GNSS – from Experts to Everybody

- Case study 1: Surveying

- Case study 2: Vehicle navigation

(Technology management in user segment – lessons learned)

- You wish maybe to talk about technology, I will to talk about money

- Standardization

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Case 1: Surveying
Macrometer V-1000

- Codeless L1 receiver (turned out to have major technological shortcomings, despite of high accuracy)

- Heavy 60 – 80 kg, could not acquire time or almanac, needed to be preprogrammed location specific.

- Introduced 1983 – outdated 1986

- Cost $250,000 (1983) -> in current money $525,000 per unit (3%)

- Geo/Hydro Inc. went bankrupt as new technology (and thereby competition emerged).
Trimble 4000(s)

- Code correlating unit, which could acquire time and satellite signals independently.

- Significantly lighter (20 kg), smaller and less expensive $40,000 (1986) -> today’s money $75,000 per unit.

- Post processing automated and could be done with any PC.

- Still had deficiencies, like required car battery to run, external PC for data logging and GUI.
GPS satellite vs. User equipment disparity

-I have to admire the people who designed GPS, because it was designed not for the 1980s but for the modern days.

-The satellite constellation was so much more advanced to anything we could build in the electronics industry in the 80’s (ASICs, memory capacity, CPU power, telecom,…) 

-Electronics industry needed to catch up.

-Then something happened...
January 28th, 1986
Ashtech MD-12

- Integrated receiver, antenna, GUI and data memory

- First model, where the basic technological concept has survived to modern day.

- Cost $30,000 (in today’s money $50,000). The price curve was very steep in 1980’s, but flattens out in the 1990s. First 7 years -> 1/10th of the cost Next 14 years -> 1/10th of the remainder

- The early pioneers were not successful as they could/did not plan for the fast development of the electronics industry and equipment price decline.
I will skip a few years...
2009

Conclusion:

GPS has taken the skill out of surveying
Case 2: Vehicle Navigation
In vehicle cost in 1993 $12,000 -> in today’s money $18,500
2008

Garmin: $250, inclusive of all US maps
Conclusion:

GPS has taken most of the skill out of navigation
Conclusion overall

-Cost reduction drives the market

-New applications arise when lower price for GPS and related technology is reached or when more availability is produced (INS+GPS or GPS+Glonass)

-More people can afford using GPS when price is lowered

-Cost of GPS has been low for some time, but adjacent technology has been catching up (memory, digital maps, flat screens)
Standardization

- Has been elementary for the success of GPS

- RTCM (2.1., 2.2., 2.3., 3.0), NMEA 0183, FGCC tests for performance and compatibility

- For the Glonass and interoperability of GNSS we need stronger control and standardization on how to handle Glonass interchannel bias to maintain compatibility especially in the VRS networks.