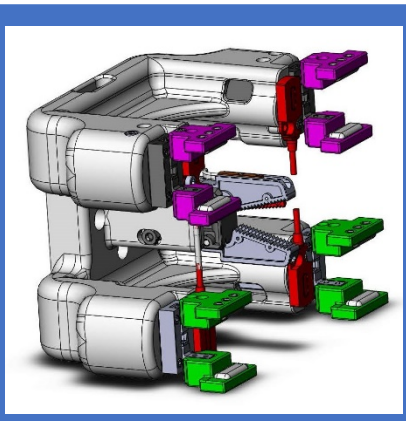
# Introducing Additive to Automation with End-of-Arm Tooling

### Phoenix Analysis & Design Technologies (PADT) Case Study

## ROBOTICS AND THEIR ROLE IN THE FACTORY OF THE FUTURE

In the factory of the future automation is king. Manufacturers can drastically reduce lead times, reduce labor costs, and increase overall efficiency through the use of robotics at several stages in their workflow. These machines serve a variety of functions on the factory floor, including everything from gripping and positioning parts to welding and painting assemblies in the later stages of the manufacturing process. While each function serves a unique purpose specific to the task it will perform, they all utilize an essential component known as End-of-Arm tooling (EOAT).



*3D model of Savage Automation's EOAT*

This element is the part located at the end of the robotic arm that can be customized to serve specific functions, such as those previously mentioned. Traditionally, companies that produce EOAT have used extruded aluminum, or machined aluminum frames often making them heavy and cumbersome. However, one manufacturer has found a solution to reduce weight without sacrificing strength or durability, using 3D printing.

## SAVAGE TURNS TO ADDITIVE TO SOLVE AN INDUSTRY-WIDE ISSUE

Formed in October of 2017, Salt Lake City-based company, Savage Automation, specializes in building EOAT used in the manufacturing and assembly industries, with a focus on injection molding part removal and downstream processing. With 11 years of experience in injection molding and a history of working with numerous tooling applications, founder and owner Richard Savage set out to develop a solution that would help to eliminate heavy and overly complex EOAT.

> **"I am not the first to do this, but I believe that Savage Automation has the industry experience to make this idea successful where others may lack the hands-on practice with EOAT."**
>
> - *Richard Savage, Founder & Owner – Savage Automation*

Savage found that by implementing additive technologies, new design capabilities opened up, such as better mounting solutions for grippers, sensors, and suction cups. Components such as vacuum and electrical connections could be routed through the body of the EOAT, instead of being strapped to the frame; keeping them out of the way during use and making the EOAT itself simpler and easier to set up. With simpler setup, Savage Automation was able to reduce changeover time, and reduce the potential risk of damage due to incorrect set-up. 3D printing also allows for the creation of over 50% lighter parts that cause less wear on the robotic servo motors, and allow for faster robot movements with less vibration. Once implemented, Savage Automation found the vibration to be almost non-existent.

## FINDING THE RIGHT MATERIAL FOR THE JOB

*Robotic arm with Nylon12 CF EOAT in use on the factory floor*

When it came to material capabilities, Fused Deposition Modeling (FDM) offerings from Stratasys, specifically their Carbon Fiber Filled Nylon 12 (Nylon12 CF), proved to be an effective alternative to the bulkier metals used in traditional manufacturing methods. This material effectively allows Savage Automation to manufacture a lighter End-arm-effector, without compromising strength and durability. Thanks to Nylon12 CF's lightweight yet rigid makeup, the EOAT held its dimensions well when being tested under various constraints. This is a factor that is key when designing a component that must interact with other parts made up of a variety of materials, shapes, and sizes. On top of that, by utilizing the soluble support built into parts printed with this material, Richard was able to add features like routing cables, and vacuum lines into the tool through hidden channels; allowing for better spatial management and streamlined appearance of the tool.

Machinability of the material was also key for Savage Automation for creating threads and fine finish details.3D printing provides rapid iteration of more complex parts thanks to a production time faster than traditional methods, and unique build practices that allow for the creation of intricate components without the need for much post processing or assembly. This allows Savage Automation to create EOAT that can be customized for any application that is relevant to their customers, and rapidly iterate designs for challenging processes.

Along with industry knowledge of tooling, Savage has built up a familiarity with 3D printing thanks to his experience with Phoenix Analysis & Design Technologies (PADT). Savage had partnered with Utah Sales Executive, James Barker on a 3D printed mold demo at Salt Lake Community College. After starting his business, PADT was a strategic partner for investigating materials and printing methods for his EOAT manufacturing process.

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**"James has been there to guide me through the materials selection and test prints. Together, we were able to reduce the lead time on my last project, even with two print revisions, and were able to get the EOAT body and gripper fingers printed in less than a week. "**

- *Richard Savage, Founder & Owner – Savage Automation*

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Moving forward, Savage plans on continuing to explore the capabilities of 3D printing in the world of EOAT. Due to the significant role it plays in his company, it will be implemented in every tool they create.

Want to see Savage Automation's Carbon Filled Nylon 12 EOAT in action? **Click Here** to see a video of the 3D printed frame in use on the factory floor.


*EOAT attached to 3D printed frame*

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