FOUR QUESTIONS ON THE STATUS OF GNSS

GNSS: Evolution or Revolution

The market for Global Navigation Satellite Systems (GNSS) has never looked so buoyant. Are we in the midst of a revolution or simply witnessing evolution pre-planned and destined to run its course? Two fictional respondents, the revolutionist and the evolutionist, here answer four pertinent questions.<P>

GNSS applications are becoming mainstream and available in a growing number of devices. And improvements in the signals via new satellite systems and new technology such as secure user plane (SUPL) for wireless devices will improve reliability and functionality. Everyone would agree that there is a lot going on in GNSS. This is manifested in all-new systems like Galileo and Compass, new signals from existing systems like GPS L2C and L5, and new satellites from Glonass. At user level we are seeing new applications, falling prices and better performance. GNSS is making its appearance everywhere, sometimes obviously, as with in-car navigation systems and in mobile phones, providing a caller's location during an emergency call. However, there are also less obvious applications, such as GPS providing the precise timing for many financial and banking transactions, and container ports controlled by computers that use GNSS to track assets.

Question 1
Are we experiencing revolution or evolution in GNSS systems and signals? The evolutionist would reply that we are seeing an organised and logical evolution. The GPS Wing (the group responsible for managing the GPS system on behalf of the US Department of Defence) is building on the successes of the past, keeping the successful "legacy" C/A and P(Y) code signals and adding new civilian and military signals to build capability and resilience. GPS L2C is designed as a second civilian signal, GPS L5 is optimised for safety-critical applications and the GPS M-code signal will provide the strategic capabilities required by the military well into the future. The GPS Wing is even looking beyond the next generation of GPS Block 2 satellites (Block 2 follow-on, the first of which are to be launched later this year) to the future Block 3 satellites. In addition, Glonass satellites are steadily being launched to bring the system to full capability. Galileo is moving ahead and Compass is waiting in the wings, possibly to march forward on a similar development timeline to Galileo, maybe even ahead.

But the revolutionist would tell us we were experiencing a revolution. GPS will more than double its number of signals over the next few years, Glonass looks as if it will be fully operational around 2010 and Compass and Galileo may not be far behind. So within, say, five years, twice the number of signals and systems will probably become available. This will revolutionise accuracy, availability and integrity. Civilian users will, for the first time, have the opportunity to use two frequencies for normal navigation, for example, GPS L1 C/A code and GPS L2C. This will all but eliminate positional ambiguity caused by ionospheric conditions, which provide the majority of errors in single-frequency GPS receivers. Positional accuracy will become better than a metre, opening up the possibility for applications accurate to a lane of a road, and automated systems, such as collision avoidance and active safety.

Question 2
But GNSS does not even work indoors; how can such limited capability be viewed as revolutionary? According to the evolutionist the indoor problem will not be solved any time soon, even with new technologies like SUPL (Secure User Plane Location) and advanced assisted-GPS. At best, this will limit the evolution and ubiquitous adoption of GNSS consumer technology. At worst, GNSS could even become discredited, as its supporters try to move it too fast into areas of application where expectations of it cannot be met; consumers will get frustrated by technology that does not work well everywhere. This is evidenced by the current 'media-fest' about GPS sending lorries down unsuitable minor roads. Whilst we know this is the fault of routing algorithms, not GPS per se, it's 'SatNav' or 'GPS' that gets the bad name.

The revolutionist responds differently to this question: the 'indoor problem', says he, will be fixed over the next few years. Technologies are in place and significant progress is being made. This revolution began with assisted-GPS, where almanac and ephemeris (precise satellite location) data is uploaded to reduce the search window, resulting in quicker fixes and the ability to acquire lower-power signals, including limited ability to navigate indoors. There is also the promise shown by ground infrastructure-based positioning. Candidates are local transmitters or pseudolites and triangulation techniques from either Wi-Fi

or cellular base-stations. The beauty of these is that they work best where ground infrastructure is dense, such as in cities, where GPS may struggle. In addition, new wireless technologies, particularly SUPL, will prove a facilitator here, from both technology and commercial perspectives. SUPL works by passing signalling and data over the 'user plane' of a mobile device, the regular communications interface used by millions for surfing the internet or sending SMS messages. SUPL could change the industry, as it is "network agnostic" and enables anyone to offer location-based services (LBS).

Question 3

Aren't receiver manufacturers guilty today of focusing solely on GPS and not taking other GNSS such as Galileo, Glonass or Compass seriously? Our evolutionist will reply that agreements have been reached between the various systems regarding interoperability. For example, in July 2007 the United States and the European Union agreed to jointly adopt and provide an improved design for their respective GNSS. However, this is a long-term agreement and in the space segment will take many years to realise. Meanwhile, if adding signals to existing GPS L1 C/A code receivers increases cost or has other negative effects, such as consuming more power, people will tend to stick to what they have today. This is clear from the consumer chip-set manufacturers who are now commercially offering only GPS L1 C/A code technology. To improve performance people are turning to augmentation systems. For example, in Europe the European Geostationary Navigation Overlay System (EGNOS) provides correction and event-flag data for users with high-integrity requirements. On the ground, the planned Local Area Augmentation System (LAAS) is envisaged around airports to enable GNSS-only approach and landing. Space-based augmentation systems and ground-based augmentation systems such as these are a logical and evolutionary step. Indeed, these systems are designed specifically to overcome some of the inherent weaknesses in current GPS-only performance, particularly positional accuracy and integrity.

The revolutionist response to this is that many GNSS technology developers are well aware of current performance limitations and are keen to add additional signals. One of our customers has told us that it will 'take any additional satellites we can get (to improve performance)'. Indeed, many current customers are investing in Galileo technology development. A good example is for in-vehicle systems, where the new Galileo signals will be live during the expected operational life of the units. The PR China Compass system is also generating interest, although most people are currently adopting a "wait and see" strategy until more information on the system and its commercial availability enters the public domain.

Question 4

But is GNSS about to become a true utility, alongside thingslike communications, power and water? The evolutionist will say we are some way off that situation becoming a reality. Today, mass-market consumer GNSS is focused on in-vehicle navigation systems and so-called personal navigation devices (PND). It is also true that cellular phones are increasingly being bundled with assisted-GPS technology. This was initially driven by emergency location requirements, although increasingly, with SUPL, GPS in mobile phones is becoming a differentiator in its own right. Recent forecasts predict that within twelve to eighteen months cellular-phone navigation applications will overtake PND shipments.

The revolutionist, in contrast, will assert that GNSS is on the cusp of becoming embedded in many devices. There has been a major shift in the industry over the past twelve months, with the Cambridge Silicon Radio (CSR) acquisition of NordNav and Cambridge Positioning Systems (CPS), and Broadcom's acquisition of Global Locate. Also of note are the TomTom acquisition of TeleAtlas, and the tie up between Navteq and Nokia/Garmin. All these moves, and others like them, mark the maturation and consolidation of technologies that will shape the industry. Up until now the GNSS industry was the preserve of GNSS specialists. CSR and Broadcom represent major silicon players taking up positions in GNSS. They have changed the structure of the industry forever.

Evolution or Revolution

What is the viewof the present author? On the one hand, an element of evolutionary natural selection is inevitable. Some signals will win; some will lose out. Some players will grow; others will be acquired or will fade away. On the other hand, we will look back on now as a key turning point in the story of GNSS, with many new and innovative applications emerging that will stimulate growth in the market. The next few years will be remembered as the time during which GNSS grew up, became very widely known and taken for granted by the masses.

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