SESSION 1 – INDUSTRY 4.0 AND THE IMPACT ON AGRICULTURE 4.0
1.1 – Industry 4.0: Impact on Both Development and Product *Massimo Ribaldone* (SDF Group - Italy)
1.2 – Smart Logistic for Effective Process *Franco Oliaro* (ROJ - Italy)
1.3 – Agriculture 4.0 – The Challenges Ahead & What to Do About Them *Ulrich Adam* (European Agricultural Machinery, CEMA)

1.1 – Industry 4.0: Impact on Both Development and Product

Massimo Ribaldone (SDF Group - Italy)

What does Industry 4.0 mean for SDF Group? For SDF 4.0 means Industry but also Agriculture 4.0 Industry 4.0 has an impact not only on the process but also on the development of the product.

We went from drawing made by hands to what today is called Digital Communication through CAD 2D and 3D, Virtual prototype and Virtual Reality. By Digital Communication, the engineers can have access to a really high quantity of data.

The key points of 4.0 are Sensors, Connectivity and Big Data. Sensors always connected and able to send information about the status of the components, by the new high speed connectivity can have the possibility to connect and to be connected everywhere and continuously to an high quantity of data with fast and easy access. We are talking about Internet of Things, Iot.

An important topic we can achieve using all these key points is, for example, the Predictive Maintenance. By using new products generation, we can always be connected and check the conditions of the parts. When an imminent failure is detected, Service is alerted and the part could be automatically ordered to Spare Parts. This is a good example of interaction among Sensors, Connectivity and Data. To reach Predictive Maintenance can be very important: it is possible to reduce costs and risks. To be able to understand when a component is near to the failure and to change it before the final failure can reduce not only the costs of the repair, but above all can increase the safety of the operators.

The main impact of 4.0 on the development is the high quantity of data that engineers can have and the possibility to monitor the product during its entire life cycle. This allows engineers have many more data that can be useful to develop the product of the future. Seen all this, how will agriculture change accordingly? The farm of the future will be connected and smart. All the elements of the farm will be easily connected among them and the farmer will have all aspects of his farm under control and can intervene before a fatal failure occurs.

1.2 – Smart Logistic for Effective Process

by Franco Oliaro (ROJ - Italy)

ROJ is a SME, with more than 50 years of history, located in Biella with about 240 employees: it design and produce electronic systems.

Within its Group, specialized in textile machinery, ROJ has always distinguished itself for its typical Italian creativity and independence.

In 2013 two important projects were started: one in the Mechatronics for Agriculture, focused on systems and electronic motor drives designed to control the precision planters; the other, for the internal logistic improvement, was initiated with the aim to better control the material flow according to some of the principle that today are recognized under the name of Industry 4.0.

The initial situation saw different types type of materials incoming in different places and different models of flow for different processes.

The objectives were to reduce the material handling, to reduce the inventory failures, to implement flexibility with discipline, to find one place for everything and everything in its place, to set a FIFO rule and to implement the material traceability; in one few words: a smart Logistic system, integrated with the ERP system.

The actual solution is based on the introduction of the “Logistic Package” in the ERP system integrated with three “departmental software”, able to control “physical” items, the “loading units”, which physically contain the materials and logically “contain” the information related to the same material (p/n, S/N, quantities, approval status, process steps…): the material with its “loading unit number” bring forward in the process its own information.

1.3 – Agriculture 4.0 – The Challenges Ahead & What to Do About Them

Ulrich Adam (European Agricultural Machinery, CEMA)

Agriculture 4.0 is as a huge promise and a tremendous opportunity for the farming community and agricultural technology providers. The change driven by digital technology uptake in agriculture will likely be fast, complex, and profound. The benefits in terms of higher resource efficiency, greater environmental protection and more advanced levels of automation in agricultural production processes are expected to be substantial. The higher in-depth knowledge of processes and the abilities to act accurate and swift might be a trigger to a fundamental change of those very processes.

However, taking a serious look at the future roll-out of Digital Farming, it is evident that a number of major challenges lie ahead: for instance, in the aim to create seamless connectivity and interoperability, success will depend on how quickly it will be possible to connect all relevant devices (machines and systems) due to developments in infrastructure, common languages and suitable APIs and thereby enable them to mutually exchange data to FMIS, cloud, and service platform. Looking at the uptake by users, avoiding overly complex data ecosystems and promoting ease of use in systems has been identified as one of the critical barriers for access to Digital Farming technologies (apart from cost). In terms of the sensitive question of data ownership, clear rules and practices will need to be established with regards to the control, access, and portability of data.

In light of these challenges, the paper will present and discuss CEMA’s views and activities to allow the provision of comprehensive digital services for entire production processes and farm entities. In so doing, the paper will briefly discuss three different aspects: firstly, industry-led initiatives to promote connectivity, interoperability, suitable communication technologies and ease of use in vehicles and systems. Secondly, the strong need for multi-stakeholder action, particularly the cooperation with researchers and the farming community to promote information about and trust in digital technology. Finally, the strong enabling role that CEMA believes European governments and policy-makers can play to ensure an inclusive, successful and speedy digital transformation in agriculture by strengthening digital infrastructure in rural areas, making public data available, providing public investment support for digital technologies, granting research funding, and setting appropriate, balanced regulation.

SESSION 2 – ISO BUS: PRESENT SITUATION, PROBLEMS, POSSIBLE SOLUTION
2.1 – ISOBUS: State of the Art and Future Directions *Peter Van der Vlugt (*Agricultural Industry Electronics Foundation e.V., AEF Isobus)
2.2 - ISOBUS for Trailed Sprayers – Implementation and Experience *Willy Peeters* (John Deere Fabriek Horst – Nederlands)
2.3 – ISOBUS: the Industry Perspective *Marcello Mongiardo* (CNH – Italy)

2.1 – ISOBUS: State of the Art and Future Directions

*by Peter Van der Vlugt (*Agricultural Industry Electronics e.V., AEF Isobus)

Part 1 (Introduction and short history)

The introduction of ISOBUS products into the market in the mid-2000s didn't go in an easy way. Equipment manufacturers were taking different approaches in engineering interpretation since the ISOBUS standard was really complex and written from a theoretical point of view in the ISO working groups. Also naming of ISOBUS products and marketing information were confusing to end-customers and dealers. This unstructured approach and the lack of proper conformance testing was the reason for founding the AEF back in 2008.

Part 2 (AEF and ISOBUS Today; State of the Art)

Since then, AEF has grown to a mature and independent Industry Foundation with over 200 members, offering a broad range of Guidelines, Software tools and Products to overcome the mentioned problems. This offering to it's members consists of the AEF Conformance Test, the AEF ISOBUS Database, AEF Plugfests, and numerous Guidelines to help and improve the implementation of ISOBUS products. ISOBUS has been broken down into smaller parts, the so-called *Functionalities*, of which each separate Functionality can be brought to an AEF Test Lab for Conformance Testing. AEF works with 5 recognized Test Labs throughout the world, and the certified compliant products are stored in the AEF Database.

Part 3 (Organization and Project Team work in AEF; Future Electronics technologies and applications)

AEF is managed through the Chair Group and a General Manager with his back-office, taking care of the day to day business of AEF. Decisions and approvals are taken by the Steering Committee with 11 core members in total of which 3 are associations (AEM, FederUnacoma, VDMA). Through the General Manager and Steering Committee the 11 Project teams are managed in their scope of work by prioritizing technology and market needs. More than half of the project teams work on Future Electronics technologies such as TIM and security, High Speed ISOBUS, Wireless Communications, High Voltage and Camera Systems.

Part 4 (International bodies and cooperation)

As Farming 4.0 becomes increasingly important, and Data Management and Data exchange interfaces between systems are now facing the same challenges as the interoperability of ISOBUS previously, and even more, AEF is intensifying the cooperation with other industry groups such as AgGateway. Also in line with EU projects, compliancy and regulations, a closer cooperation with CEMA has started as well to address issues jointly at EU level. As examples; jointly address the upcoming IoT challenges, RMI regulations or for instance Functional Safety aspects. Although AEF focuses primarily on electronics for machines and equipment in the field, it's interfaces to the outside world and beyond are a different playground. International cooperation is crucial to get this next step to succeed.

2.2 - ISOBUS for Trailed Sprayers – Implementation and Experience

Willy Peeters (John Deere Fabriek Horst – Nederlands)

Isobus development for trailed sprayers, build in Horst started in 2005. Major challenges were the fact that software in the controls used was not owned by John Deere and the Horst factory was not staffed for software developement. Decision was taken to connect to a 3th party working on the development of ISOBUS for John Deere balers and also involved in the the ISBOBUS standard. Within John Deere, most experience with ISOBUS was on the VT side, less on the implement side. The ISOBUS TaskController for section control, a very important item for sprayer needed to be developed (including the tool chain) within John Deere as so far only propriatary communication was used.

The AEF Plugfest proved to be a very important event to validate AEF compliance and essential during the development. Many different John Deere units (eg tractors,) got involved during the development which expanded and increased the knowledge and experience of the John Deere organisation overall in relation to ISOBUS and implements and key relations have been build with 3th parties for pratical validations. Trailed sprayers were the first John Deere implements to be DLG certified in 2007 and AEF certified in 2016. Challenges is comply with the current and future ISOBUS standard(s) as this is key for Europe and still develop machine/manufacturer specific features.

2.3 – ISOBUS: the Industry Perspective

by Marcello Mongiardo (CNH – Italy)

Part 1 (Introduction)

Since ISO organization in early 90s took the lead in the definition of an industry standard for the communication protocol among electronic devices of different manufacturers, it become immediately clear that this technology would have become key for the AG electronics.

Part 2 (Today)

The essence of the ISO11783 standard is still to fulfil the multi brand approach of a large percentage of farmers in using agricultural machinery. Hundreds of plug and play ISOBus applications have been developed and launched in the market in the last decade also thanks to the synergies that industry manufacturers have found on the non-competitive activities.

Part 3 (The near future)

Automation among machines and equipment of different manufacturers is a clear example where the collaboration between competitors becomes unavoidable both for technical reasons and for affordability of investments. TIM (Tractor Implement Management) is the next step for ISOBus. The system will require ag equipment electronics to operate with encrypted communication using advanced security libraries.

Part 4 (Future Challenges)

As technology evolves, manufacturers can take advantage of new opportunities providing farmers with a higher productive and more efficient farming cycle. Higher speed communication protocols and wireless in field communications are two examples where, up to a certain extent, the ISOBus concept could be applied.

SESSION 3 – SPECIFIC MECHANIZATION: THE FORESTRY MACHINES
3.1 – Challenges and Drivers for Forest Technologies and Techniques in German Forestry *Ute Seeling* (Kuratorium für Waldarbeit und Forsttechnik e.V., KWF – Germany)
3.2 – A Case Study: Ground Yarding Operations in Mountainous Terrain *Raffaele Cavalli* (University of Padova - Italy), *Dzhamal Amishev* (FPInnovations – Canada)

3.1 – Challenges and Drivers for Forest Technologies and Techniques in German Forestry

Ute Seeling (Kuratorium für Waldarbeit und Forsttechnik e.V., KWF – Germany)

Looking back over the last decades there has been a rapid development of forest technology leading to a quickly increasing mechanisation.
In Germany the frames for these developments were mostly set by the terrain and also by the recommendations of silviculture and restrictions of nature conservation.
Concerning the terrain it is typical for Germany that there is a wide variety of stands. About one third is characterised by slope, about one third by sensitive soils (humide or partly humide) and one third can be regarded as easy terrain conditions (flat and dry) where forest machines can drive. Concerning silviculture the regimes have changed a lot. Mixed forests with unevenaged trees and a high percentage of beech and other broadleaves are the silvicultural targets, and a nature oriented management integrating many requirements of nature protection are real challenges for modem forest technology.
Within that framework of terrain characteristics and silvicultural requirements the drivers for the development of forest technology mainly have been:

- efficiency / productivity;
- safety at work;
- soil protection;
- forest certifications and
- digitalisation.

The German Centre for Forest Work and Forest Technology (KWF) is supporting this development since decades by investigating, testing and evaluating innovations with regard to all three pillars of sustainability

- social aspects like work safety and ergonomy;
- environmental aspects like soil protection and
- economical aspects like costs and efficiency.

In the presentation examples will be given for the state of the art and the role of KWF.

3.2 – A Case Study: Ground Yarding Operations in Mountainous Terrain

Raffaele Cavalli (University of Padova - Italy), *Dzhamal Amishev* (FPInnovations – Canada)

While modern fully mechanised ground-based systems are a default option for safe and productive harvesting, they have always been limited by terrain factors such as slope, soil strength and or roughness. There is a limit with regard to the physical feasibility of operating machines on steep slopes because both the weight and also the force from the momentum created during traction loss can affect stability. There is a huge interest to improve traction of harvesting machines when operating on steep slopes. One way to improve traction and stability on steep slopes is through assisting harvesting machines by winch and cable to anchor locations such as tree stumps or stationary equipment. This technology offers potential for improving the safety, productivity, and efficiency of a harvesting operation, as well as for improving machine mobility and reducing soil disturbance through the reduction of slip.

With the exponential development of such technology, an integrated approach must be developed for conducting productive and injury-free mechanical harvesting operations on steep slopes that draws on the skills and accountabilities of the working team. Beyond a certain physical threshold, the only feasible and achievable solution providing some “intelligent behaviour” to machines and systems would be the role of mechatronics application. One of the most relevant points could be the possibility to introduce the concept of “teleoperation” using unmanned ground vehicles. Combining teleoperation with winch-assist technology would provide a platform for extending the range of ground-based equipment to previously infeasible terrain conditions.