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The 21st century will likely be remembered in future history books as one filled with geopolitical and scientific challenges. The rising Dragon and resurgent Bear challenge America's dominance over the world, and the last major peer-to-peer conflict we fought was over 70 years ago. Throughout all this turmoil, advanced science and engineering will prove our savior, and investing wisely in certain technologies will almost certainly pay off handsomely in future conflicts. Plasma physics is a lucrative field full of potential that could help our Navy and Marine Corps survive throughout the century, whether it is through providing abundant energy through nuclear fusion, using plasma images for defensive and offensive purposes, or simply inspiring the next generation of American students forward.

As a child, I grew up keenly aware of the potential science and technology have for our world. One of my favorite reading materials, the NASA website, featured articles on extremely advanced technology that we could use to become a spacefaring civilization. My favorite book series, the realistic sci-fi Three-Body Problem trilogy, featured massive, interplanetary battleships that could travel from one end of the Solar System to the other in weeks and inspired me to start seriously thinking about my future as a scientist or an engineer. As I did that, I realized that one of the things realistic sci-fi and futuristic governmental plans had in common was that they all required incredible amounts of energy that we could never field today. I realized that nuclear fusion held that promise of near-infinite energy, and as I went deeper into the scientific rabbit hole, I eventually found myself obsessed with physics. Specifically, plasma physics, as the subject itself seemed like the embodiment of the future, with so many future technologies betting on a thorough understanding of plasma. Darryl Watkins is an inspiration to me precisely because of how confident he is with pursuing his interests, no matter how difficult they are. Plasma physics is a notoriously difficult subject because of the mathematics and concepts involved, and the fact that Watkins has managed to survive and thrive in this field is a testament to his intelligence and determination. At the same time, he has served his country well by working for the Naval Research Laboratory as an intern. My career goals are similar to his and Rear Admiral Lorin Selby in the way that I strive to excel in both STEM and warfare, and both serve as an inspiration of the highest quality to me.

Plasma physics is an area of critical importance to the Navy and Marine Corps because of its potential we have barely begun to exploit. Nuclear fusion has the potential to give the world clean, safe energy that will last for hundreds, if not thousands, of years through careful manipulation of plasma. The most researched version of fusion involves slamming deuterium (an isotope of hydrogen) nuclei into tritium (another isotope of hydrogen) nuclei to create 1 helium nuclei and a neutron that flies off at 10% the speed of light. The neutron's kinetic energy could be turned into heat energy, which quickly translates into usable electrical energy. Future weapons systems, such as lasers or railguns, have shown to be feasible in sea trials but still require enormous amounts of power that most combat ships in the Navy cannot provide. Equipping each ship with a miniaturized fusion reactor could yield enough energy to be able to effectively use new weapons in combat. Fuel requirements could be dealt with by extracting the necessary fuel (most likely deuterium and tritium) from seawater, the very liquid that surrounds our ships. Current experimental reactors are successful in creating fusion, but end up consuming far more energy in creating the conditions for the fusion reaction in the first place, as controlling and sustaining the extremely hot plasma is difficult. Many companies and governments around the world declare they will develop the first operational fusion reactor by the 2030s or 40s, meaning that very soon, billions of people will no longer need to worry about using unreliable or carbon-emitting energy sources.

Laser-Induced Plasma Filaments (LIPF) is another plasma-based technology that is of critical importance to the Navy and Marine Corps because of its ability to create false images that can fool missiles and people alike. It works by having lasers ionize parts of the air, sometimes tens to hundreds of meters away. The plasma generated in that region can appear very hot and glow, and a system of precisely controlled lasers could go as far as to mimic a fighter jet's heat signature since the plasma can be controlled to a degree. This could be very useful in aerial combat since many missiles are heat-seeking and therefore could be fooled by LIPF-generated images. LIPF decoys would be far more effective than flares, since flares cannot be generated directly in front of the missile, nor can they be used repeatedly or have their heat signature modified in the middle of combat to more closely resemble the heat signature of a fighter jet. In addition, since humans will see LIPF-generated images as resembling glowing orbs, this technology could also be used to great effectiveness in psychological warfare. However, more investment by the Department of the Navy is needed to make good use of LIPFs, as the technology is still in its infancy.

Imagine this: It's June 12th, 2040. Russia's continual annexation of Ukraine, now a NATO member, has spiraled into an all-out war with the rest of Europe. In the opening days of the war, Russian and Belarusian forces cut across the border between Poland and Lithuania to separate Latvia, Lithuania, and Estonia from the rest of NATO and to reinforce Kaliningrad Province, where the Russian Baltic Fleet is based. The U.S. 6th Fleet is called upon to launch an amphibious assault into Estonia, which will have fallen into Russian hands by the time the bulk of the fleet arrives. The hope is to force Russia to divert forces to prevent the Marines from reaching Moscow, while NATO forces fighting the Russian invasion counterattack and join up with the Marines. Many of the U.S. ships in the upgraded 6th Fleet have been equipped with derivatives of Lockheed's Compact Fusion Reactors that provide much-needed power for the onboard HELIOS laser system. As the fleet nears its destination, Russian ships from the Baltic Fleet and coastal defenses open up with a barrage of anti-ship missiles. This is where the Navy's massive investment into plasma research pays off. Captains no longer need to worry about power consumption as the HELIOS laser systems on the escort ships engage the incoming missiles, being powered by fusion reactors that use plasma to generate enormous amounts of energy. Combined with the effectiveness of AEGIS missile interceptors and conventional CIWS systems, few Russian missiles hit their targets.

After the unsuccessful Russian attack, the U.S. carriers launch dozens of F/A-18s carrying Harpoon anti-ship missiles to destroy the Russian ships. Without LIPF pods, it would have been an extremely dangerous mission, with a good chance of at least half the jets not coming back. But as the Russian ships and Su-27s fire missiles at the incoming wave of aircraft, the Navy's investment into plasma research has once again proved to be of great value. The LIPF pods use lasers to generate plasma at a safe distance from the jets in a way that resembles a F/A-18's heat signature, and after years of research and development, they have been sufficiently miniaturized in a way that allows them to be carried and used by aircraft. The plasma decoys, in tandem with chaff, flares, and jamming, draw away the deadly missiles from the real planes, leaving the jets free to fire their missiles at the enemy ships.

When the Marines land on the Estonian beaches, they are met with overwhelming enemy opposition, but they manage to take a small beachhead. As night falls, remaining Marine armored units play their ace in the hole: using LIPF pods attached to their vehicles to create glowing, eerie plasma images of objects that aren't really there but can be seen on both visual and thermal imaging. Enemy troops are thrown into a panic, as they have never encountered glowing plasma images that are seemingly unaffected by gunfire and look like spirits that continually advance on their lines without stopping.

Enemy morale is at a low point, and their combat effectiveness is drastically reduced. The next day, the Marines and additional reinforcements begin their slow but unwavering trudge towards Moscow.

The Navy and Marine Corps of the future will hopefully never have to fight in a massive global conflict, but if we do, we must be prepared to win. Plasma physics-based technologies could be one of the many critical keys to victory through limitless energy, ingenious decoys, or inspiring the next generation. Whatever the case may be, advancements in naval STEM will bring us many steps closer to world peace. Perhaps that is what posterity will remember us for.