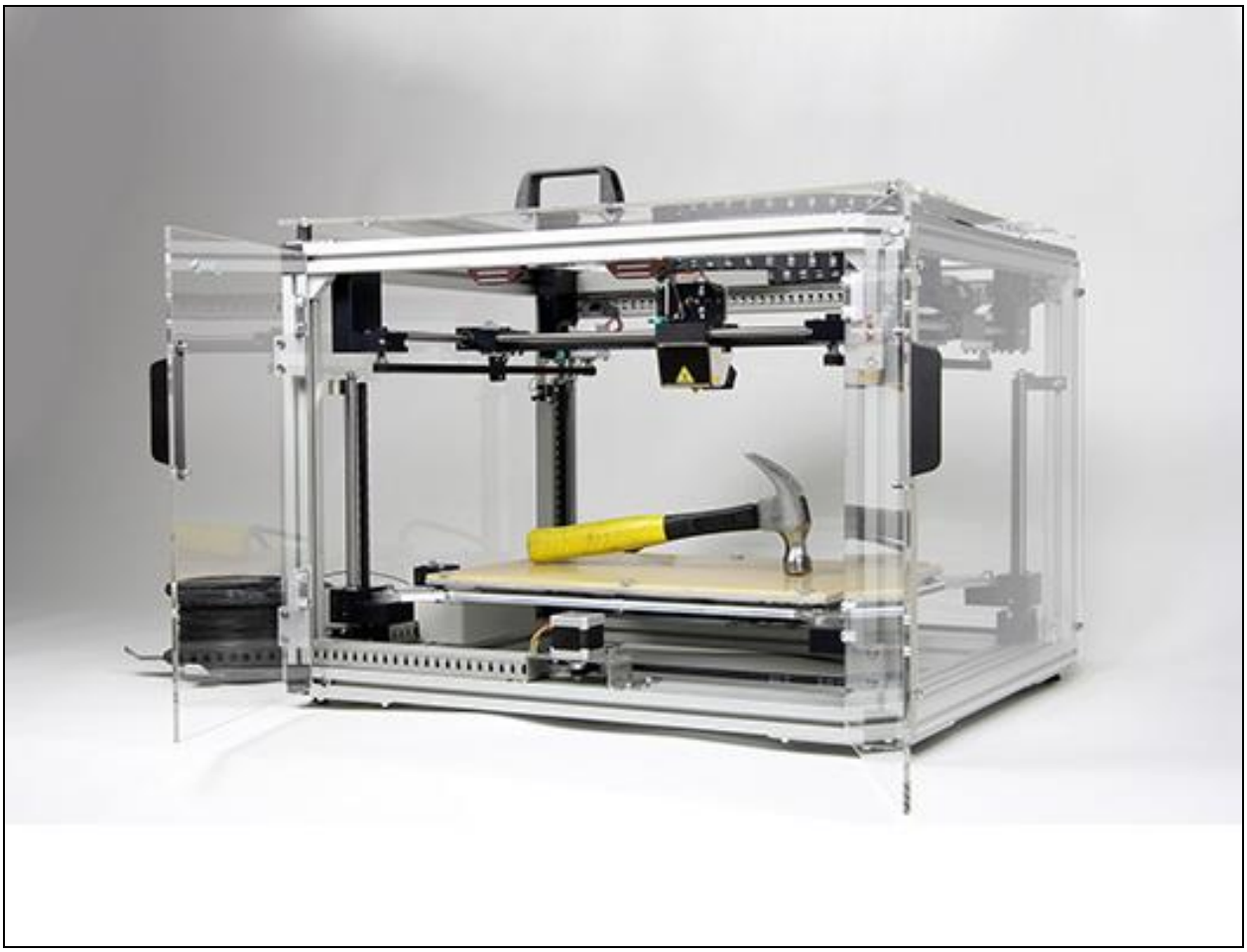

Photo courtesy of Inhabitat.com

3-D Printing: Implications for American Diplomacy

Lieutenant Commander Pete Zubof
United States Navy

If you're a self-avowed geek like I am, you have a deep appreciation for science fiction inspired technology. For example, the Star Trek television series introduced the "transporter," a machine that allowed matter to be moved from one location to another instantaneously as a packet of energy. One relatively new piece of technology, the 3-D printer, does a reasonable job of emulating "transporter" technology in many aspects. While it doesn't literally "beam" matter from one location to another, 3-D printing technology does allow the assembly of an exact

The opinions, conclusions, and recommendations expressed or implied within /luce.nt/ are those of the contributors and do not necessarily reflect the views of the Naval War College, the Department of the Navy, the Department of Defense or any other branch or agency of the U.S. Government.

replica at another location using bulk raw materials. The potential exists, therefore, to bypass many logistical barriers currently impeding elements of our national security efforts overseas.

Every year, the American military spends millions of dollars and thousands of man hours ensuring its supplies, from bullets to spare parts, are available to troops in combat areas of operations (AORs). Increasingly, many of these AORs are geographically and politically isolated, delaying logistical efforts. Resupplying our military forces has become an affair often frustrated by the fickle political atmospheres within states these routes traverse. In the land-locked country of Afghanistan, for example, the military is heavily reliant upon travel routes that pass through the sovereign territory of neighboring states. Changes in the diplomatic climate, therefore, can result in these border states limiting access to these routes or closing them altogether.

Afghan supply routes enter the AOR through two primary geographic origins. The southern routes originate in Pakistan at the port city of Karachi. U.S. and NATO forces have historically relied upon these routes for up to 85 percent of their logistical requirements. Starting in 2009, however, multiple diplomatic disputes resulted in frequent and prolonged access denials by the Pakistani government. In response, a second supply network was set up via a northern ingress, originating in the Black Sea and passing through various former Soviet republics before finally arriving in Afghanistan. These northern routes enjoy an increased level of security and stability compared to the Pakistani routes. However, access is dependent upon Russian and other state governments' approval, certainly not a guarantee in the current political environment. Additionally, these routes are costly. A report in 2012 put the additional costs for utilizing northern routes at $2.1 billion.[1]

In an attempt to stabilize costs, U.S. diplomats negotiated a deal in July of 2012 to guarantee supply route access through Pakistan but at what cost? In 2009, the same year as the first Pakistani supply route embargoes were enacted, Congress approved the Enhanced Partnership for Pakistan Act (commonly known as the Kerry-Lugar-Berman bill, or KLB). It authorized a tripling of US economic and development-related assistance to Pakistan, or $7.5 billion over five years to "improve Pakistan's governance, support its economic growth, and invest in its people." The KLB sets Pakistan up as the fourth highest recipient of U.S. foreign aid, behind only Israel, Iraq and Afghanistan itself.[2] This represents a huge investment in a state with marginal internal stability and transient diplomatic loyalties. In general, foreign aid is recognized as a tool of "soft" diplomatic power. Publically, foreign assistance to Pakistan goes, at least in part, to assist Pakistan security efforts in the region and fund Pakistan's own "war on terror." The US reality, however, is the soft power of aid dollars ensure that its supply routes to Afghanistan remain unrestricted—a $7 billion bribe to keep supply routes open.

Some may question how 3-D printing could have an impact on this diplomatic situation. 3-D printing is not "true" transporter technology. That is to say, it does not completely solve the need to transport goods from one location to another. However, what it has potential to do is dramatically simplify logistical needs and reduce the number of individual shipments necessary to meet a given specific needs. Raw source materials, the building blocks that power 3-D printers, could be brought in by bulk shipment and stored in-country for extended periods, dramatically reducing the amount of

logistical traffic required at any given time. From that bulk material, everything from basic construction components to military hardware, end even ammunition, could be "printed" on site.[3]

3-D printing technology could also resupply isolated AORs or individual bases via alternative modes of transportation. Large, complex items, previously relegated to cumbersome and dangerous surface travel, could have their component bulk materials shipped in by air. However, the components themselves could be "printed" at the location; therefore, the larger complex item could be printed on site, bypassing the need for ground transportation altogether.

The U.S. military is already testing the waters of 3-D printing technology. Last spring, the USS ESSEX (LHD-2) became the first US warship to have a 3-D printer installed by the CNO's Rapid Innovation Cell Print the Fleet project. The ship started out small, making disposable medical supplies (like syringes) and plastic models for flight deck control, but the potential is virtually limitless. The real challenge will be manufacturing parts that can live up to the rigorous safety and stress requirements for complex military uses, such as aviation.[4]

Unmanned aerial vehicle (UAV) technology may provide the perfect proof of concept for the military. UAVs, especially the small, man-portable type, have many of the same complexities of larger aircraft. Yet due to their small size and lack of human occupant, their manufacturing requirements are less rigorous, allowing for more experimentation. The University of Virginia recently used their own 3-D printer to create a proof of concept drone for MITRE Corporation, a DOD contractor. The result was encouraging: a remotely controlled aircraft capable of speeds up to forty-five miles per hour and with the ability to stay aloft for up to an hour. Even more important, the entire craft can be built in 31 hours via 3-D printer for a cost of about 800 dollars.[5]

As more and more technologies receive approval for military use, the feasibility for utilizing 3-D printing technology in combat zones increases. In the Afghanistan example, the reduced traffic flow and concentration on bulk delivery facilitated by 3-D printing would reduce transportation costs and allow consideration of alternate routes into the AOR. This may favor northern access routes, minimizing Pakistan's influence on the logistical puzzle. The net result? Billions of dollars could be saved each year by reducing the U.S. need to use its soft power to ensure access to critical logistical infrastructure.

Diplomatically, 3-D printing technology allows for the possibility of a refocus of national efforts, both politically and economically. Every year, the United States pays foreign governments millions of dollars to ensure that critical logistical choke points remain open. Yet these same choke points are still subject to the whims of a foreign government, directly impacting the ability to project U.S. power abroad. As 3-D printing technology improves, so does our ability to flex logistical lines away from these compromised choke points. Perhaps one day, we can hope to bypass them altogether.

As a kid, I marveled at the technological possibilities that science fiction offered for our future. We are still searching for a way to make some of those possibilities into reality—I've got a spot reserved in my garage for a flying car. Yet some of the seemingly most far-fetched of science fiction technologies are starting to become reality, with very real implications for national security.

[1] Marcus Weisgerber. "Alternate Afghan Supply Route Tab: $2.1 billion." Military Times. June 30, 2012. http://www.militarytimes.com/article/20120630/NEWS/206300309/Alternate-Afghan-supply-route-tab-2-1-billion (accessed November 19, 2014).
[2] Center for Global Development. "Aid to Pakistan by the Numbers." Center for Global Development. n.d. http://www.cgdev.org/page/aid-pakistan-numbers (accessed November 19, 2014).
[3] Jon R.Drushal and Michael Llenza. "3-D Printing Revolution in Military Logistics." Atlantic Council. November 20, 2012. http://www.atlanticcouncil.org/blogs/new-atlanticist/3d-printing-revolution-in-military-logistics (accessed November 19, 2014).
[4] Sydney J. Freedberg "Navy Warship is Taking 3D Printer to Sea; Don't Expect a Revolution." Breaking Defense. April 22, 2014. http://breakingdefense.com/2014/04/navy-carrier-is-taking-3d-printer-to-sea-dont-expect-a-revolution/ (accessed January 15, 2015).
[5] Jordan Golson. "A Military-Grade Drone That Can Be Printed Anywhere." Wired. September 9, 2014. http://www.wired.com/2014/09/military-grade-drone-can-printed-anywhere/ (accessed January 15, 2015).