**IntroductIon**

In America when we think of a person who makes maps most often what comes to mind has some combination of traits of Charles Mason and Jeremiah Dixon, who bravely defined our “Mason / Dixon Line,” or Gerardus Mercator who gave us the “Mercator Projections”. One might say our mental archetype would be the “mathematical outdoorsman” or the “mathematical artist.” A healthy robust man of intellect prepared for adventure. ASPRS has many healthy robust young adventures, both men and women, who work every day to make our world maps both in the office and in the field.

As we continue to diversify as a community, we would like to share how we are working to engage our young women in the adventure of map making. The American Association of University Women (AAUW) has a vision and it is simple: “We bring people together for the common goal of breaking through educational and economic barriers for women and girls.” The authors of this article are active ASPRS leaders who also share a passion for AAUW and the advancement of equity for women and the promotion of Science, Technology, Engineering and Mathematics (STEM) education for young women. Amanda D. Aragón is the sitting chair of the ASPRS Student Advisory Council and a graduate student at New Mexico Highlands University in Environmental Science and Anthropology. Dr. Melissa J. Rura serves as the Book Review Editor for *Photogrammetric Engineering and Remote Sensing (PE&RS)*, the academic journal of the American Society for Photogrammetry and Remote Sensing (ASPRS). Rebecca (Becky) Morton is the incoming president of ASPRS and the President and CEO of GeoWing Mapping Inc.
TEAMING ASPRS WITH AAUW

Encouraged to join the AAUW as an undergraduate math student by three math professors, Dr. Renee Fister, Dr. Maeve McCarthy, and Dr. Darla Kremer, Dr. Melissa Rura has been a member of AAUW for many years. She fondly remembers her first AAUW sponsored activity, a trip to the Oak Ridge National Laboratory with these professors in the late 90’s and her first exposure to the National Lab system. As a young woman being guided into an academic path she was both inspired and dismayed to hear and see the “barriers for women and girls” in math, science, engineering and technology from both the men working at the lab and women who had brought her to participate in the program. In part, as a consequence of this experience, she has continued to work on problems that relate to overcoming barriers and within organizations that make that work a priority.

Incoming ASPRS President Becky Morton is an active AAUW member and particularly values the ability to work toward empowering young women within both organizations. Ms. Morton has been active in the Oakland-Piedmont Branch of AAUW since 2009. The Oakland-Piedmont AAUW Branch has a strong program of advocacy for women and girls in the local community and a STEM camp program for middle school girls called Tech Trek, is a shining example. The Tech Trek STEM program is designed to immerse and empower young women to address the question “Why so few women in STEM?” The City of Oakland in California has, in the recent past, had a national reputation for inner-city violence, racial tension, and poverty, see “Community Policing and Crime: The Process and Impact of Problem-Solving in Oakland” 2008. Although improving in these areas, the fact remains that particularly young women in Oakland experience a stressful and sometimes dangerous school environment which often fails to nurture their drive toward learning and achievement. The young women selected for Tech Trek are selected by their teachers because they have tremendous potential and the pool of candidates is always many times larger than the available scholarships. This year (2016) the Oakland-Piedmont Branch sent twelve young women from the Oakland school district to Sonoma State University on a full scholarship for a week-long hands-on STEM learning experience.

As part of an initiative of outreach to the ASPRS community to encourage diverse populations of practitioners, professionals and researchers, the sitting ASPRS Student Advisory Council Chair, Amanda D. Aragón, participated in the AAUW sponsored Tech Trek to incorporate a geospatial training component. Ms. Aragón was particularly proud of her participation in the program and she describes her experiences below.

Figure 1. Building a map of pixels. Students were given 1-inch x 1-inch cut out colored paper “pixels” and asked to recreate the world pixel by pixel on the grid they created.

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PIXEL MATRIX – A SUMMER CAMP PROJECT

Amanda Aragón led a hands-on geospatial science learning experience, where sixty girls from the state of New Mexico were interviewed and selected for the week-long learning accelerated experience on the campus of New Mexico Institute of Technology in Socorro, New Mexico. In addition to robotics, computer science, biology and other areas of research, they participated in the “Pixel Matrix,” an interactive, youth, group learning activity to promote understanding and cognitive skills by integrating remote sensing and geography skills with a hands-on learning experience.

The young women had the opportunity to build a map of the world pixel by pixel on a large designated floor space. Students were provided with a short presentation about how to read and locate objects on a map, how to understand coordinate systems and some basic concepts of remote sensing.

By evaluating an image to the fundamental building block the “picture elements” (i.e., the pixels) that comprise the larger image, the students were introduced to the general concept of how satellites observe ground features. A demonstration image, such as a zoomed-in image from the Landsat Satellite Mission, was displayed to explain how researchers acquire and process data. Using an open floor space structure, such as a classroom or gymnasium, the students created their own grid using strings to establish the equator and prime meridian as their foundation to build their world map. The students were provided with several diced 1-inch x 1-inch cut out colored paper “pixels” of various colors and asked to recreate the world pixel by pixel on the grid they created. They were also provided with atlases and a map projected onto a larger screen to use as a reference in building their map. In participating in this activity, directly placing the students on the map itself enforced the learning of space and place on a 2D surface as observed from above. This exercise also promoted team building and communications skills.

Interestingly, each group took on a different approach in creating their shape. The group assigned to Australia started by dumping a pile of pixels in the center and disbursing them to the outer boundaries of the continent. The North American group collaborated on focusing on just the boundary itself with the careful detail of the outline. However, the group assigned to Europe took on an entirely different method and layered rows of a pixel on the grid starting in the north and worked their way south towards the equator. It was also observed that if the continent was more foreign and unfamiliar to the students, such as Asia, the students were less likely to address the details of the boundaries.

When time was up, all the students stepped back and revealed a completed world map. The groups were then asked to explain the experience and what they learned. A student representative from each group described what they observed, how they collaborated as a group, why they chose this method and a little insight they discovered reading about that continent from the atlases provided.

The feedback from the students was phenomenal. There was a high but controlled energy level in the room as students displayed an eagerness to complete the task. Some of the students who were asked what they learned from the project admitted that they had never had a geography lesson in the classroom where they enjoyed discovering so much information about the world. Another group explained how they were intimidated by the assignment at first, when presented with the scale of the project and quantity of pixels. However, when they started working together they successfully accomplished the task and were very satisfied with the outcome. Overall the Pixel Matrix was a successful project and provided potential interest in the geospatial and imaging sciences.
Ms. Aragón developed this learning activity as an exploration of ways to encourage and promote the new generation of geospatial thinkers to become more involved through progressive learning activities. She believes that new approaches, like the Pixel Matrix, can innovate and build a connection with youth, providing a lasting impression that can trigger an interest in geospatial pathways in STEM. She designed this project to teach students at the K-12 level a fun and a collective way to build their own map and understand the fundamentals behind the technology involved. The project allowed exploration of concepts in highly technical fields while including critical thinking and group interaction skills that can carry on into advanced academics and career choices for the young women involved.

As we look back over the history of ASPRS, our membership has embraced many women leaders, directors, and presidents, including our incoming president, Becky Morton, and vice-president, Anne Hillyer. Our past female past presidents include Tamsin G. Barnes (1985), Marilyn M. O’Cuilinn (1990), Tina K. Cary (1996), Karen Schuckman (2005), Kari J. Craun (2006), Marguerite Madden (2007), Kass Green (2008), Carolyn J. Merry (2010), Bobbi Lenczowski (2012). Six out of eleven of the current ASPRS Board of Directors are women!

Listening to the Tech Trek young women from Oakland, California talking about their experience and their newfound love of science and math, Becky Morton was encouraged by the ability of the program to provide life-changing positive experiences for young woman through organizational programs and scholarships. She is equally encouraged by the current environment for young women in the fields of geospatial science and within the ASPRS organization. ASPRS has a long history of supporting young people coming into the geospatial sciences through grants and scholarships and scientific publication. The fact that women are embracing these opportunities is evident in the trend in ASPRS membership toward increased diversity. There is still a long way to go to achieve the diversity we hope for within ASPRS membership, but outreach efforts such as Ms. Aragón’s AAUW Tech Trek geospatial science program is exactly what is needed to get us to our goal. It is amazing to see young people’s eyes light up with excitement when they “get it” and when they catch the “I love maps” bug. Some of these Tech Trek young women will become geospatial scientists and will look back at the learning experience and organizations such as ASPRS and AAUW that turned them on to their life’s passion for science.

Although the majority of geospatial workplaces are still predominately male, professional organizations such as AAUW and ASPRS are actively advancing toward diversity and living the AAUW vision of “…bring[ing] people together for the common goal of breaking through educational and economic barriers for women and girls.” For more information about Tech Trek see (http://www.aauw.org/what-we-do/education/tech-trek/).