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FEATURES

COVER PHOTO: US robotics technicians assigned to the Robotics Systems Joint Project Office train members of the Bahraini Special Security Force (BSSF) on the MARCbot-N, Talon 3B, SUGV 310 and FasTac robot systems at Camp Leatherneck, Afghanistan, July 5, 2010. BSSF members were learning these systems in hopes of developing their own robotics unit to support the International Security Assistance Force. (US Marine Corps photo by Lance Cpl. Marionne T. Mangrum/Released)

DEPARTMENTS

The *DTJ* Forum issue presents three special feature articles—each is focused on a specific technology that some might say falls "outside the box." War bots, agile vessels and composite construction, the subject matter of our feature articles, actually embrace technical aspects have been in place for awhile. But, it is their application that makes their stories unique. They represent turning points that will lead to increased capability, more efficient strategies, and enhanced safety and speed. They signal the way for new mind sets that will ensure our Nation's prominence in ventures yet to come.

PLASTICS
Challenge Traditional Thinking for BRIDGE BUILDING

By Gary W. Capone, National Account Manager and Mark Henderson, Senior Vice President, Government Markets, Innovative Green Solutions, LLC

Locomotives are heavy—extremely heavy, which is why railway bridges have historically been built from strong, often dense, materials, like timber, concrete or steel. No one would ever dream of using recycled plastics, such as former milk jugs, for this purpose. After all, such plastics are too weak to ever be considered as a possible medium for bridge building or are they?

In 2009, the garrison and engineering team at Fort Eustis took a major step, challenging such traditional bridge-building ideas. It took "out-of-the-box" thinking to dare contemplate the possibility of us-

ing recycled plastic to replace two rotting bridges made from timber. In fact, the existing structures, built in wet-lands, were so rotted some training operations had been suspended. Still, Fort Eustis committed to building two railroad bridges, designed to support 120-ton locomotives, out of recycled milk jugs and scrap automotive bumpers—discarded material found in overabundance in our nation's landfills.

THE PROCESS

The decision to build the bridges from Recycled Structural Plastic Composite (RSPC) material was innovative, but the first, and often most difficult, step required being open to innovation. Phillip Reed, Fort Eustis DPW Engineering Division chief, discussed how the bridges challenged the traditional approach to procurement:

"In a way, the project validated the philosophy of no longer providing a 100%-complete design and saying 'don't think, just follow the design.' We wanted to start with the final objective in mind and let our partners help us 'create the solution.'"

With Fort Eustis fully focused on finding the best solution, the team there needed to proceed with evaluating traditional construction designs while, at the same time, it remained open to ideas that may have never been tried before.

Enter Innovative Green Solutions, LLC, a company dedicated to commercializing emerging technologies which offers both performance and environmental advantages over traditional products. Innovative Green Solutions introduced RSPC technology to Fort Eustis leaders. In turn, Fort Eustis, directed Centennial Construction, the prime contractor, to consider designs using both traditional materials and any design proposals that might incorporate "green" or "recycled" materials to replace their decayed, existing bridge structures.

Responding to this opportunity, Innovative Green Solutions built a team capable of delivering a railroad bridge, constructed of almost 100% recycled material. This includes pilings, end-caps, spanners, I-beams and railroad ties. The key partnerships in this team were Parsons-Brinkerhoff, a nationally renowned firm in the bridge-building industry, English Construction Company, a well-respected bridge construction firm and Axion International, the manufacturer of the innovative RSPC materials. In addition, the materials inventor, Dr. Tom Nosker of Rutgers University, was involved with the design and construction.

The result: innovation won. With Centennial as the prime contractor, the RSPC design was found to be cost competitive on a first-cost basis, while providing significant life-cycle cost savings due to its extremely low-maintenance requirements. The result

New technologies, like RSPC, force us to make choices. Will we build with traditional designs and materials, or embrace new technologies? Will we continue to expand our landfill waste or will we recycle into new and better products? Will we stay "in the box" or venture out, innovate and challenge conventional thinking?

was a clear advantage over traditional materials. Mr. Reed explained how procurement goals are changing and how this project illustrates the need for new solutions:

"The new mindset is to lower energy and maintenance costs, to go green and be sustainable. These bridges accomplish all of those goals; in fact, this project hit the sustainable ball out of the park."

The material used in the bridges is not only recycled, but also recyclable. If the Army ever decides it no longer needs these bridges, the material can be melted down and turned into new pilings, I-beams and railroad ties ready for the next project. The project presents a sustainable solution, removing plastic waste from landfills. In fact, the materials used in the bridges at Fort Eustis diverted 334,000 pounds of plastic waste from landfills, and are expected to last for more than fifty years with virtually no maintenance.

THE GROUNDWORK

More than a decade before the bridges at Fort Eustis were imagined, Rutgers University scientists worked to find ways to combine different plastics to achieve synergistic results. Over the years, they developed material blends that were stronger and more creep resistant than their individual components, and that outperformed traditional plastics. These materials already had the advantage of being more resistant to the elements than traditional materials. The researchers also developed innovative efficient shapes to keep the construction cost and time down to an absolute minimum.

At Fort Bragg, an Army Corps of Engineers team, along with the Office of the Secretary of Defense's Corrosion Prevention and Control Program, ACSIM's Installation Technology Transition Program and Axion International built the RSPC bridge, capable of handling M1A1 Tank traffic. This bridge, built with R&D dollars was heavily instrumented and the results exceeded expectations. While the original bridge, at Camp MacKall continues to exceed performance expectations, Fort Bragg has built a second tank-capable bridge and plans a third.

Dr. Roger Hamerlinck, Senior Acquisition Policy Specialist, Office of the Asst. Secretary of the Army for Acquisition, Logistics and Technology, explained the significance of the new "technology" used in building these bridges:

"The Department of Defense spends $22.5 billion dollars annually on equipment and infrastructure as an impact of corrosion. For the Army, this number is approximately $5.8 billion annually. This (RSPC) bridge is less expensive to build than its alternatives, it provides greater corrosion resistance, and it is practically maintenance free. The Army estimates that we will receive a 34 to 1 return on investment by using this technology."

After the success of the first tank bridges at Fort Bragg, Fort Eustis was the first to assess the new technology in a pure competitive bid format against "old school" materials.

RECYCLING AND SUSTAINABILITY

The RSPC technology used at Fort Bragg and Fort Eustis relies on plastic waste diverted from landfills and incinerators. Individuals in the US generated 250 million tons of waste in 2008, and although recycling programs have provided an alternative to landfill disposal, our success is far from universal. We recycle 56% of paper, 34% of all metals and 23% of all glass. However, of the 30+ million tons of waste plastic generated per year, an amount almost equal to the total metal and glass waste combined, plastics are only recycled at a 7.1% rate (EPA - Municipal Solid Waste Generation, Recycling and Disposal in the United States: Facts and Figures 2008).

Finding viable applications for recycled plastic has proved challenging. Now, with the development of RSPC material technology developed by Rutgers University and its proven effectiveness at Fort Bragg and Fort Eustis, plastic waste has a new destiny. Instead of sending plastic milk jugs, detergent containers and automotive bumpers to the landfill, they can be transformed into infrastructure (like bridges, piers, retaining walls, sound barriers and pilings) offering superior performance and durability over traditional materials.

THE FUTURE

We are at a cross roads. Sixty plus years ago, the United States had a massive construction boom leading to explosive growth in our infrastructure. We have reaped the benefits of that construction boom with the most sophisticated and comprehensive roadway system in the world. Decades later, our nation's bridges are wearing out. In 2005, the Bureau of Transportation Statistics estimated that there are over 75,000 structurally deficient bridges in the United States.

The RSPC material offers exceptional strength and durability. It is impervious to moisture and insects. This makes it ideal for harsh environments where steel, wood and concrete corrode quickly. Whether in a salt water bay, a brackish inlet or a fresh water river or lake, the material will not corrode, rot or leach harmful toxins into our environment.

Daniel J. Dunmire, Director of the DOD's Office of Corrosion Policy and Oversight, explained the potential of this technology when discussing the Fort Bragg bridges:

"This {RSPC} bridge, able to withstand heavy loads with little to no maintenance, expected to last at least 50 years, is no longer the bridge of the future—it's the bridge for today. It also meets national environmental goals of being completely recyclable. This technology is not only good for [the Department of Defense, but should be immediately transferred to state departments of transportation for use with short-span bridges wherever possible."

New technologies, like Recycled Structural Plastic Composite (RSPC), force us to make choices. Will we build with traditional designs and materials, or embrace new technologies? Will we continue to expand our landfill waste or will we recycle into new and better products? Will we stay "in the box" or venture out, innovate and challenge conventional thinking? Despite the success at Fort Eustis, Mr. Reed discussed the challenges of adopting the new RSPC technology:

"The next industry challenge will be educating engineers and designers on the use of the materials and inspecting these structures. I envision this taking off like a rocket—it is a no-brainer for forward-thinking planners. Engineers must leave their comfort zones and embrace this new technology." **DTJ**