Engineers Help Fight Ebola Outbreak in Africa

By Captain Andrew K. Hill

Recently, U.S. Army Africa (USARAF) took part in stemming the 2014 Ebola outbreak in West Africa. The engineering effort fell into three areas:

- Operations of the U.S. Agency for International Development (USAID) disaster assistance response team (DART).
- Construction of Ebola treatment units (ETUs).
- Activation of the Monrovia Medical Unit.

The unity of effort, regional understanding, and understanding of the commander's intent were doctrinal principles used to highlight the successful operational foundation provided by USARAF for follow-on units.

By December 2014, reported cases of the Ebola virus disease in West Africa had reached more than 17,000. The outbreak, starting in December 2013, was a small occurrence that became a regional crisis by October 2014. The U.S. government response began by sending a team from the Centers for Disease Control and Prevention; and in September 2014, USAID requested support from the Department of Defense.[1,2] The response became Operation United Assistance, which hinged on the construction of multiple ETUs in Liberia. The Engineer Regiment response began by tasking USARAF to provide a civil engineer planner for the USAID team in Monrovia, Liberia.

DART

A DART consists of a small group of U.S. Department of State personnel and other government and humanitarian resources. DARTs from USAID deploy to "coordinate and manage an optimal U.S. government response, while working closely with local officials, the international community, and relief agencies."[3] In September, the Ebola DART in Monrovia was one of four deployed by USAID, with others in Iraq, Syria, and South Sudan. The same month, three military planners were requested for the Ebola DART. This was the first time that a DART would include military personnel.

A U.S. Navy officer deployed as a logistics planner, and a U.S. Air Force officer served as an air planner. The author, an operations officer for the USARAF Deputy Chief of Staff Engineer, provided engineer expertise as the civil engineer planner. DART integration began with a safety briefing that covered Ebola and other, more standard threats. With the health and safety of the team a paramount concern, a contract emergency response flight was on hand for U.S. personnel who might contract Ebola. A small clinic at the U.S. Embassy in Monrovia, Liberia, treated other, standard maladies. Because compound fractures, amputations, or internal bleeding would have been untreatable with the available medical infrastructure, car accidents were deemed the largest risk to U.S. government workers. Despite world perceptions, such standard threats present the largest risk to nonmedical personnel during the outbreak.

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The logistics and air planners focused on runway assessment, air bridge development, and other logistic requirements. The civil engineer planner met with personnel from nongovernmental organizations in Liberia to develop a unified approach for the American engineer response. With a variety of agencies and personnel operating in theater, it became imperative to "achieve and maintain unity of effort . . . between the joint force and interorganizational partners"[4] to ensure a rapid and synchronized response. The main effort was the creation of new treatment facilities. The Liberians needed more beds quickly; but since nongovernmental organizations had provided this capacity in the past, nobody in the U.S. contingent had a plan for constructing an ETU. Doctors Without Borders, the largest and most experienced organization, was providing an ETU with 200–300 beds.

An Ebola growth model by the Centers for Disease Control and Prevention would shock the world with the possibility of infections ranging in the millions by January 2015.[5] This message created a sense of urgency and brought much-needed resources to help stem the outbreak. Typically, DARTs deploy to areas after a disaster to help coordinate recovery efforts. This approach starts small, avoiding massive logistic capability and aid that would overwhelm existing infrastructure, build dependency and, ultimately, stifle a self-reliant local recovery. The West Africa Ebola outbreak proved different, presenting a disaster more similar to an enemy invasion than an earthquake or flood. The response was new for the DART, so the U.S. government required "innovative and adaptive leaders and cohesive teams that thrive in conditions of complexity and uncertainty."[6]

ETU

An ETU, in the context of this outbreak, is a 100-bed facility approximately the size of a soccer field, separated into two risk level zones where confirmed and suspected victims can be isolated and treated. It includes ward areas, staff changing and resting areas, various levels of chlorinated water distribution, electrical production and distribution, a morgue, and other ancillary facilities, such as a separate visitor area and a room for religious and social workers.

There are four major lines of effort for an ETU:

- Construction.
- Nonmedical management, such as electrical and water supply.
- Medical care and management.
- Resupply.

The DART was responsible for synchronizing the nongovernmental organizations and agencies responsible for each line of effort. By September, the plan consisted of at least one ETU in each of Liberia's 15 counties, with more in the densely populated Montserrado County, which contains the capital city of Monrovia. U.S. military support was newly arrived, and time was of the essence. Fortunately, the Armed Forces of Liberia started initial planning for ETU construction.

A 14 September briefing about the Liberian construction plans brought together representatives from the U.S. military, the World Health Organization, Doctors Without Borders, and the Centers for Disease Control and Prevention.

The U.S. military personnel worked with the Liberians to develop the bills of material, site adaptations, and contracting documents needed to start construction. Since construction was to start immediately, efforts had to be synchronized, not duplicated. The Liberian military would supply labor and expertise in local methods, the World Health Organization and other organizations would provide conceptual plans and medical expertise, and the U.S. military would provide survey and design capability and funding for materials and equipment.

The first product was a conceptual site layout adapted from World Health Organization plans featuring standard Liberian construction and U.S. Army and commercial tents. The concept was e-mailed to USARAF for computer-aided design drawings. USARAF later used the drawings to geospatially site-adapt the plan to scouted construction sites.

The initial bill of material required a regional understanding of construction to develop appropriate solutions. Designing and building U.S. military standard facilities would over-engineer and lengthen times for ETU construction. Every day without plans meant another day that the

An engineer from the Armed Forces of Liberia cuts wood braces for the Tubmanburg ETU.

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U.S. government was not building ETUs. The bill of material went to USARAF, where it was combined with the concept layout to develop performance work statements. Contracting documents were key to meeting the commander's intent and starting work on the first joint ETU at Tubmanburg, Liberia.

Joint Forces Command was established on 17 September 2014, and four more members of USARAF deployed to Monrovia to form the Joint Forces Command J-7 Engineer. Known as the J-7 (Forward), it had primary responsibility for site surveys, forward contract management, and information gathering. The J-7 (Main) in Vicenza, Italy, provided engineering solutions through providing reachback and focusing effort on contracts and site adaptations.

Monrovia Medical Unit and Redeployment

Along with ETUs, USARAF engineers had a large part in planning another major element of the U.S. response. A 25-bed, U.S. Air Force expeditionary medical support hospital would provide advanced medical treatment to any health care workers who contracted Ebola. The facility became known as the Monrovia Medical Unit.

As the J-7 (Forward) gained personnel, it also gained logistics, air, and engineering planning capabilities that rendered the original military DART planners redundant. As a result, the first military members of a DART redeployed to their respective home stations in early October. USARAF continued to function as the Joint Forces Command headquarters until the 101st Airborne Division took responsibility for Operation United Assistance on 25 October. USARAF engineers weren't alone; they gained support from the 36th Engineer Brigade, the U.S. Army Corps of Engineers, and the U.S. Air Force. In Liberia, they worked closely with USAID, the Armed Forces of Liberia, and the U.S. Marine contingent that mentors them. In 38 days, the USARAF engineer team completed 58 designs, 28 performance work statements, and 30 equipment and material estimates and saw the groundbreaking of six ETUs and the Monrovia Medical Unit.

The unity of effort among various agencies and organizations through sustained communication, regional understanding, and partnership with the Liberian military ensured appropriate construction methods and a rapid, synchronized approach that paved a positive way forward for the people of Liberia. Foundation-setting work by its engineers show that USARAF is a trusted and respected partner that achieved long-term strategic effects in Africa.

Endnotes:

[1]Centers for Disease Control and Prevention, "Update: Ebola Virus Disease Epidemic—West Africa, December 2014," 19 December 2014, <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6350a4.htm?s_cid=mm6350a4_w>, accessed on 22 January 2015.

[2]International Information Program (U.S. State Department), "U.S. Offers More Aid for Response to Ebola in West Africa," 16 September 2014, <http://iipdigital.usembassy.gov/st/english/article/2014/09/20140916308491.html>, accessed on 22 January 2015.

[3]USAID From the American People—Who We Are, "Office of U.S. Foreign Disaster Assistance," <http://www.usaid.gov/who-we-are/organization/bureaus/bureau-democracy-conflict-and-humanitarian-assistance/office-us>, accessed on 6 November 2014.

[4]Joint Publication 3-0, *Joint Operations*, 11 August 2011.

[5]Centers for Disease Control and Prevention, "Estimating the Future Number of Cases in the Ebola Epidemic—Liberia and Sierra Leone, 2014–2015," 26 September 2014, <http://www.cdc.gov/mmwr/preview/mmwrhtml/su6303a1.htm>, accessed on 6 November 2014.

[6]Training and Doctrine Command Pamphlet 525-3-1, *The Army Operating Concept*, 31 October 2014.

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