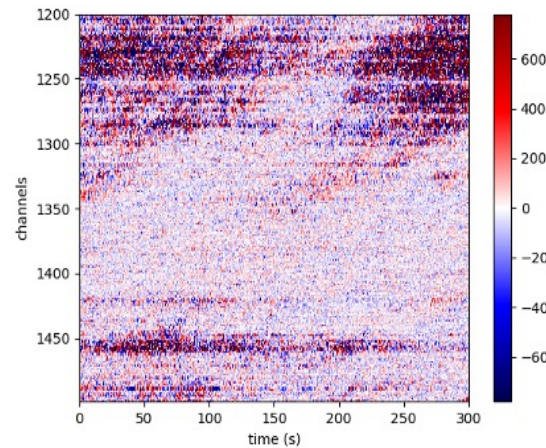
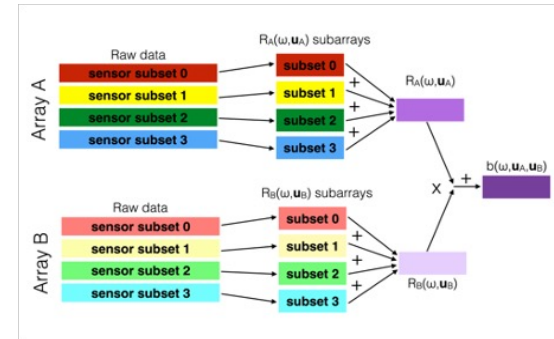
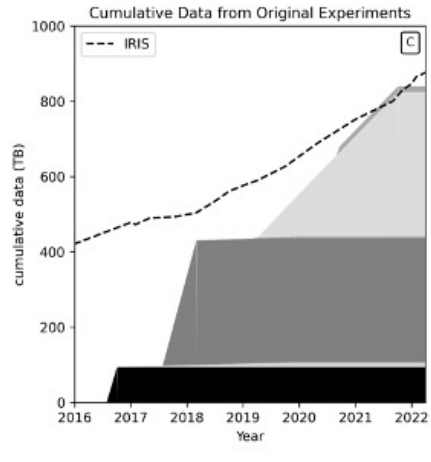


# Scalable Computational Seismology for All

- an OAC CAREER proposal-



Eileen R. Martin / NSF 2227018

Associate Professor, Dept. of Geophysics, Dept. of Applied Math and Statistics, Colorado School of Mines

eileenmartin@mines.edu

# Interdisciplinary background



B.S. in math, B.S in  
computational physics  
(2008-12)

Ph.D. in computational and  
mathematical engineering (2012-18)



M.S. in geophysics  
(2016-17)

Assistant professor of  
math (2018-21)

Assistant professor of  
geophysics, and of  
applied math and  
statistics (2022-24)

# First attempt – DOE YIP in **early 2019**



B.S. in math, B.S in computational physics (2008-12)

Ph.D. in computational and mathematical engineering (2012-18)

Assistant professor of math (2018-21)

Assistant professor of geophysics, and of applied math and statistics (2022-24)



M.S. in geophysics (2016-17)

Motivation? Better sense of what DOE cared about from prior experiences.



DOE CSGF Fellow (2012-2016)



Affiliate, geophysics department (2016-20)

# 1st attempt – DOE YIP in early 2019



unsuccessful

- Proposed topic:  
*"Real-time Compression and Summarization for Large-scale Streaming Sensor Networks"*
- Reviewers:
  - 4 x encourage funding
  - 1 x discourage funding
- Lessons learned from reviewer comments:
  - Have a concise statement of objectives
  - Articulate connections and dependencies between tasks
  - Need a gradient of specificity
  - Make it clear what new work requires funding to continue (especially when using startup \$ for preliminary results)

# Late 2019 – struggle to find an NSF program

- Computational Math:
  - My colleagues told me this was the program I needed to apply to
  - The program manager gave me clear, discouraging comments:
    - I needed to do less algorithms and applications, and more math
    - I needed to get a regular computational math NSF grant before applying for a CAREER grant
- Geophysics:
  - Most applications I work on require new geophysical methods
  - I had a strong reputation in the geophysics community, but I was a math faculty
  - Geophysics program didn't support methods research
- Civil, Mechanical and Manufacturing Innovation:
  - Aligned with urban geophysics and infrastructure applications
  - I had gotten an EAGER grant on a different computational civil eng. problem
  - Reviews would be extremely dependent on openness of civil engineer reviewers to new geophysical/computational methods

# Considering program(s):

Did you know you can apply  
for a CAREER grant with a  
secondary program review?

Thanks for this advice, Leah Johnson!



# Looked at recent CAREER awardees' programs

and tried to look for researchers "like me"

## Awards made through this program

Browse projects funded by this program

Map of recent awards made through this program

> Organization(s)



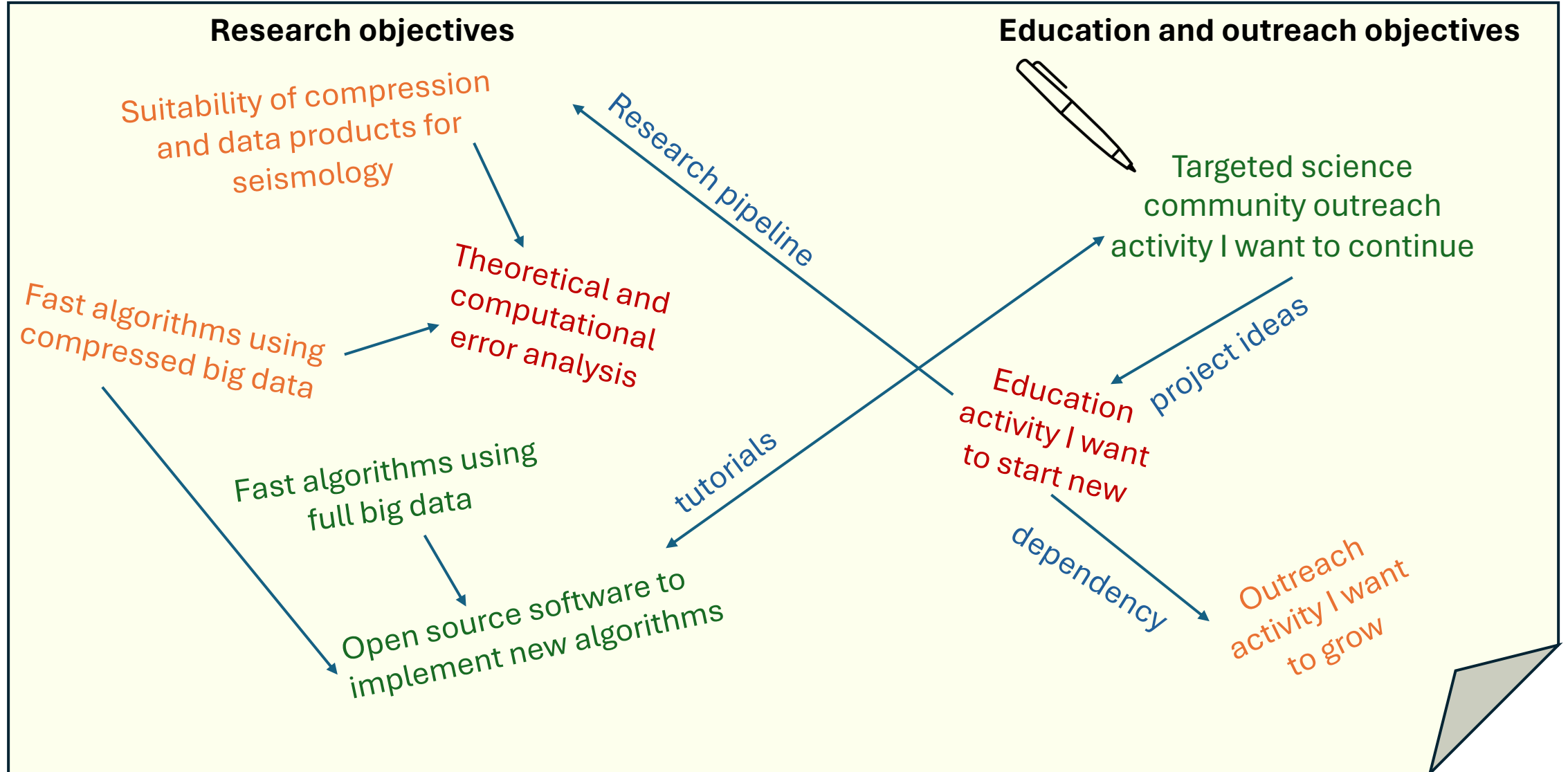
- Sent a one-pager to program manager, Alan Sussman
- Had a phone call and confirmed alignment with OAC, with ability for secondary review by EAR/Geophysics

Found computational scientists with **OAC CAREER** grants with titles indicating applications:

- Amanda Randles
  - Biomedical engineering
- Tan Bui-Thanh
  - Aerospace engineering
- Aparna Chandramowlishwaran
  - Electrical engineering, computer science

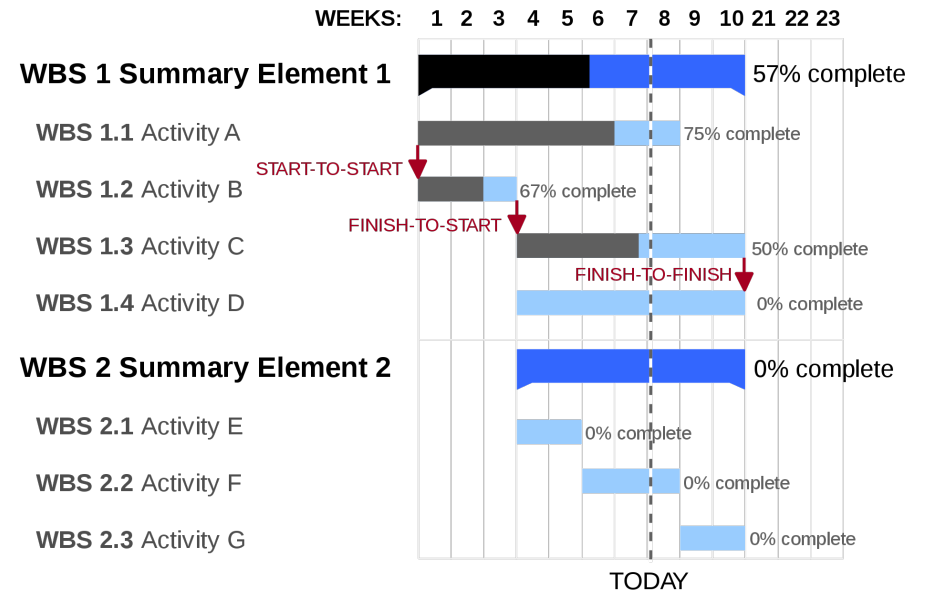
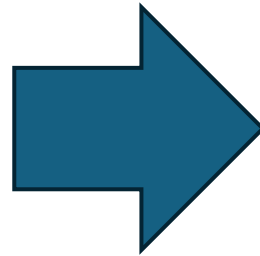
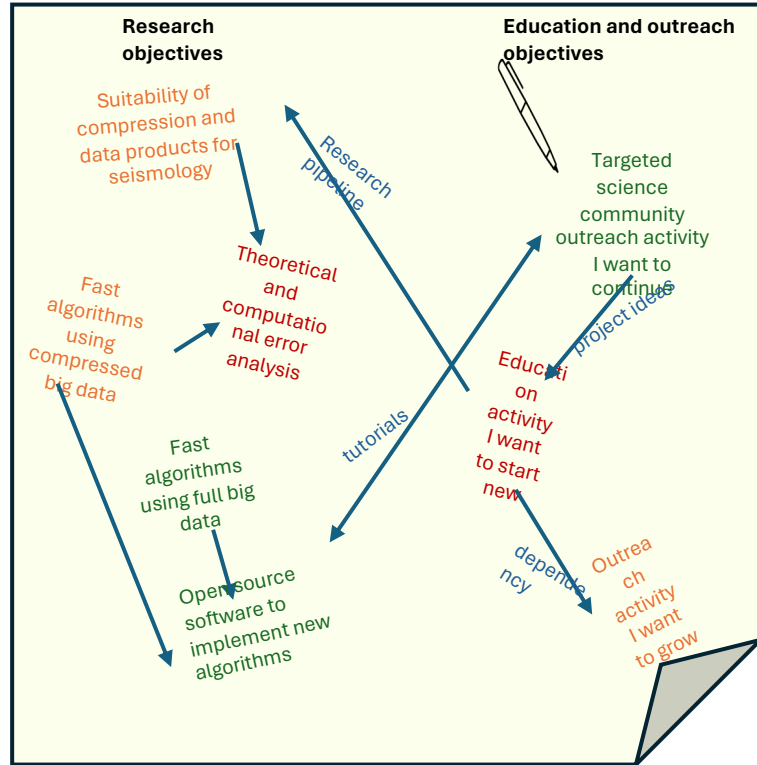


# Planning process on giant paper – happening while choosing program





# Planning process on MORE giant paper



Example Gantt chart, figure from Garrybooker on Wikipedia

# Process to refine writing

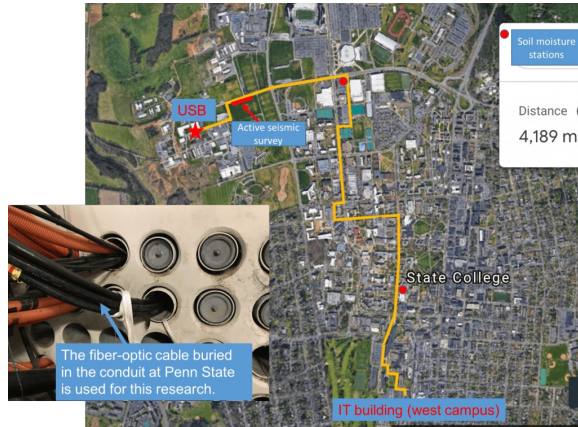
- Junior faculty proposal writing group
  - Focused on summary and intro
  - Questions from people in other fields
  - Reduced jargon
- Got copies of successful CAREER proposals from coworkers
  - Organizational structure
  - Ways to **make important points stand out**
  - Strategies to integrate research with education/outreach



Source: Jeremy Keith, Wikipedia

# Showing connection to targeted science community

Start discussions at least one month (ideally more) before application due



Use case #1: urban seismology  
Penn State FORESEE Array Data

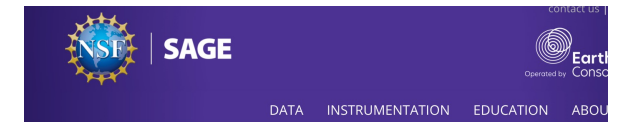


Education and outreach:  
Earthscope



Use case #2: cryoseismology  
Rhongletscher Data

Figure from Idefix on Wikipedia

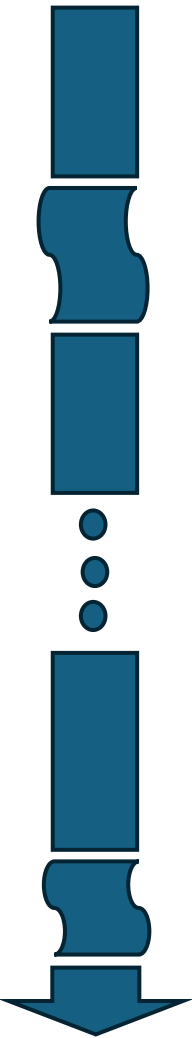


HOME / INITIATIVES / DAS RCN

**Distributed Acoustic Sensing (DAS)  
Research Coordination Network (RCN)**

Education and outreach:  
DAS Research Coordination Network

# Summary of preparation and award timeline:

- 
- August 2019, Got rejection and reviews from DOE YIP
  - October 2019, Started slowly planning for NSF CAREER
  - March 2020, Re-learned how to teach and support students
  - Mid-to-late April 2020, resumed working on proposal
  - July 2020, Submitted NSF CAREER proposal
  - January 2021, "Recommended for funding" note
  - June 2021, Actually got notified of funding moving forward
  - July 2021, Award started at VT
  - January 2022, Moved to Mines and replanned education/outreach



# Biggest impact: continuously sustained funds in this key research theme helped support critical mass of research on related projects



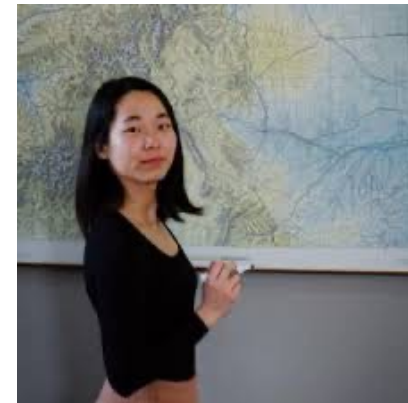
**Sam Paulus**  
undergrad at VT, now at  
Northrop Grummon



**Joseph Kump**  
MS at VT, now PhD  
student at UT Austin



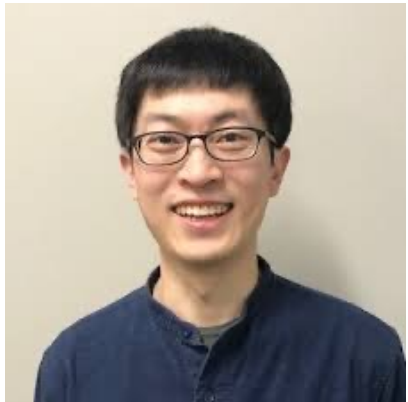
**Julius Grimm**  
MS in IDEA League, now PhD  
student at ISTERre Grenoble



**Seunghoo Kim**  
undergrad at Mines,  
now PhD student at Stanford



**Ahmad Tourei**  
MS & PhD at Mines



**Shihao Yuan**  
Postdoc at Mines



**Nikhil Punithan**  
MS at Mines



**Georgia Brooks**  
MS at Mines



**Hafiz Issah**  
PhD at Mines



**Rachel Willis**  
PhD at Mines