



# Transforming Remotely Conducted Research using Education Ethnography & Rapidly Evolving Technologies



## The INSPIRE Program

Integrated NSF Support Promoting Interdisciplinary  
Research & Education

This Project Spans 3 NSF Directorates:  
Ocean Sciences (OCE)  
Education & Human Resources (EHR)  
Computer & Information Science & Engineering (CISE)





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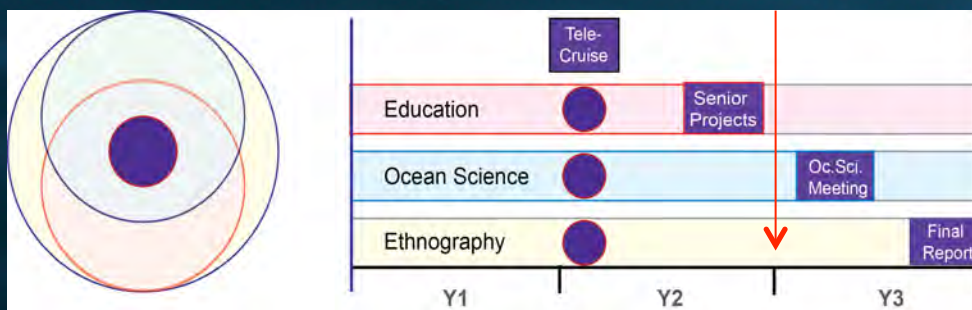
## What *WERE* We Thinking???



Goal: 2013 showed we *could* connect a UNOLS ship to shore via Telepresence. But *should* we? How can we use telepresence better, to facilitate active remote participation in research and undergraduate teaching.

Concept: A telepresence-enabled cruise nested within *Ocean Science* research that also forms a basis for research into *Educational* methods and *Ethnography*.

Motivation: Telepresence is not a “normal” way for working in the oceans and, on their own, oceanographers are not the best people to work out what the “new normal” should be. But ships keep shrinking so anything that can relieve demand for science berths is worth trying.







# Transforming Remotely Conducted Research The NSF-INSPIRE “TREET” Partnership



## Co-PIs:

Amy Pallant (Concord): Education      Katy Croff Bell (OET): Ocean-Telepresence  
Sheila Jasanoff & Zara Mirmalek (HKS): Ethnography      Kanna Rajan: (JPL/MBARI): Robotics

## Mentors:

Steve Carey (URI): Geology      Cindy Van Dover (DUMML): Biology

## Early Career Scientists:

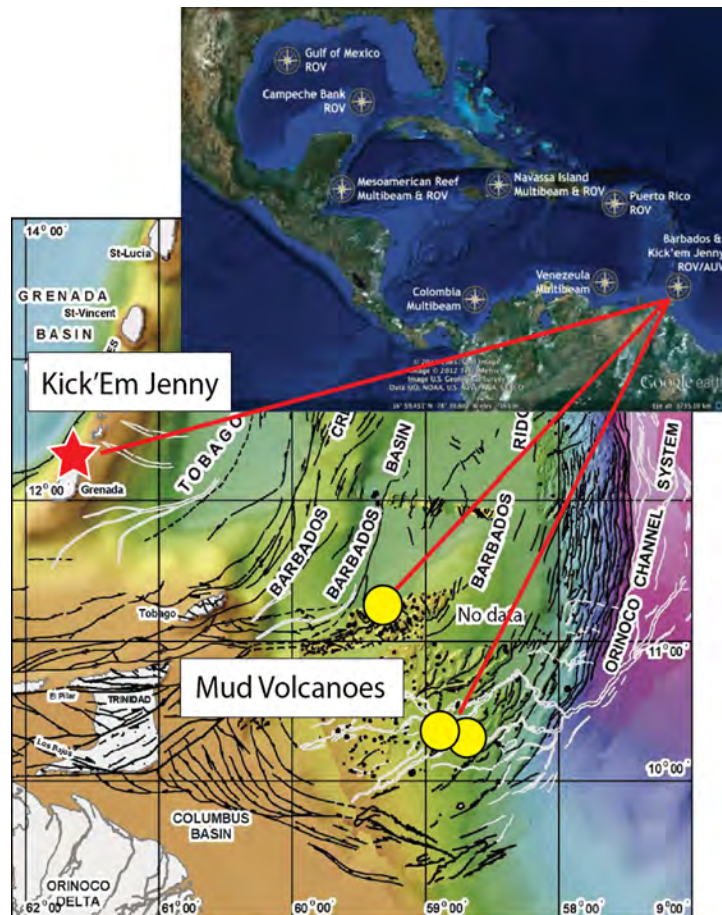
Eric Mittlestaedt (U.Idaho)      Anna Michel (WHOI)      Scott Wankel (WHOI)  
Masako Tominaga (Michigan State)      Chris Roman (URI)      Pete Girguis (Harvard)







# Transforming Remotely Conducted Research The Compelling Ocean Science Research Project



- Investigating the fate of  $\text{CH}_4$  and  $\text{CO}_2$  released to the oceans from *natural* examples of gas-rich seafloor fluid flow.
- Volcanic exhalations at Kick'Em Jenny submarine volcano (Steve Carey).
- Cold Seeps at the Barbados Mud Volcanoes (Cindy Van Dover).
- Multi-disciplinary investigations using methods in geophysics, imaging, and *in situ* biogeochemical sensing.
- Nobody to be allowed on the ship!!!





# Transforming Remotely Conducted Research Y1: Synchronous Winter Semester Seminar Series



## 13 Week Seminar Series: Mondays @ 6PM EDT

**Seminar in Remote Deep Sea Research & Exploration**

The spring 2014 seminar series is designed to introduce the project and provide undergraduates students with background they will need to undertake research during the second year of the project.

The seminar will provide:

- an overview of the program
- background on science and research pertinent to the sites to be studied
- an introduction to the technology and the robotic vehicles
- planning time for the research

The seminar will be held on Monday nights at 6:00 p.m. EST.

**Week 1: Jan 26-31**  
Chris Gorman (Co-PI), Amy Palmer (Co-PI) and Zora Minicich (Co-PI) introduce the program as a whole, overview of ethnography, education and evolving technologies

**Week 2: Feb 3-7**  
Katy Croft Bell (Co-PI), Steve Carney and Cindy Lee Van Dover, provide overview of technology and scientific research opportunities

**Week 3: Feb 10-14**  
Michigan State University (Masako Tomeraga)

**Week 4: Feb 17-21**  
Harvard University (Peter Giroux)

**Week 5: Feb 24-28**  
University of Idaho (Eric Minicich)

**Week 6: Mar 3-7**  
University of Rhode Island (Chris Roman)

**Week 7: Mar 10-14**  
Woods Hole Oceanographic Institution early career scientists (Anna Michel and Scott Whiting)

**Week 8: Mar 17-21 Spring Break (No Zoom session)**

**Week 9: Mar 24-28**  
Feasibility discussion: Discuss your research ideas with scientists and other students. Get ideas about tools and techniques.

**Weeks 10-11: Mar 31 - Apr 11 (Presentations March 31 and April 7)**  
Student presentations of research goals

**Week 12: Apr 14-18**  
Moving toward a plan for the cruise.  
Chris Gorman and Katy Croft Bell to present plan for the cruise that is feasible, equitable, get feedback from group.

**Week 13 (TBD)**  
Finalizing the plan (timing to be determined)  
Chris Gorman will explain final plan for the cruise.

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### Topics Covered:

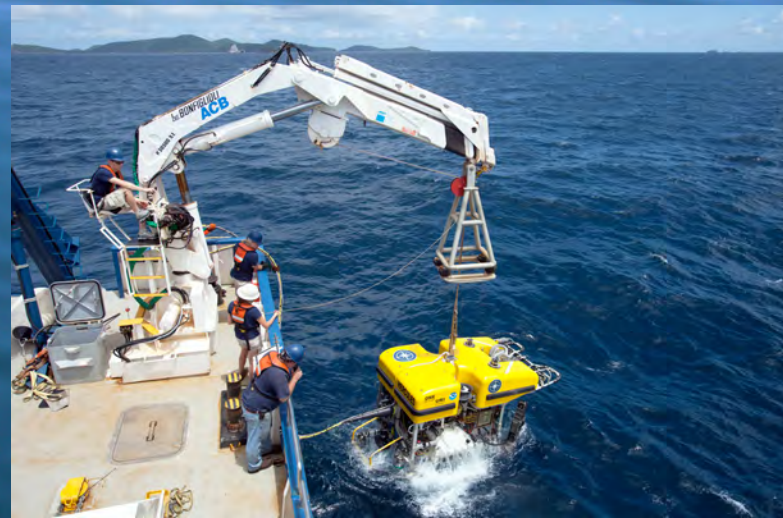
Introduction to the Technology  
Lectures on the Mentors' Interests  
Presentation of Student Projects

Introduction to the Field Areas  
Lectures on the ECS PIs' Interests  
Detailed Pre-Cruise Planning





# Transforming Remotely Conducted Research Y2: The TREET Cruise At Sea







# Transforming Remotely Conducted Research Y2: The TREET Cruise On-Shore





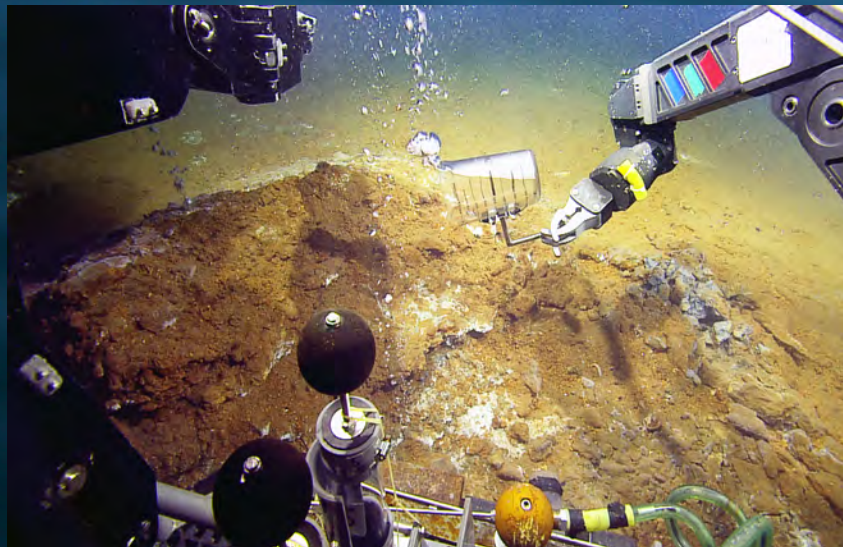


# Transforming Remotely Conducted Research 3 Weeks, 17 Dives, All Project Data Collected



The Concord Consortium

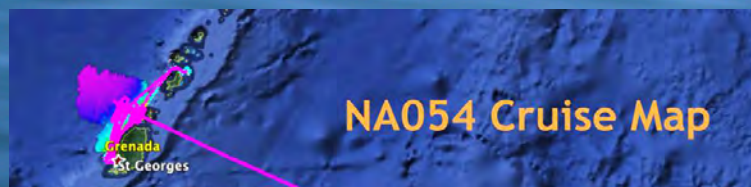
OCEAN EXPLORATION TRUST







# Transforming Remotely Conducted Research 3 Weeks, 17 Dives, All Project Data Collected



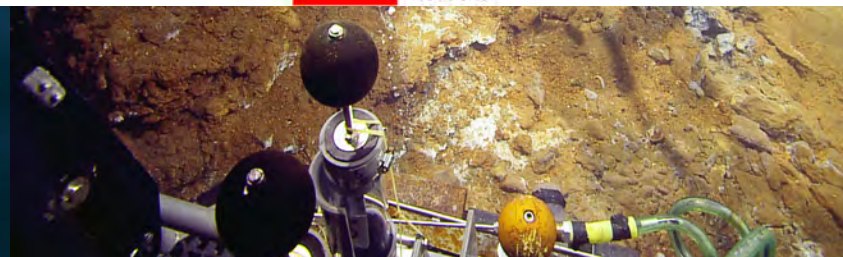
NA054 Cruise Map

Objectives to get a Passing/Worthwhile Grade for all our "Volunteer" Science Participants (ECS & Students)

Data Needs:		Chris R	Eric	Pete	Scott	Anna	Masako	Carly	Cody	Laney	Tyler	Silas	Taylor	Alex
Locale	Science Operations													
KEJ Crater	Detailed mapping in KEJ Crater	✓						✓	✓					
	Photo-mosaic in KEJ Crater	✓						✓	✓					
	Magnetic Survey of KEJ						✓			✓				
	Laser Spec at somewhere/anywhere			✓	✓	✓								
	Fluid flow somewhere/anywhere		✓											
	Bubble flow in KEJ	✓												
KEJ Flanks	Geology/fluids outside KEJ crater											✓		
	Dive-based studies of KEJ flank										✓			
KEJ Seeps	Animal photos at KEJ seeps													✓
	Laser spec at KEJ seeps													x
BMV Seeps	Laser spec at BMV												x	
	Bubble & fluid flow at BMV	✓	✓										✓	

Updated 28-Sep

Key  
 Achieved  
 Attempted  
 To Be Done  
 Not Done







# Transforming Remotely Conducted Research Y2: Synchronous Spring Semester Seminar Series



## 5 Week Series: Thurs @ 6PM EDT (Midnight in Germany!!!)

### Ocean Science Research Updates from each Laboratory:

April 2<sup>nd</sup>: WHOI      April 9<sup>th</sup>: URI (Roman/Carey)      April 16<sup>th</sup> Harvard  
April 23<sup>rd</sup>: Michigan State      April 30<sup>th</sup>: U.Idaho







## Transforming Remotely Conducted Research Y3: Long Term Outcomes from the Project



1. Work up of the **Educational Research** data-sets:
  - presentation to DESSC in Dec 2015
  - publication in peer-review literature in 2016
2. Work up of the **Ethnography Research** data-sets:
  - presentation to DESSC in Dec 2015
  - publication in peer-review literature in 2016
3. Special session on **Telepresence-enabled** Ocean Science and Exploration at Ocean Sciences Meeting, March 2016  
(Co-Chairs: German, Demopoulos, Bell, Raineault)