Machine control in Construction
User consultation Group
Geomatics & Urban planning

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“The first rule in any technology used in a business, is that automation applied to an efficient operation will magnify that efficiency”
In the next years less and less people will have the skills to work in construction.

Still construction needs and market will keep growing in the coming years.

Need for optimization, productivity, environmental controls, HD mapping, data...

=> Automation needed
Who is Septentrio?

RELIABLE & ACCURATE
GNSS POSITIONING

• Reliable positioning
• Advanced anti-jamming & anti-spoofing technology
• Robust and secure FW

APPLICATIONS KNOW HOW

• Machine control & guidance
• Reference stations & scientific applications
• Aerospace and defense
• Survey, Mapping and GIS
• UAS & Robotics

YOUR OEM PARTNER

• Our mission is to make our customers successful

Accuracy + Reliability + Availability + Security
Major trends in Construction/Mining Geomatics

**Autonomous**
- Sensor Fusion
- SLAM
- Robotics
- Continuous operations

**Connectivity**
- Monitoring
- Tracking
- SWARN tasking (collaboration)
- Remote operations
- Smart factory

**Accurate Localization**
- Accurate positioning
- Orientation
- Best availability
- Resilience

**3D – Info, cloud, VR, AR**
- 3D information as opposed to only 2D systems
- Further mapping with extra sensors
- 3D modeling
- 3D printing
- Virtual and Augmented Reality
- UAV mapping

**Wearables**
- Personnel tracking (safety)
- Virtual and Augmented reality
**Needs in GNSS technology**

- **Available Accuracy (GNSS+)**
  - Relative/absolute accuracy
  - GNSS & GNSS/INS
  - Corrections compatibility

- **Available Orientation**
  - Vehicle and material orientation
  - POI
  - Dual antenna or GNSS/INS

- **Reliability**
  - No risk of jamming (AIM+)
  - Anti-spoofing (e.g. OS-NMA)
  - Redundancy (GNSS/INS)

- **Network & sensors**
  - Synch to sensors (events, PPS, ports)
  - Ethernet & IP communication
  - Easy corrections delivery

- **Environmental**
  - IP67/IP68
  - Robust temperature / solar storms
  - Vibration robustness (LOCK+)
  - Ease of integration for certifications

- **Quality indicator & EoU**
  - Bundled corrections (no base station) [ready for HAS]
  - Fallback corrections
  - Detect problems fast
  - React Fast
  - Facilitate support
  - Ease of Use

- **GALILEO**

- **Ease of Use**
  - Environmental
  - IP67/IP68
  - Robust temperature / solar storms
  - Vibration robustness (LOCK+)
  - Ease of integration for certifications

- **Septentrio**
CONSTRUCTION

“RELIABILITY is important – a day lost can cost up to 1000 eur per operating machine”

PROFILE

Market: Construction
User case: High Speed Railway project (mountains)
Project: Follo Line in Oslo
Business model: Engineering

PRODUCTS USED

For drilling automation

SIDE TECHNOLOGY

Cloud, GNSS, Display

SECONDARY USE CASE

Stake out
- Mapping precisely before work

MAIN USE CASE

Difficult environment (mountain, metallic, interference)

Arm sensors (bucket, stick, boom)

Dual antenna GNSS

END USER BENEFITS

Avoid days lost (can reach 1000 eur)
1: Availability under difficult mountain conditions
2: Resilience to jamming events in Norway
3: Robustness for the difficult conditions and environments (mountain, metal)

LOCATIONS

Process
1: Stake out done on terrain
2: Data uploaded via cloud to MC system
3: Machine is guided via ctrl display
4: Excavator performs needed work
5: Final results uploaded to cloud

USE CASE DETAILS

Cloud
Dual antenna GNSS
Arm sensors (bucket, stick, boom)

Difficult environment (mountain, metallic, interference)

HIGH AVAILABILITY (MULTI-CONSTELLATION incl. GAL)
RESILIENCE AGAINST INTERFERENCE
ROBUSTNESS

END USER BENEFITS

GNSS requirements
GNSS: Accuracy (height important) cm’
Orientation: For vehicle orientation and leveling
Environment: Difficult (mountains and metallic surfaces), scintillation
Reliability: For optimized work and vibration robustness
Difficult environments
- Solution = GNSS/INS
- Powered by multiple GNSS constellations
- Galileo multi-signal value

Value of more signals

Avoid accidents
GNSS Interference
Septentrio lead on interference mitigation technology

AIM+
Signal Diversity protecting jamming/spoofing
Conclusions

• EU has important challenges with the **evolving macro-economics** in Construction

• Construction **automation and optimizations** are needed

• GNSS offers a key element towards the **transformation in construction market**

• **European GNSS developments** will provide the advantages for this transformation
Questions?

1. How do you see the adoption of 3D Machine Control systems in EU for the coming 4 years

2. How far do you see the adoption of AUTONOMOUS construction machines

3. How do you see the adoption of European GNSS systems vs Asia new entrants in the market
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