9-2012

# CAN Bus Technology Enables Advanced Machinery Management

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**Abstract**
A controller area network (CAN) provides the central communication link on virtually every modern agricultural machine. Tractors, combines, and other powered vehicles use CAN Bus technology to connect multiple individual electronic control units (ECUs) and exchange sensor and control data. The advent of CAN technology has improved vehicle diagnostics, simplified electronic control design, and enabled advanced implement management through standards such as ISOBUS.

**Keywords**
Controller Area Network (CAN), bus, ECU, ISOBUS, Iowa, CyCan, Corn stover

**Disciplines**
Agriculture | Bioresource and Agricultural Engineering

**Comments**
This article is from *Resource Magazine* 19, no. 5 (2012): 10–11.

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In addition to serving the primary needs of electronic design in agricultural machinery, CAN Bus systems can also provide high-precision machinery performance and logistics information. In agriculture and bioenergy applications, parameters for machinery performance and management are widely used for equipment sizing and cost estimation. Direct measurement of CAN Bus metrics, including average operating speed, engine load, implement engagement, and fuel consumption, can help supply chain managers design equipment solutions that maximize field and transport efficiency while lowering equipment costs.

## The CyCAN data logging platform

With that in mind, a research team at Iowa State University has developed a series of technology solutions to directly capture CAN Bus machinery management parameters. The CyCAN data logging platform is a standalone ECU specifically aimed at quantifying the key parameters of agricultural machinery. CyCAN data loggers connect directly to the ISOBUS diagnostic port in the tractor cab and provide direct access to all available CAN Bus information. The CyCAN data loggers can also merge this CAN data with GPS information to support spatial analysis of machinery systems.

## Capturing essentials and more

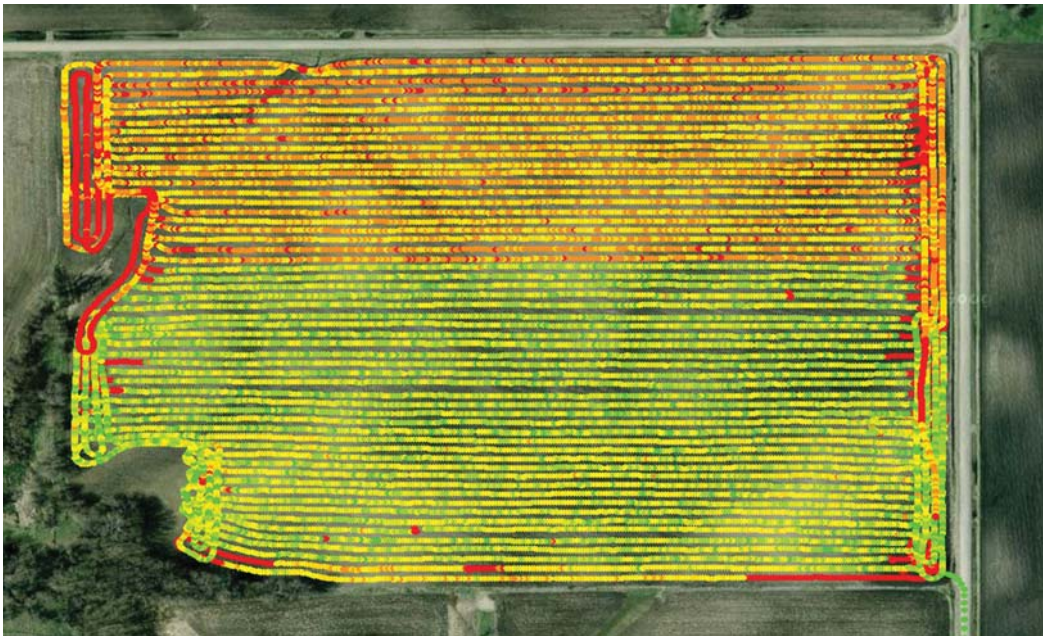
To date, this technology was used to capture high-precision logistical data on over 6,000 ha (15,000 acres) of corn stover biomass production. The machinery operating state is determined automatically based on a matrix of CAN information. For example, the ground speed and PTO speed of the tractor used to bale the biomass can be analyzed to distinguish between in-field productive time, in-field downtime and maintenance, and over-the-road transportation time. Additionally, by capturing ISOBUS virtual terminal messages, information from ISOBUS balers, such as bale drop location, bale pressure, and bale length, can be captured to create yield maps of the harvested biomass.

## More advantages

The automated and deployable nature of this technology also allows researchers to determine averages and distributions of machinery performance within a given supply chain. By integrating machinery performance into their event modeling systems, researchers can develop risk and cost distribu-


**This CyCAN data image logger connects to the ISOBUS diagnostic port and provides direct access to all available CAN Bus information.**

tion models for biomass supply chains and accurately model the impacts associated with modification to the supply chain. Additionally, analysis of engine loading provides a direct assessment of the power requirements for specific tractor-implement pairs and can be used to optimize tractor sizing for a specific application. The integration of GPS information allows all of these performance indicators to be compared for a variety of soil and terrain conditions.



**GIS analysis of fuel consumption while baling corn stover at two rates in a single field. Green indicates high fuel consumption, and red indicates low fuel consumption.**

The accessibility and standardization of CAN Bus technology has opened up tremendous opportunities for machinery performance researchers and will serve as the platform for new advances in machinery management and agricultural supply chain logistics. The possibilities are just beginning to be explored.

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**CAN Bus information can enable detailed assessment of new machinery systems, such as single-pass harvesting of corn grain and stover.**