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Corridor Business Journal

\$2.00 | A LOCALLY OWNED BUSINESS WEEKLY IN IOWA'S CREATIVE CORRIDOR | MAY 3 - 9, 2021

## Autonomously yours

Crystal Group helping pioneer vehicles of tomorrow today



VSI Labs Vice President of Business Development John Cooper explains the features of an autonomous test vehicle at a stop at Crystal Group's Hiawatha facility. Crystal Group manufactures the AVC0161 rugged computer VSI officials called "the heart" of the vehicle. CREDIT KATHARINE CARLON

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When the COVID-19 pandemic shut down conferences and industry events, VSI Labs, a leading researcher of active safety and autonomous vehicle (AV) technologies, refused to hide away the latest industry advances in a garage.

Instead, the Minnesota-based testing organization took to the nation's highways,

launching a series of cross-country drives to showcase its state-of-the-art autonomous test vehicles, highlight various vendor technologies and collect data for those same partners on performance under different conditions and driving environments.

Last week, VSI's latest 2,500-plus mile road show – the Automated Trip South from Minneapolis to Austin, Texas and back – brought two specially outfitted Ford Fusion Titanium hybrids to the Cor-

ridor, offering a peek at the future of driverless automation.

The "beating hearts" of the vehicles? The AVC0161 autonomous vehicle computer manufactured at Crystal Group's Hiawatha headquarters, which is being deployed in defense, industrial and commercial settings as part of a futuristic – but coming – driverless future.

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## MANUFACTURING



Industrial Program Manager Brian Hamed and Technical Director Micah Snodgrass, both of Crystal Group, welcomed VSI Labs to its campus last week as part of that company's Automated Drive South to test and promote autonomous technology, including Crystal Group's rugged computer. Inside the vehicle, a monitor displays data captured by front and back cameras and LiDAR. CREDIT KATHARINE CARLON

## CRYSTAL

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Founded in 1987, Crystal Group is a maker of rugged high-performing computer hardware that delivers real-time, seamless, secure data processing, storage and transmission in what the company calls "unpredictable, unmanned and un-

forgiving environments."

According to Brian Hamed, Crystal Group's Industrial Program manager, the high-end computing device found a following in the defense, industrial and commercial space thanks to its liquid-cooled ability to support the rapid processing units needed to capture and prioritize massive amounts of real-time data recorded by onboard sensors, radar, LiDAR (Light

Detection and Ranging) and cameras. The computer allows for 360-degree situational awareness and split-second decision making in automated vehicles.

"One thing we're trying to do is grow our autonomous business. It's pretty exciting to see it in a vehicle, actually," he said of the test drive, one of several VSI Labs has taken throughout the pandemic. "To actually see the drive, to see some of the different databases and systems that hold information you can see on their website... it's really interesting to see and exciting for us, as a company and as employees who helped build it and support that equipment."

Several dozen Crystal Group employees came out last week to see the result of their efforts in a test car full of autonomous vehicle innovations. In addition to Crystal Group's ruggedized computer, VSI Lab's current demonstration vehicle features RTK Navigation from OXTS, LiDAR from Ouster, thermal cameras from FLIR, signal phase & timing from Bolton & Menk, simulation by Siemens, tire grip indicators from Nira Dynamics and HD maps from HERE HD Live Map, to name just a few.

The vehicle – not quite capable of driverless action yet – offers adaptive cruise control that adjusts speed to maintain a safe distance between cars; path following, which synchronizes localization data with a target path or HD map to calculate trajectory, acceleration and deceleration; and automatic emergency braking that engages immediately when it detects a pedestrian. It also features map-based lane changing, INS localization, point cloud localization, vision- and map-based lane keeping, highway interchanging via high-definition maps, and object detection, tracking and avoidance to avoid collisions.

**What does it mean?**

"What they're trying to do is replace the human driver," said Micah Snodgrass, technical director at Crystal Group, adding vehicles can't do that – at least, not yet. "Nobody's 100% of the way there yet, right? So

it's taking over most of the normal boring driving function. Think if you were a driver's ed instructor. You still have the main driver there with their foot ready to hit the brake pedal. But you have a teenager sitting there controlling the vehicle under normal, non-life threatening, non-weird, non-bad-weather situations. So, it's watching the road, noticing lane markers. The computer might not be able to handle some construction zones. But for the most part, it'll take a normal trip from point A to point B as long as there's nothing unusual."

John Cooper, vice president of business development for VSI Labs, said his company's cross-country test drives aren't conducted in service of building the perfect automated vehicle. It's all about testing various systems on VSI's open architecture.

"It allows us to plug and unplug LiDAR X for LiDAR Y, camera A for camera B, radar X for radar Y," he explained. "We have a real open architecture, and the core of that architecture right now is, we're happy to say, is the Crystal rugged machine... We just know when we plug it in. It works."

Phil Magney, founder and president of VSI Labs, said using Crystal Group's computer as a base to test driverless vehicle functions for its coast-to-coast awareness campaigns was a natural.

"We need stuff that is really rugged and can handle the harsh conditions," he said. "When it's 95 degrees, and we're at the test track, and we're doing emergency braking all day long, and just slamming on the brakes... time after time, after time, any other computer, any typical computer would fail under those conditions. This computer is very, very ruggedized in its ability to handle shock, vibration and massive temperature fluctuations. It's a water-cooled system, so it's probably the best computer platform you could have for doing R&D of these technologies. And it's got a ton of computing power in it, it's got dozens of processors and tons of memory and storage and that sort of stuff. It's really core to the whole system."

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