Introduction to the Wind Energy Science, Engineering, and Policy (WESEP) Real-Time Research Seminar (RTRS) Spring Semester, 2014

J. McCalley

WESEP 594

September 4, 2014

Other things:

- Website from Kung
- WESEP Laboratory

Overview

a. **Qualifier**
b. **Program evaluation**
c. **Courses**
d. **WESEP 594 activities**
e. **Semester schedule**
f. **Recruiting**
g. **Industry internships and international experiences**
h. **WESEP Laboratory**
i. **PhD studies**

Qualifier

Objective of exam: The objective of the qualifier exam is to determine if the student is able to perform research at the level required by the Ph.D. degree.

Expected timeframe of exam: The qualifier exam is to be administered during the third full semester following the student's entry into the program.

Qualifier

Exam format: The student submits a 5-7 page paper one week in advance of the exam date and provides a 15-minute oral summary of the paper, followed by approximately 15 minutes of questioning by the evaluation committee. The qualifier exam is “open” (i.e., anyone may attend the sessions). The major professor is particularly encouraged to be present. The student may be questioned on the content of the submitted paper and presented materials, information from graduate courses taken to date (particularly related to fundamental concepts), and research methods and approaches.

Qualifier

Problem to be addressed: The student should develop a research problem related to the dissertation. This may include an articulation of the dissertation problem itself or a sub-problem within the dissertation topic. Some amount of literature review is appropriate. The student will be asked to expound on a research problem and its significance, list the main questions to be answered, propose the method(s), identify needed resources and potential issues that might emerge, and explain expected outcomes. The student should drive the idea and area of work with guidance from the major professor.

Qualifier

Participating students this fall:

- Heather Sauder
- Morteza Khosravi
- Helena Khazdozian
- Aaron Rosenberg
- Michael Czahor
- Matthew Fischels
- Mat Wymore
- Armando Figueroa
- Cai Bin
- Jeremy Van Dam

Intending to do all in one week, perhaps in 2 different sessions.

Qualifier

Proposed dates	JDM	JKJ	PS	GT		Students
October 20-24				No on entire week		
October 27-31				No on 10/28 and 10/31		
November 3-7						Mat 11/3-6 Michael 11/5-6
November 10-14						Morteza 11/10-14
November 17-21			No on 11/19-11/21	No on 11/19-11/21		

Program Evaluation

- Go to www.igert.windenergy.iastate.edu/
- Click “About” in upper right-hand-corner
- Select “Program Evaluation”

Will be doing it again this year

Courses

1. **Wind resource characterization and aerodynamics of wind farms**

AER E 481. Advanced Wind Energy: Technology and Design

AER E 541 Incompressible flow aerodynamics

AER E 545. Advance Experimental Technique for Thermal-Fluid Studies.

AER E/ME 546 Comp fluid mechanics/heat transfer

AER E 570 Wind engineering

AER E 572 Turbulence

AgEds 451 Agricultural law

Agon 505 Environmental biophysics

EE 553 Power system operation

EnSci 381/382 Environmental systems I, II

Mteor 507 Mesoscale meteorology

Mteor 543 Dynamic Meteorology

Mteor 605 Micrometeorology

Courses

2. **Wind energy conversion system and grid operations**

AER E 422 Aeroelasticity

Aer E/EM 514 Advanced Mechanics of Materials

AerE 525 Finite Element Analysis

AER E 541 Incompressible flow aerodynamics

AER E /ME 546 Comp fluid mechanics/heat transfer

CE 541 Dynamic Analysis of Structures

EE 552 Power system planning

EE 553 Power system operation

EE 554 Power system dynamics

EE 556 Power electronic systems

EE/AER E/ME 577 Linear systems

EE 578 Nonlinear systems

IE 510 Network analysis

IE 534 Linear programming

IE 631 Nonlinear programming

IE 632 Integer programming

ME 517 Advanced machine design

ME 543 Introduction to random vibrations and nonlinear dynamics

ME/EM 564 Fracture and Fatigue

Courses

3. Manufacturing, construction, and supply chain

AER E /EM 514 Advanced mechanics of materials

AER E 522 Design and Analysis of Composite Materials

AER E 525 Finite element analysis

CE 460 Foundation engineering

CE 533 Structural steel design II

CE 534 Reinforced concrete design II

CE 535 Prestressed concrete structures

CE 541 Dynamic analysis of structures

CE 561 Applied foundation engineering

EE 516, Computational Methods in Electromagnetics

IE 503 Intro to sustainable production systems

IE 514 Production scheduling

IE 541 Inventory control & production planning

IE 543 Wind energy manufacturing

IE 546 Geometric variability in manufacturing

IE 549 Computer aided design & manufacturing

ME 520 Material & manufacturing in design

ME/EM 564 Fracture and fatigue

MSE 554 Polymer composites & processing

MSE 569 Mechanics of composite/combined materials

SCM 522 Supply chain planning & control systems

Courses

4. Turbine reliability & health monitoring

EM/MSE 550 Fundamentals of NDE

EM 551 Fundamentals of ultrasonic NDE engineering

MSE/EE 588 Eddy current NDE

Stat 500 Statistical methods

Stat 506 Spatial statistics

Stat 511 Statistical methods

Stat 533 Reliability

Stat 542 Theory or probability and statistics I

Stat 543 Theory of probability and statistics II

Stat 551 Time series analysis

Courses

5. Economics, policy & public perception

Econ 501 Microeconomics

Econ 537 Commodity markets: analysis and strategy

Econ 580 Intermediate environmental /resource economics

Econ 581 Advanced environmental economics

JIMC 547 Science communication

JIMC 560 Risk perception and communication

Soc 415 Sociology of technology

Soc 549 Sociology of the environment

Courses

WESEP 512:
Tentatively scheduled to be offered spring semester.
I will serve as instructor.

Format:

To go through concepts of “Advanced Wind Energy Concepts.”
Will use a text plus…

- Each student takes 2-3 lectures.
- I take the rest.
- Will avoid overlap with WESEP 511.
- This is a course development procedure.

WESEP 594 Activities

1. Broaden cognitive approaches:

4 Seasoned researchers will provide lectures on how they "do" research; how they *think* while doing it, addressing:

- How do we become aware of the problems we work on?
- What are the attributes of a "good research problem"?
- To what extent can research be planned?
- What is the interplay between creativity and literature review?
- What is the desired "end-product" of a research project (paper? "contribution"? patent? technology transfer? impact? graduated student?); how in the research process does choice of "end-product" affect what happens?
- When does bottom-up and top-down thinking yield their greatest potential?
- How are solution approaches identified?
- What constitutes acceptable evidence that a problem is indeed solved?
- What organizational structures and modes of human interaction are effective in facilitating research?

1. Atul Kelkar (ME)
2. Nicola Elia (EE)
3. Carmen Bain (Sociology)
4. Stephen Sapp (Sociology)
5. Leonard Bond (CNDE)
6. Yu Wang (Political Science)

WESEP 594 Activities

2. Develop leadership skills:

2 classes/semester to be dedicated to ethics, communication, and leadership issues. Do you have suggestions???

This activity is central to the WESEP program because (a) research activities are fraught with ethical decisions and (b) high wind penetration will lead to complex human interactions between landowners and land managers, manufacturers, utilities, regulators, state and federal agencies, policy-makers, ecologists, and non-government organizations.

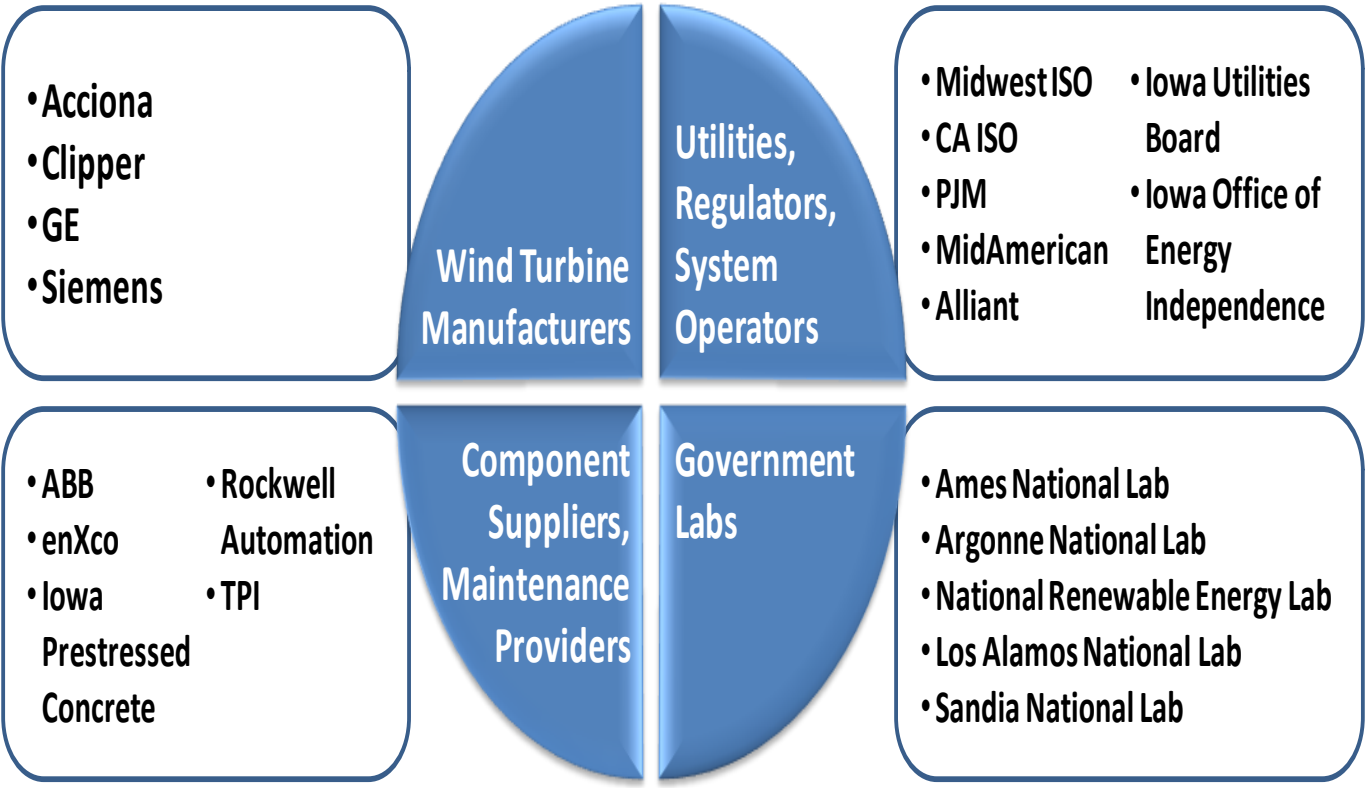
Have already made decision for Clark Wolf to give two lectures on "Professional Ethics and Research Integrity" and one on "Conflict over Wind Energy"

WESEP 594 Activities

3. Industry lectures:

2-3 lectures will be given by individuals from industry.

Do you have suggestions???



Confirmed:

- **Stephen Nolet, TPI Composites**
- **Robert Nelson, Siemens**
- **Ryan Konopinski, GE Energy**

Possibilities:

- **Bruce Gamble, Chief Engineer, American Superconductor**
- **Robert Duckworth, Oak Ridge National Lab**
- **Jonathan Lynch, Northern Power**
- **Mike Snodgrass (MidAmerican Energy)**
- **GIVE SUGGESTIONS!**

WESEP 594 Activities

Your presentations:

- Each student to provide presentation: two presenters per class
- Presentation should focus on their research:
  - ➔ objective, motivation, approach, any results,
  - ➔ relationship to the work of other WESEP students
- Presenter selects technical paper; distributes 1 week in advance together with dissertation topic
  - ➔ Paper to provide foundational background for important element(s) of the disst topic
  - ➔ All WESEP 594 students to read paper to gain background and prepare for seminar
- Each presenter has 20 min + 5 min Q&A
- Rest of the class provides "Response" (< 1 pg) by end of class:
  - ➔ How does the work relate (or could relate) to my own disst work?
  - ➔ How does the work relate (or could relate) to the disst work of other WESEP students?
  - ➔ What are the strengths of this research?
  - ➔ How could the research be enriched/improved?

Any comments on this approach???

Student Response to Presenter

My name: **(Class students fill this out before class)**

Today's Student Presenter 1: **(Class students fill this out before class)**

Research paper 1 author, title: **(Class students fill this out before class)**

Research topic Student 1: **(Class students fill this out before class)**

1-page response:

- ➔ How does the work relate (or could relate) to my own disst work?
  (Develop 1 paragraph narrative before class)
- ➔ How does the work relate (or could relate) to disst work of other WESEP students?
  (Develop 1 paragraph narrative before class)
- ➔ What are the strengths of this research?
  (Develop 1 paragraph narrative in class)
- ➔ How could the research be enriched/improved?
  (Develop 1 paragraph narrative in class)

Turn in to instructor at end of class.

Instructor reviews; passes on to Presenter 1 the next week

Semester Schedule (very tentative)

WEEK	Date	Presenter
1		
2	9/4	J. McCalley - Introduction
3	9/11	J. McCalley – Integrated energy/transportation: continent-wide infrastructure design
4	9/18	Robert Nelson (Siemens)
5	9/25	Steve Nolet (TPI)
6	10/2	Clark Wolf – Research integrity
7	10/9	Mat Wymore, Helena Khazdozian
8	10/16	Aaron Rosenberg, Michael Czahor
9	10/23	Jeremy Van Dam, Cai Bin
10	10/30	Matthew Fischels, Heather Sauder
11	11/6	Morteza Khosravi, Armando Figueroa
12	11/13	Clark Wolf
13	11/20	Clark Wolf
14	12/4	Ryan Konopinski (GE)
15	12/11	Huiyi Zhang, Nick Brown, David Jahn

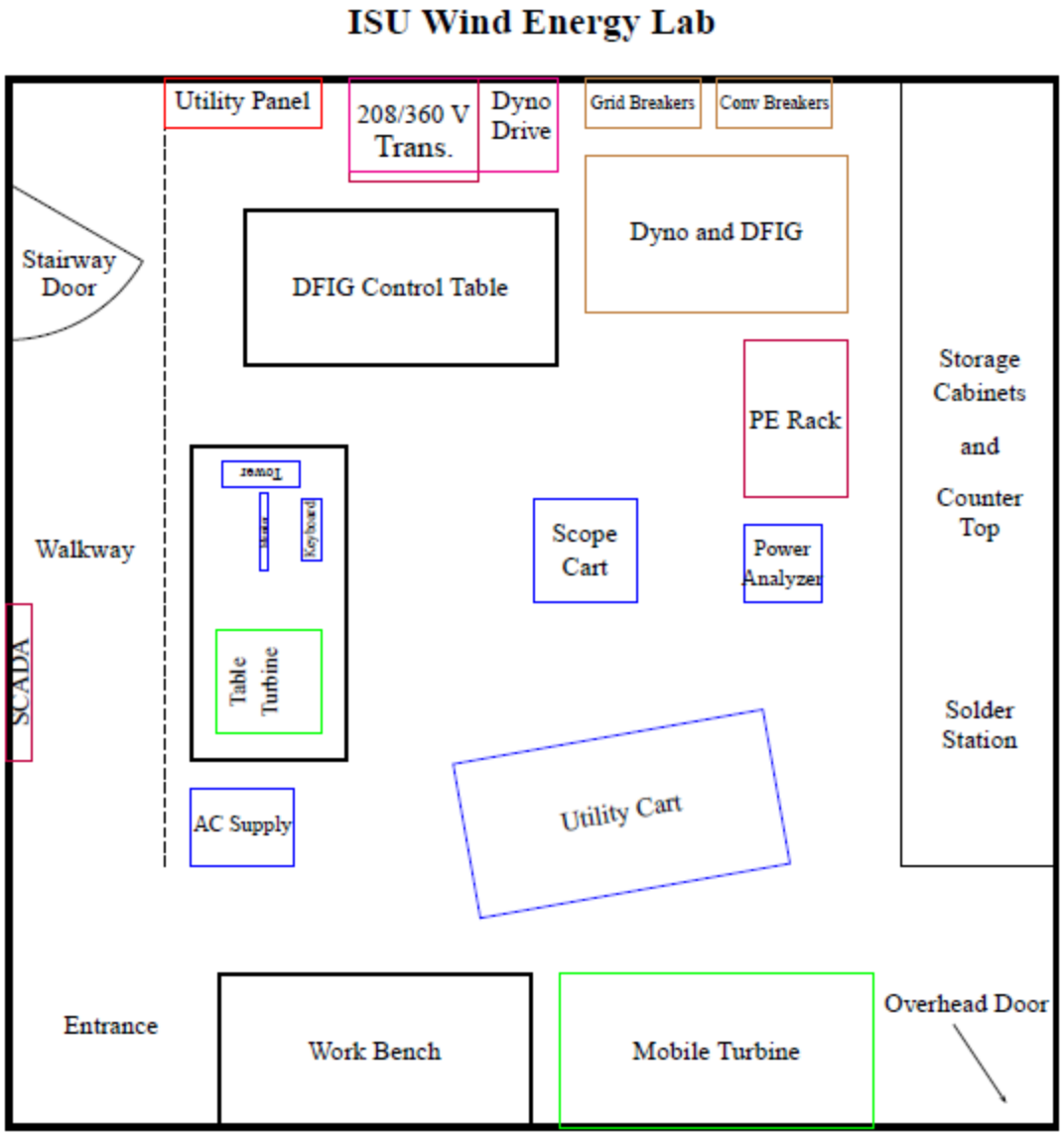
Recruiting

- Several of you are volunteering to help recruit.
- Major effort this year.
- Have objective to be successful at recruiting 10 by next year.
- Old strategy depended on website and email.
- New strategy is to GO THERE!!!
- Targeting job fairs
- If you want to do it, we pay your airfare, hotel, any other cost
- You give us 1-2 days of your time, participate in job fairs.
- Also feel free to make contact with faculty in advance to see if you can give a seminar (if you want, but not required).
- Focused on UG schools w/o PhD programs.
- You previously suggested Ohio State, Penn State, UIUC, Northwestern, Marquette, U. of Chicago, U. of Oklahoma, Colorado State, Valparaiso, Calvin College, Dordt.
- Any suggestions on recruiting?

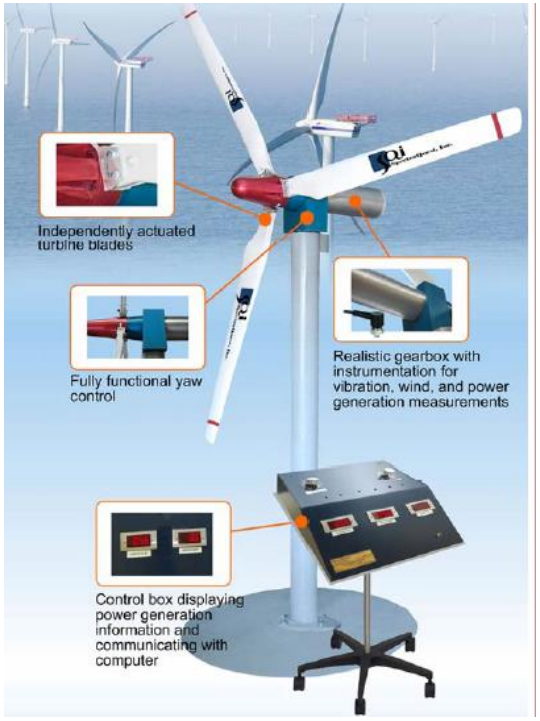
Industry Internships and International Experiences

- This is van excellent way to enrich your research and your education in general
- Please talk with those who have done it
- Those who have done it please talk with those who have not
- YOU need to make this happen!
  - Talk to your advisor and make him/her understand your interest; also mention that industry experience offloads need for support and international experience has transportation/accommodations paid.
  - Seek out your own opportunities
  - Talk to me
- Timing on these is up to you but may be best during summer

Wind Energy Laboratory



- Metals Shop in Howe Hall
- Close to wind tunnels.
- To have two lab-scale turbines, one has tower (below) and one is table top (to go in wind tunnel)
- SCADA/visualization system
- Dyno/machine /control equipment



PhD Advice

Please review this website:

www.eecs.harvard.edu/htk/phdadvice/

1. Introduction
2. Why Ph.D. thesis could be really difficult for a student
3. Types of Ph.D. theses (from Allen Newell)–not a topic of this talk
4. Growth of a star (the transformation process that some students go through to become a mature researcher)–which stage are you in?
5. Stages of Ph.D. thesis research
6. Methods to get into the depth of a topic (or how to come up with good ideas)
7. Breaking myths
8. Pitfalls to avoid (easy ones to avoid listed first)
9. Some other general advice
10. All the effort is worth it (believe it or not)