Performing Solutions

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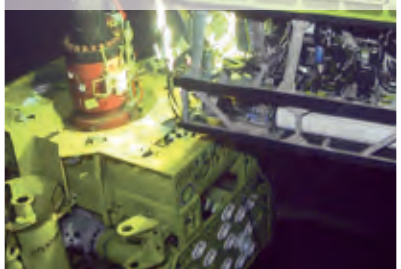
Sandwich composites chosen for automotive simulator dome



Sandwich Composites

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One of the world's most advanced automotive simulators is now in operation with the vehicle development department of Daimler AG in Sindelfingen, Germany. With its 360° screen and a 12-meter (40 ft) long rail for transverse movements, it allows the realistic simulation of highly dynamic driving maneuvers such as double lane changes. It is capable of simulating journeys and driving conditions for passenger cars, trucks and buses.

The carbon fiber-sandwich composite simulator dome (which is 7.67 meters (25.16 ft) in diameter and 4.52 meters (14.83 ft) high) was manufactured by Hahlbrock GmbH (Wunstorf near Hannover) who has developed special expertise in the production of large technical moldings.

The dome comprises five main components: platform, spherical dome, roof, doorframe and door. Carbon fiber sandwich construction, which was used throughout, was chosen to produce a finished structure that would offer a high strength-to-weight ratio and high stiffness values. Hahlbrock specifically chose DIAB foams – having successfully used them for various shipbuilding and industry projects in the past – due to their consistency and high quality. Under normal operating conditions, the dome is subjected to acceleration forces of up to 1 g as it travels transversely at 10 meters per second (36 km/h). In an emergency it must be able to safely withstand deceleration forces of up to 2 g.

Both the self-supporting spherical dome and the roof need to provide ultra-low deflection properties even when experiencing high dynamic loads to avoid any display problems with the projected images. The roof also has to carry the weight of the eight projectors.

The eight images are projected directly onto the inner surface of the spherical dome that has been finished with a robot-applied, high-gain paint. The maximum allowable deflection of the complete sphere is a few millimeters and the maximum local deflection is just 0.8 mm (0.03 in).

To meet these exacting specifications, Hahlbrock used a special epoxy resin infusion technique developed by the German Aerospace Centre (DLR) in Braunschweig and the Composite Technology Centre (CTC) in Stade. The company also made extensive use of 5 axis CNC machines to produce the molds and accurately trim the core and the finished cfrp components.

Individual sheets of Divinycell structural core measuring 2,440 x 1,220 mm x 50 mm (96 x 48 x 1.96 in) were thermoformed to create the correct profile. Then two preformed cores were bonded together to achieve the required core thickness of 100 mm (4 in). Final fairing of the core surface was also carried out by a 5 axis CNC machine.

The dome consists of 10 identical spherical segments with each segment comprising three preformed cores.