



# Axle Box Innovations Uses Essentium Solutions to Contribute to U.S. Made Drone Platform

**TECHNOLOGY DEVELOPMENT FIRM ASSISTS SKYFIRE CONSULTING WITH A 3D PRINTED DRONE PLATFORM BUILT FOR A LARGE FORESTRY AND FIRE PROTECTION CLIENT.**

## EXECUTIVE SUMMARY

Using the Essentium High Speed Extrusion (HSE™) 3D Printing Platform and engineering materials, Axle Box Innovations exceeded expectations for SkyFire Consulting's drone platform built for a large forestry and fire protection client. At the end of the project, Axle Box was able to:

- Produce the drone mid-body with Essentium HTN-CF25 at the lowest price point.
- Produce Essentium PA-CF side covers designed to fail before the mid-body without sacrificing thermal stability.
- Achieve superior performance during flight tests, high-speed impacts, and overall functionality assessments.

## SITUATION OVERVIEW

From idea inception to product launch, getting a product to market in the public safety or defense sphere is a race to overcome barriers to entry before funds run out. This industry is notoriously difficult to break into, and companies may need to seek assistance during the pivotal stages of product development. That is where Axle Box comes in. This premiere technology development firm takes the brunt of the engineering, product development, and financial risk to help small companies bring public safety technology into the marketplace.



One of the tools Axle Box employs to bring products to market is the Essentium HSE 3D Printing Platform. During production Axle Box first utilizes the HSE 180•ST 3D Printer to produce prototypes with low-cost materials that offer excellent surface finish and balanced mechanical properties. Once the design is complete, the final product is printed on the HSE 180•HT 3D Printer using ultra-performance materials that offer best-in-class thermal and mechanical properties. This process allows Axle Box to optimize production times and get to market faster than competitors.

When SkyFire, a world-class drone solutions company, asked Axle Box and its team of engineers to support its effort to build a drone platform for one of its forestry and fire protection clients, the race to create the product was on.

“California is a large state with nearly every type of climate and temperatures that vary wildly. To create a platform that could perform in this environment, we needed a material set that would be able to withstand harsh conditions, be structurally rugged, and not look like a 3D printed part,” explained Matt Sloane, CEO of SkyFire.

## THE CHALLENGE

To meet the client's standards, the drone needed to be made in the U.S., achieve 25+ minute flight times, be field serviceable, and have the autonomy to track objects, take photos, and help replace piloting skills for routine data capture missions. The first step to bring the drone to life was to build the body. SkyFire turned to Axle Box to 3D print the mid-body and side covers of the drone with exceptional material properties, the lowest price point, and the fastest lead time.

Axle Box pursued engineering-grade materials for these parts to give the drone exceptional strength, stiffness, and thermal resistance. To achieve the best result, the team at Axle Box compared the material sets offered from different service providers and determined Essentium HTN-CF25 and Essentium PA-CF were the optimal materials for the mid-body and side covers, respectively.

## THE SOLUTION

Essentium HTN-CF25 is high-temperature nylon with a 25% carbon fiber reinforced core and has the highest heat deflection temperatures and tensile and flexural strength compared to competitors. These properties made it the perfect choice for keeping critical components in the mid-body safe from dangerous weather events such as a firestorm.

"The side covers needed to have carbon fiber reinforcement and thermal stability but with less strength and stiffness so that they would fail before the mid-body, allowing the drone to be field serviceable," explained Madison Jones, engineering and design lead at Axle Box. "Essentium PA-CF met these requirements, ensuring that the side covers would both hold up in harsh environments and be easy to replace."

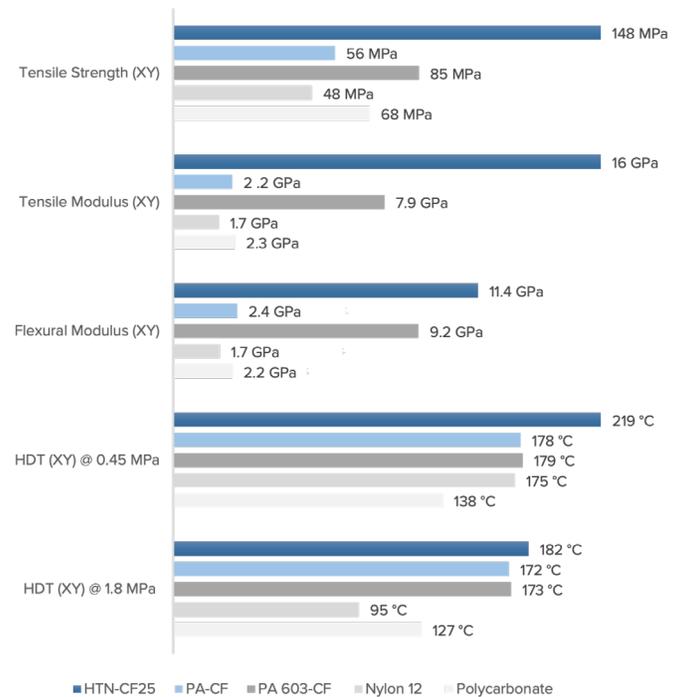
Once the materials were selected, Axle Box worked closely with SkyFire's experts to conduct design for manufacturing reviews. Using the HSE 3D Printing Platform and Essentium materials, it delivered the functional prototypes within days, instead of the weeks it would have taken with competitor products. The speed of the HSE 3D Printing Platform gave Axle Box the ability to prototype, conduct flight test protocols, and make iterative changes at such a fast pace that they were able to reduce time and costs to scale up manufacturing.

## BUSINESS OUTCOMES

Additionally, the fast pace of the prototype iterations created using the HSE 180 3D Printing Platform allowed Axle Box to land on a design for the drone mid-body and side covers that offered optimal strength and minimal material waste. In the end, SkyFire received mid-bodies and side covers for its drone platform that exceeded mechanical property expectations, for the lowest cost and fastest lead times when compared to competitors.

"Additive manufacturing has been an incredible help to us in the process of developing our aircraft," explained Matt Sloan. "As we fly through testing protocols, there are always design changes to make the aircraft perform as we expect it to, and without the ability to print new parts on the fly, we would have spent more in the development process. We've decided to use additive components in the final production models as well, thanks to Essentium's range of high-strength and high-temperature materials. Having a partner in Axle Box that can help us determine which filaments meet our needs, and get these products built quickly is essential to our success."

## FFF FILAMENT PROPERTIES



*Essentium, Inc. provides industrial 3D printing solutions that are disrupting traditional manufacturing processes by bringing product strength and production speed together, at scale, with an open ecosystem and material set. Essentium manufactures and delivers innovative industrial 3D printers and materials enabling the world's top manufacturers to bridge the gap between 3D printing and machining and embrace the future of additive manufacturing.*