

# Emerging Standards for Highly Automated Agricultural Machines



CASA FARMSAFE!2012

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## *Send in the Drones!*

- Current production agricultural machines now possess a high degree of electronic (fly-by-wire) control.
  - Engine
  - Transmission
  - Hitches
  - Hydraulics
  - Steering assist

- As a result, computers control many of a machine's functions—that allows automation
- Recent automation developments include:
  - Automatic steering
  - Automatic headland sequences
  - Tractor / implement sequences
  - Automatic headland turns

# Automation: Ag Industry Status

- Imminent developments in automation
  - Synchronized vehicle movement: one machine coordinates the movements of a second machine
    - Two machines, two operators
      - John Deere Machine Sync
      - CaseIH V2V
    - Two machines, one operator
      - Fendt GuideConnect



# JD Machine Sync

- [http://www.deere.com/wps/dcom/en\\_US/products/equipment/ag\\_management\\_solutions/guidance/machine\\_sync/machine\\_sync.page](http://www.deere.com/wps/dcom/en_US/products/equipment/ag_management_solutions/guidance/machine_sync/machine_sync.page)

- <http://caseihharvesting.com/vehicle-2-vehicle-concept-from-caseih>

# Fendt GuideConnect



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# Fendt GuideConnect

- <http://youtu.be/aBatgn2JJWs>



## Autonomous machines in development!

- Kinze Autonomy Project
  - Tractor and grain cart
  - Tractor and planter
- John Deere orchard tractor

# Kinze Autonomy Project

- <http://www.kinze.com/>

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# John Deere Orchard Tractor



- NWIP for the Highly Automated Agricultural Machine Safety Standard (HAAM) has been approved by the US TAG and submitted to ISO TC23 SC3.
- It appears this standard may proceed under the Vienna agreement (co-designation as an EN standard)
- International voting on the NWIP closes 12 October 2012.

- **Scope (first proposal)**

This Standard specifies safety requirements for highly automated operation of agricultural tractors, their implements, and self-propelled agricultural machines.

To ensure the safety of such systems, this standard specifies requirements for general operation, audible and visual indicators, obstacle detection, and machine motion.



- General Requirements
  - Visual alarms
  - Audible alarms
  - Remote operator interface
  - Machine mode switch
  - Machine occupant control
  - Remote stop control
  - Machine overrides
  - Operational speeds

- General Requirements (continued)
  - Communication system
  - Positional requirements
  - Working area—Definitions
  - Maintenance shutdown
  - Perception system
  - Perception system tests
  - Machine guarding system

- Highly Automated Operational Procedures
  - Engine start
  - Motion initiation
- Manual operation
  - Pendant control
- Instructions
  - Operators manual
  - Safety and instructional signs

# Acknowledgements

- Photos are from the following websites:
  - <http://www.deere.com>
  - <http://www.caseih.com>
  - <http://www.kinze.com>



THANK YOU

Merci

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