Submitting a CAREER Proposal

When is the best time to submit my CAREER proposal?

- When you have a good research idea and a well-developed, well-written proposal with:
  - An important problem, a compelling approach to solving it, and with promising preliminary results.
  - An “actionable” Broader Impact and Integration of Education and Research plan.

What program do I submit to?

- Read solicitations from candidate programs.
- Do an award search in FastLane using key works.
- **Talk to program directors.**

What if I choose the wrong program?

- Program Directors will find the best home:
  - The right community/right panel

What about the CRII program?

Should I submit to CRII first?

- CRII program is to enable young PIs to recruit graduate students, begin research, and get preliminary results that they for larger proposals to continue the work.
- A PI may not submit a CRII proposal in the same calendar year in which he/she submits a CAREER proposal.

What if my CRII award and CAREER proposal are on the same topic?

- You can't be funded by two project to do the same work.
- However preliminary results from the CRII can be used for a CAREER project—
  - be very clear on what has been/will be done with the CRII and what is proposed in a CAREER grant.

What if I have an institutional "start-up package", have a clear idea for a CAREER project and have preliminary results, do I need a CRII grant?

- If you are ready to submit a CAREER proposal, you do not need a CRII award

How will my proposal be reviewed?

Once in the right program, program directors:

- “Bin” your proposal into a panel that covers similar topics or requiring similar expertise;
- Assign to 3-5 panelists who are qualified to review it; (COIs are noted and no one with a COI is assigned to it or is part of the discussion.)
- Add additional ad hoc/mail reviews when needed.

How will my proposal be reviewed?

At the panel:

- Each panelist assigned to your proposal presents the
  - strengths and weaknesses of the
    - Intellectual Merit and
    - Broader Impact including integration of research and education.
  - Ad hoc reviews are also discussed.

- Panelists further discuss the proposal and place it in a recommendation category
  - (e.g. Highly Competitive, Competitive, Low Competitive, Not Competitive).

What do review panels look for?

- What problem are you trying to solve? Articulate your objectives using absolutely no jargon. (Clear summary)
- How is it done today, and what are the limits of current practice? (Related work)
- What's new in your approach and why do you think it will be successful? (Include preliminary work)
- Who cares? If you're successful, what difference will it make? (Impact)
- What are the risks and the payoffs?
- How much will it cost? How long will it take? (Budget; 5-year project?)
- What are the midterm and final "exams" to check for success? (Evaluation plan)

George H. Heilmeier, President and CEO of Bellcore

How are decisions made as to what to fund?

Multi-Stage Process:

- CISE has programs and/or clusters—
  - PDs holding the panel make recommendations from each panel
  - The clusters typically discusses competitive proposals across all panels to determine recommendations for funding
  - Intellectual Merit—must be good science
  - Broader Impact—must pass a bar of quality in terms of scope and “actionability”
  - Integration of research and education
- Clusters brief the division director (DD) and deputy division director for approval
- PDs write justifications, DDs concur, and send recommendations to Grants office
  - has up to 4 weeks to make an award

What do I do if I am funded?

A program director will typically contact you to:

- Negotiate budgets if necessary;
- Require you to address reviewers' concerns;
- Ask for your input into writing a public abstract;
- Follow-up on IRB approvals, if appropriate,;
- Require that you set up a CAREER award website to showcase results and Broader Impact activities;
- Explain the expectations for content for Annual and Final reports

What do I do if I am declined?

Understanding the reasons:

- Carefully read the reviews and panel summary and ask yourself:
  - Did I select an important problem and was I clear about what it is?
  - Did I explain, with preliminary results, that my approach is credible?
  - Are the concerns critical? Are they “show-stoppers”? Addressable?
- Wait a while, reread your proposal and the reviews and re-ask the above questions
- Talk to the program director about how to improve your proposal

If declined should I resubmit the same proposal?

- Ask yourself:
  - Is this (still) an important problem?
  - Has the topic/approach been overcome by events—someone else has a better idea?

- If the topic/approach still viable:
  - Re-write the proposal—more than what is said by the reviewers may be problematic
  - Update review of the literature and add work you have done since the last proposal
  - “Addressing the reviewer concerns” may apply only to the first panel and not to totally new set of reviewers

How do I handle a declination?

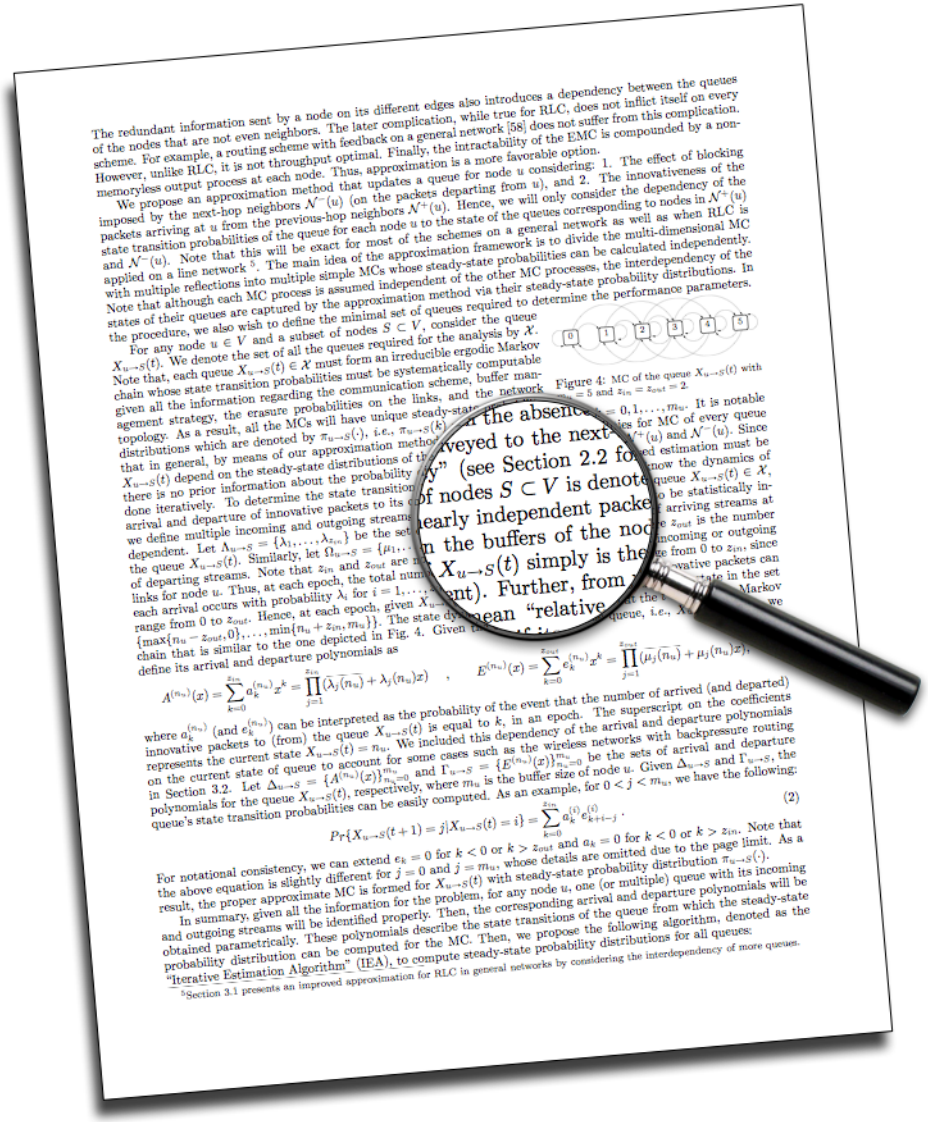
- Even the most accomplished PIs get
- It always hurts to get declined.
- Acknowledge the disappointment to yourself and move on.

Top Ten Mistakes to Avoid in Writing CAREER Proposals

CISE Mixed Advisory Taskforce on Technology, Education, Research and Science (CISE MATTERS)

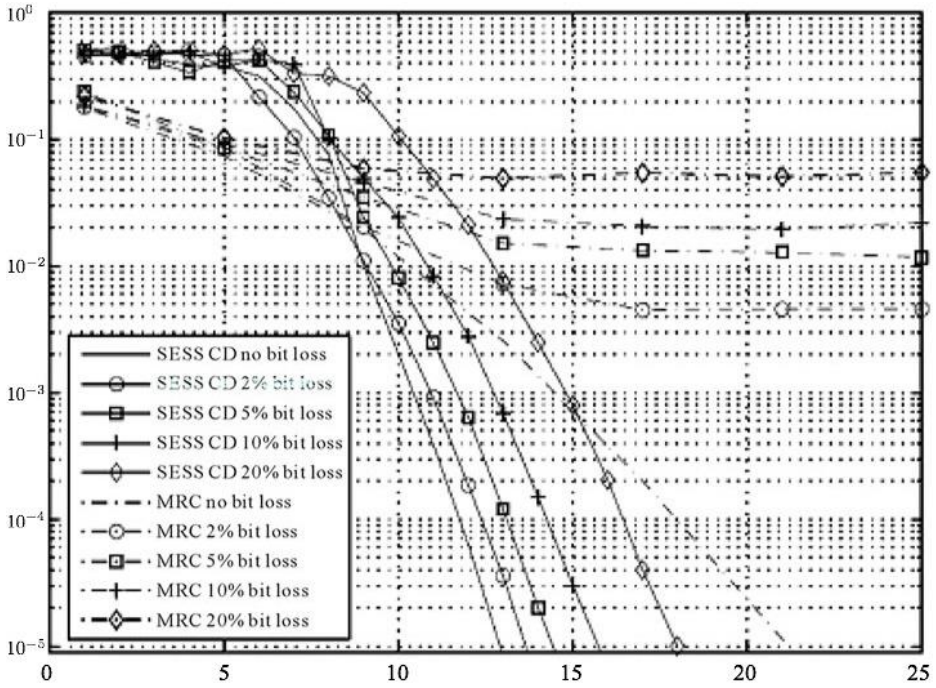
Number 10: Fonts Too Small

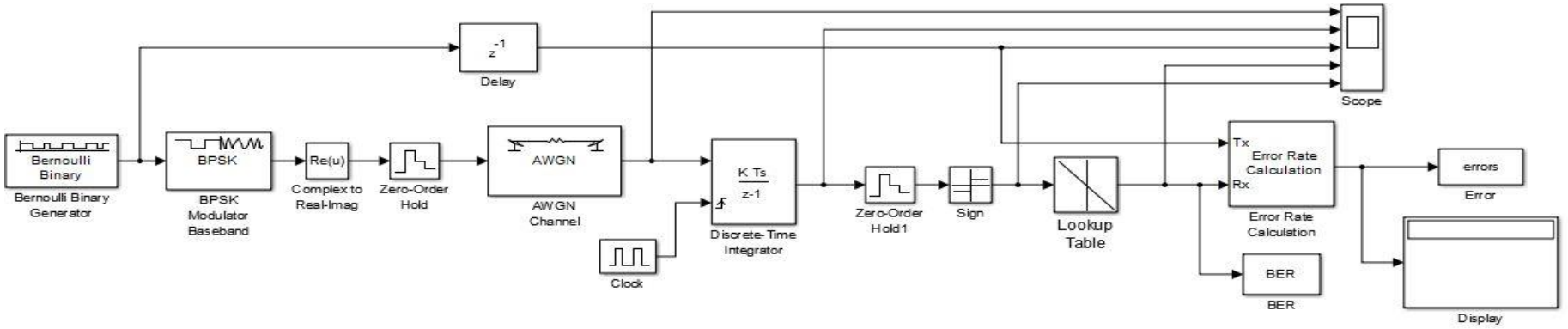
- Small fonts promote reader fatigue
- Reviewers DISLIKE small fonts
- PAPPG mandates:
  - 11 point font minimum
  - 1 inch margins
  - 6 lines max per vertical inch



Number 9: Figures Illegible

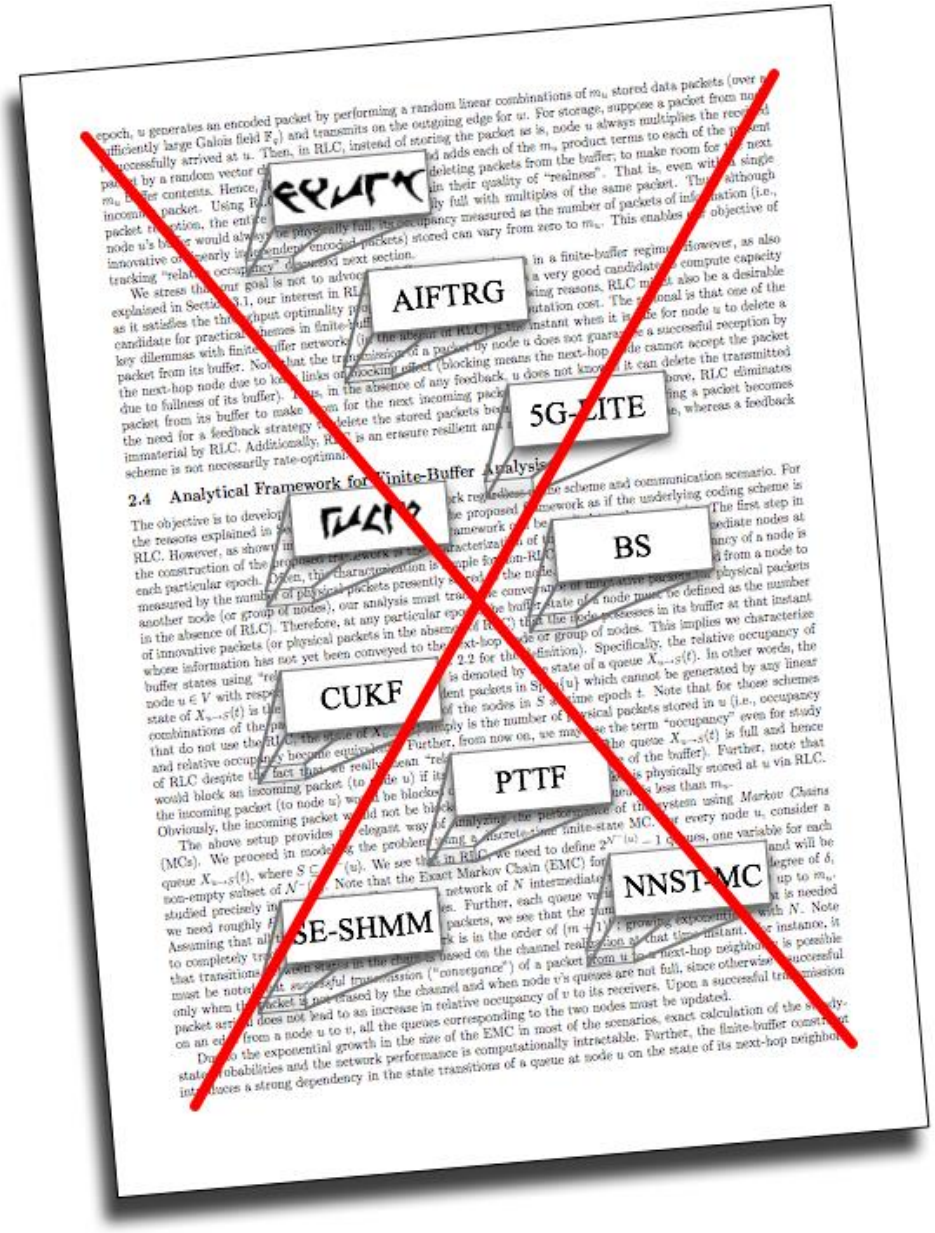
- Avoid “crowded” visuals
- Don’t assume reader will print in color
- Use vector graphic formats





Number 8: Acronyms and Abbreviations

- Acronyms constitute a **private language** that excludes the reader.
- Acronyms are often **cryptic**, and make text hard to read.
- Reader will NOT memorize your abbreviations!



Number 7: Dissing the Competition

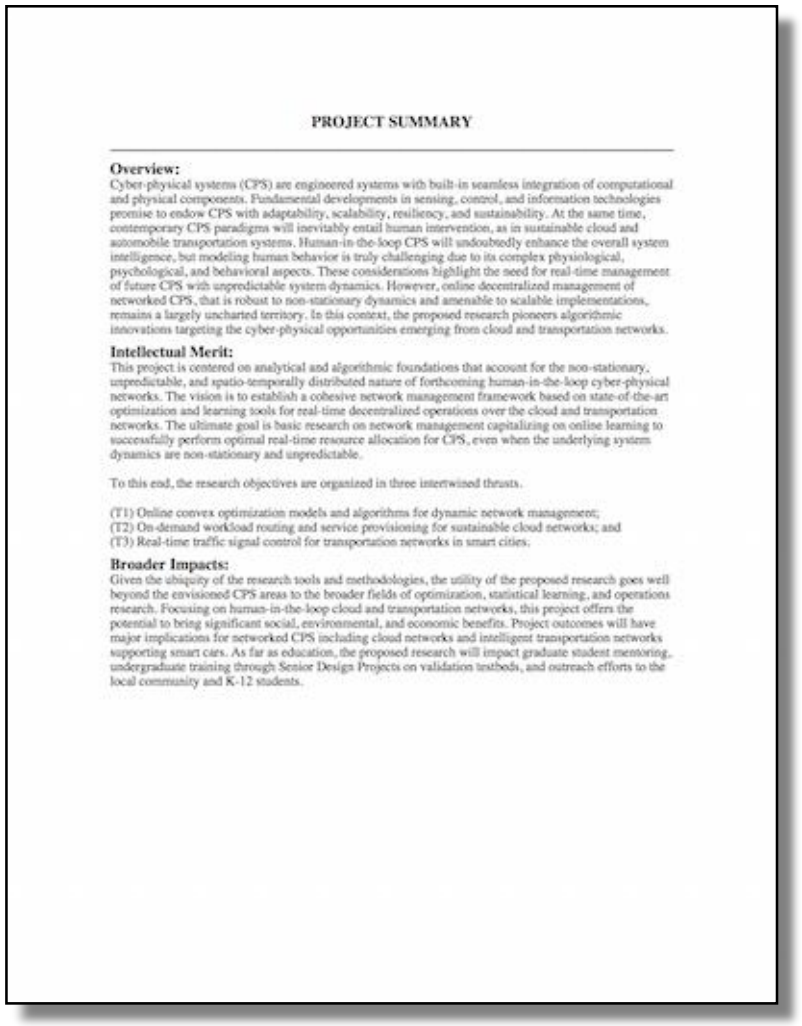
- Good idea: Citing others' work
- Bad idea: Slighting others' work

("Others' work" might be sitting on the panel)

Number 6: Poor distinction between preliminary results and proposed work

- Make a clear demarcation
- Distinguish your results from others’
- Identify obstacles you anticipate
- Highlight what you bring to the table

Number 5: Misleading Project Summary



PROJECT SUMMARY

Overview:
Cyber-physical systems (CPS) are engineered systems with built-in seamless integration of computational and physical components. Fundamental developments in sensing, control, and information technologies promise to endow CPS with adaptability, scalability, resiliency, and sustainability. At the same time, contemporary CPS paradigms will inevitably entail human intervention, as in sustainable cloud and automobile transportation systems. Human-in-the-loop CPS will undoubtedly enhance the overall system intelligence, but modeling human behavior is truly challenging due to its complex physiological, psychological, and behavioral aspects. These considerations highlight the need for real-time management of future CPS with unpredictable system dynamics. However, online decentralized management of networked CPS, that is robust to non-stationary dynamics and amenable to scalable implementations, remains a largely uncharted territory. In this context, the proposed research pioneers algorithmic innovations targeting the cyber-physical opportunities emerging from cloud and transportation networks.

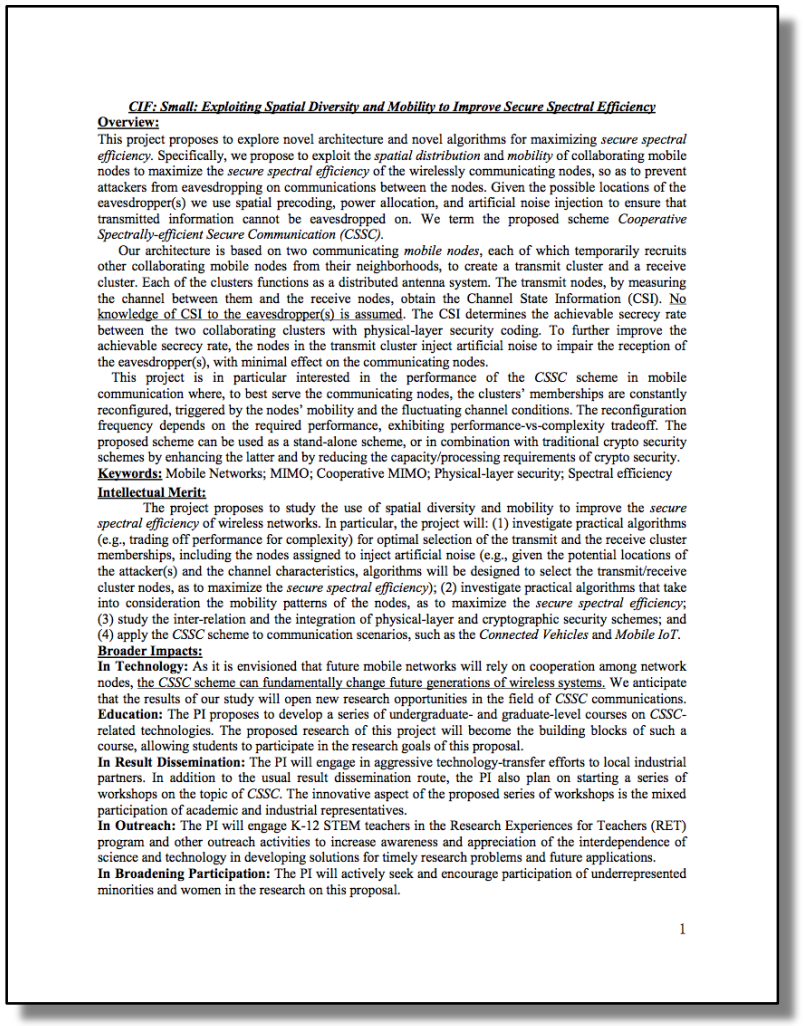
Intellectual Merit:
This project is centered on analytical and algorithmic foundations that account for the non-stationary, unpredictable, and spatio-temporally distributed nature of forthcoming human-in-the-loop cyber-physical networks. The vision is to establish a cohesive network management framework based on state-of-the-art optimization and learning tools for real-time decentralized operations over the cloud and transportation networks. The ultimate goal is basic research on network management capitalizing on online learning to successfully perform optimal real-time resource allocation for CPS, even when the underlying system dynamics are non-stationary and unpredictable.

To this end, the research objectives are organized in three intertwined thrusts.

(T1) Online convex optimization models and algorithms for dynamic network management;
(T2) On-demand workload routing and service provisioning for sustainable cloud networks; and
(T3) Real-time traffic signal control for transportation networks in smart cities.

Broader Impacts:
Given the ubiquity of the research tools and methodologies, the utility of the proposed research goes well beyond the envisioned CPS areas to the broader fields of optimization, statistical learning, and operations research. Focusing on human-in-the-loop cloud and transportation networks, this project offers the potential to bring significant social, environmental, and economic benefits. Project outcomes will have major implications for networked CPS including cloud networks and intelligent transportation networks supporting smart cars. As far as education, the proposed research will impact graduate student mentoring, undergraduate training through Senior Design Projects on validation testbeds, and outreach efforts to the local community and K-12 students.

Good



CIF: Small: Exploiting Spatial Diversity and Mobility to Improve Secure Spectral Efficiency

Overview:
This project proposes to explore novel architecture and novel algorithms for maximizing *secure spectral efficiency*. Specifically, we propose to exploit the *spatial distribution* and *mobility* of collaborating mobile nodes to maximize the *secure spectral efficiency* of the wirelessly communicating nodes, so as to prevent attackers from eavesdropping on communications between the nodes. Given the possible locations of the eavesdropper(s) we use spatial precoding, power allocation, and artificial noise injection to ensure that transmitted information cannot be eavesdropped on. We term the proposed scheme *Cooperative Spectrally-efficient Secure Communication (CSSC)*.

Our architecture is based on two communicating *mobile nodes*, each of which temporarily recruits other collaborating mobile nodes from their neighborhoods, to create a transmit cluster and a receive cluster. Each of the clusters functions as a distributed antenna system. The transmit nodes, by measuring the channel between them and the receive nodes, obtain the Channel State Information (CSI). No knowledge of CSI to the eavesdropper(s) is assumed. The CSI determines the achievable secrecy rate between the two collaborating clusters with physical-layer security coding. To further improve the achievable secrecy rate, the nodes in the transmit cluster inject artificial noise to impair the reception of the eavesdropper(s), with minimal effect on the communicating nodes.

This project is in particular interested in the performance of the *CSSC* scheme in mobile communication where, to best serve the communicating nodes, the clusters' memberships are constantly reconfigured, triggered by the nodes' mobility and the fluctuating channel conditions. The reconfiguration frequency depends on the required performance, exhibiting performance-vs-complexity tradeoff. The proposed scheme can be used as a stand-alone scheme, or in combination with traditional crypto security schemes by enhancing the latter and by reducing the capacity/processing requirements of crypto security.

Keywords: Mobile Networks; MIMO; Cooperative MIMO; Physical-layer security; Spectral efficiency

Intellectual Merit:
The project proposes to study the use of spatial diversity and mobility to improve the *secure spectral efficiency* of wireless networks. In particular, the project will: (1) investigate practical algorithms (e.g., trading off performance for complexity) for optimal selection of the transmit and the receive cluster memberships, including the nodes assigned to inject artificial noise (e.g., given the potential locations of the attacker(s) and the channel characteristics, algorithms will be designed to select the transmit/receive cluster nodes, as to maximize the *secure spectral efficiency*); (2) investigate practical algorithms that take into consideration the mobility patterns of the nodes, as to maximize the *secure spectral efficiency*; (3) study the inter-relation and the integration of physical-layer and cryptographic security schemes; and (4) apply the *CSSC* scheme to communication scenarios, such as the *Connected Vehicles* and *Mobile IoT*.

Broader Impacts:
In Technology: As it is envisioned that future mobile networks will rely on cooperation among network nodes, the *CSSC* scheme can fundamentally change future generations of wireless systems. We anticipate that the results of our study will open new research opportunities in the field of *CSSC* communications.
Education: The PI proposes to develop a series of undergraduate- and graduate-level courses on *CSSC*-related technologies. The proposed research of this project will become the building blocks of such a course, allowing students to participate in the research goals of this proposal.
In Result Dissemination: The PI will engage in aggressive technology-transfer efforts to local industrial partners. In addition to the usual result dissemination route, the PI also plan on starting a series of workshops on the topic of *CSSC*. The innovative aspect of the proposed series of workshops is the mixed participation of academic and industrial representatives.
In Outreach: The PI will engage K-12 STEM teachers in the Research Experiences for Teachers (RET) program and other outreach activities to increase awareness and appreciation of the interdependence of science and technology in developing solutions for timely research problems and future applications.
In Broadening Participation: The PI will actively seek and encourage participation of underrepresented minorities and women in the research on this proposal.

1

Fair

Number 4: Lackluster Education Plan

- Should be integrated with research plan
- Think **beyond** your present teaching duties

Number 3: “It wasn’t clear …”

Symptoms:

- Long-winded explanations
- Too many superfluous details
- Poor organization of thoughts into words

Remedies:

- Use fewer words
- Read first two pages aloud
- “Make every word tell”

Number 2: Confining yourself to your PhD work

- CAREER proposal should be forward-looking
- Move above and beyond your PhD work
- "Imagine a world …"

(yes)

(no)

Number 1: Research Plan lacking Cohesion

- Don’t staple together unrelated ideas

- Don’t offer a laundry list with no prioritization

- Don’t make everything look like a nail to your one hammer

- Tell a story with your narrative

Questions?

U.S. DEPARTMENT OF ENERGY | Office of Science

Writing good ECRP proposals

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- I have posted these slides to my linkedin page: https://www.linkedin.com/in/soniasachs/

High-Level Rules for Successful Proposals

1. **Good Problem:** Important, timely, exciting, challenging. Of high impact for DOE mission.
2. **Good Fit:** Why are you uniquely qualified to solve this problem?
3. **Promising Solution:** Why is your approach likely to succeed, better than prior approaches?
4. **Right Balance:** Different from your prior work but relies on your experience
5. **Good Story:** Weave a compelling narrative
6. **Right Program:** Has the DOE office you are applying to funded similar projects
7. **Enough Time:** Creative process takes time, requires iteration
8. **Follow Instructions:** Check restrictions on budget, required sections
9. **Role-Play as Reviewer:** What mistakes have you observed in things you have reviewed?
10. **Get Feedback:** Ask a mentor/peer to read it

Adapted From Prof. Mary Hall, U. Utah, SC'17

Good Story, Good Story, Good Story

- **Need to draw reviewers into your story**
  - Use Journalistic style
  - Each paragraph invites the reader to read the next one
  - Plan an impressive punch line in the first 1-2 pages
  - Everything that is essential need to be in the first few pages: leave details for the rest of the proposal
  - Chose a reasonable scope, be very clear with what you promise, don’t overpromise. Be plausible.
  - Use assertive statements

Good Problem, Promising Solution

- **Relevant to DOE, High Impact is anticipated**
- **Innovative ideas, not incremental**
- **Think Heilmeier Catechism (top 5)**
  - What are you trying to do? Articulate your objectives using absolutely no jargon.
  - How is it done today, and what are the limits of current practice?
  - What is new in your approach and why do you think it will be successful?
  - Who cares? If you are successful, what difference will it make?
  - What are the mid-term and final “exams” to check for success?
    - Have a thorough evaluation plan using DOE apps or mini-apps (like Mantevo)
- **Details need to be convincing**
    - Provide evidence
    - Make a convincing case that you’ll be able to deliver
    - Include risks, mitigation strategies, costs.

Good Fit, Right Balance

- **You have significant prior results in the area**
- **Your have unique background and experience to tackle the research**
- **You show leadership capabilities**
  - Impressive publication list for the number of years after PhD
  - Conference program committee member/chair experience
  - Working experience with the DOE Labs helpful
  - Working experience with industry may be helpful, depending on the topic
  - Awards, patents, copyrights, and other recognitions
- **You show that you understand DOE**
  - Program Managers and Reviewers know if you are taking a NSF Career proposal, making minor changes, and submitting it to the DOE ECRP program…

What else to consider

- Good targeted literature survey of the area
- Make sure to cite relevant work, acknowledge contributions while differentiating your approach
- Use real or realistic test cases (DOE Applications or mini-apps), to develop, validate or demonstrate your techniques.
- Understand the DOE practices (software, algorithm development, large apps)
- Pay adequate (but not obsessive) attention to polish, and to issues such as spell-checking, proof-reading, and layout
- Attend SC conferences
- Talk with the program manager (before the call is issued, timeline is similar every year)
- Get a mentor/collaborator at a Lab
- ECRP is extremely competitive
- Don’t wait until the last year of eligibility to apply
- Don’t give up, learn as much as you can from a declined proposal