2020 CAMX AWARD FINALISTS

Sponsored By: Composites One

COMBINED STRENGTH AWARD

PPP Composite Bridge Deck Project

Structural Composites, Inc

The Composite Bridge Deck is used to replace conventional decking. Designed for a 100-year life the deck uses a low-cost simple construction approach. The innovation is in the simplicity of the construction. Modules consist of two single skin PRISMA preform framed sections that can be produced with open or closed molding. Sections can be easily inspected and repaired prior to bonding the two sections together at the frame caps. Another feature is the use of CoCure technology to form the wear surface of the deck. CoCure coatings are combined with aggregate forming a tough durable wear surface.

Co-sponsors: IACMI, Composite Application Group, McKinney Excavating , Compsys Inc, Interplastic Corp, University of Tennessee, Acralock, West System, SUPERIOR Fiberglass, METYX USA, Dr. Steffen Phd., Luna Technology, Neel-Shaffer

Collaborators: This project is an excellent example of the power of collaboration. Collaborative efforts generated some of the core technologies, collaborations with material suppliers and prior collaborations with the Florida and Missouri DOT all helped generate the technology that is employed in the PPP bridge deck. These form the foundations that were leveraged in the collaborative efforts of this team. IACMI has the lead role on the overall project. They are leveraging experience from their work at the institute and the deep industry and government connections they have developed. Composite Application Group (Chattanooga TN) plays a key role in identifying bringing all the technology partners together. University of Tennessee and Luna Innovations bring world class leaders in structural health monitoring onto the collaboration team. Tennessee DOT is a collaborator wanting to learn more about this composite technology and how it can be used in the state. The bridge deck is sized to be small enough to not require DOT approval and it thus gives the TDOT a way to collaborate without taking on risk. The supply chain is also very important to this collaboration. Interplastic Corporation is providing the CoCure Resin and coating technology, Compsys is providing its PRISMA Preform technology, Superior fiberglass and Metyx are supplying reinforcements, Acralock and West system are providing adhesives. All of these suppliers are providing materials and technical support for this project at no cost. We have two other important collaborators these are McKinney's Excavating. McKinney is using its PPP funding to remove the old bridge and install the new composite bridge. We are also fortunate to have Dr. Robert Steffen as a project PE with deep experience in composite bridge work. Our first bridge deck efforts were with Dr. Steffen at Georgia Tech back in the 1990's.

The Largest Piece Manufactured by the RTM Light in Colombia

Soling SAS

Our product was a series of covers to cover the largest drinking water tank in Colombia (53,342 sq ft). The form of installation is made by overlapping the covers with each

other. The main market for this product is drinking water storage tanks. The raw material used was GRP as a substitute for asbestos. The biggest challenge was to inject by the RTM Light method a self-supporting roof with a surface area of 207 sq ft per roof, for which it was necessary to use finite element design tools to simulate the part and the mold for the injection process.

Collaborators: To achieve the objective of this project it was necessary to involve the different suppliers of raw materials, these companies became a fundamental part because they had to guarantee the quality conditions of each of their products so that they did not affect manufacturing times. With regard to the manufacturers of the injection and vacuum equipment, special support was given because they had not manufactured equipment to work with these conditions. Having involved the different companies means that these new projects are evaluated as stages of growth, where together we can analyze which markets or products we can expand to.

Composite Manhole Covers Solve Iron Problems

LyondellBasell

With rising construction activities worldwide, the manhole cover market is expanding. Through the collaboration between LyondellBasell and Composite Access Products (CAP), composite solutions are replacing traditional materials like metal and concrete used in manhole applications due to its superior properties like strength, corrosion resistance, and molding capabilities. Through CAP's compression molding process of LyondellBasell's thermoset material, cost improvements and rapid production cycles are realized when compared to Resin Transfer Molding (RTM) and other fiberglass (FRP/GRP) casting processes. This process enhances quality by reducing entrapped gas, ensuring a complete thermoset polymer cure, delivering fully impregnated fiberglass, and eliminating many post-process operations.

Co-sponsors: Composite Access Products (CAP) was started in 2015 by W. Chad Nunnery. After learning of the desire for advanced composite utility cover solutions - Made in America rather than molded overseas and stamped with an American sounding brand- CAP was formed in McAllen, Texas. CAP uses high tonnage compression presses for the best blend of quality and affordability.

Collaborators: With LyondellBasell's BMC composite solution and manufacturer Composite Access Products, composite manhole covers are delivering many benefits to municipalities including corrosion resistance, lighter weight, reduced theft, and high-tech data transmission through encapsulated radio frequency identification all while being produced with a more environmentally friendly method. Recently CAP added San Antonio to the list of cities that have approved their composite manhole covers, making this quite a breakthrough as San Antonio is one of the US's largest cities in population size. CAP's President Chad Nunnery said, "we are extremely excited to make our first San Antonio covers, and we are certain CAPs can help the San Antonio area municipalities reduce sewer overflows." Reducing water inflow into sanitary sewers and subsequent SSOs will reduce water pollution. CAP, the first compression molder to create traffic-rated composite covers in the USA, began molding their first covers just over three years ago and already have installed covers in nearly 300 municipalities. In addition to the variety of benefits that CAP's composite covers provide, CAP also can deliver cosmetic appeal with colors, graphics and even stone, and sand-like appearances. CAP is revolutionizing this 160-year-old industry dominated by cast iron foundries with 'high tech' cover solutions. Furthermore, the molded product is transparent to data allowing communications without piercing the manhole cover with antennae holes. In their CAP RF®, CAP molds radio-frequency identification tags (RFID) into the composite cover raw materials to help municipalities with asset management which can work with cities' geographic information systems (GIS). There are even technologies than can transmit real-time data to utility teams through CAP covers which helps reduce SSOs with early detection. San Antonio has been an early adopter of these SSO detection systems with over seven hundred manhole cover transmitters spread around the city.

Device for Testing of GFRP on Specimen Level for the Application in Longitudinal Leaf Springs

Institute for Plastics Processing at RWTH Aachen University

The device is a clamping group that mimics the clamping of a longitudinal GFRP leaf spring on specimen level. The clamping consists of two steel halves with one half connected to the testing rig. Aluminum layers covered with polyamide clamp the specimen. The pressure transverse to the fiber direction is applied via tightening of two titanium bolts, with the load directly measured on the bolt shafts. Bolts are in spherical bearings to allow only tensile loading on the bolts. The system is in use to determine the fatigue life of GFRP material under three point bending and fiber transverse pressure.

Co-sponsors: The device was developed in a joint research project with the following partners: Mr Francesco Italiano (Ford Research and Innovation Center Aachen) Mr Alberto Girelli (Ford Research and innovation Center Aachen) Prof. Dr.-Ing. Christian Hopmann (Institute for Plastics Processing at RWTH Aachen University)

Collaborators: This research was conducted as a joint research project with the Ford Research and Innovation Center Aachen. It was funded via the RWTH Ford Alliance Contract. The research presented has the rank of public research.

Lightweight, Lower-cost COPVs for Hydrogen FCEVs, Providing Extended Vehicle Range through use of 3M Matrix Resins

3M Company

A lightweight, cost-effective composite overwrapped pressure vessel (COPV) for hydrogen storage in fuel cell electric vehicles (FCEVs) is introduced. The carbon fiber vessel is enabled through use of advanced resin technology and unique composite design. 3M Matrix Resin 8833, a nanocalcite-modified epoxy with high tensile modulus, imparts an increase in fiber delivered strength (FDS) to the composites. This increase in FDS enables the redesign of these thick-walled structures,reducing weight, eliminating expensive fibers and lowering manufacturing costs. In FCEV applications where the outer dimensions of the tank are fixed, a redesign can use an expanded liner volume thus increasing vehicle range.

Co-sponsors: HyPerComp Engineering

Collaborators: The introduced COPVs are the result of a joint effort by 3M as the resin developer and HyPerComp Engineering Inc. (HEI) as the designer and manufacturer. 3M, which leads the project, is responsible for developing and supplying the nanocalcite-modified epoxy resin, initiating, finalizing and executing the development study on the low-cost composite vessel. HEI, as the designer and manufacturer for the COPVs, works closely with 3M to develop, fabricate and test the filament wound high pressure composite vessels for their specific application in FCEVs. With over 10 years' experience working with modified resin systems from 3M, the innovative and professional expertise by HEI enables lighter weight, lower cost, higher storage capacity pressure vessels for the next generation storage solutions. The combination

of expertise from 3M and HEI results in a high level of competitiveness in the marketplace.

Unsurpassed Innovation Award

Real-time AFP InSitu Thermal/Video NDE Mapped to True Global Coordinates

Trilion Quality Systems

The Trilion InSitu NDE system uses a thermal/video camera to image the robotic AFP build of composite structures, providing real-time quality assessment of the composite build of either thermosets and thermoplastics. AFP uses a thermal lamp or laser to warm the material surface and composite fiber tape as it is placed into position and consolidated during the continuous build. The Trilion InSitu NDE system looks to do the majority of inspection in real-time, reducing build time to 25% currently, with autonomous reporting of defects.

Collaborators: Trilion worked with General Atomics, Joby Aerospace and Toyota to meet their cutting-edge needs for real-time total quality measurements for their Urban Air Mobility type vehicles. Trilion has 40 years' experience with optical NDT and quality systems and was the ideal partner for this product. Trilion provided all designs and hardware, while Toyota supported engineering efforts to evaluate the system and Joby provided the facilities. The ARAMIS Photogrammetry technology developed with General Atomics as their RVAT Digital Manufacturing technology is a TRL-9 capability. The InSitu NDE technology is an outgrowth of Trilion's ARAMIS Thermography technology designed specifically for AFP composite layup. The software developments follow from the RVAT Digital Manufacturing and composite quality to the Xi Digital-Twin.

Automotive Trunk Floor: Thermoplastic Composite / Thermoplastic Honeycomb Technology

EconCore N.V.

A revolutionary, fully recyclable thermoplastic composite combining a sandwich panel of PP honeycomb and GMT composite skin reducing the weight of the trunk floor of the Hyundai Creta by 20%. The entire trunk-floor is made from a single sheet of a sandwich preform in one-shot, short-cycle compression molding process. The edges of the part are aesthetically finished within the same forming cycle, with the decorative carpets added onto the surface. Furthermore, the living hinge allowing foldability of the flooring part is made at once as the part is molded, cutting the need of introduction of secondary operations.

Co-sponsors: DPA Moldados ThermHex Waben GmbH

Collaborators: ThermHex Waben GmbH (Germany, thermoplastic honeycomb supplier), DPA Moldados (Brazil, Tier 1 and a compression molder) and EconCore (Belgium, honeycomb technology provider) joined forces to develop this new solution. Automotive supplier DPA Moldados, which fabricates interior trim components and delivers the part to Hyundai, has been active in selecting the most suitable composite skin materials and in developing and optimizing of the compression molding process. ThermHex Waben delivers the thermoplastic honeycomb material to DPA, and during development has been active with regards to optimization of the weight of the honeycomb structure. The two parties, along to EconCore, have been collaborating throughout the phase of development optimizing the material and process parameters, ultimately delivering the weight saving solution at competitive costs.

Manufactured Polymeric-based UV Cured Structures for Residential Construction

Mighty Buildings Inc

Mighty Buildings produces building components for residential construction manufactured with a 3D printing process using polymeric UV cured materials. The manufactured structures are intended to be used as building elements defined as a portion or entirety of a wall, floor, and roof of the building. Mighty Buildings invented Light Stone Material (LSM) – a photopolymer thermoset composite that is instantly cured with light during the layer-to-layer extrusion process. The manufacturing method is large-scale additive manufacturing that allows production of building components of different shapes and sizes with complex geometries. Both the LSM material and 3D printing process are UL certified.

Collaborators: Mighty Buildings believes in disruption through collaboration. Because we are leveraging a new technology for use in the conservative construction industry it has been an imperative for us to engage with end-users (both B2C & B2B), building officials, regulatory bodies, vendors, and others in order to ensure that we are properly addressing their pain points and concerns. A core of our business practice is to engage with these stakeholders early in our design & development process. This allows us to ensure we are meeting market needs and addressing regulatory concerns from the beginning. Some examples of this collaboration include: - Based on their work with Mighty Buildings, UL developed the new UL 3401 standard for 3D printing in construction and had Appendix U introduced into the 2021 International Residential Code to guide building officials. Mighty Buildings was the first company to achieve certification under UL 3401 standard. - Mighty Buildings' products are the first residential units with 3D printing to be certified under California HCD's Factory Built Housing (FBH) program for commercial-scale production. The engagement began two years before the first approved unit to ensure full regulatory compliance. Other states/countries have similar programs making for simplified expansion. - Mighty Buildings engaged EYRC, a leading architecture firm, and Buro Happold, a leading engineering firm, to design a new product line – the Mighty House. The Mighty House product line was designed as a demonstration/base model for the Mighty Kit panelized system. - Mighty Buildings partnered with national home builders like Meritage Homes with a goal to achieve annual volume of manufacturing 10,000 prefabricated modules with Mighty Buildings. - Mighty Buildings is working with ASTM in their work to develop new international standards for 3D printing in construction to underpin the building code and efforts by UL & others to further the regulatory framework.

First High Performance Palm Fibers and Reinforcements

Intexive Consulting

PalmFil is the world's first textile fibers and reinforcements extracted from the byproducts of pruning of date palms, such as the frond stalks. It expands the palette of natural fibers and increases the biodiversity of fiber crops. Resulting in more sustainable and economical supply, which encourages the industrial shift back to natural fibers. PalmFil

is versatile available in many forms, including, long fiber tows, chopped fibers, rovings, nonwoven , woven , and unidirectional. The unique features of PalmFil make it an excellent sustainable material for reinforcements of composites in automotive and sporting goods, as well as plaster reinforcements in construction.

Collaborators: PalmFil is developed by a team of Egyptian innovators with more than 50 years of combined experience in fiber science, textiles technology and composites engineering. The team is led by Dr. Mohamad Midani managing partner of Intexive and under the guidance of the legendary Professor Dr. Hamed EL-Mously, the founding father of date palm byproducts development and research. The team members include: Dr. Mohamad Midani, Managing Partner of Intexive Consulting Dr. Ahmed Hassanin, Associate Professor- Textile Engineering Department at Alexandria University Dr. Tamer Hamouda, Senior Researcher in the Textiles Division at the National Researchh Center Lobna El-Seify, Lecturer Assiatnt and PhD student in Materials Engineering Department at the German University in Cairo.

Additive Production of Molds for Aerospace Components

Roboze Spa

Composite materials are frequently used in every industrial sector, especially in aerospace, where the need for low weight structural components fuels research and development since 1937. Given the recent developments in additive manufacturing, Leonardo Aerostrutture tested Roboze technology (FFF) in the production process of laminates for aerospace components. The application investigated concerns the replacement of traditional metal moulds, often related to high costs and long processing times with CNC machines, with polymeric elements (Roboze Carbon PA - Carbon PEEK). Both moulds have been successfully used for the hot forming process and autoclave cure guaranteeing adequate mechanical, thermal and self-lubrication properties.

Collaborators: Roboze, thanks to scientific partnerships with specialized companies and research centers in the world, is able to collect market's feedback and transform them into concrete solutions. The main goal of the company is to make its offer versatile and accessible to its target. The focus of these partnerships are divided into three target areas: • product improvement: improved versions of existing products / services dedicated to the current target audience; • product range extension: increasing innovations based on existing products for the current market; • market extension: new product innovations and printing materials to meet new market targets. The external collaborations aim to integrate different technological knowledge into the company's production processes to extend the technological capabilities of Roboze products and services. Strategic R&D alliances touch two fundamental aspects: • sharing of costs and risks with the partner • access to complementary knowledge. To date, the company has partnerships with Sabic and Solvay Specialty Polymers. In addition the company has collaborations with suppliers and strategic customers for the implementation of their products.

Fast Press Cure, A Disruptive High Volume Composite Manufacturing Method

TRB Lightweight Structures Ltd

FPC (Fast Press Cure), TRB's fully automated process has been developed to unlock composites at scale, resulting in the manufacture of complex components in a fraction of the time of traditional hand lay-up. The automated process includes the manufacture of TRB's proprietary prepreg customised to the application and TRB's assembly line which cuts, presses, cures and assembles components in a cycle time under 15 minutes. It can also incorporate EMI shielding, thermal insulation and high voltage insulation in the layup process, to enable the right material mix and structure.

Collaborators: TRB Lightweight Structures has not collaborated with outside parties in the development of the process. All the R&D and engineering work has been done in-house. We have partnered with customers and others to accelerate the deployment of this technology. We entered a joint venture with Toyota Tsusho to serve North American customers, opening a high-volume composites manufacturing facility in Richmond, Kentucky earlier this year. In addition, we have partnered closely with customers to design composite parts for high-volume production.

UltraAnalytix: A Patented Non-destructive Method for In-service and Quality Assurance Inspection

UTComp

UTComp has developed the patented UltraAnalytix™ inspection system for industrial tanks, pipes and other assets made of fiber-reinforced plastic (FRP) and other composite materials. UltraAnalytix™ inspection features innovative ultrasound analysis technology to provide a fast, accurate, safe and cost-effective way to test the strength and condition of composite assets throughout their life cycle. This enables clients to determine remaining service life of equipment and prevent catastrophic failures that endanger public safety and the environment.

Collaborators: UTComp has undergone independent third party validation studies at the University of Alabama and York University, both of which concluded that the method provides reliable results. Also, many of our global clients that have adopted the UTComp System after conducting their own blind comparison tests. This wasn't contribution to the making of the inspection system but a means for validation and continued belief and support of UTComp's method of inspection. Last year, the National Research Council of Canada Industrial Research Assistance Program (NRC IRAP), a federal program that supports the development and commercialization of innovative Canadian technologies funded UTComp. NRC IRAP funding supported research that helped extend the reach and application of UTComp's UltraAnalytix™ technology for quality assurance and inspection of equipment and materials made from fiber-reinforced polymers (FRP). The goal of the seven-month project was to develop hardware, software and operating parameters for automated ultrasonic inspection during the production/manufacturing of FRP infrastructure products and components. The support helped UTComp take another step in validating the UltraAnalytix advantage for customers all along the value chain of composites to develop the QCAnalytix quality control system. This year, NRC IRAP has provided funding in UTComp's development of an Internal Pipe Inspection system based on the same UltraAnalytix technology for the internal inspection of underground pipelines. This will hopefully reduce or eliminate the need for excavation, plant/production shutdown.