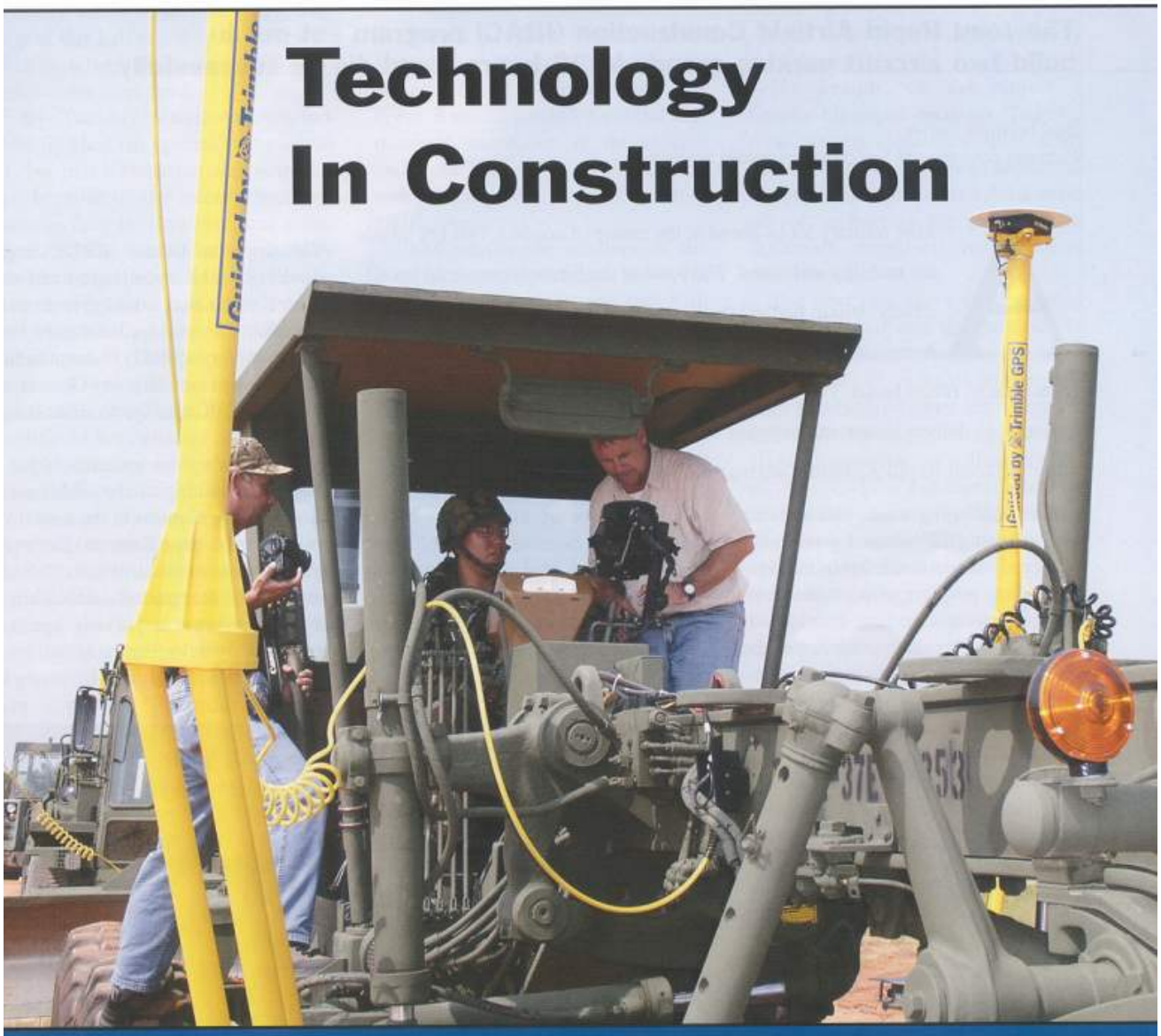
Associated Construction Publications
Reed Construction Data

www.acppubs.com September 27, 2004

Construction

Edition serving Maryland, North Carolina, South Carolina, District of Columbia, and Virginia since 1933

Technology In Construction



Bragg's Rapid Airfield Construction

FOCUS: Materials, Services, and Supplies Users' Guide

Ft. Bragg's
Rapid Airfield Construction

The Joint Rapid Airfield Construction (JRAC) program set out to build two aircraft parking aprons in 96 hours – and did so successfully.

By Christina Fisher.
Pictures courtesy of Spectra-Integrated Systems.

As the military looks ahead at the nature of conflict, two key words are mobility and speed. The force of the future is preparing for relatively small battles that require troops to move in quickly, demonstrate a show of force and then move onto the next conflict or, hopefully, return home. This would require the ability to land aircraft in remote locations to deliver troops and supplies as quickly and safely as possible, something the Joint Rapid Airfield Construction (JRAC) program has set out to do.

The JRAC program began with the idea of using GPS-based grade control equipment on earthmoving systems. Two projects using these technologies were conducted in 2000-2001. As the program progressed, the need to control dust to prevent helicopter brownout conditions in the Middle East became an issue. These conditions can lead to poor visibility for pilots and cause excessive damage to the engines. The U.S. Army and the U.S. Army Corps of Engineers, Engineer Research and Development Center (ERDC) began looking at soil stabilization and matting systems that would give them the capability to build a helicopter landing pad very quickly, later conducting Operation Brown Out at Ft. Campbell, Kentucky, to demonstrate and test the system.

Equipped with GPS control systems, the earthmoving equipment moves out.

From there, the research began to focus on taking these stabilization and matting systems to the next level, which was expedient taxiway and parking apron construction. The idea was to hit the ground and within 48 hours construct a parking apron to bring an airfield from a MOG 1 to a MOG 2. A MOG 1, or Maximum On Ground rating of one, is a plain airstrip with a single runway. A pilot can land a plane, turn it around on one end and park it, load or unload the plane, and take off. With a MOG 1 airfield, you only have the capability to have one plane on the ground at a time. With one plane at the end of an airfield, there is no room to land another plane.

By building a parking apron off to one side of the airstrip and bringing that airstrip to a MOG 2, one aircraft can be parked off the airstrip, freeing up the runway for another landing. This is what JRAC focuses on.

"It is important to understand that JRAC takes a relatively intact airstrip that only requires minimal grading or improvements," said Chad Gartrell,

Cutting and filling operations begin on apron 1.

research civil engineer with the ERDC. "Engineering units can already handle that with the equipment in their arsenal. The real focus for us is to take commercially available technologies and techniques and construct additional taxiways and parking aprons."

JRAC, then, provides a way for the soldiers to go into an area quickly, assess the condition of an airfield, then decide on the spot what options are available for that airfield to stabilize it and establish additional taxiways and parking areas as needed. Based on its assessment, a military unit can look at what options and materials are quickly available to build these additional areas in a short period of time.

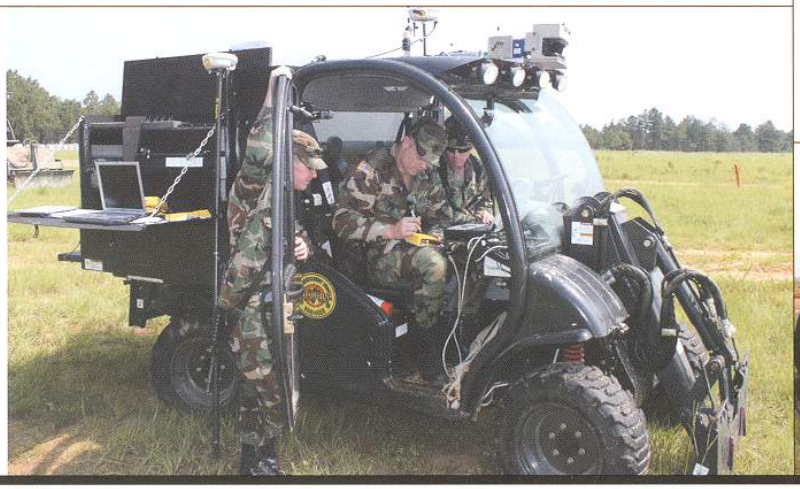
To demonstrate JRAC technologies, the ERDC chose Ft. Bragg, North Carolina, and Sicily Assault Landing Zone (ALZ). Chad explained that they chose Ft. Bragg because there are several unsurfaced landing strips there, and they wanted to mimic the soil conditions found over most of the earth's surface, about 70 percent of which is a sandy/silty material. The soil at Sicily ALZ fits this category. Furthermore, Ft. Bragg officials were very interested in being involved, and the soldiers of the 20th Engineering Brigade and the 37th Engineer Battalion were instrumental in carrying out the demonstration.

The objective at Ft. Bragg was to simulate a real-world scenario. Although the original plan called for planes to drop in materials from the air as they would in a real situation, the Iraq war and the commitment of these aircraft elsewhere made this difficult to arrange. Therefore, all materials were brought to the site as if they had been brought in ahead of time.

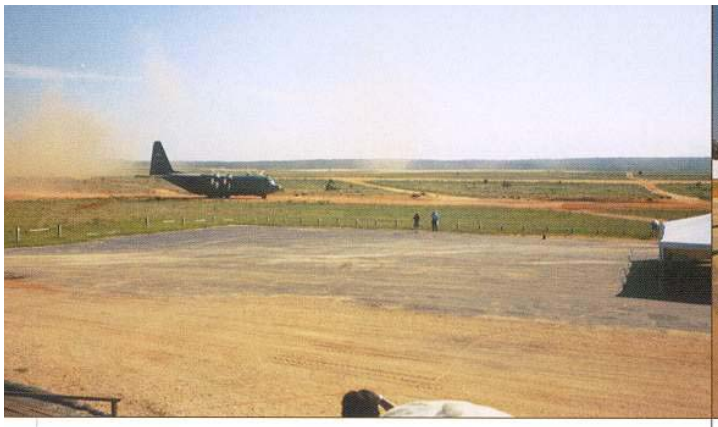
Key to the JRAC program is a prototype recon vehicle known as the RAVEN – Rapid Assessment Vehicle Engineer – that is a modified Bobcat Toolcat 5600 utility vehicle. Onboard the RAVEN was a Real Time Kinematic (RTK) GPS survey system provided by Trimble that included all of the equipment needed to provide survey grade accuracy for the collection of the topographic data that is needed for the design.

Also onboard the RAVEN was a rapid soils assessment kit developed by the ERDC. This kit included a microwave, small sieve tower for the soil and determining different gradations of soils, tools for collecting samples, and an electronic balance.

The RAVEN also came equipped with two Panasonic tough book computers onboard. One of these was in the cab and stored, among other software programs, Trimble's TerraModel



Left: The RAVEN prototype recon vehicle. Below: Soldiers work with the rapid soils assessment kit.



A C-130 lands at Sicily ALZ...

...and successfully parks on apron 1.

Design program. Once a topographical map of an area was obtained, this information was downloaded into the TerraModel program. From there, apron templates were placed on the topographical map in TerraModel to determine which type of apron to construct. Ultimately, JRAC will be able to access a catalog of apron designs and apply them based on the topography of the area and the demands of the mission; for example, a three-aircraft apron, a two-aircraft pad, side by side or across the strip from each other.

The other computer was mounted outside the vehicle's cab within a cabinet containing the soils classification kit. This computer has the programs necessary for soils classification. There is also a satellite communications system onboard. The goal here is to be able to call the command center, relay the soil analysis, and determine soil stabilization and design options for the mission's requirements. This equipment gives the command center real-time information about conditions. Small cameras mounted at the front and back of the cab give the command center real-time pictures as well.

Working with Autonomous Solutions, Inc. in Wellsville, Utah, the RAVEN was equipped with autonomous controls, a camera and a laser to scan the topography while driving. This combination allows an operator to be in a safe location while mapping an area and discovering any terrain gaps that might exist.

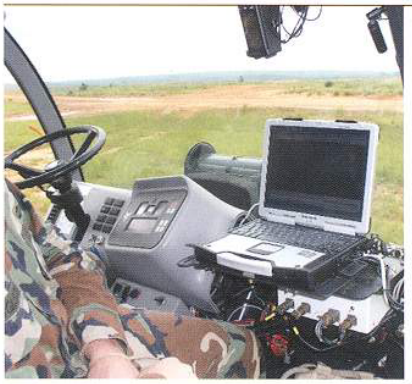
For the JRAC program the autonomous feature of the RAVEN offers two benefits, explained Chad. When an assessment team is unable to enter a hostile environment to gather terrain information, the RAVEN can be dropped in and a soldier can remotely drive the vehicle and do some preliminary mapping and information gathering from a secure location. Secondly, when the RAVEN is outfitted with an automated Dynamic Cone Penetrometer (DCP), soil strength can be remotely assessed as well.

Taking the concept of autonomous operations even further, the RAVEN could be programmed with GPS coordinates so that nobody would have to operate the vehicle at all. Once an area was mapped out with GPS coordinates, the RAVEN could then be instructed to drive a path and conduct a DCP test every few feet. "Nobody would have to operate it – even in the rear," said Chad. "Assuming the RAVEN doesn't meet with any obstacles or gets destroyed, it will drive the path."

Once site assessment is complete, construction is ready to begin, and again the RAVEN is equipped to handle it. "At Ft. Bragg, we used the RAVEN with a forklift attachment to move matting material," said Chad. "The vehicle progresses along with the mission and easily transitions from one role to another, which makes it unique."

The mission of the Ft. Bragg demonstration was to construct two parking aprons and land and park a C-130 on them within 96 hours from the beginning of the site assessment phase. The clock started ticking at midnight on Sunday, July 11, when, using night vision goggles, soldiers began with a site survey and calibration of equipment. At the same time, soil samples were collected. By daylight, a complete topography and site design was created, and soldiers began classifying soils and analyzing moisture content.

By mid-morning on Monday, apron designs were underway and soon completed, with clearing and grubbing on the first apron underway by lunch. By 2:30 p.m., apron 1 had been cleared and work began on apron 2, which was completed by early evening. By 8:00 p.m., cutting and filling operations were in progress – cutting on apron 2 and filling on apron 1. All of the grading and earthmoving equipment – a Cat 130G motorgrader, a Cat Deuce (Deployable Universal Combat Earthmover), and a Cat 615 scraper – used Trimble's SiteVision GPS control systems, which was critical for working at night and meeting the



The RAVEN's cab. The computer stores the TerraModel program and apron templates.

48-hour deadline.

By 2:00 a.m. Tuesday, it was determined that a two-system design would be used on apron 1, consisting of a multi-purpose landing mat on half the apron and a stabilization system composed of Type 3 cement and polymer mixed together and compacted on the other half. A polymer coating would be also be sprayed on top of this half of the apron to seal it. Mat installation began first while fill operations continued.

By Tuesday afternoon, soldiers had finished fill operations on apron 1, but mat installation was suspended because of the intense heat and soldier fatigue. However, soil stabilization was started on apron 1 by another small crew. Mat installation resumed by 8:00 p.m. Tuesday, and all the matting was installed by 11:00 p.m. By 3:00 a.m. Wednesday, apron 1 was finished, meeting the goal of completion of one apron within 48 hours.

After getting some sleep, soldiers resumed stabilization operations at 11:00 a.m. Wednesday morning on apron 2. Apron 2 used only a cement and fiber stabilization system. After this stabilization operation was completed, the apron was coated with another layer of polymer. Work was completed by 4:00 a.m. Thursday and a U.S. Air Force Special Tactics Squadron (STS) from Pope Air Force Base conducted a careful and thorough inspection of the airstrip and both aprons. A C-130 landed and parked safely at approximately 10:00 a.m.

> The prototype recon vehicle known as the RAVEN – Rapid Assessment Vehicle Engineer – is a modified Bobcat Toolcat 5600 utility vehicle.

Chad credits the soldiers of the 20th Engineering Brigade, the 412th Engineer Command, and the 37th Engineering Battalion with making things happen. "These were young men with limited construction and machine operating experience, but we heard nothing but good feedback from them. They found the JRAC system to be fairly simple and easy to understand."

The vendors on the project – Spectra-Integrated Systems, Trimble, Autonomous Solutions Inc., CMI Terex, Bobcat, Midwest Industrial Supply, and others – also did a great job of supporting the project with materials, supplies, maintenance and training.

The next two years will be spent doing research and test sections to develop the materials and systems to handle a C-17, a much bigger aircraft that is three times the weight of a C-130. Pending funding, the next JRAC demonstration will be in 2007 at a C-17 capable airstrip. Meanwhile, the Air Force's Special Tactics Squadron will be tracking take-offs and landings at the Sicily Assault Landing Zone, providing useful data on the stability of the two apron systems. The ERDC is also studying the application of JRAC in cold environments.

"The demo tried to do things as realistically as possible," said Chad. "We had to get it done regardless of what occurred. We had a few hiccups to deal with, but in the real world that will happen.

"It's important to remember that this was a two-system test. In real life you may construct only one apron, which would speed up the process. If you have good, stable ground, you can just clear an area, compact and lay mat, taking raw property to a parking apron in 48 hours. Using conventional methods, this would have taken two to three weeks, not two to three days." ■

Below: Soldiers from the 37th Engineering Battalion and 20th Engineering Brigade were instrumental in the success of the demonstration.