Annual Report

Track 2: Developing a Sustainable RESESS Program

Project/Grant Period: 09/15/2009 - 08/31/2014

Reporting Period: 09/01/2012 - 08/31/2013

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Award ID: 0917474

Sponsor: NSF GEO-OEDG

Organization: UNAVCO, Inc.
What are the major goals of the project?
RESESS, Research Experiences in the Solid Earth Sciences for Students, is a summer internship program designed to increase the number of individuals from underrepresented populations in geosciences who will enter graduate school and complete Master’s and PhD degrees in the Earth sciences, with support from the National Science Foundation under Award No. 0917474 GEO-OEDG. RESESS accomplishes this through three project goals:

1. Increase the impact of the RESESS program with the purpose of increasing the number of undergraduate students in geosciences who will enter graduate school and complete a Masters degree or higher.
2. Build a RESESS Sustainability Framework.
3. Provide opportunities for research interns to articulate the relevance of geoscience to societal problems to a variety of audiences, particularly in recruiting students to RESESS.

Accomplishments

Major Activities
The primary activity of the RESESS program is to provide a summer research experience for undergraduates from underrepresented groups. This cohort of interns spends the summer in Boulder, Colorado conducting research and engaging in professional development through various programmatic activities. 2012 marked the eighth year of the program. The 2012 RESESS student cohort included 17 interns representing 14 different educational institutions from across the United States including Puerto Rico. In selecting interns from the applicant pool, the panel endeavored to balance institutional diversity while selecting the most qualified applicants.

The 2012 cohort included 10 returning students and seven first-year interns. This brought the total students served by the program to 37. Interns were matched with science mentors in their field of interest. In 2012, five students were placed with scientists in the USGS, in Lakewood, Golden, and Boulder, Colorado, and one in Reston, Virginia. Seven interns worked with scientists at the University of Colorado at Boulder, and two worked with scientists at UNAVCO (David Mencin and Glen Mattioli). Thirteen interns worked in the Boulder-Denver area, and four of the ten returning interns worked elsewhere in the country, including at Penn State University, Miami University of Ohio, the USGS in Virginia, and University of New Orleans.

Specific Objectives
Student Research and Skills Development The RESESS program aims to provide an authentic research experience for students in a geoscience discipline. Broadly categorized the research projects of the 2012 interns were focused in the following topical areas:

- Hydrology (5)
- Seismology (5)
- Geophysics (2)
- Soil chemistry (1)
- Landslide hazards in GIS (1)
- Geomorphology (1)
- Mineralogy and thermochronology (1)
- Carbon storage in vegetation (1)

The program was designed for students to also develop and improve their communication skills,
both scientific and public, written and oral. Students participated in a 10-week writing workshop to develop writing skills, understanding of scientific publication reading and writing, development of scientific abstracts and effective means of communicating via graphical depiction of research results. Students wrote scientific abstracts of their research projects and submitted them to a scientific conference as well as published them in the internal publication Earth, Wind, Sea and Sky. Students participated in a colloquium, following standard scientific conference format, where they gave an oral presentation of their research. They also participated in a local external science poster session with SOARS interns. For the poster sessions they developed a conference-quality poster and answered attendee questions for the duration of the multi-hour session. These posters were then presented at scientific conferences in fall.

All interns submitted abstracts to scientific conferences. In the fall of 2012 and winter of 2013, interns gave 22 presentations at national meetings of scientific organizations. In particular, seven interns presented posters or talks at AGU, and four presented posters at GSA. RESESS interns also presented at several other conferences including AISES, SACNAS, NABG, and the Ivy STEM Symposium.

**Significant Results**

**Publications and Presentations.** One RESESS intern published a first author paper covering the results of her two-summer research in the journal *Geophysical Research Letters* (publication title listed below). Of the seven RESESS interns who submitted abstracts for poster presentations to the 2012 AGU Fall Meeting, all had their abstracts accepted, and two were asked to give oral presentations. One student presentation focused on tropospheric delay in a GPS signal and large vertical displacement observed during the collapse of the Soufrière Hills volcano in Montserrat had an audience of more than 75 people. The second intern’s research focused on the relationship between fluid injection wells (related to fracking) and seismic activity in two Ohio locations. Over 115 people attended her presentation.

**Intern awards.** Two interns were accepted into the MSPHD’S program (Minorities Striving and Pursuing Higher Degrees of Success in Earth System Science; [http://www.msphds.org/](http://www.msphds.org/)). MSPHD’S is an 18 month-long professional internship program run by IBP (Institute for Broadening Participation). The RESESS program now has a total of seven interns admitted to this program; 19% of all RESESS interns.

One 2012 intern was awarded the best student paper at the 2012 National Association of Black Geoscientists conference. His poster was selected from over 45 student posters and talks. This is an award given by the Geological Society of America, and it provides him with registration for the 2013 GSA meeting in Denver.

One 2012 intern was recognized twice by the American Indians in Science and Engineering Society (AISES) National Conference. She received first place honors in the poster presentation category for work focused on the aftermath of a 2010 wildfire in Fourmile Canyon that burned 6,181 square acres. She researched the effects of straw on soil erosion intended to minimize the risk of flash floods in the canyon. She also received the AISES Leadership Award was in recognition of her demonstrated qualities of a leader (i.e. respect, integrity, vision, communication skills, etc.).

**Evaluation.** The evaluation of RESESS in 2012 included post summer evaluations of both mentors and interns. The post summer survey of the interns was conducted in mid-November. Seventeen RESESS interns received an email inviting them to participate in the evaluation process.
Response rate included two partially completed surveys and nine completed surveys. The post summer survey of the mentors was conducted in early February. Eleven mentors received an email inviting them to participate in the evaluation process. Seven mentors completed the survey.

The post evaluation of both mentors and interns suggests that the participants in the RESESS internship program continues to be positively impacted. All of the responding mentors described their overall experience with the RESESS program as Excellent (86%) or Very Good (14%). Meanwhile, all the responding RESESS interns strongly agreed with the statement “RESESS was helpful in preparing me for my future education and career” and either agreed or strongly agreed that RESESS was one of the best learning experiences they have ever had. Additionally, the program appears to be achieving progress towards its primary goal of “Increasing the number of students from populations underrepresented in the Earth Sciences who enter graduate school and complete an advanced degree.” (Table 1)

<table>
<thead>
<tr>
<th></th>
<th>Definitely Will</th>
<th>Probably Will</th>
<th>Probably Will NOT</th>
<th>Definitely Will NOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seek full time employment</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Enroll in a part-time graduate program while working.</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Work for a while and then enter a graduate program full-time.</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Enter a full-time graduate program (Masters or Doctorate) right after graduation</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other (Unsure)</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
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</table>

Table 1: Intern responses to “How likely are you to do each of the following immediately after you complete your undergraduate degree?”

**Key outcomes**

**Sustainability.** One of the goals outlined in the Track 2 RESESS Proposal was to develop external financial support for an increasing number of interns over the five-year period of the award. The award budget included support for the following number of interns for each of years one through five: 11, 13, 10, 7, and then 6 interns. The proposal also stated “The total number of students will increase from 12 in Year 1 to a minimum of 12 in Year 5, through external support of the program.”

The U.S. Geological Survey (USGS), COCONet, and UNAVCO provided supplemental funding to the RESESS program. The USGS contributed funds toward the salary of three RESESS interns, through hiring them as students for the summer (25% of the total funding for students). COCONet is an NSF-funded Project managed by UNAVCO. The COCONet award provided full salary support for one intern and purchased a laptop for a new intern (11% of the total funding). UNAVCO also provided summer travel support to students through their NSF Facility Cooperative Agreement (7% of the total external funding). The Plate Boundary Observatory (PBO), managed by UNAVCO, covered the salary for 3.5 interns, their domestic travel, and miscellaneous expenses (46% of the total external funding).

Out of projected year 4 costs of $353k for the student program (not including core staff) for 17 interns, $90k or 25% of that cost was covered by the external funding sources listed above.
These partnerships have further strengthened interactions between the USGS and other organizations across all UNAVCO programs.

**Program Alumni Outcomes.** The 2012 cohort brings the total number of RESESS program interns to 37. When interns are promoted out of the program they are considered alumni. Follow up with alumni regarding their activities and achievements are conducted bi-annually. Fifteen RESESS alumni are currently in undergraduate programs in Earth or environmental science across the country. The other 22 have all graduated from university with a Bachelor’s degree. Of the graduates, 77% are currently in graduate school and 9% are in the geoscience workforce. For the current graduate students, nine are pursuing Master’s degrees, seven are pursuing Ph.Ds., and one is pursuing a JD in environmental law. The seventeen RESESS alumni in graduate school are located at 15 different institutions.

**Recruitment and program applicants.**

In the winter of 2012-2013, the recruiting approach of 2011-2012 was continued as it was effective. The internship opportunities were posted through UNAVCO media including website and mass mail to community members. UNAVCO community members include over 100 full and associate members. Advertisements were posted on websites of scientific organizations (GSA, AGU, etc.), scientific organizations serving minority students (SACNAS, NABGG, IBP, etc.), and other sites (e.g. GeoCorps America).

Recruitment through the American Geoscience Institute (AGI) list serves was also used again, this time directly to faculty rather than department chairs. An email recruiting message about RESESS and three other internships (including the IRIS REU program) was sent to tenured and tenure-track faculty members in geoscience departments of universities and 2-year institutions around the country via AGI.

In the interest of both improving efficiencies and leveraging existing UNAVCO infrastructure, the application process was integrated into the UNAVCO career portal. Prospective interns completed an online application through the UNAVCO Human Resources Department. Resources and contact information were made available to any students who encountered difficulty with the application system. The transition to the career portal saved a significant number of work hours collecting and collating application materials into application packets. Utilizing the existing system made complying with federal guidelines with regard to sensitive demographics (race, ethnicity, disability, etc.) less challenging. In addition, the application process mirrors a “real-world” experience of applying for employment and allowed all applicants, not just the ones selected for the program, experience with completing a job application. Evaluation of the process indicated it yielded efficiencies and a large number of candidates from diverse populations.

In total, 89 completed applications were received. Sixty-three percent of applicants were female. Summaries of the demographics of the entire applicant pool as compared to the U.S. population are shown below. UNAVCO/RESESS recruitment was highly effective for the American Indian or Alaskan Native and Asian populations and those identifying with two or more ethnicities, with the percent of applicants exceeding the percentage of the general US population. Recruitment for Black/African American applicants was effective in that the percent applicants mirrored the US population. Applicants from Hispanic/Latino and Native Hawaiian / Pacific Islander were below national percent demographics.
### Table 1: Demographics of the 2013 Applicant Pool

<table>
<thead>
<tr>
<th>Demographic</th>
<th>2013 Applicant pool (%)</th>
<th>US population (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian or Alaskan Native</td>
<td>2.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Asian</td>
<td>7.9</td>
<td>4.7</td>
</tr>
<tr>
<td>Black or African American</td>
<td>11.2</td>
<td>11.2</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>27.0</td>
<td>14.9</td>
</tr>
<tr>
<td>Did not disclose</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>Native Hawaiian or Pacific Islander</td>
<td>0</td>
<td>0.3</td>
</tr>
<tr>
<td>Two or more</td>
<td>4.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Caucasian</td>
<td>40.4</td>
<td>67.3</td>
</tr>
<tr>
<td>Disability-yes</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Disability-unknown</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>Disability-no</td>
<td>96.6</td>
<td></td>
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</tbody>
</table>

### Training and Professional Development

In addition to having an opportunity to do authentic research, interns received training in critical thinking, reading and analyzing journal articles, writing a research abstract and research article, preparing a scientific poster, and giving a talk. Technical training on tools with TLS instrumentation (Terrestrial Laser Scanner) was conducted on-site and in the field. Local geology instruction was provided on field trips.

Interns were provided with an optional GRE preparation course that met outside work hours. The intent was to help them prepare for the GRE as well as to learn general test taking skills and strategies. Interns also participated in a half-day graduate school workshop at the University of Colorado designed as an informal way for interns to meet graduate students and talk with them about graduate school-related questions.

Interns were provided leadership development opportunities during the first week of the summer session. The leadership training sessions were attended by all interns; including those who would be conducting research at non-Boulder locations. The goals of the leadership training were to provide an opportunity for interns to develop a strong sense of group with their cohort and to provide them with a toolbox of leadership skills to practice during the time of their summer internship. Evidence of the effectiveness of the leadership week includes interns keeping in close contact with each other throughout the year via Facebook, conferences, and visiting each other, as well as communication with the RESESS program staff.

Field Trip. Interns participated in a 2-day field trip focused on the geology, geomorphology, and Earth processes of Colorado's Front Range and the broader Rocky Mountain region, with an overnight stay at CU's high elevation Mountain Research Station. Dr. Mahan and 6 CU graduate students led the field trip. This trip provided field experience for the interns, an opportunity to learn about the local geology, and a bonding experience for the cohort.

Graduate Assistant Professional Development. The RESESS program subaward employed a University of Colorado graduate student in Geological Sciences to assist interns with feedback and support on their a) research project b) poster and oral presentations, c) abstract preparation for conference submission and for the RESESS volume “Earth, Wind, Sea, and Sky.” The Graduate Assistant also contributed to the weekly Writing Workshop and met with students individually to provide feedback on scientific writing.
Mentor Professional Development. All mentors (research and writing) were provided with training and professional development opportunities throughout the summer. The primary mechanism was one-on-one mentoring with the RESESS Program Director.

Dissemination of Results

Lecture Series. The Geophysics Minority Recruitment Lecture Series is jointly funded by RESESS and the IRIS REU Award. The lecture series provided alumni of our programs the opportunity to connect with potential program applicants, share information and outcomes of the RESESS program and answering questions about the programs.

The speakers for the 2012 – 2013 lecture series included:
- Justin Brown - 2004 IRIS Internship Alumnus & Post-Doc at Cal Tech
- Stephen Hernandez – 2006 - 2008 RESESS Alumnus and 2009 IRIS Internship Alumnus, NSF Graduate Research Fellow, & PhD student at UC Santa Cruz
- Sandra Saldana - 2005 IRIS Internship Alumnus & Geophysicist, Noble Energy
- *Olamide Dada- 2010 RESESS Alumnus, M.S. Student at University of Louisiana, Lafayette

*This speaker was new for 2012-2013 but was not requested by any institutions.

To advertise the lecture series, over 30 physics departments at Historically Black Colleges and Universities (HBCUs) and geoscience and/or physics departments Hispanic Serving Institutions (HSIs) around the country received emails announcing the program, plus follow-up phone calls. This year, 3 lectures were scheduled in the physics department at minority serving institutions:
- Morehouse College, J. Brown
- Morgan State University, J. Brown
- University of Houston-Clear Lake, S. Saldana

This is number of venues is fewer than normal for the program and is likely attributable to the timing of the announcements. From this year’s lectures, RESESS received 9 applications from students at schools where the lectures were delivered and ultimately accepted 1 of these students into the program (although she ultimately declined the position). Meanwhile the IRIS REU received no student applications from institutions where we have provided recruitment lecturers. See future work for plans on increasing impact next year.

Conference Recruiting. Targeted recruiting during this past year has included RESESS participation in meetings where the primary purpose is the support of historically underrepresented students in the geosciences, as well as other scientific and educational meetings. RESESS interns and staff participated in the following:

• National Association of Black Geoscientists (NABG) 2012 Annual Meeting
• Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) including a UNAVCO and IRIS-funded geosciences field trip prior to the SACNAS national meeting that provided 50 students with the opportunity to broaden their geosciences experience.
• American Indian Science and Engineering Society 2012 Annual Meeting
• Ivy STEM Plus Symposium 2012 at Penn State U.
• GSA 2012 Annual Meeting in Charlotte, NC
• AGU 2012 Annual Meeting in San Francisco
• GSA Southeastern meeting in Puerto Rico, 2013
Additional outreach avenues included social media via UNAVCO (Facebook, YouTube), and sharing social media strategies and posts with IRIS and the EarthScope National Office. In May 2013 the first RESESS Newsletter was distributed to the broader “Friends of RESESS” contact list including over 100 individuals. ([http://resess.unavco.org/lib/email/2013/spring/spring.html](http://resess.unavco.org/lib/email/2013/spring/spring.html))

**Plans for next reporting period**

**Recruitment.** Modified timing of recruiting for the Geophysics Minority Recruitment Lecture Series. In the past, announcements have been sent in early August. In 2012 announcements were sent in mid-September, after the start of the school year, to see if they generated more response and interest. Unfortunately, it appears this had the opposite effect, as faculty seemed busy with the semester and many speaking calendars were already filled. In 2013, targeted, personalized inquiries will be made both pre- and post-semester start.

Program recruitment efforts will focus on California and the schools that are on a quarter system. Many of these schools have high populations of students that could be key candidates for the RESESS program. Dr. Schwartz (of UCSC) will reach out to geology departments of University of California and California State Universities with information about the RESESS program, its successes and how to apply.

**Intern Follow-up and Alumni Network:** Beginning in 2013 an alumni network will be formed with the intent of providing ongoing structure and support to former RESESS interns as well as a mechanism for them to easily connect and network. This network is expected to strengthen the program in that it also provides peer mentoring opportunities and mentoring possibilities for the current intern cohort.

**Evaluation.** Next year, both mentor and intern post-summer surveys will be distributed earlier in the fall semester with the goal of improving response rates.

**Summer Research Program.** Field camps or attending a university on a quarter system prevent potential interns from applying. Next year we will institute a staggered cohort as a pilot test to increase the ability for the program to attract students from quarter system schools (California State Universities and University of California schools in particular). One or more qualified students from a quarter system will be admitted to the RESESS program on the staggered start schedule. The staggered start will consist of the quarter system student(s) beginning their internship up to three weeks later than other interns and staying three weeks longer, after other interns have left. This will require logistical changes in the program including finding housing options for the last three weeks and a mentor who is open to the shifted mentoring schedule, among other things. The intent is to test the strategy to be able to reach a more diverse applicant pool. Dr. Schwartz of the University of California at Santa Cruz will assist with targeting recruitment for the students on the shifted summer schedule.

**Outreach and Dissemination of Findings.** Additional efforts will be directed to programmatic outreach including developing social media channels, continuing (and potentially expanding) the RESESS newsletter, and building stronger connections with geoscience organizations including the American Geosciences Institute (AGI), American Geophysical Union (AGU), American Association of State Geologists (AASG), Association for Women Geoscientists (AWG), and Society of Exploration Geologists (SEG), among others.

**Diversification of Funding.** Continued diversification of funding of the RESESS program will be a significant focus for the next year. Diversification plans include partnering with other organizations with a similar mission to develop strong non-federal funding strategies,
developing relationships with private industry representatives (via SEG and conferences) where there is a demonstrated need for increased diversity with regard to workforce development.

**Mentoring Support.** Professional Development for research and writing mentors will continue with an increased focus on streamlining resources for mentors and providing academic references to best practices. Mentors will be provided with a comprehensive mentoring information packet in early spring, immediately after agreeing to volunteer for the program. The information packet will include key program dates, tips on working with undergraduate students, programmatic information about RESESS and organizational information about UNAVCO.

**Products**

**Journals**


**Conference Papers and Presentations**

[https://gsa.confex.com/gsa/2012AM/finalprogram/abstract_208691.htm](https://gsa.confex.com/gsa/2012AM/finalprogram/abstract_208691.htm)


[https://gsa.confex.com/gsa/2012AM/finalprogram/abstract_210289.htm](https://gsa.confex.com/gsa/2012AM/finalprogram/abstract_210289.htm)


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Other Publications
Earth, Wind, Sea and Sky, (2012) UNAVCO.

Websites
RESESS website: http://resess.unavco.org/

Programmatic web site for the RESESS Program and is a primary communication mechanism for the program. Content includes information about current interns, program Alumni, mentors and program staff. Announcements, news, photos, video and other media information is provided. An FAQ provides information for students about the program and how to apply. Links to the online application and calendar of events are also provided. A password protected area of the web site includes information for interns during their internship including writing workshop
assignments, forms for travel authorization and other programmatic elements. The web site is housed within the UNAVCO web domain and maintained by UNAVCO personnel.

**Impacts**
The RESESS program is dedicated to increasing the diversity of students entering the geosciences. The geosciences encompass a broad range of disciplines, including all areas of solid earth science and geology and is a field that historically has had little participation from non-white groups. The RESESS program provides undergraduate students from historically underrepresented groups the opportunity to conduct scientific research as well as provides a support structure to help them gain entry to graduate programs in geosciences. Since it’s inception, the RESESS program has provided 37 undergraduate students with the support structure and experience necessary to complete a Bachelor’s degree in the geosciences. All RESESS students who have completed their Bachelor’s degree have either entered graduate school or are working in a geoscience-related job.

**Impact on other disciplines**
The geosciences are part of the broader Earth system sciences including atmospheric and oceanic sciences. Due to the nature of the geosciences being part of a broader system-science there are organic collaborations and interactions at professional conferences and meetings, within academic departments and in research efforts. Increasing the number of diverse geoscientists, as the RESESS program does, results in a more diverse environment for the broader Earth system science community.

**Impact on the development of human resources**
**Mentors.** The RESESS program impacts each mentor in that they are acquiring skills that can be transferred to other mentoring relationships with students. The RESESS program partners an undergraduate student with a professional scientist for an 11-week period during the summer. Mentors for 2012 were from academic institutions, NSF-facilities, and government agencies. All mentors volunteered their time and had varying amounts of experience mentoring undergraduates in research projects. Mentoring of undergraduates is challenging because they are still acquiring depth of geoscience content knowledge and compared to graduate students they have limited mathematics and statistics skills.

**Student Skills.** The RESESS program provides support to students historically underrepresented in the geosciences for their pursuit of academic degrees in the geosciences and/or geoscience-related professions. The program exposes students, who otherwise may not have had the opportunity, to research and the spectrum of career options available with geoscience degrees. These students are influential with their academic peers and often information about the program and impacts of the program are transferred to non-RESESS students in the home academic department of the interns. The broad range of home academic institutions the 2012 intern cohort multiplies the impact of the RESESS program.

**Impact on physical resources that form infrastructure**
Increasing Diversity of NSF Facility. The NSF geodetic facility (UNAVCO) manages the RESESS program and provides infrastructure. During summer, when interns are participating in the program, the mere presence of a more diverse workforce has an indirect effect on the perceptions of staff working full-time in the facility.
Impact on society beyond science and technology
The majority of interns in the 2012 RESESS program come from families that have not been involved in science as a profession or career. The intern interactions with their friends and families about their experience in RESESS, the research they conducted, the knowledge they gained about graduate school and how to apply all have a profound influence on individuals in the community that are not directly involved in the program.