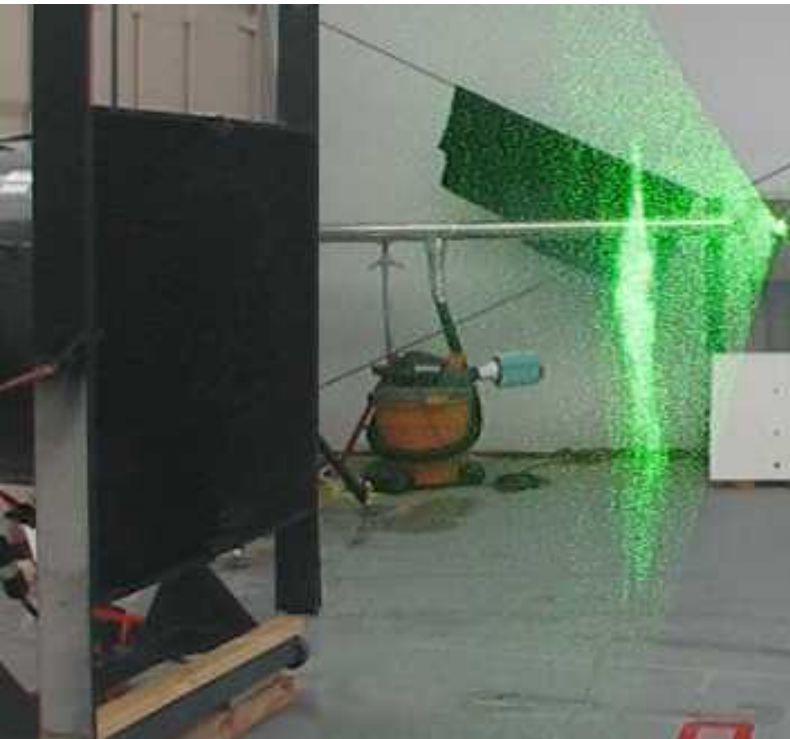


Exceptional service in the national interest



Sandia Wake Imaging System

TTU Laser Safety Committee Brief

10/14/2014

Brian Naughton

Sandia Wind Energy Technologies Department



Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

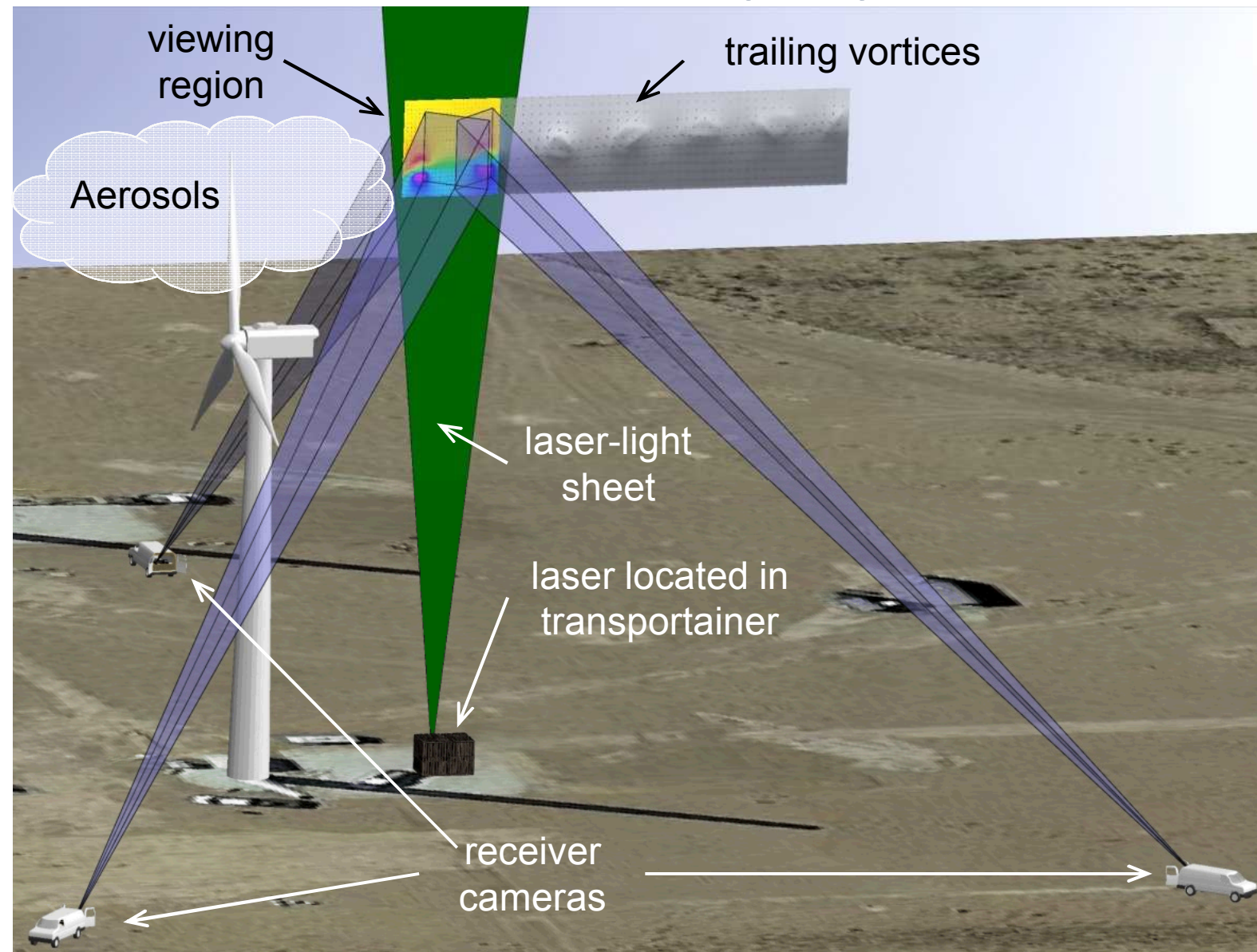
Outline

- Wake Imaging System project overview and status
- Sandia Work Planning and Control process
- Safety planning status for Wake Imaging System

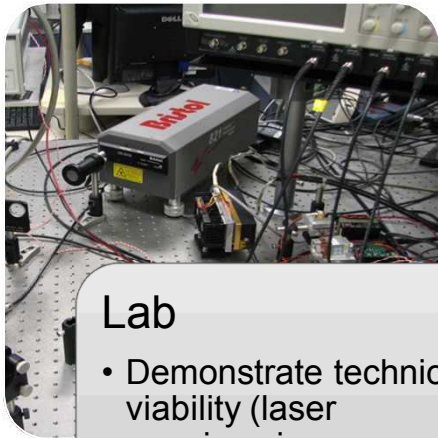
Objective:

Share project goals and begin discussions leading to a safe, successful project outcome.

Notional SWiFT Deployment

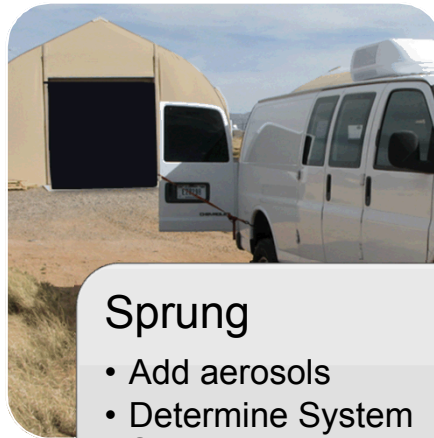


Project Development Stages



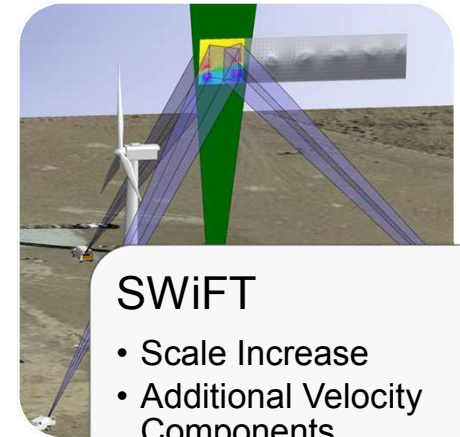
Lab

- Demonstrate technical viability (laser, receiver, image processing)
- 15 cm × 15 cm measurement window



Sprung

- Add aerosols
- Determine System Sensitivity and Measurement Uncertainty
- 2 m × 2 m measurement window



SWiFT

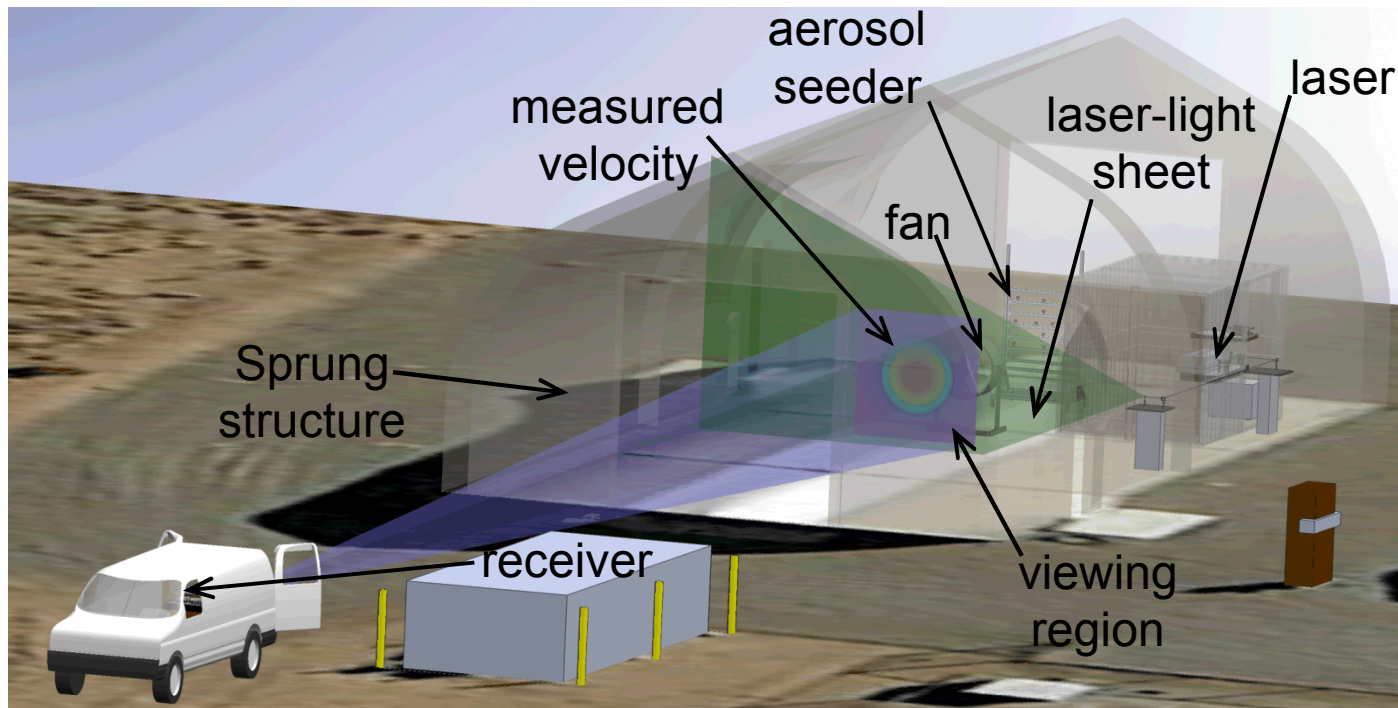
- Scale Increase
- Additional Velocity Components
- Outdoor Aerosol System
- 5 m × 5 m measurement window

Risk reduction approach:

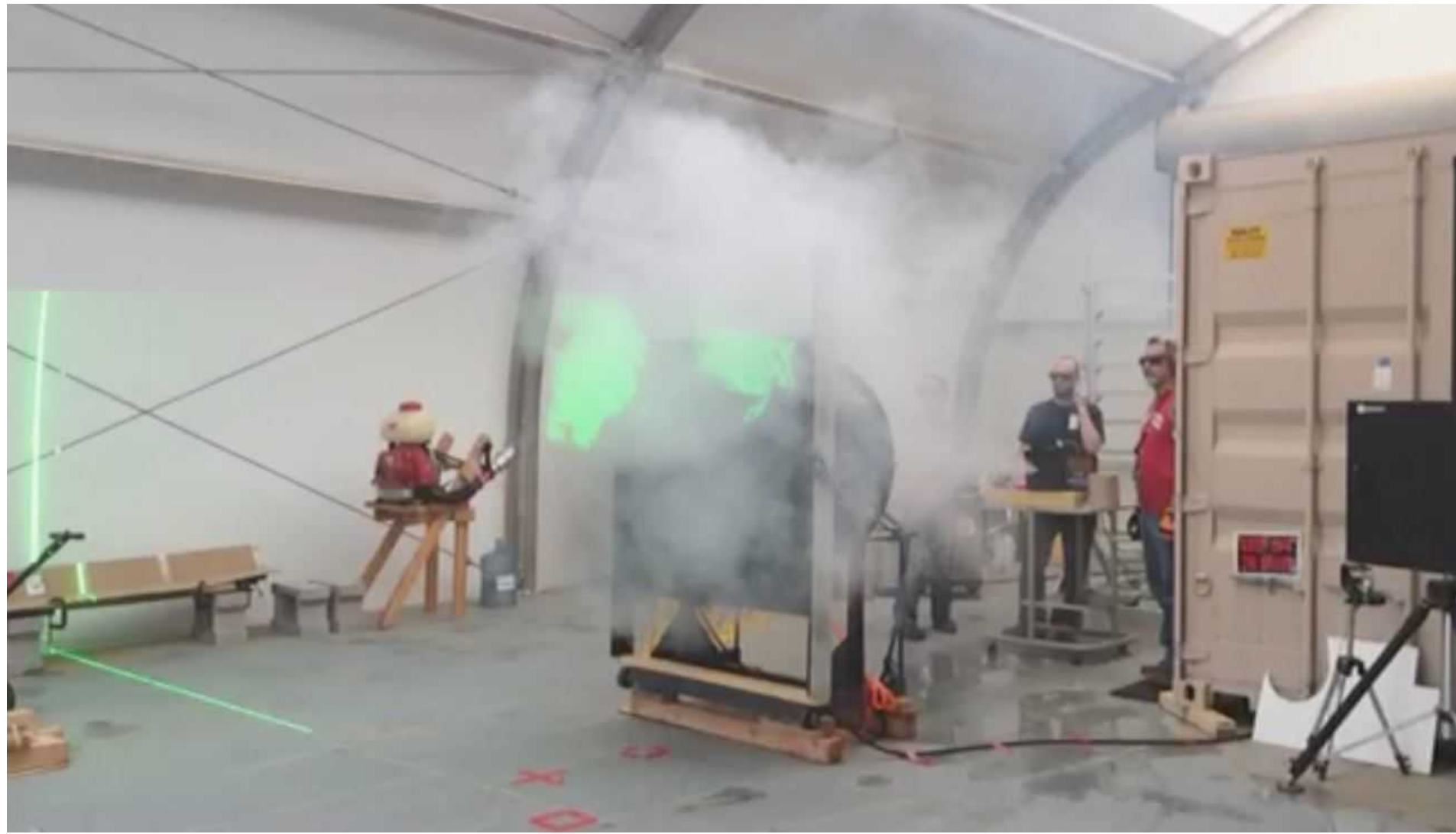
- Demonstrate simplest possible system
- Address make-or-break components
- Build up from lab to field-test to SWiFT experiments
- Identify and resolve ES&H issues early
- Leverage deep expertise, equipment, and facilities at Sandia to save time and money

Sprung Scaling Experiment

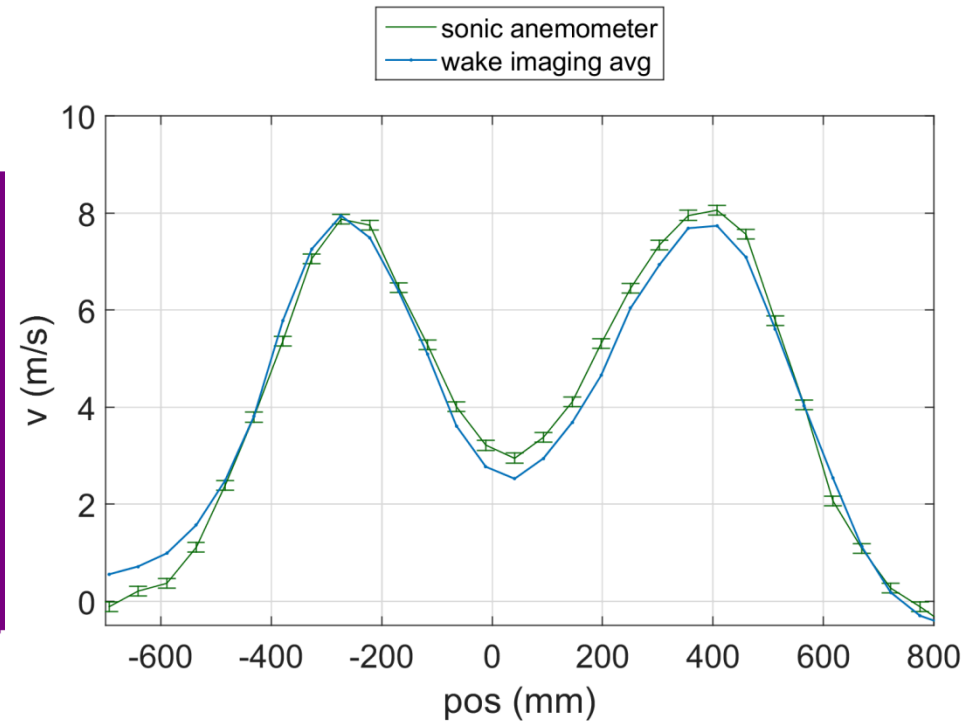
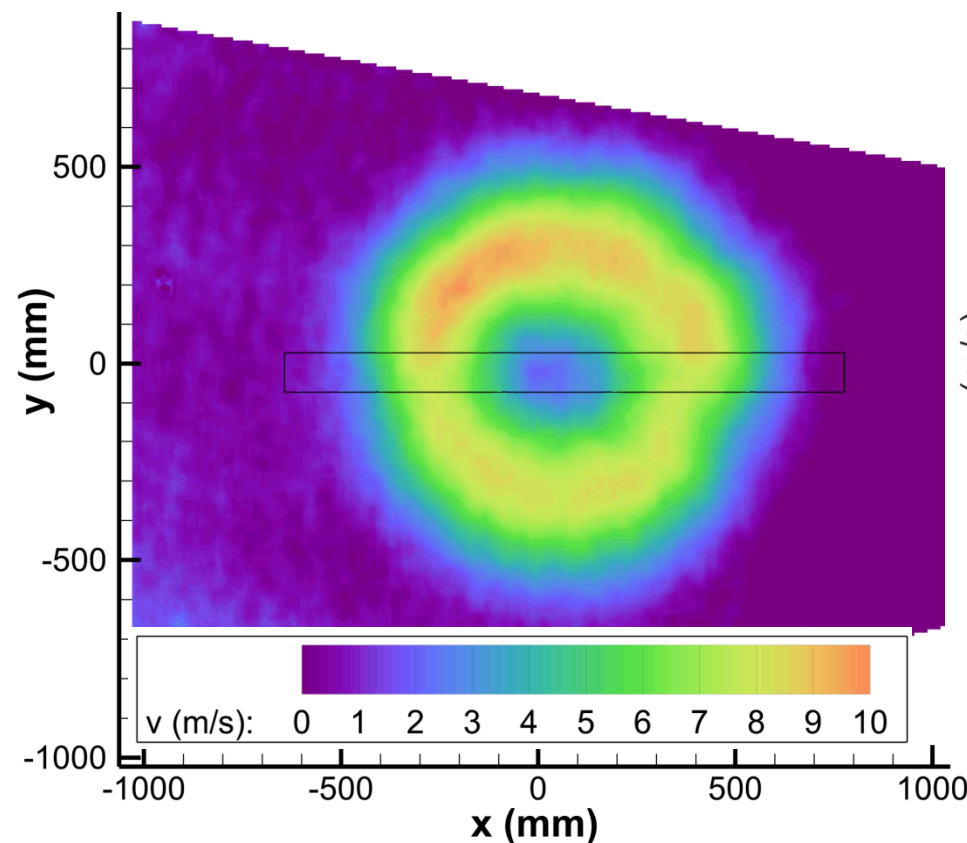
- Intermediate scale to integrate system components at more cost effective scale than possible at SWiFT facility
- New components include: aerosol system, representative flow field, separation of laser and receiver subsystems
- Demonstrate successful imaging of velocity field
- Determine system sensitivity and development pathways for major system components



Sprung Experiment



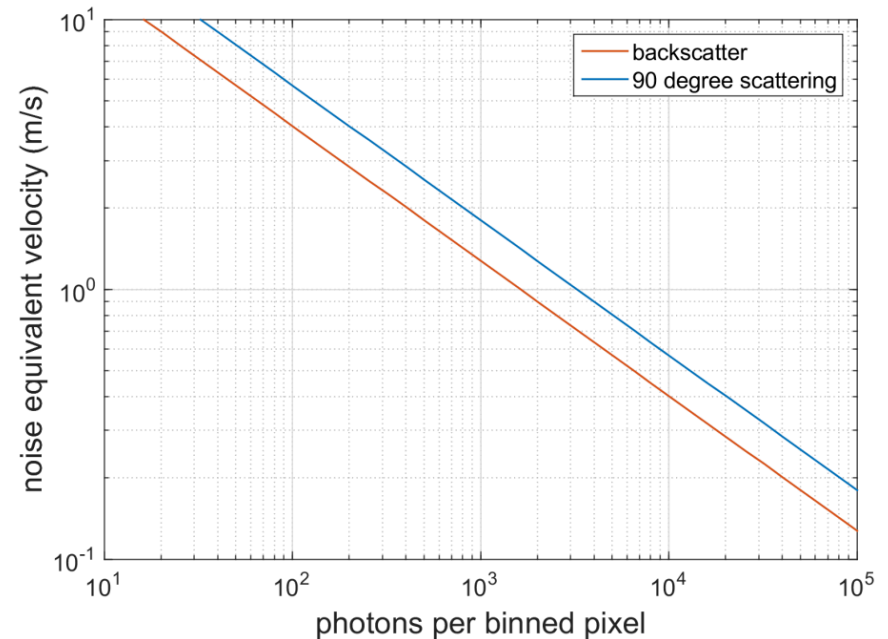
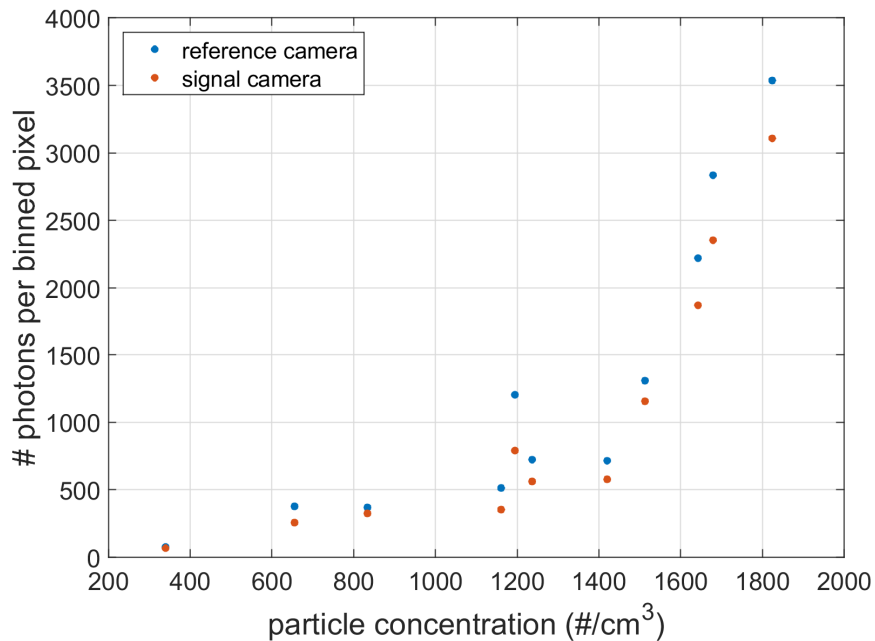
Velocity Measurement Comparison



- Independent sonic anemometer data compares well
- Velocity image processed to match sonic anemometer spatial resolution
- Velocity bias exists between different wake imaging system data sets

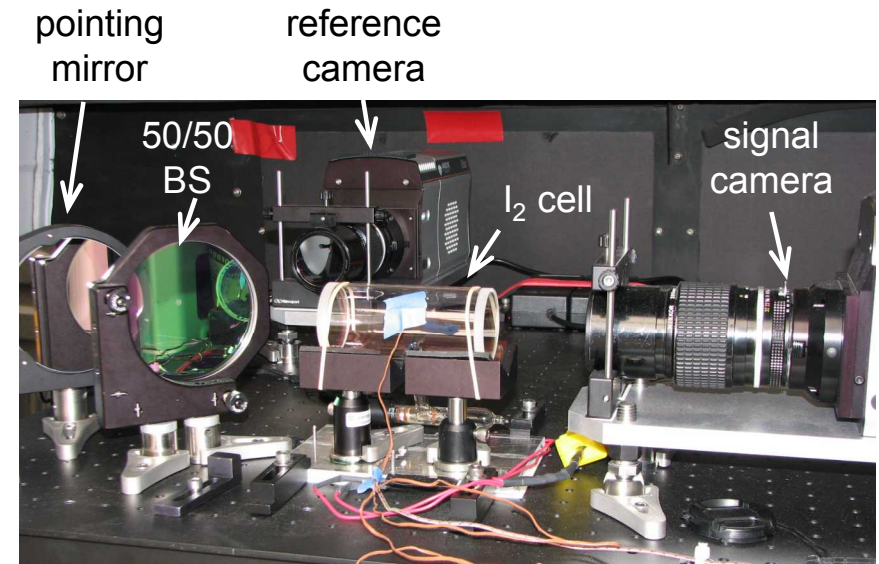
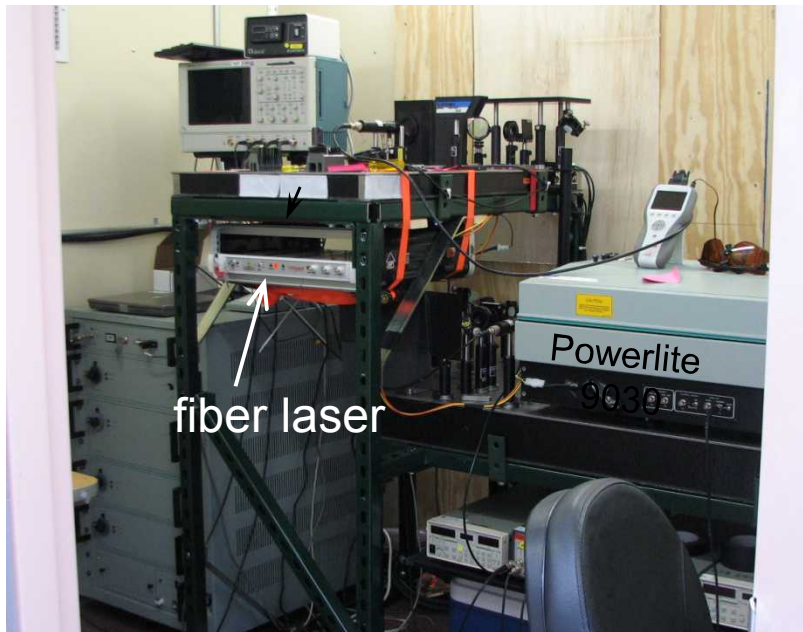
Sensitivity Results and Implications

- Particle scattering efficiency at receiver determined by varying concentration without fan flow present
- Particle size distribution and concentration measured with APS
- Noise equivalent velocity represents the minimum resolvable velocity variation
- Predicting signal levels involves multivariate trade-space: laser pulse energy, particle density and size distribution, range, aperture diameter, receiver binning
- Anchoring system sensitivity analysis was motivation for Sprung test

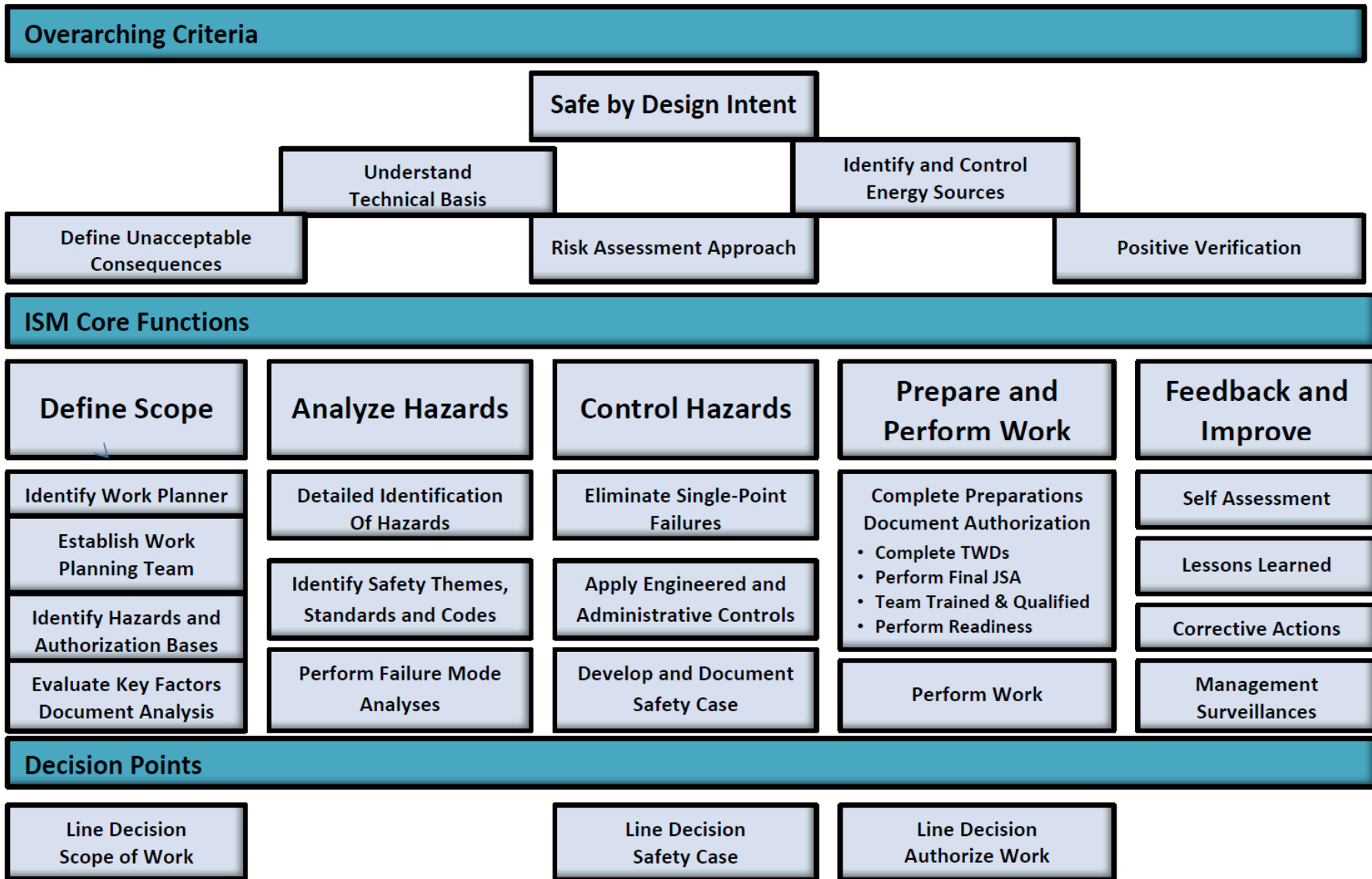


FY15 Project Plan

- Address remaining technical and safety risks
- Finalize design and obtain quotes for laser/receiver system to be deployed at SWiFT
- Design, build and test aerosol system at SWiFT (possible flow visualization experiment)

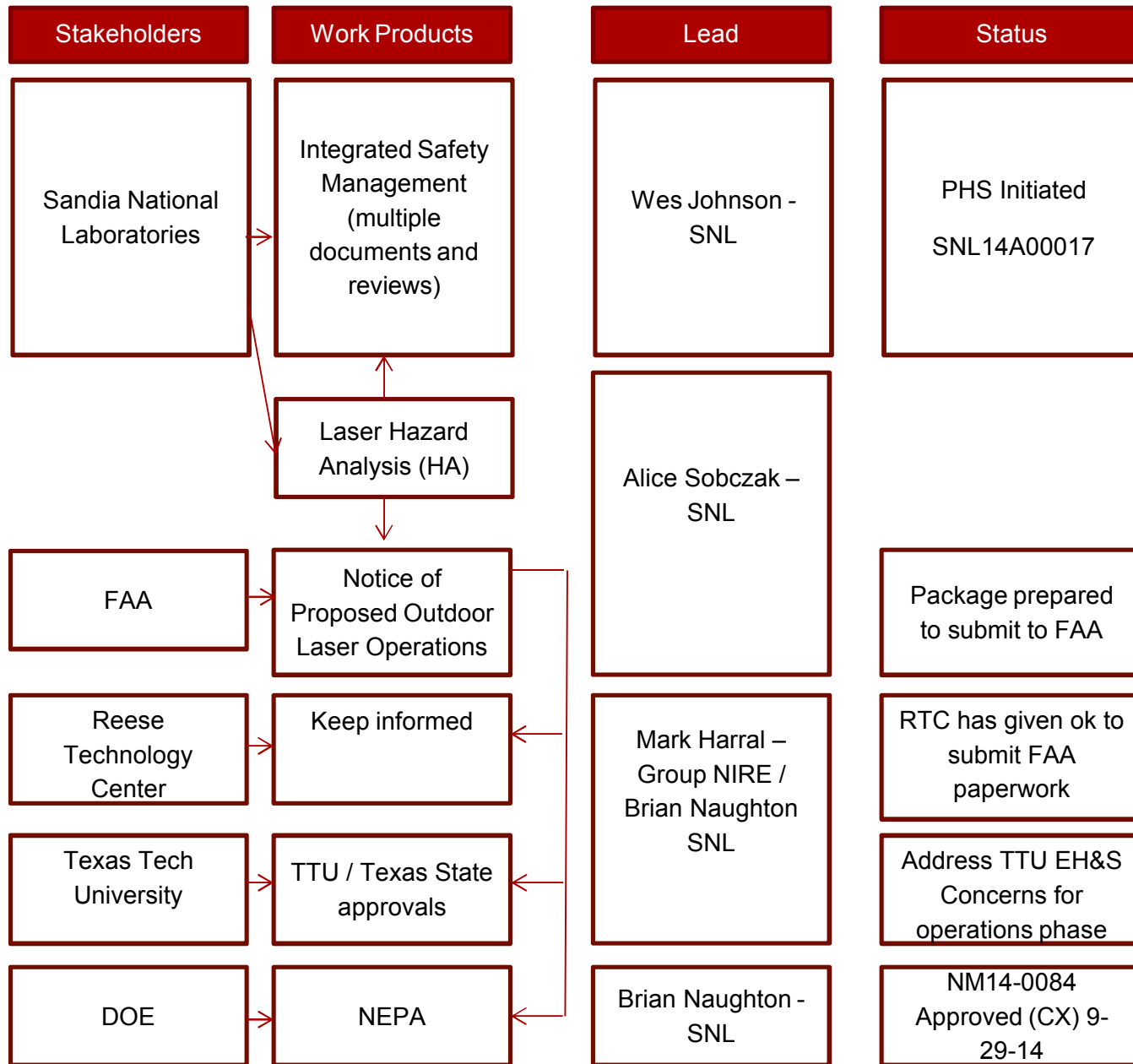


Sandia Work Planning and Control



Wake System Safety Planning

- Build from existing Technical Work Documents (TWD)
 - SNL Wind Department (06121) – SWiFT TWD
 - SNL Aerosol group (06633) – Aerosol Complex TWD
 - SNL Laser group (01118) – Class IV laser TWD
- Sprung Wake Imaging Testing Plan
 - Integrated Operating Plan and experience to build from
- Add new team members
 - TTU personnel
- Obtaining approvals
 - NEPA
 - FAA
 - Texas Laser License



SWiFT Laser Configuration

