Precision Farming, sensor applications for guidance systems

Marcus Reutemann
March 2012

JOHN DEERE

Agenda

- Importance and necessity of „Precision Farming“

- Precision Farming – based on GNSS positioning

- Guidance-Systems

- Documentation

- Telematics

- Conclusion

Precision Farming

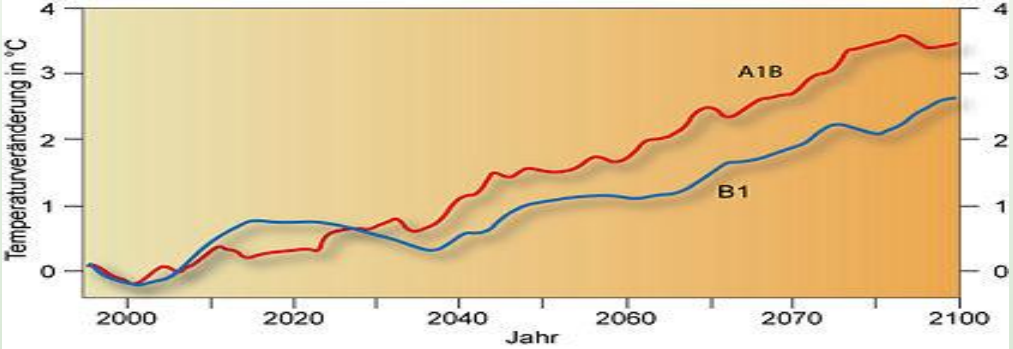
Precision Farming backround

Growing population, Climatic change, Resources (Soil, water, fertilizer, etc)

JOHN DEERE

Precision Farming backround

Growing population, **Climatic change,** Resources (Soil, water, fertilizer, etc)



Increase in CO2 concentration as a function of the region (till 2100):

- Increase the temperature to 2.5 ° C
- Decrease in summer precipitation (up to - 30%)
- Increase in winter precipitation (up to ≥ 30%)
- Increase of extreme values

(Heat, drought, heavy rain, storms

Source: DKRZ, KomPass

JOHN DEERE

Precision Farming backround

Growing population, Climatic change, **Resources (Soil, water, fertilizer, etc)**

Fact: Over 3 million acres of the best U.S. farmland is lost every year, about 50 acres of prime and unique farmland every hour.

Fact: By 2040, California alone will lose over 1,000,000 acres of its unique Central Valley farmland to low-density urban sprawl

Fact: Of the 7,000 plant species that people consume, 103 species account for 90% of the worlds crops

Fact: Annually, population growth adds 78,000,000 more people to the planet while 27,000,000 tons of topsoil is lost

Source:Population & Habitat Program © April 2000

JOHN DEERE

Precision Farming backround

Made in the future, the increasing production in agriculture and higher yields per unit area

Global Production

=

Farmland **X** **Yield**

- Irrigation
- chemical Inputs
- technology

(Source: DLG Kolloqium 2008)

Solution

- Stronger plant varieties
- new crop technologie
- new agricultural intelligent machine systems
- Sensors and IT e.g.:
  - GNSS sensors
  - Elektronic components
  - Information systems

For process monitoring and process control

=> **Precision Farming -> iSolutions**

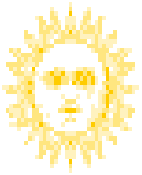
Precision Farming over the Year

Year Around intelligent, innovative and integrated Solutions

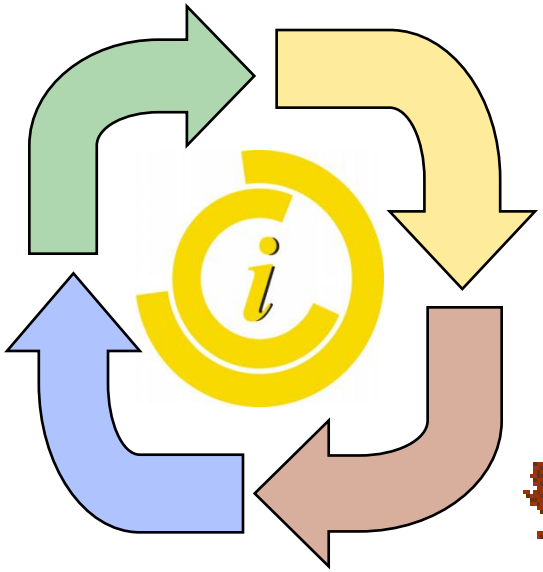
Spring

- Fertilizing and spraying
- Sowing, mowing and hay harvest

Summer

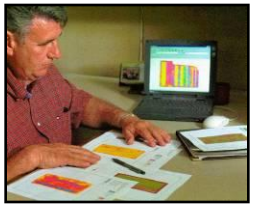


- Harvesting, tillage
- manure fertilization



Winter

- Documentation
- calculation



Autumn

- Corn / Beet Harvest
- Seeding and tillage

JOHN DEERE

iSolutions

5 criteria for iSolutions

- **Intelligent**
  1) Electronic controlled system
  2) Driver assistance systems
  3) Increase the productivity (€ / ha)

- **Innovative**
  4) improvement / changing traditional practices in agriculture

- **Integrated**
  5) For the entire John Deere product line (use the "Green-to-Green" advantage)

Precision Farming iSolutions

Steering systems

Automated solutions

Documentation

Telematic

Section control

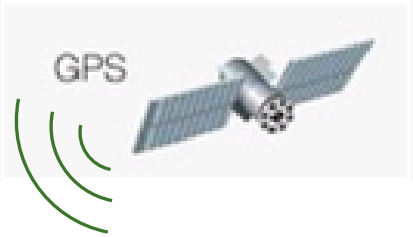
i- Solutions

JOHN DEERE

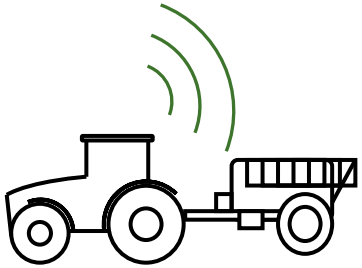
Precision Farming – based on GNSS

Precision Farming

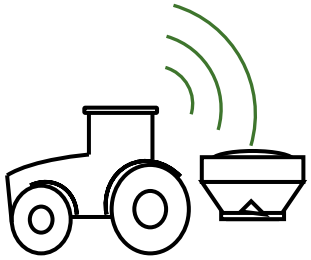
Fundamental: GNSS positioning



harvest

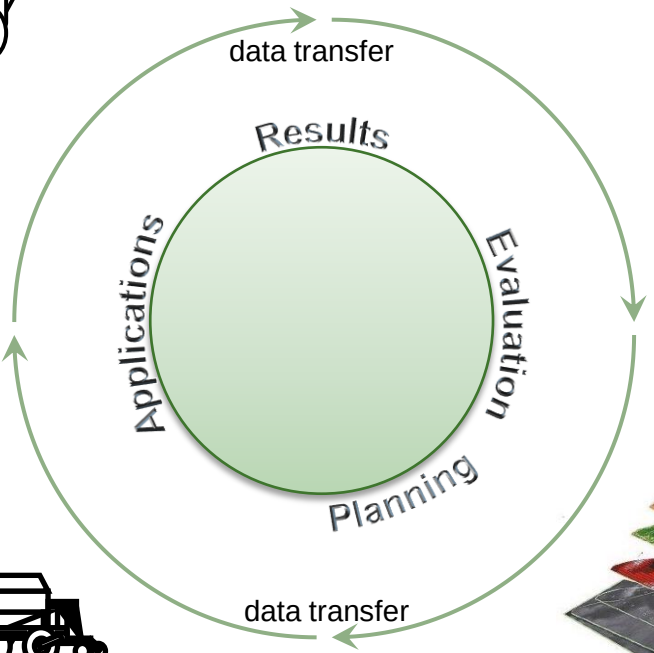


plant protection



fertilization

Plowing and sowing



analysis

planning

Source: Science/NZZ

JOHN DEERE

GPS - Global Positioning System

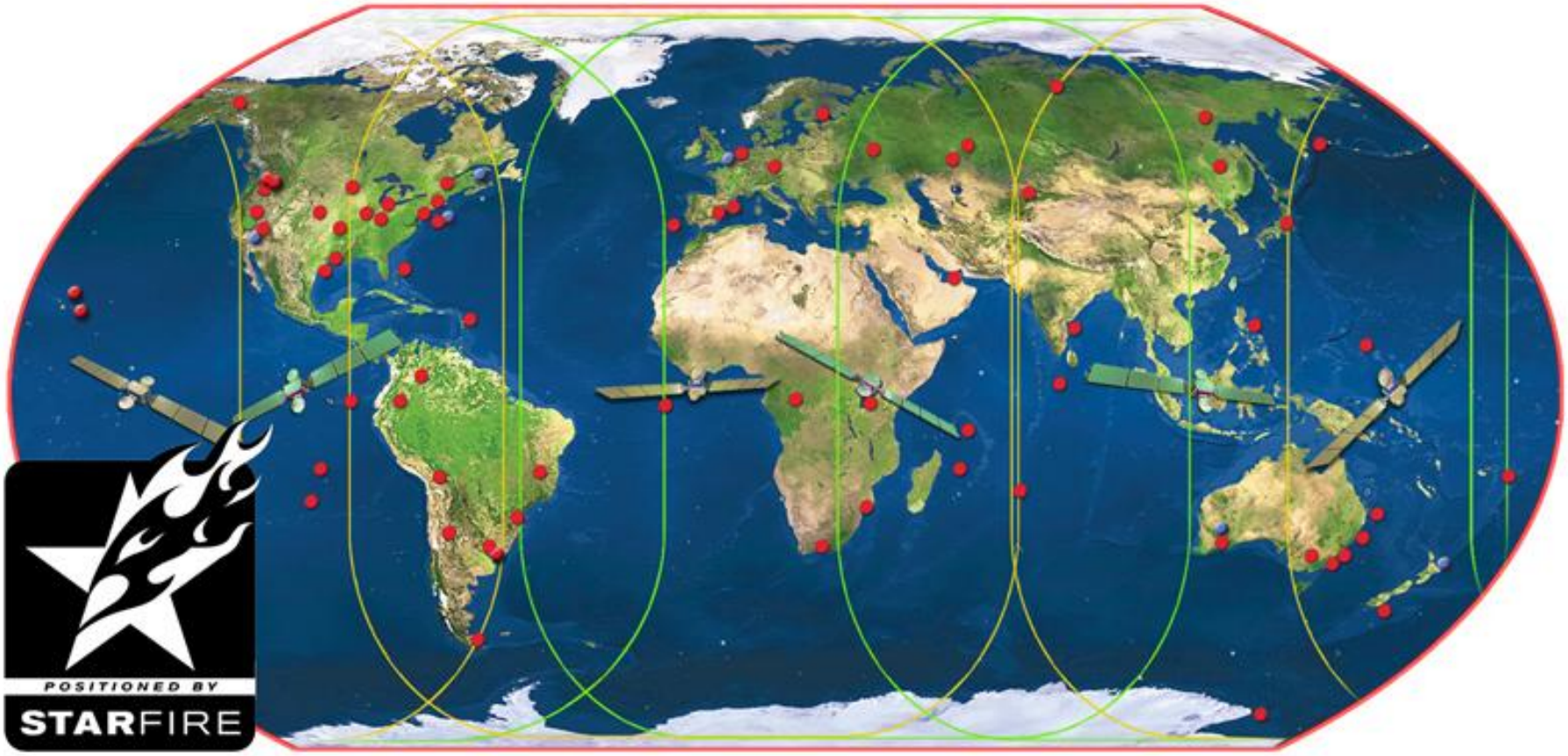
ACCURACY GUIDE FOR SOME COMMON TASKS

Accuracy level	Correction type	Source & pass to pass accuracy	Pass to pass accuracy	Task	Cost
Low	Satellite	EGNOS *free* WAAS *free*	About 1m	Tillage Lime spreading	£
	Satellite	John Deere SF1 *free* OmniSTAR VBS	30cm +/-20cm	Slurry spreading Spraying	
Medium	Satellite	OmniSTAR XP OmniSTAR HP John Deere SF2	15cm 10cm 10cm	Harvesting Drilling Mowing Spray (pre-em)	££
High	Land base station	RTK	2 cm	Planting Beds systems Large fleets Repeatability Controlled traffic farming	£££

Source: Weekly Farmers; 2009

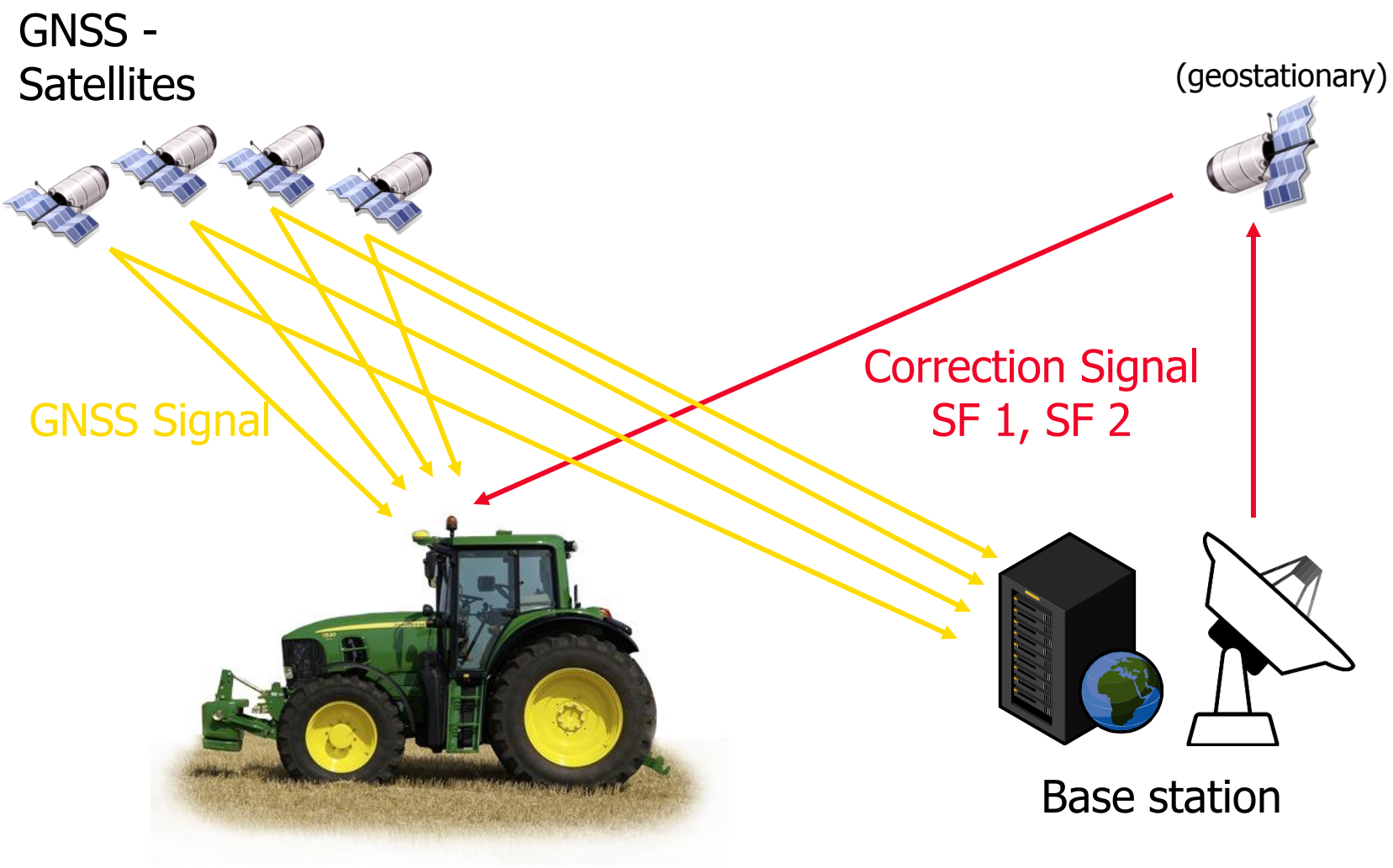
JOHN DEERE

StarFire



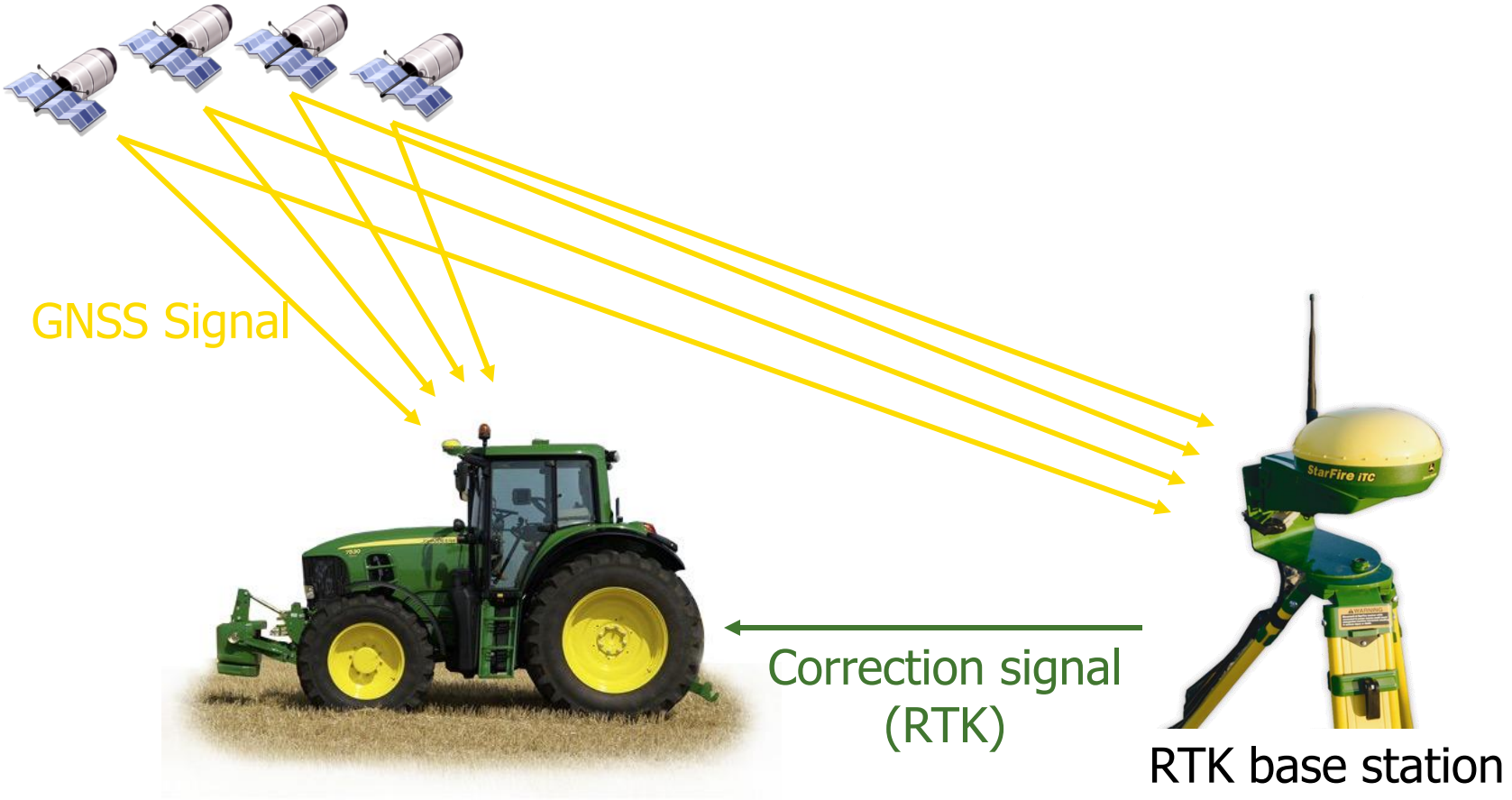
JOHN DEERE

Geostationary corrections

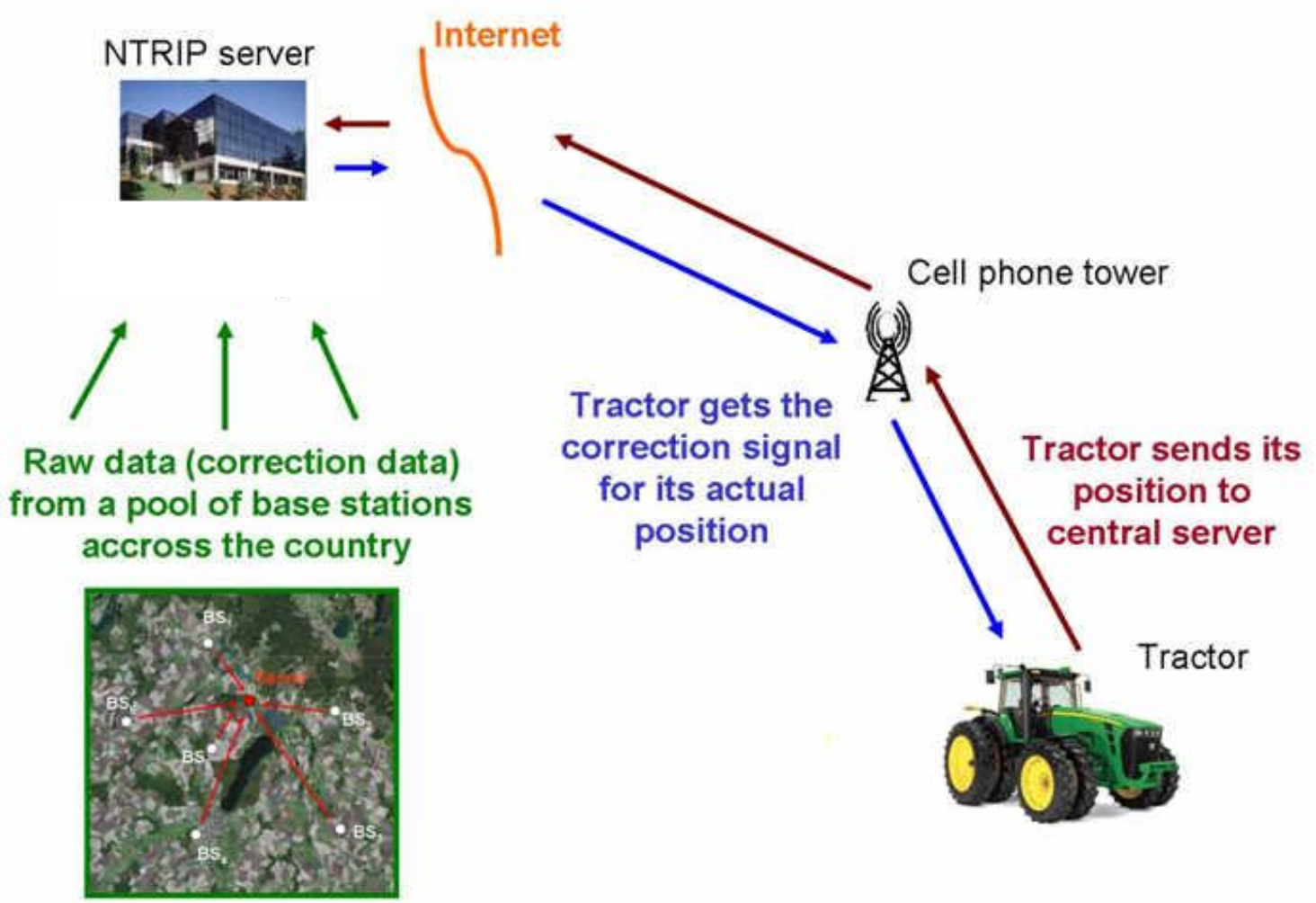


JOHN DEERE

RTK – Real Time Kinematic

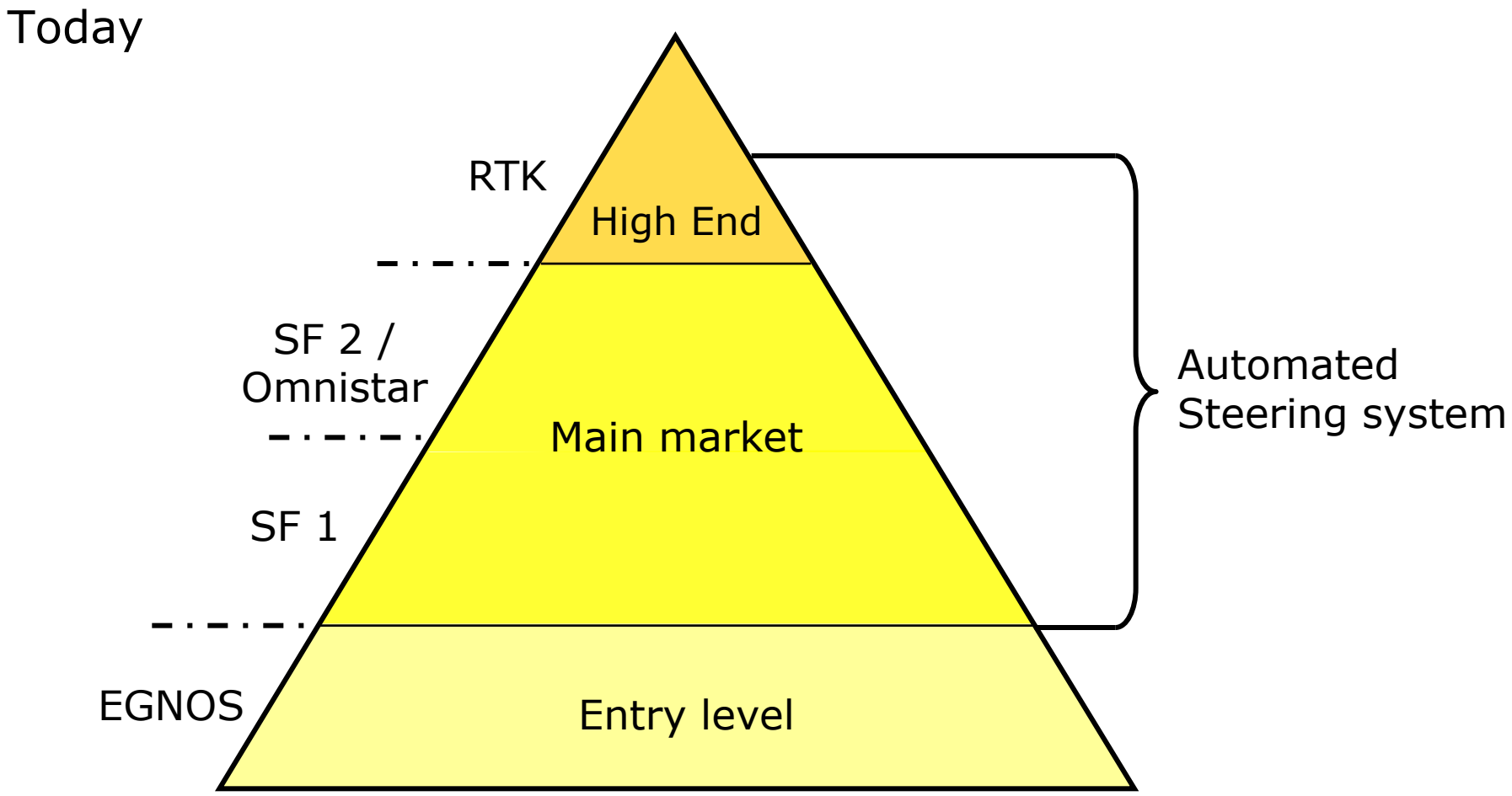


Cellular RTK – Real Time Kinematics



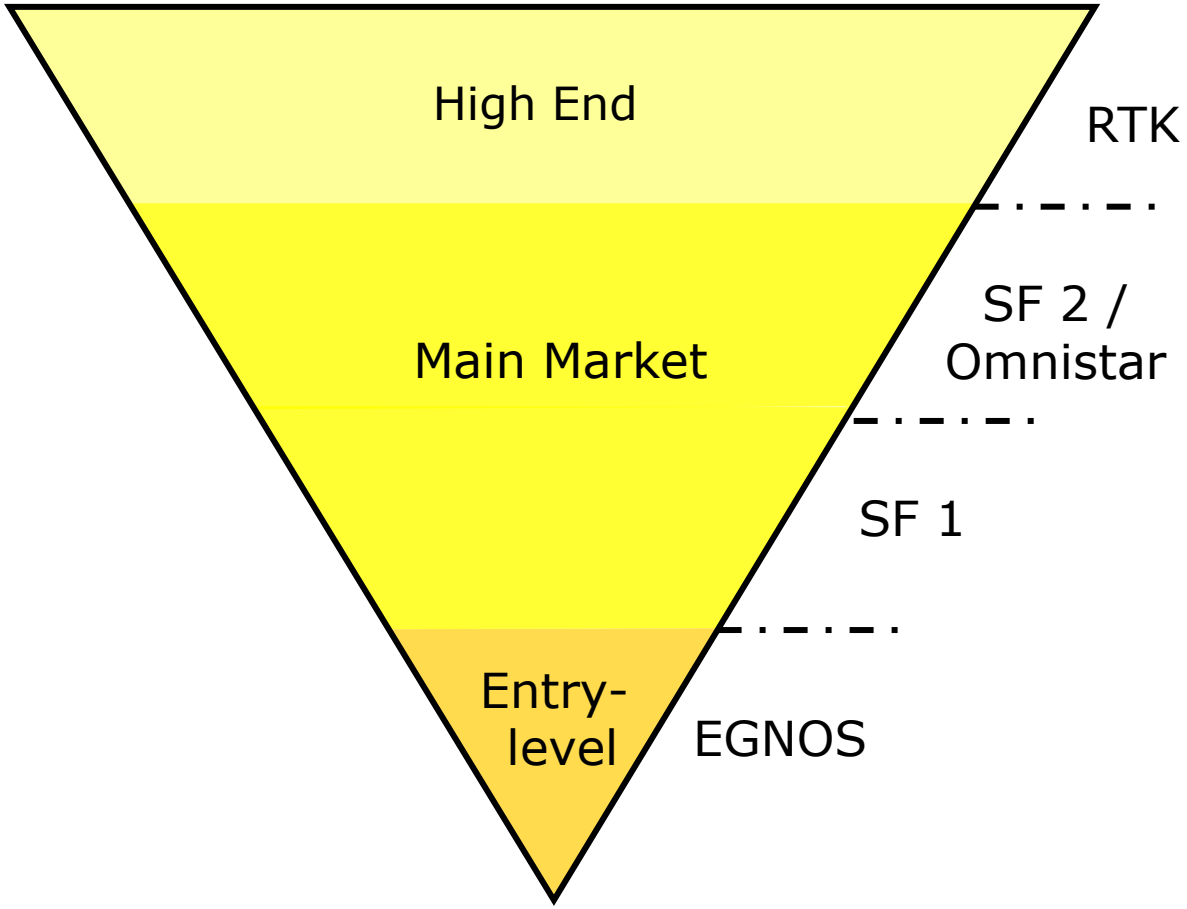
JOHN DEERE

Precision Farming - Correction Signals



Precision Farming - Correction Signals

In 5 Years



JOHN DEERE

JD AutoTrac Systems –

Steering systems

Precision Farming common components

GreenStar Displays

StarFire GNSS Receiver

Full integration with the John Deere family

JOHN DEERE

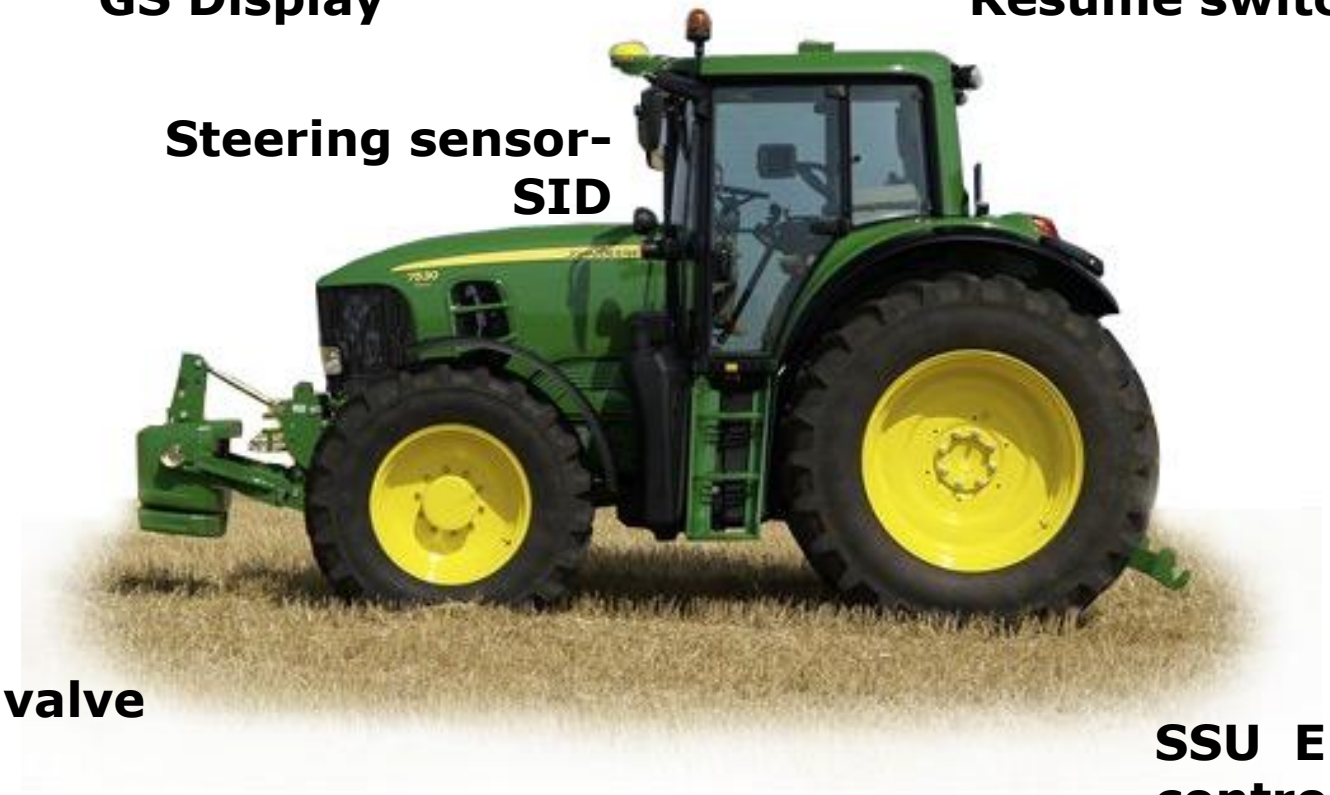
Precision Farming AutoTrac

SF GNSS Receiver

GS Display

Resume switch

Steering sensor-SID



EH valve

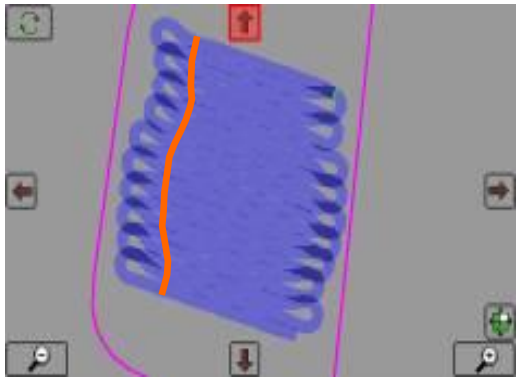
SSU EH-control

Steering angle sensor

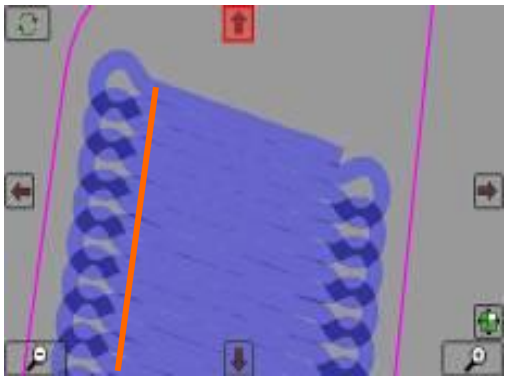
JOHN DEERE

iTEC Pro – Equipment control

- provides total equipment control
- reduces operator fatigue
- provides higher efficiency, resulting in input savings
- works with straight track guidance



→ *without iTEC Pro*



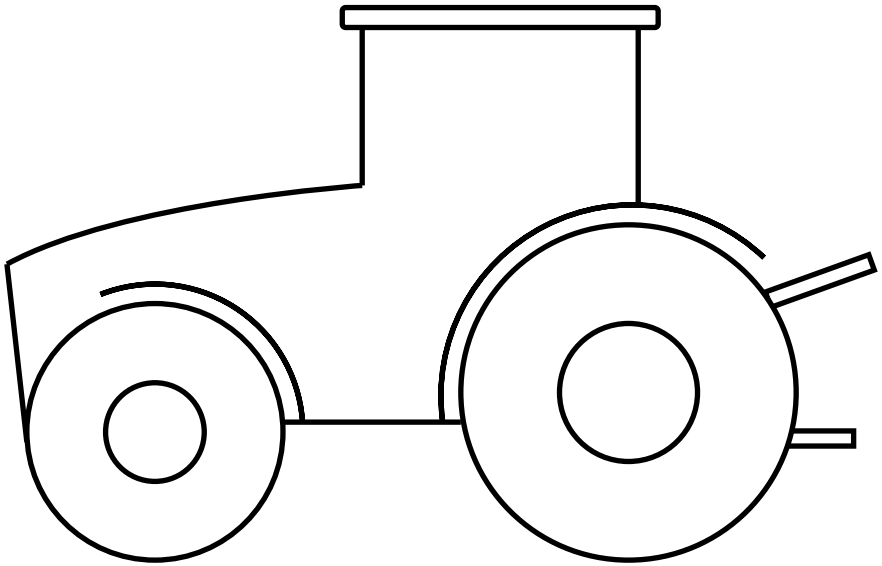
→ *withiTEC Pro*

iGuide – Passive implement guidance

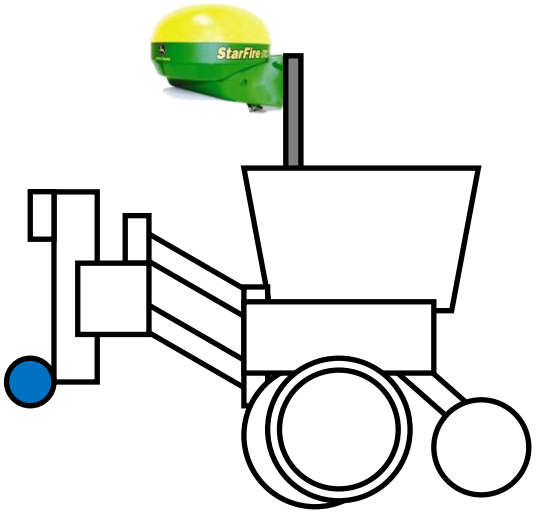
- reduces operator fatigue
- provides precise implement placement
- results in more consistent guess row width

iGuide + RTK
=
No implement drift you've experienced in curved and sloped fields

iSteer – Joint Venture with implement manufacturer



- GreenStar 2630 display
- StarFire 3000 GPS Receiver (on the Implement)
- iSteer Activation



- Controller
- Hydraulic valves
- Sensors and Wiring
- Hydraulic cylinder, mounted on the implement (optional)

AutoTrac RowSense

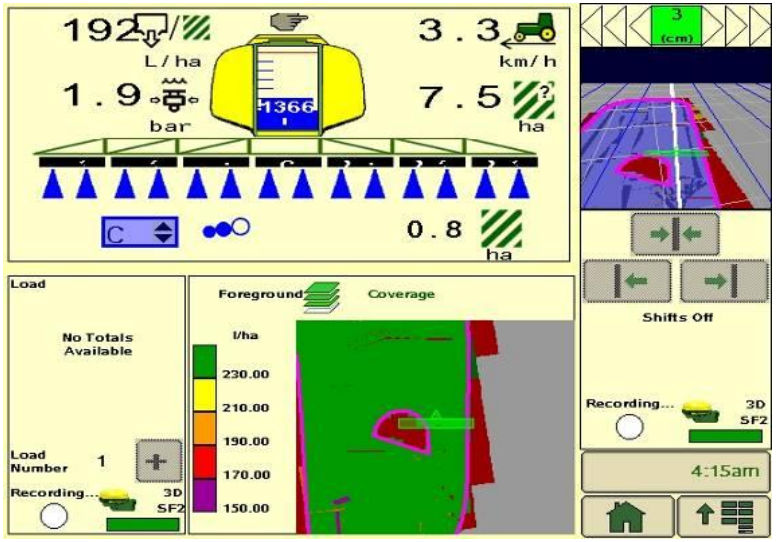
Combination of AutoTrac and Row feeler.

- Fusing together satellite position data from the StarFire receiver with feeler data gathered from the row sensors.
- The combine is guided by the data gathered from the feelers, which is then aligned with the corresponding satellite position data
- Harvesting at a consistent speed around curves, through waterways, or weeds is easy with this automatic guidance system

Sprayer Pro

Accurate spray function

- Reduced headland overlap
- Reduction of input costs
- Increased operating speed
- Reduced operator fatigue
- Increased attention towards other issues
- Environmentally friendly by reducing overspray



JOHN DEERE

JD iSolutions – Documentation

Documentation systems

4 Features, 1 monitor

GreenStar 2600

Guidance

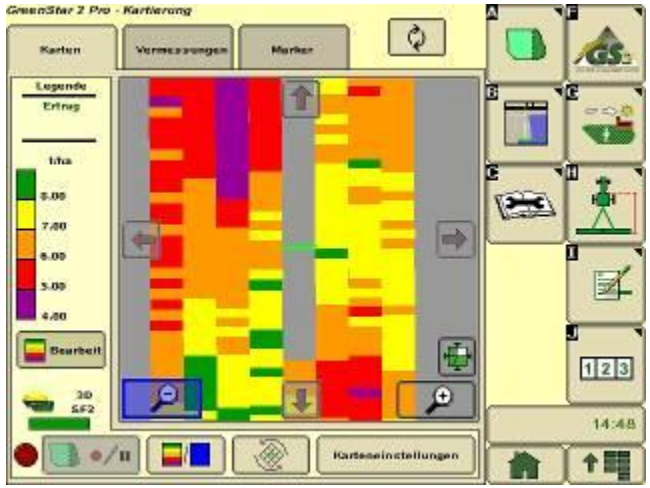
Documentation

ISOBUS compliant

performance Monitor

All functions available at the same time

Yield maps in real time

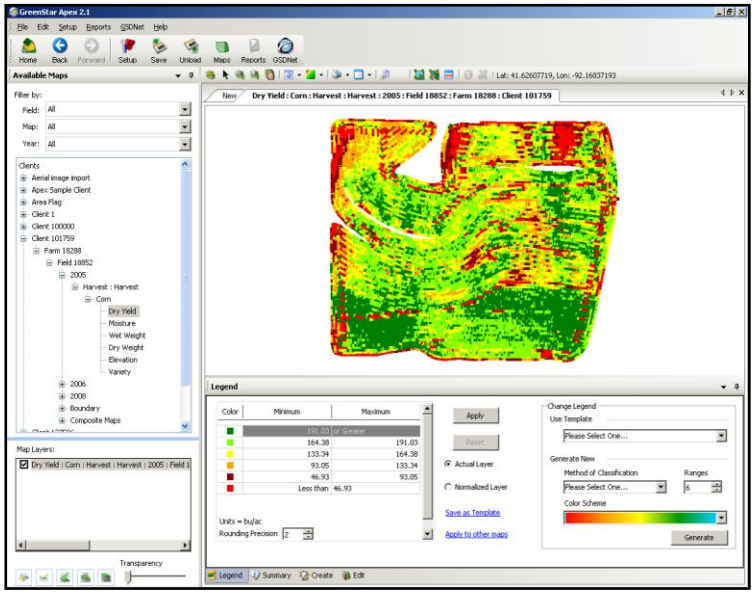


JOHN DEERE

Office Software

Farm Management Software

- Field management, machine management, driver management, etc.
- Creation of Task Reports data based on Documentation
- Generation of yield maps and application maps for Billing management



JOHN DEERE

Documentation

Challenges

- Calculation of specific rates of fertilizer through the use of leaf reflectance sensors
- Variable application rates based on application maps

Benefit

- Use of fertilizers / pesticides as required (to meet the needs of the plant)
- Reduction of losses due to overdose
- Reduction and optimization of working capital

JD Link - Telematic

JDLink
Maschinen-Management

Management of an entire fleet of machines
Observation and evaluation of fuel consumption
Machine communicates via SMS or email when ...

- Maintenance is due

- The machine leaves a predefined geographic area or drives on
- The machine starts operating outside of pre-
- defined times

Geographical location of the machine via GPS signal

John Deere

Conclusion

Conclusion

- Agriculture faces major Challenges. In the global change agriculture is getting more and more important
- To solve these challenges successfully you need new scientific and technical innovations.
- More than ever, system solutions need inter- and multidisciplinary research strategies.


JOHN DEERE