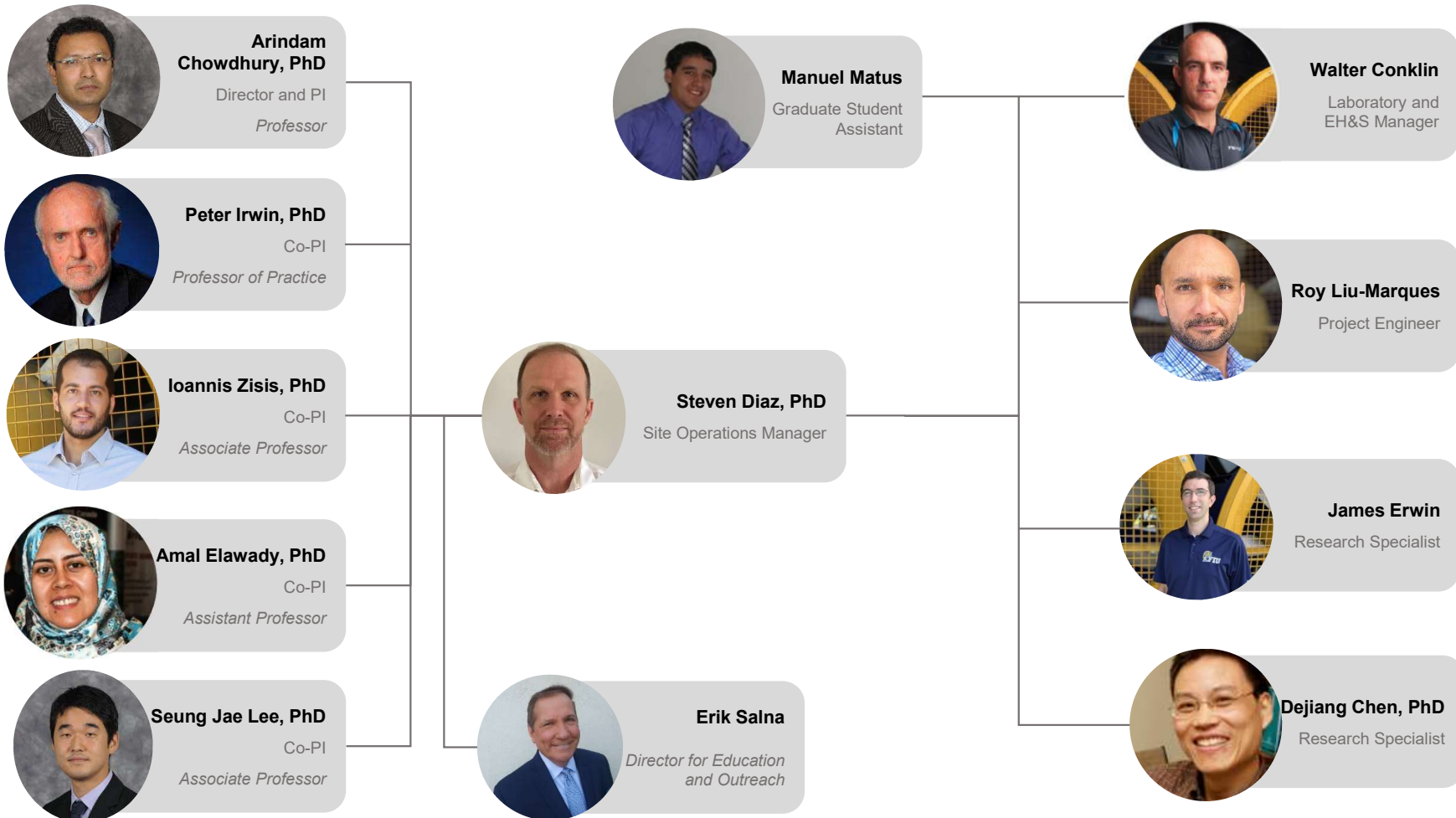


Load Cells



Accelerometers

NHERI WOW EF Team



Unique Experimental Resources and Testing Capabilities

- Up to Category 5 hurricane winds simulations
- Multi-Scale Testing (full-, large-, small-scale)
- Destructive Testing (to predict progressive failures in buildings and infrastructure elements)
- Wind-Driven Rain simulations (to study water intrusion)
- Various Structures (buildings, bridges, renewable energy systems, lifeline infrastructures)

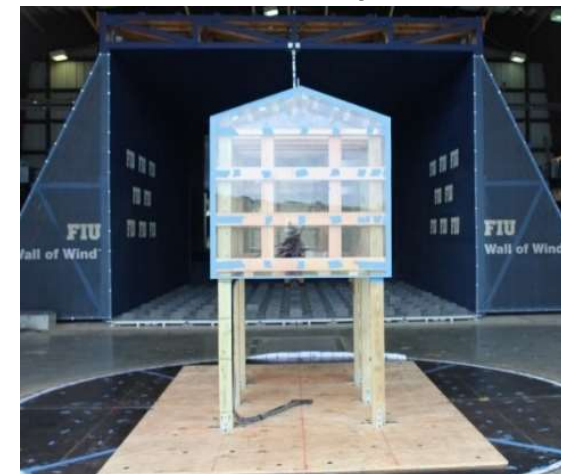
Example Project: Wind Effects on Elevated Houses



One-story



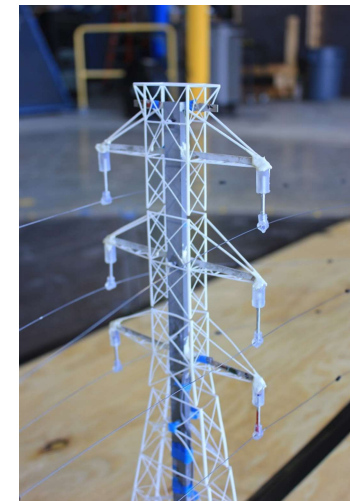
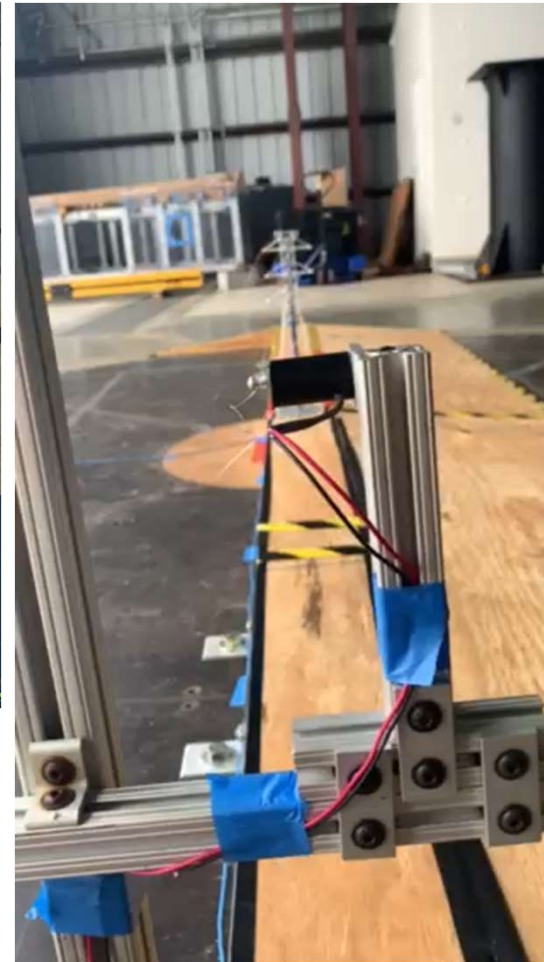
Two-story



Abdelfatah, N., Elawady, A., Irwin, P., Chowdhury, A. (2020) "A Study of Aerodynamic Pressures on Elevated Houses" Wind and Structures, Vol. 31, No. 4 (2020) 335-350; doi: <https://doi.org/10.12989/was.2020.31.4.335>.

Abdelfatah, N., Elawady, A., Irwin, P., Chowdhury, A., (2020) "Wind Pressure Distribution on Single-Story and Two-Story Elevated Structures" (5th) Residential Building Design & Construction Conference, State College, Pennsylvania.

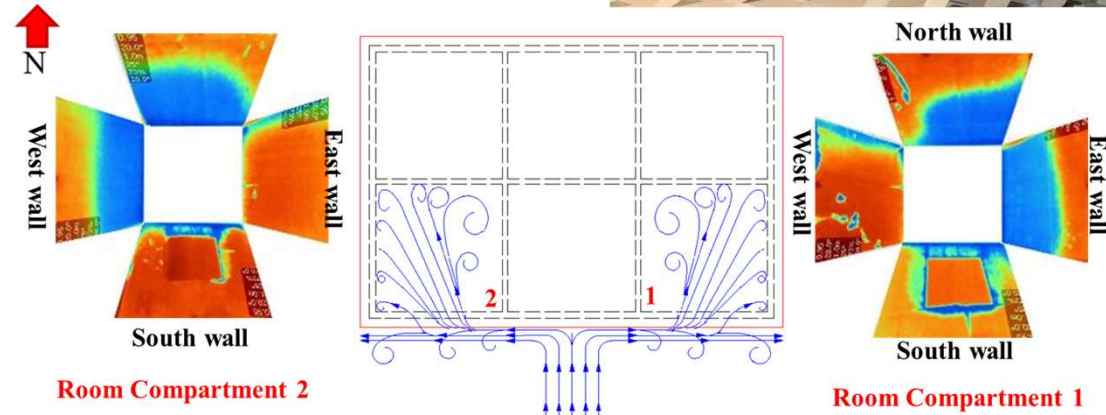
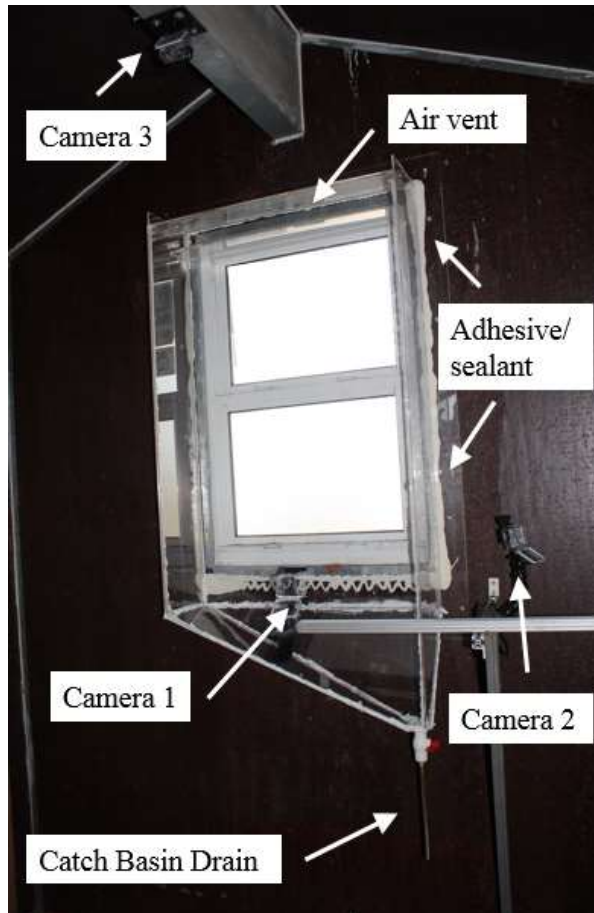
Aero-elastic Testing



Azzi, Z., Matus, M., Elawady, A., Zisis, I., Irwin, P., Chowdhury, A., (2020) "Aeroelastic Testing of Span-Wire Traffic Signal Systems" *Frontiers in Built Environment*, 6:111. doi: 10.3389/fbuilt.2020.00111

Azzi, Z., Elawady, A., and Chowdhury, A., "Large-scale aeroelastic testing to investigate the resiliency of transmission infrastructure to hurricane storms" XI International Conference on Structural Dynamics EUROLYN, Athens, Greece, 22–24 June, 2020.

Wind-Driven Rain Testing



Sai Vutukuru, K., Moravej, M., Elawady, A., Chowdhury, A., (2020) "Holistic Testing to Determine Quantitative Wind-Driven Rain Intrusion for Shuttered and Impact Resistant Windows" Journal of Wind Engineering and Industrial Aerodynamics, 206 (2020) 104359. <https://doi.org/10.1016/j.jweia.2020.104359>

Full-scale Testing

Example: Full-scale testing to study performance of systems under wind



Elawady, A., Alawode, K., Jae Lee, S., Sai Vutukuru, K., Zisis, I., Chowdhury, A., "Wind-driven Rain and Wind-induced Vibrations for Façade Systems" XI International Conference on Structural Dynamics EURODYN, Athens, Greece, 22–24 June, 2020.

Azzi, Z., Habte, F., Vutukuru, K., Chowdhury, A., Moravej, M., "Effects of roof geometric details on aerodynamic performance of standing seam metal roofs" Engineering Structures, Volume 225, <https://doi.org/10.1016/j.engstruct.2020.111303>

Destructive Testing

Example: Aeroelastic and aerodynamic responses of traffic signal systems



1:10 aeroelastic model tested at the WOW



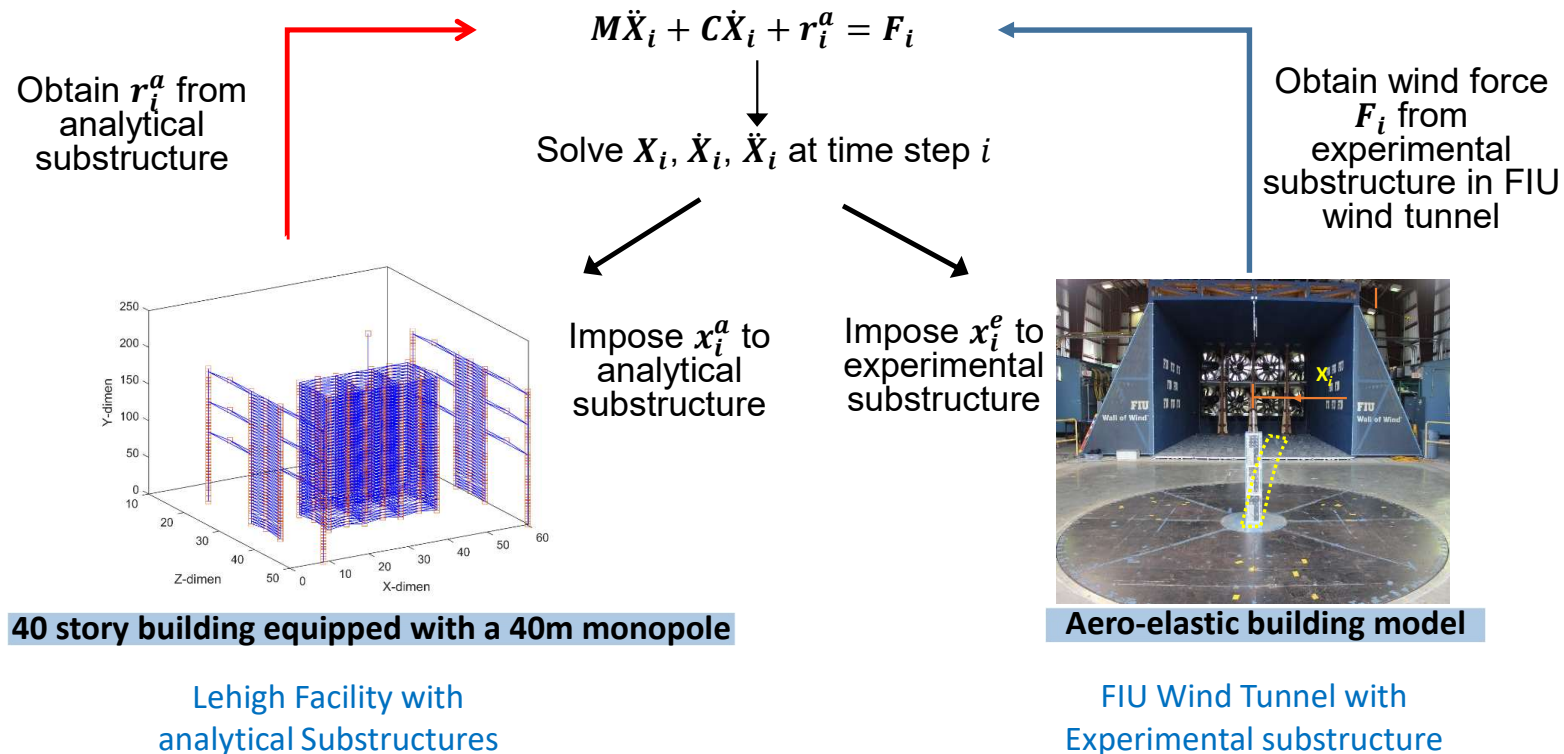
New Capabilities!

Non-Synoptic, Downburst Flows and Their Interactions with Structures



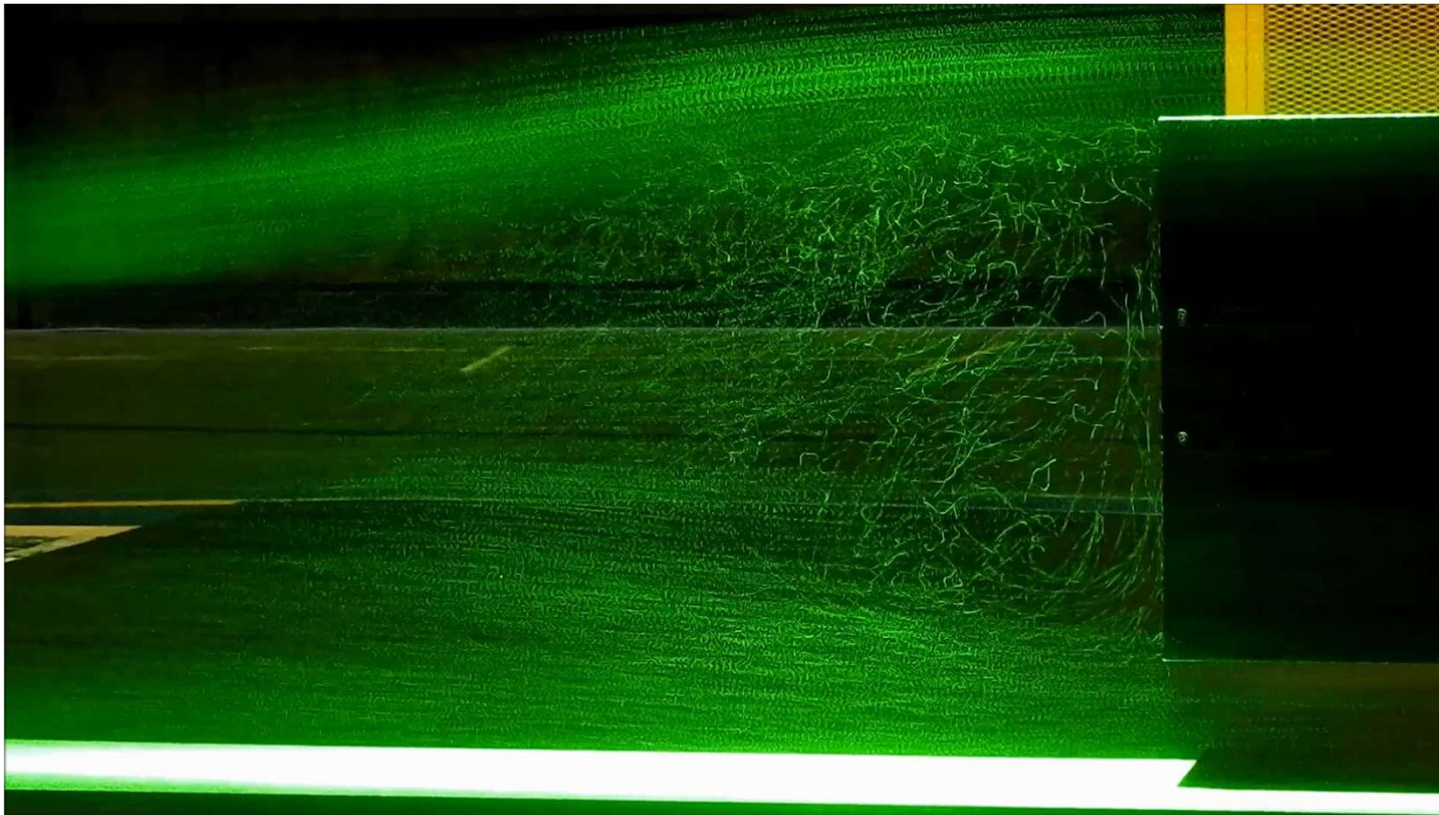
Cross-Awardee Capabilities

WOW EF and Lehigh EF to enables Real Time Hybrid Simulation (RTHS) for wind applications



New Capabilities!

Example: Validating numerical and computational modeling using PIV system



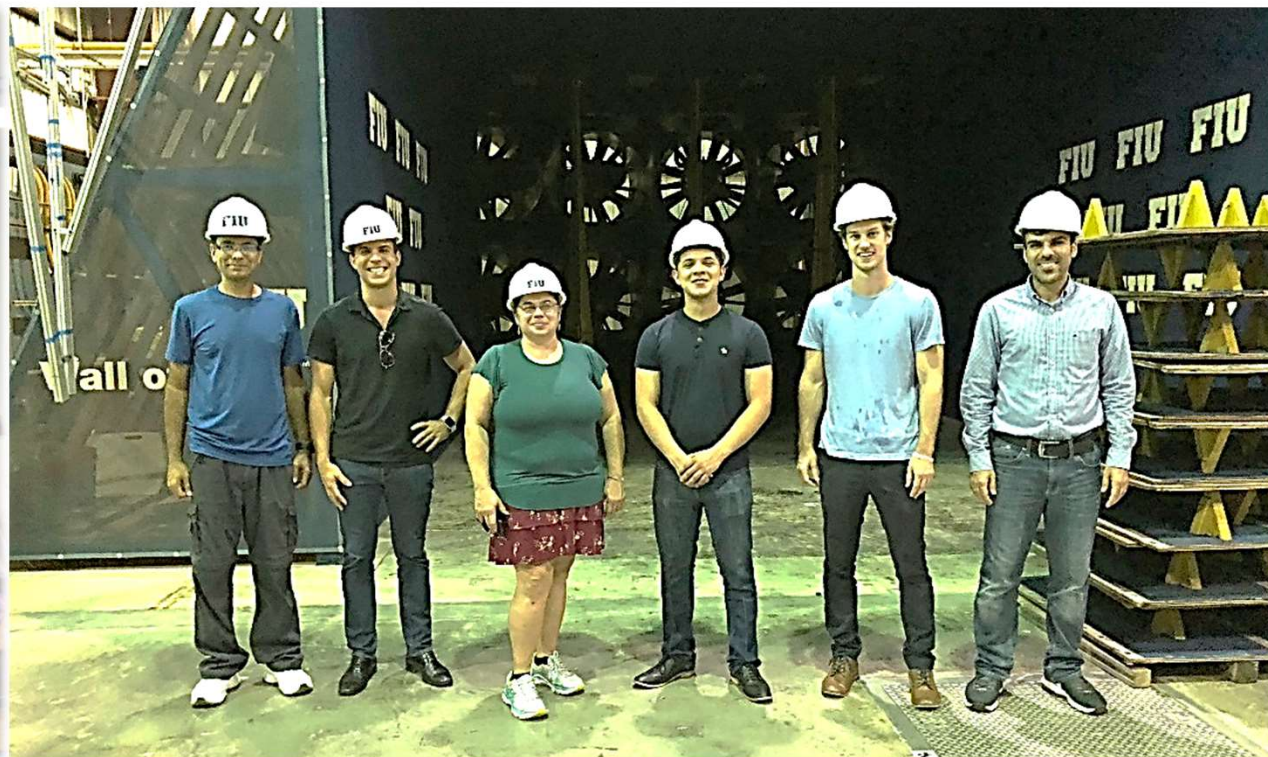
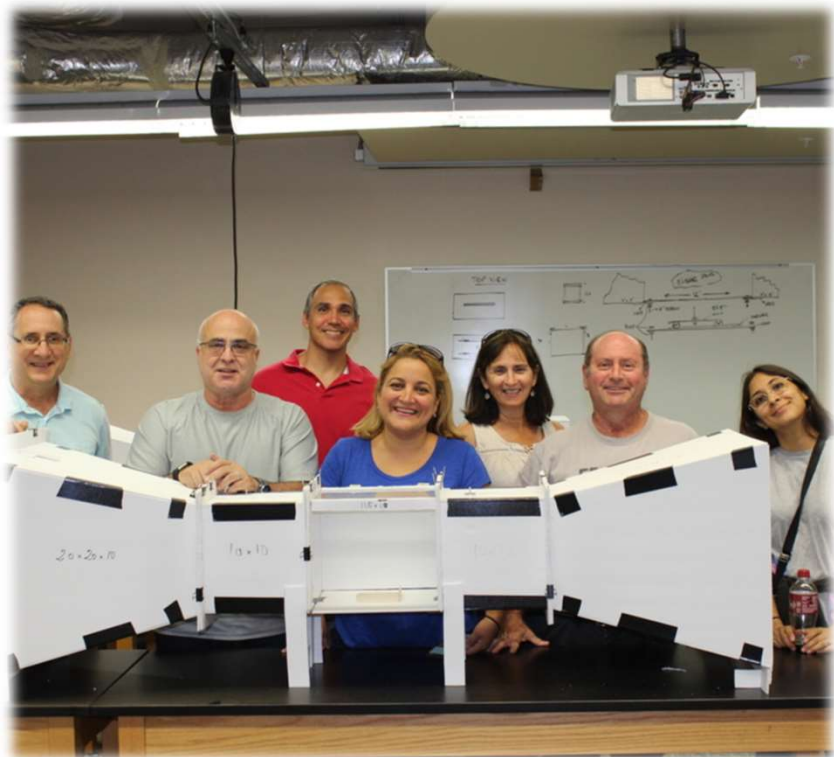
Outcomes: New niche in fundamental fluid mechanics area to propel transdisciplinary research.

The vision for NHERI is to enable frontier research and education to:

- Predict the **lifecycle performance of civil infrastructure** under hazards
- Reduce **reliance on physical testing** through computational modeling
- Translate **research into innovative mitigation** strategies and technologies
- Integrate **research, education, outreach** to train a inclusive STEM workforce

Integrate Research, Education, and Outreach

Example: REU, RET, K-12 Programs



Outcomes: Train teachers and students to build an inclusive STEM workforce

NHERI WOW EF Workshops



Research Planning Workshop

<https://fiu.designsafe-ci.org/events/upcoming-events/>

NSF Award Search: Simple Search

Upcoming Events | DesignSafe-CI

Research Planning Workshop (FIU)

designsafe-ci.org/learning-center/training/workshops/fiu-ef/research-planning/

Apps FIU Home - FIU College... Zoom Sign In SharePoint FIU CANVAS Login FIU Shared Drives - Eng... FIU My FIU Home - Panther180... FIU Approve Transactions FIU Travel and Expense... Login | Academic A...

FIU RESEARCH PLANNING WORKSHOP

NHERI Wall of Wind (WOW) Experimental Facility (EF) is currently accepting requests from faculty (potential EF users) to attend Research Planning Workshops, throughout the year, at the WOW EF in Miami, FL.

The Research Planning Workshops are designed for individuals and smaller groups (2-3) to help them determine the best way to engage with the WOW facility while developing NSF proposals. This one-day workshop can be scheduled any time of the year. The main focus of these workshops is to:

1. Help potential EF users in developing the experimental section of their individual or collaborative NSF proposals in a one-on-one setup with the EF team
2. Provide researchers with information on the capabilities of the NHERI WOW EF to advance natural hazard engineering research
3. Provide a tour of the NHERI WOW EF and describe the three main types of multi-scale tests (aerodynamic/aeroelastic, destructive and wind-driven rain) conducted at the NHERI WOW EF
4. Discuss the NHERI Science Plan and recent advancements in experimental and numerical research in natural hazard mitigation
5. Help users to explore opportunities to utilize the NHERI WOW EF for NSF projects, including but not limited to, projects focusing on validating computational fluid dynamics and other numerical simulation methods

There is no registration fee, however, participation and financial support are limited. For more information about this workshop, contact Roy Liu-Marques (rlumarg@fiu.edu) or Arindam Chowdhury (chowdhur@fiu.edu).

Workshop Registration

Name (required)

Title (required)

Affiliation (required)

Email (required)

Preferred Date 1: (required)

Preferred Date 2: (required)

Preferred Date 3: (required)

NHERI WOW EF Webpage: <https://fiu.designsafe-ci.org/>



THE NHERI NETWORK IS SUPPORTED BY MULTIPLE GRANTS FROM THE NATIONAL SCIENCE FOUNDATION.

Acknowledgement

- NHERI WOW Experimental Facility is supported by a grant from the National Science Foundation ([#1520853](#)).
- Renewal of NHERI WOW Experimental Facility is supported by a grant from the National Science Foundation ([#2037899](#)).



Wall of Wind, International Hurricane Research Center

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