Monday, April 2, 2018

8:00 AM  Introductions & Overview  Chuck Farrar, NSEC & Pablo Prando, Legal Counsel
- History of the program
- Outline the schedule and course elements
- Review what we hope to achieve

Meeting Room

8:45 AM  Entrance Evaluation  Ellie Vigil, NSEC
- Evaluate participants' understanding of the internship learning objectives prior to the start of the program.

Meeting Room

9:00 AM  Science, Engineering, and Technology  Chuck Farrar, NSEC
- Define science, engineering and technology
- Understand the relationship between science, engineering and mathematics
- Introduce the concepts of length and time scales
- Discuss technology maturity

Meeting Room

9:45 AM  Discussion & Break  Chuck Farrar, NSEC

Meeting Room

10:00 AM  Hypotheses, Theories, Facts, and Laws  Mike Todd, UCSD
- Define the fundamental terms used in the process of doing science
- Facts, laws, theories, hypotheses
- Understand the relationships among these terms and how they evolve
- Introduce the scientific method

Meeting Room

10:45 AM  The Scientific Method  Dave Clark, NSEC
- The scientific method is an approach to how scientists solve problems
- The hypotheses and knowledge of science are always evolving
- Uncertainty and error are absolutely central to scientific thinking and the scientific method
- There are well-established Hallmarks of good science and scientific expertise

Meeting Room

12:15 PM  Lunch  Chuck Farrar, NSEC
- Social lunch with speakers and other scientists

Institutes Break Room
1:15 PM  National High Magnetic Field Lab  
Vivian Zapf, MPA-CMMS  
NHMFL

3:00 PM  Doing Science Part 1 - Hooke's Law  
Eric Flynn, NSEC  
Institute Labs

- Employing the scientific method
- Designing experiments
- Making measurements
- Assessing and managing sources of error, variability, and uncertainty
- Qualifying accuracy and reliability of a scientific tool
- Teams of two

Participants will be presented with the problem of determining the relationship between force and displacement for several spring-like systems in order to build an instrument for measuring force.

4:45 PM  Afternoon recap  
Chuck Farrar, NSEC  
Meeting Room

5:00 PM  Break

6:30 PM  Social at the Bradbury Science Museum  
Dave Clark, NSEC  
Bradbury Science Museum

- Interact with laboratory scientists in a casual setting
- Informal tour of museum exhibits
- Appetizers and refreshments provided

8:00 PM  End of Day's Program
Tuesday, April 3, 2018

8:00 AM Morning Recap
Chuck Farrar, NSEC
Meeting Room

8:15 AM Confidence and Uncertainty
Francois Hemez, XTD-IDA
Meeting Room
- Describe how to compare physical measurements and numerical predictions
- Understand the difference between random variability and systematic bias
- Articulate elements that provide “confidence” in simulation-based predictions
- Recognize sociological and human factors of “confidence.”

9:00 AM Assessing Technology and Science
Duncan McBranch, PADGS
Meeting Room
- The stages of technology and increasing pace of change
- Case studies on technology evolution: DNA fingerprinting, brain imaging
- From “valid science” to “does it work” to “what does it mean”
- Assessing Science and Engineering
  - Journals and the peer review process
  - Quality and impact: are all journals created equal?
  - What makes an expert?
  - Case study on bad science going mainstream: vaccines
  - Standards for scientific assessment in the law

9:45 AM Statistics - Variation, Uncertainty, Probability
Scott Vander Wiel, CCS-6
Meeting Room
- Distinguish accuracy and precision
- Be familiar with measures of average and variation
- Distinguish between variation amongst individuals and uncertainties in estimated values
- Be familiar with probability concepts in judicial contexts
- Identify the prosecutor’s fallacy in equating rarity of an event to probability of innocence
- Understand why inference from a match (e.g., fingerprints, DNA) should account for how the suspect is identified

10:30 AM Discussion & Break
Chuck Farrar, NSEC
Meeting Room
10:45 AM Does One Big Earthquake Lead to Another?  
Paul Johnson, EES-17  
Meeting Room

11:45 AM Lunch  
Social lunch with speakers and other scientists  
Chuck Farrar, NSEC  
Institutes Break Room

12:45 PM Nicholas C. Metropolis Center  
Home to LANL’s (and some of the world’s) largest and most powerful high performance computers. Combined tour and seminar in the Data Visualization Corridor.  
Francois Hemez, XTD-IDA  
TA-3

3:00 PM Presenting Science Part 1  
Practice presenting and defending science effectively  
Practice scientific peer review  
Prepare, present, argue, and discuss results from Doing Science Part 1  
Eric Flynn, NSEC  
Meeting Room

4:45 PM Afternoon Recap  
Chuck Farrar, NSEC  
Meeting Room

5:00 PM End of Day’s Program
Wednesday, April 4, 2018

8:00 AM   Morning Recap
Chuck Farrar, NSEC
Meeting Room

8:15 AM   Verifying & Validating Simulation Models
Francois Hemez, XTD-IDA
Meeting Room
Define what is code verification
Define what is model validation
Describe the three broad categories of uncertainty in numerical predictions
Recognize the potential for uncertainty and assumption-making in simulation models

9:00 AM   Discussion & Break
Chuck Farrar, NSEC
Meeting Room

10:00 AM   Discussion & Break
Chuck Farrar, NSEC
Meeting Room

10:15 AM   Break

11:00 AM   Climate Models and Predicting Future Climate Change
Phil Jones, T-3
Meeting Room

9:15 AM   The Art of Approximation
Catherine Plesko, XTD-NTA
Meeting Room
Cultivate the habit of connecting notional measurements to concrete examples
Understand what the units of a measurement mean
  Propagation
  Obfuscation
  Similarity
Know what dimensional analysis is and how to use it to
  Check a calculation's accuracy
  Estimate an unknown quantity
11:45 AM  **Lunch**  
Social lunch with speakers and other scientists  
Chuck Farrar, NSEC  
Institutes Break Room

12:45 PM  **Doing Science Part 2 - Standing on the shoulders of giants**  
Designing experiments  
Assessing and managing sources of error and uncertainty  
Properly wielding scientific tool  
Teams of three  
Alex Marchi, MPA-11  
Institute Labs  
Participants will be presented with the problem of determining the relationship between RPMs and thrust. The teams will have to rely on the instrument they build in Part 1.

3:00 PM  **Presenting Science Part 2**  
Practice presenting and defending science effectively  
Practice scientific peer review  
Prepare, present, argue, and discuss results from Doing Science Part 2  
Marchi & Flynn, NSEC  
Meeting Room

4:45 PM  **Afternoon Recap**  
Chuck Farrar, NSEC  
Meeting Room

5:00 PM  **Dinner at El Farol in Santa Fe**  
Departure at 5:00pm. Approximately 45-minute shuttle ride to and from the venue.

9:00 PM  **End of Day’s Program**
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker</th>
<th>Location</th>
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<tbody>
<tr>
<td>8:00 AM</td>
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<td>Chuck Farrar, NSEC</td>
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<td>8:15 AM</td>
<td><strong>Statistics - Causation or Coincidence?</strong></td>
<td>Scott Vander Wiel, CCS-6</td>
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<td></td>
<td>Understand how a p-value relates to preponderance of evidence</td>
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<td>Apply hypotheses test reasoning to an accusation of unequal promotion</td>
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<td>practices Understand elements of establishing causal relationships</td>
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<td>Reason about causation conclusions in observational studies</td>
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<td>Gain awareness of contradictory conclusions in scientific literature</td>
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<td>Learn how control for hidden factors can alter apparent inequities</td>
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<td>Practice brainstorming lurking factors that impact salary differences</td>
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<td>Pablo Prando, LC-LM</td>
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<td>Explore Key Terminology Challenges</td>
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<td>Discuss Similarities and Differences in Culture and Methods</td>
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<td>Recognize Possible Misconceptions About Science</td>
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<td>Understand that Not All Science is Created Equal</td>
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<td><strong>Beyond Pluto: The Search for the Edge of the Solar System</strong></td>
<td>Herb Funsten, ISR-DO</td>
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1:00 PM  **Doing Science Part 3 - Analysis**  
Scott Ouellette, W-13  
Institute Labs  

Task: Predict the maximum lifting power of a quad-rotor helicopter  
Tools: Quad-rotor helicopter, assorted masses, findings from Part 1 & 2  
Same teams of three  

Participants will be presented with the problem of determining the maximum lifting power of a quad-rotor helicopter. They will be required to rely primarily on their findings from Parts 1 & 2. Emphasis will be on data analysis, making predictions, and determining confidences.

3:00 PM  **Judging Science Part 1**  
Pablo Prando, LC-LM  
Meeting Room  

Mock Admissibility Hearing: Cross motions to exclude expert witness testimony  
Attorney led direct testimony of both expert witnesses  
Participants meet to begin formulating cross examination questions  

There will be read ahead material regarding a mock hydraulic fracturing case.  
Bill Carey, EES-14 & Robert Currier, C-PCS - mock expert witnesses  
Steve Scholl and Jerry Dixon - participating attorneys

4:45 PM  **Afternoon recap**  
Chuck Farrar, NSEC  
Meeting Room

5:00 PM  **End of Day’s Program**
Friday, April 6, 2018

8:00 AM  Morning Recap
Chuck Farrar, NSEC
Meeting Room

8:15 AM  Judging Science Part 2
Pablo Prando, LC-LM
Meeting Room
Participants continue to formulate cross examination questions
Attorneys available to assist
Participants conduct cross examination of both expert witnesses
Bill Carey, EES-14 & Robert Currier, C-PCS - mock expert witnesses
Steve Scholl and Jerry Dixon - participating attorneys

10:30 AM  Discussion & Break
Chuck Farrar, NSEC
Meeting Room

10:45 AM  Augmented Reality
David Mascarenas, NSEC
Meeting Room

11:45 AM  Lunch
Chuck Farrar, NSEC
Meeting Room
Social lunch with speakers and other scientists

1:00 PM  Judging Science Part 3
Pablo Prando, LC-LM
Meeting Room
Participant discussion and ruling on motions
Open dialogue about the case with expert witnesses
Bill Carey, EES-14 & Robert Currier, C-PCS - mock expert witnesses
Steve Scholl & Jerry Dixon - participating attorneys

3:00 PM  Exit Evaluation
Ellie Vigil, NSEC
Meeting Room
Evaluate participants’ understanding of the internship learning objectives after completing the program.

3:15 PM  Closing and Feedback
Chuck Farrar, NSEC
Meeting Room
Overview of the course
Feedback from participants

3:30 PM  End of Program