On-Site Manufacturing

Composites manufacturing began in the United States over half a century ago, beginning with boat construction where complex, corrosion-resistant parts could be made in production quantities. Industrial composites were developed to meet the need for large storage tanks and piping systems. The military played a major role in pushing the envelope for what could be built using composites with applications such as submarine radar domes and lightweight aircraft. Today, composite structures are getting larger and more diverse then what was imagined even a decade ago.

It is no coincidence that Boeing's Dreamliner is the most fuel-efficient commercial jet built to date and the first to use composite materials for most of its construction. The wind energy industry would not be possible without composite turbine blades, which now measure almost 250 feet in length. Corroded steel bridges are increasingly being replaced with composite alternatives that are easier to assemble on site and deteriorated concrete infrastructure elements are being reinforced with composites. Meanwhile, the world of sport continues to push the performance and size of composite structures. Indeed, sailboat masts in the 400-500 foot range are currently on the drawing boards.

Closed-mold processing has enabled the composites industry to become environmentally friendly with a minimum investment in capital equipment. The environmental footprint of a composites manufacturing facility is quite small, often consisting of temporary structures erected for a specific project. The goal of our proposed research is to establish a blueprint for a forward deployed composites manufacturing facility that could support the infrastructure development requirements for military engagements and disaster relief. Composite construction offers the following advantages for this application:

- Raw materials can be transported in discreet quantities and support a wide range of structural elements
- Manufactured products can be custom designed to be site specific
- Modular construction can accommodate transportation challenges
- Indigenous labor force can be utilized and manufacturing capability can remain after immediate military or disaster relief need
- A wide spectrum of needed components can be manufactured using the same raw materials

The first task of the proposed research will be to develop a catalog of potential applications based on the military's recent experience in Afghanistan, Iraq, Haiti and Sumatra. As a minimum, the following needs will be addressed:

- Transportation infrastructure, such as roads, bridges and airstrips
- Housing and other buildings
- Water storage, piping, wells and sewage treatment
- Conventional energy (transmission poles) and renewable energy (wind blades and towers; hydropower)
- Boats and other transportation vehicles

- Port facilities, such as piers and floating docks
- Fuel storage and transportation systems, including LNG

The second research task will be to develop a manufacturing process protocol and supply logistics program to meet the requirements for a forward-deployed composites manufacturing facility. A premium will be placed on commonality and versatility to accommodate the widest range of composite structures with a minimum variety of materials.

Forward deployed manufacturing will provide unparalleled logistics support capability to commanders in the field. The development of on-site manufacturing will also give the U.S. military the ability to respond to any crisis or disaster anywhere in the world with infrastructure support designed to create an immediate and lasting impact. U.S. composites manufacturing personnel and material suppliers will also benefit and can translate the technology for domestic applications.

Reinforcement fiber and resin are easily transported in quantities as needed, by air if required. Composites manufacturing facilities don't require heavy equipment and can indeed "build themselves" if panelized construction is used. Resins can be formulated to cure at various temperatures, so climate control is not essential except in extreme cold locations. The entire "factory" can remain on-site for long-term economic development or can be packed up without a trace after the military deployment.

It is anticipated that component designs will be developed to take advantage of modular construction. This will allow major structural elements, such as panels, to be fabricated in a production environment and transported to erection sites as dictated by the limitations of the local infrastructure. Established secondary bonding techniques will be utilized to erect final assemblies at the location where they are needed.

This project is structured as a "dual use" application, supporting both military logistics and disaster relief. We also envision a domestic demand for On-Site Manufacturing to respond to rapidly emerging business opportunities. Dual use will ensure that the capability is cost effective and evolutionary.

We are currently soliciting industry partners to support this initiative and realize global business opportunities.

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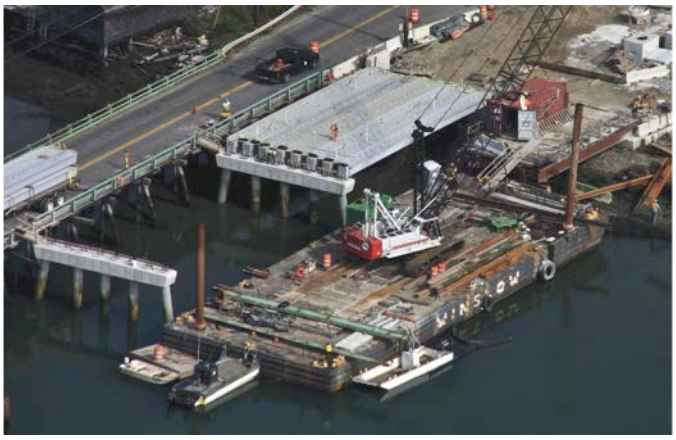
U.S. Marines with NATO forces stand guard on a temporary military bridge in Marjah, Afghanistan.



This 32-foot-wide, eight-span, 540-foot long composite bridge uses hybrid composite beams manufactured by Harbor Technologies.

Skybuilt developed this integrated renewable energy system for remote locations.

This 75 meter wind turbine blade built by Siemens consists of a single component made from epoxy resin and balsa reinforced with glass fiber.

Military fuel storage tank with ISO container frame for intermodal transportation.

These very large storage tanks were fabricated from glass fiber-reinforced plastic by Ershigs Inc. to contain hydrochloric acid.

U.S. Army Corps of Engineers Thumrait Air Base, Oman water tanker offloading facility

Composite pipe up to 4 meters in diameter has been manufactured for water handling. Shown here is an LNG re-gasification seawater intake pipe.

Composite fishing boats were built to aid Indian tsunami victims.

The 42-foot Advanced Composite Riverine Craft was developed by Seemann Composites based on resin infusion

Composite modular extendable rigid wall shelters were developed by Will-Burt to support forward deployment operations.

InovaTec composite houses are assembled in 25% of the time needed for conventional construction, don't require cranes, resist earthquakes and CAT 5 hurricanes and are insulated to R 24 values.