Creating a Thriving Workplace:

A conversation about the successes and challenges in building a stellar CI workforce in NSF Major Facilities

Organized by NSF Funded projects:

CI CoE PILOT

cicoe-pilot.org

Grant # 1842042

CI

ci4resilience.org

Grant # 2042054/2042055

June 2021

CI CoE PILOT

CI For Resilience

Welcome!

CI CoE Pilot (funded in 2018):

- Understand the CI needs of NSF Major Facilities (MFs)
- Develop a Blueprint and a model for a CI CoE that would provide advice about the CI underpinning the data lifecycle of NSF MFs

CI4Resilience (funded in 2020), Kerk Kee PI:

- Understand how NSF MFs reacted and adapted to the pandemic
- Understand how CI can help to adapt or could help in future crises

Began to understand the uniqueness of MF CI workforce needs

Ewa Deelman, University of Southern California
CI COE Pilot PI, CI4 Resilience Co-PI

June 2021

CI CoE PILOT

CI For Resilience

Workshop Organizing Team

- Joel Brock (Cornell, CHESS)
- Laura Christopherson (CI CoE, UNC)
- Rafael da Silva (CI CoE, USC ISI)
- Kerk Kee (CI CoE, TTU)
- Angela Murillo (CI CoE, IU-Purdue)
- Jaroslaw Nabrzyski (CI CoE, ND)
- Chris Romsos (OR, RCRV)
- Mats Rynge (CI CoE, USC ISI)
- Karan Vahi (CI CoE, USC ISI)
- Wendy Whitcup (CI CoE, USC ISI)

CI CoE PILOT

CI For Resilience

OPENING REMARKS

01

2019 NSF Workshop on Connecting Large Facilities and Cyberinfrastructure

Connecting Large Facilities, Connecting CI, Connecting People

Spring 2020

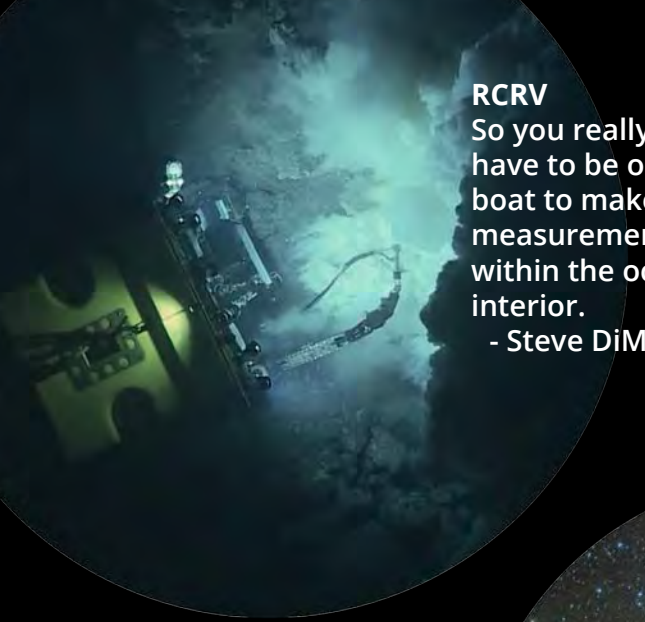
CI CoE PILOT

Hiring and Retention

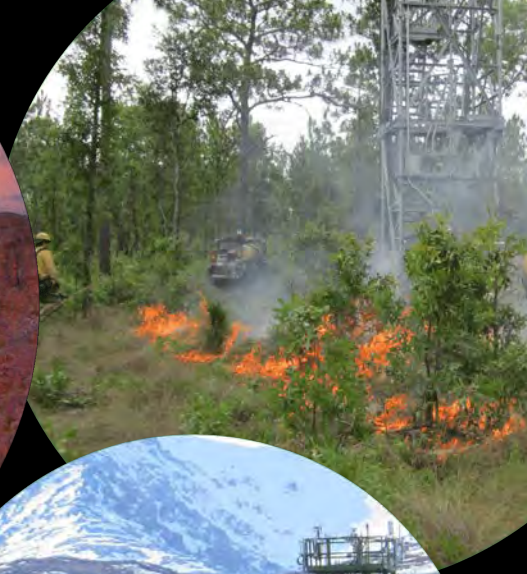
- How do you advertise and recruit for open positions?
- What avenues have proven successful for obtaining employees?
- Describe your hiring process. What works well about your current hiring process?
- What barriers do you encounter when filling vacant positions in your organization?
- What type of person are you looking to hire? (Domain scientists, purely software, etc.)
- What skill sets are you looking for in candidates?
- What types of positions do you have difficulty filling? (Indicate professional title/credentials and/or functional roles.)
- Is retaining employees an issue? If so, what are you doing to facilitate retention?
- What support does your institution provide in helping you retain employees?

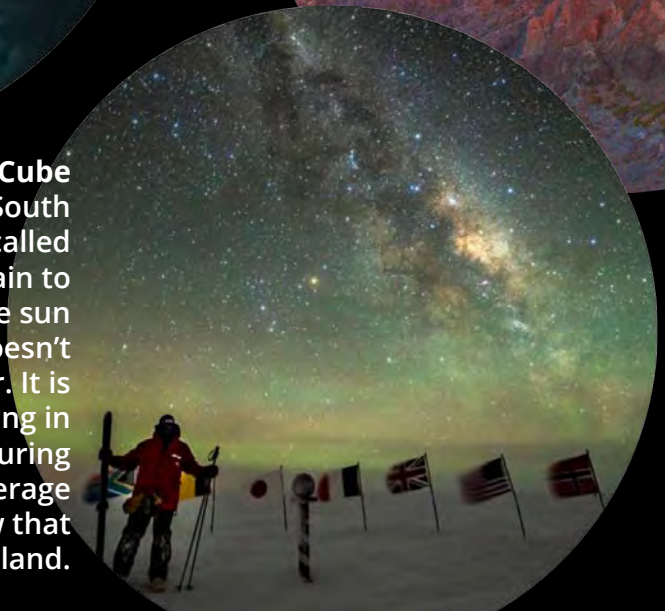
We have over 50 video conferencing systems scattered over about four different locations on two different continents to allow scientists and engineers to collaborate as if they were in the same room.

- Jerry Brower, Gemini Observatory



RCRV
So you really have to be on a boat to make measurements within the ocean interior.
- Steve DiMarco



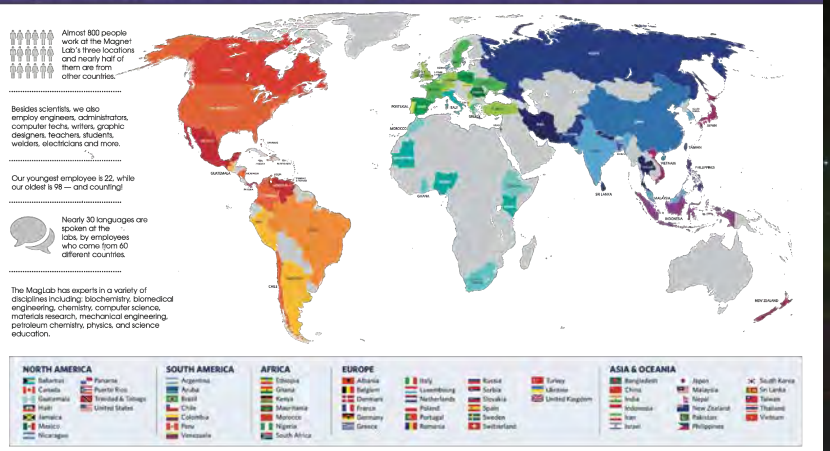


IceCube
During winter at the South Pole, a skeleton crew, called winterovers, remain to maintain the station. The sun sets in February and doesn't rise again until November. It is very difficult to get anything in or out of the South Pole during these months. The average temperature is so low that most aircrafts cannot land.

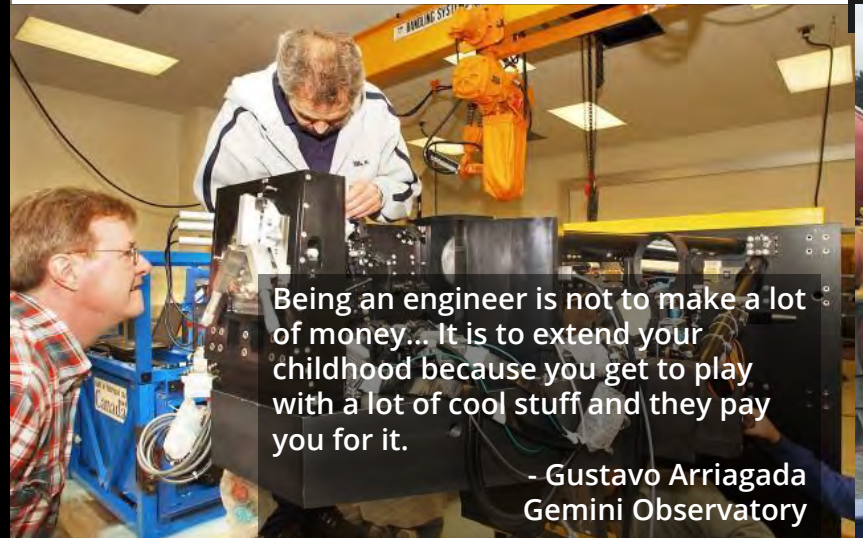
NEON
The days can be long and the work rigorous at times, including hiking in tough terrain, but the work is interesting, meaningful, and immersed in nature.

A Culturally Diverse Staff

MagLab employees come from all over the world

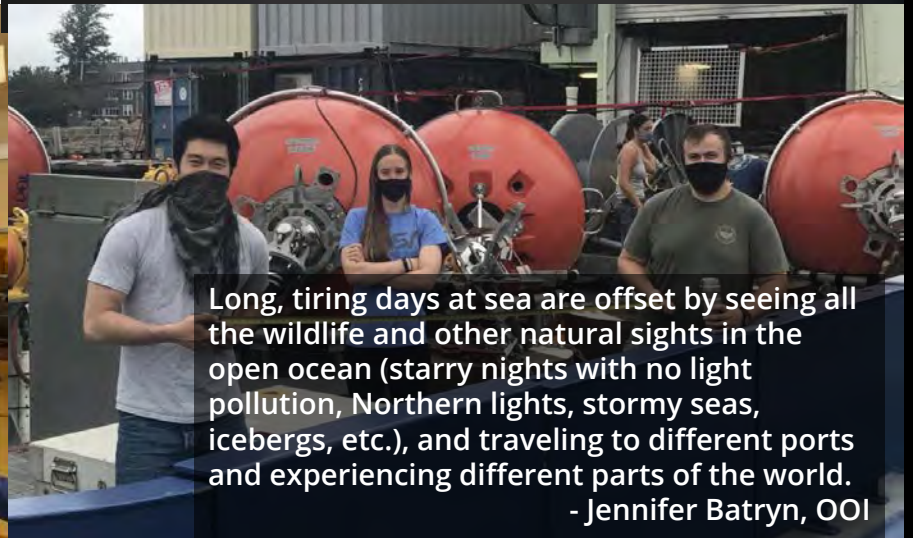


They trekked out there to take some measurements and do some troubleshooting. Afterward, they took a break in the snow lying down to look up at the stars and Milky Way.



Being an engineer is not to make a lot of money... It is to extend your childhood because you get to play with a lot of cool stuff and they pay you for it.

- Gustavo Arriagada
Gemini Observatory



Long, tiring days at sea are offset by seeing all the wildlife and other natural sights in the open ocean (starry nights with no light pollution, Northern lights, stormy seas, icebergs, etc.), and traveling to different ports and experiencing different parts of the world.

- Jennifer Batryn, OOI

Agenda

9am PT/12pm ET Opening Remarks

9:15am PT/12:15pm ET Keynote: Creating a Trained and Motivated User Base for Large Research Facilities and Their Data

10am PT/1pm ET Panel 1: Remote/Distributed Team Work

10:45am PT/1:45pm ET Break

11:15am/2:15pm Panel 2: Non-Traditional Work Settings

12pm PT/3pm ET Activity: Creating a work culture that taps into intrinsic motivations

2:30pm PT/4:30pm ET Closing Remarks

CI CoE PILOT

CI For Resilience

Keynote: Creating a Trained and Motivated User Base for Large Research Facilities and Their Data

Clare E. Reimers

Distinguished Professor, College of Earth Ocean and Atmospheric Sciences, Oregon State University and Project Scientist for the RCRV Project

02

NSF

Creating a Trained and Motivated User Base for Large Research Facilities and Their Data

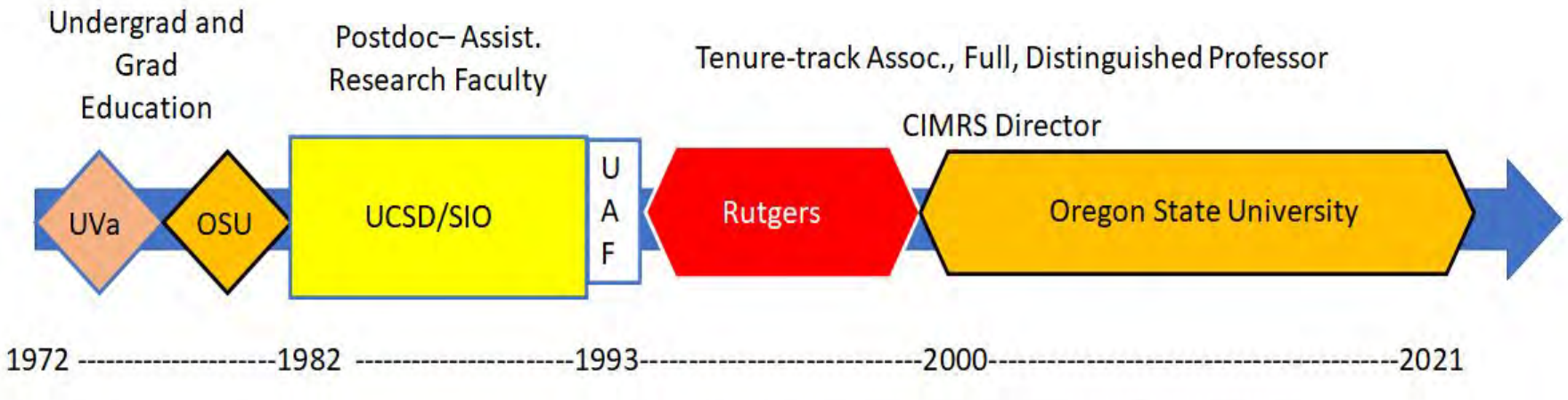
Lessons from the Academic Research Fleet and UNOLS

Presentation for the CICoE Workforce Development Workshop
6/29/2021

Clare E. Reimers
Oregon State University

Arctic & Antarctic | Astronomy & Space | Biology | Chemistry & Materials | Computing | Earth & Environment | Education | Engineering | Mathematics | Nanoscience | People & Society | Physics

SPEAKER ACADEMIC HISTORY



First Cruise USGS 1976

First ARF Cruise 1977-R/V *Wecoma*

First cruise as chief scientist 1987

UNOLS Rep., Council member, FIC, FIC Chair

2011 First Chief Sci Training Program

ARF: R/V Atlantis and ROV Jason 2019

MESSAGE

Large Research Facilities are valuable and often unique assets for advancing science and for workforce development, but these goals can only be fully met when the science user community understands and contributes to:

- *what facilities offer*
- *how they are managed and funded*
- *how they are accessed and scheduled*
- *user responsibilities and risks*
- *capabilities available to promote collaboration, data sharing, and outreach*

ACADEMIC RESEARCH FLEET

2021 Fleet Composition

Ship/Class	Owner	Operator	Length-Over-All (m [ft])	Delivered (y)	Projected End of Service (y)
Global Class					
RV *Thomas G. Thompson*	Navy	UW	84 [274]	1991	2036
RV *Roger Revelle*	Navy	SIO	84 [274]	1996	2041
RV *Atlantis*	Navy	WHOI	84[274]	1997	2042
RV *Sikuliaq*	NSF	UAF	80 [261]	2014	2045
RV *Marcus G. Langseth*	LDEO	LDEO	71 [235]	1991	2023
Ocean/Intermediate Class					
RV *Kilo Moana*	Navy	UH	57 [186]	2002	2032
RV *Neil Armstrong*	Navy	WHOI	73 [238]	2015	2045
RV *Sally Ride*	Navy	SIO	73 [238]	2015	2046
RV *Endeavor*	NSF	URI	56 [184]	1976	2022
RV *Oceanus*	NSF	OSU	54 [177]	1976	2021
RV *Atlantic Explorer*	BIOS	BIOS	51 [168]	1982	2026
Regional Class					
RV *Hugh R. Sharp*	UDel	UDel	44 [146]	2005	2035
Coastal/Local Class					
RV *Robert Gordon Sproul*	SIO	SIO	38 [125]	1981	2023
RV *Pelican*	LUMCON	LUMCON	35 [116]	1985	2023
RV *Walton Smith*	UMiami	UMiami	30 [96]	2000	2030
RV *Savannah*	SkIO/UG	SkIO/UG	28 [92]	2001	2031
RV *Blue Heron*	UMinn	UMinn	26 [86]	1985	2025
RV *Rachel Carson*	UW	UW	22 [72]	2003	2033

R/V Sally Ride/ SIO

Access through funded research projects
Scheduling through UNOLS

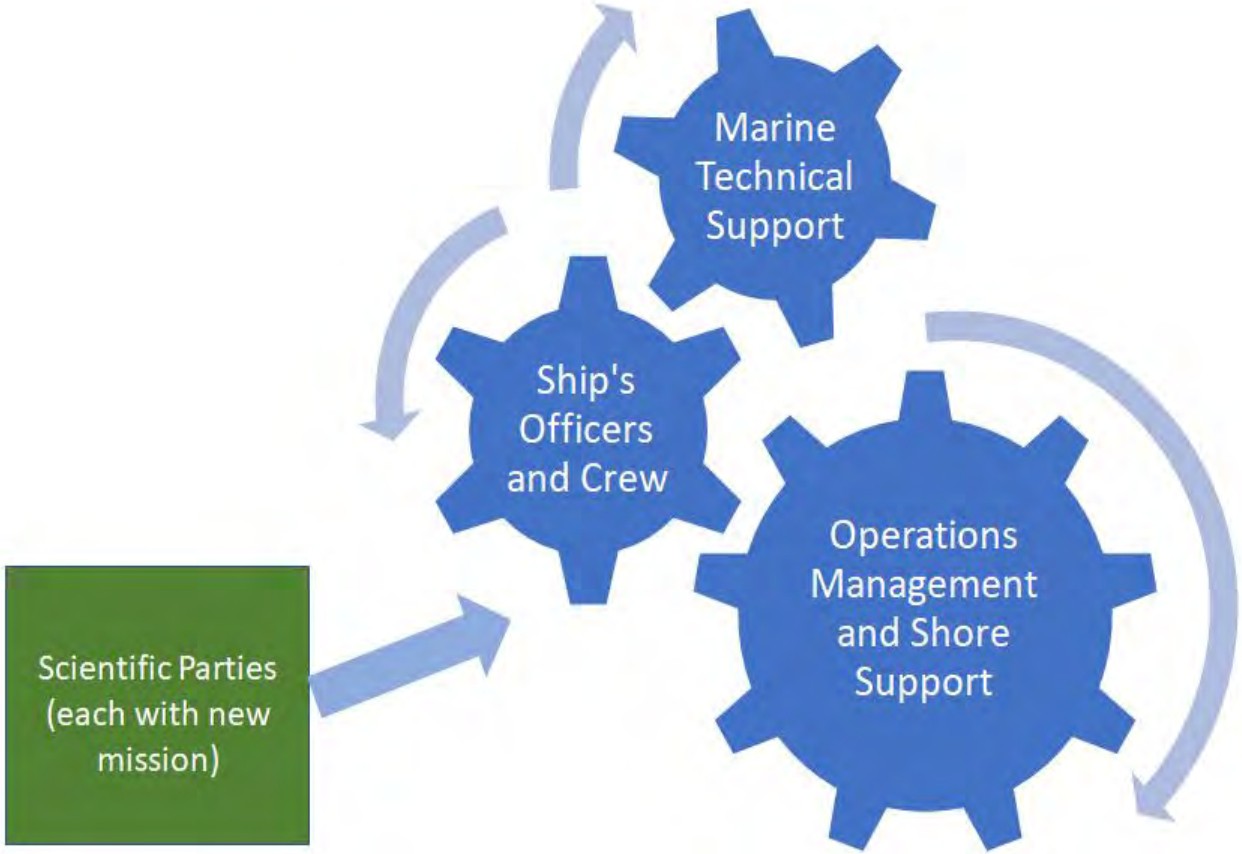
FLEET RENEWAL

2025 Fleet Composition

Ship/Class	Owner	Operator	Length-Over-All (m [ft])	Delivered (y)	Projected End of Service (y)
Global Class					
RV *Thomas G. Thompson*	Navy	UW	84 [274]	1991	2036
RV *Roger Revelle*	Navy	SIO	84 [274]	1996	2041
RV *Atlantis*	Navy	WHOI	84[274]	1997	2042
RV *Sikuliaq*	NSF	UAF	80 [261]	2014	2045
RV *Marcus G. Langseth*	LDEO	LDEO	71 [235]	1991	2023
Ocean/Regional Class					
RV *Kilo Moana*	Navy	UH	57 [186]	2002	2032
RV *Neil Armstrong*	Navy	WHOI	73 [238]	2015	2045
RV *Sally Ride*	Navy	SIO	73 [238]	2015	2046
RV *Taani*	NSF	OSU	61 [199]	2022	2052
RV *Narragansett Dawn*	NSF	ECOC	61 [199]	2023	2053
RV *Gilbert R. Mason*	NSF	GCOC	61 [199]	2023	2053
RV *Atlantic Explorer*	BIOS	BIOS	51 [168]	1982	2026
RV *Hugh R. Sharp*	UDel	UDel	44 [146]	2005	2035
Coastal/Local Class					
RV *Walton Smith*	UMiami	UMiami	30 [96]	2000	2030
RV *Savannah*	SkIO/UG	SkIO/UG	28 [92]	2001	2031
RV *Blue Heron*	UMinn	UMinn	26 [86]	1985	2025
RV *Rachel Carson*	UW	UW	22 [72]	2003	2033

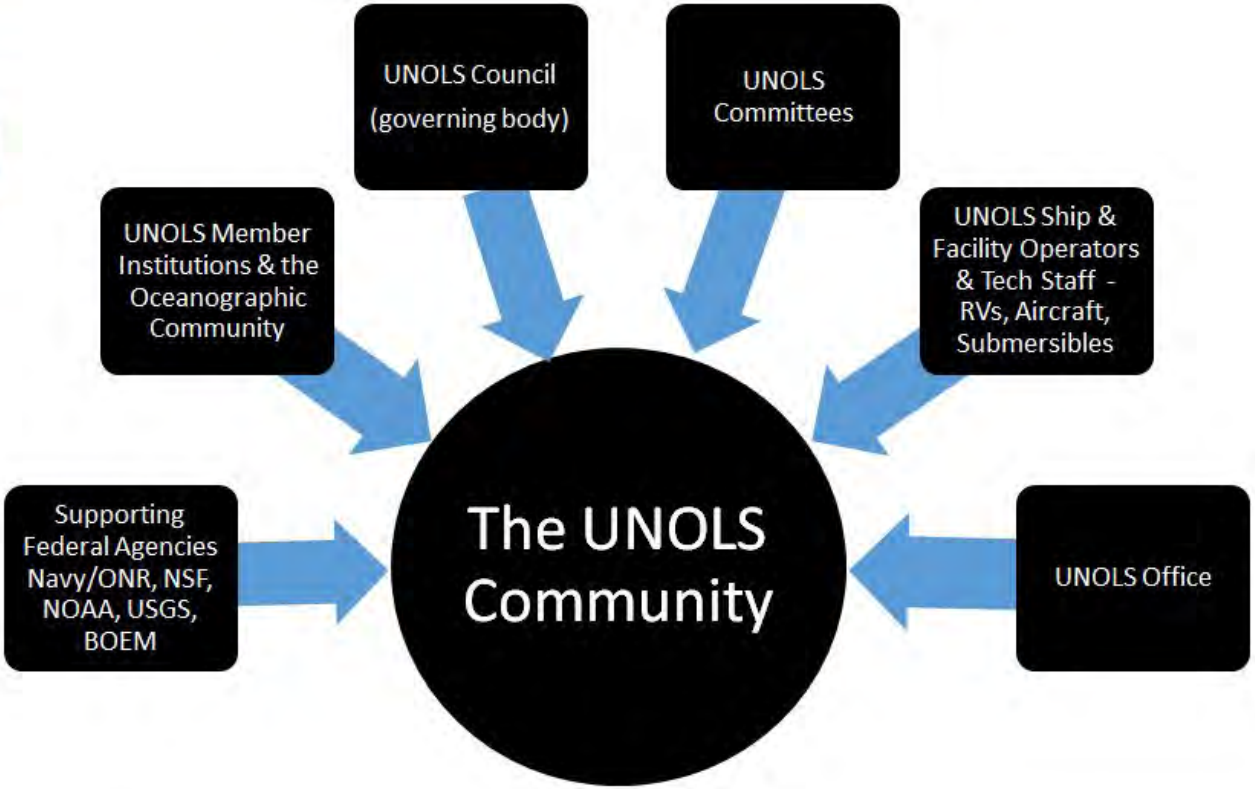
3 RCRVs
NSF Facilities to modernize the ARF

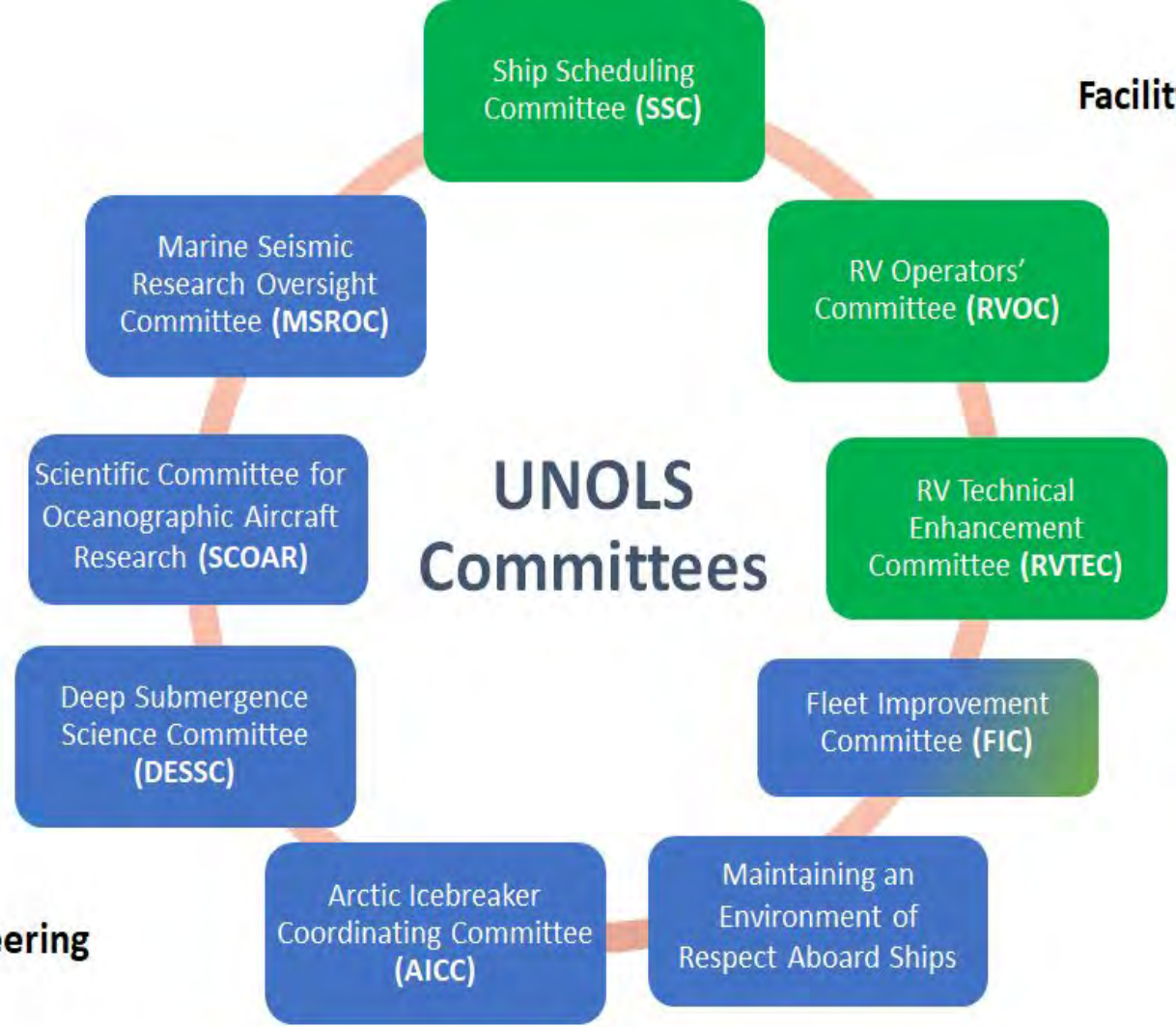
RESEARCH VESSEL WORKFORCE



Integration
Efficiency
Motivation
Success

WHAT IS UNOLS?





Facility workforce driven

Science and engineering workforce driven

NAVIGATING THE SYSTEM

In 2010 UNOLS Fleet Improvement Committee set out to address several observations :

- a decline in ship time requests (STR) linked to research proposals
- new researchers lacked knowledge about the STR system and the impacts of requests on proposal success and budget
- many researchers were unfamiliar with what equipment and services ships and other supporting facilities in the ARF had to offer
- many ocean scientists lacked an understanding of the duties of a chief scientist, how to interact with facility operators and marine technicians, and the skills needed to be a cruise leader
- opportunities to acquire samples and test developing equipment could help new investigators to develop future programs

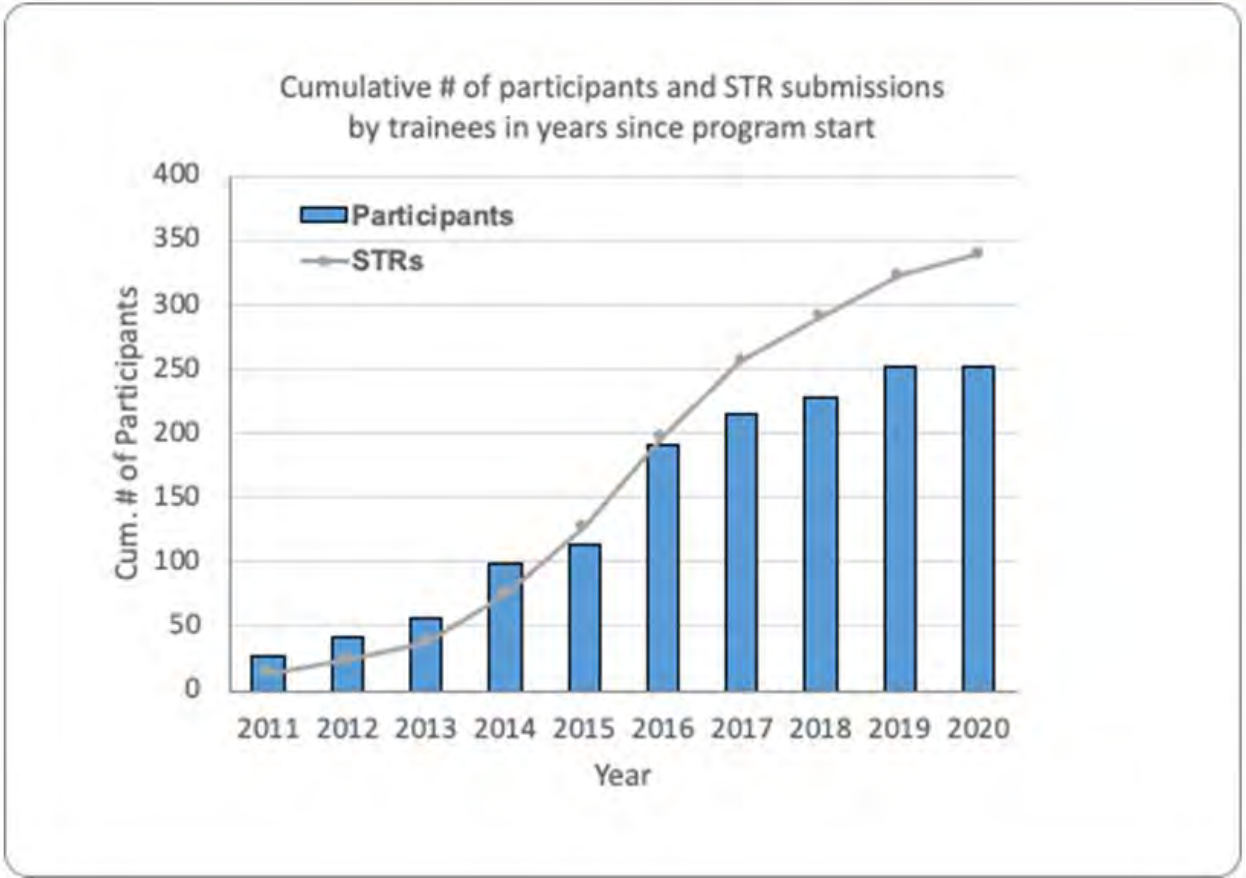
CHIEF SCIENTIST TRAINING PROGRAM INITIATED IN 2011

Enlisted experienced scientists, marine technicians and operators to train participants in "cradle to grave" phases of expeditionary multi-disciplinary oceanography

In 1.5-day **workshop format** discussed initial proposal, facility requests, science and cruise logistics planning, cruise execution, post-cruise reporting, pitfalls

Through **multi-day cruise on a research vessel** had participants assemble a synergistic advanced science plan, communicate across the team and with the operator, become familiar with ship's equipment and the operational environment, lead and maintain the cruise plan, set evolving priorities, follow rules of safety and appropriate conduct, report outcomes

PROGRAM CONTINUATION



Initial program involved 4 cruises on 3 different intermediate-sized vessels.

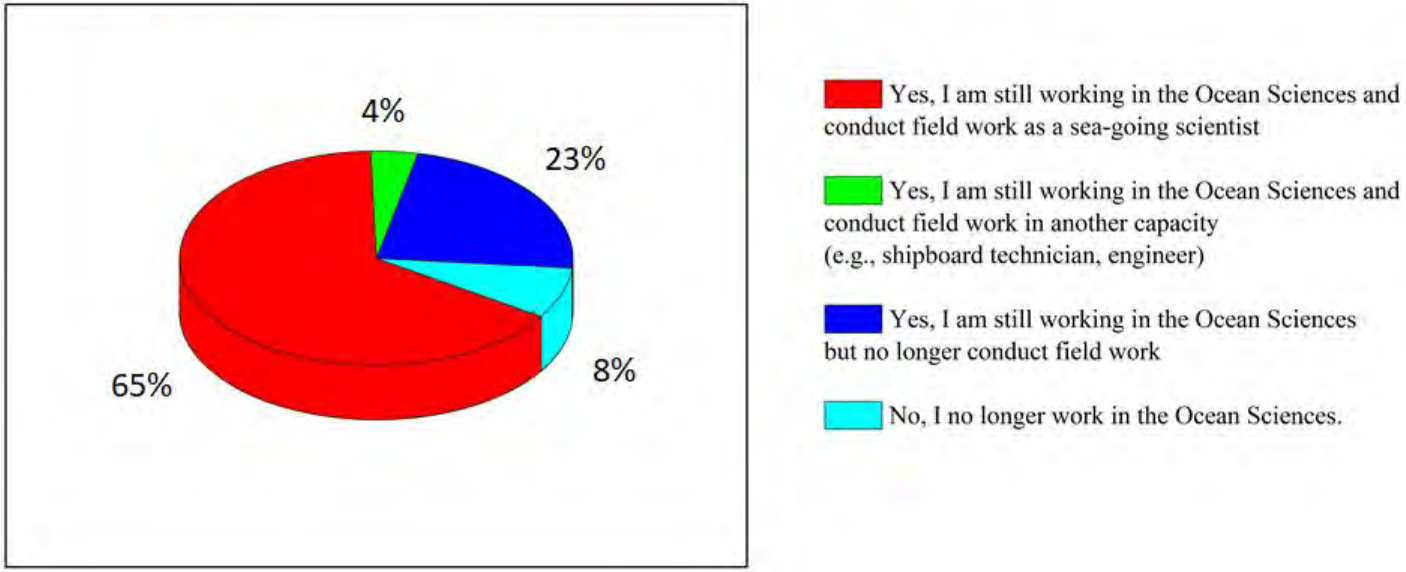
To date: 12 ships have hosted one or more Chief Scientist Training workshops/cruises enlisting 251 participants (mostly early career) selected by an application process.

UNOLS Office has tracked number of STRs submitted by these trainees after their program participation.

OUTCOMES- 10 YEAR RETROSPECTIVE

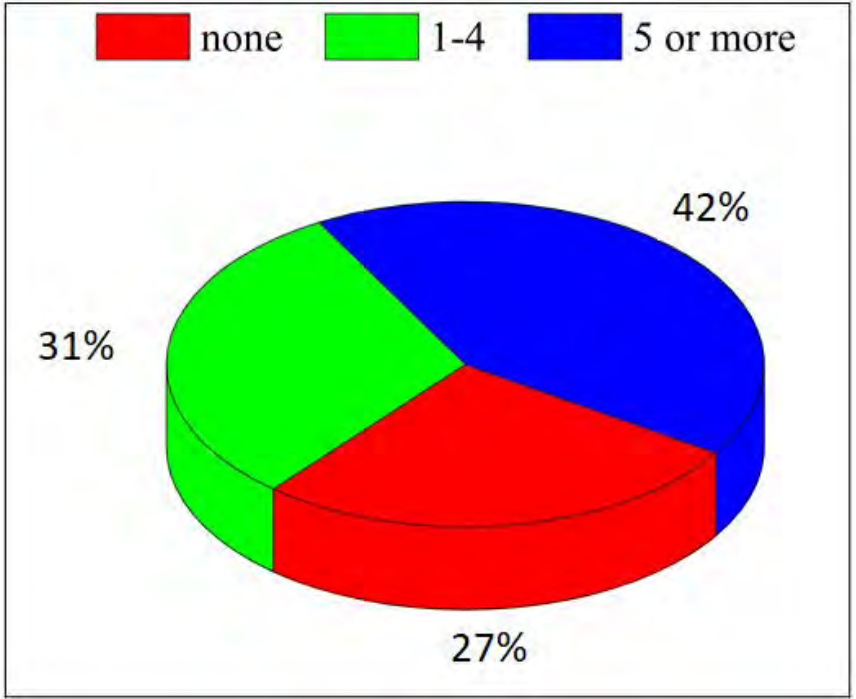
Survey sent in June 2021 to the 56 participants from the first 4 workshops/cruises conducted 2011-2013; 26 responded.

1. Since your program participation, have you continued active field work in a discipline of the Ocean Sciences?



FURTHER FACILITY USE

2. Subsequent Research Cruises (excluding day trips)



3. Subsequent Cruises as Chief Scientist

R/V *Weatherbird II*
R/V *Savannah*
R/V *Pelican*

LASTING IMPACTS: CONFIDENCE AND COLLABORATION

4. Please describe ways your participation in the UNOLS Chief Scientist Training Program has contributed to your career advancement.

"The program gave me insight into the UNOLS organization, the ship time scheduling process, how to prepare to be a good Chief Scientist, and made me much more confident about applying for grants that included ship time."

"The program made me more confident in planning my own research at sea and helped me to train students in conducting research at sea during the annual RGNO Namibia field course."

"The program contributed to my career advancement from post-doc to assistant professor and has provided me with an argument in NSF grants that I am qualified to lead a research cruise."

"The UNOLS Chief Scientist Training Program cruise in 2011 was my first research cruise where I designed the project on my own. I felt confident both during and after the cruise that I could do this. The cruise was short, but it gave me confidence and immense motivation to carry on an academic path."

"For me, the greatest value was the scientists I met and relationships I built."

SCIENTIFIC RESULTS AND NEW IDEAS

5. Please provide a listing of any research publications or thesis that includes results from you cruise participation.

Journal Publications Reported:

Frontiers Mar Sci.
JGR Atmospheres
Ann. Rev. Mar Sci.
Methods in Oceanography
Smart Materials and Structures
Journal of Plankton Research
Molecular Phylogenetics and Evolution
ISME Journal
Limnology and Oceanography
PLOS One
Microbiology Resource Announcements
Environmental Microbiology
Journal of Great Lakes Research

"subsequent research with collaborators I made on the Chief Sci cruises has led to publications and dissertation studies of graduate students in my group"

"No publications, but I do have a funded NSF proposal now that the cruise gave me the confidence that the idea would work"

"The cruise also provided samples that were used as the basis for my postdoctoral work"

"This program helped me prepare successful proposals to Ohio Sea Grant and develop collaborations with Environment and Climate Change Canada and the Canadian Coast Guard"

OTHER RETROSPECTIVE COMMENTS

Takes time for early career scientists to achieve funding success necessary for cruise leadership

"It took some time before I had the success with grant funding to become a chief scientist, but now I have two cruises this year (one already completed) and next as a UNOLS chief sci and I credit the training program with preparing me for the myriad logistical and organizational steps required to pull off a successful cruise. I'm very thankful for the experience."

"While funding for cruises continues to be extremely difficult to obtain, taking advantage of this and other ship-of-opportunity cruises has provided many opportunities to gain valuable experience and ultimately yielded pathways for me to get minority and underserved students out to sea to share the experience with them, yielding better prepared graduates from our program."

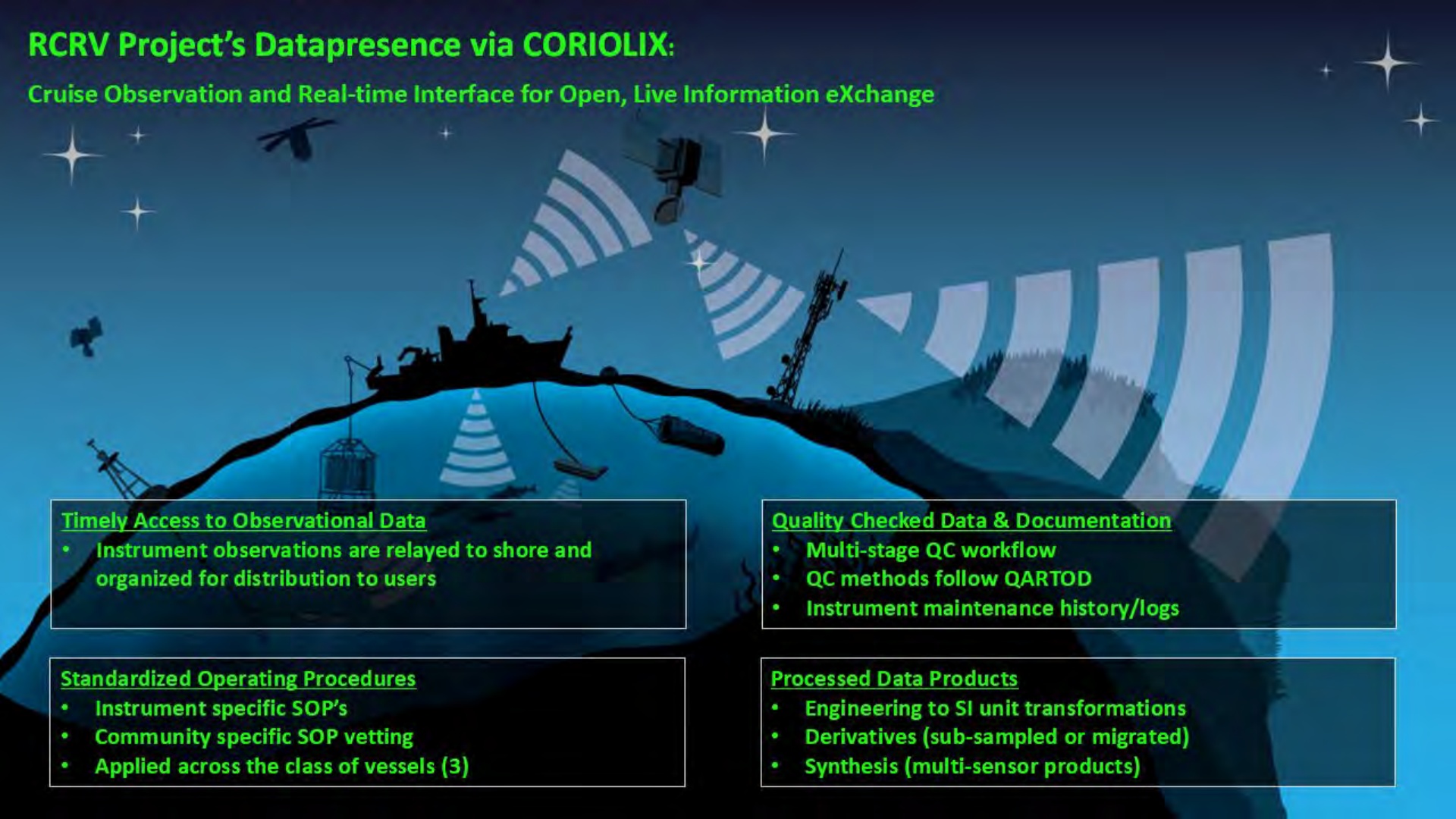
CRUISING WITH CYBERINFRASTRUCTURE

WHAT IS BEING IMPLEMENTED?

- **New Software tools for cruise planning, coordination and data sharing**
- More sensors and corresponding data streams
- Near-realtime QA/QC
- Near-realtime standard data products
- Interactive data alerts
- Ship-to-shore sharing of data and engagement with onshore specialists.

RCRV Project's Datapresence via CORIOLIX:

Cruise Observation and Real-time Interface for Open, Live Information eXchange



Timely Access to Observational Data

- Instrument observations are relayed to shore and organized for distribution to users

Quality Checked Data & Documentation

- Multi-stage QC workflow
- QC methods follow QARTOD
- Instrument maintenance history/logs

Standardized Operating Procedures

- Instrument specific SOP's
- Community specific SOP vetting
- Applied across the class of vessels (3)

Processed Data Products

- Engineering to SI unit transformations
- Derivatives (sub-sampled or migrated)
- Synthesis (multi-sensor products)

CORIOLIX

Tue Jun 22 2021 21:45:52 UTC

RV TestShip17

Last Data Collected
44.64062° N, -124.30998° E Depth 81.3 m Tue Jun 22 2021 21:45:51 UTC

Home | Login | Cruise Tools | Cruise Chart | Sensor Plots | Status | Sensors | Data | Documents | Settings | My Account | About

THIS IS A DEMONSTRATION SITE

CORIOLIX

Distributed application
- Shore and Ship CI

Web accessible
- Consistent interface
- User based roles and permissions

Compatible with
- ARF planning and inventory tools
- Data assembly center workflows
- Scientific Data Access Protocols

Integrated with
- Data acquisition
- Calibration and maintenance schedules

Where to start?

Sensor Status
Monitor sensor systems for real-time state of health

Time-series
View real-time data from shipboard sensors

Cruise Chart
Visualize underway data on a map; review and plan cruise tracks

Create Account
Create & manage your account

Data Access
Access real-time data and data products via download or 3rd party client tools

Documents
Catalog and explore manuals, calibration files, and other metadata

Remote Participation

CORIOLIX provides **real-time access to data and tools** on both **ship and shore**. Shoreside users see the same data, plots and tools as the science party on the vessel. Changes to logs and metadata are automatically copied from ship to shore and vice versa. Shoreside access allows **remote participation** by scientists on shore, data **quality control** by sensor specialists, and **public access** to data and tools for outreach and education.

Feedback

ARF: R/V Atlantis and ROV Jason 2019

MESSAGE-REVISIT

Large Research Facilities are valuable assets and often unique for advancing science and for workforce development, but these goals can only be fully met when the science user community understands and contributes to:

- *what facilities offer*
- *how they are managed and funded*
- *how they are accessed and scheduled*
- *user responsibilities and risks*
- *capabilities available to promote collaboration, data sharing, and outreach*

CONCLUSIONS

- We do not want to leave it to chance and privilege that access to and information about federally-supported Large Facilities is shared widely.
- During operations, programs that invite new users should be part of facility management and workforce development.


Daniel K. Inouye Solar Telescope


Vera. C. Rubin Observatory


Regional Class Research Vessels


Antarctic Infrastructure Modernization for Science

Sources: Claire Raftery/Association of Universities for Research in Astronomy, Inc./National Solar Observatory (top left); W O'Mullane/ LSST Project/NSF/AURA (top right); Artist Rendering by Glosten (bottom left); Leidos (bottom right). | GAO-20-268

RV *TAANI*

QUESTIONS or DISCUSSION?

CI CoE PILOT

CI For Resilience

Panel 1: Remote/ Distributed Team Work

- Alisdair Davey NSO
- John Haverlack - ARF
- David Schultz - IceCube
- Wendy Whitcup - CI CoE

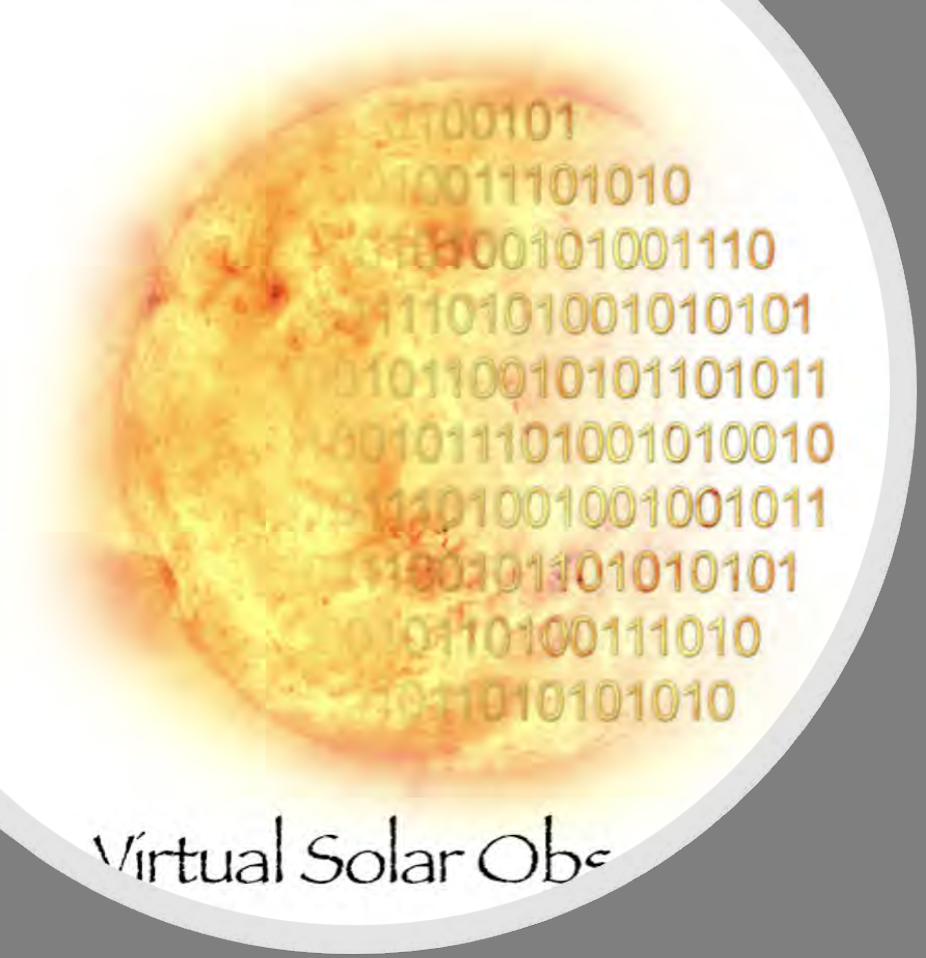
03

Virtual Solar Observatory

Alisdair Davey

Daniel K. Inoue Solar Telescope
Data Center Scientist

Maybe the sharks are a metaphor?

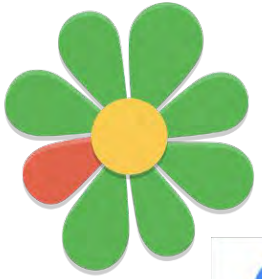


Virtual Solar Observatory (VSO)

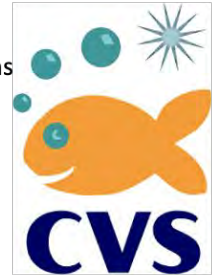
- Homogenous access to heterogeneous data
  - I don’t need to know the details of where and how, just give me the data I WANT!
  - Data providers all round the planet
- Data validation services
- Small Team (6-11 people) since 2002
  - As many as 7 institutions (3 time zones)
  - Scientists and programmers
  - Written in Perl
- Almost daily interactions with each other
  - Status
  - Programming support / Trouble shooting
  - User interaction
  - Supporting projects like SolarSoft and SunPy which can use VSO under the hood

Collaboration technologies

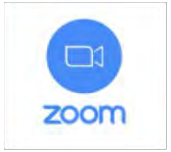
git



- Programming in Perl
  - Documentation in the code
  - Moving slowly to Python?
- Internet Relay Chat -> ICQ -> Conversations -> Element (matrix)
  - Worked out early that mail was just too cumbersome.
  - Invite data providers to our discussions
- Early adoption of wikis / ticketing
- Code versioning is important
  - CVS (some code now in git)
  - Custom scripts to parse CVS to see what's changed daily
- Hard to move on from what you know (are comfortable with!)
  - git learning curve makes us pause!



WIKIPEDIA
The Free Encyclopedia



VSO (Small Team)

Other Takeaways

- Personalities / character of the team greatly affect cohesion
  - Face to face versus online (remote) collaboration changes how people interact
  - Face to face meetings are still important especially when you are nearly always remote
  - Allowing socialization in interactive spaces helps with teamwork (with caveats)
- When you are the first one you end up being very reactive. It's hard to go from reactive to pro-active!
- Don't underestimate beer as a collaboration tool

Challenges

- Small teams can be very collaborative especially when they are all highly invested in what you are doing, but it still must be clear who is in charge even / especially in projects that have been going for many years with the same people.
  - Enforce management structure where necessary
- Working with people you have at best minimal influence (remote data providers) over is challenging! Changes to machines / web servers / databases / personnel will happen. Often only find out about changes when things break!
  - Shot ourselves in the foot by not insisting on minimal data standards in the beginning
  - Didn't build in testing from the beginning
- Changing face of IT infrastructure

Successes

- Project is still going after nearly 20 years!
  - VSO is a focused project to serve the solar physics community. Having a strong focus aids greatly when working with a remote team. Near daily interaction helps this
- We encourage training and updating skills. If you learned something new, write a wiki page about it and give a short presentation or demonstration
  - Covering for each other – spreading knowledge wealth – supporting team ethos

U.S. Academic Research Fleet (ARF)
University of Alaska Fairbanks (UAF)
R/V Sikuliaq

John Haverlack (jehaverlack@alaska.edu)

- IT Manager UAF College of Fisheries and Ocean Sciences (CFOS)
- B.S. Physics ‘94 Virginia Tech
- Linux Systems Administrator / Programmer / IT Manager since 1991
  - Transmeta Corporation
  - Sourceforge Inc.
  - Alaska Satellite Facility (UAF)
  - College of Fisheries and Ocean Sciences (UAF)

IceCube Neutrino Observatory

David Schultz

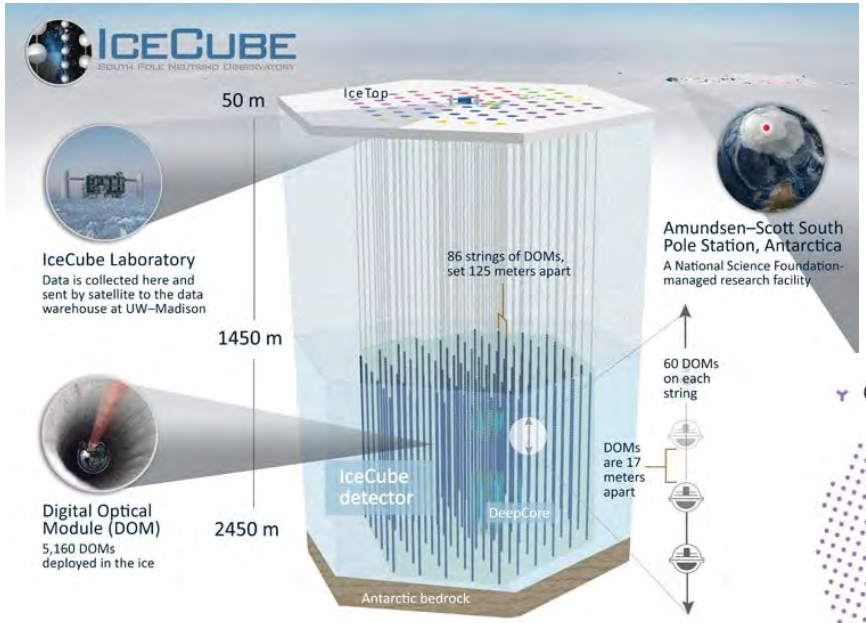
- Production Software Manager
  IceCube Neutrino Observatory
  University of Wisconsin–Madison

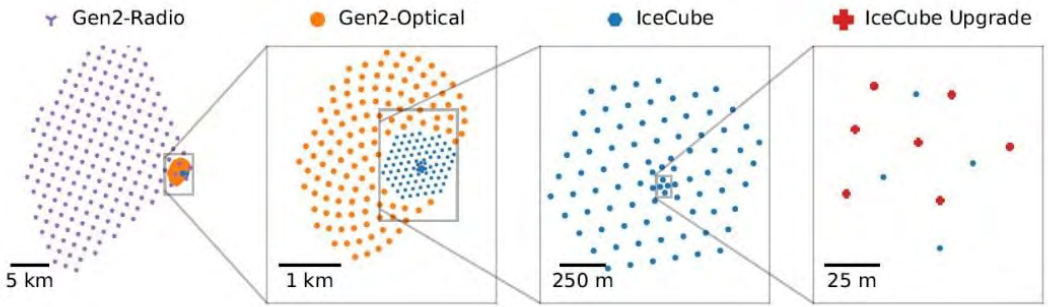
Computing grid. Dedicated sites in blue, opportunistic/cloud in green.

What is IceCube?

Construction: 2005-2010, future upgrades

Operation: 2010-?





One Success - Distributed Training

IceCube has a long history of workshops to train people

Pre-pandemic, these were typically once or twice a year in-person

In the last year, we've hosted multiple virtual workshops (with full recordings) on various topics:

- Traditional intro to IceCube/software
- Software languages in depth: C++, Rust

With the large number of grad students, this helps establish a base software proficiency and gives them experience if they go into industry

One Challenge - Collaborative Work

Because IceCube is a global collaboration, we have many people working in different time zones throughout the world

- Most supervisor / lead positions are in US
- Most developers are in Europe or US, but some are in Japan, New Zealand, and Australia

Additional problem: most work is “in-kind” contributions from grad students, who report to their professor instead of a central manager

We’ve tried various things, but haven’t found a good solution yet

Wendy Whitcup - CI CoE Pilot

- Wendy Whitcup
  - UCSB, Anthropology, tech, SCRUM, PMP
- CI CoE Pilot
- Challenge
  - Acting as a new Project Manager
    - Specific to MFs
- Success
  - Building relationship with MF personnel

CI CoE PILOT

CI For Resilience

Break

- We will resume 2:15 EST / 11:15 PST

CI CoE PILOT

CI For Resilience

Panel 2: Non-Traditional Work Settings

04

- Ralf Auer - IceCube
- Joel Brock - CHESS
- Laura Greene - MagLab NHMFL
- Chris Romsos - RCRV

Creating a Thriving Workplace

Cyberinfrastructure Center of Excellence

Ralf Auer, IceCube / WIPAC
University of Wisconsin-Madison

29 June 2021

WIPAC
Wisconsin IceCube Particle Astrophysics Center

Self Introduction

- Research Cyberinfrastructure Manager for UW-Madison's *IceCube* project
  - $300M Neutrino observatory, located at NSF's *Amundsen-Scott* research station, South Pole, Antarctica
  - https://icecube.wisc.edu
- joined the IceCube project in 2009
- physics degrees, then moved on into IT and project management
- key responsibilities:
  - maintain IceCube data center at South Pole (~150 servers, ~70kW, ~1PB/yr)
  - hire, train, and supervise on-site detector operators
  - interface between detector operations, researchers, and IT

WIPAC
Wisconsin IceCube Particle Astrophysics Center

Atypical work environment

- deploy to South Pole for ~2 months every year for upgrade and maintenance task, as well as on-site operator training
- very limited accessibility to site (Nov – Feb only), hard deadlines for season prep
- limited cargo capacity, delivery uncertainties, logistical challenge
- very limited communication channels between North / South – low bandwidth satellite internet for a few hours/day (modem speed!)
- medical and psychological clearance required every year to deploy
- everything running on unreliable diesel generators, power situation very unstable
- no vendor access to site, limited tech support channels
- no mail ordering or express shipping of parts → wait for a year!

Atypical work environment

- South Pole located @ 10,000ft altitude, 0% humidity → outside of most equipment specs, ESD is serious problem
- satellite communication window moves up ~4min/day, shifts work hours constantly
- 2 FTE 24/7/365 staff on-site for IceCube project
- on-site operators can't leave or be replaced → very thorough, multi-stage hiring process every year, includes medical and psychological screenings
- site not accessible outside of summer season → operator training in Madison → scale replica of data center
- 24/7 sunlight for 6 months during summer, 24/7 darkness for 6 months during winter

CI WFD Challenges at CHESS

Joel Brock, Director
jdb20@cornell.edu

Located 5 stories under the athletic playing fields, the Cornell High Energy Synchrotron Source is a high-intensity X-ray source which provides 1000 users/year state-of-the-art facilities for research in Physics, Chemistry, Biology, and Environmental and Materials Sciences.

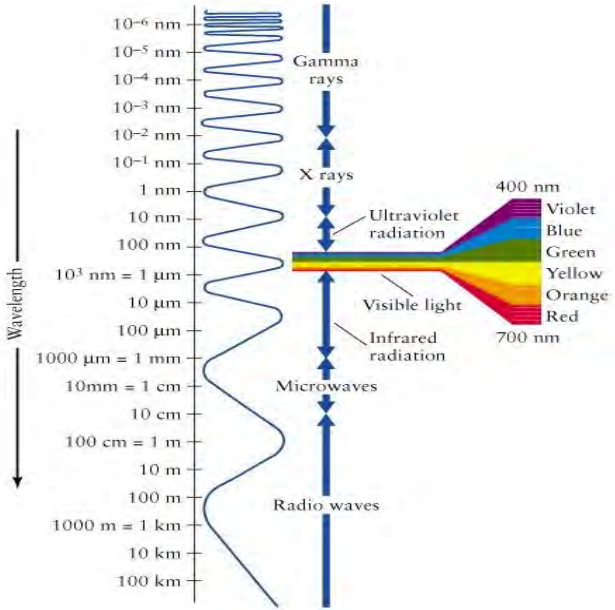
CHESS is supported by NSF (CHEXS), AFRL (MSN-C), NIH (MacCHESS), and NYSTAR.

X-rays and X-ray Sources

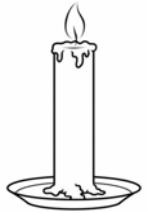
X-rays are short wavelength or energetic light.

X-rays are uniquely suited to penetrate opaque material and non-destructively probe the structure of matter on length scales ranging from shipping containers to medical x-rays to the atomic-scale.

Synchrotrons are exceptionally bright sources of x-rays. If a medical x-ray unit is a candle, a synchrotron corresponds to the lights at a football stadium.

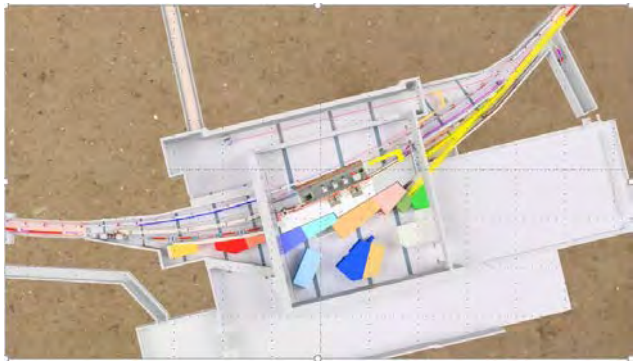


https://science-edu.larc.nasa.gov

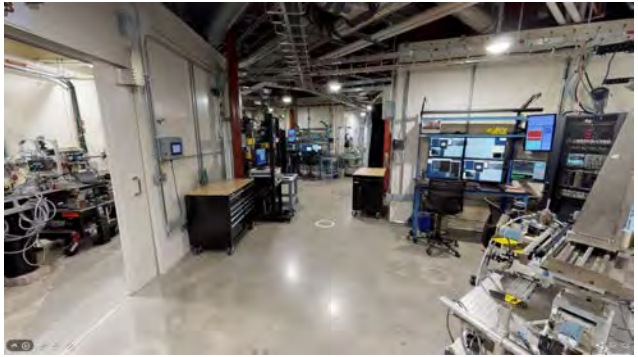


http://www.sportingnews.com

• Introduction to CHESS

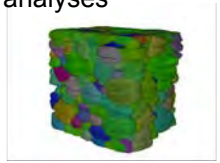


LINAC, booster synchrotron, and storage ring (CESR) create the relativistic (6 GeV, 100mA) positron beam

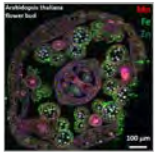


Undulator magnets “shake” the positron beam, creating a highly collimated beam of intense EM radiation (X-rays) which is delivered to experimental stations.

CHESS users come from diverse disciplines, studying a wide variety of samples in diverse environments, using multiple techniques and analyses

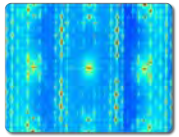


Grain Mapping of **Structural Materials**

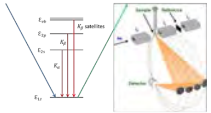


X-ray Fluorescence Microscopy of **plants**

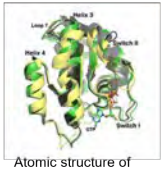
Chemical mapping of objects of **Cultural Heritage**



Atomic Structure of **Quantum Materials**

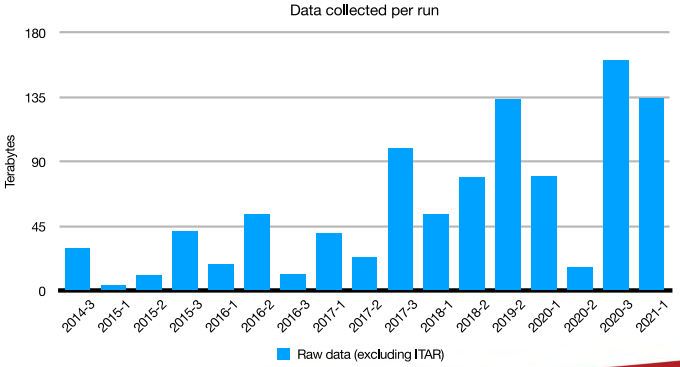


Spectroscopy of **biological enzymes**



Atomic structure of **biological macromolecules**

Steadily increasing data rates



3D Virtual Tours: https: //www.chess.cornell.edu/3d-virtual-tours

CHESS/CLASSE IT

Some statistics:
- 500+ computers/servers
- 3 major OSs
- 3 major buildings
- 60+ networks
- 250 on-campus users
- 1000 visitors/year
- 3000+ tickets/year

Main activities:
- Responding to service requests
- Maintaining infrastructure and services
- Protecting against security threats
- Researching/developing new capabilities

Research projects

CESR CBETA CMS g-2
CHESS CBB Cosmology
OSC SRF HEP Theory
Photocathodes Astro Theory

Instrumentation
Control systems
Software development
Code management
Data acquisition/processing

End users

(incl. CHESS users, visitors, remote users)

Computers, software,
Accessories
Service requests

User resources

Help Desk, training
Weekly newsletter, online docs
Printers, A/V equipment

Central services

Filesystems and backups (~2 PB)
Samba, Globus, VPN, remote access
Windows application server (WinAPP)
Automatic system updates/configuration

Compute Farm
Print server
Databases
Virtual machines

SVN, elog, EDMS
Wiki, Indico, websites
Software licenses
Autodesk Inventor, Vault

Authentication & authorization

CLASSE computer accounts
Active Directory domain controllers
Kerberos, firewalls
Security groups, file permissions

Security

Policy compliance, antivirus
Security reviews/audits
Incident response

Linux clusters

(System administration)
CESR CLASSE
CHESS Virtualization Test

Physical infrastructure

(Wilson, Newman, PSB)

Server rooms
Cooling, UPSs
Power distribution
Temperature monitoring

Networking

(Wilson, Newman, PSB)

Routers
Switches
Cables
VLANs

Name services
IP addresses, DHCP
Private subnets
Network monitoring

Coordination / Administration
CLASSE, IT@Cornell, funding agencies

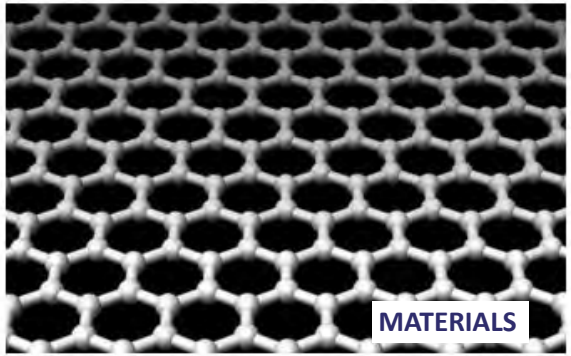
IT@Cornell: email/calendaring, wi-fi, Workday, off-campus networking

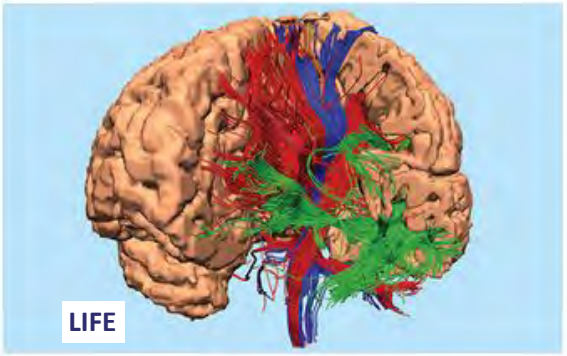
NATIONAL HIGH MAGNETIC FIELD LABORATORY

Overview to the NHMFL

Laura H Greene, Chief Scientist

lhgreene@magnet.fsu.edu





FLORIDA STATE UNIVERSITY

Los Alamos NATIONAL LABORATORY

UF UNIVERSITY of FLORIDA

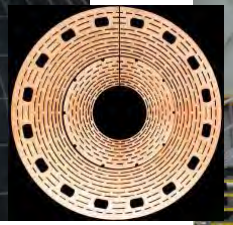
National High Magnetic Field Laboratory

101T Pulse Magnet
10mm bore

Florida State University

Los Alamos National Laboratory

University of Florida



45T Hybrid DC Magnet

900MHz, 105mm bore
21T NMR/MRI Magnet

1.4 GW Generator

Advanced MRI and Spectroscopy Facility

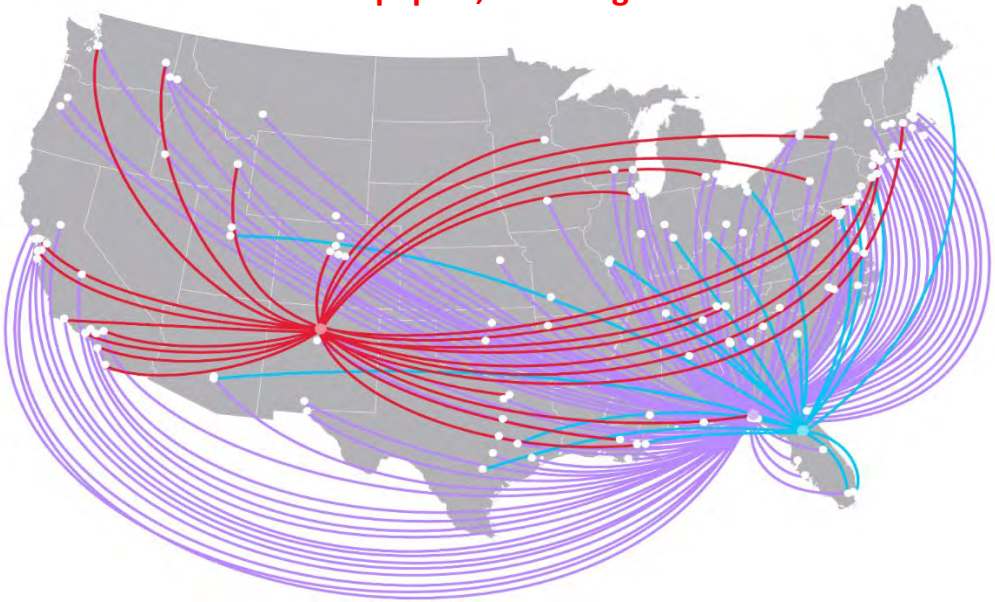
11.4T MRI Magnet
400mm warm bore

High B/T Facility
17T, 6weeks at 1mK

The MagLab Attracts Researchers From Around The World

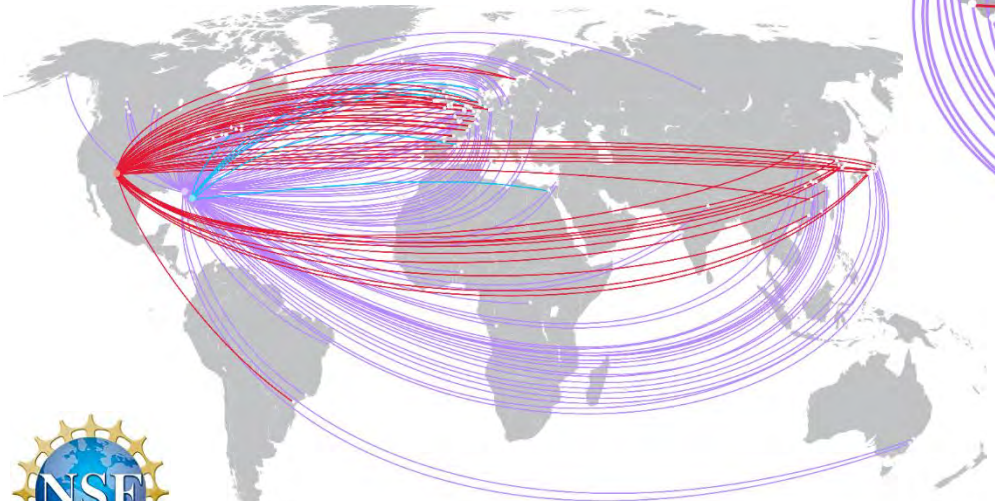
In 2019, the MagLab User Program helped to train ~300 postdocs and ~7500 grad and undergrad students

and published ~440 refereed papers, including…



In 2019, the MagLab hosted experiments by more than 2,096 users from 298 institutions across the US (76% Univ; 18% Labs; 6% Ind)

…and a total of 298 institutions from throughout the world.



7	*Proc. of National Academy of Sciences*
39	*Nature Journals*
11	*Physical Review Letters*
41	*Physical Review B*
6	*Journal of American Chemical Society*

Every year, more than 20% of the experiments' Principal Investigators are first-time-ever PI's at the MagLab

MagLab Outreach in 2019...

10,800+

visitors – the largest crowd in MagLab history – came from across the southeast to sample the 100 hands-on demonstrations on the science smorgasbord of annual Open House event.

77

scientists & staff reported conducting outreach to the community. Together, these scientists reached **7,100+** people.

1.4 MILLION+

website **pageviews**

141

middle school students in long-term mentorship or camp programs, **89%** of whom were from underrepresented minority groups.

4.5 MILLION+

minutes of MagLab video content watched on YouTube.

NATIONAL HIGH
MAGNETIC FIELD LABORATORY

The MagLab Mission: 1990-present

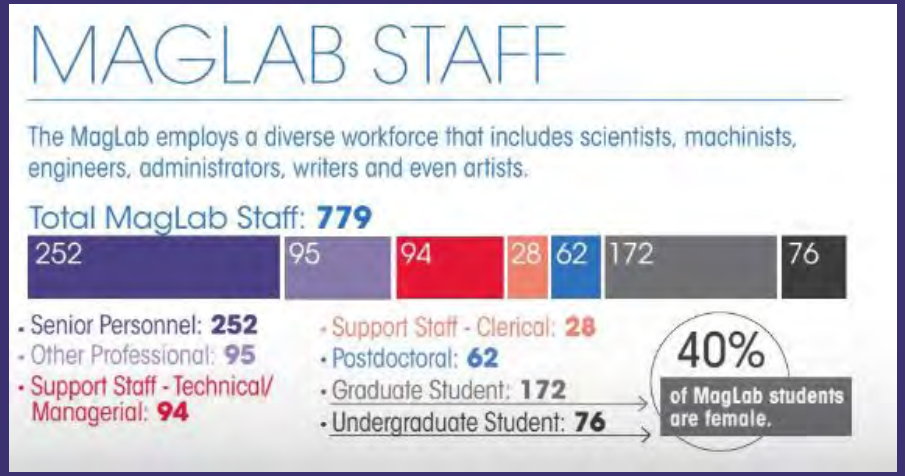
- Operate a world-leading high-magnetic-field user program
- Carry out in-house research in support of the user program
- Maintain facilities and develop new magnets/instrumentation
- Conduct education and outreach activities

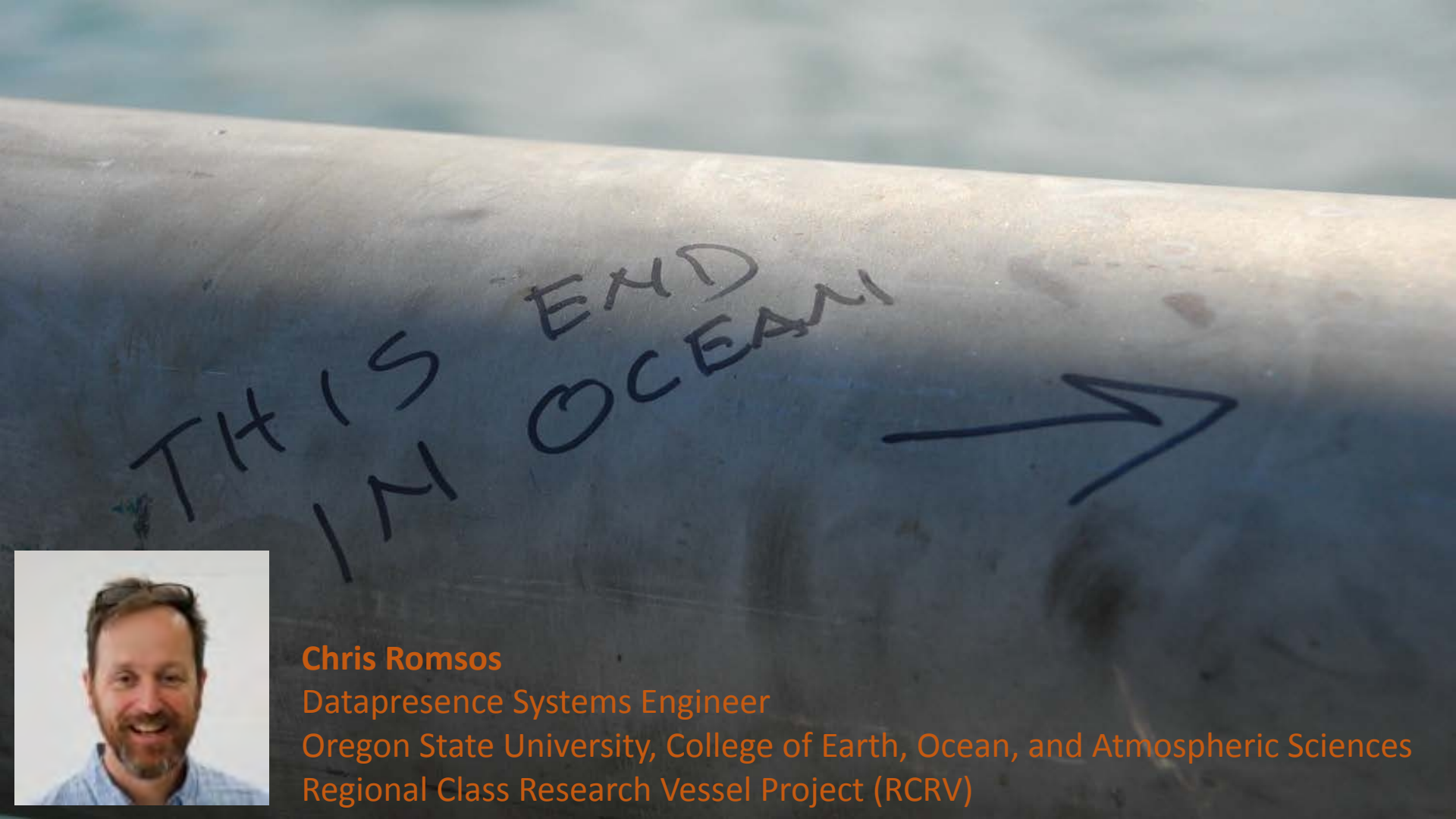
~ 94 MagLab Research Faculty with charge:

- **1/3 Personal Research**
- **1/3 Technique Development**
- **1/3 User Support.**

Credit given for education and outreach

Almost no one splits their time exactly this way; putting their time mostly into one of these categories; but all do at least some user support. Our other professionals, such as teaching faculty, also work in all of these three areas.

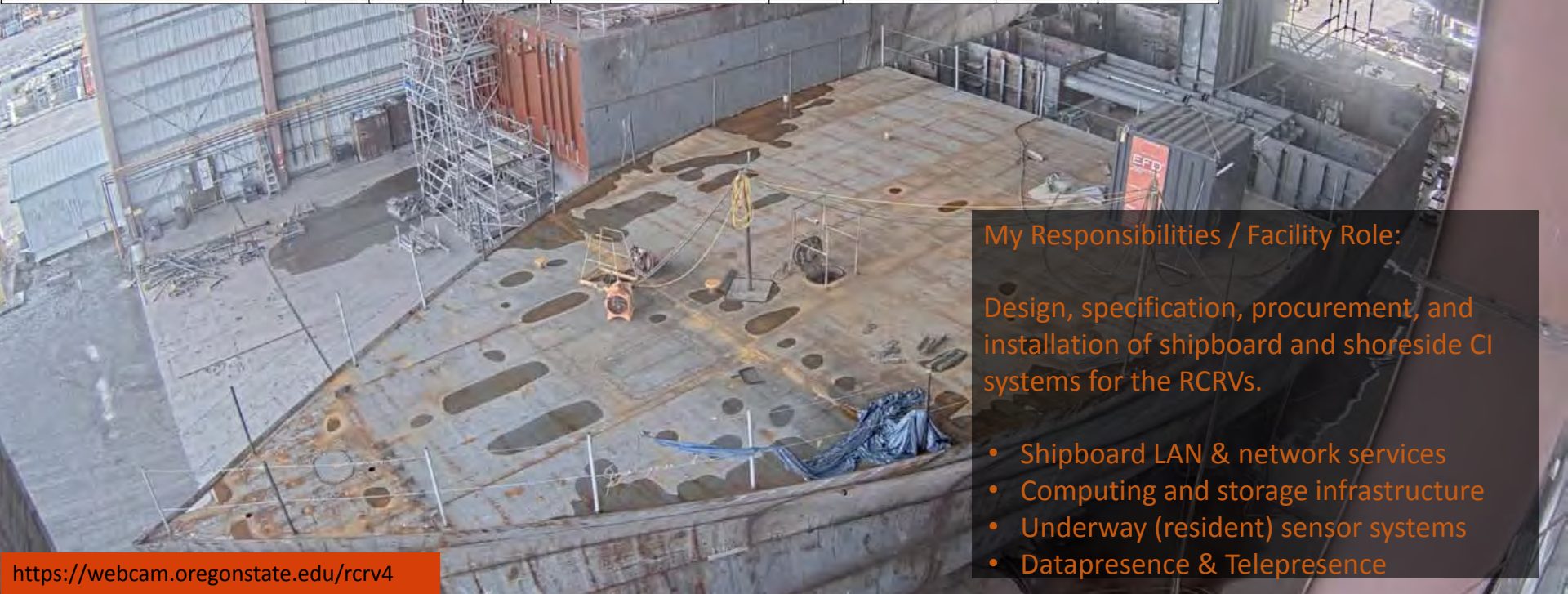




Chris Romsos
Datapresence Systems Engineer
Oregon State University, College of Earth, Ocean, and Atmospheric Sciences
Regional Class Research Vessel Project (RCRV)

Major Facility: Academic Research Fleet, Regional Class Research Vessel Project

Facility	Acronym	Location	Stage	Recipient	DIR/DIV	Program Officer(s)	Phone	Email
Academic Research Fleet	ARF	Distributed	Operations	Various (18 research vessels)	GEO/OCE	Rose Dufour	(703) 292-8811	rdufour@nsf.gov
-- University National Oceanographic Laboratory System Office	UNOLS	Seattle, WA	Operations	University of Washington	GEO/OCE	Bauke H. Houtman	(703) 292-8583	bhoutman@nsf.gov
-- Regional Class Research Vessel	RCRV	Mobile	Construction	Oregon State University	GEO/OCE	Brian P. Midson	(703) 292-8145	bmidson@nsf.gov



My Responsibilities / Facility Role:

Design, specification, procurement, and installation of shipboard and shoreside CI systems for the RCRVs.

- Shipboard LAN & network services
- Computing and storage infrastructure
- Underway (resident) sensor systems
- Datapresence & Telepresence

https://webcam.oregonstate.edu/rcrv4

Lifestyle

Time: Vessels are at sea roughly 180 days per year. So far, building the vessel hasn't required too much time at sea

Space: 20+ people aboard the ship, ~2mbps to share for Operational, Scientific, and Quality of Life….

Technical

Community of Practice: Supported by a truly remarkable technical peer community known as RVTEC

Pace: High rates of configuration change (personnel, scientific & operational equipment)

Operational: Construction project has been a big change from previous scientific research support

Pain Points: Keeping the suite of CI and services pointed toward the intersection of requirements, regulations, and potential

Unique attributes of the Oceanographic IT occupation!

CI CoE PILOT

CI For Resilience

Activity: Creating a work culture that taps into intrinsic motivations

Andrew Brown

05

Andrew Brown

Andrew Brown joined Notre Dame Research in 2018 as the division's first Operational Effectiveness, Assistant Program Director. He is responsible for improving onboarding, developing professional pathways, and enhancing overall work culture within NDR. Over the past year and a half, one project Andrew has been working on is this intrinsic motivation leadership series for all 50+ supervisors of Notre Dame research. You will see the highlights of that series today. Before joining NDR, Andrew worked for four years within the Notre Dame Office of Human Resources as a Recruiting Consultant. Andrew completed his B.A. in Psychology from Wabash College and his M.Ed. in Training and Development from North Carolina State University.

WELCOME

While we wait for others, please complete the poll question at http://pollev.com/ndresearch

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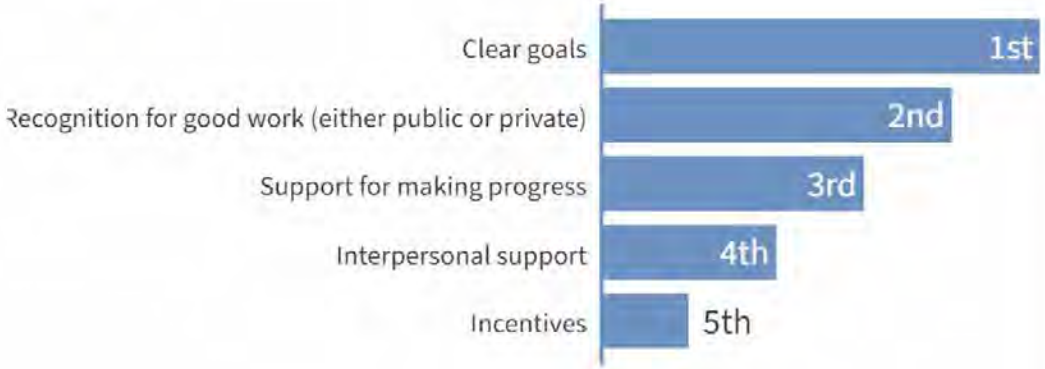
significant

Our results



Amabile's Results

#1 Recognition
#2 Clear Goals
#3 Incentives
#4 Interpersonal Support
#5 Support for Making Progress

Today we will cover

- What is Intrinsic Motivation
- Buildings Blocks of Intrinsic Motivation
  - Autonomy
  - Mastery
  - Purpose
  - Progress
- How you can use the power of intrinsic motivation for yourself and/or your team.

What is Intrinsic Motivation?

Motivation

Extrinsic Motivation

Intrinsic Motivation

Autonomy

The urge to direct our own lives.

Autonomy Pulse

- On a 1-10 scale with 10 being total autonomy and 1 being extremely micromanaged. What is your **desired level** of autonomy for your work?
- On the same scale, what is the **current level** of autonomy with your work?
- **Desired Level – Current Level = ?**

Autonomy in practice

Autonomy is not a one-size fits all approach

- Delegate authority where possible
- Trust your workers and accept that the outcome may be different from how you would do it
- Provide safety (no punishment for honest mistakes)
- Provide a clear purpose and goals
- Ensure that employees have an understanding of their roles and how their work impacts others
- **If your score was not 0 – ask yourself what specific changes would get your there?**

Mastery

Getting Better and Better at something that matters.

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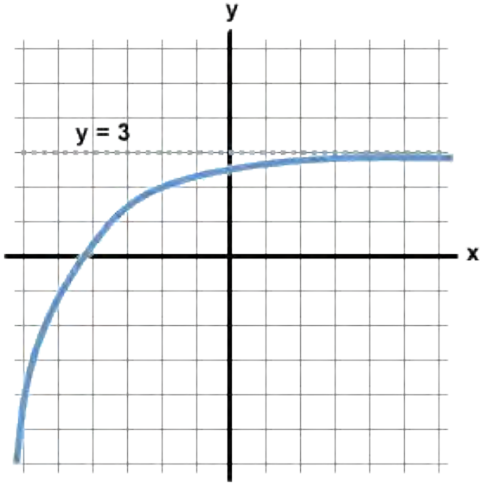
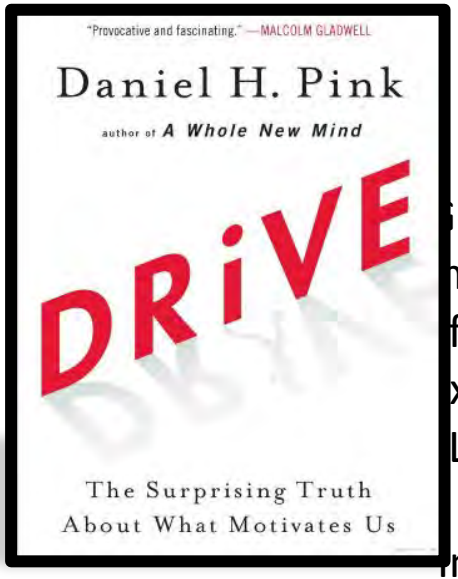
What is Mastery?

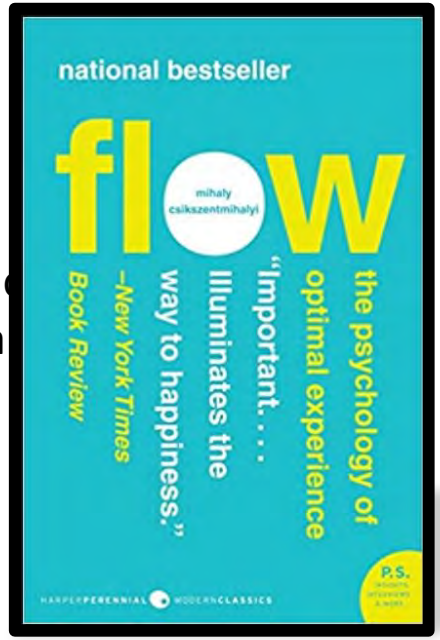




etting better and better at something that atters. Cites Mihaly Csikszentmihalyi and his fe work studying the highest, most satisfying xperiences in peoples lives what he called LOW.

n FLOW, the goals are clear, the feedback is immediate and most importantly the relationship between what a person had to d and what they could do was perfect. It was a notch or two beyond current abilities

Lets Dive in to FLOW a bit more

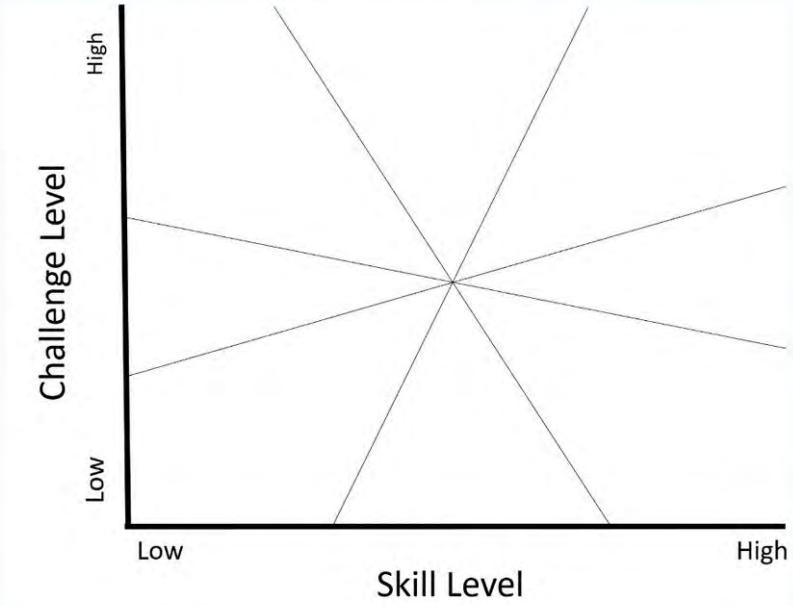


Find your FLOW

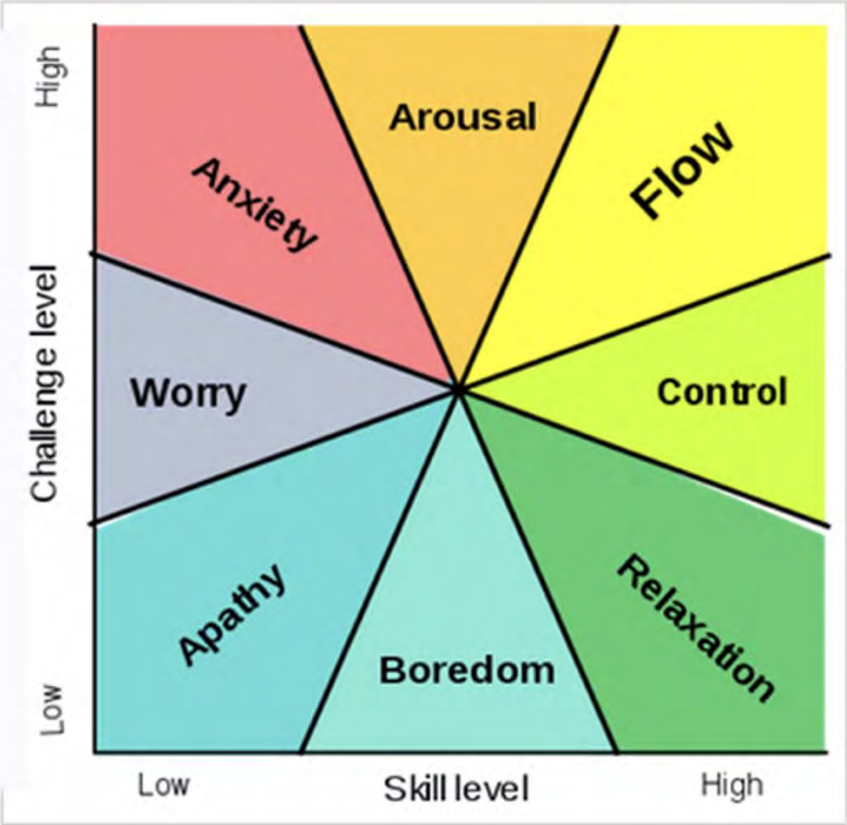
- **<u>Think about a recent activity or project (could be anywhere) where you felt the following.</u>**
- *Intense and focused concentration on the present moment*
- *A sense of personal control or agency over the situation or activity*
- *A distortion of temporal experience – time flew by*
- *Experience of the activity itself as **intrinsically** rewarding*

Respond at **PollEv.com/ndresearch**

Put a dot as to where the example you described falls on the Challenge and Perceived Skill level Graph Below



Results



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Mastery in practice

- Managers:
  - Are your employees operating in flow? How do you know?
  - If they are not, what specifically can you do to get them there?
- Employees:
  - Do you have flow moments at work?
  - If not, what needs to change (do you need to develop skills or increase challenge?)

Purpose

The yearning to do what we do in the service of something larger than ourselves

Work Purpose Word Cloud

- In one sentence, **<u>why</u>** do you do what you do?

-


think.
behind
passion
best
public
love
things
solar
because
easier
come
science
interests
people
myself
benefit
version
increase
completing
challenges
component
accessible
make
enjoy
solving
new
interesting
skills
tasks
others
parts
work.
born
match
problems
challenging
perfect
learn
rewarding.
understanding
research
involved

Research

- A.M. Grant and D.A. Hofmann, *Outsourcing Inspiration: The Performance Effects of Ideological Messages from Leaders and Beneficiaries.* 2011

Fundraising Call Center

Group 1
Met F2F with "Will" a scholarship recipient

+142% Effort
+171% Productivity

Group 2
Was read a letter from "Will" with no direct contact

No Change in effort or productivity

Group 3
Control Group

No Change in effort or productivity

Research

- A.M. Grant and D.A. Hofmann, *Outsourcing Inspiration: The Performance Effects of Ideological Messages from Leaders and Beneficiaries.* 2011
- *"Meaningful work is a cornerstone of motivation… But all too often, employees do work that makes a difference, but never have the chance to see or meet the people affected by their work."*
  - Outsource Inspiration
  - Leaders are linking pins
  - The power of 1 person

Purpose In practice

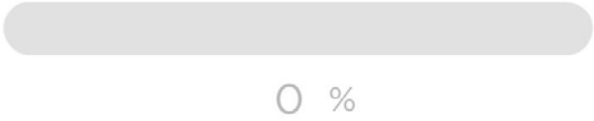
- You should know why you do what you do.
- Leaders should **be authentic.** Know your own work purpose and work with / coach your staff to help discover and experience theirs.
- **Leaders need to be linking pins** by connecting employees to the people who find their work meaningful.

Progress

The #1 motivator for inner work life is making progress in meaningful work.

Progress is….Everywhere

In your daily work…

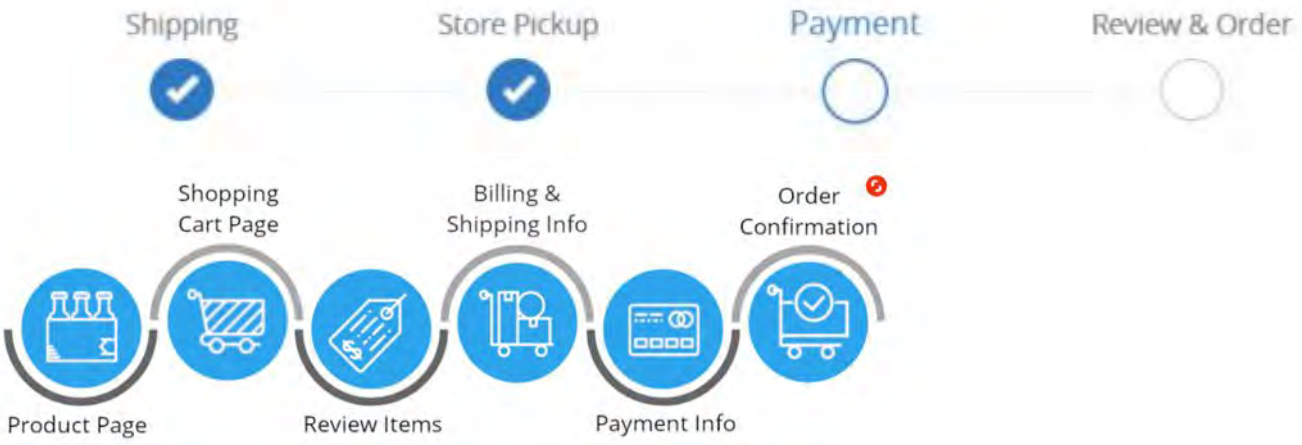


Progress is….Everywhere

Fitness

Progress is….Everywhere

Retail



Progression in Gaming

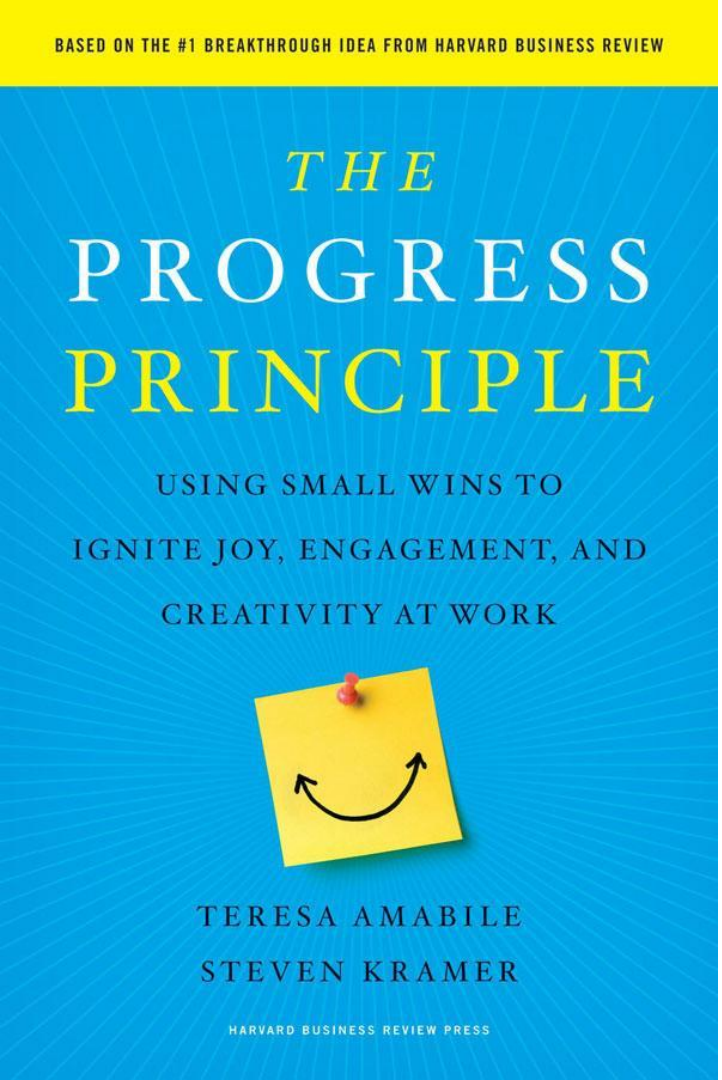
Why is progress everywhere?

Because it is a powerful motivator!

…continue that survey, keep working out, keep going towards the checkout and keep playing.

But what about Progress at work?

Loading...



The Research

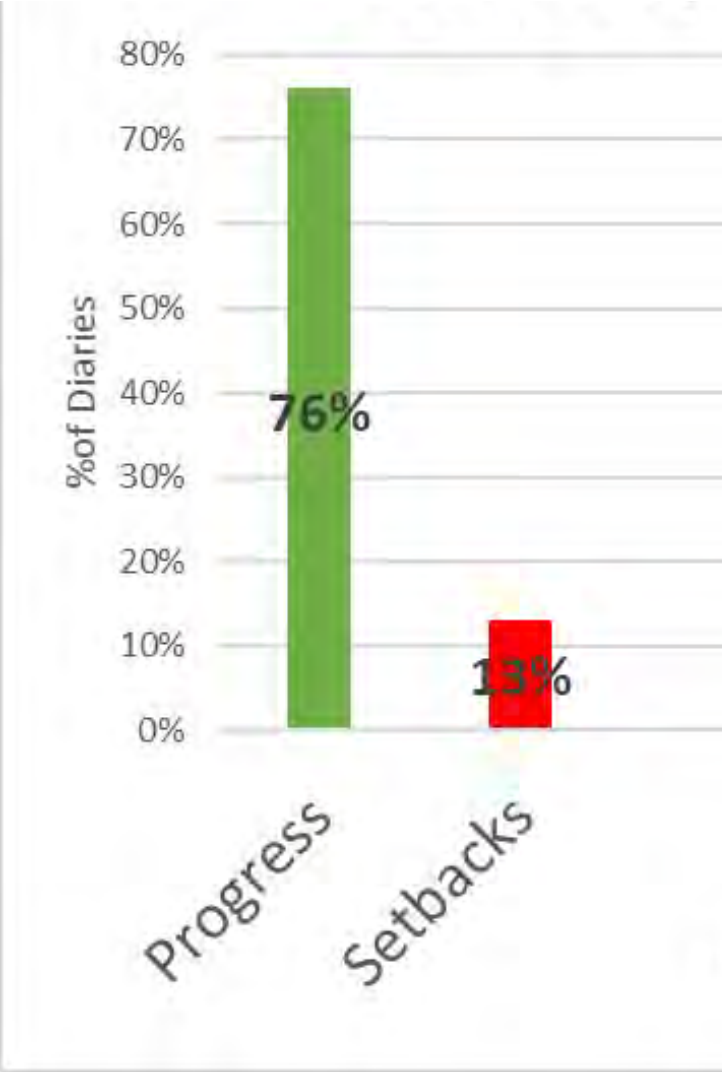
Purpose: Understand the role of **inner work life** in organizations: what influences it and how it influences performance.

Methods: Asked members of project teams to respond individually to an end-of-day email daily diary during their projects (4 months on average).

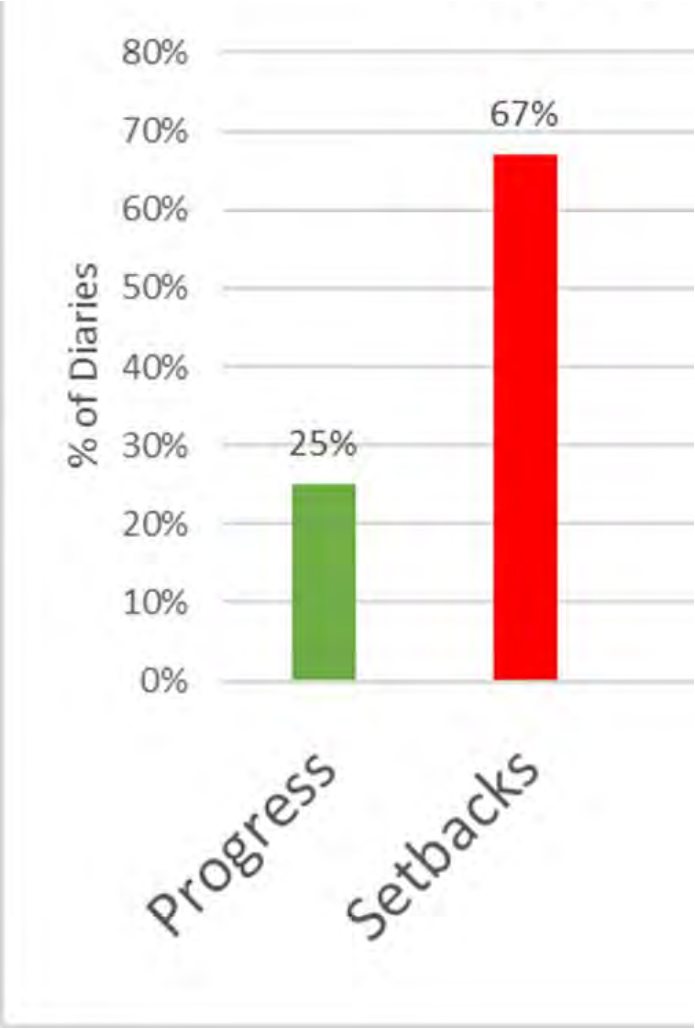
The Daily Diaries: Inquired about emotions, moods, motivation levels and perception of the work that day. Also about the work they did and what stood out to them that day.

Specifics: 26 project teams from 7 companies. 238 total people surveyed and yielded ~12,000 unique entries of qualitative and quantitative data for analysis.

What happens on Good days?



What Happens on Bad Days?



The Progress Principle

#1 driver of inner work life is making **progress** in **meaningful work**.

Rank the impact on employee motivation and emotions of five workplace factors commonly considered significant

Our results

Amabile's Results

#1 Recognition
#2 Clear Goals
#3 Incentives
#4 Interpersonal Support
#5 Support for Making Progress

Catalysts & Nourishments

- Catalysts are events supporting the **WORK.**
  - *Setting clear goals*
  - *Allowing Autonomy*
  - *Providing Resources*
  - *Providing sufficient time*
  - *Helping with the work*
  - *Learning from the problems and successes*
  - *Allowing ideas to flow*

Catalysts & Nourishments

- Nourishments are actions supporting the **PERSON.**
  - *Respect*
  - *Encouragement*
  - *Emotional Support*
  - *Affiliation*

Inhibitors & Toxins

Inhibitors are the opposite of catalysts and ***Toxins*** are the opposites of nourishers. These negative actions include failing to support the project or the person, as well as actively hindering the project or disrespecting the person in some way.

Put Progress into practice…

- Be aware of and support a work climate where progress is encouraged for all.
  - Point out progress when you see it
  - Don’t devalue progress that has been made
- Be a **catalyst** and **nourisher** where possible.
- Minimize **inhibitors** and **toxins** where possible.
- **Be linking pins** by connecting employees to the people who find their work meaningful.

Final Poll

http://pollev.com/ndresearch

Closing Thoughts

Thank you!

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CI CoE PILOT

CI For Resilience

CLOSING REMARKS

06

Closing Remarks

- Kerk Kee - PI for CI4Resilience
  - https://ci4resilience.org/
- Thank you to all of our speakers, panelists, and participants!
- Expected outcomes of the workshop
  - Workshop Report
  - More conversations
- Survey Link
- Website for workshop where we will be posting outcomes: https://cicoe-pilot.org/creating-a-thriving-workplace
- We will send out communication when the above is available

THANKS!

CI CoE PILOT

CI For Resilience

Credits/References for Opening Remarks (slides 6-8)

Slide 6:

- Photos taken from USAP's (US Antarctic Program) image gallery: https://photolibrary.usap.gov/
- Quote is from Jerry Brower at Gemini: https://www.gemini.edu/careers?utm_medium=print&utm_source=brochure&utm_campaign=Careers2016#Gustavo_Arriagada

Slide 7:

- RCRV snapshot and quote taken from: https://youtu.be/lNtosWlboSc
- IceCube Life at the Pole blog:
  - Quote from: https://icecube.wisc.edu/pole/daily-life/
  - Photo from: https://icecube.wisc.edu/news/life-at-the-pole/2021/05/week-19-at-the-pole/
- Gemini Observatory photo taken from: http://www.gemini.edu/gallery/media/sunset-over-gemini-south
- NEON photos taken from NEON's Flikr site: https://www.flickr.com/photos/neonsciencedata/albums/with/72157711338335388 and https://www.flickr.com/photos/neonsciencedata/50754027703/in/album-72157710315626111/
  - Quote from https://www.neonscience.org/get-involved/work-opportunities/seasonal-fieldwork

Slide 8:

- MagLab poster taken from : https://nationalmaglab.org/images/staff/searchable_docs/maglab_staff_map.pdf
- IceCube Life at the Pole blog quote and photo taken from: https://icecube.wisc.edu/news/life-at-the-pole/2021/05/week-19-at-the-pole/
- Gemini
  - Quote from Gustavo Arriagada video on https://www.gemini.edu/yourfuture
  - Photo from https://www.gemini.edu/gallery/media/altair-optical-bench-alignment
- OOI (Oceans Observatory Initiative)
  - Jennifer Batryn quote taken from: https://oceanobservatories.org/2021/03/women-who-make-ooi-happen/
  - Photo taken from: https://oceanobservatories.org/2020/09/a-collaborative-month-in-the-irminger-sea/