Locata

Positioning. Reimagined. Reinvented.

Locata has invented a completely new positioning technology. It creates terrestrial wireless networks which function as "a local ground-based replica of GPS". There is no other technology that can do this.

A Locata terrestrial transmitter network (a LocataNet™) supplies completely independent signals which work just like GPS in areas where GPS is unavailable. Importantly, Locata can also collaborate seamlessly with GPS satellites to greatly improve positioning for modern government, industrial, commercial or consumer applications where GPS is erratic, unavailable or jammed. Locata is the breakthrough technology that will now enable a world where high accuracy positioning is ubiquitous – anywhere it's required – indoors or out.

Reinventing GPS is not a trivial exercise, nor a challenge for the faint-hearted. Locata's passion to single-handedly transform wireless positioning for the 21st Century demanded the invention of a "family" of radically new technologies. 125 patents granted to date have laid the foundations for a new generation of devices that will deliver a level of accuracy, reliability and redundancy which is just not possible with satellite-based signals. Locata's Local Positioning System allows the world, for the first time since GPS was invented, to reimagine what can and should be possible with positioning applications. A local GPS-style positioning system, which is completely independent of the satellites, is now a reality. *Great… but why must the world have this?*

Position, Navigation and Time

Forty years ago the U.S. government invented a way to deliver wireless positioning via a constellation of satellites which rely on atomic clocks for their timing – it's the system we today call GPS. There's no question that GPS has become the cornerstone of global **PNT** – Position, Navigation and Time. Given these three elements, we can precisely locate, navigate, automate or control anything we desire. GPS is undeniably the Gold Standard which has addicted the entire world to the immense value of "positioning".

Because of this all-pervasive reach, GPS now impacts everything – from the largest scale military and industrial deployments to helping you find the nearest ATM with your cell phone. Governments, industry, and consumers have all grown critically dependent upon easy access to positioning. Every day, as GPS has evolved into *a cheap commodity far removed from its military roots,* engineers continue to create many new ways to bake this capability into extraordinarily compelling industrial and consumer uses. *And that's the problem.*

Consumer, mobile and modern apps have now stretched satellite-based GPS to its limits because the system was never designed for them. GPS has begun exhibiting a list of serious shortcomings for modern applications:

- The extremely weak space-based GPS signal is astonishingly easy to block (intentionally or accidentally), or be dangerously misled by using relatively simple, "home-made" electronic equipment [http://bit.ly/1ail3pl].
- Users have absolutely no control over how many satellite signals are in view at any time for any application. This badly effects PNT accuracy and reliability. *With GPS "you just get what you get".*
- Most countries have no local control whatsoever – you can only run a GPS system if you are a super-power which can pay for, launch and then maintain a constellation of more than 24 satellites in space.
- It's incredibly hard to change a constellation once it's operational – history shows it takes 20+ years to first establish a satellite constellation, and then another 20+ years to "modernize it".
- GPS was never designed to work in city, urban, indoor or industrial areas – precisely where modern applications need it the most today – and where most of today's accurate positioning is required.

So, despite its overwhelming importance and global dominance, there is a growing realization that GPS now faces *some uncomfortable truths*:

- The reliability, accuracy and availability of PNT which is essential for modern mobile apps cannot be delivered by space-based technology alone, no matter how many satellites are put into the sky;
- Given the time scales and costs associated with launching satellite constellations, it is very clear that *space-based systems cannot evolve fast enough* to keep up with the hyper-speed development of today's personal mobile devices.

GPS signals are either very unreliable – or totally non-existent – for mobile apps in an increasing number of modern settings, from crowded downtowns to industrial automation settings to anywhere indoors. Combine all these factors with the world's utter addiction and growing dependence on reliable positioning, *and something just has to change*. **New solutions are needed**.

What the world needs now is a complementary positioning technology that can supplement GPS where required locally, or completely replace it if necessary. The solution must work as well as GPS, which means it must enable the precise determination of Position, Navigation and Time. Furthermore, it must be readily deployed, easily embedded and seamlessly integrated into what the world already knows as "GPS". This alternate PNT solution must combine easily with GPS to enable even-better-than-GPS capabilities for an exploding number of new industrial, government, commercial and mobile consumer positioning applications.

That solution is Locata.

GPS 2.0 has arrived

Locata has developed the first and only ground-based Local Positioning System that complements or completely replaces GPS, locally. Locata calls this new combination of **satellite + terrestrial** systems **GPS 2.0**™. As the name implies, **GPS 2.0 is a fundamental advance in the technology of navigation**, designed to drive the development of next-generation wireless positioning for mobile devices and personal applications. **Locata technology answers the critical question: "What comes *after* GPS?"**

The significance of this advance stems from Locata's invention of an entirely new way of enabling PNT – *achieved without satellites and without atomic clocks*. In other words, Locata creates **satellite-free GPS**. Deploying a ground-based GPS-like positioning system is now possible. It means that for the first time, any entity can replicate all of the PNT functions of the space-based global navigation satellite system, but locally. GPS is no longer a capability reserved *only* for super-powers.

Locata is thus "The GPS for the rest of us". It's a deeply disruptive change. In fact it's a textbook Black Swan development which the GPS industry never imagined was possible. How could a private company replicate a system which cost the US taxpayer over $40 billion, and which required the engineering resources of a nation? **Locata breaks all of the "rules" which previously defined how GPS-like signals are created, viz:**

a) GPS signals are created using a constellation of 24 or more satellites;
b) GPS satellites are synchronised using an extremely complex system of multiple atomic clocks;
c) GPS must have an expensive and intricate "ground segment" of global reference stations to monitor and control the satellite constellation; and
d) GPS constellations must have the support and commitment of a super-power to deploy them, over a period of 20+ years, at a cost measured in tens of billions of dollars.

Locata has changed all that. *Forever.* The consequences that flow from this fact deserve some consideration.

The disruption facing the industry is this: Locata does not fit into any "traditional" lexicon for a discussion about GPS because it has created a totally new way of producing and broadcasting the highly-accurate wireless signals which until now *actually defined what GPS was!* In this process of redefining how a GPS signal can be created Locata delivers the core technology advance needed to fix the problems which now plague modern GPS users. Indeed, **Locata is the technology platform** underpinning a future where unfailing, superbly-reliable positioning signals will always be available to any mobile device, anywhere within a network. Positioning will be delivered wherever it's needed, with an accuracy which is today in the realms of science fiction. Locata enables a level of control that satellite-based systems will *never* approach and therefore it has the potential to become the cornerstone for a whole new positioning ecosystem delivering new and essential 21st Century capabilities. *GPS 2.0 is the logical and inevitable evolution of the original GPS.*

Think of the transition the world made in the 1990's from believing mobile phone capabilities could be supplied via the Iridium satellite phone constellation, to the reality of doing that much better today with terrestrially-based cell phone systems. The picture will then become much clearer. Locata is literally "**GPS… rebooted**".

Locata network basics

A LocataNet is created by a network of small Locata transmitters called LocataLites™. These LocataLites can autonomously and wirelessly synchronize to one another to better than 1 nanosecond via a patented process called **TimeLoc**™. This astonishing level of time synchronization is the critical and unique prerequisite needed to recreate GPS functions on the ground. Doing so without atomic clocks is the revolutionary advance which Locata brings to the science of PNT. LocataLites are currently designed to transmit in the license-free 2.4GHz ISM band – known around the world as the Wi-Fi spectrum. Using the ISM band avoids licensing requirements and vastly simplifies the roll out, integration and the operation of Locata networks. LocataLites can, however, be modified to transmit at almost any power or any frequency a customer needs, delivering a flexibility for their applications which is simply not possible with a space-based system. A properly designed and deployed LocataNet delivers unparalleled accuracy and reliability, indoors or out. Within a LocataNet, an unlimited number of Locata receivers can position themselves from the broadcast signals, just as GPS receivers do within a GPS network.

A LocataNet scales beautifully. It can be deployed to cover any specified area – from a small defined space to a large local region, from a single room to thousands of square kilometers – all using the same devices! Locata's powerful local signals can fill gaps in GPS across these areas to give unprecedented accuracy and reliability. Because LocataNets do not need satellites, they create a totally new market and business opportunity: state, corporate and private owners controlling local GPS-style networks. LocataNets allow any entity – a mine, construction site, port, warehouse, airport, strategic asset, and ultimately entire cities – **to decide for itself the coverage and level of reliability now delivered to its key positioning applications**. Positioning can now truly become a local, independently installed utility; one which is owned, controlled and run by anyone that needs this functionality. It's **Your Own GPS**™.

Locata's business: turning a huge technology advance into a huge market disruption

Locata's business model is to be the sole supplier of enabling technology to integration partners that *already* have sales and support channels in place for their respective markets. Locata began shipping commercial product in Q3/2012 and is now entering multiple markets through an "Intel Inside" partnering strategy. Importantly - Locata networks now represent **an entirely new revenue stream** for equipment manufacturers. In fact, *it is the first time* they can sell "the GPS positioning signal generators" (i.e. the equivalent of the satellites) to their customers. They are now no longer constrained to being the supplier of *only* the receiving portion of a positioning system. As Locata's networks begin to proliferate into larger and more diverse markets, the potential massive dollar value of being the supplier of accurate next-generation positioning networks to many markets is not lost on positioning services integrators. This is a huge market disruption in the making.

That is why the world's most demanding industrial, commercial and military partners have already begun to work with Locata to include Locata-powered positioning capabilities in their products. LocataNets are currently running in settings which range from small warehouses to open-cut mines to wide-area aviation-scale systems; deployed in densities ranging from a few meters apart to tens of kilometers between LocataLites. In a world-first, due in late 2014, Locata will release amazing new technology which allows partners to develop products to deliver high-accuracy, *GPS-style indoor positioning* for warehousing and machine automation.

Many of these markets have been out-of-reach to GPS-style products before Locata arrived. As Locata-powered products are developed further, new applications will open up previously untapped multi-billion dollar global markets for Locata and its technology partners. A great example of this new opportunity is represented by the trillion-dollar global supply-chain/warehousing market, where the intersection of robotic machine control and warehouse automation is driving an unprecedented demand for extremely reliable, high-accuracy indoor positioning. The same can be said for the huge efficiency gains which must be found in container terminals and port systems in the near future, driven by the arrival of massive new container ships which are being manufactured right now. These industrial markets are large enough, but most of the manufacturers also know that development work is well advanced on a path to integrate Locata technology into future mobile phone chip-sets.

As Locata continues to deliver these advances, the potential to change the positioning world with these technology developments - and hence disrupt the entire $350 billion GPS market - is self-evident.

The roster of early-adopter Locata technology partners already reads like a global leader board, a virtual "best of the best" in the positioning business.

- The world's largest suppliers of professional measurement hardware and software, **Leica Geosystems** and **Hexagon AB**, became the first commercial adopters. Leica has developed, and is now selling and shipping revolutionary new product (branded as "*Powered by Locata*") for machine control in high value mining applications. [http://mining.leica-geosystems.com/products/Jassist/Jps/]

- Locata was recently awarded a 13-year **sole-source contract by the USAF** to deliver high-accuracy wireless positioning across vast areas, even when GPS is being completely jammed. Despite their access to almost unlimited resources, the USAF – the inventors of GPS – could not achieve this feat themselves, although they had tried for many years. They had to turn to Locata. Their first LocataNet is now being installed over 2,500 sq. miles (6,500 sq. km) of the famed White Sands Missile Range in New Mexico. The USAF has acknowledged that "(Locata)… ***will become the new gold standard truth system' for the increasingly demanding test and evaluation of future navigation and navigation warfare systems for the U.S. Department of Defense.***" [*see the USAF's own article here:* http://bit.ly/LJuM9S] Contracting with a company of Locata's size to supply sole-source, world-first capabilities to the most important GPS user in the world is, we believe, almost unprecedented. This relationship surely speaks for itself, proving **Locata is a unique and totally unanticipated advance in the state-of-the-art**.

- In August 2013 Locata received global endorsement in the car industry when the USA's famed **Vehicle Research Center** (VRC) announced that Locata has been chosen as the core enabling technology for their testing and development of future collision avoidance systems for cars [http://bit.ly/13kwgjF]. Locata is working in partnership with the USA's **Perrone Robotics** to develop cutting-edge automated vehicles which promise to become industry standard test beds for new vehicle safety applications. The first VRC demonstration of this new technology was conducted in June 2014 for the US Department of Transport.

- In June 2014 Locata negotiated the sale of the first LocataNet for **port automation development**, to be installed in the R&D facility of a leading, multi-billion dollar company in this market (name under NDA). Many other important global companies in this market are also negotiating for the opportunity to access Locata technology because it enables previously unachievable capabilities for their machine control products. This machine automation sector is a huge new opportunity for GPS-style positioning, and it will only grow larger as automation becomes ever more critical for industrial efficiency gains.

- In late 2014 Locata will release **VRay**™ antenna technology for high-accuracy indoor positioning, *specifically* designed to automate forklifts, cranes, gantries and large vehicles in the massive warehousing, supply-chain and port markets. Eight years in the making and the subject of many granted patents, VRay will deliver unprecedented performance to these extremely valuable industrial sectors.

- The USAF has also entered into a new co-operative R&D contract for VRay technology *for GPS receivers*. The **US Air Force Institute of Technology** in Dayton, Ohio has now begun to develop VRay for GPS uses (for instance, building it into soldiers' helmets) as reported in the hi-tech press in late September, 2013. [http://bit.ly/1dehPQh]. This novel development promises to have a major impact on the feature sets of all future civilian and military GPS receivers, again delivering exceptional performance which is simply not possible today.

- In June 2014 Locata signed technology agreements with new EU and Chinese partner companies that specialize in the **structural deformation monitoring** markets. This is yet another multi-million dollar market now beginning to adopt Locata. The technical requirements and performance levels required for this very demanding field of positioning promptly led these integrators directly to Locata's new technology.

- The **timing and synchronization capabilities** of Locata networks has also attracted industry attention, especially after publication of a recent seminal conference paper by the University of New South Wales. It detailed a Locata system synchronizing wireless devices, over a range of 46 miles (73 km), at the nanosecond level. This unprecedented capability has important implications for national infrastructure systems that supply "time" to cell tower networks, the banking system, stock exchanges, and much more. Locata's CEO was recently invited to Washington D.C. specifically to present this technology development to the **US President's PNT Advisory Board** as "a new backup to GPS" capability. The **Department of Homeland Security** also held several days of high-level private meetings about time transfer functions. Locata is now in discussion with the US Government's most important timing body about a world-first timing demonstration for multiple government and industry stakeholders across a large area of Washington D.C. itself. *Locata simply cannot overemphasize the importance and size of the potential market this totally new capability can create, at the national infrastructure level, globally.*

The FAA has funded a US$500k project for the US Air Force Institute of Technology to research Locata's potential as a wide-area back-up to the GPS system, within the next-gen air traffic control network. Several other entities are in discussions to use Locata for the burgeoning Unmanned Aerial Vehicle (**UAV**) market. So, barely a year after Locata products first became available for commercialization, the list of Locata technology partners is *already* impressive. Yet there is much more to come, as many companies and national bodies begin to reimagine what will be possible if they deploy reliable, accurate and locally controlled positioning systems for the many vital applications which GPS simply cannot service.

Locata – The New Embedded Positioning Constellation – and what that means

Today, there are only two fully-functional satellite positioning constellations – America's GPS and Russia's GLONASS. The European Union and China are developing their own satellite constellations, but these two systems - Galileo and BeiDou respectively - are still many years from operation. Locata is designed to work independently from any of these satellite systems, yet it can be readily embedded as a Local Constellation into the next-generation, multi-constellation receiver chipsets now being designed to use all those signals. Integrated **GPS+Locata** devices will deliver a powerful "combined position solution" to give unprecedented wireless positioning capabilities to mobile devices.

The fact that Leica is *already selling* the world's first industrial version of this next-gen GPS 2.0 receiver to its customers [http://bit.ly/18u3KMO] **shows how readily this new Locata capability could be rolled out to even larger markets.** Leica's *Powered by Locata* systems created immediate market buzz, when they were released, winning last year's highly coveted Mining Magazine Product of the Year Award.

Most importantly: no-one speaks with more authority than a customer. **Newmont Mining**, the first users of the mining system, publicly admitted in a front cover article for GPS World Magazine [http://bit.ly/1kBoRUw] and [http://bit.ly/1gy3T8i]: *"We have been in the enviable position of gaining a glimpse into the future: what will be possible when the power of GPS-style (Locata) positioning is used to fill the many GPS 'holes'. The results we have obtained are, frankly, addictive. **Having experienced this revolution first-hand, it would now be extremely painful to even contemplate going back to our previous GPS-only world.**"*

How could we possibly add anything to that?

Locata's radical new technology is set to disrupt the US$350 billion [http://bit.ly/1dehPQh] positioning industry, just as it has done for the mining customer above. Nevertheless, Locata simultaneously generates a huge new opportunity *to actually create an even bigger positioning ecosystem*. Locata will enable new generations of positioning devices and apps as it continues to shrink its technology into low-cost consumer-level chipsets. Locata will create previously inconceivable – in fact, science fiction – levels of performance for next-generation machines, mobile and personal devices. A technology roadmap is now in place to evolve Locata "**all the way to an iPhone**".

Locata has created this coming revolution single-handedly, against all odds. *In this process it has also created the potential to be embedded into almost every GPS device made in the future.* Having a virtual monopoly situation in such an important technology advance is extremely unique. It will enable the foundation of a dominant and extremely valuable new global business. The arrival of this critically important new enabling technology is the basis for a future where high-accuracy, reliable wireless positioning is available *everywhere*. There will be no more "GPS doesn't work here" excuses.

Positioning can never be the same again.

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