IEEE Panel Discussion: My Background

My General Information:
Name: Dr. Jason Roney, Ph.D.
Title: Teaching Associate Professor (4th Yr, started 2014/2015 academic year)
Department: Mechanical and Materials Engineering

"Close to a Colorado Native": 5th grade through CU Boulder UG.

Degrees:
Ph.D. Mechanical and Aeronautical Engineering, University of California, Davis
M.S. Mechanical Engineering, Arizona State University
B.S. Mechanical Engineering, University of Colorado at Boulder

Prior Positions (Industry):
- Senior Research Engineer/Scientist, Exelis/ITT, 7 yrs (2007-2014)
- Modeler/Atmospheric Modeler at Sonoma Technology, Inc., 1 yr (2001-2002)

Prior Positions (Academic):
- Assistant Professor, Mechanical and Aerospace Engineering, University of Colorado at Colorado Springs, 5 yrs (2002-2007)

Educational Background

Ph.D. Mechanical and Aeronautical Engineering,

University of California at Davis

Specialty: Environmental Fluid Dynamics

Minors: Heat Transfer and Engineering Analysis

M.S. Mechanical Engineering, Arizona State University

Specialty: Fluid Dynamics, Minors: Heat Transfer

B.S. Mechanical Engineering,

University of Colorado at Boulder

UNIVERSITY of DENVER

DEPARTMENT OF MECHANICAL & MATERIALS ENGINEERING

Internship in Irvine, California at Fluor Daniel Engineering and Construction Company Between Undergrad Sophomore and Junior Year

FLUOR CORPORATION

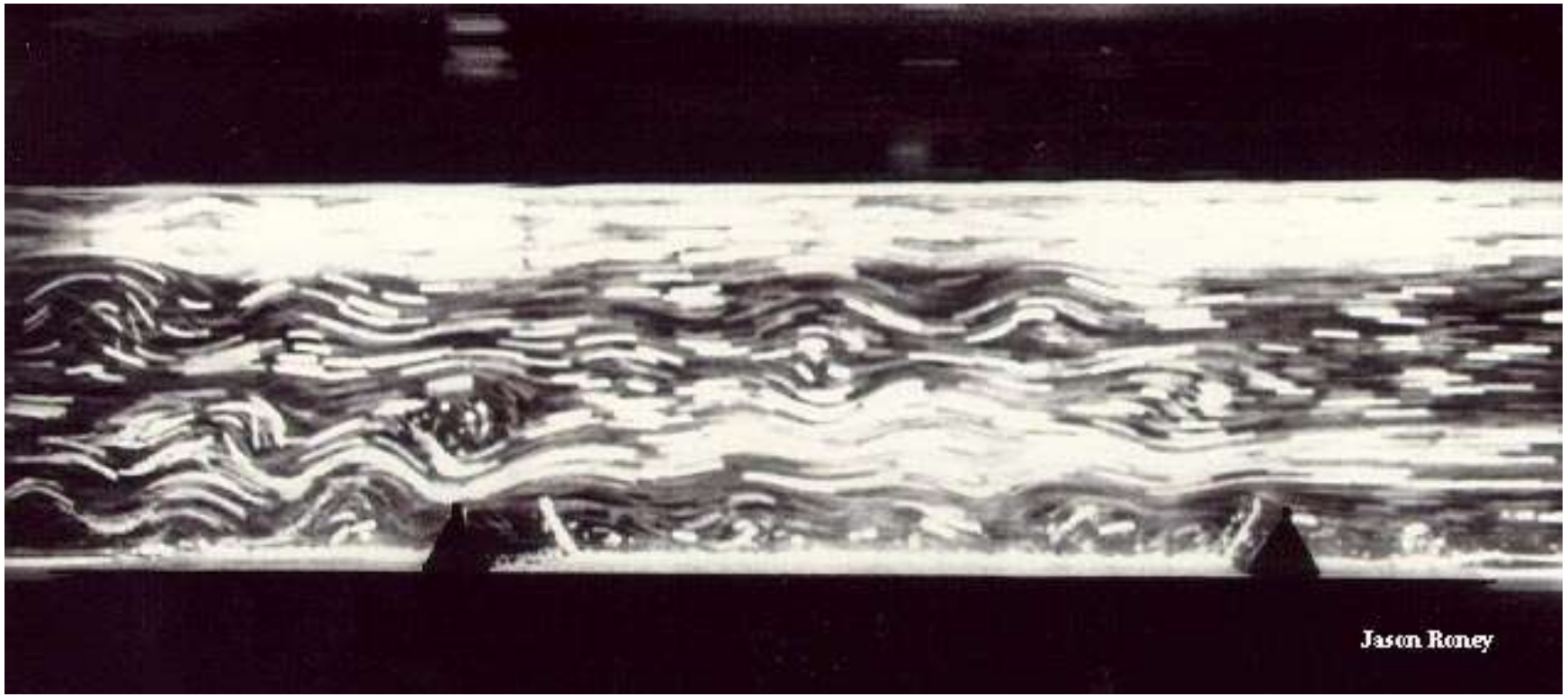
Industry Experience

Worked on lists of Materials Specification for the STAR (Shell Tabangao Asset Renewal) Program for a Refinery in the Philipines

UNIVERSITY of DENVER

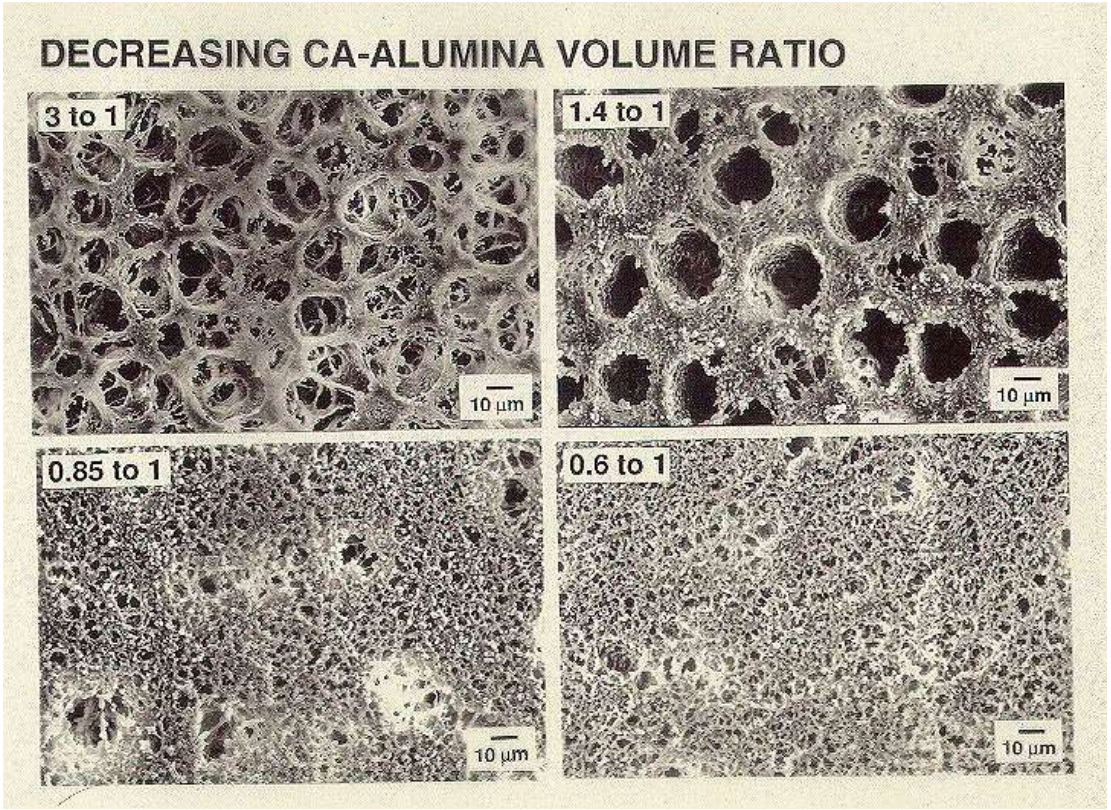
DEPARTMENT OF MECHANICAL & MATERIALS ENGINEERING

NSF REU (Research Experience for Undergraduates) Between Undergrad Junior and Senior Year



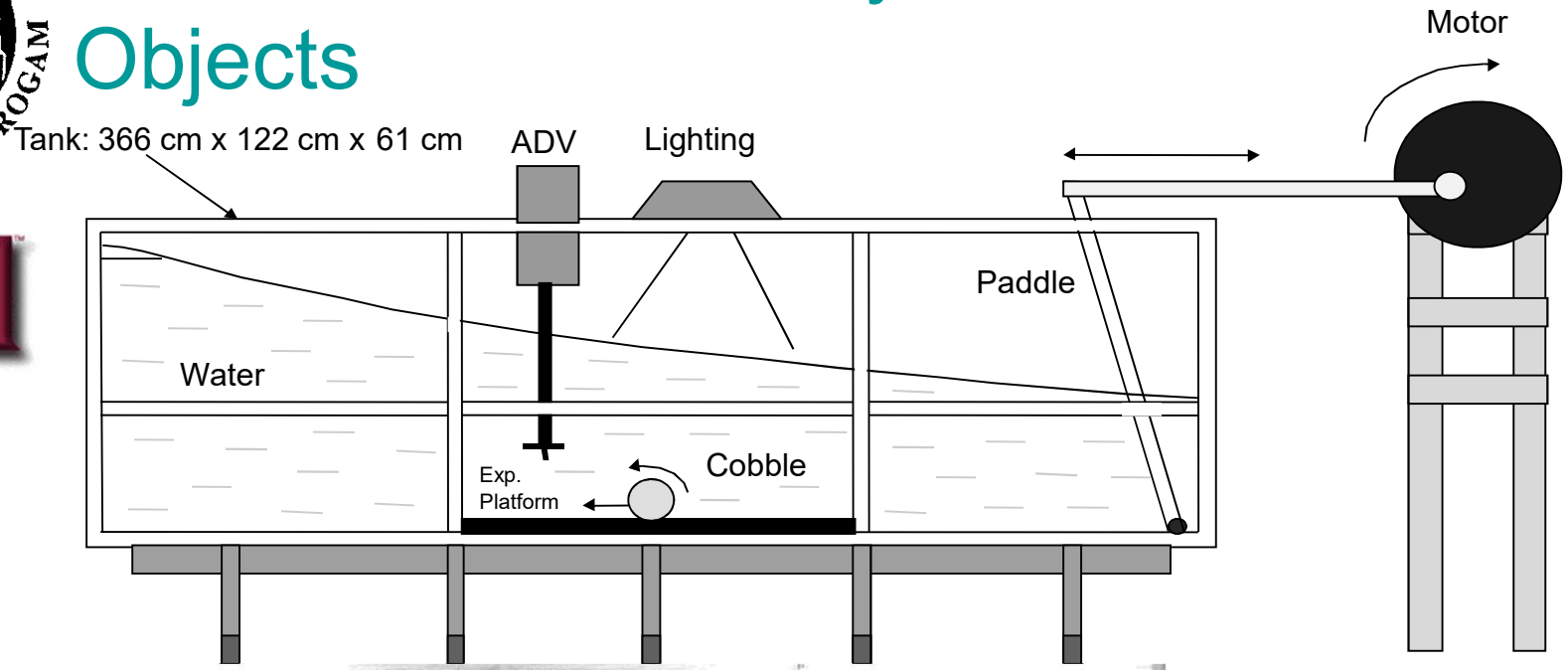
University of Wyoming, Mechanical Engineering Department
Fluid Mechanics Related to Environmental Flows

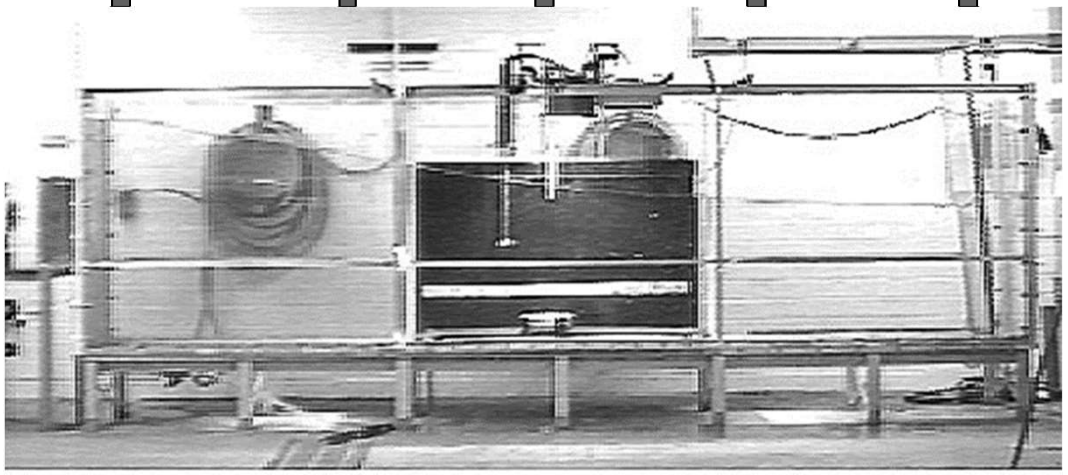
NSF REU (Research Experience for Undergraduates) Between Undergrad Senior and 2nd Senior Year



University of Minnesota, Chemical Engineering and Materials Science Department, Materials Production and Testing of Thin-Film Cellulose Acetate—Alumina Composites

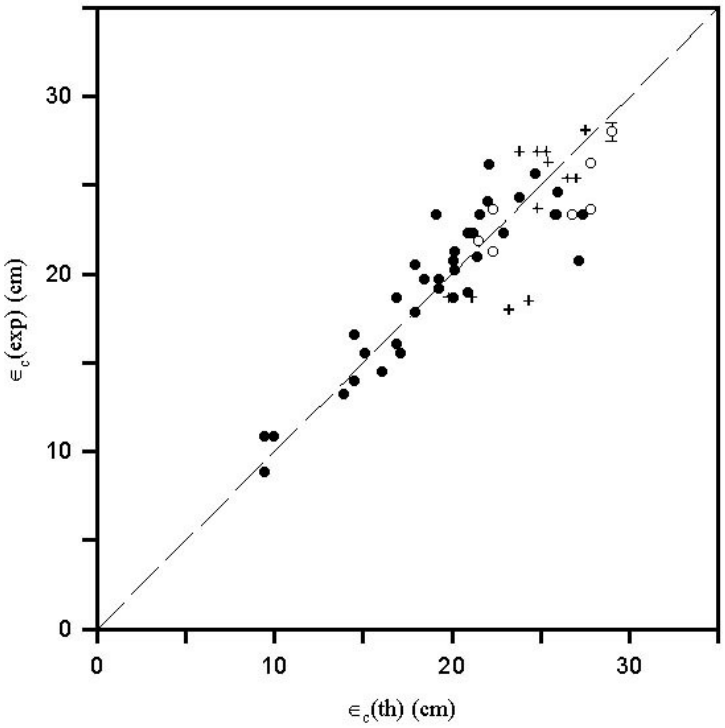
M.S. Thesis, Wave Dynamics and Objects

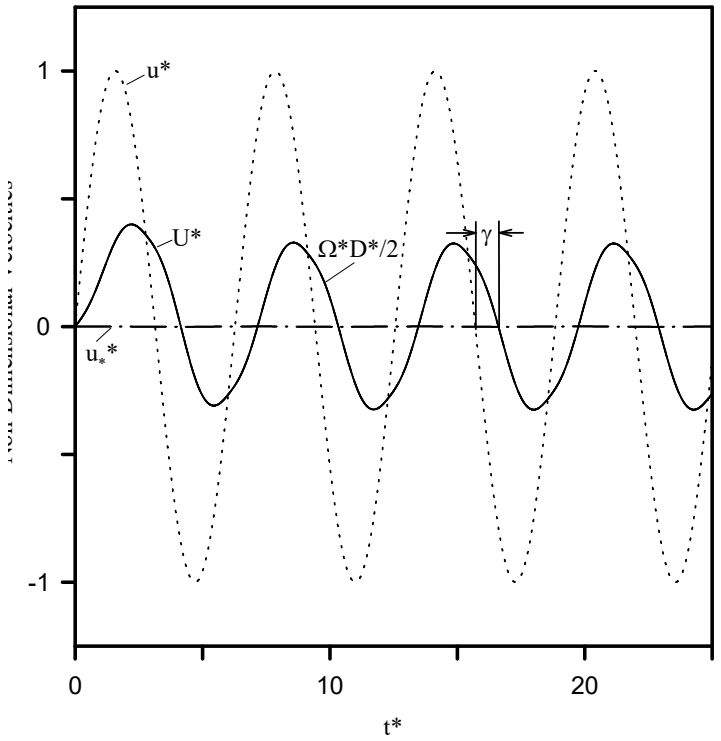




M.S. Thesis, Wave Dynamics and Objects

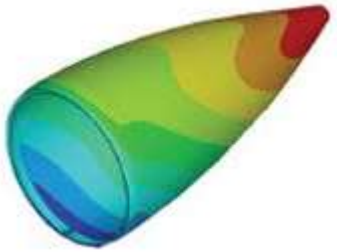
Experiment Comparison to Predictions





Internships at BFGoodrich Aerospace R&D Center in Brecksville, OH Summers During M.S. at Arizona State University

Figure 3: High Temperature Wabash Press

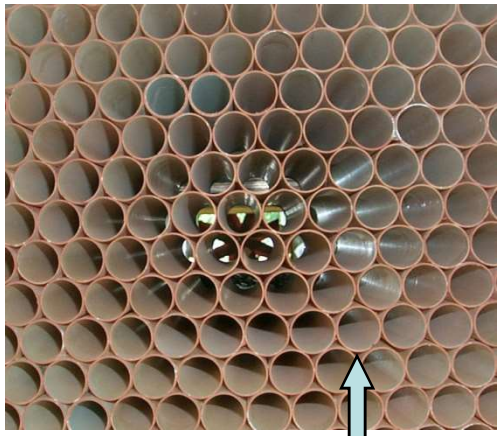


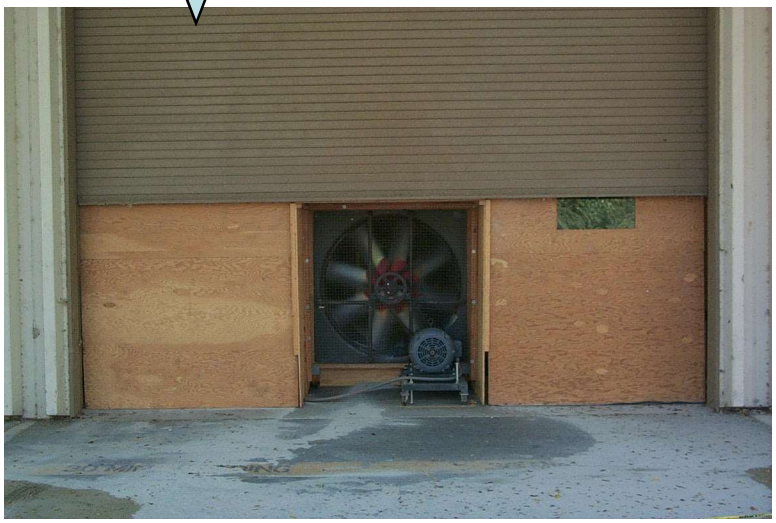
BFGoodrich Aerospace

First Summer: Researched Aircraft De-icer affects on Carbon-Carbon Composite Aircraft Brakes

Second Summer: Worked on Curing Techniques for Polyimide Curing Techniques for Materials meant to go in Texas Instruments Radome

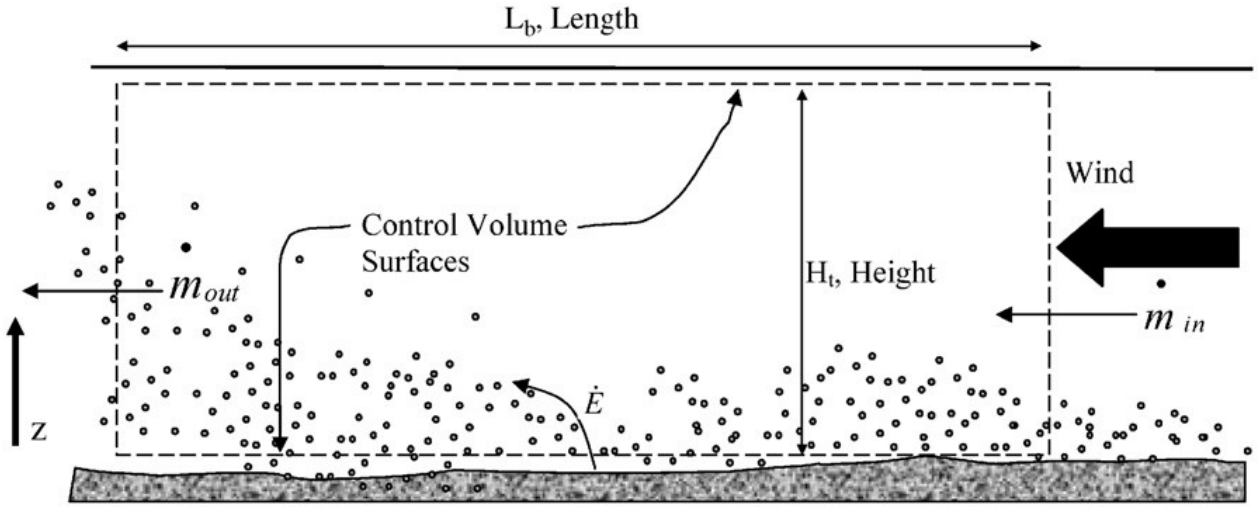
Ph.D. Saltation Wind Tunnel (SWT)

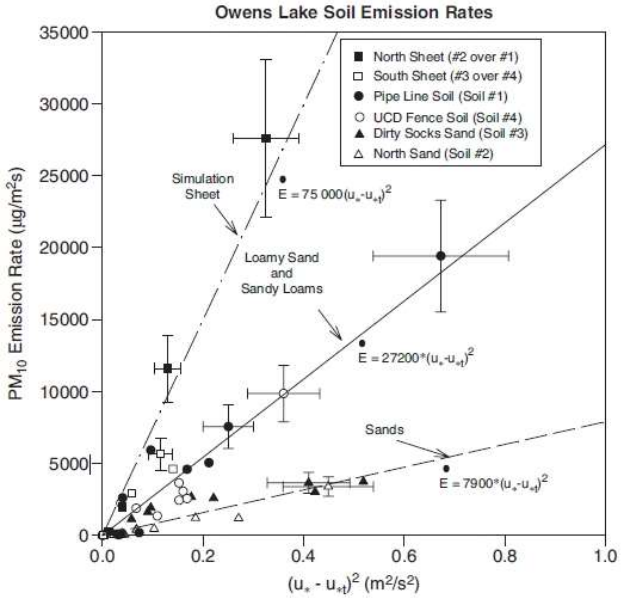


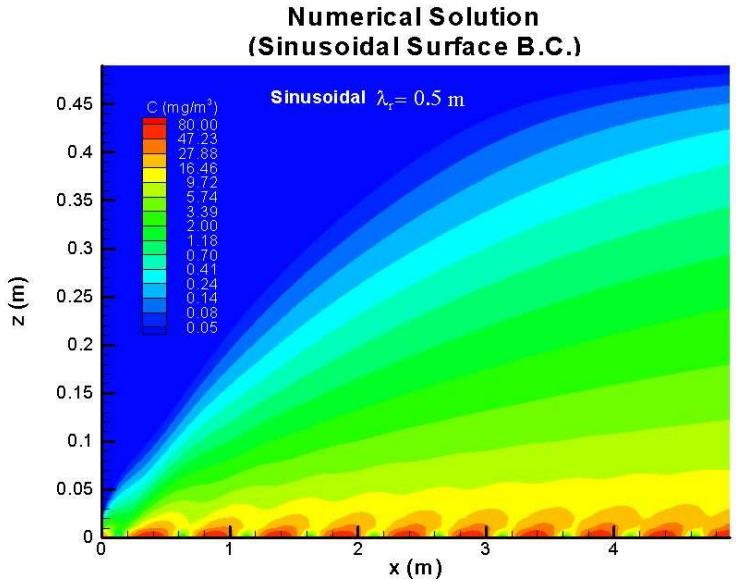


UCDAVIS AGGIES

Ph.D. Saltation Wind Tunnel (SWT)



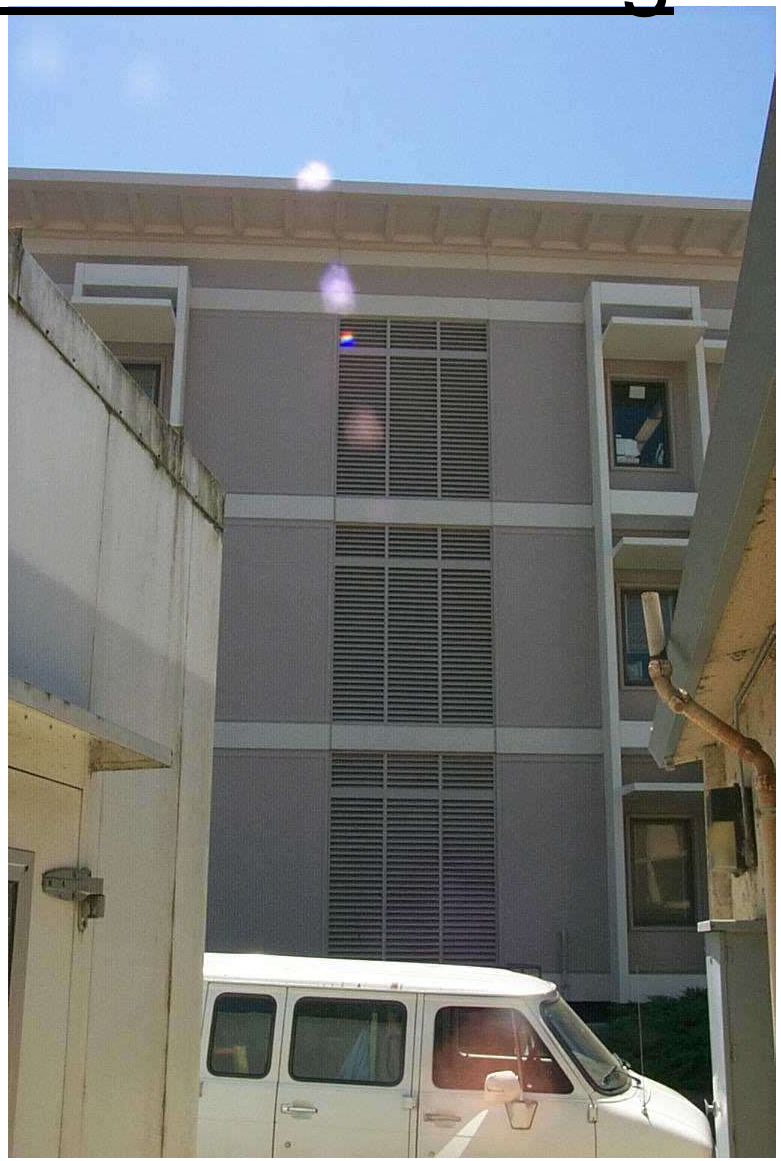




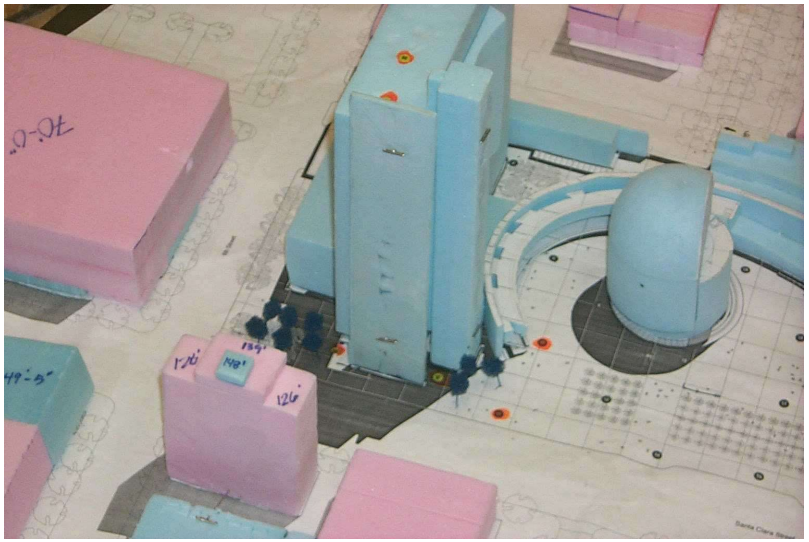
Other UC Davis Research Experience

UCDAVIS
AGGIES

Atmospheric Dispersion Modeling



Pedestrian Level Wind Studies



UCDAVIS AGGIES

Wind Turbine Siting Studies

UCDAVIS AGGIES

Industry Funding for Research

ITT EXELIS

ITT
ENGINEERED FOR LIFE

Previous Research Funding/Projects

Exelis/ITT Research Funding Activities (2007-2014):

- Primarily DoD Research
- Sponsors: Air Force Nuclear Weapons Center (AFNWC), Defense Threat Reduction Agency (DTRA) , Edgewood Chemical and Biological Center (ECBC), Defense Advanced Research Projects Agency (DARPA), ITT Internal Research and Development (IRAD)
- Collaborators: Naval Research Laboratory (NRL), Naval Surface Warfare Center (NSWC) Dahlgren, Johns Hopkins Applied Physics Laboratory
- Main Projects:

  SERPENT/VIPER External and Internal Transport and Dispersion; Nuclear Hardness Database Software Modeling and Simulation; Joint Expeditionary Collective Protection (JECP) Systems Performance Model (SPM), External and Internal Transport and Dispersion Modeling Simulation; Non-Ideal Urban Blast Review and Modeling with SHAMRC; Joint Biological Standoff Detection System Program, Open Field Trial Transport and Dispersion Modeling and Simulation; Threat Agent Cloud Tactical Intercept & Countermeasure (TACTIC) Phases II and III

Funding for Research

UCCS

University of Colorado at Colorado Springs (2002-2007):

- External, Internal Seed Grants, and Educational Grants
- Sponsors: NASA, NISSC (AFOSR), USAFA, Air Force Space Command, and the Army Space Battle Lab.
- Collaborators: United States Air Force Academy Aeronautic Research Center
- Main Projects:

  Atmospheric wind modeling for Near-Space applications (high altitude airships); Class I Federal Visibility Modeling, Nuclear Power Plant Accidental Release modeling; EDAS-CALMET-CFD hybrid models for wind energy prediction; Fugitive dust emissions from natural environments; Weather balloon payload development workforce development NASA grant; Characterizing plasma actuator boundary-layer control in an Aeronautical wind tunnel.

Sonoma Technology, Inc. (2001-2002):

- Sponsors primarily Air Quality Districts for modeling and simulation support for Ozone and PM10 problems

STi Sonoma Technology, Inc.

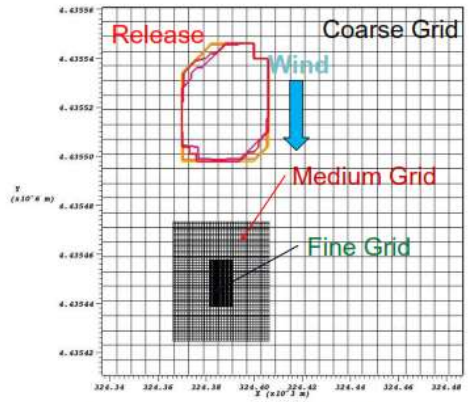
University of California at Davis (1997-2001):

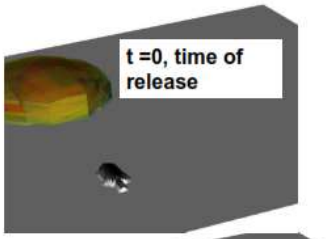
- Sponsor of Ph.D. work California Air Resource Board (CARB)
- Also did consulting work in the ABLT wind tunnel

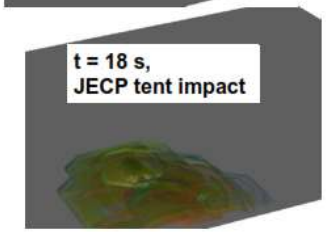
UCDAVIS AGGIES

High Fidelity Transport and Dispersion Modeling (JECP)

Medium Doman Size

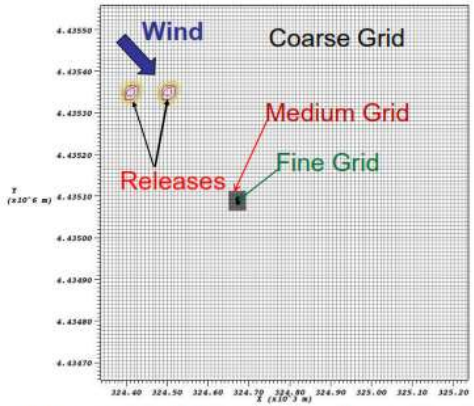






Gridding Domain: Coarse (144 m x 144 m), Medium (39 m x 48 m), Fine (9.5 m x 19.2 m)

Larger Doman Size

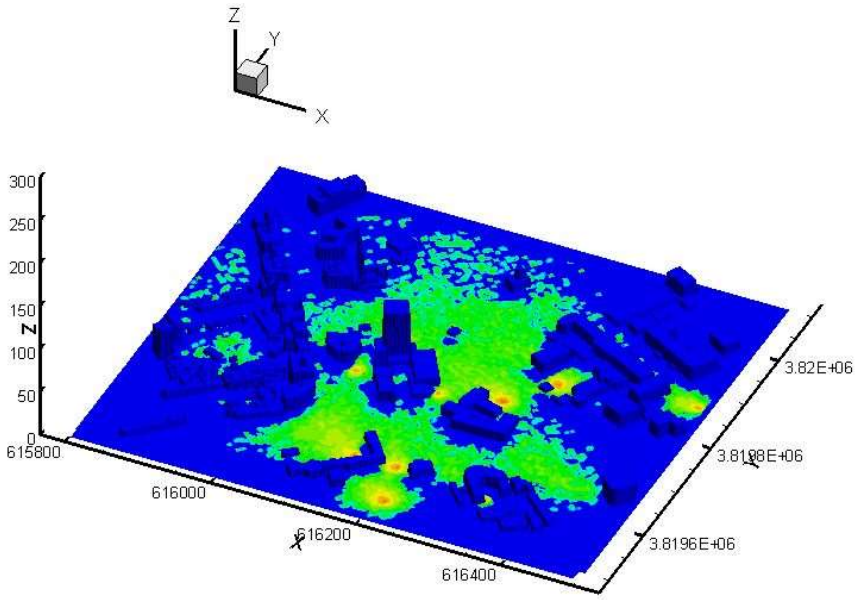


t =260 s, time just prior to JECP tent impact

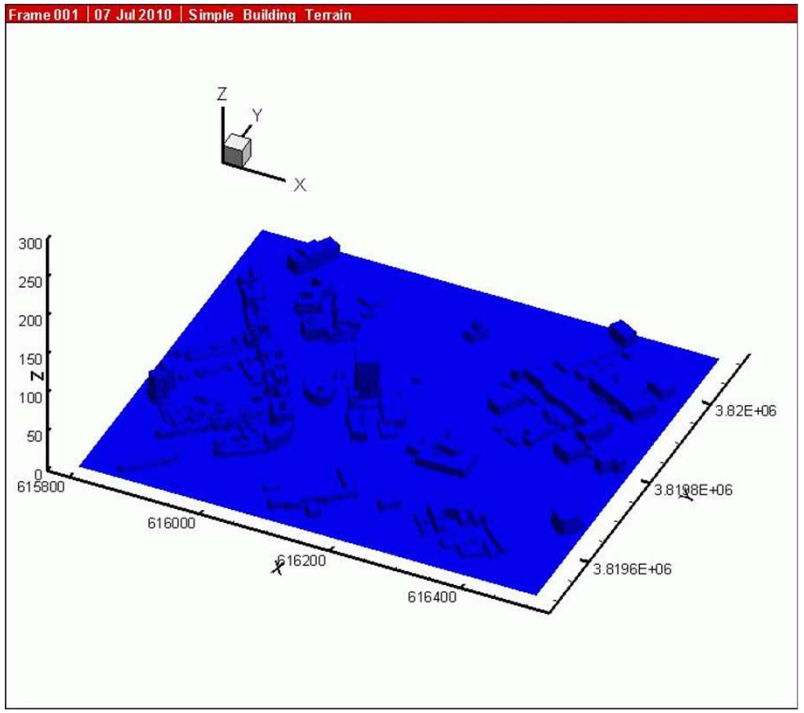
Gridding Domain: Coarse (891 m x 891 m), Medium (41 m x 46 m), Fine (9.76 m x 16.78 m)

High Fidelity Urban Chem and Bio Release Modeling

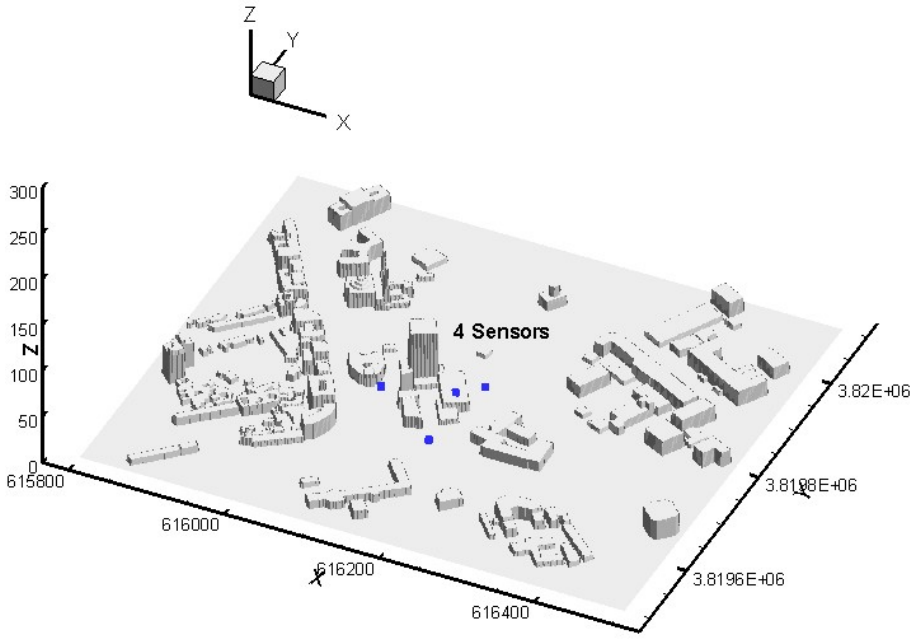
Ground Level Concentration Simulation after 2 minutes

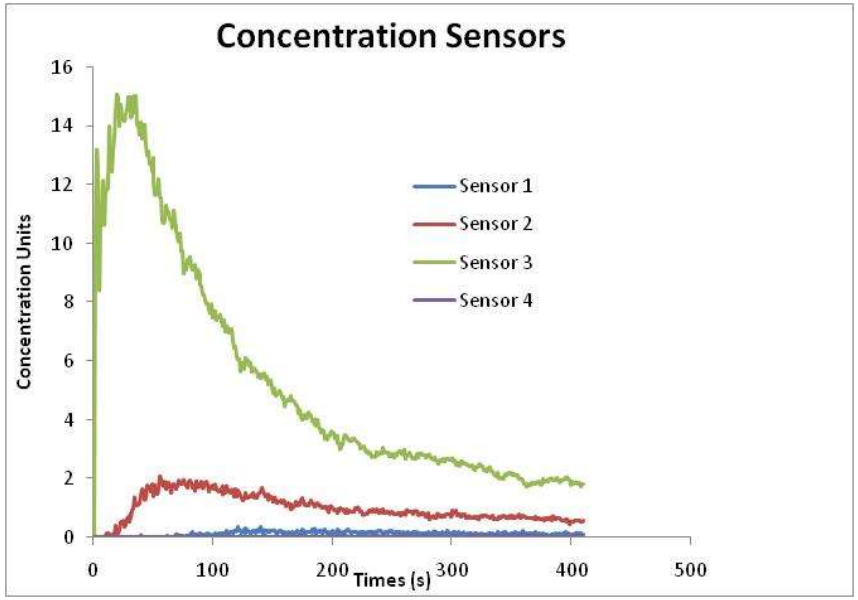


Animation from 0 to 2 minutes



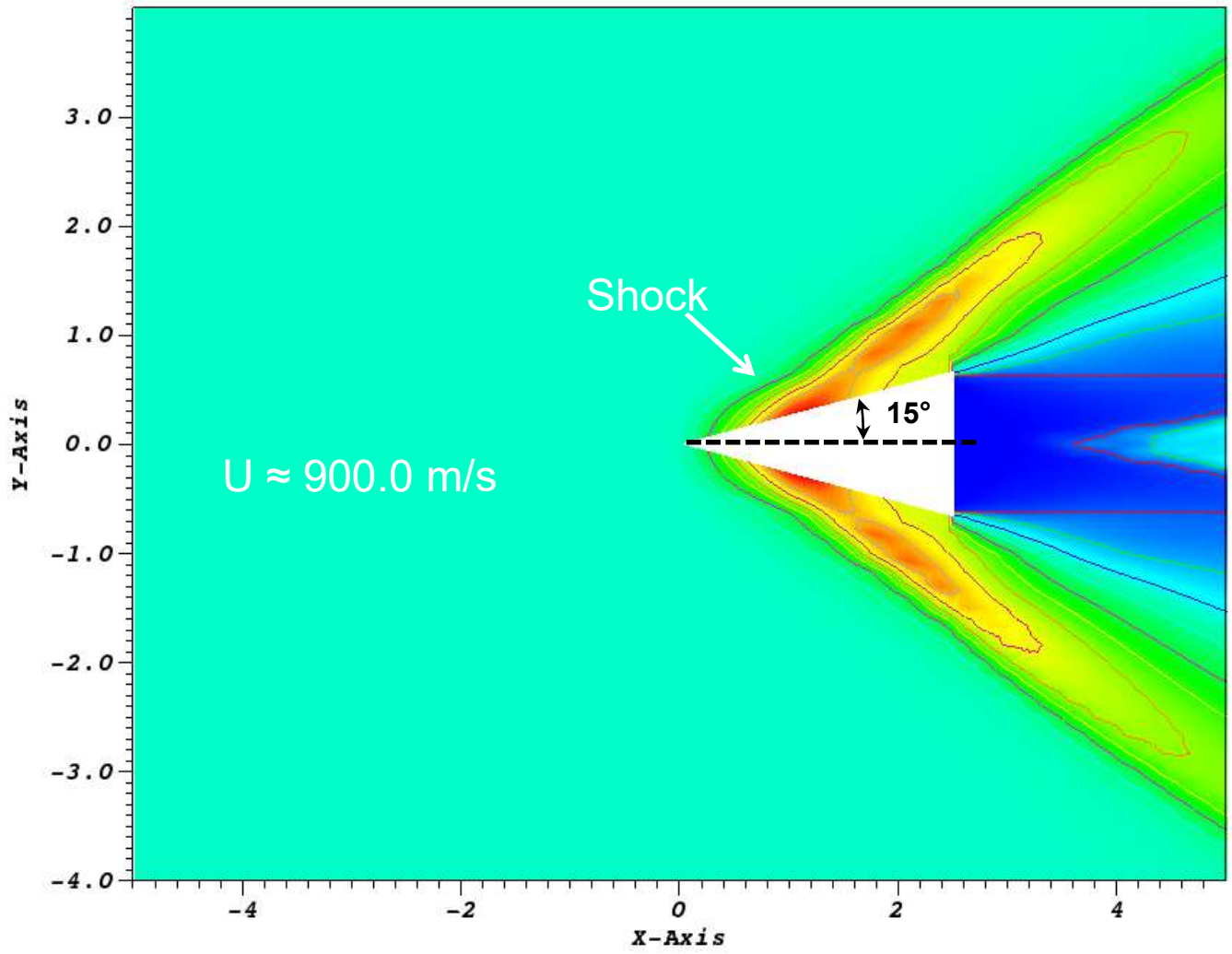
High Fidelity Urban Chem and Bio Release Modeling





Compressible Flow 2D CFD Simulation for Re-Entry

t = 0.035 seconds, Pressure



Agent Physical and Chemical Modeling

Particle Interaction Codes Developed (PIC):

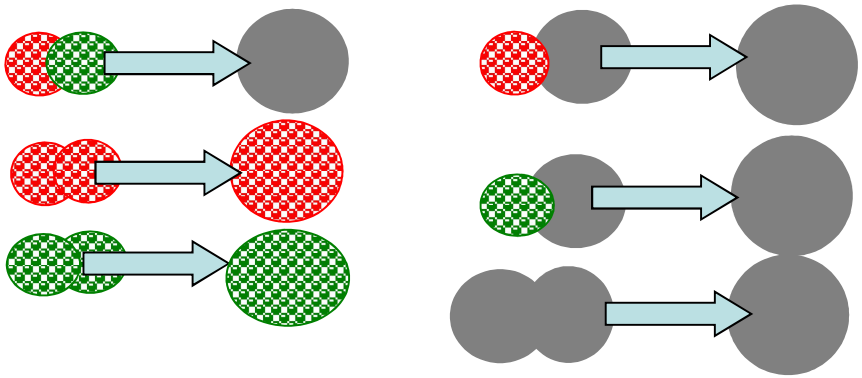
Agglomeration/Coagulation (Droplets and Particles "Sticking")

= "Threat"

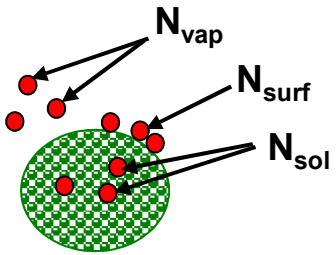
= "CM"

= "Mixed"

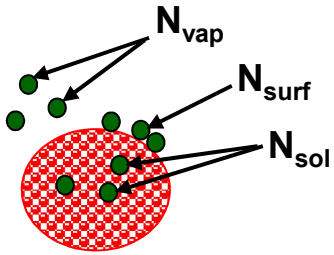
Agglomeration Possibilities by Type



Adsorption/Absorption (Gas molecules to Particles/Droplets)



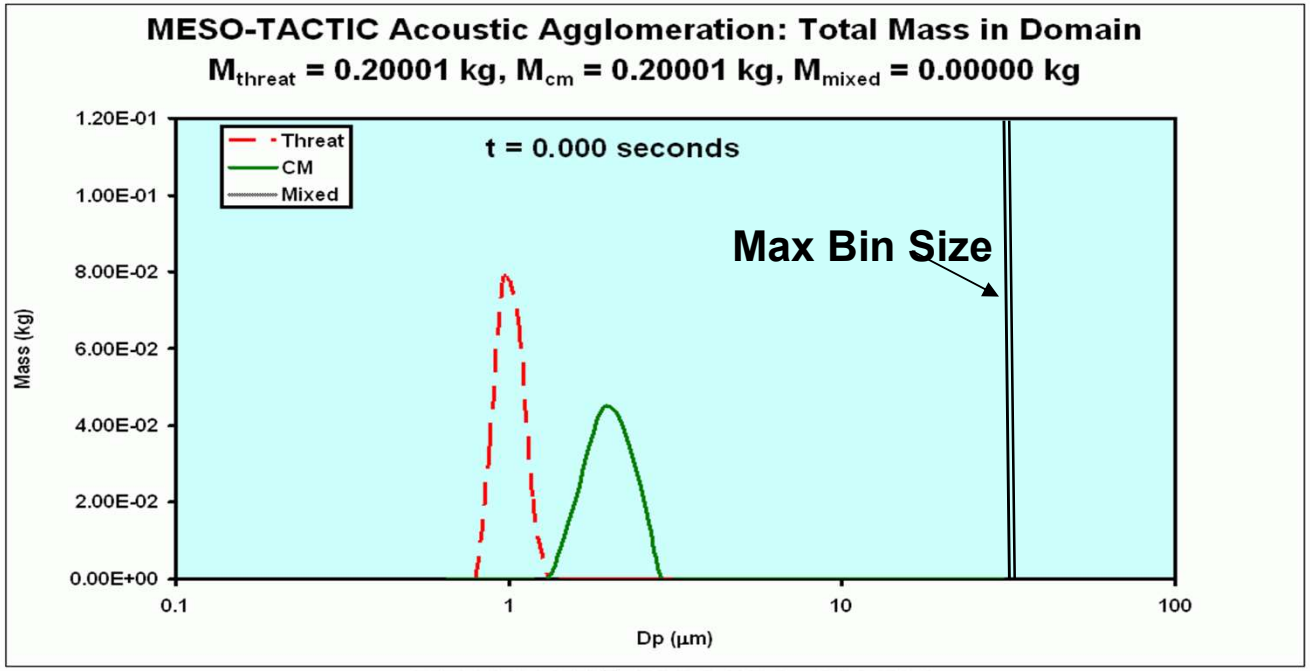
Gas "Threat"/Particle CM

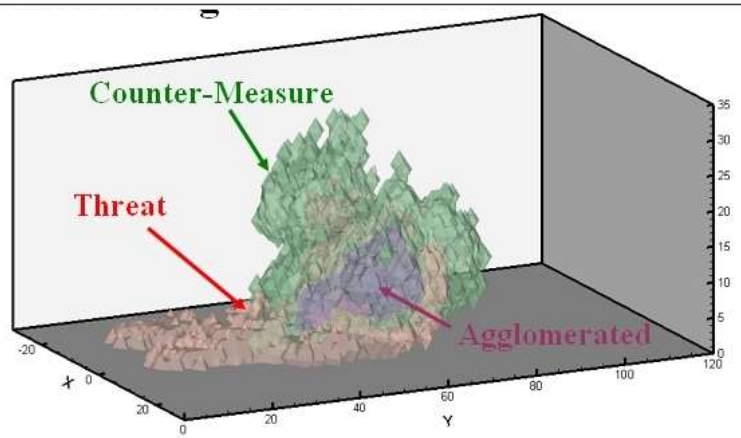


Particle "Threat"/Gas CM

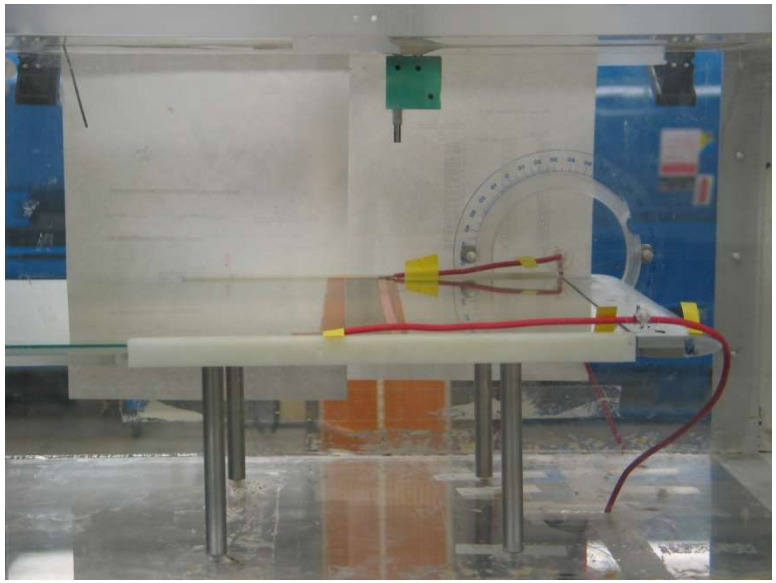
N_{vap} = # gas molecules in vapor phase
N_{surf} = # gas molecules at surface of particle
N_{sol} = # gas molecules in solution

Agent Physical and Chemical Modeling





USAFA: Plasma Boundary Layer Experiments

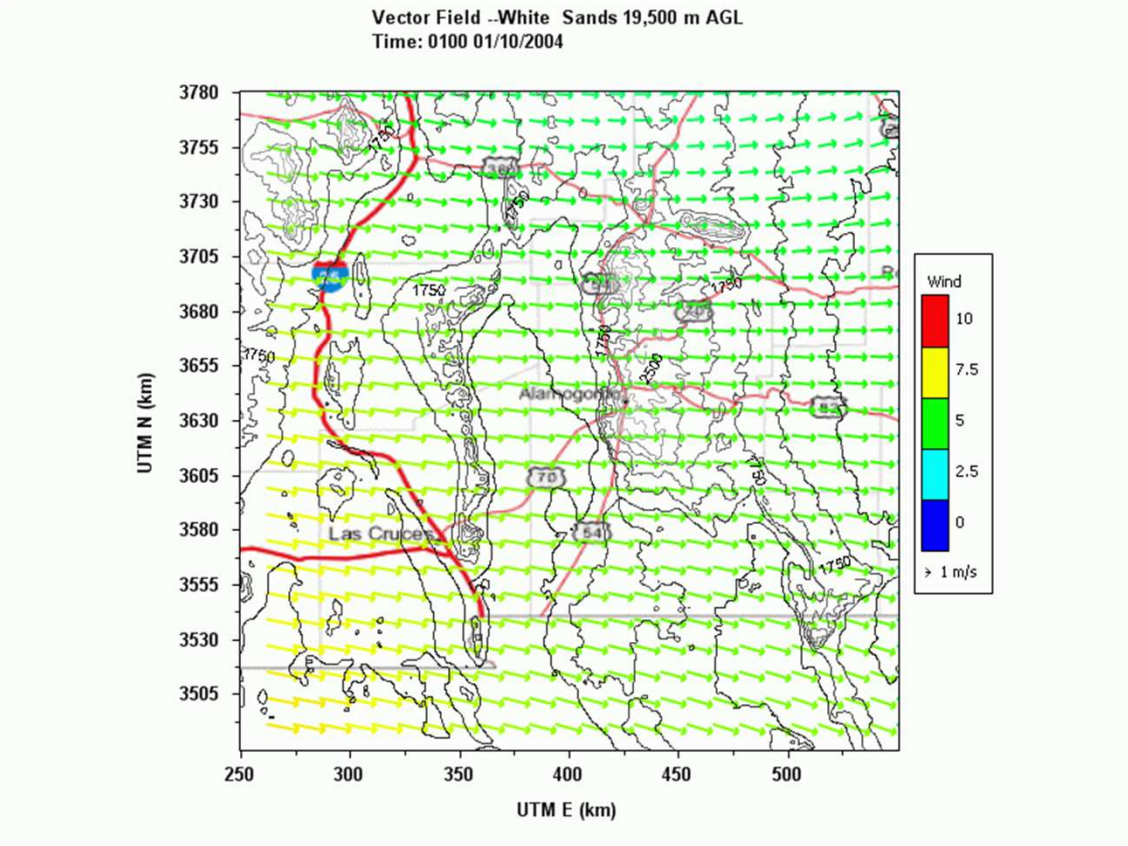


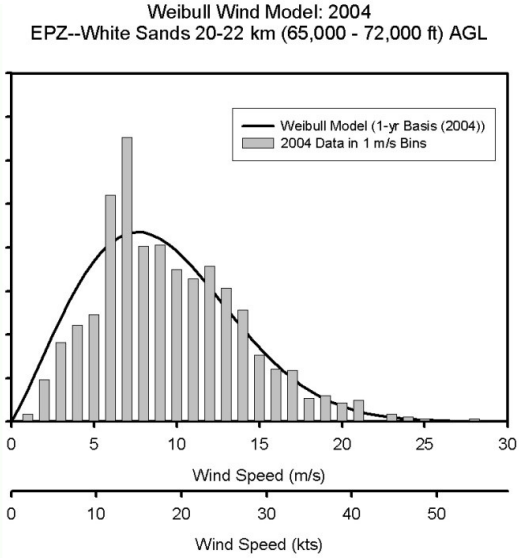
Picture of a Plasma Actuator

Established a collaboration with the USAFA Aeronautics Research Lab while at UCCS and graduated two M.S. students who did research there.

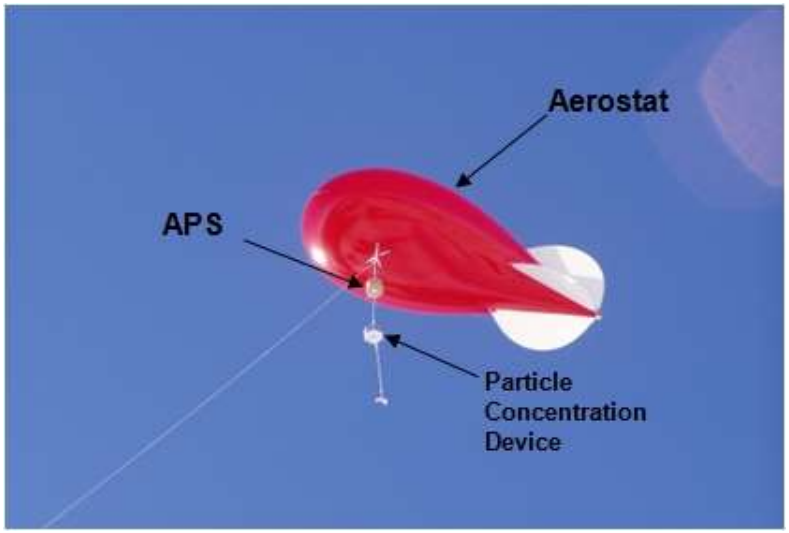
UCCS

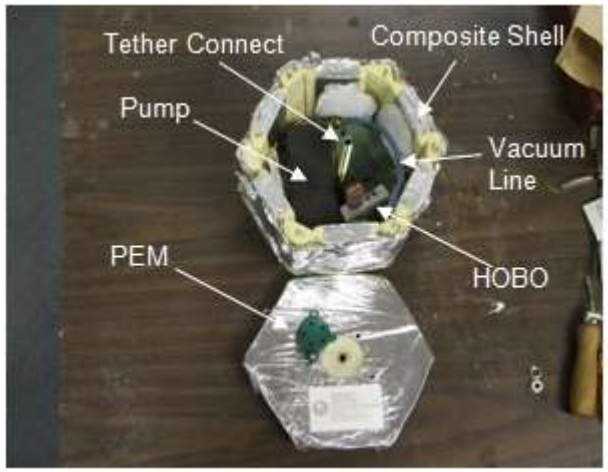
Near Space Vehicle: Wind Modeling

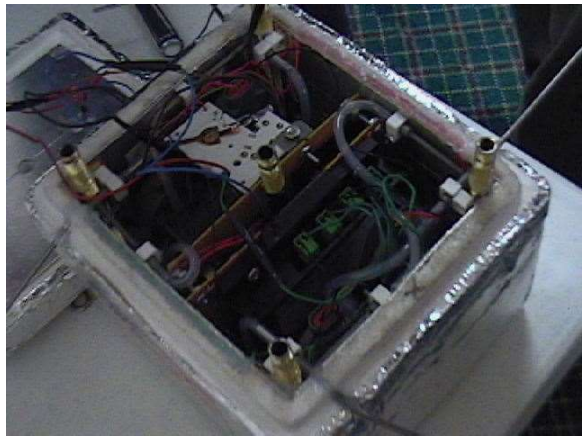




Space Grant NASA Workforce: Payload Modeling/Testing







UCCS

Wind Energy/Wind Resource Modeling

UCCS
University of Colorado at Colorado Springs

Hybrid Numerical Wind Models for Wind Energy Prediction

Principal Investigator: Dr. Jason Roney
Mechanical and Aerospace Engineering

CU Energy Initiative/NREL Symposium

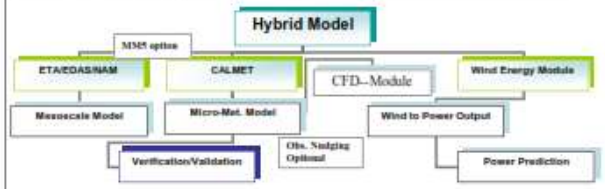
Abstract

The use of numerical models for predicting weather affecting wind energy is important, both to wind farms and individual off-the-grid operators. The methodology proposed in this study couples existing weather models in a hybrid method to provide more accurate siting and prediction at finer micrometeorological scales while using less computationally intense, freely available individual models for most scales. To make assessments, a year's total of good hybrid numerical weather prediction data will be used to produce a siting map on fine scales around a 0.5 km to 1 km horizontally at a proposed site for different vertical heights relevant to turbine levels above the ground. For prediction, the model will gives "real-time" daily predictions of 3D wind fields that are coupled to wind turbine locations providing an estimated energy output 24 to 96 hours in advance. The combination of existing models, their interfaces, and their implementation are a new and original product that can be used for wind energy prediction. The predictions will be compared with observed meteorological data in the modeling domain, and with non-proprietary wind farm energy output for validation of the model. In some cases, Computational Fluid Dynamics will be use to try and improve the prediction at finer scales, less than 0.5 km.

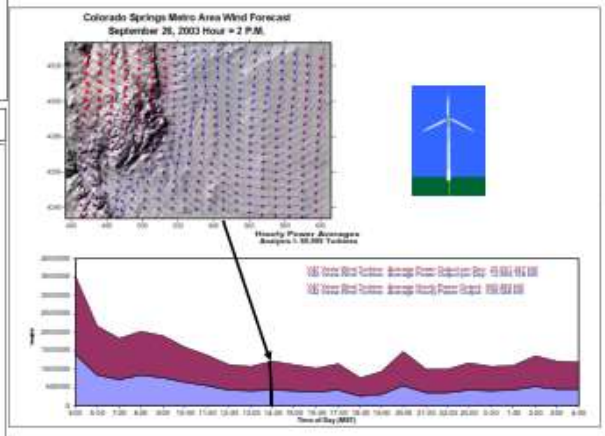
Objectives of Proposed Study

- Develop a Hybrid Wind Model to Predict Wind Fields
- Compose the Hybrid Model with the ETA/NAM Model, the CALMET Model, and an Energy Module
- Make 24-96 hour forecasts of wind energy output
- Verify Wind Fields and Models with observations
- Improve predictions with CFD modeling if necessary
- Compete with WAsP and Prediktor

Methods of Proposed Study

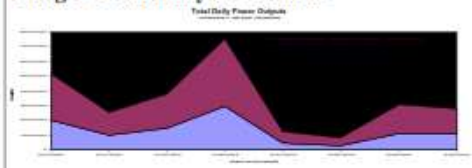


Types of Expected Results

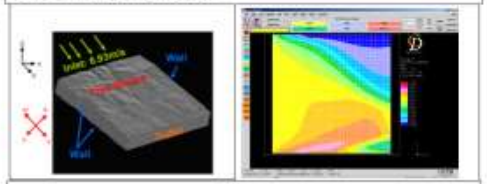


Types of Expected Results (Continued)

Longer Term Daily Predictions



CFD Improvements



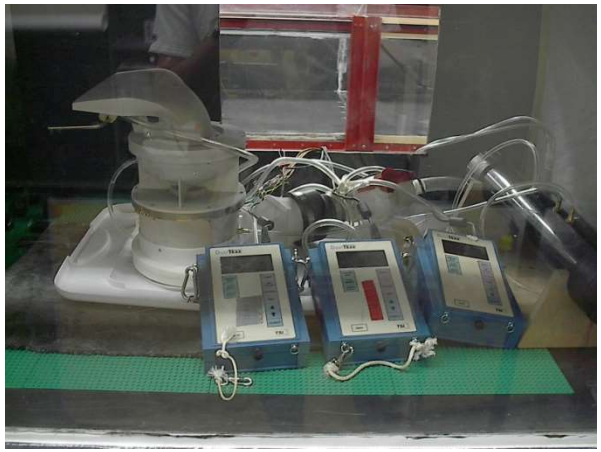
90 m topography and predicted wind resolution

Conclusions

- A Hybrid model will be developed to improved wind energy prediction by using a combination of existing models
- CFD modeling when necessary will be shown to have advantages for siting in some situations
- Improved prediction expected

Contact Information: Dr. Jason Roney, PH#: 719-262-3573. Email: jroney@eas.uccs.edu

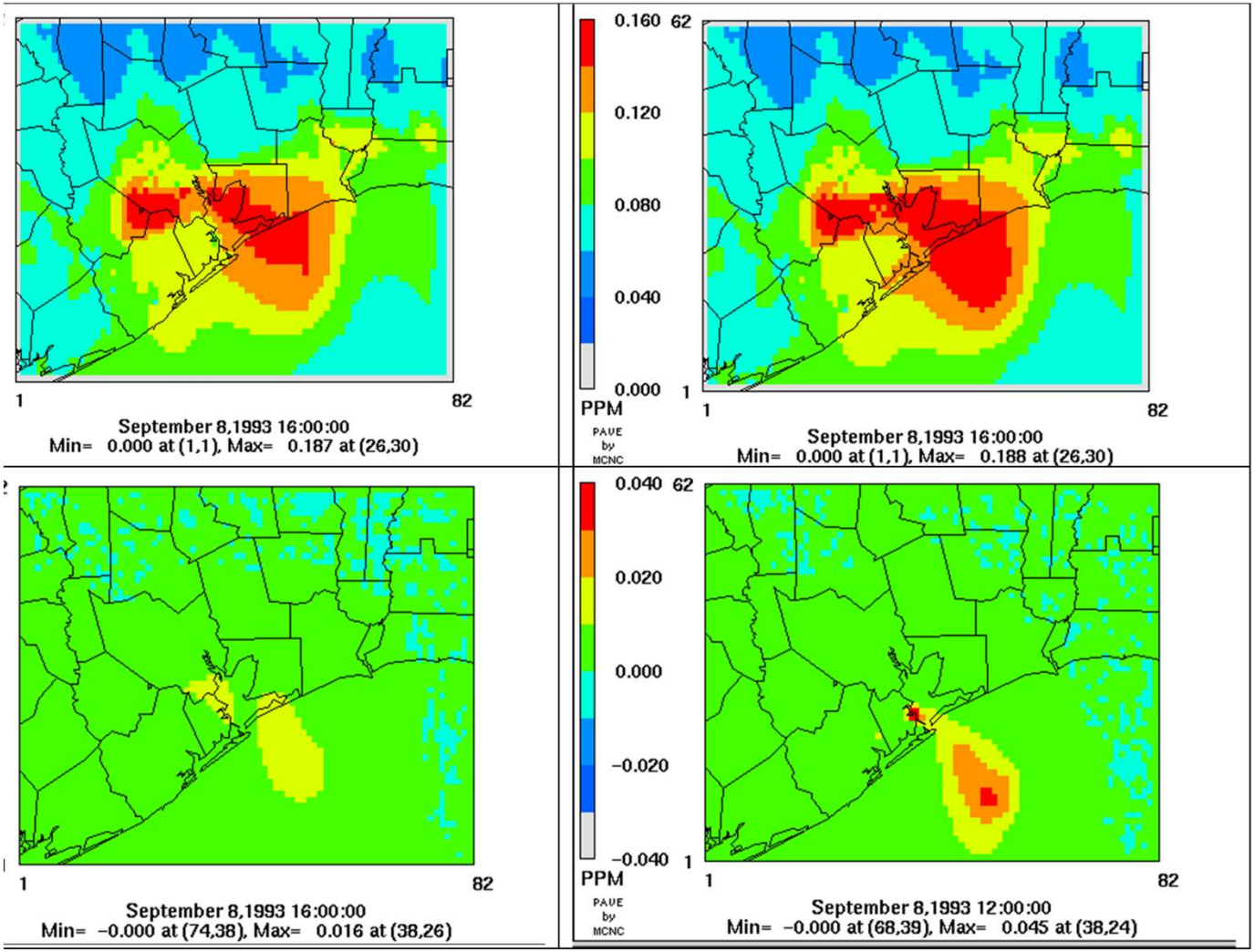
Other Wind Tunnel Modeling/Testing



SBIR Support: PADT

CH2MHill Instrument Dust Testing

Photochemical/Ozone Modeling



IEEE Panel Discussion: Career Takeaways

- Be a lifelong learner and recreate yourself as needed, but be passionate about it— It has not been uncommon for me to tap knowledge in Chemistry, Physics, Fluids, Electronics, Nuclear Physics, Energy Systems, Materials, Aerodynamics, Environmental Modeling, etc.
- I have done experiments, programmed scientific code, and used computational tools to solve problems throughout my career.
- Always have felt like a Teacher in both Academia and Industry
- Analytical/Mathematical models sometimes create sanity checks and have been valuable too.
- Engineering School gave me the ability to be analytical, and research what I do not know.
- Industry experience gave me many practical applications of the skill set learned through many years of getting a Ph.D., M.S. and B.S.
- Internships and Undergraduate Research Experiences helped me learn what I liked to do, what types of places I liked to work at, and the parts of the country I would like to be in.
- Teaching at DU has given me the ability to bring practical experience into the classroom while still presenting fundamental concepts.

IEEE Panel Discussion

Hobbies:






Built one Yurt and Repaired as Needed!

IEEE Panel Discussion

Hobbies:

Recently rebuilt after a windstorm!

Even what appeared to be a total loss was resurrected! Persist in what you care about!

IEEE Panel Discussion

Hobbies:

Running and Outdoor Activities (3 Marathons, 10+ half marathons)

UNIVERSITY of DENVER

DEPARTMENT OF MECHANICAL & MATERIALS ENGINEERING

IEEE Panel Discussion

Hobbies:

Traveling and Learning More about the World!

IEEE Panel Discussion

Hobbies:

Traveling and Learning More about the World