Club of Bologna

Strategies for the Development of Agricultural Mechanisation

Past and present of agricultural machinery standardisation

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FEDER UNACOMA

Federazione Nazionale Costruttori Macchine per l'Agricoltura

24th Annual Meeting of the Club of Bologna

"**International standards: opportunity or problem**"

November 9-11, 2013

Agritechnica 2013 – *Hannover, Germany*

DLG

Standardisation began since thousands years (star observation and calendars in Mesopotamia, Sumer and Egyptian writings), then within **advanced industrial groups**. Later it expanded to **full national industrial sectors**, to countries and finally to **continents and the world** (ISO and IEC).

ISO IEC

Some thousand years old standard still influence present life…

The United States standard railroad gauge of 4 ft and 8.5 in is derived from the original specifications for an Imperial Roman war chariot, which was built just wide enough to accommodate the back ends of two war horses.
There are two big booster rockets attached to the sides of the main fuel tank on a Space Shuttle. They are made in Utah. The designer would have preferred to make them a bit wider, but they have to be shipped by train through a tunnel from the factory to Cape Canaveral. The tunnel is slightly wider than the railroad track, and the railroad track is about as wide as two horses' behinds.

So, a major Space Shuttle design feature of what is arguably the world's most advanced transportation system was determined over two thousand years ago by the width of a horse's back!

Regional standard organisations

Europe

CEN - European Committee for Standardisation

Africa

ARSO — African Regional Organisation for Standardisation
SADCSTAN — Southern African Development Community (SADC) Cooperation in Standardisation

Americas

COPANT — Pan American Standards Commission
AMN — MERCOSUR Standardisation Association
CROSQ — CARICOM Regional Organisation for Standards and Quality
AAQG - America's Aerospace Quality Group

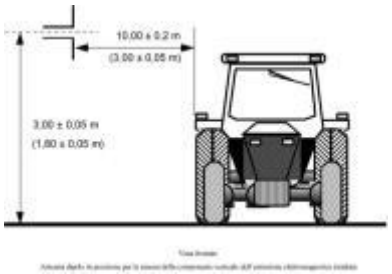
Asia Pacific

PASC — Pacific Area Standards Congress
ACCSQ — ASIAN Consultative Committee for Standards and Quality

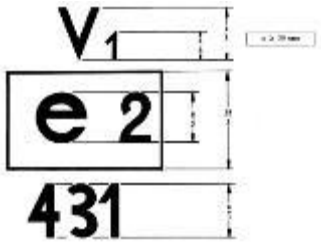
Middle East

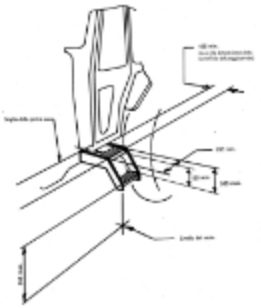
AIDMO — Arab Industrial Development and Mining Organisation
IAU — International Arabic Union

Except in Europe, no regional standards are in force; only voluntary standards exist at international level



In 1974 the EU published the first Directive on tractors (74/150/EEC). At the moment more than 40 Directives (23 of them indipendent) on tractors are in force, written in the 23 official languages of the 28 EU members.





All these Directives are defined as "old approach directives" and have limited objectives.

In 20 years of activity, EU partially succeeded in solving the safety and ergonomics problems of only one agricultural machine, the tractor.

And the other thousands of agro-food and forestry machines?







Within the EU and EFTA, frontiers are being or have been abolished (Schengen Treaty)

Technical barriers to the free movement of goods have officially been removed

The recent introduction of the Euro in 17 EU members has greatly helped this trend

- Austria
- Belgium
- Bulgaria
- Croatia
- Cyprus
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Ireland
- Italy
- Latvia
- Lithuania
- Luxembourg
- Malta
- The Netherlands
- Norway
- Poland
- Portugal
- Romania
- Slovakia
- Slovenia
- Spain
- Sweden
- Switzerland
- The Former Yugoslav Republic of Macedonia
- Turkey
- United Kingdom

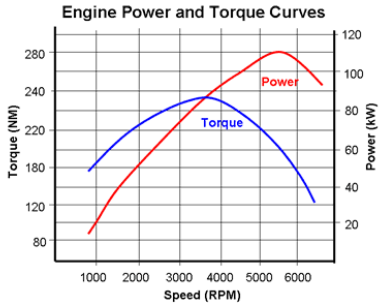
In 1989, the EU introduced the "new approach directives" (e.g. *Machine Directive 98/37/CE*), with large objectives, better determined by specific standards

These standards are published by CEN (European Standard Commission)
The CEN has 33 members (28 EU, 3 EFTA, former Macedonia and Turkey), only 3 official languages (English, French and German).
***A qualified majority is sufficient to take decisions*.**
Activity on agro-food and forestry machinery is carried out by CEN/TC 144 & 153

Present International standard situation in Europe:
OECD, ISO, EU and CEN

OECD approved the first Standard Code for the testing of tractors in 1959

At the moment, 9 Codes are in force
(1 on performance, 1 on noise, 7 on ROPS/FOPS)



Of the 34 OECD members,
27 take part in Tractor Codes
(24 CEN members and Korea, Japan, USA)

(China, India, Russia and Serbia participate to tractor Codes, even if not OECD members)

About 90 national institutions are member of ISO.
The ISO Committee for agricultural and forestry machinery (ISO/TC 23) published dozens of Standards on ergonomics and safety

Problems of ISO:

- **Standards are not compulsory**
- **A big majority of participating countries (not of members) are CEN members *(except Japan and USA)***

(!!!)

Agreements have been signed among International Standard Organisations:

→ The **EU charged OECD** of the modifications to the ROPS codes

→ The "**Vienna agreement**" has been signed **between ISO** and **CEN**

As a result, the new safety and ergonomics Standards are common

Machinery produced in conformity with the Machine Directive must be provided with the "CE" mark

Two agricultural machine categories are established:

NORMAL MACHINES

No compulsory examination is provided

The **manufacturer conformity declaration** is sufficient

ROPS, FOPS, PTO SHAFT GUARDS

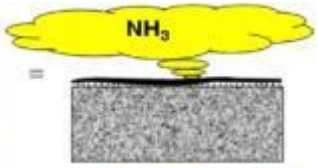
Due to their very high danger level, compulsory tests are required

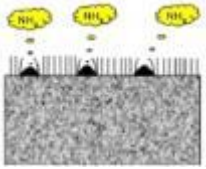
In any case, an **instruction manual** with all the necessary **safety recommendations** has to be provided

CEN and the environment

The following standards were drafted:

- controlling **fertiliser and pesticide distribution**
  (both in the field and in the orchards/vineyards)
- managing **slurry and manure**





Directive 81/391/EEC, etc. apply to the improvement of the safety and health of operators on the worker's place

(!!!)

In spite of all activity carried out, the different Organisations are still publishing standards sometime contrasting in form and content…

Ergonomic and safety have a cost, depending on:

- ✓the necessary **research and tests** to be carried out
- ✓the **standard drafting**
- ✓the **machine design, prototype manufacturing, testing**, etc.
- ✓the drafting and print of **decals**, **instruction manuals**, etc.
- ✓the **manpower training**

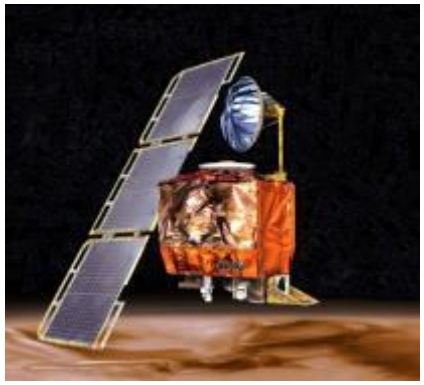
Ergonomics and safety must be congruous with the country social and economic development:

If too permissive, application is easy and standards useless

If too strict, standards cannot be properly applied

(e.g.: EU Directive on agricultural tractor noise at the driver's ear, written 35 years ago and finally came in force recently, with more than 30 years of delay)

Metric mixup…



The *Mars Climate Orbiter* was a 338 kilogram robotic space probe launched by NASA in 1998 to study the Martian climate, atmosphere, surface changes and to act as a communications relay. However, on September 23, 1999, communication with the spacecraft was lost as the spacecraft went into orbital insertion, due to ground based computer software which produced *output in non-SI units of pound and yard per second (lb; yd/s) instead of the metric units of newton; meter per second (N; m/s) specified in the contract between NASA and Lockheed*.
The spacecraft encountered Mars at an improperly low altitude, causing it to incorrectly enter the upper atmosphere and disintegrate.

lb; yd/s

N; m/s

What is a standard?

1. A document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose.

2. A publication that provides rules, guidelines or characteristics for activities or their results, for common and repeated use, for bringing together manufacturers, users, consumers.

3. The voluntary process of developing technical specifications based on consensus among all interested parties: industry, consumers, trade unions, non governmental organisations, public authorities, etc.

4. Engineering requirements (specifications) prepared to define materials, products, processes, tests, testing procedures and performance criteria in an effort to achieve certain specified purposes.

What is a standard?

ISO

A document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose.

cen

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European Commission

The voluntary process of developing technical specifications based on consensus among all interested parties: industry, consumers, trade unions, non governmental organisations, public authorities, etc.

ASABE

Engineering requirements (specifications) prepared to define materials, products, processes, tests, testing procedures and performance criteria in an effort to achieve certain specified purposes.

Policy and goals of the main Standardization Organizations and bodies:

ISO standards:

- Achieve **benefits** for business, government and society;
- Provide **practical tools for tackling challenges** in all 3-dimensions of sustainability: economic, environmental and societal;
- Distil **international expertise and good practice**, contributed by the people that understand the problems, are best placed to observe the standards in action and to maintain them at the state of the art.

Policy and goals of the main Standardization Organizations and bodies:

Vision

•To make a contribution to Europe's innovative capacity, global competitiveness, sustainable growth, and to welfare of its citizens.

Mission

• Being a leading partner of European Standards, ensuring the quality, safety, environment and interoperability requirements for products, services and organisations
• Adapting proactively to new developments and supporting European competitiveness
• Promoting the European Standardization System and its results

Strategy

• Foresee and respond to market needs
• Ensure continuous improvement throughout the system
• Build partnership
• Implement good governance

Policy and goals of the main Standardization Organizations and bodies:

European Commission

The **Common Agricultural Policy (CAP)** has identified **3 priority areas** for action to protect and enhance the EU's rural heritage:

- *Biodiversity and preservation and development of 'natural' farming and forestry systems*
- *Water management and use*
- *Dealing with climate change*

Measures to promote agricultural practices preserving the environment and safeguarding the countryside:

- *Targeting aid at rural development measures promoting environmentally sustainable farming practices*
- *Enhancing compliance with environmental laws, also through a reduction in support payments from the CAP.*

Policy and goals of the main Standardization Organizations and bodies:

ASABE

- **Improve** agricultural and biological engineering's impact on **sustainability**
- Increase biomass collection and the identification of **alternative energy solutions**

- **Ensure food safety, security, and quality** through agricultural and biological engineering
- **Develop practices** for stewardship of **soil and water resources** in agriculture
- **Advance equipment engineering as a means to increase safety and efficiency in modern agriculture**

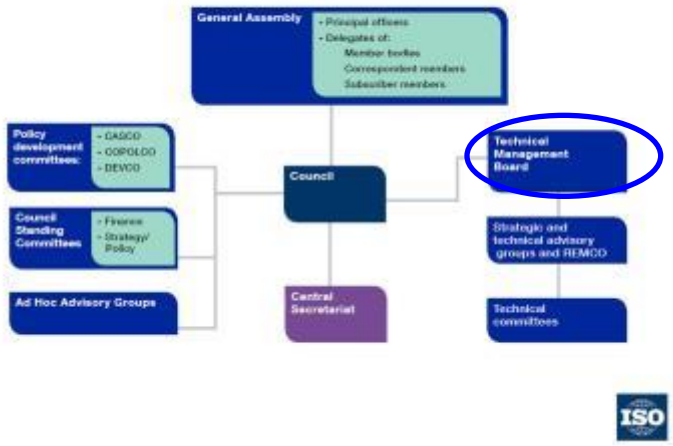
Standard development process:

ISO key principles

(http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees.htm)

1. New standard is proposed to relevant technical committee
   If proposal is accepted
2. Working group of experts start discussion to prepare a working draft
3. 1st working draft shared with technical committee and with ISO CS
   If consensus is reached within the TC
4. Draft shared with all ISO national members, who are asked to comment
   If consensus is reached
5. Final draft sent to all ISO members
   If standard is approved by member vote
6. **ISO International Standard**

ISO's structure



164 Members (Full, Correspondent, Subscriber) → **269 Technical Committees (TC)**

386 published ISO standards (including updates and 36 standards published under the TC direct responsibility)

ISO/TC 23
Tractors and machinery for agriculture and forestry
(24 participating and 41 observing Countries)

Sub Committee/Working Groups

Subcommittee	Subcommittee Title
ISO/TC 23/SC 2	Common tests
ISO/TC 23/SC 3	Safety and comfort
ISO/TC 23/SC 4	Tractors
ISO/TC 23/SC 6	Equipment for crop protection
ISO/TC 23/SC 7	Equipment for harvesting and conservation
ISO/TC 23/SC 13	Powered lawn and garden equipment
ISO/TC 23/SC 14	Operator controls, operator symbols and other displays, operator manuals
ISO/TC 23/SC 15	Machinery for forestry
ISO/TC 23/SC 17	Manually portable forest machinery
ISO/TC 23/SC 18	Irrigation and drainage equipment and systems
ISO/TC 23/SC 19	Agricultural electronics

Standard development process:

the EC New Approach to Harmonised Standard

(*http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/new-approach_en.htm*)

European Commission

European Commission : definition of Directives with "*essential requirements*" → **European standards bodies (CEN, CENELEC, ETSI): drawing up of the corresponding technical specifications meeting the *essential requirements***

Key principles

- **clear separation** between the EEC legislation and European standardisation
- EEC Directives are limited to the essential (**safety**) requirements of general interest, to ensure the free movement of products throughout the Community
- the corresponding technical specifications are entrusted to the **standardisation bodies**
- products manufactured in conformity with harmonised standards are presumed to be **conformant** to the essential requirements
- **standards are not mandatory, they remain voluntary**
- standards must offer a **guarantee of quality** with regard to the essential requirements
- **public authorities** are still **responsible** for the protection requirements on their territory (e.g. market surveillance)
- **safety clauses** require the Member States to take all appropriate measures to withdraw unsafe products from the market

CEN CENELEC ETSI World Class Standards

Flexibility: **1) it is indicated what has to be achieved but not the details of the corresponding technical solutions**
2) different options for conformity assessment;
3) regular adaptation to technical progress are not necessary

Standard development process:

European Standards EN

(http://www.cen.eu/cen/products/en/pages/default.aspx)

1. Proposal to develop an EN	Any interested party (most standardisation work is proposed through the National Standards Bodies)
2. Acceptance of the proposal	The member countries shall put all national activity within the scope of the project on hold.
3. Drafting	The EN is developed by experts within a Technical Body (or Technical Board)
4 .CEN Enquiry	Public comment at national level (e.g. manufacturers, public authorities, consumers, etc.)
5. Adoption	By formal weighted vote of CEN national members
6. Publication	Must be given the status of national standard in all CEN member countries (they have the obligation to withdraw any national standards that would conflict with it)
7. Review	At least within 5 years from its publication. (The review results in the confirmation, modification, revision or withdrawal of the EN)
8. Amendment	Supplementary document which alters technical provisions.
9. Corrigendum	The removal of printing, linguistic, editorial errors (handled by the Management Centre)

Vienna agreement

(1991)

Ensures between **ISO** and **CEN** technical cooperation by correspondence, mutual representation at meetings, and adoption of the same text, *as both an ISO Standard and a European Standard (ISO/EN)*.

Standard development process *(simplified)* : ASABE

(http://www.asabe.org/media/41378/procedure_flow_chart.ppt)

Submission of the Project Proposal Form to ASABE Standards Staff
- Purpose, scope, rationale for project
- Standards approach (new, revised, withdrawn ASABE; adoption of ISO, submission to ANSI)

REVISE, CREATE NEW, OR WITHDRAW A STANDARD

ASABE Staff ballots oversight committee for Project
- Proposal review and approval

Project Approved by oversight Committee
- Assign/appoint/identify additional SME required for dueoProcess and balance
- Appoint oversight Committee liaison to project

Project posted on website and listed in *Inside ASABE*
- Provides due process and openness announcement allowing other interested parties to volunteer for participation

Drafting of document

Standard Draft reviewed and finalized in ANSI/ASABE/ISO format

ASABE Staff ballots Draft Standard to Standards Development Committee

Draft Standard approved

ASABE staff ballots oversight committee on policy and due process review
- Updated and finalized statement on rationale of Standard
- Listing of impacted parties

STANDARD APPROVED AND PUBLISHED

Main issues addressed in the agricultural machinery standardsation

In the last decades, the main standardisation organisations and bodies dedicated and deepened their activities in many given fields of agricultural mechanization.

Today the situation is very differentiated (and complicated ...)

1 - Safety (operators, consumers)

2 - Performance

3 - Road traffic safety

4 - Ergonomics, wellness

5 - Environmental impact

6 – Electronics and mechatronics

ISOBUS inside

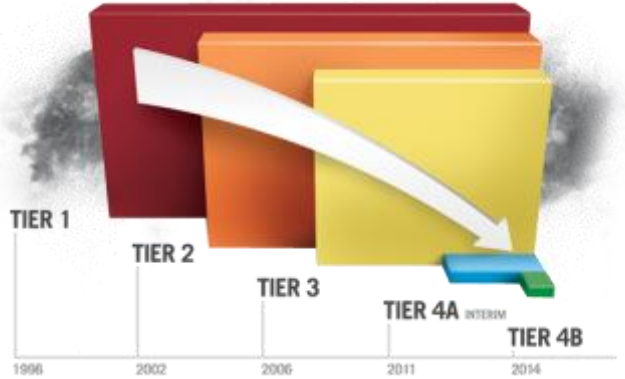
The challenge is: are the Standards pushing or running after the technical progress?

The challenge: standards pushing the technical progress

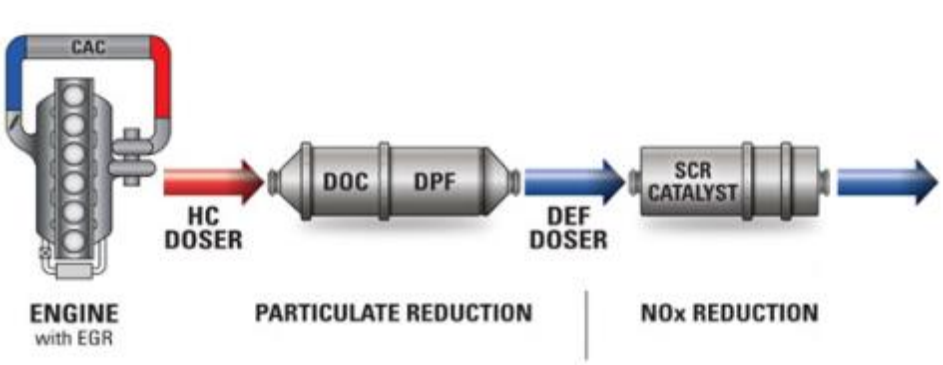
EXHAUST EMISSION REGULATIONS

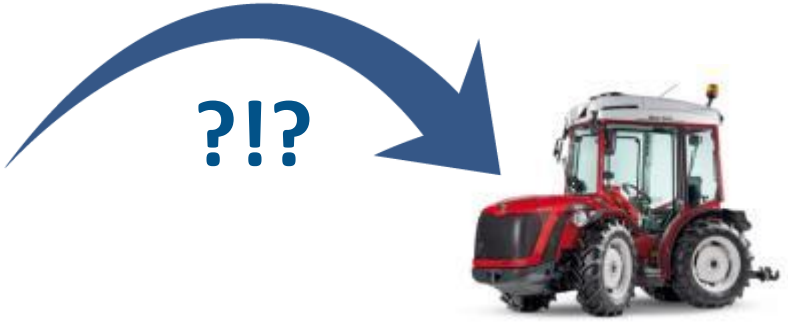
In the last 15 years the exhaust mission regulations (European "Stages" and US "TIER") forced manufacturers to modify deeply their diesel engines, providing them with sophisticated devices that have significantly changed their performance *(and not always for the better, i.e. specific fuel consumption…).*

"We are a little over-regulated already today.
The air that goes into any Tier 4 tractor
is more polluted than that coming out."
(from a recent interview to
***Martin Riechenhagen**, CEO of AGCO Corp.)*



Some problems still remain unsolved, such as the compliance with the provisions of the Law on narrow-track tractors, where at present there are serious problems of space.





The challenge: standards pushing the technical progress

TRACTOR NOISE

As previously underlined, the EU Directive on agricultural tractor noise at the driver's ear, drafted more than 35 years ago and finally came in force recently, with more than 30 years of delay)

EC type-approval system 74/150/CEE

77/311/CEE

32 years of "extension"!

2009/76/CE

(The problem was due to the impossibility of tractors not equipped with a soundproofed cab to ensure compliance with the limits. Finally, after a quite long time, the technical evolution of engines, being that the main noise source, has allowed a drastic reduction of the noise levels.)

The challenge: standards running after the technical progress

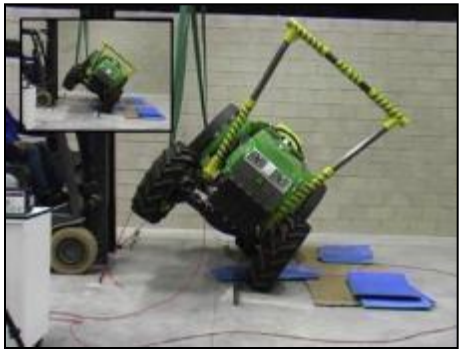
AUTOMATIC ROPS

The success of ROPS (Roll Over Protective Structure) on tractors is moving towards the foldable/deployable types. The most recent development involves the fitting of various mechanisms of folding/unfolding, at different levels of automation. The (many) standard devoted for the testing of ROPS have not yet established clear and precise criteria on how to assess the level of security of these types of ROPS.

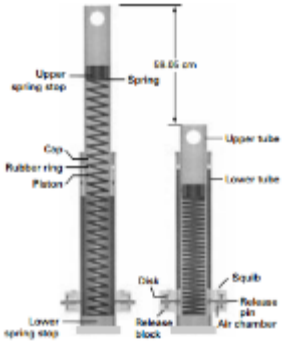
manually foldable

deployable

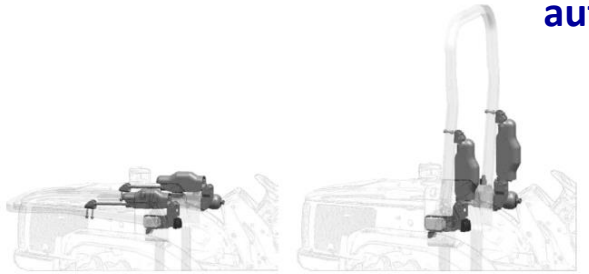
(Universidad de Navarra)



(NIOSH)



automatically foldable



inclinometer

hydraulic cilinder

How to test these kinds of ROPS?

The challenge: standards **running after** the technical progress

PTO shaft guard

How to test this shaft guard?

Until a few years ago, the **steel** was the only material used for the ROPS manufacturing, as well as PTO shaft guards were exclusively in **plastic material**.

The **technical progress** has already proposed the use of alternative materials to those classics, such as **polycarbonate resin** (commonly known with the trade name "*Lexan*") to the roofs of the tractor cabs, and **steel** for the PTO shafts guards.

NEW MATERIALS

FOPS

polycarbonate resin resistance to a weapon test

How to test this FOPS?

There is a urgent need of updating and adjustment of the standards

Standardisation successful cases - 1

(Provided that the operator's safety is probably the most investigated and well known sector of standardisation…)

Agricultural and forestry tractor ROPS - The OECD Codes: more than 50 years of story

Background

- Established in 1959
- 29 participating countries
  - 25 OECD Member Countries
  - China, India, Russia, Serbia
- National Designated Authorities
- 9 Codes [2-10]
  - Performance & Safety Codes
  - >2 000 tested for Performance
  - >10 000 tested for safety codes

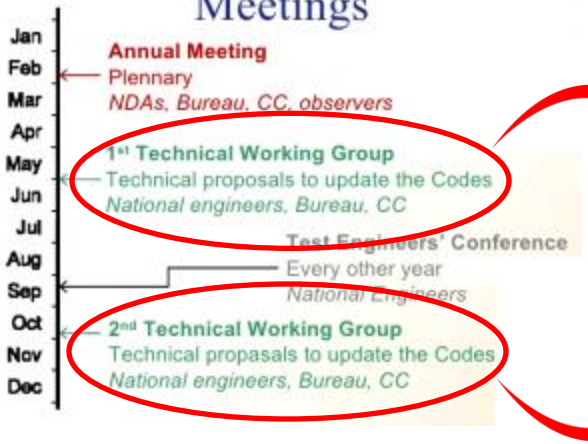
Objectives

"one tractor – one description – one test"

- simplify existing international trade procedures,
- establish specifications and basic performance criteria
- ensure a minimum of quality for the traded material
- Transparency, facilitate trade, increase the agricultural machinery market

3 Types of Activities

Meetings



Important added value: continuous updating of Codes to the tractor technical progress, thanks to the constant contact with Manufacturers

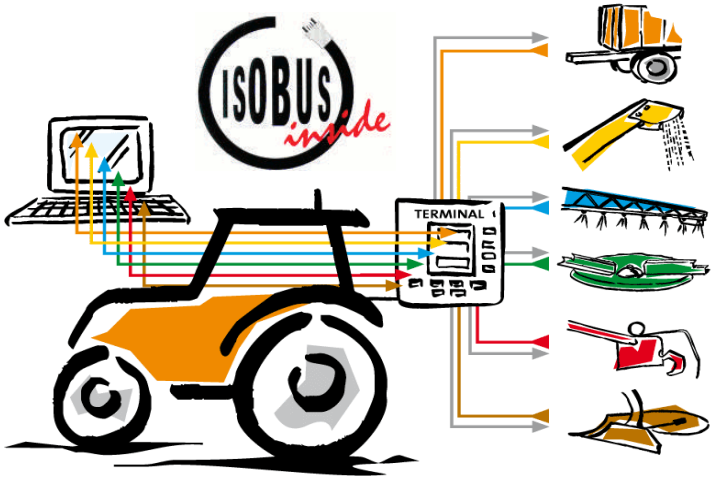
Standardisation successful cases - 2

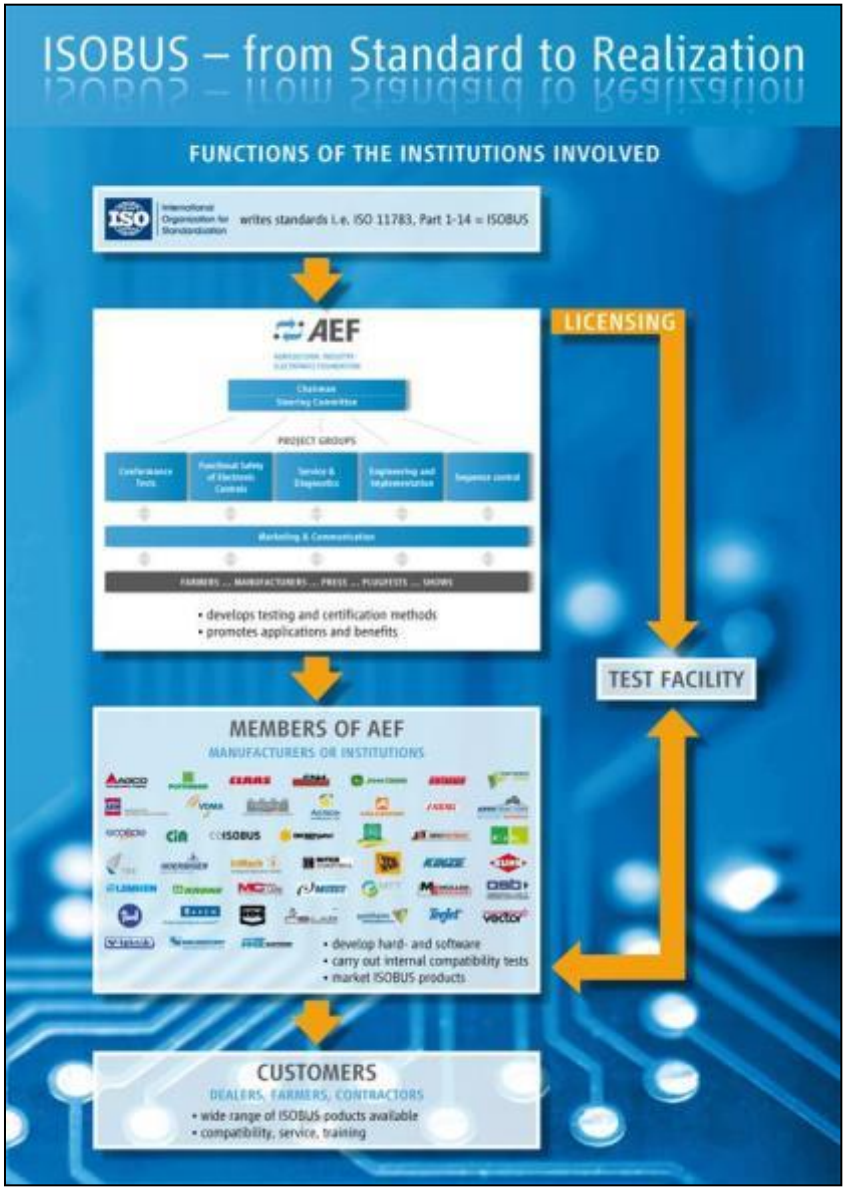
ISOBUS

(Standard ISO 11783, parts 1-14)

The **universal protocol for electronic communication** among **implements, tractors and computers**.

Primary goal: to standardize the communication, ensuring full compatibility of **data transfer** between the mobile systems and the office software used on the farm.





Standardisation successful cases - 3

2003/37/EC Directive

(*Type approval of agricultural and forestry tractors, trailers and towed equipment*)

Before this Directive came into place, the EU member states had its own procedures and standards allowing the registration or first use of agricultural and forestry tractors.
The implementation of its requirements allowed the manufacturers to sell their products all over Europe, without having to change the designs to meet any specific local requirements.

The near future: EU "Mother Regulation". A revolution for tractor standardisation

The Tractor Framework Directive 2003/37/EC, consisting of 50 Directives dedicated to tractors, trailers and towed equipment (and the related implementing legislation of 27 Member States) would be replaced by just 5 Regulations directly applicable.

Increased safety also for:

- ✓ **mandatory fitting of anti-lock braking systems on T5 fast tractors (v_{max} > 40 km/h) and their trailers**
- ✓ **higher deceleration performance**
- ✓ **improved compatibility between tractor and trailers/towed equipment.**

The "Mother Regulation" would be joined by only 3 delegated Acts, containing technical details and test procedures as well as an implementing act for administrative aspects.

Legislative act

	Regulation on vehicle functional safety requirements	*Regulation on vehicle construction safety requirements*	*Regulation on environmental and propulsion performance requirements*	*Regulation on administrative requirements*	*Regulation on vehicle's braking requirements*	Timetable for L-category vehicles, used as baseline a) Provisions on access to Repair and Maintenance Information b) Provisions on Technical services
1st Draft	31/7/2013	31/7/2013	29/3/2013	2/12/2013	14/6/2013	1/3/2013
Comments by MS and stakeholders	31/10/2013	6/11/2013	31/5/2013	_____	4/10/2013	1/3/2013 (in parallel with 1st Draft)
Interservice Consultation	3/12/2013	6/12/2013	5/7/2013	8/2/2014	8/11/2013	1/5/2013
Final Draft	17/1/2014	17/1/2014	20/9/2013	31/5/2014 (after MS and stakeholders consultation)	20/12/2013	8/5/2013
Adoption by COM	1/7/2014	1/7/2014	7/3/2014	31/7/2014	6/6/2014	15/10/2013

An important suggestion: always and for everyone…