New satellite system (SBAS) for GPS users in Australia and NZ

"Scion initial tests of new GPS augmentation system for Australia and New Zealand shows marked improvement in position accuracy".

Scion has recently completed early tests of a new satellite-based augmentation system (SBAS) for GPS users in Australia and New Zealand. The test signal is part of a broader project to provide enhanced positional information across the Australasian region. Geoscience Australia and Land Information New Zealand are collaborating to provide three different technologies to enhance the accuracy of global navigation satellite systems (GNSS) for users in the region.

Dr Grant Pearse and Ben Morrow at Scion Research have recently completed a test of the initial service. The test was carried out using an affordable commercial grade receiver modified to accept and apply corrections received from the first SBAS test signal. Results showed a clear improvement through use of SBAS (Figure 1) with a significant reduction in the scatter of positions as well as the circular error probable (the radius of a circle centred on the true position expected to contain 50% of fixes).

The SBAS signal provides information to receivers to allow them to compensate for positional errors caused by factors such as ionospheric interference. The corrections are derived from a network of ground stations in both countries and are currently being broadcast over the Australasian region by an Inmarsat I-4 series satellite (Figure 2.).

Dr Pearse remarked that the first signal (L1) is likely to be the most useful to foresters because it uses the same technology as existing systems such as WAAS in the US and EGNOS in Europe. This means that many commercial grade receivers are already capable of using the L1 corrections to achieve sub-meter precision in many circumstances.

"At the moment, the signal is in test mode, but if the system moves out the test phase many receivers such as smart phones and handheld GPS devices will be able to benefit from SBAS immediately".

The SBAS project is not stopping there and will test two new technologies that promise even better accuracy. A new SBAS signal will provide simultaneous corrections for both GPS and Europe's civilian 'Galileo' GNSS system that is currently being commissioned. The 'dual-frequency multi-constellation' (DFMC) system is likely to improve the availability and accuracy of the SBAS corrections. The third technology being tested allows a single receiver to obtain decimetre or better accuracy using 'precise point positioning' (PPP).

This technology is particularly interesting for forestry applications where it could provide very accurate fixes using much cheaper equipment or potentially replace the need for real-time kinematic corrections required for high-accuracy operations such as UAV-LiDAR surveys. The PPP system works by using dual-frequency receivers to directly estimate the effect of factors such as ionospheric or tropospheric interference. These corrections are combined with extremely accurate information on satellite orbits and clock offsets to allow PPP receivers to determine their position to within a few centimetres.

Dr Pearse said Scion can see a wide range of potential forestry applications for these technologies ranging from improvements to traditional activities such as stand mapping or walking the cutover right the way through to reducing the costs for emerging technologies such as UAV operations and high-precision applications such as LiDAR surveying.

July marked the 40th anniversary since the first GPS signal was received but Dr Pearse described this as an exciting time in the field of GNSS. "The GNSS world is seeing a period of rapid change. The US launched their last Block IIF satellites designed to keep the legacy GPS service working in February 2016. The next generation Block III satellites will usher in a modernised system that promises much greater accuracy and availability for civilian users. Crucially, the modernised system will provide a range of signals that are designed to be compatible with Europe's Galileo GNSS system to provide a much larger effective constellation with extremely precise time signals."

"Many foresters will be most interested in the below-canopy accuracy of their GPS" remarked Dr Pearse. "We are not yet sure how the SBAS technologies will perform below dense canopy where multipath (signal bouncing) can be a more significant source of error." Scion intends to examine this topic in more detail in the future. "We are looking at a more comprehensive assessment of the new signals as well as antennae characteristics which can often be more important for multipath detection and rejection." said Dr

Pearse. “The new and updated civilian frequencies (L1, L2, and L5) are intended to have significantly more powerful signals and we anticipate this will benefit receiver accuracy and time-to-first-fix below dense or wet forest canopy”. Dr Pearse and the Geomatics team at Scion are planning a series of tests once the new signals are available from a suitable number of satellites.

The Centre for Spatial Information is coordinating the SBAS test phase. More information can be obtained from http://www.crcsi.com.au/sbas/.

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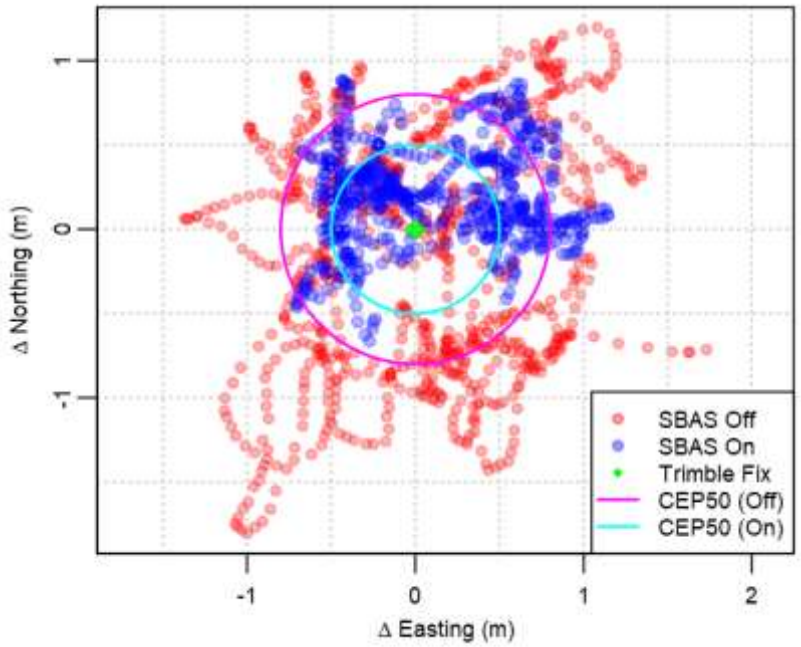

Figure 1: Results comparing positional data from a consumer GPS with and without SBAS. After stabilising, 15 minutes of data were collected with SBAS disabled. The trial was then repeated using a ‘cold start’ with SBAS enabled (PRN122 from SV38). The number of satellites used remained constant. The circular error probable (CEP50) is the radius of a circle centred on the true position expected to contain 50% of fixes. The reference point was obtained from a differential GPS fix verified against a known geodetic mark. Coordinates were in NZTM2000.

Figure 2: Inmarsat I-4 series satellite being used to broadcast the L1 and later the DFMC (L1/L5) SBAS test signals across Australasia. *Image courtesy Inmarsat, UK.*