Association of Equipment Manufacturers

NIOSH Automation Health & Safety Partnership | 08.17-18.2021

Automated Machines Coordinating Committee (AMCC)

Todays Topics

1) Safety & Product Leadership
2) Genesis of the Group
3) Current Status
4) Committee Objectives
5) Sector Integration

Safety & Product Leadership

Safety & Product Leadership

- Promote the disciple and best practices concerning safe product design and use
- Growing market access through safety, sustainability and shared solutions
  - Safety – We coordinate several product-specific and industry liaison safety efforts on behalf of our members.
  - Regulatory – We serve our members' needs by communicating worldwide standards and regulatory developments.
  - Technical – We work closely with our members to navigate the many product-specific and broad-based technical issues.

AEM/AMCC Value

“AEM facilitates Technical Committees on the many various industry sectors that allow members to discuss and inform on standards and regulatory activity in many areas of the world. It **allows for pooling of knowledge** on these subjects.” – AEM Member

Genesis of the Group

Member Statement

"What is needed is an industry forum outside of Standards and Regulatory Groups to **work on** and discuss the technical concepts surrounding autonomy." – AEM Member

Safe Product and Design Use

Promote the discipline and best practices concerning **safe product design and use.**

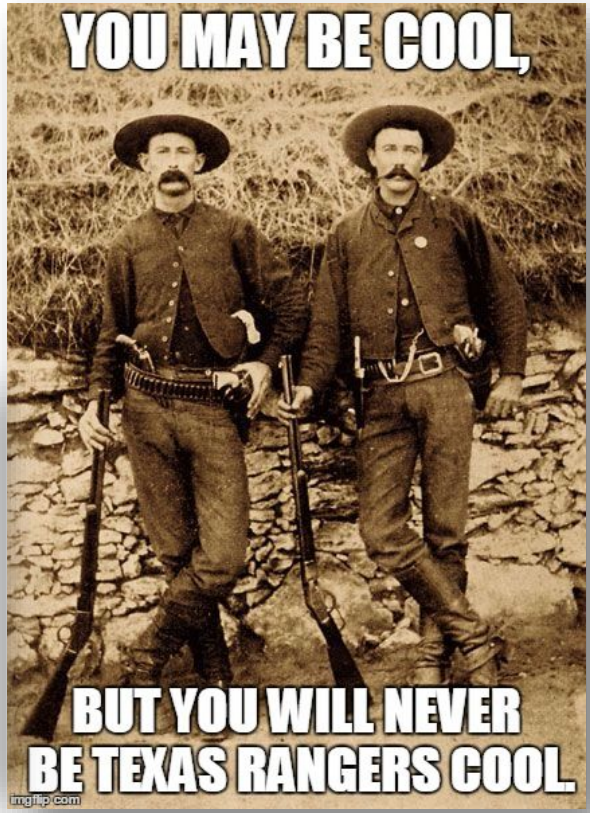
- ***All sectors need to overcome:***
  - ***Topography (water)***
  - ***Degraded visual environments***
  - ***Underfoot conditions***
  - ***EMF interference***
  - ***High Speed Communication***

“DC security robot quits job by drowning itself in a fountain”

Wild West

This group brings opportunity that others do not

- Ability to **coordinate** activity
- Prevent resource **duplication** in standards development throughout **all AEM sectors**
  - Group representation from **all sectors and SDOs**
  - Diverse perspectives



Current Activities

OECD - Organization for Economic Co-operation and Development

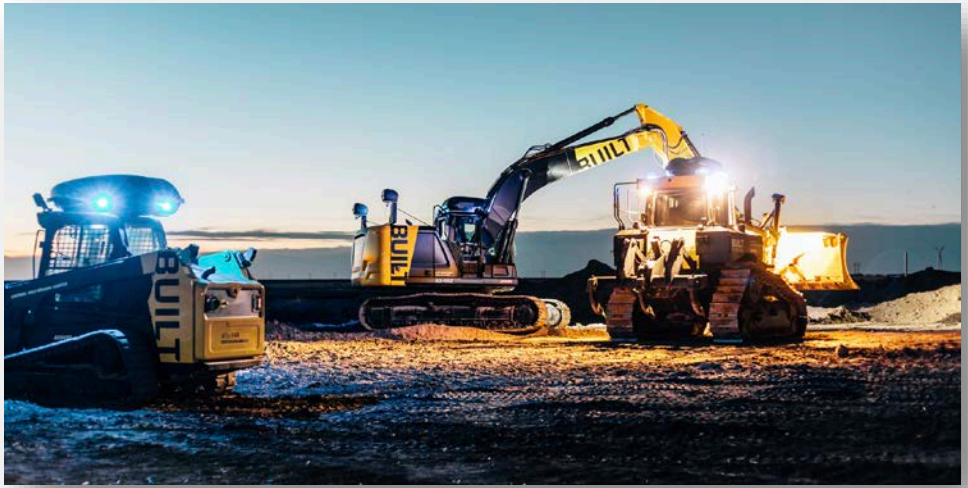
Meeting in Paris, 25-26 February 2020:

- Approved the action to set up a Sub-working Group (SWG) on “Agricultural Robots” (tractors, machinery) which will last for two years.
- Mandate
  - To **exchange information** on actual developments in agriculture, industry, research, etc
  - To **identify issues** hindering the development and use of this technology in various use cases (on global or regional level)
- The purpose of this SWG is **NOT to draft or to prepare** the drafting of OECD codes.

ANSI - American National Standards Institute

Automated/Autonomous Standards Coordination for Off-Road Machines Forum

- The forum is intended to address the following topics:
  - **Review** the potential autonomous applications in agriculture and earth-moving machinery
  - **Discuss** current progress with autonomous technology
  - **Define** future challenges for autonomous systems
  - **Discuss** global coordination: AEM, CEMA, CECE, VDMA, etc.



AEF - Agricultural Industry Electronics Foundation

- Founded in 2008
- 8 major agricultural equipment manufacturers and 3 associations
- Over 220 member companies
  - Tractor Implement Management (TIM)
    - Framework for trusted communication
    - Increased productivity and job quality for the customers
    - Providing security and functionality based on ISOBUS
  - ATLAS – EU Consortium
    - 3 Year program – **funded** by the EU
    - Goal : To build an open digital service platform for agriculture applications

Global Technical Work for Autonomy

- ISO/TC 23/SC 19 Is administered by the German Institute for Standardization (DIN) work on ISO-18497: Safety of Highly Automated Ag Machines
- ITSDF B56.5-2019 Safety standard for driverless, automatic guided industrial vehicles and automated functions of industrial vehicles
- CEMA PT4 (*Europe*) is discussing a guideline for sensing and perception for highly automated and autonomous ag machines, that they would like to propose as a draft for a new ISO standard.
- 2019 the *Japanese* National Research Group presented a document to OECD.

  It was a guideline to ensure the safe operation of farming equipment, specifically autonomously driven vehicles or vehicles with robotic technology.
- 2021, CODE OF PRACTICE Agricultural Mobile Field Machinery with Autonomous Functions in Australia

Autonomy Standards

- TC 127/SC 2/WG 22 - ISO17757: Earth-moving machinery and mining — Autonomous machine system safety
- TC 127/SC 4 – NWIP 07334: Taxonomy and definitions for terms related to automated and autonomous machines
- TC 82/SC 8/JWG 3/TC 127/SC 3 - PWI 03502: Automated Mining Systems – Reference framework and architecture for advanced automation
- TC 82/SC 8/JWG 4/TC 127/SC 3 – PWI 03510: Automated Mining Systems – Specification of interoperability of teleoperated, autonomous, and manned mining
- TC 127/SC 3 – 15143-4: Worksite topographical data (Possible Blue-green lighting)
- TC 127/SC 2/JWG 28 – 21815-1: Collision Warning & Avoidance-General Requirements
- TC 127/SC 2/JWG 28 – 21815-2: Collision Warning & Avoidance-On-board J1939 Comms Interface

Autonomy Standards

- TC 127/SC 2/JWG 28 – 21815-3: Collision Warning & Avoidance-Gen Risk area and risk level
- TC 127/SC 2/JWG 28 – PWI 21815-4: Collision Warning & Avoidance-Swing, Rotate, Articulate
- TC 127/SC 2/JWG 28 – PWI 21815-5: Collision Warning & Avoidance-Articulation, Crab Steer, Trailer
- TC 127/SC 2/JWG 1 – PWI 23724: Emergency – Remote Stop
- TC 82/SC 8/JWG 2/TC 127/SC 2 – NWIP 23725: FMS Interface to Autonomous Haulage
- TC 127/SC 3/WG 16 – PWI 23870: General standard for secure high speed mobile data communication

White Paper

- **Distributed March 1**
- **Proposed Joint Working Group**
  - Taxonomy and Terminology
  - Definitions and Descriptions

AEM
Association of Equipment Manufacturers

Common Standard for Off-Road Autonomy

March 5, 2021

Dear Leaders of ISO Off-road Equipment Committees,

Off-road machinery applies a wide range of automated and autonomous operating characteristics— with greater levels of automation, integration and services developing each year. And, as manufacturers and component suppliers collaborate on new products and equipment, the need for consistent technical terminology across equipment sectors is seen.

Both the American National Standards Institute (ANSI) and the Association of Equipment Manufacturers (AEM) see similar and parallel work emerging in autonomy-related standards of different equipment sectors. As far back as December 2019, ANSI has reached out to AEM to help promote collaboration on autonomy standards wherever possible.

With this background, industry participants within AEM have identified an important opportunity. AEM suggests that ISO subcommittees, which are aligned with different off-road equipment sectors, work together to produce common autonomy terminology and taxonomy for all off-road equipment.

This content might be published as a stand-alone standard. A common standard can provide a number of advantages.

- Focus or conserve resources by preventing duplicate or contradictory standards.
- Provide manufacturers, component suppliers and government agencies a common language for a use in autonomy subject matter.
- Provide a consistent starting point for subsequent standards, for particular product types and applications.

To pursue such a standard, it is further suggested that a joint ISO working group be established to pursue this work program. The joint working group should leverage and promote the recent and current work of both

- ISO 18497-1 "Agricultural machinery and tractors — Safety of partially automated, semi-autonomous and autonomous machinery — Principles for design — Terminology" and
- The NWIP proposal from ISO/TC 127 "Earth Moving Machinery – Taxonomy and Definitions for Terms Related to Automated and Autonomous Machines"

Please review this with the leadership of your committee or subcommittees. We look forward to any feedback or further suggestions. Please provide what feedback you can by March 19.

Best Regards,

Jeff G. Jurgens

Jeff G. Jurgens, Director Product Stewardship

cc: TC 127, TC 23/SC 19, TC 195, TC 82, TC 82/SC 8, TC 110/SC 4

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AEM Congruent Work

- Ag Technology Leadership Group
  - High Speed Machine to Implement Connectivity
  - Vehicle to Vehicle Communications
  - Sharing of Machine Data
  - Broadband connectivity
- Digitization Task Force
  - Established to help OEM’s utilize technologies to drive efficiency
  - Help OEM’s reach end users, to encourage acceptance
  - Measure tech adoption and determine why there is reluctance
  - Quantify Tech based efficiency solutions – measure and gauge usage

Committee Objectives

Opportunities to Limit Redundant Work

Commonization of activities

- Create Whitepapers and “Guidelines”
- Streamlined standard development
- Leverage existing content

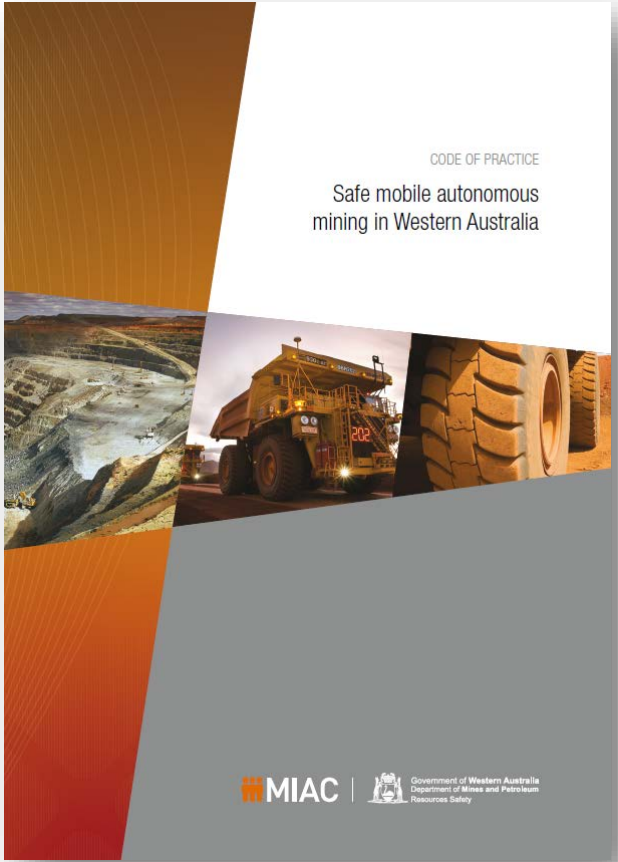
Potential Projects

- Perception Systems
- Interoperability
  - M2X
  - Enable compatibility for off road machines working on the same automated site
- Autonomous lighting/Beacon colors/Visual communication
- Cyber Security
  - Security vs. Privacy vs. Safety
  - Security Testing
    - Equipment
    - Network configurations
- On-board / Off-board safety systems

Requested Project

- OECD has requested a review and suggestions to AG
  - Australian Agricultural Field Machine Autonomy Code of Practice development

Crop Protection Australia



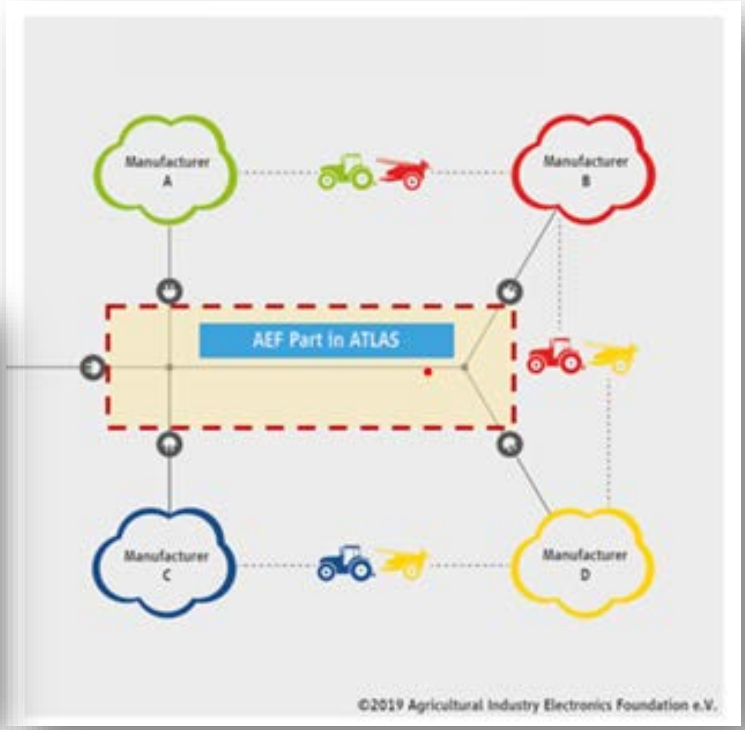
Sector Integration

Sector Overlap

- M2X communications
  - Machine to (?)
- Common sensor
- Terminology
- Taxonomy

ATLAS - Applied Cross Sector

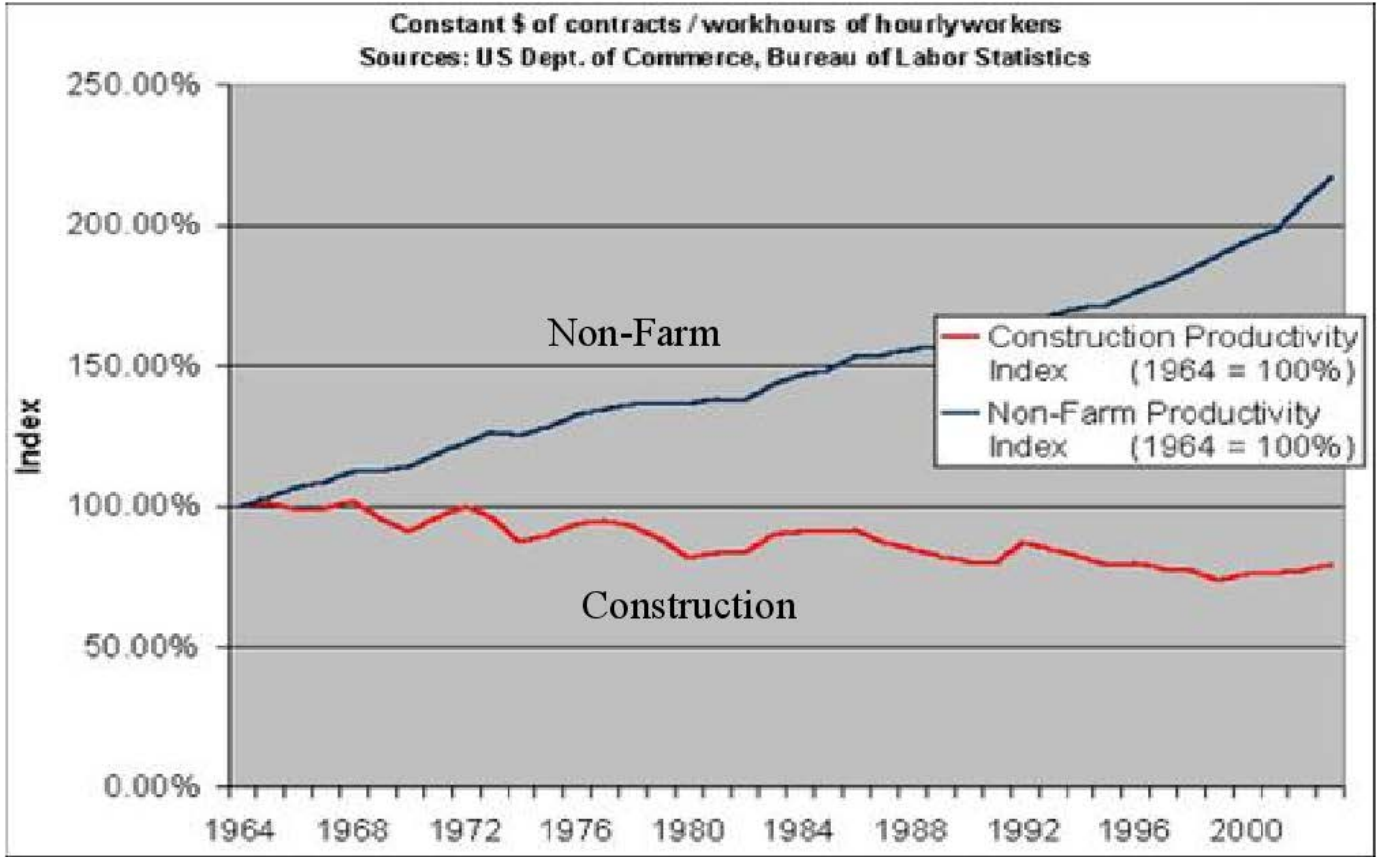
Data exchange between machines and systems used by the farmer/contractor has to be easy, protected and automated. And this is our next challenge in ATLAS as the team designs the Architecture.



AEF – ATLAS (applied cross sector)

- **Machine Tracking**: This use case aims to realize the interoperability between machines of different vendors and Construction Management Information Systems (CMIS). In this way, the user can determine the routes the machine can use, determine Earthmoving performance and collect up-to-date maintenance records of the machine.
- **Online Task Management**: This use case aims to reduce time and effort for managing sitework by enabling task orders to be planned in the CMIS and exchanged with the machines (of different vendors). Results are also transferred back to the CMIS allowing for real-time documentation of results.
- **Infield Sensor Connection**: This use case aims to help Contractors make informed decisions by providing them overviews of site information. Enabling real-time analysis of data from different in-site sensors and service providers, e.g. *weather data, topography of site, soil condition*, is instrumental in precision grading.

AEM Value


Constant $ of contracts / workhours of hourly workers
Sources: US Dept. of Commerce, Bureau of Labor Statistics
250.00%
200.00%
150.00%
100.00%
50.00%
0.00%
Index
1964
1968
1972
1976
1980
1984
1988
1992
1996
2000
Non-Farm
Construction
Construction Productivity Index (1964 = 100%)
Non-Farm Productivity Index (1964 = 100%)

Thank You

AEM

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