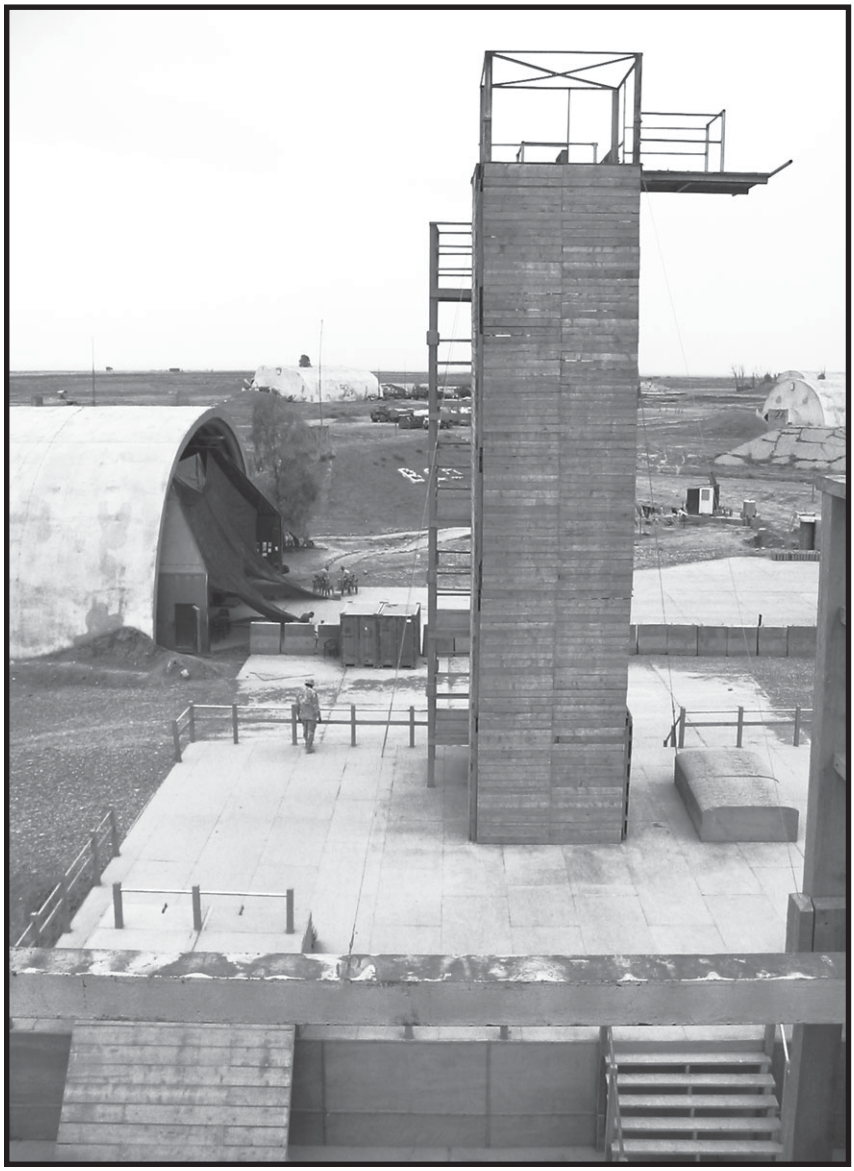
The Tale of Two Towers

By First Lieutenant Ryan J. Johnson

Charlie Company, 52d Engineer Battalion (Heavy), attached to 1st Brigade Combat Team, 101st Airborne Division, received the mission to build two rappel towers for the division's Air Assault School at Qayyarah West (Q-West) Airfield, Iraq. Charlie Company is an Army Reserve unit with headquarters and two platoons at Fort Carson, Colorado, and a detachment that includes earthmoving and maintenance troops located at Santa Fe, New Mexico. The company's 2d Platoon (with help from the maintenance troops) had six weeks to design and construct the towers. The goal was to replicate the tower at Fort Campbell, Kentucky, but resources and time would not permit that. Instead, the engineers used an existing tower for the main tower and pieced together a smaller tower from a container express (CONEX) frame and a radar dish housing.

Every rappel tower must have a solid foundation to withstand the forces that act upon it. The foundation of the existing tower was two flatbed railcars positioned side by side. The tower sat on two 9-inch steel I-beams that connected the rail cars. This foundation seemed solid, yet when the engineers first saw the tower, it was 45 feet off the rails. The railcars, and hence the tower, had to be moved back into position. Using three D7 dozers and a heavy expanded-mobility tactical truck (HEMTT) wrecker, the platoon moved the railcars back onto the rails without damaging the tower. At this point, Charlie Company's design team ensured that the tower was structurally sound before making any modifications.

The tower was fabricated using 6- by 6- by 1/4-inch angle iron with both pinned and fixed connections. The four vertical members were welded at the base to the 9-inch I-beams that connected the two railcars. The tower consisted of five sections that were 9 feet 10 inches by 8 feet 8 inches and connected by steel plates with bolted connections. Each plate consisted of eight 1/2-inch-diameter bolts, where two plates connected two vertical members. Cross-bracing and horizontal members between each section were 2- by 2- by 1/2-inch angle iron. After a visual inspection and mathematical structural analysis, leaders decided to use the existing tower as the starting point for the main tower.



Charlie Company, 52d Engineer Battalion, completed this 43-foot main tower for rappel training at Q-West Airfield, Iraq.

Many modifications had to be made. To prevent the tower from moving, the railcars were welded to the rails, the brakes were welded closed, and the tension cables were refastened and tightened. Before any construction could take place, the design team had to ensure that the tower would not tip over from the wind or the force of rappelling students. Leaders found the tower to be sufficiently supported by the railcars.

As these modifications took place, the design team worked to complete the tower. The first area to be addressed was the wooden stairs, which had to be strong and safe. A zigzag design with a landing between each flight ensured that the least space possible would be used. The vertical members were 4- by 6-inch rough-cut lumber joined by a 1/2- by 18-inch steel pole through the center of each member with a 2- by 6- by 18-inch lumber splice on each face. The stair risers and treads were cut from 2- by 10-inch material. At completion, the system consisted of 11 landings with 12 sets of stairs.

The completed 30-foot rappel tower has two free-fall sides.

The landing area needed room enough for the rappellers to land and for the belay person to maneuver. The problem was that the railcar was 5 feet off the ground and did not provide enough space for soldiers to maneuver. The solution was to build a platform on top of the railcar that would accommodate students and instructors. The design for the platform was similar to a deck raised off the ground, with reinforcements in the landing areas. The main deck rested on 4- by 4-inch studs spaced every 4 feet with 4- by 6-inch stringers and 2- by 6-inch floor joists. The joists were spaced at 16 inches on center except for the landing areas, which were spaced at 12 inches on center. The completed deck measures 45 by 58 feet and is enclosed by handrails, with stairs leading up both sides of the deck. Soil was pushed up along the other two sides of the deck so that soldiers would have adequate room to run off the ropes without fear of falling over the side.

After the tower, stairs, and landing areas were built, the top platform and sides of the main tower were constructed. Two sides of the tower were planked with 2- by 6-inch material for rappel familiarization. One side was to be a free-fall side that simulated rappelling from a CH-47 Chinook helicopter. The top platform had to accommodate six soldiers at a time, so each side had two sets of primary and secondary hookups. In addition, the free-fall side needed to extend at least 8 feet from the side of the tower to ensure that soldiers would not collide with the tower. Welders from the maintenance section constructed a top platform using salvaged materials. Five-inch I-beams were welded into place to mirror the shape of the existing top platform. The extension for the free-fall side was fabricated into this new platform, and then the entire platform was raised into position using a crane. Once the new platform was welded to the existing platform, it was covered with 2- by 10-inch lumber on its weak axis to provide a nonslip surface. To ensure safety, a double rail system was placed around the platform. These modifications completed the main tower and provided a good start toward completing the mission.

The next phase of the project was to enhance the rappel site by adding a second tower. The original plan included a 30-foot planked rappel side with a 20-foot inclined ramp to practice rappelling techniques. The material used was gathered from six radar dish housings. Each housing was 11 by 8 by 8 feet. The plan was to weld the housings together, then weld the ramp to the combined dish housing. However, the cadre arrived at Q-West and brought some changes to the project. They liked the main tower, but instead of a large inclined ramp protruding from the smaller tower, they wanted two smaller inclined ramps attached to the deck that had already been constructed.

The biggest change, however, was to have two free-fall sides on the 30-foot tower. The radar dish housings were

Charlie Company's maintenance personnel place the top platform of the main rappel tower.

discarded, and new materials were added. Charlie Company scoured through wreckage left behind from the first Iraqi war and found materials that would be much stronger. The main structural support of the tower is a 20- by 8- by 8-foot CONEX frame standing on end. Three sections of 6-inch-square tubing with 1/4-inch-thick walls made up the entire frame. This did not produce the required 30 feet of height, so Charlie Company used one of the radar dish housing units for the additional 10 feet. Even the design team felt it would be a tough job to stack the housing unit on top of the CONEX frame, but the plan came together ahead of schedule. The radar dish was welded to the frame, and reinforcement was added to support the structure. The company's maintenance troops worked many hours salvaging pieces of steel from other radar dish housings to use as reinforcement splices. In addition, they had to construct a stronger foundation to prevent tipping.

The only foundation for the CONEX frame that formed the base of the tower was the concrete it rested on. Its own mass would not be enough to support the structure once forces were applied to it, so a foundation was designed that would be structurally sound without sacrificing maneuvering space or height. The solution was to fabricate 15-foot extensions from each side of the tower and case the extensions in a concrete pad. Soldiers welded 5-inch I-beams to the base of the tower and placed 12 inches of concrete over the entire extension area. Now that the tower stood 30 feet tall, it needed stairs to take soldiers to the top.

The stairs were almost a mirror image of those at the large tower and went up in just a third of the time. The real difference in the second tower was the top platform. The cadre wanted two free-fall sides and no planked sides. The maintenance personnel had no problem fabricating a top platform that would allow four students to hook up at a time. Each free-fall side had primary and secondary hookup points with a bar running across the hookup point to simulate a CH-47 Chinook helicopter. The hookup points, each handmade so that a snap link could be inserted without damaging the rope, were also fabricated from scrap metal found at the Q-West Airfield. Customized fabrication was a recurring theme throughout the project due to the time constraints and lack of available materials. Charlie Company's soldiers had the ability and knowledge to fabricate all the parts needed to accomplish the mission.

Charlie Company had experience in tower construction from a previous mission for Joint Task Force-6, but the learning process was intense for this mission. However, the long hours and hard work paid off when the first class graduated from the Air Assault School at Q-West. When the school went back to Fort Campbell in December 2003, more than two thousand soldiers had earned their air assault wings while deployed to a combat zone in Iraq.

First Lieutenant Johnson deployed to Iraq in April 2003 with the 52d Engineer Battalion, Fort Carson, Colorado, which was attached to the 101st Airborne Division (Air Assault). He graduated from the United States Military Academy with a degree in civil engineering and is a graduate of the Engineer Officer Basic Course.