

# Apex and Apex<sup>2</sup> Services

## GNSS Positioning Services

The VERIPOS Apex and Apex<sup>2</sup> services are global, high-accuracy GNSS positioning services designed to meet all offshore positioning and navigation applications. Apex services provide sub-decimetres accuracy and are complementary to VERIPOS Ultra and Ultra<sup>2</sup> services, which, when taken together, provide the user with correction services derived from independent networks and mitigate for single-point failures.

## Precise Point Positioning

Apex and Apex<sup>2</sup> 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.

## Orbit and Clocks

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 OCDSs 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.

## Constellations

The Apex service uses satellites from the GPS constellation while the Apex<sup>2</sup> service uses both the GPS and GLONASS constellations. The satellites from the GLONASS constellation provide additional observations, which can help maintain reliable and accurate positioning when masking of satellites occurs (i.e. 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.

**Technical Specifications**

**GNSS Satellite Constellations**

Apex: GPS                      Apex<sup>2</sup>: GLONASS

**Observations Used**

Apex: GPS L1/L2              Apex<sup>2</sup>: GPS L1/L2 & GLONASS L1/L2

GPS L1/L2                      GPS L1/L2 & GLONASS L1/L2

**Positioning Technique**

Precise Point Positioning

**Reference Station Network**

VERIPOS

**Availability**

Global

**Geostationary Satellites**

25E, 98W, 143.5E, AORE, AORW, IOR, POR

**Horizontal Accuracy\***

<5 cm at 2  $\sigma$  (95%)

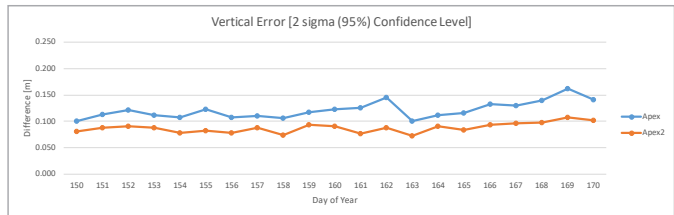
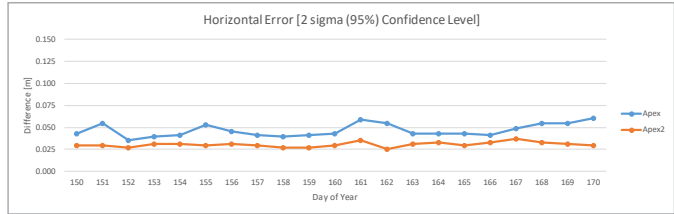
**Vertical Accuracy\***

<12 cm at 2  $\sigma$  (95%)

**Coordinate Reference Frame**

ITRF2014

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



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