

## Sophia Zhou

“Let the waves carry you where the light cannot.” (Mohit Kaushik)

The mystery of the deep blue sea is fascinating. According to the National Geographic Society, “more than 80 percent of the ocean has never been mapped, explored, or even seen by humans” despite the fact that 71% of the earth’s surface is covered by ocean. The Legend of Atlantis intrigues generation after generation of young kids, including me, with the question: “what really is there at the bottom of the sea?” Hearing Mr. Aamir Qaiyumi talking about using smart robots to map the sea floor was an “aha” moment for me. Since Nikola Tesla displayed his radio-controlled boat for a crowd in Madison Square Garden in 1898, the pursuit of creating smart unmanned systems to execute tasks that may be unsafe for humans has been chased by many engineers and researchers. On the other hand, the public has long speculated and sometimes feared futuristic smart robots, like the Terminators. The truth is that we humans need smart robots and unmanned systems to help us achieve our ambition of fully exploring our home planet as well as space.

The video on Autonomy for Unmanned Systems compelled me to learn more about the US Navy’s unmanned campaign plan. Smart unmanned systems is an important new capability for the Navy and Marine Corps to develop, build, integrate and deploy. The US Navy strives to build a more effective and distributed naval force to guarantee the freedom of sea for all. The integration and deployment of unmanned systems in military operations is an important strategy to reach this goal. A recent Congressional Research Service Report pointed out that the unmanned systems “can be particularly suitable for long-duration missions that might tax the physical endurance of onboard human operators, or missions that pose a high risk of injury, death, or capture of onboard human operators—so-called ‘three D’ missions, meaning missions that are dull, dirty, or dangerous”. Using unmanned systems will allow the Navy to take on greater operational risks while greatly improving sustainability, reducing cost, and keeping people safe.

However, developing autonomous, unmanned systems is a challenging task. To cope with dynamics and uncertainties in the environment for extended periods without the need for any direct assistance or intervention from humans, smart devices will need to be able to communicate directly with each other rather than through a central control center. The limitations of the payload size, weight, and power (SWaP) will need to be carefully considered. The processing power of onboard computers will need to be expanded. Software for unmanned system autonomy is inherently complex. For example, the unmanned systems will need to have self-learning capability, which in turn means collecting large amounts of data and processing the data for effective machine learning. The hardware as well as the software complexity will need to be managed to limit computational expense. Hardware and software will also need to be readily extensible to support the ongoing integration of new autonomous capabilities.

It was enlightening to listen to Mr. Phil Baptiste and Mr. Reece Koe talk about the Navy’s work on software and data science developments such as creating virtual reality training environments and

deploying artificial intelligence in maneuvering ships. I believe that a highly sophisticated autonomous unmanned system must be a marvel of multidisciplinary effort, with the hardware forming the body of the unmanned system and the data and the software giving the system its brain to make it truly autonomous.

I'm inspired by Mr. Reece Koe's career path. Taking advantage of the SEAP internship program to explore one's interest in STEM research as a high school student is a smart decision giving rise to a great opportunity: returning to Navy research laboratories during college to work on interesting topics. It was extremely encouraging to me to see more than half of the videos, actually 17 out of 31, featured female engineers and scientists. Often being the only girl in my advanced STEM classes, it's refreshing and welcoming to see these achieved female role models. I'm very interested in applying math and science to creatively solve high-impact problems. The internships provided by the Navy are especially appealing to me not only because of the interesting research problems, but also because of the opportunity to meet like-minded peers, interact with researchers in many different disciplines, and learn from experienced advisors. The work about artificial intelligence (AI) described by Mr. Koe is especially exciting. The copious and high quality data available in many of Navy's projects provide a challenging opportunity to apply computer science and AI to make novel advancements. AI and machine learning pose incredible potential for generating novel insights and increasing productivity through automation. My career goal is to become a tech innovator to meet high-impact needs. I plan to apply to SEAP internship when it opens and hope to learn more about computer science and AI to be able to pioneer new technologies with AI like Mr. Koe and his colleagues.

With the rapid advancement of technologies, I envision a future world where humans live securely in harmony with nature and each other. Many tasks will be executed by seamlessly integrated human-machine teams, such as medical operations, care for elderly, mining from the seabed and space, etc.. The world is mostly powered by 100% renewable energy, and we have figured out how to grow the productivity in agriculture and manufacturing industries without polluting the environment. Artificial intelligence has helped us reveal the secrets of health and life, and personalized medicine and healthcare enables each individual to live to the fullest of life. People with disabilities or impairments can enjoy a fulfilling life. The Internet of Things provides a connected smart and efficient infrastructure to even the most remote areas. Technology frees humans from many repetitive, routine and physically demanding tasks, and as such, people can spend more time on personal growth, conducting creative and innovative work, and taking care of each other. Space tourism, pioneered just a few weeks ago, is affordable for middle class families.

One of the important impacts technology advancement will have on the Navy and Marine Corps operations is improved sustainability. The US Defense Department has significantly reduced its fossil fuel consumption since the early 2000s, and technological advancement will help the military achieve, one day, completely carbon-neutral operations. Another impact I hope to see is the greatly increased connectivity, mobility, and effectiveness of the military. With the advancement in network technologies, artificial intelligence, robotics, etc., a distributed naval force equipped with these state-of-

the-art capabilities will effectively prevent and mitigate unnecessary conflicts and save and protect our country's lives. I believe that computer science and artificial intelligence will be an important part of advancing lots of current technologies, such as human-machine integration, autonomous unmanned systems, new material development and recycling, drug discovery and delivery, and so on. I would like to become an expert and innovator in artificial intelligence and contribute to building a strong and powerful Navy to ensure peace and prosperity from sea to shining sea!