

## The Maury Project 2015 Annual Report

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### LONG-TERM GOALS

The Maury Project is a graduate-level, teacher professional development program designed to promote the scientific literacy of young people by improving the background of in-service precollege teachers on the physical foundations of oceanography. This is accomplished through a process of training the trainers at a two-week workshop held at the U.S. Naval Academy (USNA) and subsequently via single-topic modules that Maury peer trainers present in sessions throughout the United States. By increasing the scientific knowledge of teachers, the Maury Project is ultimately directed toward attracting precollege students, including underrepresented minorities, to science, technology, engineering, and mathematics (STEM) studies. This is in close alignment with the ONR STEM2Stern commitment to “nurture a world-class [STEM] workforce able to contribute to, and support, a culture of innovation.”

### OBJECTIVES

This project was designed to meet the following objectives:

- Train master teachers to be peer trainers and resource persons on the physical foundations of selected oceanographic topics and/or issues.
- Develop self-contained, single-topic, teacher-enhancement instructional modules on selected oceanographic topics.
- Develop and maintain a national network of Maury peer trainers and resource persons.
- Supply Maury peer trainers with instructional resource materials to use in the 1- to 2-hour training sessions they conduct.
- Promote the adaptation of instructional resource materials on the physical foundations of oceanography for classroom use by the Maury teachers and those teachers they peer-train.
- Provide leadership training for Maury alumni who serve as *DataStreme Ocean* and *Earth's Climate System* course Local Implementation Team (LIT) leaders.

## **APPROACH**

There are three major components to this program: an annual summer workshop for master precollege teachers, the production of instructional resource materials for teacher enhancement, and the peer-training of additional teachers. The main goal of the Maury Project is to provide a core group of teachers with the knowledge and instructional resources to enable them, in turn, to train a large number of their peers on selected oceanography topics. These classroom teachers who were peer-trained by Maury participants will then adapt their new found knowledge for in-class use of oceanography topics to enhance learning experiences for K-12 students, inspiring them to consider careers in STEM disciplines. Maury peer trainers are generally eligible to receive three graduate-level credits through State University of New York's The College at Brockport upon completion of program requirements, which include conducting workshops for colleagues in their school districts and states.

Efforts are made to recruit/retain underrepresented minorities in STEM fields. The Maury Project application contains the following question: How do you intend to promote minority participation in science as the result of participating in this program? (Please note if your school is composed of 30% or more students from groups traditionally underrepresented in sciences, technology, engineering, and mathematics.) Out of the 24 teacher participants at the summer 2015 workshop, 11 met this criteria, with 3 of the participants teaching at schools with >80% minority student populations. In addition, the summer 2015 Maury Project workshop included an African-American male and a Hispanic female. (AMS does not ask for applicant racial/ethnic background.)

## **WORK COMPLETED**

In summer 2015, a two-week workshop for 24 precollege teachers on the physical foundations of selected oceanographic topics was held at the U.S. Naval Academy in Annapolis, MD. These 24 educators include 2 at elementary schools, 5 at middle/junior high schools, 15 at high schools, and 2 curriculum specialists. The USNA Oceanography Department makes available to the Maury Project essentially all of its outstanding facilities for the workshop, including the Hendrix Oceanography Laboratory. Participants have an intensive, hands-on experience in oceanography, which they are excited to share with others via peer-training workshops they conduct in their local school districts and communities. USNA support staff assisting with the Maury summer workshop included 7 Oceanography faculty, 2 Oceanography technicians, 1 secretary, and two recent USNA graduates. Staff contributed 29 hours of instruction and 30 hours of preparation and administrative support.

## **RESULTS**

End-of-workshop survey questionnaires are administered on the last day of each Maury Project summer workshop. Data collected at the end of the summer 2015 workshop is summarized below from the 24 participants who completed the survey.

When the 24 participants were asked for:

- their overall rating of the Maury Project in terms of its educational value, all gave the highest response of "excellent".

- the long-term effect on their teaching, 19 reported “great deal” and 4 “some”. One participant marked between great deal and some.
- the long-term effect on their curriculum development, 17 reported “great deal” and 6 “some”. One participant marked between great deal and some.
- the long-term effect on training of colleagues, 22 reported “great deal” and 2 “some”.

When asked “Has your perception of the value of the Navy changed as a result of your workshop participation?” 22 reported “increased” and 2 reported “remained the same.”

When asked “Has your perception of the value of NOAA changed as a result of your workshop participation?” all 24 reported “increased.”

When asked how they would rank the Maury Project workshop with other summer workshop experiences they have had since becoming a teacher, 15 participants indicated that it was the best, 7 indicated that it was one of the best (top 5), and 2 participants did not respond to the question.

When asked if they would recommend that the Maury Project USNA workshop be offered in the future to other teachers, all participants provided enthusiastically positive responses.

Participants were also asked open ended questions about what they liked best and least about the workshop, as well as what they recommended be changed. Below is a summary of the “liked best” and “liked least” responses which were given multiple times.

#### What participants liked best about the workshop

Field experiences (Beach and YP observations) (8 times given as response)

Modules (8)

Demonstration by the teachers (7)

Knowledge of the faculty (7)

Contact with other educators (6)

Annapolis/USNA as a site (3)

Content (3)

Breadth and depth of the instruction (3)

Contacts to the Ocean community (2)

General flow of the program (2)

Exposure to the Navy (2)

Freedom to share material/expertise (2)

#### What participants liked least about the workshop

Lectures (length and detail) (9 times given as response)

Not enough ship time (3)

Drop the Ice Center tour (2)

Don't print the slides (waste of paper) (2)

What participants recommended be changed to improve the workshop format

Several suggestions given by participants on the evaluation are quite valuable. Others may be good ideas, but not necessarily doable due to priorities, costs, or practicality. It is important to note that largest number of criticisms has only five or less (mostly just one) expressing items for what could be changed in the workshop. This suggests that there is little consistency on what to modify to improve the program.

The following are selected responses from the evaluation question about what they recommended be changed, along with the AMS response:

Too much lecture, in terms of length and depth (7) and the lectures need to be more interactive (3) – Project staff try to have a good balance in the amount of lecture vs hands-on. It is important to note that the lectures and the modules (the hands-on piece) should be viewed as a single unit (perhaps this should be announced at the beginning). The purpose of the lectures is to provide basic understanding of the topics, especially for those who have little or no background in the subject matter. The percentage breakdown of various types of instruction is:

Lectures	25/80	31.25%
Guest speakers	4/80	5
Hands-on (Demos and Modules)	17/80	21.25
Field experiences (Boat, beach, aquarium and lab visits)	22/80	37.5
Administration	6/80	7.5
Social events	6/80	7.5
TOTAL	80/80	100%

Please note that hands-on activities, field experiences and lab visits (58.75%) far exceed the time for lectures and guest speakers (36.25%). Also, 7 respondents commented positively on the quality of the instructors and their knowledge of the subject matter. It is essential that some lecture be incorporated to understanding the basics of the material to guide participant learning of the subject matter.

Drop the tour of the National Ice Center (3) –With the decrease of staff at NIC, it is becoming more difficult to see actual operations. The Command brief is of marginal value. Project staff are exploring the possibility of shifting this tour to NASA Goddard.

Don't print out slides (waste of paper) – provide them on thumb drives (2) – While there may be environmental concerns regarding the use of paper, thumb drives are not allowed, hence this option is not permissible. Project staff make all slides available on a website so participants have a permanent digital copy of the material. Making paper copies available also enables notetaking.

Make schedule available early as part of the read ahead package (2) – The schedule can be in a state of flux, sometimes even after the workshop begins. This type of suggestion will be considered however.

Have a structured get-together on Day 1 so teachers can get to know each other (2) – Difficult to do on arrival day, since a number of people arrive late in the evening and would not be present. However, many of the arriving teachers get together informally after arrival to meet each other and most

everyone go out for dinner on Sunday evening. There is an introduction of everyone at the beginning of the first day (Monday morning) and there is an icebreaker on Monday evening.

With the training of 24 new participants in the Summer 2015 Maury Project workshop, a total of 526 teachers representing all 50 states, the District of Columbia, Puerto Rico, American Samoa, Argentina, Guam, Mexico, South Africa, Canada, Great Britain, Australia, Switzerland, Japan, and the U.S. Department of Defense Overseas School System have become peer trainers since the first USNA summer workshop in 1994. Workshop reports received by AMS indicate that, since 2002, workshop participants have conducted 648 peer training sessions for 7826 teachers. Additionally, the Maury Project alumni have provided significant leadership in precollege ocean science education curriculum reform. About 30 Maury workshop alumni have played key rolls in the development and national implementation of the graduate-level AMS *DataStreme Ocean* (2003-present), *DataStreme Water in the Earth System* (2001-2008), and *DataStreme Earth's Climate System* (2009-present) in-service teacher professional development courses, which have trained thousands of other teachers.

## IMPACT/APPLICATIONS

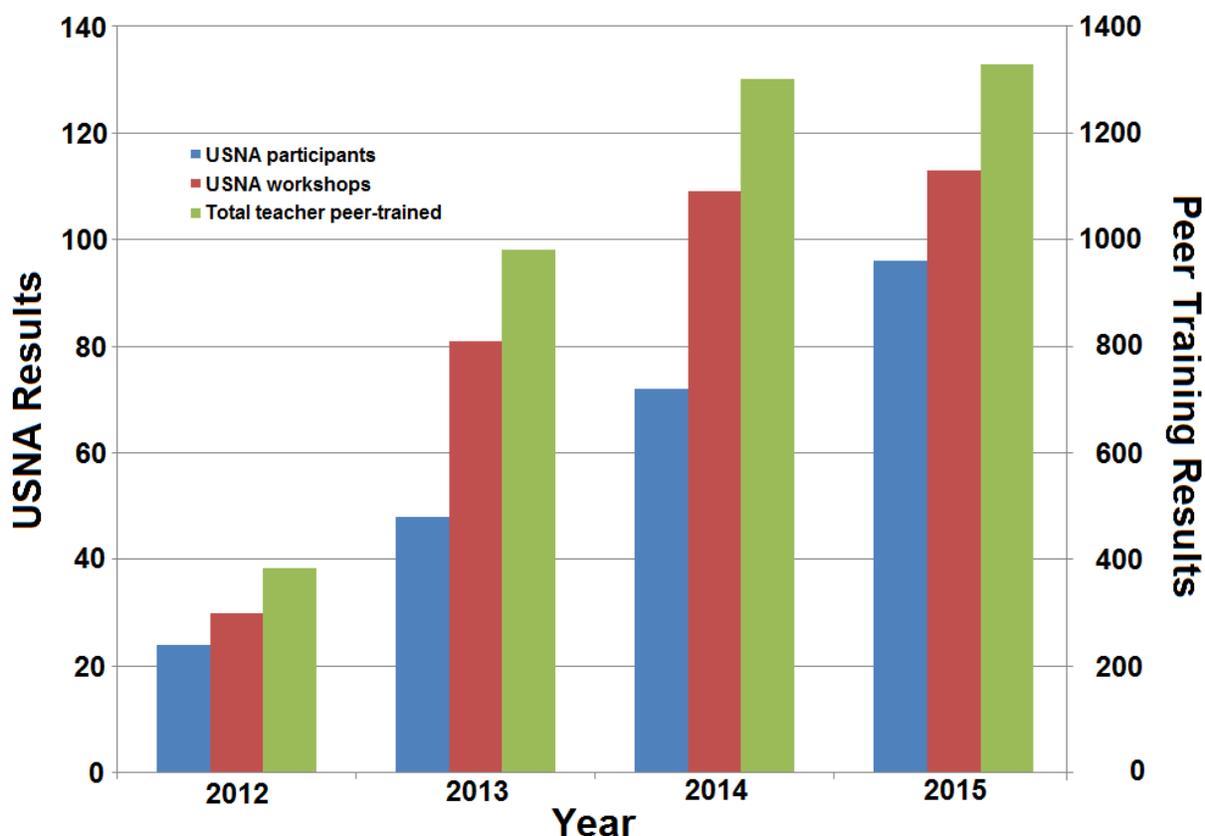
Maury Project summer workshop participants are committed to offering a minimum of two single-topic training sessions lasting from one to two hours each, primarily directed toward precollege teachers. The table below lists workshops conducted by the 2012, 2013, and 2014 workshop groups. Note that Summer 2015 participants will begin to conduct their required workshops during school year 2015-2016 and a few Summer 2014 participants may still submit required workshops.

***Table 1: Maury Project Peer Training Workshops (2012 - 2015)***

<u>Year</u>	<u>USNA Participants</u>	<u># of Peer-Training Workshops</u>	<u># Trained</u>
2012	24	30	383
2013	24	51	597
2014	24	28	322
2015	24	<i>(just completed training, few workshop opportunities)</i>	

The 2014 Maury alumni have so far conducted 28 workshops for 322 persons (mostly precollege teachers). One 2015 alumni has already offered four workshops. During the FY15 reporting period, additional workshops were conducted by Maury alumni from groups prior to 2014. Figure 1 displays the cumulative number of participants, peer-training workshops held, and trainees from 2012-2015. For example, the 2015 numbers include results from 2012-2015.

## Maury Project Teachers Trained - 2012 to 2015



*Figure 1 – Maury Project Teachers Trained from 2012-2015. USNA participants (blue) represent the number of summer workshop participants and USNA workshops (red) represent the number of peer-training workshops. Total teachers peer-trained (green) is the number of participants at the peer-training workshops. All results shown are cumulative from 2012-2015.*

To see the multiplying effect of this program, consider that since 2002; at least 648 workshops have been conducted by Maury peer trainers across the country, reaching 7826 persons. And while AMS does not have exact records on the period 1994-2001, it is estimated that at least several thousand additional persons were impacted by Maury peer training. Most of those trained were teachers, who from AMS evaluation data have been shown to impact, on average, about 150 students per year. Therefore the peer-training multiplier effort demonstrates the large-scale impact made by 24 highly trained teachers per summer USNA workshop.

### TRANSITIONS

Maury Project alumni continued to provide leadership in other AMS oceanography-related teacher training and learning materials development initiatives, including participation in Local Implementation Teams (LITs) for the *DataStreme Ocean* and *DataStreme Earth's Climate System* semester-long graduate-level courses, which are offered nationally to about 250 teachers each year. In school year 2014-2015 *DataStreme Ocean* course offerings, Maury Project alumni lead approximately

14 LITs. Through spring semester 2015, a total of 3910 (precollege teachers were trained by this program. There are currently about 60 teachers registered for Ocean this fall.

Originally funded by the NSF for 3 summers starting in 1994, the existing Maury Project workshops at the U.S. Naval Academy received additional NOAA, Navy, and AMS support. Current ONR funding provides major support for the USNA workshops through Summer 2016.

## **RELATED PROJECTS**

The Maury Project inspires participants to further their training and administrative activities. The project also directly impacts U.S. Coast Guard Academy course offerings, the *AMS Ocean Studies* introductory college-level course and AMS Diversity Projects, and has helped foster formal partnerships with COSEE and the Consortium for Ocean Leadership.

### **Leadership Roles Assumed by Maury Participants**

In addition to Maury alumni peer-training activities and DataStreme LIT participation during FY15, there are notable examples of Maury Project participants continuing their broader leadership roles in STEM education:

Barbara Walton-Faria – 2009 Rhode Island Teacher of the Year

John Moore – Chair, AMS Board on Outreach and Pre-College Education and 2009-2010 Albert Einstein Distinguished Educator Fellow

Michael Passow – 2014-2016 President of the National Earth Science Teachers Association

Richard Jones – 2014 Regents Medal for Excellence in Teaching

Victoria Gorman, Kathleen Murphy, Jeffrey Yuhas – Current members of the AMS Board on Outreach and Pre-College Education

### **U.S. Coast Guard Academy**

The U.S. Coast Guard Academy currently uses materials from the Maury Project in its Introduction to Atmospheric and Marine Science course and Physical Oceanography course. Additionally, Academy faculty routinely provide Maury Project presentations at local and regional teacher workshops and conferences, for example the South Eastern New England Marine Educators Association workshops in the fall and the Long Island Sound Educators Conference in the spring of alternating years. There is continued interest in developing an AMS *DataStreme Ocean* and *Atmosphere* Local Implementation Team in partnership with the Academy, which would offer AMS DataStreme courses to regional K-12 teachers. AMS Education Program staff will work to establish this LIT during FY16.

### **AMS Ocean Studies**

Building on the experiences gained in the Maury Project and the *DataStreme Ocean* in-service teacher professional development course, the AMS developed an introductory college-level oceanography course, entitled *AMS Ocean Studies*. Since national implementation in fall 2005, 174 undergraduate institutions and 22 high schools have introduced the course to more than 25,700 students. About 3500 students took the course during Academic Year 2014-2015/Summer 2015.

*AMS Ocean Studies* would not exist without the experiences gained from the Maury Project, including materials development. A major benefit of the *AMS Ocean Studies* course is that it reaches pre-service

precollege teachers. In addition, the U.S. Navy has periodically used *AMS Ocean Studies* course materials for distance education training of sailors.

### **AMS Diversity Projects**

The *AMS Ocean Studies* Diversity Project, an offshoot of work with the *AMS Ocean Studies* undergraduate course, was a direct result of an NSF grant and NOAA support to provide special workshop opportunities for faculty at institutions serving significant numbers of minority students. Workshops were held each summer at University of Washington and NOAA facilities in Seattle, WA from 2006-2008. The 77 minority-serving institutions (MSIs) participating in the program have offered the course to more than 8000 students, providing an opportunity to sample an oceanography course where none existed prior to this program.

AMS received an NSF OEDG Track 2 grant in August 2011 to continue Diversity Project workshops, this time focusing on implementation of the *AMS Climate Studies* course at 100 MSIs over a five-year period. As of this writing, AMS is in the final project year, having provided training for 101 faculty from 98 MSIs (with some institutional overlap). For many participating faculty members, the *AMS Climate Studies* course will accompany the offering of the *AMS Ocean Studies* and/or *AMS Weather Studies* course at their institution. At the May 2012-2015 *AMS Climate Studies* course implementation workshops, RADM (Ret.) Dr. David Titley, former Oceanographer and Navigator of the Navy, gave a highly-regarded and informative presentation on national security and climate change.

### **COSEE Partnership**

AMS and COSEE, formally named the Centers for Ocean Sciences Education Excellence under NSF support, had a Memorandum of Understanding “to promote atmospheric and oceanic science research, education, and outreach and cooperation and action,” which created new avenues of outreach and educational opportunities for potential and current teacher participants. COSEE recently changed its name to Consortium for Ocean Science Exploration and Engagement and is transitioning to an independent consortium with a dues-based membership “open to ocean science research and academic institutions and organizations with a mission to promote ocean science research and ocean literacy.” AMS will explore continued areas of collaboration with COSEE.

### **Consortium for Ocean Leadership Partnership**

At the 2011 School of Rock workshop conducted by the Consortium for Ocean Leadership, Brey presented the idea for formal collaboration on a grant to bring minority-serving institution faculty members who offer *AMS Ocean Studies* and/or *AMS Climate Studies* to a special School of Rock. The goal was to train MSI faculty to infuse curricula involving paleoclimate data from ocean cores, thereby providing MSI students with opportunities to use real research data in the classroom. The idea came to fruition in 2012 when Consortium for Ocean Leadership was awarded an NSF OEDG planning grant to collaborate with AMS and other partners to conduct the June 2012 School of Rock workshop for 12 MSI faculty at the Texas A&M University Gulf Coast Repository. In 2014, Consortium for Ocean Leadership, in collaboration with AMS and several other academic and research institutions, received NSF funding for a considerable expansion of these efforts entitled MSI-REaCH: Minority-Serving Institution-Reconstructing Earth’s Climate History Program to Enhance Ocean and Climate Curricula and Provide Authentic Research Opportunities for Faculty and Students. The project goal is to provide MSI faculty and students with immersive paleoclimate instruction, using authentic ocean core data, and mentored research experiences, for the purposes of enhancing scientific literacy and options for

integrating research-based, data-rich ocean and climate curricula for MSI faculty and students, thus strengthening pathway towards advanced geoscience study and careers.

During FY15, the project team planned and held the first MSI-REaCH advanced faculty professional development workshop, focusing on paleoclimate data gained through ocean sediment cores, in June 2015 at the Gulf Coast Repository in College Station, TX. Sixteen faculty attended the workshop and formed a Plan of Action for incorporating paleoclimate study into their curricula and using research data with students. The majority of faculty participants had offered other courses through the AMS Education Program. MSI-REaCH is supported by NSF for two more years.

## **PUBLICATIONS**

### **1 October 2014 – 30 September 2015:**

Weinbeck, R.S., Brey, J.A., Geer, I.W., Mills, E.W., Nugnes, K.A. (2015). Strengthening K-12 Teachers through AMS Education Program Professional Development Programs. *24th American Meteorological Society Symposium on Education*. Phoenix, AZ. Conference Presentation.

Asokan, A., Evans, J., Smith, D.R. (2015). A Closer Look at the Maury Project. *National Marine Educators Association 2015 National Conference*. Newport, RI. Conference Presentation and Workshop.