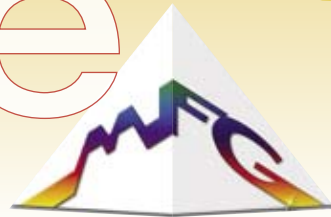


# COMPOSITES

## age

WINTER 2009



## Prime Time for PRIME

**Pre-placed Reinforcements Insure Manufacturing Excellence—  
A new approach for high quality, high volume composites**



There are two broad categories of composite materials: One where fibers are pre-placed into a mold and plastic resin flows to create the part; and another where fibers are compounded into the plastic resin ahead of time and then flowed with the resin to fill a mold.

Pre-placed reinforcement composite is the best answer for structural and quality-critical parts because it provides the most efficient use of fibers and the least variation of fiber location and orientation. Pre-placed reinforcement allows product designers to use materials closer to their dimensional limits – resulting in lighter, more efficient, and sometimes more effective parts.

For composite parts made with pre-placed reinforcements, MFG offers production technologies spanning the widest range of part sizes, volumes and applications. Recent projects include 400 gram ballistic helmets at 50,000 pieces/year, 10kg automotive structural components at 30,000 pieces/year, 6,000kg 37-meter wind turbine blades at 1,000 pieces/year, and 15-meter structural members for bridges at 40 pieces/year.

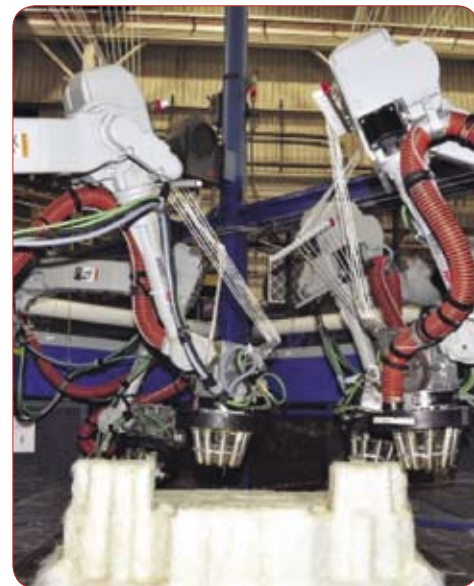
There are many suppliers of low volume pre-placed composites, but MFG is unique in offering high volume manufacturing capability that enables cost economies and design flexibility on a par with molded compounds.



*MFG Research Team: Tom Patti, Dave Naas, Brian Jones, John Stitt, Richard SESCO and Brenda Sanger.*

In 2007, a group of teammates from MFG's Advanced Manufacturing Center (AMC) under the leadership of Pete Emrich, VP of Technology, embarked on a mission to advance the state-of-the-art of pre-placed reinforcement technology. This initiative started with equipment modifications to reduce energy and material waste. It led to many new investigations including partnering with PPG Industries to develop a new binder capable of supporting increased production rates, advances in the use of robots with high tech glass delivery choppers, and improved control systems.

MFG has named this new manufacturing process PRIME. PRIME has been used for more than a year for Corvette parts, resulting in improved uniformity of fiber deposition. For more information on how PRIME may benefit your products and your customers, please contact Keith Bihary at 440-994-5110 or Brian Kane at 440-994-5250.



*Corvette underbody preform nears completion. 25 large preforms per hour are produced. This new process has been used by MFG for Corvette parts for more than a year now.*



*Electrically heated chopper head simultaneously dispenses and sets the string binder. The new system uses proportional control of fiber deposition based on tool velocity and modulated air flow during forming to control loft and reduce energy. The preform tooling, which determines the fit and shape to the mold, is also upgraded to reduce fiber distortion in the part.*

# First Blades Roll Off the Line ... in Aberdeen

Nicknamed "Hub City" because it once served as an important intersection for busy railroad lines, Aberdeen, SD is the home of MFG's new facility dedicated to producing wind energy blades. In October, a year after the business deal was finalized with General Electric and the Aberdeen Development Corp., MFG South Dakota commemorated the roll-out of the first finished blade.

"It's 132 feet long and weighs 12,000 pounds, but I can't tell if it's a boy or a girl," general manager Wes Shamp jested to more than 220 plant employees.

There's a steep learning curve involved in the technology of blade production. Many new teammates received training at MFG Texas in the months prior to the plant turn-on. MFG SD is ramping up to a planned output rate of multiple sets of blades/day.

The immensity of the blades makes transportation to the destination a project in itself. Two forklifts are required to hoist a blade onto a transportation trailer. Cars in front and behind pilot the trailer and, with the help of a remote control, a driver in the trailing car helps negotiate corners.

MFG entered the wind energy blade market in the late 1980's and has watched sales climb 8-fold over the last 6 years, according to Wind Energy Champion, Carl LaFrance.



*MFG SD teammates Darcy Moffenbier, Shelli Fleming, Sara Jo Bertsch, Danielle Taylor, Alley Shelton working the line at the new Aberdeen plant.*

## Curious About Wind Energy?



Two excellent websites that will bring you and your family members up to speed on how this renewable energy source works and where the technology is heading:

<http://www1.eere.energy.gov/windandhydro> The US Department of Energy provides comprehensive and easy to understand information: wind energy basics; how wind turbines work; history; R&D and more.

<http://www.windpower.org/en/kids> The animated website, Wind with Miller, is loved by kids of all ages. It is a fast and fun way to get a grasp on wind power. Produced by the Danish Wind Industry Association it also contains a number of educational activities and a teacher's guide.

## Generation II Radomes Introduced at ITC Show

Culminating more than a year of concentrated effort by MFG Galileo Composites, the new Generation II radome was announced at the International Telemetering Conference in October. The Gen II radome design features enhancements based on a Defense Advanced Research Projects Agency (DARPA) project to advance technology for ground-based radomes. The DARPA assignment was completed by MFG Galileo in early 2008, and focused on exploring new methods to increase radome RF performance characteristics while decreasing lifetime maintenance costs.

Among the features of the Gen II radomes is a non-symmetric geometric panel configuration (a design approach preferred by some end-users) and an impedance-matched bolting seam. Both the Gen II and legacy panel designs are now produced with technology advancements that result in added durability and reduced maintenance cost. According to Clint Lackey, GM at MFG Galileo, "We believe that offering customers a choice of panel design, along with the most advanced seam construction available, will give us a strong competitive edge. This accomplishment is clear evidence of our team's commitment to listening to and implementing customer requests."

In addition to the engineering team at MFG Galileo, MFG Design Center teammates contributed to the development of the geometric design. At MFG Research, teammate Sib Banerjee provided structural analysis while physical testing, and qualification of materials was conducted by teammates Dave Barron and Kurt Butler. A terrific MFG family achievement!



# Standing for Excellence

## Spotlight on MFG Design Center

MFG's Design Center provides company-wide design engineering support for customer projects and internal R&D. For customers, this value-added service is part of MFG's commitment to help them incorporate the best practices of composite manufacturing into new concepts, retrofits and design changes. Internally, it provides MFG's proprietary entities with engineering to support their new product initiatives.

Using GoToMeetings (remote sharing software that enables users to meet with other computer users via the Internet), the MFG Design team interfaces with MFG teammates, customers and tooling suppliers to advance new designs or update existing designs for manufacturability, cost, quality and timing reduction.

To help customers better understand composites manufacturing design issues, a *Design For Manufacture & Assembly* online course focusing on SMC/LCM products was developed. This course was initially created to assist Freightliner engineers and designers to enhance part quality, optimize manufacturing processes and reduce cost. The course is now selectively available to all MFG customers to help them with techniques for adjusting designs for the various processes.

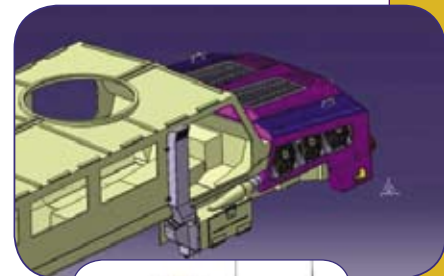


*MFG Design Center engineering team (L to R): Rad Siderius, Corporate Director John Fernandes and Roy Dickinson. Collectively, John, Roy and Rad have more than 50 years of combined Catia design experience with emphasis in composites.*

Here are a couple examples of interesting projects the MFG Design team contributed to recently:

**Galileo panel design** Working with shipping container size limitations, dimensional specs for the finished radome, and a requirement that no panel edge be parallel to another, the team used their CAD tools, engineering expertise and “Yankee ingenuity” to creatively solve the quasi-random pattern challenge. The final solution involved a combination of 3 different shapes fit together to form a perfect dome, and the first Gen II dome was delivered this summer.

**MFG Northwest MRAP hood** The MFG Design team drove the product redesign for a retrofit MRAP hood. To convert the metal design to a lightweight composite part capable of withstanding a 260 lb soldier jumping from the roof onto the hood, the team designed “styled features” and defined the reinforcement shapes. The new design also added a raised pattern as an anti-skid safety feature. With the combined effort of the MFG Design Center, MFG NW teammates, and the engineers at BAE, the new hood is now supporting troops in hot spots around the world.



  
**Teammate  
Applause**

Promotions and New Arrivals



**Tony Blake**  
Director of R&D  
MFG West



**Todd Finney**  
Director of Business  
Development, MFG  
Galileo Composites



**Larry Ewalt**  
Facilities Manager,  
MFG SD



**Pat Weber**  
Health, Safety  
and Environmental  
Manager, MFG SD



**Roy Dickinson**  
Senior Design  
Engineer, MFG  
Design Center



**Ross Graf**  
Quality Manager,  
MFG South Dakota

# New Market Entry: Composite Powder Metallurgy Trays

MFG Tray Company is introducing a new product line in January, created specifically for the powder metallurgy market. Powder metallurgy is a process for forming metal parts by heating compacted metal powders to just below their melting points. Although the process has existed for more than a century, in the last 25 years it has become a preferred way of producing high-quality parts for a variety of applications – primarily automotive manufacturing.

According to Mike Carr, MFG Tray general sales manager, “This opportunity was identified by one of our reps that observed tens of thousands of traditional cardboard, metal and wooden pegboard handling trays in various sizes used in this industry. Don Nawrath of Quigley & Assoc. brought our team the idea to displace the current materials and, as we learned more about the application, it became apparent that a composite tray design could deliver added efficiency and improved handling – at a cost savings to customers.” A unique advantage of the MFG Tray product is its suitability for both automated and non-automated production lines, so a customer’s investment will serve them regardless of future improvements to their manufacturing process.

The new MFG Tray product line is constructed of LFT (long fiber thermoplastic) and is available in two different sizes. Chuck Kappelt and John Kremm with the MFG Tray engineering team were responsible for the outstanding engineering work that made this new product a reality.



*MFG Tray’s new product line for the powder metallurgy market is used for handling, moving and storing fragile, green parts between production machinery (presses) and sintering furnaces.*

## 3000<sup>th</sup> B-Model Nacelle Hits the Highway



*MFG West teammates (L to R): Tony Drake, Moises Mejia, Juan Olivas, James Enslow, Aurelio Hernandez, Raul Lopez, Jose Cisneros and Gonzalo Mejia.*

*B-Model nacelle #3000 hits the highway in Adelanto, CA.*

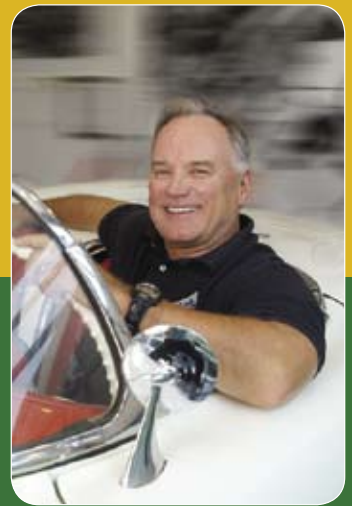


The structure that houses the generating components, gearbox, drive train, etc. of a wind turbine is called a nacelle. MFG West has been providing specialized composite manufacturing and value-added secondary assembly for nacelles for many years. The current generation in production is called the B-Model nacelle, and teammates recently loaded up and sent off the 3,000th unit to General Electric.

These huge structures are manufactured in three pieces that are bolted together inside. Trucked out on flatbed trailers from the MFG West facility in the high desert of California to destinations as distant as Florida, transportation can be expensive and challenging. MFG West, MFG Design Center and the customer are currently collaborating on new designs that will make shipping easier.

## Molding the Future

*By Richard S. Morrison*



We are delighted to announce the successful development of “PRIME” — which is an acronym for “pre-positioned reinforcements insuring manufacturing excellence”. PRIME was developed by our Teammates and our Advanced Manufacturing Center (AMC), which is located at our MFG Research Company. Under the leadership of VP of Technology, Pete Emrich, our AMC Team worked closely with material and equipment suppliers to develop and commercialize a process for producing the best composite laminates in high volume applications.

PRIME uses a set of sophisticated robots with high-tech glass delivery choppers combined with advanced binders and control systems. The result: Reinforcements precisely where needed, molding after molding, suitable for high volume, commercial production. Several automotive parts and truck parts have been upgraded to the PRIME process.

The mainstream method for producing the best composites uses pre-positioned reinforcements. Pultrusion, filament winding, RTM Lite, infusion, hand lay-up and autoclave are processes where the reinforcements are pre-positioned. SMC molding (which we also do) flows the reinforcements in the mold and, although a good process, is not as good as PRIME, and may be unsuitable for structural applications.

If you would like to know more about PRIME, please contact Keith Bihary (440-994-5110) or Brian Kane (440-994-5250).

From all of us at MFG, Happy Holidays!