John (Jack) Badman III Testimony - April 19, 2007 for the April 24, 2007 Hearing

I want to thank Chair Mary Landrieu, Ranking Member Stevens and the other distinguished members of the Subcommittee for this opportunity to talk about my company's experiences with the Alternative Housing Pilot Project.

I'm Jack Badman, CEO of RE: Formed Systems. First, let me say that better and cheaper approaches to providing disaster planning, response and recovery do exist—they exist now, and are available to FEMA, to the federal government, and to the American taxpayer.

Five years ago I founded our firm to find a way to build Force 5 hurricane proof houses for the price of wood housing, hence prevent having to rebuild every time a hurricane hits. This was expanded into our Emergency Planning, Response and Recovery System, which we submitted to Alabama for consideration in the Alternative Housing Pilot Program.

Alabama and Mobile County selected our system to feature in their proposal they told us was titled, "Mobile County Alternate Housing Pilot Program," stating that all thought we best met the RFP's criteria. We had discussed doing a demonstration of our Emergency Housing, and how quickly a lot of it could be assembled by unemployed workers, then show how it all transitions into Temporary Housing. Then how all these materials would be incorporated into permanent housing. We had hoped to a large Emergency response development, but Mobile County said FEMA controlled how much money we would get.

FEMA did not select us, and we haven't received a debriefing. We are unaware of a selected concept that better met their RFP's criteria, so we hope to better understand their rationale in a debriefing.

We offer a "pay one time" and "ship one time" approach that results with virtually indestructible housing suitable for any location that Katrina struck. Our emergency housing, which competes with tents, hotel rooms and cruise ships, is highly flexible. It can be a studio or a 1 to 5 bedroom shelter. Each family is allocated what they need, in a private, secure family shelter. They don't have to cohabitate in a tent with other families. 1000 various sized shelters can be erected within 12 hours of a storm's passing. We anticipate being able to construct and furnish shelters faster than emergency workers can sort out who will be assigned which shelter. Lots of preplanning is involved, but it is highly cost effective, and very responsive to evacuees' needs in a time of crisis..

While families inhabit our shelters, without disturbing them except for 2 hours, their shelters can be expanded quickly into temporary housing via adding our toilet and kitchen modules. This replaces FEMA trailers, with a long list of benefits.

When no longer needed, the materials for our emergency to temporary housing is disassembled and locally reassembled into our permanent force 5 hurricane proof, submergible housing. All material is shipped one way and is consumed locally. Money spent for emergency to temporary housing materials is not wasted since all those materials are incorporated into our permanent housing. Nothing becomes surplus or obsolete, nor needs to be shipped to storage yards, stored and refurbished.

During the next emergency response everyone gets fresh, new, next generation materials. In future storms no one will feel they're getting used housing or less-than-the-latest.

In Summary, instead of paying first for "Emergency Housing" via tents, cruise ships or hotel rooms, then paying for "Temporary Housing" in the form of trailers, then paying for permanent housing, our system has all the materials in our Emergency housing included in our Temporary Housing, and all that is included in our permanent housing, which will never again have to be replaced. Each phase just adds more materials to the previously used materials. Our permanent housing conceals all materials behind new finishes, so nothing looks used.

This approach was honored as the "Disaster Response" cover story of CM *[holding up a copy of the magazine]*, the official magazine of ACMA, the American Composite Manufacturers Association, and the world's largest trade organization for polymers. It's on our website, ReFormedSystems.Com. A photo from the 1st of my 4 trips to New Orleans is on the cover. What it doesn't show is right behind the teddy bear is its owner's body. Saving money has not been our only objective.

We feel FEMA failed to recognize some of the benefits we bring: Our system cost is about 1/3 their current cost, it is far faster, and prevents having to spend money for future damage – hence it has an extremely low life-cycle cost. In the future, we suggest FEMA address what should be their most important goals, make these goals are their primary focus and ensure they select the new, vitally-needed innovative approaches that work toward meeting these goals.

FEMA should be seeking new innovative approaches that can provide permanent units that can be sited anywhere, including on the coast and under sea level. It requires a variable wall system to develop the flexibility needed. We are unaware of any of the selected systems can do this or any of the following:

FEMA should look for systems which don't use wood, gypsum or SIP panels, hence materials that are not prone to future flood and mold damage. Seek structures designed to be submergible, which can have the muck and mold cleaned. Evacuees will lose the use of their houses until cleaned out, but no structural damage should be likely.

In floodable areas, FEMA should not use materials such as wood and SIPs that float and add buoyancy forces if underwater.

Seek materials that are very compact and only ship one way via high-speed common carrier, so the highways and commuters are not affected by slow traffic, trucks pulling trailers, etc. Hence with shipping costs and aggravation that are far lower. Ideally nothing has to be eventually returned to storage yards, refurbished, etc..

A great advantage would be in systems that require very few skilled workers to assemble it, and don't compete for scarce carpenters. Hence unemployed persons seeking hard but rewarding work can earn money while taking pride in helping their communities respond or rebuild. And not require scare cranes or other equipment.

Systems should not have a fixed sized unit and not be "design specific" or copyrighted like a Katrina Cottage – This allows communities determine how their units will look. And aids community buy in.

Key is taxpayers shouldn't be asked to keep paying for Disaster Recovery over and over again. The criteria should be: "Fix it once so it never has to be fixed again." This is in the Gulf's best interest. By rebuilding with what won't be destroyed, taxpayers will back it. More money will gladly flow into the Gulf. Mortgages and insurance with be available. Tax incentives should pass to back this new approach. Find systems which are ideal for the areas that now can't get mortgages or insurance.

Because FEMA did not recognize the need for the above, we are concerned that FEMA is not asking the right questions. As CM explains in more detail, there are approaches that can be of great benefit to FEMA, the evacuees, the communities, the states, and the taxpayers.

As such, we feel Congress should now do an additional Pilot Project that encourages the development of additional projects in order to test the additional diverse ideas available.

We suggest this new Pilot Project be viewed as venture capital, and suggest FEMA draw on the technical community to help rank and select those projects with the greatest potential return on investment and long-term payback. With such an enhanced selection process, Taxpayers should see new hope, that there will be improvements, new approaches, new effective planning, etc. By investing additional Pilot Program funds effectively now, $Trillions can be saved over time, making it of outstanding help to humanity, not just taxpayers. We hope Congress and FEMA will give us an opportunity to work together for the common good.

Official Magazine of the
American Composites Manufacturers Association

February 2007

CM Composites Manufacturing

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Disaster Response

Can Composites Prevent This?

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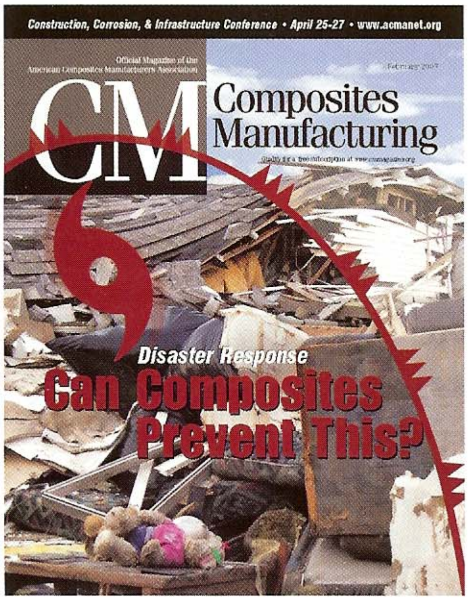

Cover: John Badman III who wrote to the editor: "Behind all the debris, there is the real tragedy. Many of the photos I've taken were shot before dead bodies were recovered. Our firm [RE: Formed Systems, Inc, or REFS] was started five years ago to try to prevent this. Without composites, I could not find out how to do it. With them, I could. I hope that this article will be able to show that composites can go a long way to prevent such tragedy."

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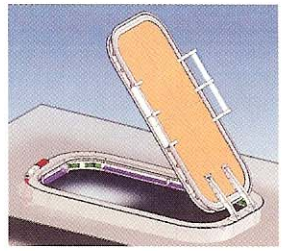

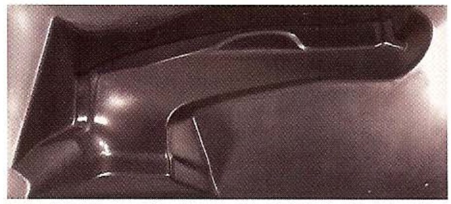

Correction: In the January issue of Composites Manufacturing, Resmi Jaimon's trailer was inadvertently left off her article, "India's Composites Industry to Another Year of 25 Percent Growth." Resmi Jaimon is an international freelance writer based in Kochi (Kerala), India. She is published in 30 print and online publications including CM and has ghostwritten contents for corporate brochures and websites: www.resmijaimon.com; resmi.writer@gmail.com. CM *regrets the omission.*

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Composites Manufacturing (ISSN 1084-841X) is published monthly, except November/December is a combined issue by the American Composites Manufacturers Association (ACMA), 1010 N. Glebe Road, Suite 450 • Arlington, VA 22201 USA. Subscription rates: Free for members and non-members in the U.S., Canada, and Mexico; $45 for international members, $55 for international non-members. Periodical postage paid at Arlington, VA and additional mailing office at Fulton, MO. POSTMASTER: Send address changes to *Composites Manufacturing* P.O. Box 336 Congers, NY 10920. The magazine is mailed to ACMA members and is also available by subscription.

One Composites Company's Innovative Strategy for the Future

"Based on lessons learned after Katrina, we are in the process of retooling the agency into a more nimble and responsive one for America." — FEMA Director David Paulison

The "right" tools are one of the keys to success. In fact, the right tools—seeking the best approach, leadership, strategy, indeed, seeking every advantage—are essential. Even with the best intentions, an initiative may fail or result in sub-optimal outcome if the right tools are lacking. Any FEMA retooling must therefore place emphasis on providing the most responsive and responsible approaches to disaster relief, approaches that are faster and more cost-effective than the recent and on-going response to hurricane Katrina—approaches that save taxpayers billions of dollars and minimize opportunity for fraud, waste, and abuse. Such an approach that meets critical human and

Disaster Response & Global Challenges

By Carl Magnell

community needs immediately after a disaster, uses the same system components to progressively rebuild from emergency shelters to temporary housing and, finally, if desired, results in a permanent Force 5 hurricane proof home, is now possible through innovative use of composites.

This composite-based systems approach to disaster response has been developed by RE: Formed Systems (REFS) of Greenwich, Connecticut. What the company has done is eliminate the current "pay three times" response where, ironically, the cost of providing either emergency or temporary shelter may often exceed the cost of building a permanent home. The estimated system cost in providing all three phases of disaster relief for REFS-constructed disaster response communities is comparable (on a square foot basis) to existing stick construction while providing a final product that is designed to ACI standards and, as noted, capable of surviving Force 5 hurricanes. The company anticipates providing all 3 phases for the approximate cost of any one of the current phases.

Final recovery efforts in the impacted Gulf Coast states are far from over and in many cases, remain in the planning stages. To meet projected costs for Katrina the Federal government alone has allocated $105 billion and the U.S. insurance industry will pay $40.1 billion to settle claims (according to August 2006 estimates).

What are the tangible results from these record-breaking actual and programmed expenditures? In truth, far less than could or should be the case. While much has been said and written about the inadequate response to Hurricanes Katrina, Rita, and Wilma from Federal, state and local authorities, it is now time to focus on a disaster response system that can prevent this outcome in future natural or man-made disasters.

The Need for a Better Approach

Consider the required response to the 2005 hurricanes, which included these essential phases:

- Emergency shelters;
- Temporary housing; and
- Permanent reconstruction (ideally, able to survive future hurricane events).

In the immediate aftermath of Hurricane Katrina, displaced persons were brought to emergency shelters (such as the Superdome in New Orleans) then further relocated at enormous cost to available hotels, motels, and even cruise ships. Many were relocated to distant cities, again at significant cost. In addition to the financial burden on taxpayers, these evacuations imposed non-monetary costs to individuals and communities, including separations from other family members and loss of community integrity. While perhaps secondary to the cost in human terms, the lack of an effective pre-planned response generated widespread fraud and financial abuse, now estimated by CorpWatch at over $2 billion.

The response for temporary housing was/is to use trailers and mobile home units. According to FEMA, 93,296 trailers and 7,878 mobile homes were brought in to the impacted areas (Alabama, Mississippi and Louisiana) at an astonishing cost of more than $70,000 per unit. This cost may be low, given the additional estimates for transportation, site preparation, and the eventual expense of returning the trailers to storage. Such an expenditure, in the words of Louisiana Senator David Vitter, "is wasteful when there are cheaper and better alternatives."

In addition to the high monetary cost, the only possible mode of providing this temporary housing had (and will always have) a major, adverse impact on highway traffic. The third component of natural disaster response, permanent reconstruction, is barely underway. While hurricane Katrina provides a striking example of the lack of proper disaster response tools, it is by no means the only example. In fact, all recent natural or man-made disasters have had similar results due to the current inability to enable a more positive response.

FEMA's current disaster response approach is thus non-complementary. Each phase incurs costs that are not only substantial and cumulative but, regrettably, cannot be usefully "captured" by any other phase.

REFS' Approach

REFS is an extremely flexible system with only a handful of separate stock components. Three components are used for Phase 1 emergency shelters. One additional FRP stock component is added for emergency or temporary long-span structures. Five components

Figure 1. REFS Temporary 2-Room Shelter w/Bath and Kitchen Modules

Figure 2. Temporary Housing

are required for low-cost, hurricane and flood-proof, permanent housing. The original three components are re-used as the structure transitions from emergency shelter to temporary or permanent housing. The system also uses two standardized, proprietary FRP modules, one for baths and one for kitchens; laundry, HVAC system, etc. are contained within these 2 modules. These modules are added to emergency shelters during the transition to temporary housing. When no longer needed for temporary housing, all materials, including the modules, can be used in the company's permanent housing.

All components are factory pre-cut to precise dimensions and color-coded, thus enabling assembly by non-skilled, non-literate persons (or persons literate in languages other than English and Spanish). The use of high strength polymer materials means that the heaviest components (the 4-foot x 8-foot panels) weigh only 28 lbs (12.7Kg). When compared to three-quarter-inch plywood weighing 70.4 lbs (31.9 Kg) or 111 lbs (43.7 KG) for the thinnest (6 inches) SIP, this low weight enables erection of emergency structures without use of cranes or other materials-handling equipment (MHE). Moreover, because of FRP, the modules only need boom trucks, not the heavy cranes needed by other FEMA systems, to place a whole or half-a-house. An added plus is that, relocating components, if needed, can be done by hand

Figure 3. Typical FEMA trailer park

and/or boom truck.

Another REFS feature is the optimal blend of factory and on-site techniques. All planning, measuring and cutting is done in the factory. Only the very compact, lightweight composite materials are sent to a site. There, the "heavy" system materials are added as needed. These may include sand, gravel and, for Force 5 hurricane-proof permanent housing, reinforced concrete. A second benefit is that panels can be pre-cut to respond to more than one application, providing flexibility not found in other disaster alternatives. These composite components will not be rendered obsolete since they can always be re-configured for other uses (until they are incorporated into a permanent structure).

Components utilize varied manufacturing processes including injection molding, RTM, pultrusion and extrusion. Resins and reinforcements likewise offer multiple options, depending upon specific requir ments. REFS flexibility will benef designers who can optimize design b considering the three traditional factors i composite design: materials, desired produ form, and process options.

Other Options

One result of hurricane Katrina is the recer FEMA Alternative Housing Pilot Progran While a priority program objective w "innovative concepts," none of the selecte housing products have the comprehensi 3-phase capability offered by REFS. Instea several highly promoted alternative including Katrina/Mississippi cottages, European prefabricated unit and modul units featuring fiber cement siding an metal roofs were selected for the $40 million pilot program. The largest fundir grant was designated for trailers. Mississip will gain 7,261 Park Models—trailers o wheels with front porches that are used b the U.S. National Park Service to hou employees in remote areas.

How does REFS see itself when compare with these alternatives? Any compariso must incorporate how well an alternati meets the most critical objectives of a disast response, namely:

- How quick is the response;
- How flexible is the response to actual people needs;

Table 1: Phase Response Comparison

PHASE	Emergency	Temporary	Permanent	Pay
FEMA	Tents, Hotels Cruise Ships	Park trailers, rentals, cottages and modular units	Not a FEMA responsibility; Private, HUD, etc.	3 times
REFS	On site shelters	Expand shelters; add modules	Reuse materials; add concrete	Once

- Do adverse impacts result from the response;
- How cost effective is the response; and
- Does the response provide permanent solutions that prevent future recurrences as well as facilitate availability of mortgages and insurance at affordable rates.

REFS officials claim that the company's system is not only superior in meeting all of these objectives but does so for all three disaster phases (emergency/temporary/ permanent) at a square foot cost that is comparable to current stick constructed permanent homes. This fact sets the company apart from any other alternative since no other alternative (nor the current FEMA response) transitions from use as an emergency shelter into temporary housing and, if desired, into a permanent home that can be sited on a coastline and survive a Force 5 hurricane. REFS, enables any disaster response agency, including FEMA, to pay once for an integrated, rapid and effective response, not multiple times for discrete, non-complementary alternatives.

Cost estimates for a FEMA trailer vary from $60,000 to over $120,000. The actual costs of the Park trailers has not been disclosed but is expected to cost more than the current FEMA trailers. Katrina cottages will likely cost more than $200/square-feet. In Louisiana, the average cost for the Katrina cottages to reported be $125,000.

When compared to the current FEMA approach (see below), a pre-planned REFS systemic approach provides disaster agencies with unmatched flexibility, speed and cost-effectiveness in rapidly meeting emergency, temporary and, when desired, permanent needs.

Scenario Strategy

Pre-planning by FEMA or any disaster response agency is a necessary first step for any alternative. Preplanning include critical tasks include identifying suitable emergency and temporary response sites, estimating the approximate response requirement (depending upon event severity), locating required utilities and executing appropriate contingency contracts.

• Phase 1: Emergency Response

Pre-positioning REFS composite components near anticipated/high probability hurricane (or other natural disaster) locations is the first step. The low weight and simple packaging of components provides disaster planners with maximum flexibility. A typical U.S. semi-trailer will carry up to 26 emergency shelters in 4 sizes (192 square-foot shelters consist of 29 pieces on a pallet 4-foot x 8foot x 5-foot, or 160 cubic feet). Trucks hauling components will not need escorts, as is the case with FEMA trailers. If necessary, components can also be flown in, a practical impossibility for any alternative solution. Transport of REFS emergency response shelters is estimated at one-fiftieth the current FEMA transport cost.

So, how would a new composite system deploy in anticipation of a hurricane (or other disaster)? Assume that a hurricane is expected to make landfall in the Florida panhandle within the next 36 hours. FEMA would, at this time, order shipment to the panhandle area of the estimated required number of short term (emergency) units. For this hypothetical scenario, that'd be 1,000 units. Which of the pre-planned FEMA emergency response locations are used will be determined by FEMA as the hurricane path becomes better defined. These locations are already surveyed, rough-graded if needed and permanently staked. An estimated 39 semi-trailers are required per 1,000 emergency shelters, depending on the number of each of the four sizes desired. REFS emergency shelters can be in place and ready for occupancy in about 6-12 hours, about the time local response teams need to identify: 1) Who needs shelter; and, 2) The size shelter needed. On site assembly is in the mode of an auto or computer assembly line, rather than typical construction.

A REFS emergency shelter is the alternative to a FEMA tent and is the lower red portion shown in Figure 1. This unit provides only shelter and can do so (with pre-planning) within 12 hours of the hurricane's passing. Food and toilet facilities will be provided in nearby also pre-planned structures.

• *Phase 2: Temporary Housing*

Unlike other options, when pre-planned, this new system can now quickly transition from emergency to temporary housing by simply expanding the emergency shelter. The blue modules shown in Figure 1 are brought in and hooked up to the emergency shelter; once hooked up, the occupants are inconvenienced for about two hours while the unit transitions into temporary housing.

A typical REFS temporary unit (the second smallest of six sizes) provides one bedroom, a living room, kitchen, and bathroom, with a total area of 384 square-feet, or 35 percent more area than a FEMA trailer at 284 square-feet. Since REFS is available in more than one size, disaster responders such as FEMA can place families in the size unit they need.

The flexibility inherent in the REFS system maximizes the options available to disaster responders. For example, the unit shown here is easily expanded into a two-bedroom (or even larger) unit. REFS units can be ganged together (see Figure 2) to facilitate utility connections and make optimum use of available land. If needed, 10 and 12 room units can be planned for medical clinics, small office areas, etc.

An important advantage of the system is built–in security for occupants. These measures include fire, security and medical alert system (the latter, as needed). Occupant security is further enhanced since all utilities are accessed by service personnel from the outside of the unit. Occupant access to units is only one step up rather than elevated, as with trailers. These units also can be sited in the floodplain, if necessary, since they are able to survive flood events. Components can be configured into large, long span temporary buildings. Unlike large tents, the long span temporary buildings do not require center or multiple poles in the center of the structure, nor do they have water or snow load problems.

It is important to note that familiar home amenities are easily incorporated. A temporary housing unit can include parking,

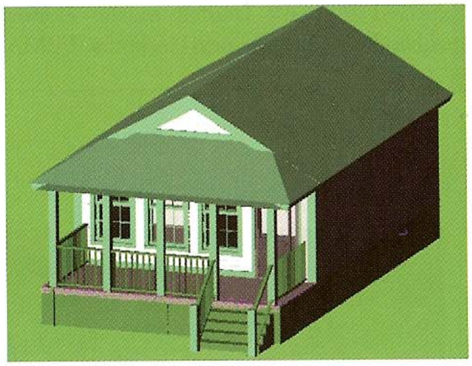


Figure 4. New Orleans "Shotgun House"

Figure 5. REFS (shown with exposed porch)

privacy fencing, yards, thus adding modest amenities in a difficult time. What this composite temporary housing offers is thus different from a typical FEMA trailer park.

• *Phase 3: Permanent Housing*

The final transition is from temporary to permanent housing. The inherent advantages of composites are now merged with the strength of reinforced concrete, as this material is introduced into the cavities formed by the composite wall panels. Composite reinforcement bars are used to further strengthen a permanent REFS house, thus incorporating the best properties of both materials. The reinforcement bars also tie the composite/concrete roof panels to the walls thus ensuring that the typical challenge of roof to wall attachment is solved. REFS permanent housing/structures will perform and meet code requirements as well or better than current concrete houses.

The components used to prov emergency and temporary housing can be fu used in this final transition and numer architectural options are available. Virtu any 1-2 story design can be erected a virtually any exterior skin applied, for examp clapboards, brick, stucco, block, vertical sidi stone, etc. The local community can determ the desired motif or motifs. In New Orlea for example, where the "shot-gun" look i tradition, this look can be maintained, shown in Figures 4 and 5.

Inherent flexibility permits design to ad to specific requirements. For example, oce front locations. As noted by ACM Composites Growth Initiative Director, Jo Busel in an earlier (October 2006) *CM* arti "18 inches of wave action contains enou energy to demolish a (typical stick constr tion) house." Permanent housing can assembled so that units located on or nea coastline incorporate thicker reinfor concrete walls. This dimension can then reduced for housing or structures built furt inland, housing that can thus anticipate respond to specific location demands. T final transition to a permanent house res in a Force 5 hurricane-proof structure also will survive floods since the interior system is structurally immune to the probl faced by traditional interior construct materials and is easily decontaminated sho flood waters intrude.

REFS officials claim the composite sys is equally suitable for normal, non-disa applications, ranging from modest to up-s housing and commercial and instituti facilities. The system is amenable to a w range of architectural options.

To summarize, the FRP composite sys offers the following advantages for disa response:

- Lightweight; transportable by all transp modes;
- Rapidly assembled/disassembled by unskilled labor;
- Easily expanded/reconfigured without impact on occupants;
- Fully meets emergency, temporary and permanent needs; eliminates current "p three times" situation;
- Reusable until structure is made permanent; and
- Suitable for coastal, below adjacent wat level sites (e.g., New Orleans) and flooc zones.

Other Applications

The flexibility of the REFS FRP comp system could have other applications:

- Flood control mitigation;
- Security barriers;
- Infrastructure (schools, commercial, medical, police, etc); and
- Military bases (permanent and expedient).

Consider, for example, FRP composite flood control. Flooding is a periodic natural disaster for which there are no cost-effective solutions except the slow process of filling and deploying sandbags via volunteer workers. Levees and dams are the typical engineering response, but these are so costly that only the most significant locations in both economic value and human impacts are typically protected in this fashion. Moreover, where aesthetic considerations are important, periodic flooding is often an accepted cost due to the fact that levees and floodwalls spoil the view of the water resource to the community. Finally, erecting permanent levees and floodwalls often intensifies the downstream flood impacts. As a result, many communities in the U.S. and globally turn to sandbags as the primary flood control means.

A recent industry market study concluded that flooding in the United States is concentrated, with approximately 75 percent of flood damage claims occurring in just 16 states. At least 6000 cities and towns and tens-of-thousands of businesses, schools, etc. are flood prone and require temporary flood protection, Unofficially, the U.S. Army Corps of Engineers estimates indicate that the length of temporary flood control walls erected annually has ranged between 225-350 miles. At an average height of six feet, the total constructed surface area ranges between 7,125,000 to 11,150,000 square feet per year. At a conservative cost of $25.00 per vertical square foot for sandbags, the annual U.S. cost for flood protection using sandbags is in the range of $180 to $275 million. The REFS FRP system looks to provide a faster, more cost-effective, non-permanent (or permanent, if desired) response, flood control components including two primary assemblies, the base plate, and the flood barrier. The flood control components include only three components; a base plate, panels and ties.

A REFS flood control composite barrier is:

- One of only two flood control systems usable as a high (8 foot or more) flood barrier wall;
- A cost-effective system, whether used as a low or high flood wall;
- Flexible, adaptable to changing conditions; and
- The only high wall system that does not depend upon the underlying terrain to restrain rotational vectors.

The flood barrier system when compared to sandbags is faster to install and remove, less labor intensive, reusable, has minimal infiltration through wall so requires less pumping. The component assembly can be done indoors, then trucked to the site and placed. Fill material is protected from toxic water and can be reused.

In a typical situation, the flood-prone location will be analyzed from historical data and any requirements for site preparation identified. Site preparation is minimized by the ability to use existing paths, sidewalks and streets. The site-specific barrier requirement will be pre-planned with each barrier section coded as to its precise on-site location. Floodwall ties are unique to each site. These also will be coded. These ties represent eight percent of the total system. Ninety-two percent of components are usable at any location. Clients (cities, communities, private entities) may elect to use their own personnel or contract for flood barrier assembly/disassembly. If clients elect to erect

("Disaster Response..." continues on p. 45)

("Disaster Response..." from p. 19)

the barrier, composite components for training (two sections of the flood barrier) will be kept on hand for this purpose.

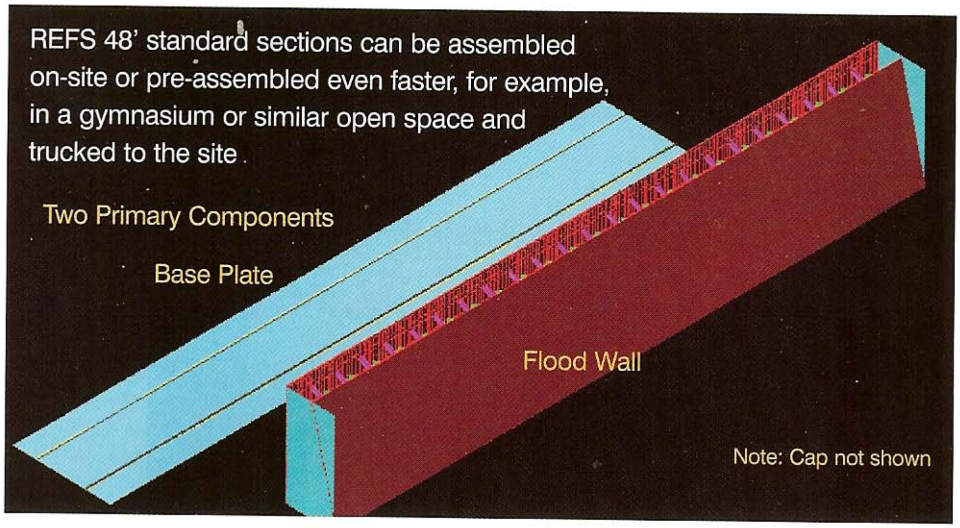
When needed, composite components are rapidly shipped with each component tagged as to its functional location. Assembly can be done on-site by mostly unskilled labor (volunteers, if available) or at a central location with the sections trucked to their locations. The REFS flood barrier is a very light-weight system (until filled at the point of installation) and a 48 foot standard section can be carried by 4-6 persons eliminating the need for materials handling equipment (cranes, etc.).

At the installation location, base plates are positioned and the sections then placed upon the base plate at their pre-determined locations. Sections are joined and, as required, needed elevation or directional changes are made with pre-planned site specific sections. Filling of the section interiors (normally, a sand-water slurry) is rapid, using standard concrete mixers to quickly add a slurry that transquare-feetorms lightweight composite barriers into a wall that's as heavy as concrete. Once the flood event has passed, the flood barrier system is dismantled and returned to storage or prepared for another use. Decontamination, if required, is done before the flood control barrier is disassembled and cleaned.

While 48-foot sections are standard, shorter sections are used, as needed. For locations where a permanent barrier is desired, concrete is used in lieu of the sand-water slurry.

Homeland Security and Force Protection

Physical security is an unfortunate fact of the 21st Century. REFS composite system offers the fastest capability to emplace temporary or permanent barriers against both ballistic and blast contingencies, using emplacement methods similar to those used for flood control but with ballistic resistant reinforcement added to the sand fill. Tests have proven ballistic reinforcement fabrics backed by sand provide excellent protection and are cost effective.



In military applications, a combination of ballistic/blast reinforced composite structures and barriers offers un-paralleled flexibility. Added protection is easily obtained by filling wall cavities with available local fill materials, such as sand, dirt and gravel. Moreover, the ability of facilities to be very rapidly emplaced underground, when required, adds significant force protection capabilities that are not now available, for example with modular units now used by U.S. Forces and contractors in the Middle East. As with any of the company's systems, all components can be rapidly disassembled, moved, and reused or made permanent by the addition of concrete cavity fill (or in remote areas, locally available fill materials, such as sand, soil, gravel, etc).

A New Approach

REFS is thus poised with a unique composites-based approach that can respond to many of the most challenging global disasters, whether natural or man-made. Its flexibility and responsiveness are unmatched by current alternatives. CM

Carl Magnell has more than three decades of experience in construction related activities. After active service in the U.S. Army Corps of Engineers (where he was an engineer brigade commander, the U.S. forces Engineer for Korea and Commander/Director of USACERL, the Army's infrastructure focused laboratory), he served as Director of Research for the Civil Engineering Research Foundation (CERF). He has written for professional journals and authored four major national studies on civil engineering related topics. He is a graduate of the United States Military Academy (West Point), holds graduate degrees in Civil Engineering and Political Science from the Massachusetts Institute of Technology (MIT) and is a graduate of the Aspen Institute/University of Maryland College of Business and Management Executive Management Program. For more information, contact Carl Magnell at comagnell@comcast.net