From GPS to multi-GNSS

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u-blox at a glance

- **Swiss semiconductor company**
  - Founded in 1997
  - Listed on the SIX Swiss Exchange since 2007 (SIX:UBXN)

- **Core competencies**
  - Satellite based positioning technologies
  - Cellular communications technologies
  - Short range radio technologies

- **Product offering**
  - Integrated circuits – the foundation of our solutions
  - Modules – fully implemented, drop-in solutions
  - Services – delivering added value to our solutions

- **Market focus**
  - Automotive – robust, automotive grade products
  - Industrial – durable components for professional electronics
  - Consumer – mass market ICs and modules
u-blox at a glance

Revenue history and guidance

- u-blox is fast-growing and cash-flow positive

Global market leaders rely on u-blox’ local presence

- Note: official reporting in Swiss Francs
- ** Guidance for the full year of revenues between CHF 335-345 million
u-blox in China

1997  u-blox founded in Switzerland
2001  u-blox subsidiary in Hong Kong
2007  u-blox representative office in Beijing
2011  u-blox representative office in Shenzhen
2013  u-blox shows BeiDou receiver only 3 weeks after publication of BeiDou specification
2013  u-blox representative office in Shanghai
2014  Launch of u-blox M8 GPS, BeiDou, GLONASS receivers. World’s first chip with BeiDou in ROM.
2015  u-blox representative office in Chongqing
Long-lasting experiences with GNSS platforms

**GPS-MS1E**
- World’s first SMD GPS module

**ANTARIS**
- GPS
- Dead Reckoning

**ANTARIS 4**

**u-blox 5**
- GPS
- Galileo ready

**u-blox 6**
- GPS
- Galileo ready
- Dead Reckoning

**u-blox 7**
- GPS, GLONASS

**u-blox M8**
- GPS, GLONASS, BeiDou, Galileo
- 3D Dead Reckoning
**GNSS L1 Frequencies**

- GPS, Galileo, and QZSS transmit on the same frequency.

  - BeiDou operates at a lower frequency.
  - GLONASS operates at a higher frequency range.

- The diagram shows:
  - BeiDou P2 at 1561 MHz.
  - GPS, Galileo, QZSS at 1575 MHz.
  - GLONASS L1OF at 1598 MHz.
  - A different range from 1610 MHz.
Receiver requirements

- Reception of more than one frequency has impact on receiver design
- GPS, Galileo, QZSS requires only small bandwidth → Minimal power consumption
- Multi-GNSS requires a large bandwidth → 40 to 50% higher power consumption
Multi-GNSS improves performance in urban areas

- A car driving through an urban canyon only have a slot like view to the sky.
  - This limits the number of visible GPS satellites (blue).

- Adding satellites (red) from other GNSS improves PDOP and accuracy
- More line-of-sight satellites help to suppress multipath and hence improve accuracy
Multi-GNSS improves performance in urban areas

- Roadtest in City of London make performance benefit of multi-GNSS (green) over GPS (red) obvious
Galileo

- In-Orbit Validation phase completed
- In preparation of Initial Operational Capability
  - 5 fully operational satellites available (9. Sep 2015)
  - 2 additional satellite scheduled for launch on 11. Sep 2015

- u-blox will support Galileo on u-blox M8 receivers
  - Galileo with GPS improves accuracy with hardly any power increase.
  - Triple constellation mode further improves accuracy
Questions?
locate, communicate, accelerate

Thank you!