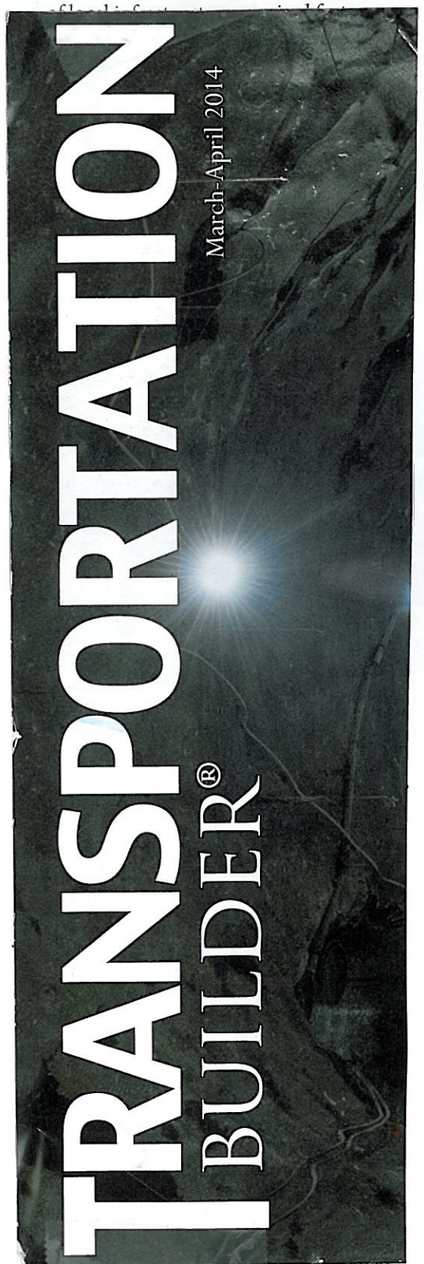

There were other concerns: the lack

to achieve the zero injury record that the project enjoyed."

Photos courtesy of Michigan Tech Research Institute.

DRONE: UNSURFACED ROAD CONDITIONS ASSESSMENT SYSTEM

Drones, or more precisely unmanned aerial vehicles (UAVs) have made recent headlines for everything from Afghanistan to border patrol to deliveries from Amazon.com. But in a first-of-its-kind application, the Michigan Tech Research Institute (MTRI) has developed a UAV system using high-resolution photography and 3D modeling to perform assessment of unpaved roads, which according to the Federal Highway Administration (FHWA) account for nearly a third of the more than four million miles of road in our national transportation infrastructure.

Many of those 1.3 million miles of unpaved stretches—relied upon by rural residents to reach their homes, jobs and mail, farmers going to commodity markets, and kids to schools—fall to the responsibility of local governments and transportation agencies.

The cutting-edge technology of the Unsurfaced Road Conditions Assessment System (URCAS) provides local road managers with information needed for decision-making about maintenance and repairs. Using the URCAS portfolio of detailed information and imagery lets them analyze damage including potholes, washboarding (corrugation), crown damage and rut detection—and for a pittance of the cost otherwise. The technology translates to cost of analysis about $1 per mile, or a fraction of the rate even for the least expensive Pavement Surface Evaluation and Rating (PASER) method at approximately $8 per mile.

The ultimate goals of the research-and-development program, funded by the U.S. Department of Transportation's Commercial Remote Sensing and Spatial Information Program, were to design, build, and test a prototype remote sensing-based unpaved road condition assessment system that can compete with manual methods, and to incorporate such measurements into a decision support system (DSS) to aid in managing an unpaved road network.

"We looked at a few different ways to do it, and a UAV system gives us the ability to rapidly gather the imagery needed to understand the road conditions and distresses. Managers were looking for a way to accurately assess the severity and amount of problems," explained Program Director Colin Brooks of MTRI. "Most often we're talking about gravel roads, so to be able to see those kinds of distresses, we're looking at checking changes in the crown of the road. You need pretty high-resolution data to do that. We fly a hexacopter at 80 to 100 feet high, so at a low altitude with a very high-resolution camera to make a 3D image of the road surface."

All told, the system requires the UAV platform to collect the data—a hexacopter is both easy to operate and very stable in flight—using an off-the-shelf digital camera as its sensor for the two pieces of software that form the remote sensor processing system—one to collect that data, while the other detects the location and severity of the distresses.

Meeting the parameters of the industry-standard "Unpaved Road Condition Index" requires only about five minutes of flight time for gathering the sample segments. The Federal Aviation Administration (FAA) is expected to finalize federal regulations in the next 18 months making it commercially practical throughout the country.

"Where we found the most interest is from administrators responsible for large amounts of unpaved roads, easy to see from the air and vital to the local infrastructure," Brooks explained. "South Dakota has counties where nearly the entire road network is unpaved. This offers a more rapid and affordable way to be proactive rather than reactive. They can make this part of [their] standard assessment basis, either by acquiring the equipment to gather the data themselves, or by having it provided as a service. We plan to be flexible and provide either means."

The remote-sensing platform has been verified in seven sites and counting in Michigan, Iowa and Nebraska, with testing this spring in South Dakota, giving a whole new meaning to being a flyover state.

"We are interested in this kind of opportunity to reach our work out to a larger audience," said Brooks. "We are very excited in its capabilities and think that rapid UAV-based mapping of unpaved roads is a good place for this new technology to be applied in the nearer term. We also think that these methods could be applied to paved roads and bridges, especially as technology develops, prices drop, and people feel more comfortable with UAV-type infrastructure assessment tools."