Globally playing it safe

by Kevin Borras and Andrew Pickford

From its military underpinnings, to its increasing adoption as a mass-market product, GPS is now facing competition from other positioning methods, including Europe's Galileo. The GPS industry can either choose to compete or cooperate with these young upstarts but the result may owe more to national politics than technological innovation. TTi looks deeper…

Some technologies can be regarded as 'enablers'. A technology such as vulcanisation enables the mass production of tyres for the car-hungry public. A technology such as WAP enables mass-market delivery of services and information to mobile phones. Being able to determine location using the US Department of Defense sponsored Global Positioning System (GPS) is a key enabler for public safety and location-based services. *TTi* has regularly reported its use in several telematics applications such as navigation, asset management, geo-fencing, stolen vehicle recovery and passenger information systems. The value of GPS in telematics is well understood although primarily in high added value vertical markets and self-positioning applications.

However, in the larger picture GPS is also an enabler for military warfare, aircraft navigation and covert tracking. In fact GPS has always existed in a parallel universe reserved for strategic technologies alongside the radio spectrum, data encryption and radioactive material – political enablers are frequently pawns used by governments in international trade arguments. The potential for GPS to emerge as a low cost mass-market service enabler has never been greater but it will need to be piloted through a tougher political maze, increased competition from terrestrial positioning methods and other satellite-based solutions such as the European Union's own constellation: the much-talked about and just as often delayed Galileo (see story in News story). The drive to push GPS into high volume commercial and mass market services has never been greater with European Commission estimates for location technologies and applications ranging from a US$10bn to US$40bn market size within five years.

Battle lines

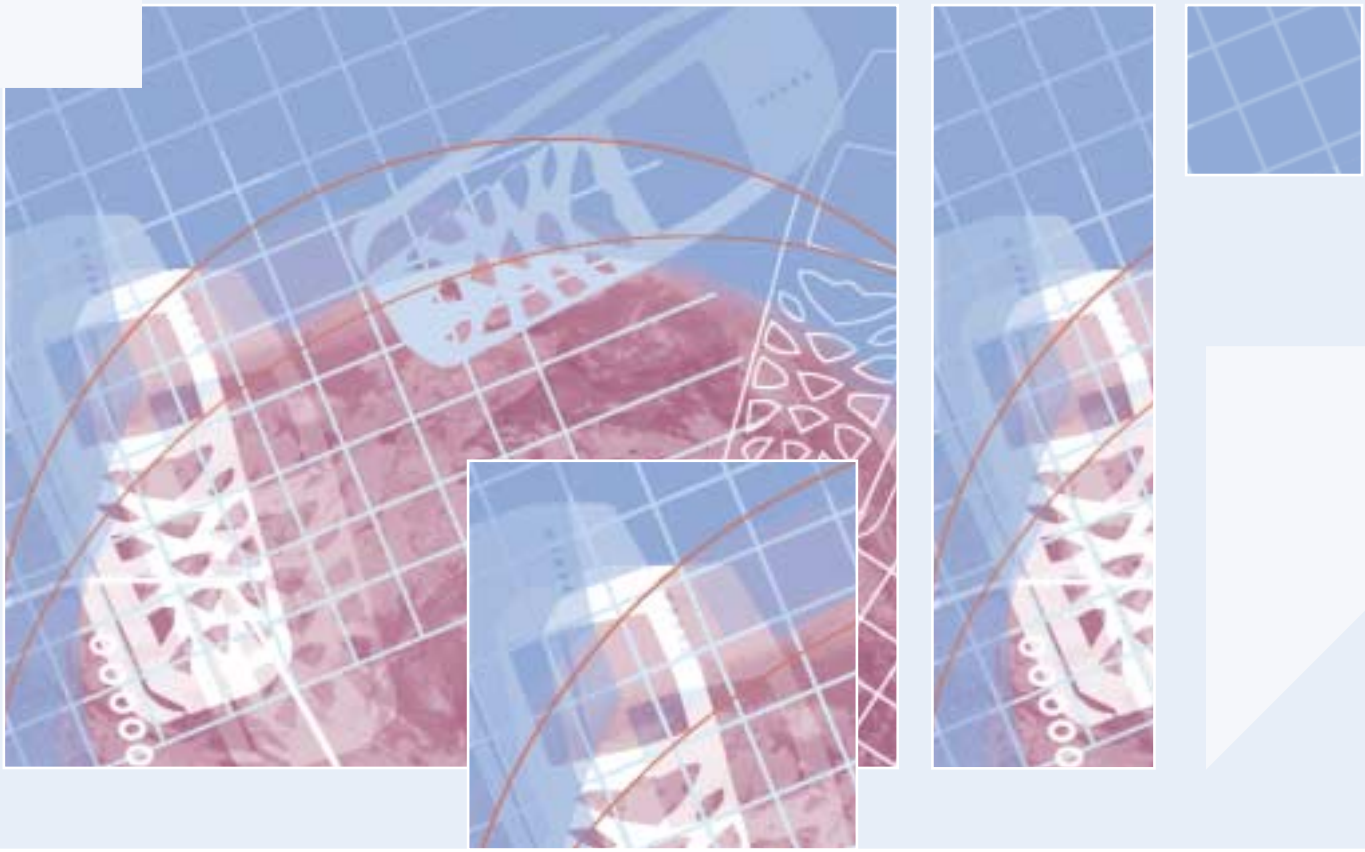
In 1999 the European Commission requested the member states of the European Union to support an ambitious project to develop a Global Navigation Satellite System (GNSS) known as Galileo. As well as reducing the dependency of European positioning technology developments and services on the US GPS, it would create employment and a market for new products.

The technology-led Galileo initiative has since triggered the search for commercial and mass-market location-enabled services. It has also had the effect of creating a new sense of urgency to accelerate the upgrade of GPS to provide a more spectrum efficient service and locate users more precisely in more demanding environments. The US GPS Joint Project Office is currently studying how the upgrade of the GPS satellites can be advanced from the current 2015-2018 to no later than 2010.

Galileo is scheduled to provide full user capabilities between 2007 and 2008 supported by an industry of chipset manufacturers, routing engine providers, vehicle manufacturers routinely integrating positioning in all vehicles and application service providers (ASPs) offering a variety of subscription and transaction-based services to fleet managers and drivers. At this stage we cannot reliably predict the future of navigation and positioning technologies in 2007 or 2008 but the drivers of (and risks to) market growth are already visible (Figure 1).

Position uncertainty

In 1997 delegates to the Moscow airshow saw an effective reminder of one of the weaknesses of satellite systems – GPS's very low level signal received at ground level was masked out by intentional interference from a jammer. GPS was lost for a radius of over 200km.



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Furthermore, the use of GPS as a sole navigation aid for aircraft was finally settled when the US-based FAA announced that back-up systems are required to ensure the highest reliability for aircraft navigation and landing. As *TTi* readers will already be aware many vehicle positioning and navigation systems already have backups to temporary signal loss including map matching the vehicle's position to the most likely road and wheel rotation counting (dead reckoning). The advent of low cost solid state inertial guidance systems will enable a vehicle's position (or hand-held terminal) to be maintained over a short period until the vehicle's position can be updated externally – by GPS, Loran-C, Galileo or terrestrial methods such as Enhanced Observed Time Difference (E-OTD).

Finally the high profile demise of Ford's global plans to equip middle tier vehicles with the 'WingCast' location-based travel services (including emergency assistance and information) was partially compensated for by Ford's decision to outsource to Thales Telematics for a similar service, but in Europe only. Trafficmaster has also upgraded its range by adding GPS to its traffic information product range. Seemingly, only mixed success for GPS then.

Public safety net

So, has GPS lost its way? Probably not. In 2001 the total market for autonomous GPS receivers used was less than 2 million units, including in-vehicle systems. By comparison, by mid 2002, GPS had been reduced to its bare essentials and squeezed into a CDMA handset for US consumers. Over 1.5 million CDMA handsets using GPS were then shipped by Sprint PCS in less than 9 months to meet FCC requirements placed on US operators to improve public safety by locating 911 callers. When fed with assistance data to improve sensitivity and calculating the handset position in the CDMA network itself it is possible to calculate a user's position accurately. Well, maybe. The exact performance of this low cost alternative to Differential GPS (familiar to surveyors and mariners) is known as Assisted GPS but its performance in consumer handsets has, surprisingly, not yet been publicised by CDMA operators.

Regardless of industry politics and selective reporting, the development of GPS products has accelerated to the point where the technology is now available as a component to be integrated at silicon level in mass-market terminals. Road users in Europe have yet to benefit from these recent improvements in GPS but, in the meantime, use be made of location-based traffic information from operators such as T-Mobile, Vodafone, O_2 and Telenor.

The innovation here is not the positioning technology (an approximate method known as Cell ID) but the coupling of 'content' (such as dynamically updated traffic information) with a bearer (e.g. SMS), a pricing model (such as number of traffic reports) and mass marketing to drive awareness.

A new approach, currently being tested by a few 'business model' pioneer

Location technology: the route to mass market

Drivers of growth:

- Increasing concern for public safety following high profile terrorist campaigns;
- Wireless operator efforts to create innovative services to slow the decline of average revenue per user (ARPU);
- Public domain generic application programme interfaces (API) consensus building;
- Plans for the wholesale sale of 'location data' to stimulate third party application development;
- US E9-1-1 and EU E-112 caller location mandates backed up by local enforcement;
- Increasing awareness of 'location' as a beneficial tool and compelling services supported by vehicle manufacturers or travel service providers;
- Improvements to positioning performance in more demanding environments (e.g. dense urban and indoor);
- Charging of Heavy Good Vehicles for distance travelled (Directive 1999/62/EC);
- Acceptance of the need for explicit user consent for the disclosure of location to an application provider;
- Rewarding application service providers with a significant share of revenue received by wireless operators from location-based telematics services.

Risks to growth

- Continued high unit cost of location-equipped terminals limiting their use in legally mandated and market-based high-added value segments;
- Continued privacy concerns – perception of that privacy could be compromised;
- Poor applications roaming and interoperability – not meeting the expectations of informed GSM and other digital air interface users.

Figure 1: From vertical-market to mass market applications

GSM operators in Europe is to provide wholesale location information to application service providers that already understand or at least are ready to invest in the location-based telematics service. Wholesale deals push the risk of new services being launched to the application service providers with the wireless operating merely acting as a 'pipe' to exchange a user's (or asset's) location for a useful service.

Wireless network operators in Europe and the US are already creating awareness of location-based travel and telematics services through partnerships with content providers and broadcast media groups. Although, across the pond the US mass market for GPS is being led more by public safety rules than compelling consumer applications. Working out the details of convoluted cost recovery mechanisms to fund mandated network upgrades have suspended most of the discussion on (revenue-generating) location-based services.

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Matchmaking

In mainland Europe, the use of RDS-TMC to provide traffic content is well known, but by increasing the accuracy of the user's location, a travel service provider is able to increase the relevance of the information delivered. Regardless of whether we use SMS, RDS-TMC or WAP to deliver content to a vehicle, its driver or a despatcher the timeliness, relevance and reliability of the content to users means repeat business for operators – up to a point. Knowing my truck's location to within 50m doesn't help if I only want to know when the goods have arrived at their final destination. Also, having an estimate that is accurate to 100m is no use if my maps are only accurate to 200m. So, matching the correct positioning technology to the geographic relevance of the content with attractive pricing may make all the difference between a 'vertical' market of truck operators charged for distance travelled and mass market asset management for small fleet owners and commuters.

Informing a vehicle despatcher when a vehicle has arrived at a target location or warning a driver that he is approaching congestion is relevant. These 'information push' services do not wait for the despatcher or driver to request information. So, relevant and up to date information can be delivered based on conditions or events previously agreed with the user of the location-based service.

Market led or regulatory push?

The 1999 European Commission Directive 'On the Charging of Heavy Goods Vehicles for the Use of Certain Infrastructures' means that fleet operators will need to invest in technology to record the distance travelled of each vehicle having a maximum permissible weight of more than 12 tonnes.

The charges paid by (heavy goods) vehicles to travel in Europe are converging on three parameters that aim to internalise the external costs of road travel – Eurospeak for charging a fee based on impact on the environment; distance travelled, vehicle weight (fixed as maximum permissible gross weight) and level of emissions (banded category).

Can governments make markets? Well, the Swiss government is currently deploying 60,000 wireless tracking devices that use GPS expected to generate US$424m annually in road usage fees. Germany is close behind and the Dutch governments desire to charge all of its registered 10 million vehicle population has been diluted to apply only to those that fall within the European Directive's definition. All member states will need to comply by 2003 and all vehicles over 12 tonnes (with only a few exceptions) will

need to comply.

Charging for road use has traditionally been dominated by politics and DSRC technologies but, to accompany Infra Red, GPS has also emerged in the form of Vehicle Positioning Systems (VPS) from several suppliers.

So, governments can generate revenue, in this case to offset the environmental impact of heavy trucks but, the question remains: can governments make markets?

Well, having access to US$17bn of orbiting GPS satellite hardware led companies, primarily US-based, to develop solutions for marine navigation and desert warfare well before the mass market adoption of GPS. Optimistic forecasts of industry growth led to a rush of development of Intellectual Property and complex cross licenses, that has enabled products that border on mass-market availability.

However, the wireless industry's interest in integrating location technology such as GPS into compact multi-media communication devices (previously used for voice) has created the mobile data industry and a value chain of suppliers and eager application developers. Recently, the Dutch GSM operator KPN discovered over 70,000 distinct applications had been created by a cottage industry of software engineers for its new 'i-mode' mobile phone platform. A healthy sign for the future of mobile applications and independence from the underlying communications (and location technologies).

> "So far, GPS has been navigated through a complex political maze"

End game

So far, GPS has been navigated through a complex political maze. From being created by the defence departments within the US government, breaking into the civilian space as an afterthought and nearly scarred by international political interference, GPS has emerged as one of the few truly globally applicable enabling technologies.

It is facing competition from other equally viable terrestrial positioning methods that are also being matched with the appropriate applications and business models.

GPS has around five years to prepare for competition from, or in cooperation with, the emerging Galileo project, to ensure equipment interoperability that will ultimately benefit highway users. So, the use of location technology as a basis for new wireless services, distance-based charging and improving public safety is evident. This is the background for GPS technology development. But, as we have seen so far, the path of GPS may be dictated more by politics than patents or performance. ■

Notes

Directive 1999/62/EC can be found in the Official Journal of the European Commission of 17 June 1999 (L 187/42). The FCC requirements for E9-1-1 can be found at www.fcc.gov under 'Initiatives'.