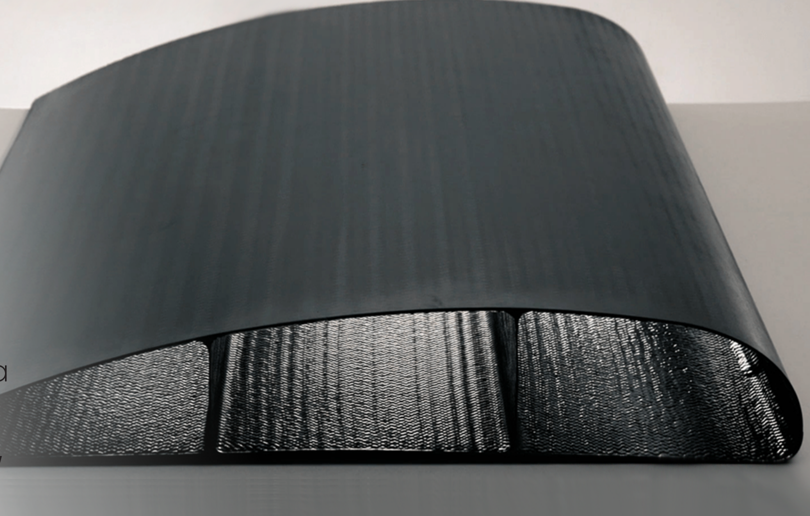
Hawthorn
COMPOSITES

WATCH ONLINE

# CO-CURED **WING STRUCTURE** DEMONSTRATION

Learn how Hawthorn Composites can create a co-cured wing structure using a combination of dry carbon fiber application & overbraiding, liquid infusion, and Smart Tools.

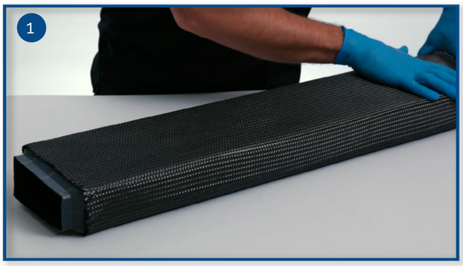


Hawthorn Composites delivers high value complex composites by deploying low cost materials with liquid infusion and novel manufacturing methods. This combination significantly lowers labor and material costs while maintaining structural integrity and weight neutrality when compared to conventional prepreg and autoclave cured components.

To start, we pull braided biaxial dry carbon fiber sleevings over each of the three smart tools to create the sheer webs and part of the structure of the control surface (Figure 1). The Smart Tools are fixtured together to prevent shifting, and then pre-shaped dry carbon fiber noodles are secured at each smart tool interface (Figure 2).

Next, 2 layers of quasi-isotropic carbon fiber fabric, called QISO, are laid into the mold to form the lower skin of the control surface. Veil can be attached to the outside of the fabric to assist with resin & air propagation. We then place the laid up smart tools into the mold on top of the lower skin and one layer of the upper skin fabric is pulled over top of the tools. Next multiple custom formed noodles are placed into the trailing edge of the control surface and sealed by the lower skin (Figure 3). Finally, the 2nd layer of the upper skin is pulled over the 1st layer and secured in place (Figure 4).

Now that the lay up is complete, we begin to close the mold (Figure 6) We place the upper half of the clamshell mold onto the lower half and secure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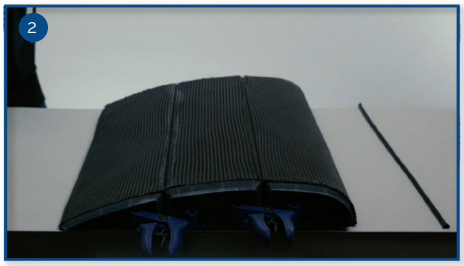
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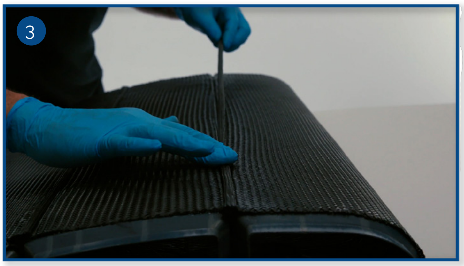
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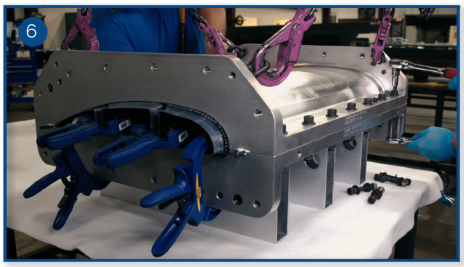
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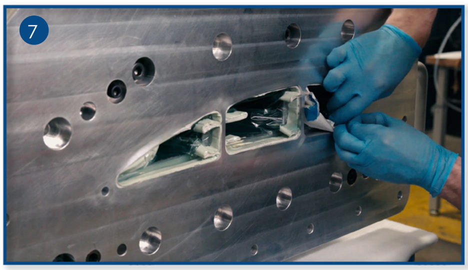
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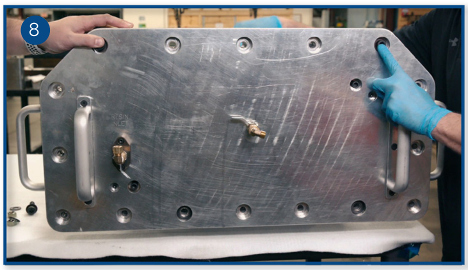
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it with bolts. Next, we attach the first set of end plates, called intermediate seal plates. Once these are secured with bolts, vacuum bags are pulled through each of the Smart Tools and sealed to the intermediate seal plates (Figure 7). This setup provides a vacuum & pressure barrier between the internal tool cavity and the dry carbon fiber preform. This will allow us to maintain vacuum & pressure throughout the process.

After the vacuum bags are secured, the 2nd set of end plates, called pressure plates, are attached to the mold (Figure 8). This will allow the internal cavity of the mold to be pressurized to 75 psi of pressure, creating a reverse auto-clave like effect inside the mold.

We are now ready to begin the infusion process. The mold is placed into an oven and plumbed for infusion. We attach two resin exit lines and one resin inlet line to the mold (Figure 9). We will be making the control surface using light resin transfer molding. Next, the mold and resin is preheated and resin is infused to fully wet out the carbon fiber preform. Once complete, the exit and inlet tubes are closed, allowing the pressurized Smart Tools to create a hydrostatic force to consolidate the preform and voids during cure.

After the cure is complete, we remove the mold from the oven and disassemble the end plate. Next vacuum bags are removed from each cavity and the now elastic Smart Tool is extracted with low force from the cured composite part (Figure 10). After extraction, each Smart Tool is placed into the pre-heated reforming mold, the upper lid of the reforming mold is secured, vacuum bags are pulled through the Smart Tools and sealed to the mold (Figure 11), and vacuum is pulled to reset the geometry of the Smart Tools. Once cooled, the now rigid Smart Tools are ready to begin the next production cycle (Figure 12).

Using the combination of techniques shown in this video; including Smart Tooling, low-cost raw materials, and resin transfer molding, enables the design and fabrication of low cost composite parts with structural integrity and weight neutrality when compared to conventional prepreg and autoclave cured components.

When comparing the Hawthorn method of manufacture to the industry standard manufacturing methods of pre-preg and autoclave cure, we commonly achieve cost savings of 20-50% over the baseline.

Hawthorn Composites utilizes dry carbon fiber, resin infusion, and novel manufacturing methods to make complex geometry composites parts that are equal in performance and quality to baseline manufacturing methods at significantly lower cost.


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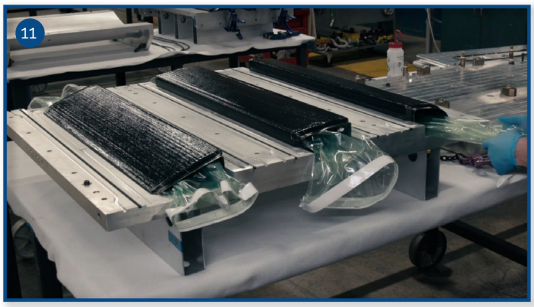
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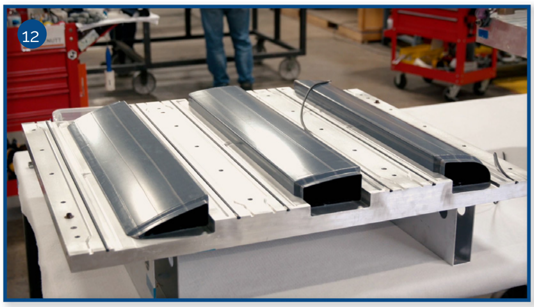
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