

NOAA Hosts Boy Scouts of America Oceanography Merit Badge Events

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Abstract— The United States Boy Scouts of America (BSA) programs are designed to cover a range of different youth development activities. Central to the BSA program is the merit badge system. Merit badges provide an opportunity for scouts to learn about a specific topic, which may be focused on a hobby, physical activity, or prospective career field. There are more than 120 different merit badges that any Scout may earn, each with its own set of requirements. BSA introduced an oceanography merit badge in 1964. Very recently, a significant increase in demand for this particular merit badge throughout the Hampton Roads region of southeast Virginia was noticed by members of the National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service (NOS) Center for Operational Oceanographic Products and Services (CO-OPS) Atlantic field office in Chesapeake, Virginia. CO-OPS also noted a limited number of opportunities to earn the badge, with some local events being booked beyond several years. In a pursuit to assist with the growing regional demand, a group of scientists, engineers, and marine technicians at the CO-OPS office in Chesapeake gathered to review merit badge requirements and then consulted with several contacts at Old Dominion University (ODU) that has recently been holding several different annual BSA merit badge events, including oceanography. The CO-OPS team designed a one day program that could be held at the Chesapeake field office and could meet all BSA badge requirements. The CO-OPS Chesapeake office is home to over 40 professionals in various fields of ocean science and marine technology and the facility houses a significant amount of oceanographic sensors, instrumentation, and a number of laboratory facilities. The first CO-OPS oceanography merit badge event was conducted during August 2011. Since, it has continued to be held on an annual basis, with five successful events completed to date. All five annual events reached the maximum registration limit of fifty scouts. An overview of the event program that CO-OPS has designed and continued to develop over the past 5 years will be presented along with examples of how interactive exhibits at the field office facility have been used to address BSA oceanography merit badge requirements.

Keywords—*Boy Scouts of America, oceanography merit badge, NOAA's Center for Operational Oceanographic Products and Service, NWLON outreach*

I. INTRODUCTION

The Boy Scouts of America (BSA) is one of the United States largest and most distinguished youth development organizations. BSA programs are designed to cover a range of

different development activities for young people including character building, citizenship and caring for the community, leadership qualities, outdoor skills, ability to overcome obstacles, and personal fitness [1]. BSA's programs and activities are designed and developed based on the belief that helping youth is a key to building a more conscientious, responsible, and productive society. A nationwide study recently conducted by Baylor University found that those who attain BSA's highest rank, Eagle Scout, are more likely to have higher levels of planning and preparation skills; be goal-oriented and network with others; be in a leadership position at their place of employment or local community; report having closer relationships with family and friends; volunteer for religious and nonreligious organizations; donate money to charitable groups; work with others to improve their neighborhoods [2].

Central to the BSA program is the merit badge system. Recently after establishment in 1911, the BSA offered 57 different merit badges. Today, the number of merit badges that a scout can earn has grown to more than 120. Each merit badge focuses on a specific subject and study area and each has its own set of requirements for earning. Badge requirements typically involve an assignment, event, and/or activity led by adult subject matter expert in the specific study area.

The BSA introduced an oceanography merit badge in 1964. As of 2007, it was ranked 76 out of 122 badges offered. While the nationwide number of merit badges earned per year for many of the different badge subjects continues to grow, the number of BSA oceanography merit badges earned per year has remained relatively flat over the past three years, at slightly over 10,000 per year. Also, the total number of oceanography merit badges earned to date, 278,355, is a relatively small number compared to the number of badges earned in other science subjects such as aviation (586,975), geology (625,840), and weather (562,112).

Although there are no statistics available to quantify nationwide popularity or growing interest in the BSA oceanography merit badge, a significant increase in demand for this particular badge in the Hampton Roads region was recently noticed by the National Oceanic and Atmospheric Administration (NOAA) National Ocean Service (NOS) Center for Operational Oceanographic Products and Services (CO-OPS) Atlantic field office in Chesapeake, Virginia. Unfortunately, CO-OPS also noted a very limited number of opportunities to earn the oceanography badge in the region;

this initially seemed surprising considering Hampton Roads covers a coastal area where the ocean is an intimate part of society and everyday life. Given the broad range of related material covered in requirements and the BSA oceanography lesson book [3], it is very difficult for a scout to complete this merit badge on his own.

The growing interest in the BSA merit badge was first brought to the attention of CO-OPS by NOAA IT specialist, Joseph Colby, who is a leader for a local Boy Scout troop during his personal time. It was noted back in 2011 that a growing number of BSA troops throughout the Hampton Roads area were showing interest and submitting inquiries about the pursuit of an oceanography merit badge, but troops were having difficulty in finding opportunities to earn the badge. CO-OPS learned that the Old Dominion University (ODU) in Norfolk, VA sponsors a one day merit badge event twice a year, but in 2011 the ODU event registration was booked through the year 2018.

In a pursuit to assist with the growing regional demand for opportunities to earn a BSA oceanography merit badge, Joe gathered a group of scientists, engineers, and marine technicians at the NOAA CO-OPS office in Chesapeake to review badge requirements. The group consulted with several contacts at both ODU and NOAA's Monitor Marine Sanctuary (Newport News, VA) who had recently been supporting BSA events. It was determined that a merit badge event conducted at the CO-OPS Chesapeake office could meet all BSA badge requirements and have a high likelihood of success.

NOAA\NOS's Center for Operational Oceanographic Products and Services maintains and continues to develop over 300 real-time coastal observatories, which make up the National Water Level Observation Network (NWLON) and Physical Oceanographic Real-Time Systems (PORTS®), throughout the United States. NWLON consists of over 200 observatories throughout the U.S. coastal regions, including the Great Lakes, as well as Pacific and Caribbean island territories. PORTS consists of regional integrated suites of observatories at twenty-four major harbors throughout the U.S. Real-time data and analysis products from NWLON and PORTS provide critical support for safe and efficient navigation throughout all major U.S. coastal waterways.

CO-OPS headquarters is located in Silver Spring, MD. The Chesapeake, VA office is one of three regional field offices and home to several groups involved in a range of different activities including: engineering design and development, ocean measurement system test and evaluation, system integration, oceanographic sensor calibration, field installation of ocean observatory stations, geodetic surveying, oceanographic data analysis, and IT and database support. CO-OPS field office in Chesapeake is home to over 40 professionals in various fields of ocean science and marine technology and the facility houses a significant amount of oceanographic sensors, a number of ocean system laboratory facilities, and an extensive suite of state-of-the-art geodetic survey equipment.

The extensive amount of high technology oceanographic and meteorological measurement equipment housed in the CO-OPS Chesapeake office in combination with technical

expertise amongst resident employees was a major inspiration for CO-OPS' first hosting of a BSA oceanography merit badge event. Additionally, several CO-OPS employees who are members of the Marine Technology Society Hampton Roads section received word from fellow MTS members indicating a high likelihood of volunteer support for the event from other local organizations outside of NOAA.

The first CO-OPS oceanography merit badge event was held in August 2011 and it has continued to be held on an annual basis since. CO-OPS fifth annual BSA oceanography merit badge event was recently completed during July 2015. All five annual events reached the maximum registration limit of fifty Scouts.

II. DESCRIPTION OF NOAA CO-OPS BSA EVENT

CO-OPS oceanography merit badge event is designed as a single day event that can accommodate up to 50 scouts. It begins with a general introduction to CO-OPS and the Chesapeake facility, followed by an oceanography science lesson presented to all 50 troops. The lesson is designed to be interactive and includes several lab demonstrations and a Q&A session. A best attempt is made to follow lesson topics in the BSA oceanography merit badge guide book [3]. The lesson is approximately 1 hour with the last 15 minutes used provide an overview of the work conducted at the CO-OPS Chesapeake office. Examples of the real-time data provided by CO-OPS observatory stations throughout the Hampton Roads region are shown using CO-OPS website.

Following the science lesson, the troops are split up into several small groups and rotated through set of 5-6 different interactive exhibit stations. With each event, a best attempt is made to arrange a diverse group of exhibits to include topics covering all four branches of oceanography – geological, chemical, biological, and physical. The focus of most CO-OPS applications is long-term, real-time physical coastal measurement systems and related physical oceanographic analysis. Support from several volunteers at different organizations throughout the region has enabled a diversified curriculum. Volunteers from the Nauticus Maritime Museum (Norfolk, VA), College of William and Mary Virginia Institute of Marine Science (VIMS), Virginia Beach Aquarium, and the Old Dominion University (ODU) have come to setup exhibits at the events. Additionally, members of several different NOAA program offices with locations in the region have come to support the event including the Office of Coast Survey, Chesapeake Bay Office, and National Marine Sanctuaries.

The following are just some examples of the many different interactive exhibits that have been used at events over the past five years. Groups of 8-10 scouts are rotated through the series of exhibits, spending approximately 30-40 minutes at each.

Marine Instrumentation - This station is led by members of the CO-OPS Chesapeake office. It consists of an exhibit of several different sensors and system components used for measuring physical oceanographic and meteorological parameters throughout CO-OPS observatory network. An age range of different sensors are used to show how measurement technology has evolved over the years. Several sensors are

turned on and either sending data to a display or logging to a device. Scouts can collect measurements, learn how sensors operate and then observe data collected. Examples of measurements collected include: range to a flat horizontal target (like a wall) with a radar water level sensor on a moving cart, wind with a fan on an anemometer, air and water temperatures, conductivity/temperature/depth casts in a stratified tank. The exhibit also includes a display showing real oceanographic and meteorological data from one of CO-OPS local observatory stations. An explanation of which types of sensors in the exhibit are providing the real-time, online data at the field station is provided. The exhibit focuses on topics of physical oceanography, measurement systems, marine electronics, and real-time data telemetry.

Waves in the Marine Environment – A set of several 4' long, 2' wide, 6" deep plastic tanks that include a manual rotating wave paddles are set up on table. The tanks are partially filled with water. At the end opposite of the wave paddle is a pile of beach sand, a handful of small rocks and a shovel. Scouts can generate a series of different coastline shapes with the sand and shovel and then observe how continuous waves generated using the paddle can cause the coastline to change shape. Scouts can then use small rocks to build various structures, such as jetties or retaining walls and then observe impacts to sediment transport and/or retention in response to additional wave motion. This exhibit focuses on topics of physical oceanography and coastal engineering.



Fig. 1. Activity demonstrating impacts of ocean wave energy on coastlines.

Build a Buoy- This station has consistently been a favorite among scouts at all 5 annual events. Led by Andrew Larken from NOAA's Chesapeake Bay Office, Norfolk, VA, location, the exhibit is centered on a design competition. Scouts are provided access to a supply of varying sections and sizes of PVC pipe and connecting joints, zip ties, and Frisbees. The

scouts are given 30 minute to design a floating structure that can hold as many golf balls as possible. After the design and build is complete, the structure is floated in a small, water filled tank. Scouts provide a demonstration test in the tank by loading their structures with as many balls as possible. The focus of this activity is on engineering design, development of buoy platforms, and physical oceanography.



Fig. 2. Scouts demonstrating buoy designs in the 'Build a Buoy' activity.

Hydrography demonstration – Each scout receives a small box that contains inside a surface that is a rough, scaled model of an ocean floor with some interesting bathymetric features. The box contains a porous cover that prevents the scouts from seeing the model sea floor, but allows the Scouts to poke a graduated sounding stick through the lid to reach the model sea floor surface. Scouts collect multiple measurements with the sounding stick and then use the resulting data to sketch of map of the model sea floor on gridded paper. Upon completion, scouts remove the box lid to see what is really below then assess the accuracy and resolution of their paper bathymetric sketch. This activity has been led by Gene Parker from the NOAA\NOS Office of Coast Survey's Norfolk, VA location. The focus of the activity is on marine geology and ocean bathymetric surveys.

Ocean Acidification – Shannon Ricles from NOAA's Monitor Marine Sanctuary, based in Newport News, VA, has

led several different versions of this exhibit and activity which focuses on long term changes to ocean chemistry and impacts on marine biology. To demonstrate impacts of carbon dioxide mixing with seawater and the resulting increase in acidification, several household products, such as vinegar, ammonia, soda, and bleach, are used to show the effects of acidification on eggshells and exoskeletons of various marine animals.



Fig. 3. Scouts prepare to submerge several objects into household substances to demonstrate the impacts of ocean acidification.

Several other interactive exhibits in the event's rotation have included various lessons on Chesapeake Bay ecology provided by both members of Old Dominion University and College of William and Mary Virginia Institute of Marine Science; exercises to demonstrate the impacts of marine debris on marine life, led by both volunteers from the Virginia Beach Aquarium and NOAA Marine Sanctuaries; exercises to model and demonstrate deep sea exploration of ship wrecks led by Rebecca Hill from the Nauticus Maritime Museum, in Norfolk, VA.



Fig. 4. Julie Morgan of Old Dominion University, uses a 3D watershed model to demonstrate various impacts of runoff in an estuarine watershed.



Fig. 5. Eileen Hoffman, of Old Dominion University, shows and discusses Chesapeake Bay native oyster species.

III. SUMMARY

In a pursuit to assist with the growing regional demand for opportunities to earn a BSA oceanography merit badge, a group of scientists, engineers, and marine technicians at the NOAA CO-OPS field office in Chesapeake, VA have developed a one day merit badge event that can be completed at this field office. The event has been conducted annually for five consecutive years. Every year the event registration has reached the maximum capacity of 50 scouts. Much support has been provided by volunteers from several other organizations across the region in setting up interactive exhibits in the event's rotation. This program developed by NOAA CO-OPS, with assistance for regional partners, demonstrates how a NOAA field office facility and associated equipment can be used to support an education and outreach program. In addition to the benefits that the event provides young scouts, through a hands-on educational experience, many benefits also result for the CO-OPS Chesapeake office and its members. The event provides a valuable opportunity to share with young scouts, parents, and troop leaders the work that CO-OPS does throughout the region and the value of real-time data provided by CO-OPS ocean observing network. Also, the act of recruiting local volunteers has significantly enhanced communication between CO-OPS and several other local organizations, including many local members of the Marine Technology Society.

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