



STEM Student Experiences Aboard Ships (STEMSEAS) Program

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UNOLS Annual Meeting: November 30, 2016



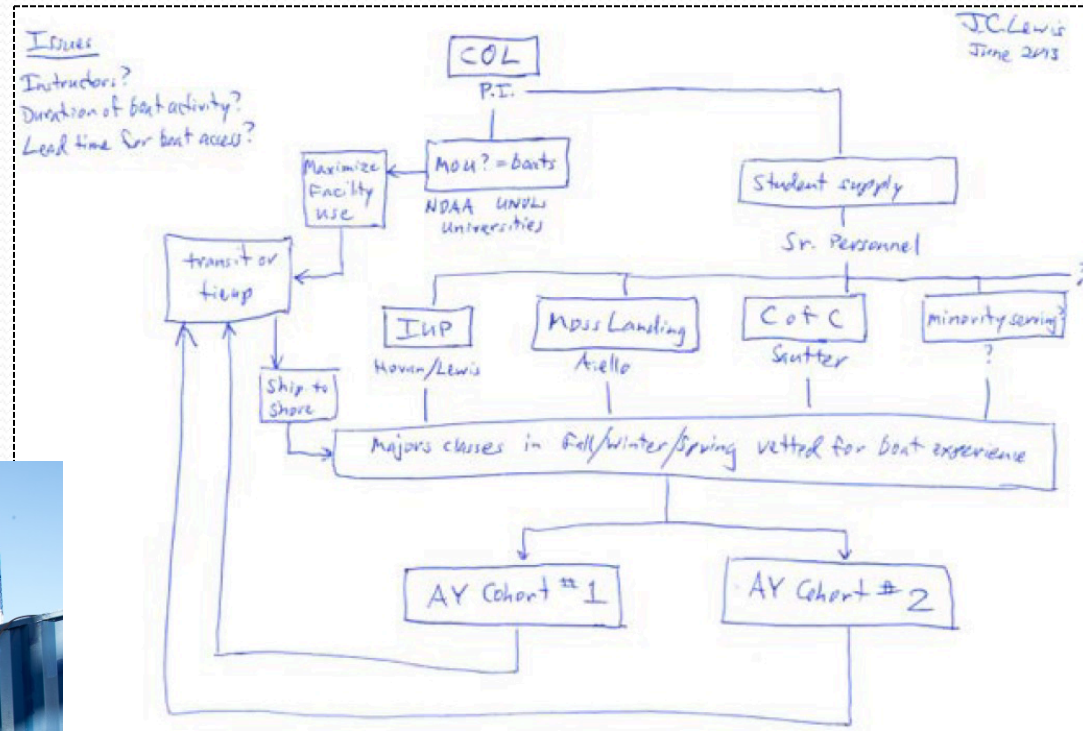
What is STEMSEAS?



- STEMSEAS takes advantage of under-used capacity on University National Oceanographic Laboratories System (UNOLS) vessels to provide undergraduate students with high-impact experiences.
- STEMSEAS sails both declared geoscience majors and non-majors with undergraduate faculty mentors for 5-10 day ship transits.
- STEMSEAS aims to increase the number of meaningful shipboard experiences available to undergraduate students, introducing students to essential skills and competencies for geoscience careers, and exposing non-STEM students to STEM issues and careers.

It began, as all good ideas do,
~~In the shower~~
~~In a dream~~
On the back of a napkin

School of Rock on the U.S.
drilling vessel *JOIDES RESOLUTION*
informed our thinking.



Developed in response to the 2015 NSF solicitation:

Improving Undergraduate STEM Education: Pathways into Geoscience (IUSE: GEOPATHS)

PROGRAM SOLICITATION **NSF 15-526**



National Science Foundation

Directorate for Geosciences
Division of Atmospheric and Geospace
Sciences
Division of Earth Sciences
Division of Ocean Sciences
Division of Polar Programs

Directorate for Education & Human Resources
Division of Undergraduate Education
Division of Human Resource Development

Letter of Intent Due Date(s) (required) (due by 5 p.m. proposer's local time):

January 07, 2015

Letter of Intent (Required) Due Date

August 14, 2015

Letter of Intent (Required) Due Date

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

March 16, 2015

Full Proposal Submission Deadline

October 05, 2015

Full Proposal Submission Deadline

IUSE: GEOPATHS Program Goals

- Increase the number and diversity of students
 - pursuing degrees and careers in the geosciences
- Prepare students for any geoscience career
 - considering ALL pathways available to them in the geosciences, including teaching
- Build on & contribute to the evidence base
 - for effective student engagement, learning, and retention in STEM

We saw great potential to contribute to NSF long-term goals...

Three Pillars: Long-Term Goals

- **Improve STEM Learning & Learning Environments**
 - Improve the knowledge base for defining, identifying, and innovating effective undergraduate STEM education teaching and learning for all NSF-supported disciplines, and foster widespread use of evidence-based resources and pedagogies in undergraduate STEM education practice.
- **Broaden Participation & Institutional Capacity for STEM Learning**
 - Increase the number and diversity of undergraduate students recruited and retained in STEM education and career pathways through improving the evidence base for successful strategies to broaden participation and implementation of the results of this research.
- **Build the STEM Professional Workforce for Tomorrow**
 - Improve the preparation of undergraduate students so they can succeed as productive members of the future STEM workforce, regardless of career path, and be engaged as members of a STEM-literate society.

Core Operating Principles

1. Target students ...
 - i. at key junctures as undergraduates
 - ii. from communities poorly represented in geosciences
 - iii. that are primarily STEM-interested
 - iv. in non-STEM majors poised to be STEM advocates
2. Leverage ship capabilities whenever feasible
3. Establish synergistic relationships with UNOLS operators
4. Add value by doing science on transits whenever feasible
5. Seek diversity among mentors
6. Sail experienced mentors with new mentors
7. Deliver content related to ship track
8. Provide time for reflection while on transit
9. Facilitate research if opportunity arises
10. Provide avenues for career exploration
11. Measure impact and add to the evidence base



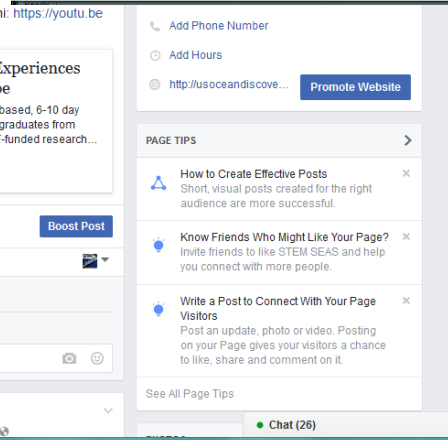
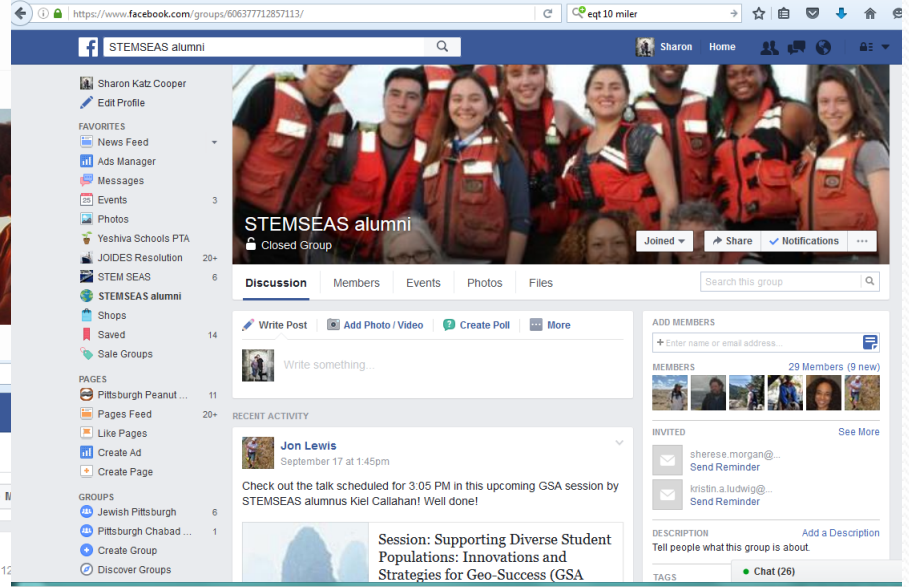
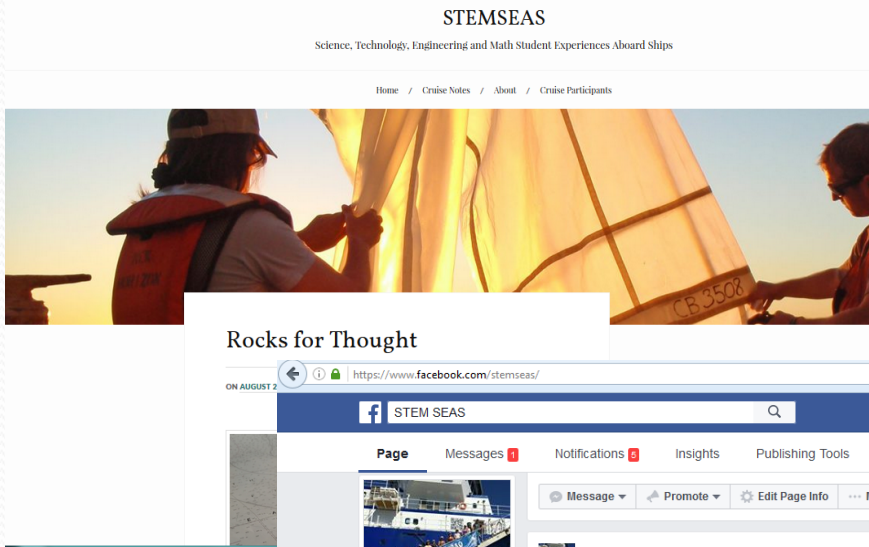
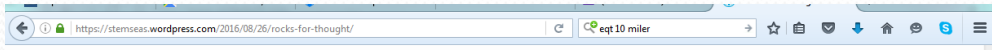
What STEMSEAS did in Year 1

We opened applications for 30 slots in 2016 and received nearly **900 applications**.

Dates	Vessel	Operator	Starting Port	Ending Port	No. students
May 10-18	R/V Oceanus	OR State U.	San Diego, CA	Honolulu, HI	9
July 15-20	R/V Endeavor	U. of RI	Morehead City, NC	Gulfport, MS	11
August 17-23	R/V Sikuliaq	U. AK Fairbanks	Seattle, WA	Seward, AK	10



Established web presence



Goal: Target students from communities poorly represented in geosciences

Which of the following best describes your ethnicity? (check all that apply) (N=30)

23%	(1) African-American/Black
3%	(2) Asian-American/Asian
40%	(3) Hispanic or Latino
10%	(4) Native American or Alaska Native
	(5) Pacific Islander
30%	(6) White/Caucasian
	(7) Other (please specify)

Also:
60% female, 40% male, several U.S. military vets, 1 student with identified disability that required accommodation



Goal: Target students at key junctures as undergraduates

- 27% from 2YCs, 73% from 4-year colleges

What is your year in school for Fall of 2016? (N=30)

1	(1) Freshman
8	(2) Sophomore
12	(3) Junior
7	(4) Senior
2	(5) Other, please specify*



My career goals have changed because of this program. I am certain I want to pursue a career in science doing field work. The exposure to a real field setting made me certain I was meant to follow this career path.

– May student

Goal: establish synergistic relationships with UNOLS operators and have a diversity of mentor/instructors

Vessel	Senior Mentors (expertise)	Trainee Mentors, expertise	Other Mentors, expertise
R/V Oceanus Operator: OSU	Kristen St. John, Ph.D., James Madison U. (paleoclimatology, paleoceanography) Mark Leckie, Ph.D., UMass (micropaleontology, biostratigraphy)	Raquel Bryant, UMass grad student (advisor Mark Leckie)	
R/V Endeavor Operator: URI	Kaatje Kraft, Ed.D., Watcom CC. (science education) Steve Pekar, Ph.D., Queens College (stratigraphy, micropaleontology)		Joe Montoya, Ph.D., GA Tech (biological oceanography, biogeochemistry) Ryan Sibert, U. of GA Ph.D. student; advisor: Samantha Joye, (biogeochemical cycling)
R/V Sikuliaq Operator: UAF	Jon Lewis, Ph.D., IUP (structural geology, active tectonics) Kris Ludwig, Ph.D., USGS (oceanography, marine geology, public policy)	Raquel Bryant, UMass grad student (advisor: Mark Leckie)	Karen Thomson, Ed.D., Independent Consultant (science education)



Comments from operators

I feel the STEMSEAS project went great. No hassle for the ship or crew. The crew dove in and worked with the students. The instructors and students were most appreciative and that made us all feel good.

I think the right students were chosen, as they did not seem to be from 'top flight universities', however they now know that oceanography and the sciences in general exist. The students seemed to get a lot out of the program, and it was a positive and enjoyable experience for them and myself.

In my opinion, the time, money, and effort put in to the program is well worth it. I hope the project continues. -- Master R/V ENDEAVOR

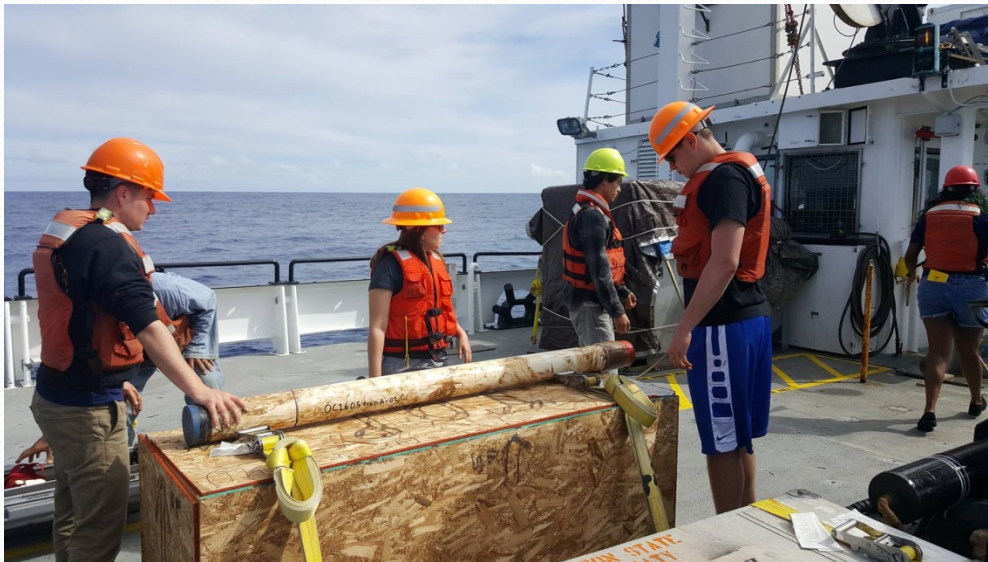
I got the feeling that the people who participated in the cruise were really interested in things and were all active participants. In general, I felt things went very well and, for what it's worth, would recommend that the project continue. – Oceanus

crew

WRT the STEM Seas transit cruise, I would have to say that it was a pleasure having them out. Although they were a little green when it came to cruise planning, we were able to work through their questions and concerns. I think their next cruise will go even smoother. – Oceanus crew

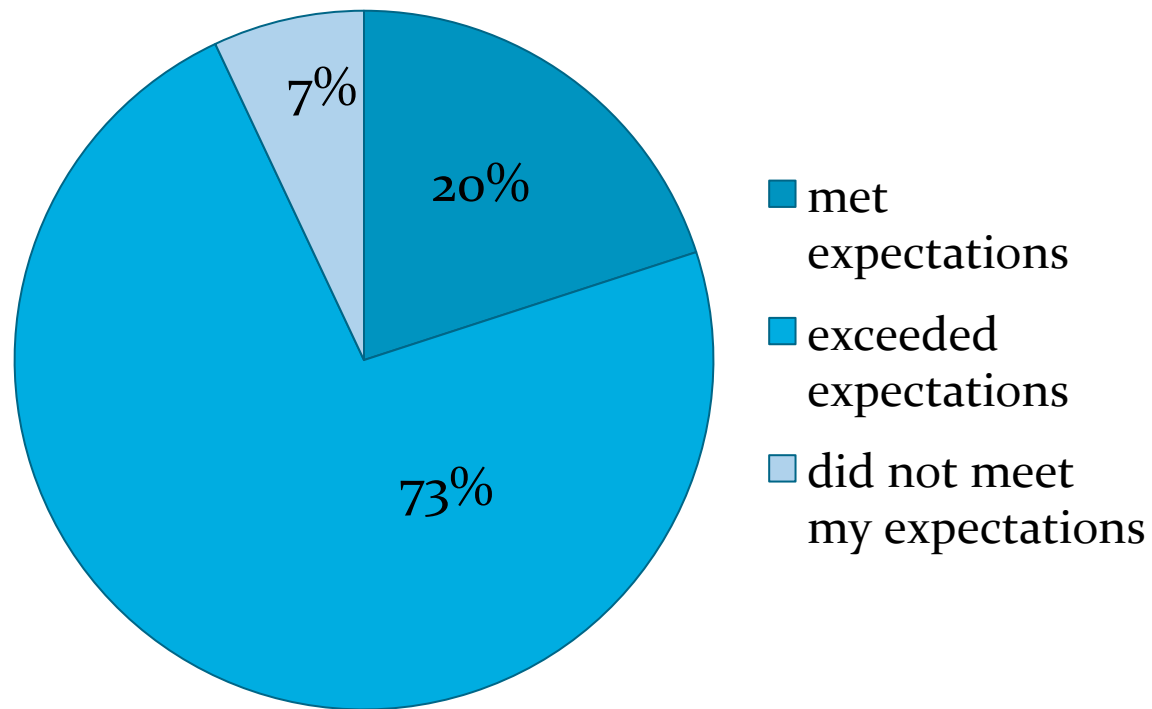
Goal: Add value by doing science on transits whenever feasible

- Coring on Oceanus with assistance from OSU team
- Calibration of equipment for ECOGIG cruise on Endeavor
- Planned collection of bathymetry data and coring for USGS and Geological Survey of Canada pocket project on Sikuliaq (weather prevented coring)



Student perceptions of their experiences

The STEMSEAS Program. . .



I had not expected the people to be so incredibly amazing. I didn't expect this to have such a powerful impact on my views of myself and my thoughts of going to graduate school. -- July student

How would you rate the interactions with instructors/mentors?

Worst										Best
0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	7%	20%	3%	70%



Learning from people who are so passionate about what they research (faculty and grad student), I feel more motivated to continue on to graduate school in the geoscience field. – August student



How would you rate the interactions with peers/meeting new people?

Worst										Best
0	1	2	3	4	5	6	7	8	9	10
								13%	17%	70%

How would you rate the STEMSEAS program overall?



Worst										Best
0	1	2	3	4	5	6	7	8	9	10
						3%	10%	3%	23%	60%

The program was a once in a lifetime opportunity that I will forever appreciate. I was very fortunate to receive this opportunity and I strongly believe that continuing the program will be to everyone's benefit. I can see the future of this program producing and transforming many students into STEM careers. I personally was able to witness a transformation through this program. – May student

Having participated in the STEMSEAS program, how have your **ACADEMIC/EDUCATIONAL** goals changed, if at all? How did the program influence those changes?

I was never sure on whether or not I wanted to attend graduate school and pursue my masters degree, but after being a part of STEMSEAS I am 100% sure that it is the path I should take. Being acknowledged on the questions we would make and complimented on the work we did by such educated individuals made me realize that I want to be around these type of people all the time. – May student

I think I will put my plans for vet school on hold and may pursue a graduate degree in marine science and continue to do research. – July student

*Originally, I'd been satisfied with finishing my undergraduate degree and then becoming a park ranger, but this program has me considering going to graduate school. **I can't believe people get paid/funded to do amazing things like sail/research on R/Vs!***
– August student



Overall, what was the main benefit of your participation in the STEMSEAS program? What did you get out of it?

- *I felt like it opened my eyes to new possibilities I was not aware of. I rekindled my certainty of science and field work. I feel like I have a new set of support in my future endeavors. – May student*
- *STEMSEAS allowed me to experience what it is like to be onboard a research vessel and get a hands-on practical approach as to how scientists go about gathering data from research expeditions. STEMSEAS helped me to be more focused on career path involving the geosciences while at the same time shows an array of other possibilities. – July student*
- *The main benefit of this program was coming out with a new appreciation of the geoscience field. I did not realize how interrelated all the science fields were within this one field. I also loved all the new friends I made through the program. – August student*
- *I met amazing individuals, made great connections, learned a ton, and am really considering graduate school as a result. Overall, I heavily advocate for this program and see so much potential. – August student*

My main benefit was learning that I absolutely, 100% love the ocean and that I love geoscience. I'm told all the time that most people don't love their work, that I shouldn't expect that in a job and that I shouldn't go for a job in what I love. This experience solidified to me that this is something I need to do because I am the happiest person I know when my mind is filled with rocks. This experience has given me more faith in myself and my ability to make the right decision for the next step in my life. – July student



What's next?

- We have applied for continued funding through NSF.
- Working with Jon Alberts, we have identified several potential transits for 2017
- We want to get to know and work with many of YOU, to identify synergies and get feedback and ideas to make this work well long-term.

Ship	Start	End	days	Start Port	End Port
Hugh Sharp	06/25	07/02	8	Lewes, DE	Panama City FL USA
Hugh Sharp	07/26	08/1	7	Panama City FL	Lewes, DE
Oceanus	04/19	04/22	4	San Diego, CA	Newport, CA
Ravelle	07/06	07/10	5	San Diego, CA	Seattle, WA
Ravelle	09/17	09/21	5	Seattle, WA	San Diego, CA
Sally Ride	07/12	07/16	5	Seattle, WA	San Diego, CA
Sikulialq	04/22	04/26	5	San Diego, CA	Newport, OR

Questions? scooper@ldeo.columbia.edu or jclewis@iup.edu



Inspiration

