

3D PRINTING II

VOLUME 5, ISSUE 7

OFFICE OF INFORMATION AND TECHNOLOGY (OIT)

INTRODUCTION

Health is more than just a state of well-being. It's about being able to do activities that make a person love life and illustrate who they are. A doctor who cannot perform surgeries due to loss of an arm; a farmer's inability to drive a tractor due to a hand contracture; or a patient, who had a cholecystectomy due to difficulty digesting foods with high fat content... these people are nowhere near an optimal level of wellness. However, what if there was a solution to eradicate these issues? With [three-dimensional \(3D\) printing](#) there is.

The future is filled with endless possibilities, including creating objects from a printer. It's an evolutionary movement from spewing toner on a white sheet of paper to building layers of plastic until an object is formed. This Tech Insight [revisits our previous Tech Insight on 3D Printing](#) with an updated overview, the development of 3D Printing at the Department of Veterans Affairs (VA), the largest integrated healthcare system in the United States, and various 3D printing success stories for patients.

OVERVIEW

In 1983, 3D printing, which is also known as additive manufacturing, came on the scene, but people did not really start to take notice until recent advances were achieved in the technology. [Chuck Hull](#) invented a method called [stereolithography](#), commonly known as 3D printing. He discovered the process that used ultraviolet lasers to make 3D objects layer-by-layer after becoming agitated with the long production times of prototyping. This set off a fortunate number of events, and in 1986, Hull patented his innovation, ultimately becoming the father of 3D printing.

The 3D printing industry is estimated to grow by more than 31 percent per year through 2020, and generate more than \$21 billion in revenue, [according to an insights report](#). Presently, 3D printing is changing the healthcare system by creating materials like scoliosis braces, hearing aids, and headphones that monitor oxygen levels and heart rate.

SUCCESSFUL 3D PRINTING STORIES

In March 2017, the [VA Center for Innovation \(VACI\)](#) partnered with [Stratasys](#), a manufacturer of 3D printers and 3D production systems, to make this effort for VA patients a dream come true. This partnership will serve more than eight million Veterans a year and change the dynamic of how hospitals function. Five 3D printers were installed in five VA hospitals in Seattle, Albuquerque, San Antonio, Boston, and Orlando. This initiative was built upon the work being completed in 3D printing at other VA hospitals, including the [McGuire VA hospital](#) in Richmond, Virginia. These printers can design near exact replicas of body parts tailored to each Veteran.

Gary Brayshaw, a Veteran in Washington State, is devoted to outdoor sports and recreational activities. His regular routine consisted of chopping wood until his [Dupuytren's contracture](#) made it nearly impossible to do so. Mary Matthews-Brownell, an occupational therapy hand specialist, reached out to Seattle VA 3D printing leadership to help her create a custom-made 3D printed split for Brayshaw. Ben Salatin, a clinical rehabilitation engineer at the [Albuquerque VA hospital](#), and Matthews-Brownell collaborated to [make her vision a reality and created a 3D printed orthotic](#) that allowed the patient to pick up an axe again.

Ismael Baca, a Veteran, was in a tragic accident where he sustained a spinal cord injury and became bound to a wheelchair. Salatin observed that Baca had a hard time turning on the toggle switches on his wheelchair joystick due to loss of finger function. To create a solution, Salatin 3D printed a press-on adapter to widen the toggle switch so Baca could access the controls with ease. This allowed Baca to use and maneuver his wheelchair with great ease. The toggle design was shared with other VA hospitals so that other Veterans could take advantage of this solution. The design can be customized to fit different needs of any Veteran and implemented to the wheelchair joystick.

These success stories show how expert professionals from various specialties can work together and utilize 3D printing technology to make a patient's life less challenging.

FUTURISTIC PORTABLE 3D PRINTER

In present day 2018, researchers in a lab in Toronto, Canada are testing a device that could, one day, be used directly on a patient to print new skin. Axel Günther, an engineering professor at the University of Toronto, says, "It forms the tissue right above the wound." The device prints a "bio-ink" gel filled with collagen, skin cells, and fibrin – a protein that aids in healing wounds. Gunther's vision is to create a business model that resembles a regular printer and ink cartridges. He envisions a "handheld instrument that can be sterilized, and then you have these custom cartridges that are single use and in touch with the patient, and they can be

scalably manufactured.” He suggests creating a small portable printer, instead of a bulky instrument, and ordering more cartridges.

Usually, skin grafts cannot cover a large surface area of skin due to lack of skin available. However, the printer could cover an entire wound completely and aid in the process of healing the skin better and fighting off infections.

Currently, the research is in its beginning stages and will need more animal testing prior to human clinical trials. A challenge the researchers face is having enough skin cells available to print due to the time it takes to grow cells. However, they are working on an alternative method that uses a few number of cells. The researchers have plans to use “universal donor” stem cells; these stem cells could be “mass-produced and wouldn’t be rejected by individuals.”

CONCLUSION

3D printing is a nascent, but rapidly growing technology, even though it has been around for more than 30 years. Moving forward with this innovation is vital for progressing healthcare forward. There’s still great deal of work that needs to be done in advancing the technology for widespread, completely dependable use that will best serve the general population and Veterans. The effort at VA can serve as a catalyst to see the approval of 3D printing across many amputees and all orthotic patients.

It is crucial for VA medical centers to be connected to the correct 3D tools and staff who know how to utilize them to provide Veterans the ability to access personalized 3D printed body part replicas, assistive technology devices, and other tools. The overall vision for 3D printing is for it to be available at all 168 VA hospitals across the nation. This way, many more Veterans can participate in the activities they love again.

TECH INSIGHT SERIES

The monthly Tech Insight series aims to help readers make better decisions and be more informed customers of OIT products and services by providing them with high-level overviews of technologies that impact or will impact VA’s IT environment. Tech Insights introduce topics in an easily digestible fashion by presenting background information on the topic, clearly explaining its importance within VA, and providing recommendations for success from OIT. All Tech Insights are available [here](#).

DISCLAIMER: This document includes links to websites outside VA control and jurisdiction. VA is not responsible for the privacy practices or the content of non-VA websites. We encourage you to review the privacy policy or terms and conditions of those sites to fully understand what information is collected and how it is used.