NSF SOARS®

Community Outreach Meeting

July 9–10, 2024

UCAR | COMMUNITY PROGRAMS

NSF | research | mentoring | community SOARS®

U.S. National Science Foundation
Significant Opportunities in Atmospheric Research and Science (NSF SOARS®)

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NSF SOARS®

Executive Summary

On July 9-10th the NSF SOARS Leadership team (NSF SOARS Team) convened a community outreach meeting for the purpose of discussing the future of NSF SOARS. The NSF SOARS® team wants to revolutionize and expand the delivery of experiential and scientific training programs in order to nurture and retain student interest in the Earth System Sciences (ESS). The goal is to increase student access to the ESS field by utilizing creative and innovative methods, cutting edge collaborations with the private sector, and expanding the interdisciplinary reach of the ESS field. The program team challenged the participants to ideate on how NSF SOARS® could evolve to meet the needs of students and the workforce. Goals for the meeting included:

1. Evaluate what is working and what could be improved in how the NSF SOARS program currently operates
2. Re-envision the future of the NSF SOARS program to meet evolving needs of students

Method

The attendees met over a day and half to discuss the strengths and opportunities for improvement at NSF SOARS, the needs of ESS enterprise represented at the meeting, and future funding potential and sustainability. The NSF SOARS team separated the participants into groups to cover the topics (i.e., 'sector needs of today and tomorrow' and 'dreaming the future') presented in the agenda (APPENDIX X) and used a series of padlets to cover the discussion points. Over lunch participants had the opportunity to meet with Proteges and listen to their perspectives. Meeting minutes and the padlets were combined into this report for future reference.

The suggestions from this meeting included below will be used for both 1) developing a renewal proposal to the U.S. National Science Foundation (NSF) for continued funding of NSF SOARS and 2) finding extramural funding and sponsorships to support the expansion of the program beyond the scope of what NSF typically funds.

Findings

Participants in the meeting, listed below, identified three (3) key areas for exploration in the upcoming proposal: Essential Skills, Building on Current Program Success, and Exploring Career Pathways.

Essential Skills

Proteges must develop essential skills to thrive in future work across the ESS Enterprise in the 21st Century. Communication skills, including writing, presenting, summarizing, and creating visuals or posters, are crucial, with particular emphasis on science writing for clear and persuasive dissemination of complex ideas. Additionally, the ability to lead, contribute to, and organize proposals is vital, supported by robust project management skills for Principal Investigators (PIs), including budget development/execution and team leadership. Mastery of coding and computational skills, including Python, GIS, R, Linux, GitHub, and machine learning or AI applications, is increasingly important in today's technological landscape. To ensure Proteges remain adept and competitive, current professional development workshops during the summer program must be reimagined and continuously updated to keep pace with evolving technologies.

Building on Current Program Success

Participants recommended continuing to leverage the unique strengths of NSF SOARS, including its multi-year structure, the formation and nurturing of supportive cohorts, and exposure to the ESS enterprise. The program should incorporate metacognition into professional development sessions and expand the holistic approach to mentorship and coaching. This should include encouraging Proteges to reflect on their future career paths, fostering self-awareness, and professional growth. The program could emphasize the use of student journaling and blogging, as alternative forms of technical writing, to enhance writing skills and support metacognitive practices. This comprehensive strategy is designed to cultivate well-rounded, self-aware professionals, making it a compelling investment opportunity for those looking to support the next generation of scientific leaders.

Exploring Career Pathways

A strength of NSF SOARS is the potential for exposure to a variety of career paths within the ESS enterprise across academia, the private sector, NGOs, and within local to federal government. To facilitate this, a structured progression of career exposure across different sectors is suggested, complete with defined learning objectives and more structured experiences in the first year that will evolve with multi-year involvement. Additionally, leveraging the experiences and career trajectories of alumni will be a key resource in this initiative. Anecdotal evidence has shown that there is significant enthusiasm from Proteges in understanding the potential societal impacts of these career pathways as motivation to pursue ESS. This approach aims to provide Proteges with a comprehensive understanding of potential vocations and their societal contributions in order to continue to entice participation across roles.

Meeting Report

Background:

The NSF SOARS program is supported by the U.S. National Science Foundation (NSF) under the Award #2230301. Established in 1996, NSF SOARS is dedicated to promote research, mentoring, and community for students pursuing atmospheric science, ESS, and related sciences. For 28 years, 269 undergraduate students, known as Proteges, have participated in NSF SOARS®, some of whom have become leaders within the Earth system science community. Annual funding for SOARS® by NSF has decreased from $816,513 in 2020 to $642,976 in 2025. The University Corporation for Atmospheric Research (UCAR) is committed to amplifying the program and is seeking ways to increase the capacity, security and longevity of NSF SOARS by expanding the funding and using the 28 year old legacy to build a revolutionary, experiential scientific training program. In March 2025, UCAR will submit a proposal to NSF describing how the program will evolve to remain the ESS leader in undergraduate-to-graduate career and research pathways programs.

Attendees:

Representatives from the ESS community within the private industry, academia, and government as well as team members from UCAR University Community Programs (UCP) and U.S. National Science Foundation National Center for Atmospheric Research (NSF NCAR) were invited to participate in the two (2) day meeting. Below is a list of attendees, in no particular order, with NSF SOARS alumni designated with an asterisk*.

NSF NCAR|UCAR|UCP	Private Industry	Government	Academia/REU
• Becca Hatheway - SciEd/NSF SOARS • Marissa Vara - SciEd/NSF SOARS • Kadidia Thiero - SciEd/NSF SOARS • Sarah Swanson - UCAR • Liz Mulvihill - UCAR UCP ETC • Rebecca Haacker - NSF NCAR EdEC and Former NSF SOARS PI/Program Lead • John Ristvey - UCAR UCP • Claire Mowry - UCAR UCP • Curtis Walker* - NSF NCAR RAL	• Kevin Petty - Aeris LLC • TJ Mattimore - Vaisala Inc. • Scott MacKaro - Vaisala Inc. • Eva Ramm - Vaisala Inc. • Josh Hacker - Jupiter Intelligence	• Aaron Piña* - U.S. Forest Service • Alisha Fernandez* - Department of Energy's Pacific Northwest National Laboratory	• Richard Clark - Millersville University and UCAR Member Representative • Jo-Anne Manswell -Butty- NOAA Center for Atmospheric Science and Meteorology at Howard University • Becca Edwards - Cooperative Institute for Research In Environmental Sciences • Debra Bolton - Haskell Foundation, Education and Research Fellow • Wendilyn Flynn - University of Northern Colorado, Greeley and UCAR President's Advisory Committee on University Relations (PACUR) Member

Community Discussion - July 9th Morning

NSF SOARS Overview

Kadidia Thiero, former NSF SOARS Principal Investigator/Program Lead, presented an overview of the NSF SOARS multi-year program and its holistic approach to the mentor model including the three essential pillars of NSF SOARS: Research, Mentoring, Community. The primary discussion points and questions focused on the following:

1. Participants asked about how Proteges develop their science identity over the course of the Program including learning the type of research they enjoyed and what they did not want to do in the future. Questions were also asked about how they keep in touch with administrative staff and alumni. NSF SOARS leadership support participants throughout the year when requested, and there is support for preparation and attendance for professional conferences and opportunities to attend alumni events throughout the year.
2. There was some discussion about how the multiple mentor model works (i.e., mentor training and how mentors were vetted and supported). While the multiple mentoring model (i.e., research, communications, computation, peer, and coach for first-year Proteges) has been part of NSF SOARS in the past, it creates competition for the limited number of scientists available (with increased number of internships at NSF NCAR) and it is not certain how it would translate in other sectors. Is there a way to modernize the mentoring pillar (e.g., team projects, near peer mentors, mentors from organizations in all sectors)?
3. There was discussion across the sectors on how the multi-year potential of NSF SOARS works. Alumni in attendance shared the experience of returning to Boulder to continue to build on skills they had learned in the previous years. Proteges can return for up to four (4) years. Short-term and long-term goals are set every year a student participates, and can carry throughout returning years.
4. Members of the government and private sector questioned whether there continued to be alignment between the purpose of NSF SOARS as managed by UCAR and what the community needs. They questioned whether the goal was or should be to exclusively produce researchers within atmospheric sciences. If that was the case, then the business model should reflect a more intensive experience exclusive to that goal.

Strengths and Opportunities for Improvement

Marissa Vara, UCP Higher Education Specialist, led a discussion on NSF SOARS strengths and weaknesses. The sector representatives discussed the following aspects of the presentation:

Strengths

1. Importance of Scientific Writing
    a. Scientific writing can be challenging for some at other levels of NSF NCAR/UCAR. Writing coaches have been provided for early career staff.
    b. Writing is a great way to help people think. Talking through the problem and articulating it.
    c. Artificial Intelligence (AI) in the writing process is a tool that should be considered to critically evaluate writing.
2. Research Papers
    a. Across the sectors, the NSF SOARS team was encouraged to continue to provide opportunities for a variety of writing opportunities. It was thoroughly emphasized that writing skills are incredibly important across the sectors.
    b. Research papers are important in a large part of the private sector. The process of writing a research paper (e.g., iterations, responding to peer review) is valuable in all sectors.
    c. Suggestion from the group was to have mandatory writing assignment options (e.g., research paper, technical report, policy briefs) during the years in NSF SOARS.
3. Academia vs Private Sector
    a. The NSF SOARS team shared that there is a trend in the surveys of Proteges saying they plan to go into the private sector instead of academia. Given these trends, private sector representatives questioned whether UCAR continues to be in a strong position to create pathways into the careers that students want to pursue. The NSF SOARS team believes that UCP/UCAR continues to be in a good position to lead this effort and is well positioned to expand into the private sector.
4. Be Unique (How is NSF SOARS different from other Research for Undergraduate (REU) programs)?
    a. One (1) of three (3) items in the purpose statement (APPENDIX X) was unique to other REUs. Factors such as the offsite in industry is not seen in the other organizations.
    b. The advantages of a multi-year program
        i. It can take two years to fully understand the research process.

ii. NSF SOARS excels in the area of establishing a community within each summer cohort. REUs attempt this, but not at the same level as NSF SOARS.
iii. Returning Proteges can mentor Proteges earlier in their NSF SOARS tenure.
iv. A more in depth research project can take multiple years to complete.

The participants were split into groups by sector and asked the following questions:

1. What challenges are students facing in undergraduate and graduate degree programs?
    a. Understanding that challenges are part of the process - failure is a critical part of learning (external vs. internal motivation and they may be used to getting "As" in high school)
2. What do they need to smoothly transition between them?
3. How does NSF SOARS fit/complement the educational profile/ecosystem of UCP|NSF NCAR?

Challenges

1. Understanding that challenges are part of the process - failure and growth is a critical part of learning (external vs. internal motivation & they may be used to getting "As" in high school)
    a. Research is different from learning concepts.
2. Some institutions tend to approach students with a deficit lens, which contributes to imposter syndrome and low self-esteem , academically.
3. Exposure to a variety of STEM experiences not typically offered at a student's home institution can be difficult to navigate.
    a. As with most research experiences, NSF SOARS mentors are the primary influence (.e.g. develop project ideas, guide research, assist in making research decisions, communicating research findings)
4. Navigating this AI world (e.g., ethical challenges, understanding the ability to seek and apply opportunities to benefit humanity)
5. Preparation to choose and enter a workforce

a. Unaware of job prospects outside of academia (especially private sector), can be demotivating.
b. Integrating "career skills"/"power skills" into a curriculum that's already packed - they need these regardless of their path.
c. One area of improvement, and this may already have occurred, is to expose Proteges to 'other' pathways where they can use their skills and experience outside of the universities/labs and common agencies/organizations that hire them. This does happen organically, but seeking out individuals from other career sectors to come meet Proteges/interact with the program would always be helpful.
d. Focus on identity building and how to integrate one's true self in doing science.
e. Coping mechanisms/grit. Giving permission to self-advocate
f. Communication skills are key

Promote Smooth Transition

1. Demystify the process & structure of graduate programs, "how to do research," what will be expected of them, and what to expect from their mentors.
2. Setting high expectations and normalizing challenge
3. Create a supportive peer environment to help students gauge their experience ("is what I'm going through normal?")
    a. The importance of team-based interdisciplinary work and peer learning
    b. Thinking about alumni as near peer mentoring
4. Emphasize understanding and appreciating the similarities and differences in work styles between the mentor and mentee
    a. Not creating 'mini-mes'
5. Remind students that research is not the only important aspect of the experience
6. Accountability and leadership change from early to mid-careers

NSF SOARS complements the Ecosystem of UCP|NSF NCAR

1. NSF SOARS was envisioned as a pathway to an atmospheric science career using primarily research at NCAR. Future NSF SOARS could be seen as a

pathway to the Earth System Science Enterprise including exposure to work done in all sectors (i.e., private, academic, government).

   a. Why is Future NSF SOARS(addressing the Earth System Science Enterprise) something that UCAR should be leading?

2. Creating pathways to the sciences is one of the greatest ideals present in education.
   a. The importance of having a 'safe space' for career exploration
3. As NSF SOARS continues training research mentors on working with students in a bi-directional model, it will help create a supportive research environment at NSF NCAR|UCAR|UCP.
   a. Rather than taking away stressors, work with Proteges about how to handle the stresses. No one does that for you in the 'real world.'
4. We also have to identify if we are sending "producers" or "thinkers" out into the workforce. Having come from higher education, it seems like our goal is to send "producers" with wealth being a goal rather than stewardship of the natural world for, at least, seven generations into the future.

Sector Needs of Today and Tomorrow Part 1

Liz Mulvihill, UCP Education and Training Center (ETC) Director, set the stage for individuals to gather in breakout rooms by sector: private, government, academia (virtual and in-person). Members of each group were asked to consider the professional gaps within their industries and specifically:

1. How does a program like NSF SOARS support those needs?
2. What skills do students need to develop both in formal settings (e.g. in classrooms) and "super" skills (e.g. communication)?
3. What credentials accelerate career pathways (e.g. do students really need PhDs?)

Gap Needs

1. All/MAJORITY
   a. Aid students to discover new careers by creating a pathway to research while helping students explore other pathways to science.
   b. Empower students to use self efficacy measures to express science identity.

   c. Extensive writing experience critical across the board.
2. PRIVATE SECTOR
   a. Emphasize the importance of fundamentals/foundational skills.
      i. Writing Expertise
      ii. Oral presentations
      iii. Media training
      iv. Active listening
      v. Interpersonal Skills
      vi. Computation
      vii. Networking/Relationship Building
   b. Share mentoring expertise with private sector
   c. Create a pathway to research while helping students explore other pathways to science.
   d. Consider that exposure to business skills is better than relying on NSF SOARS to teach business skills. Private sector will teach Proteges when they are hired.
3. ACADEMIA
   a. Expose students to careers they may not be familiar with, provide the opportunity for students to interact with mentors in the field, and allow students to have practical and relevant experiential training that can lead to relevant workforce opportunities and graduate school opportunities.
   b. Provide mechanisms/opportunities that universities cannot - the holistic learning and engagement opportunity.
   c. Professor/Research Scientists: what they think research is vs. what it actually is (e.g., lead by example, emphasize teamwork and project management skills).
   d. Exploratory/transdisciplinary research are typical in academia
4. GOVERNMENT
   a. Currently NSF SOARS does not support these needs to fill the gaps for the workforce entering government positions.
   b. Proteges need to develop writing and communication skills that are concise and can be understood by a general audience.

c. Proteges need to meet people who work in government, including people in Congress and the Senate.
d. Government Applications and Interviews
    i. Help students understand the nuances of a USA Jobs resume
    ii. Interviewing skills - Demonstrate thinking on one's feet in order to provide a solution to a real world problem.
e. Expose Proteges to budgets and how to justify grants.
f. How to ask the right questions.
    i. Some of the most intelligent speakers and leaders in meetings don't dominate, but ask the right questions that take the conversations in the direction you need the group to go. Graduate school is a lot of passive learning. Need to learn how to create an atmosphere where people can learn and grow. Critical thinking aspect, how are we honing in, how can we teach to be a critical thinker and look at policy/bill (could be contrary to your personal beliefs), then you have to defend it.

Formal settings and "super" skills

1. All
    a. Communication, Networking, Social Interactions
    b. Working with different data/file types
    c. Knowing different coding/data processing
    d. Sankey diagram is widely used - take coding skills and create a visual way to communicate
    e. Classes on visual analytics - people want better than bar graphs and pie charts now
    f. GIS is very useful
    g. Cloud computing and data analysis/statistics
    h. Computationally: python, github, SME-AI, applied some sort of machine learning/AI
    i. How to write a proposal for each sector

2. PRIVATE
    a. Creative Multi-tasking Problem Solving

b. User-centric design thinking .
    i. How to find the gap between community and customers.
    ii. How to create a product that meets the customer's needs. You can find product managers. You can find scientists. It's hard for scientists that can be product managers.
c. Networking
d. However, in an effort to do more the program should be mindful to not lose the importance of concentrating on teaching fundamentals. Exposure is beneficial so engaging in programs and sitting in those places will provide access to needed skills.
e. No one size fits all to private industry. There are various company stages, how they are structured, and business model. Take caution when building a one-size fits all, except for fundamentals. Do have to open doors.

3. ACADEMIA
    a. Education framing, "Soft-skills", résumé writing - federal, conferences - networking, etc
    b. In atmospheric science:
        i. computational dynamics,
        ii. Minors: core and foundational dynamics
        iii. Second (2nd) degree programs: coding, programming, exposure to machine learning, statistical analyses,
    c. Leading the charge with change (software, branching out and championing internal changes)
    d. Conflict management
    e. Management skills
    f. Teaching “Best practices” and modern approaches to make their teaching more effective
    g. How to Mentor
4. GOVERNMENT
    a. Global climate models - how to access and collect/download data
    b. Writing Skills
        i. Scientific writing skills are key and applicable to any professional sector Proteges enter into after leaving the program.

ii. Learn how to write a proposal for research topics for fellowships. This will transfer to writing proposals in the future for grant funding or any endeavor for project work.
iii. Writing a peer-reviewed paper.
iv. Writing an abstract on the same work in different ways to distinct audiences, e.g., conferences or groups to present the work (oral presentation versus a conference paper).
v. Telling the story: this would begin as having an overall vision of what the need and scope of what is being achieved/studied, how to break it down to different audiences, and having the skill to place the correct amount of detail on the storyline on the presentation/paper so the work reaches a wide audience

c. Proposals
   i. Create a budget
   ii. A timeline
   iii. Learn how to fund your work, how to develop the right team to fit that budget and accomplish the work you want to do.
d. Communication skills:
   i. Technical writing,
   ii. Writing memos,
   iii. Oral communication (presenting at workshops and annual conferences)
   iv. How to create a concise but impactful powerpoint presentation that engages the audience and allows for 2-way conversation
e. Relationship building - public/private partnerships
f. Foundational science and connecting to the public on why this matters (science serving society)
g. Basic science, operations, applied science

Acceleration Credentials

1. PRIVATE
   a. Masters or Doctorate. It is possible to demonstrate PhD experience without a PhD. PhD provides an idea of where a potential employee may

fit in the field. However, a PhD can impact you negatively because a PhD can narrow you so much that you can't expand the box.

b. For certifications, AMS has some preferences, however, overall not as important. We have to retrain them anyway.

2. GOVERNMENT
    a. Doctorate, Masters, and Bachelors
        i. USFS fire weather and atmospheric science - most people need a PhD to lead at the lab level, but a software engineer in this group would need a bachelors, support scientists need Masters
        ii. A Masters degree combined with experience in the field can meet job requirements
        iii. Policy fellowships require a PhD
3. ACADEMIA
    a. Credentials to accelerate pathways
    b. Technical skills - Python, GIS, R, Linux, coding
    c. Interpersonal skills, interdisciplinary approach - physical science with social science.
    d. Develop an interdisciplinary course with minimal prerequisites that will attract students from different disciplines to engage in a project - like a wicked (tough to solve) problem, and work on reasonable transdisciplinary solutions.

Community Discussion - July 9th Afternoon

Proteges Conversation Debrief

Attendees were joined for lunch by the majority of Summer 2024 Proteges. The students were scattered at each table and were encouraged to ask questions to the representatives from the government, private and academia. Upon returning to the meeting room, Marissa Vara led a debrief on what the attendees had learned.

What's working well and what could be improved?

1. NSF SOARS values of community and holistic approaches to the students is appreciated.

2. The mentorship program is beneficial; however, the students would like more in-person meetings rather than virtual.
    a. Face-to-face interactions are valuable. There are fewer of these types of interactions compared with before the pandemic.
    b. Workshops on writing resumes and participating in interviews would be valuable
3. Proteges want more exposure to career possibilities. It is valuable to take advantage of the opportunities to meet representatives from different ESS sectors in order to understand the many possibilities in the field. One suggestion was to create videos to highlight the pathways of successful representatives from each of the sectors. Note: COMET has produced some *Careers in the Weather, Water and Climate Enterprise* videos that could be used for this purpose. Link: https://www.youtube.com/playlist?list=PLsyDl_aqUTdHcuoC4Ag6Bgi0Nozpslc6S
    a. The participants warned to be mindful of the potential for webinars/video meetings fatigue in designing experiences.
4. There was a general consensus from the students that the opportunities in Academia were smaller than years past. The university representatives suggested that the NSF SOARS program made sure academia is described in a more realistic way that includes both positives and negatives.
5. Students would appreciate the option to either pursue a single project or a variety of projects.
6. A workshop on project planning and management would be worthwhile.
7. While it is recognized by the Proteges that a workshop on computation is important, how the workshop is structured and the outcomes need to be reevaluated to provide more value.

What have they done/experienced/learned so far?

1. Computational skills - visualization of data, challenges and growth in data analysis
2. Writing exercises

What are they looking forward to?

1. The continuation of learning what areas of the workforce within ESS that interest the Proteges and how that differs from working in a classroom setting.

One student shared that they had discovered that they enjoyed the machine learning aspect of ESS than research and the prospect of academia.
2. For those that found a project that elicited excitement and curiosity, the students looked forward to continuing their project into the next year.
3. The majority of the Proteges are looking forward to graduate school

What support do they anticipate needing?

1. Life outside of the classroom is daunting. Students shared a fear of needing to make the perfect decision, getting started, and the level of skills they would need in order to be successful. The more exposure to possibilities the more secure they may feel.
2. There was a discussion on the difference between mentoring and coaching (i.e., connecting Proteges to the right people) and how to help the students recognize the difference. For example, Proteges can be coached outside their field of expertise on how to approach the private sector with a relevant resume, and better interview and networking skills, but a mentor within that expertise would be able to discuss application across sectors.

Sector Needs of Today and Tomorrow Part 2

Liz Mulvihill asked that each of the groups that met prior to lunch to discuss professional gaps to share the primary topics that were deliberated. The result of sharing across the sectors were the following suggestions:

1. Create a workshop that provides students with a problem to solve across disciplines, with limited requirements, that highlights what is needed when you are part of a project team.
2. Rethink what it is that NSF SOARS is trying to accomplish. Is it to create researchers or is it to create team members that question the structure?
3. Build Super Skill training based on tracks that highlights what is needed for academia compared to government jobs or the private sector.
4. Continue to promote Self-discovery: Understanding how you are wired and how that connects to the job that you think you want and what the role needs.

Analyzing the Day: Program Discussion

Becca Hatheway, UCP/ETC Center for Science Education (SciEd) Director, requested direct and honest feedback from the attendees on how UCAR can improve the NSF SOARS program. Mixed sector groups were formed to discuss each of the questions.

What areas are we missing?

1. Backwards design the program. Redesign and revise goals based on alumni, Proteges and workforce feedback then design the program to meet those goals and how to measure progress.
    a. Should the program be expanded to provide exposure to all sectors in the ESS Enterprise?
    b. Is NSF SOARS the right name (with the emphasis on research)?
2. What is the capacity to expand the program?
    a. There needs to be an evaluation of program capacity.
    b. Number/amount of resources and mentors: What are the limitations in finding a consistent number of mentors to support a growing body of Proteges?
    c. Capacity to extend the program based on current staff
    d. Commitment to professional development with expectations
3. There needs to be more direct contact with research scientists at NSF NCAR. The COVID impact of hybrid and remote work cannot be underestimated in loss of exposure.
4. Teach how to build relationships and community within the ESS field.
5. Perform a cost benefit analysis of students staying in Boulder, Colorado and placing them elsewhere (i.e., place based opportunities in different locations).
6. A platform is needed to incorporate (again) the voices of alumni.
7. Goals for Future NSF SOARS
    a. Develop leaders (e.g., contribute to the impact on science as a whole, community impact, contributions to basic science) in the ESS Enterprise. Define the role that NSF SOARS should play in the development of leaders.
    b. Retain X% of Proteges in ESS Enterprise
    c. Participants in NSF SOARS enjoy research

What have we been duplicating that happens elsewhere?

1. NSF SOARS is a victim of its own success.
    a. There are too many other organizations in the same space to be able to reach the same level of excitement as the alumni of 1996.
    b. REUs are larger, higher quantity, and better supported than before.

What do we not need to do?

1. In order to demonstrate action, consider a statement like this: "We function in work environments that honor a plurality of identities from various communities and backgrounds"
2. Do not be redundant with the other UCAR internal internship programs.

Community Discussion - July 10th Morning

How to Continue to Grow NSF SOARS?

Becca Hatheway divided the group into small teams made of a combination of sectors. Each group was asked to:

1. Dream the Future of NSF SOARS
2. Present ambitions, ideas, and aspirations

Dream

1. Concentrate on "we build scientists" - Encourage repeat participation over the years so that you're building an actual pathway where fundamentals are built over time. A single summer participation is not a pathway to a career.
    a. Participants build on skills learned in the previous years. Connect the skills or learning objective to the tracks for government, academia, and industry.
        i. Writing: research paper → team member proposal writing→ how to be the PI building a proposal from multiple writers
        ii. Coding: Python class 1 → Python application

2. Create mini-symposium around understanding of what is required for careers paths
3. Capitalize on the multiple-year approach of NSF SOARS as a differentiator. Create Tiers of Exposure
    a. First-year stay on the campus - learning fundamentals
    b. Exposure to careers and research in different sectors (CHOOSE YOUR OWN PATH). For example for those who want a sampling:
        i. Second-year - Exposure to gov't research
        ii. Third-year - Exposure to academia research
        iii. Fourth-year - Exposure to industry research
    c. Include more structure in the first year. Develop learning objectives for multiple career paths in different sectors
4. Increase the focus on communication, interpersonal relationships, and working within a team.
    a. Importance of working in teams
        i. Identify strengths right away
        ii. Self organized groups
        iii. Project management
    b. More peer-to-peer mentoring. Students are more comfortable talking with peers and more likely to share with each other. Pair up a first/second year and try to keep them together, if possible. (note: UMBC has a process for doing this). NESSI has three students to three mentors (teams of six).
    c. Teamwork may not be loved by all students especially if not done well. Relate this to real-world projects and project management.
    d. Develop self efficacy.
    e. Increase sense of community - share lived experiences, struggles, etc.
    f. Activities that help them identify their strengths, learning styles, roles in team environments (ie. personality tests)
    g. Create more small group activities to help students learn how to work in a group and understand what they each bring to the group. Build their collaboration skills that will help them pursue future careers.
    h. More interdisciplinary engagement. Help students see opportunities outside of research.

   i. More teamwork activities throughout vs. just 1-week intensive at the beginning of the program.
   j. Increase community engagement to expose students to how their research/work have direct impacts. Who uses it/how they use it?
   k. Emphasize Importance of metacognition - Strengths, challenges, fears, students backgrounds, asset-based. Reflection on what your future looks like. CURIOSITY
5. Increase Alumni engagement
   a. Allow alumni to reach out to the Proteges.
6. Promotes adequate resources (funding) and staffing
7. Bring back the two (2) students sponsorship to the AMS career program

Ambitions, Ideas, and Aspirations

1. Network of Folks: Expanding NSF SOARS with a network of folks to help distribute the students.
2. Creating an Alumni Website/Hub
   a. Create a place where we can see every single Protege and create the connection.
   b. Having this connection could be adding a representation for students.
   c. Sharing the different alumni could share the variety of pathways that they went through
3. Creating partnerships at national labs.
4. Creating bridges: Creating bridges of an informal setting of different career sectors talking with current Proteges potentially at the end of the summer program. Do check-ins for it every year to see if anything has changed. This would create a support system further than the summer program but when they finish their academic career and move into the workforce.
5. Utilizing Professional Societies: early career options, career fairs, Summer Policy Colloquium
6. Encourage meeting other people from similar and different backgrounds: Maintain the idea of community, if we can continue this after Proteges leave the program would be an idea to invest in.

7. Pay mentors and require them to do more training: Give mentors and volunteer, but be offered a small stipend to participate in professional development on how to be a good mentor.
8. Aspire to double the number of students who have the opportunity to participate.
9. UCAR is distributed via member universities. Send students across the country to match them with their research interest (industry, research, gov) around a local problem/question (community engaged learning).
10. Teamwork in the real world: Add more teamwork activities throughout the program. Working in teams is essential to the current workforce. Help students learn about good team dynamics and a supportive workplace environment. Offer strategies on how to motivate and work well within a team. This can help with project management skills as well.
11. Require reflection activities
    a. journaling/blogs - can increase writing skills and metacognition
    b. Metacognition is essential to the current workforce and should be included during professional development sessions.
    c. Make these writing activities a part of the program, not done on their own time.
12. Make it a Time Requirement - be prestigious. Require two (2) or three (3) years commitment. Differentiate from other programs in the time commitment required in order to "graduate" as a NSF SOARS participant. This will increase Industry trust in the quality of the Proteges from NSF SOARS.

Sponsorship Discussion

Sarah Swanson, UCAR, Executive Director of Friends of the National Center facilitated a discussion about expanding the funding stream options for NSF SOARS.

What does sustainability look like for NSF SOARS?	Philanthropic Funding Ideas	Blended Approach	Concerns
• Tie to NSF or to other agency goals/focus.Science • Workforce Development • Ties to industry • Have to show what makes us innovative. • What is a five (5)-years' plan that shows we have a growth mindset? • Can we pilot new ideas throughout the five (5)-years' grant? • Could pilots also show innovation in funding opportunities?	• Give alumni a chance to support the program both individually and corporate • Alumni Engagement/Association: Networking, Mentoring, Donations annually, Connections to Industry	• Corporate Model: Keep parts of the program local to Boulder, but also allow students to work within company partners. Maybe as a group • Talk with NSF: need to discuss with the program officer about philanthropic match ideas. NOTE: Do not want to give the impression that we don't need NSF funding.	• Will sponsors have expectations not in line with our mission? • Be up front about who owns the IP from the beginning • Needs to be willingness on both sides to make it workContracts/NDAs/Etc. • Think through possible issues upfrontLogistics issues with interns getting to company

Appendix 1

NSF SOARS Planning Meeting Agenda

July 9-10, 2024

Google Meet Link

Or dial: (US) +1 484-841-5709 PIN: 826 011 183#

Tuesday, July 9

8:30 AM - Informal Continental Breakfast Meet and Greet

9:00 AM - Welcoming Remarks and Introductions with Bill Kuo

9:30 AM - Overview of NSF SOARS and Q&A

9:50 AM - Break

10:00 AM - Identifying What's Working Well and Could Be Better

- What challenges are students facing in undergraduate and graduate degree programs and what do they need to smoothly transition between them?
- How does NSF SOARS fit/complement the educational profile/ecosystem of UCP?

10:50 AM - Break

11:00 AM - Sector Needs of Today and Tomorrow - Part 1

- How does a program like NSF SOARS support those needs?
- What skills do students need to develop both in formal settings (e.g. in classrooms) and "super" skills (e.g. communication)?
- What credentials accelerate career pathways (e.g. do students really need PhDs?)

11:50 AM - Walk over to FL2 for lunch

12:00-1:00 PM - Lunch with Proteges in FL2 cafeteria atrium

- What's working well and what could be improved
- Talk about their experiences coming into NSF SOARS and looking ahead - what have they done/experienced/learned so far, what they are looking forward to, and what support they anticipate needing

1:00-1:15 PM - Walk back to FL4 and reconvene with virtual participants

1:15 PM - Debrief from lunch conversations

1:45 PM - Sector Needs of Today and Tomorrow - Part 2

- Share out from each group discussion in Part 1
- Identify commonalities and unique sector needs

2:30 PM - Break

2:40 PM - Analyzing the day: Program Discussion

- What areas are we missing?
- What have we been duplicating that happens elsewhere?
- What do we not need to do?

3:40 PM - Wrap-up and preview next day

- Tomorrow: Discussion on how to continue to grow NSF SOARS
- Tonight: Digest today and dream big!

4:00 PM - Adjourn

Wednesday, July 10

8:30 AM - Informal Continental Breakfast Meet and Greet

9:00 AM - Discussion on how to continue to grow NSF SOARS

- Dream the Future of NSF SOARS
- Present the Dreams

10:30 AM - Break

10:40 AM - Sponsorship Discussion

- What does sustainability look like for NSF SOARS?
- Philanthropic Funding Ideas
- Blended Approach

11:30 AM - Wrap-Up and Gratitude

12:00 PM - Optional Informal Lunch with Box Lunches

1:00 PM - Adjourn

Appendix 2

Purpose Statement:

The NSF SOARS program is supported by the U.S. National Science Foundation under the Award #2230301. Established in 1996, NSF SOARS is dedicated to supporting and promoting research, mentoring, and community in atmospheric science, the Earth system sciences (ESS), and related sciences. For 28 years, 261 undergraduate students, known as Proteges in the program, have participated in NSF SOARS, some of whom have become leaders within the Earth system science community.

NSF SOARS is an undergraduate-to-graduate and career pathways program created to include multi-year summer research opportunities; mentoring by expert scientists, engineers, and science professionals; and a supportive learning community. The summer research experience includes opportunities to engage in original scientific research, written reports, and presentations, seminars, as well as peer and community mentoring. Proteges are eligible to participate in the program for up to four years.

What would NSF SOARS look like if it started today based on the needs of students and the current workforce of 2024? The program team wants to revolutionize and expand the way students see experiential and scientific training programs in order to retain involvement in the ESS. The objective is to increase student access to the ESS field by utilizing creative and innovative methods and cutting-edge collaborations with all sectors, including private, government, and academic. The intention is to expand to the interdisciplinary nature of the ESS field, focusing on the intersection of the ESS and atmospheric sciences and maintaining the renowned mentoring model.

The NSF SOARS team is proposing to match Proteges with multiple sectors, including private and government organizations, as well as continue working with academic institutions and the NSF NCAR. Proteges could be matched within the same sector or work in different sectors over multiple years of participating in the program, with an agreement in place to support Proteges holistically, utilizing the NSF SOARS mentor model.

Action items needed from our community are:

- Information on what the different sectors need students to develop during their academic and internship experiences in order to be successful in a future career in that sector
- Information about how each sector can benefit from engaging with students during their academic careers
- Assistance with the business model development
- Mentor/PD commitment from partners, including internship opportunities at partner
- Letters of Support for proposal
- Other feasible support and/or ideas from partners

The NSF SOARS endeavors to remain a resource and provide support for all students to achieve success in higher education and in the Earth system science (ESS) workforce, with the goal of this workforce actively contributing to finding solutions to our most pressing scientific and societal challenges and supporting economic growth in this country.