WinEO & MOVILOC

Analysis, control and monitoring as pillars for Precision Agriculture

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GeoSMART Planet: Resources + infrastructures & YOU!
WHO WE ARE

- Multinational conglomerate since 1984. Private capital.
- Offices in Spain, Portugal, Poland, USA, Germany, Romania, Malaysia, and India
- Over 1,000 employees
- Roots in Space and Defense
SPACE AND APPLICATIONS

SATellite GROUND SEGMENT SYSTEMS

- Ranked #1 Worldwide as independent Satellite Control Centre provider to commercial telecom operators
- Over 230 Satellite missions worldwide have used GMV technology
- Main European supplier of critical GNSS ground components
- Ranked #3 as Galileo system developer

CUSTOMERS

- Space Agencies
- Satellite Operators
- Main manufacturers

QUALITY

- CMMI Level 5
**WHAT IS PRECISION AGRICULTURE??**

- It is a holistic and environmentally friendly strategy in which farmers can vary input use and cultivation methods – including application of seeds, fertilizers, pesticides, and water, variety selection, planting, tillage, harvesting – to match varying soil and crop conditions across a field (Srinivasan, 2006)

- Managing each crop production input – fertilizer, limestone, herbicide, insecticide, seed, etc. – on a site-specific basis to reduce waste, increase profits, and maintain the quality of the environment (John Deere, 1998)

This objective is achieved through the incorporation of various technologies, such as GPS, Geographic Information System (GIS), Business Intelligence (BI), production monitoring, Variable Rate Technology and Remote Sensing.

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<tr>
<th>Profit monitoring</th>
<th>Direct and Remote Sensing</th>
<th>Precise navigation &amp; positioning</th>
<th>Variable Rate Technology</th>
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</thead>
</table>

| GPS / Earth Observation |

**GEOGRAPHIC INFORMATION SYSTEMS + BUSINESS INTELLIGENCE + MANAGEMENT SYSTEM**
OUR PROPOSAL

WE TACKLE...

- Minimize production costs
- Minimize environmental impact
- Efficient farm operations
- Control production procedures
- Reduce heterogeneity

BY MEANS OF

Optimization of operations during the growing campaign, based on:

1. Remote Sensing (WinEO)
2. Agroclimatology (WinEO)
3. Agricultural Fleet Management System (MOVILOC)
4. Decision support system (GeoBI)
OUR INTEGRATED SOLUTION

MOVILOC: Agricultural Fleet Management
WinEO: Remote Sensing and Agroclimatology
WinEO GeoBI: Data Analysis and Decision Support System
WinEO

Remote Sensing & Agroclimatology for Site Specific Management
WinEO, SERVICE CHAIN

Data Mining

- Agroclimatic data
- Satellite images
- Field data
- User data
- Crop models
- Onboard sensors...

Production of Basic Data

- Image pre-processing
- Production of vegetation indices
- Kriging, continuous agroclimatic variables
- Integration of external information....

Value Added Products

- Derived data and indicators
- Statistics segmentation (zonification)
- Delimitation of different management units
- Data service;
  - Yield estimations
  - Biomass estimations
  - Harvest progress monitoring
  - Diseases and pests monitoring
  - Variable Rate Management
  - Maturation curve
  - Soil water balance
  - Irrigation scheduling
  - Others (on-demand)...

Data

WinEO GeoBI

- Summarized data
- Comparative data
- Trends analysis
- Time series analysis
- Analytical Reports
- Development and events
- Site specific management
- Predictive models
- Maturation monitoring...

WinEO Users

- Analysis
- Monitoring
- Decision Making
- Practices Improvement

Services platform

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SATELLITE CROP INDICATORS

WHAT FOR?

- Crop variability mapping – Site Specific Management
- Crop phenology monitoring - Paddock and farm zoning
- Yield prediction – Variable harvest
- Production quality estimation
- Early disease detection – Adjust rated treatments
- Nutrient deficit control - Variable Rate Fertilisation
- Irrigation scheduling – Variable water dose...

NDVI crop biomass NDVI EVI
SATELLITE CROP INDICATORS

LEAF AREA INDEX (LAI)

FRACTION OF ABSORBED PHOTOSYNTHEISTICALLY ACTIVE RADIATION (fPAR)

NATURAL COLOR (VIS-RGB)

LAI (VECTORIZED)

fPAR (VECTORIZED)

Image © DigitalGlobe
Sugarcane nitrogen fertilization map in 3 levels of demand

Image © DigitalGlobe
## Weather Variables & Forecasts

<table>
<thead>
<tr>
<th>Weather Variables</th>
<th>What for?</th>
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<td>2. Dew point temperature</td>
<td>2. On-farm strategic use of meteorological information</td>
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<td>3. Relative humidity</td>
<td>3. Tactical decision making based on weather information</td>
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<td>5. Wind speed</td>
<td>5. Applied Climatic Water Budgeting (Water availability, Irrigation schedule)</td>
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<td>6. Solar radiation</td>
<td>6. Thermal Time (degree growing days)</td>
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<td>7. Evapotranspiration (ETc &amp; ETr)</td>
<td>7. Agroclimatic Classification</td>
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<td>9. Water loss balance</td>
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</tbody>
</table>
WEATHER VARIABLES & FORECASTS

AIR TEMPERATURE (°C)

RELATIVE HUMIDITY (%)

EVAPOTRANSPIRATION (l/m²)

Soil Water Balance - 2011 Campaign
Irrigation Sector ID: COR.S02

Irrigation or Rainfall (l/m²)

Soil Moisture (l/m³)

- Irrigation
- Rainfall
- Soil Moisture
- Field Capacity
- Permanent Wilting Point
WinEO GeoBI
Decision Support System for Farm Management
WinEO GeoBI: DASHBOARD & GIS

Dashboard
- Graphical display of tactical metrics & near real time data
- Enable faster respond to production dynamics
- Unified point of view for reports and operational trends connected with KPIs & forecasting capabilities.

GIS Interface
- Spatial data entry, management, retrieval, analysis, and visualization functions
- Designed to assist in decision making while solving a spatial problem
- Full integration with business intelligence

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WinEO GeoBI: REPORTING & ANALYSIS

Static Reports
- Data visualization with interactive HTML5 charts
- Integrated multi-Level zoom
- Data Exploration and interaction providing better understanding of the situation

Dynamic Reports
- Ad Hoc Analysis supporting drilling, slicing, dicing, pivoting, filtering, interactive charting
- Built-in calculations to perform what-if analysis or advanced custom analytic functions
- Expanded chart formatting options
AGRICULTURAL FLEET MANAGEMENT

PROBLEM...

- Optimization of resource allocation, scheduling, routing, and real-time monitoring of vehicles and materials

SOLUTION...

- **Fleet management systems** based on:
  - precise navigation (GPS)
  - onboard sensors (speed, hour meter, RPM, engine idle ...)
  - mobile communications (GSM/GPRS)

- Tools to **supervise and control the use of the machines** and the associated administrative functions
MOVILOC

Agricultural fleet managemet, MOVILOC records and transmits...

- Real-time tracking and monitoring
- Route history lookup
- Alarm management (harvest speed, engine idle, sensors alarms)
- Truck loading parameters
- Verification of compliance with timetables and speed limit for each stage of travel
- Recording of the time waiting at different positions (weighting, stops along the way,...)
MOVILOC

- Functions supporting the comprehensive **control** over the work performed by each driver.
- Provision of **real time information** on (i.e.);
  - the routes and distance travelled
  - whether routes have been completed on time and in full
  - control over whether scheduled daily stops have been made
- **Compatible** with a wide range of peripherals and sensors
- **Flexible service** which can be easily integrated into ERPs, corporate Intranet, etc.)
- **MOVILOC** is **fully integrated** with **WinEO GeoBI** through web services
Conclusions
PRECISION FARMING BENEFITS

- **Cost reduction**
  - Optimized on farm decision making
  - Optimized use of seeds, fertilizers, agrochemicals
  - Reduction in water consumption & energy costs

- **Increased quality**
  - Consistent application of production protocols
  - Optimizing practices through constant measurement
  - Early detection and mitigation of crop stress factor
FLEET MANAGEMENT BENEFITS

- **Improvement of the operational efficiency of the vehicle fleet**
  - Daily operational data allowing to optimize planning of the mobile resources

- **Cost optimization**
  - Increase productivity and significant reduction of main operating costs
  - Optimization of labors (i.e. planting or harvesting speed)
  - Plan the maintenance of each one of the mobile assets (alarms)
  - Reduction of cost of external services. Knowing where the equipment is, what they are doing, where they stopped and for how long

- **Traceability**
  - Knowledge on where the vehicle is in real time allows monitoring and managing farm operations minute by minute
Thank You

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