

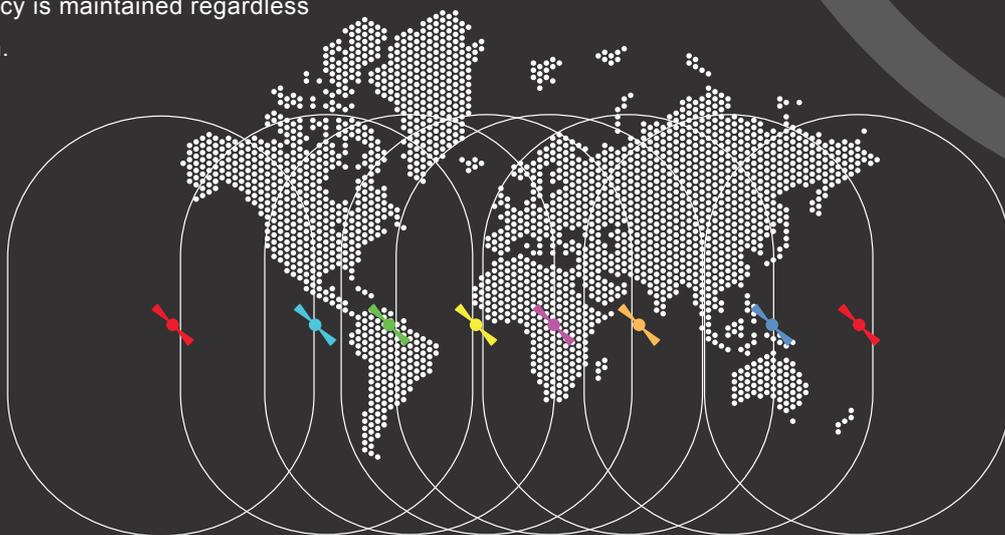
The **VERIPOS Apex and Apex²** services are global, high-accuracy GNSS positioning services designed to meet all offshore positioning and navigation applications. Apex services provide sub-decimetre accuracy and are complementary to VERIPOS Ultra and Ultra² services, which, when taken together, provide the user with correction services derived from independent networks and mitigate for single-point failures.

Apex and Apex² services operate using Precise Point Positioning (PPP) – an absolute positioning technique which corrects or models all GNSS error sources, i.e. GPS satellite orbit and clocks, tropospheric, ionospheric and multipath errors. The PPP technique consists of a single set of ‘globally applicable’ corrections to the satellite orbits and clocks, so position accuracy is maintained regardless of user location.

VERIPOS operates its own orbit and clock determination system (OCDS) which derives real-time corrections for all satellites in the GNSS constellation using proprietary algorithms. The OCDS uses data from the VERIPOS reference station network with multiple and redundant OCDS’s running in VERIPOS operated Network Control Centres in Aberdeen and Singapore. These stations are independent from the reference stations used by JPL to derive the orbit and clock corrections used by the Ultra services.

The Apex service uses satellites from the GPS constellation while the Apex² service uses both the GPS and GLONASS constellations. The satellites from the GLONASS constellation provide additional observations. This can help maintain reliable and accurate positioning when masking of satellites occur (e.g. when working close to a platform) or when suffering from ionospheric scintillation. Another benefit from using both satellite constellations is faster convergence of the positioning solution.

Apex services are broadcast alongside Ultra services via seven geostationary communications satellites to ensure availability and service redundancy.



Precise Satellite Positioning Services

GNSS Satellite Constellation

Apex **Apex²**
 GPS GPS + GLONASS

Observations used

Apex **Apex²**
 GPS L1/L2 GPS L1/L2 & GLONASS L1/L2

Positioning Technique

Precise Point Positioning (PPP)

Reference station network

VERIPOS

Availability

Global

Geostationary satellites

25E 98W 143.5E AORE AORW IOR POR

Horizontal Accuracy*

<5cm at 2σ (95%)

Vertical Accuracy*

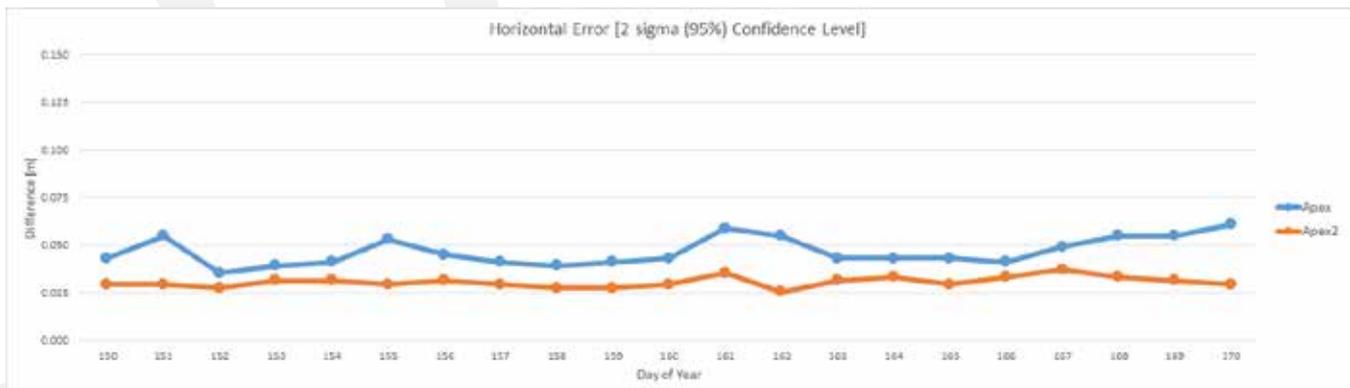
<12cm at 2σ (95%)

Coordinate Reference Frame

ITRF08

** Based on static data logged in Aberdeen, Houston and Singapore over a 7 day period. Accuracy will vary with observing conditions.*

Apex horizontal accuracy



Apex vertical accuracy



Above: horizontal and vertical position errors in VERIPOS Apex solution at a monitor site in Aberdeen.

