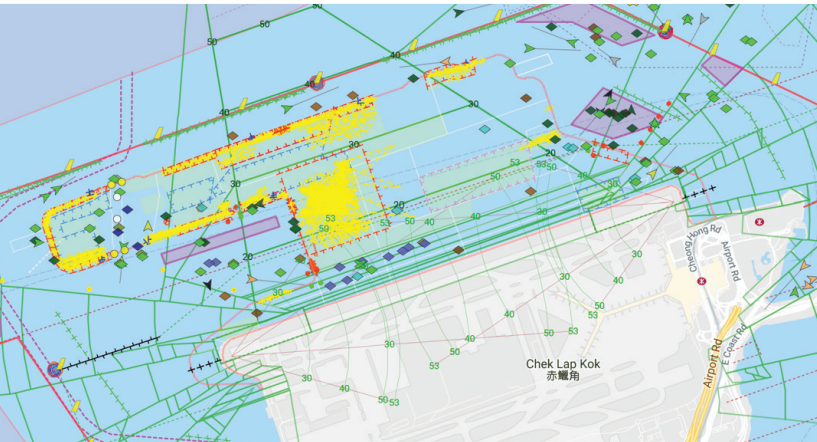


CASE STUDY | MSOLUTION



Piksi Multi proved to be the RTK GPS solution we required. In addition to its highly-accurate positioning and affordable price, its small form factor easily integrated into our system.

—Dr. Andrew H. S. Lai, mSolution Director and Founder

CUSTOMER

mSolution

PRODUCTS

Piksi® Multi

USE CASE

Real-Time Monitoring

[mSolution](#) is a consulting company that specializes in the design and implementation of mobile data solutions, especially customized, mission-critical systems—from mobile messaging to telemetry surveillance, mobile positioning to monitoring and tracking. These systems provide cost-effective solutions that address the needs corporations face on a daily basis. With over a decade of research and hands-on experience in mobile communication, mSolution exists to assist clients in developing unique IT systems that meet the needs of a wide array of business and professional applications—including government departments, utility companies and major corporations.

Challenge

Hong Kong is undergoing significant growth and has multiple, large-scale construction projects underway, primarily around the Hong Kong International Airport (HKG). These projects include land reclamation, infrastructure and new buildings—all which require different types of machinery. The varying cranes, barges and construction equipment pose a risk to aircraft during takeoff, landing and taxi. In addition to the sheer size and mass of such machinery, they are composed of metal and equipped with powerful engines and motors that may block or affect the navigation and communication signals between airport traffic control and aircraft.

To ensure that the operation of these machines does not introduce a safety hazard to airport operations, construction machines must comply with multiple regulations surrounding the airport, in particular the Airport Height Restriction (AHR). Because construction machinery can not exceed the AHR, the positions and altitudes of machines must be monitored around the clock and in real-time. It may seem that monitoring the position of the machinery could be achieved using traditional GPS, however basic GPS does not provide reliable altitude measurements.



Solution

The challenges of using heavy machinery near HKG go beyond altitude measurements. There are also multiple technical challenges. The first has to do with the continuous change in position of the machinery. For example, a crawler crane is equipped with a long boom which can be rotated 360 degrees and change its incline from 0 to 80+ degrees. The accuracy of GPS measurements of position and altitude must be very accurate—down to centimeter-level—as position and altitude of the boom changes continuously and the GPS antenna produces constant lateral and vertical offsets.

Second, the AHR is not a flat plane but many inclined planes overlapped with each other. The lowest height restriction is as low as 7.1 meters above Principal Datum (mPD) near the runway and there are also abrupt changes at the plane interceptions. Equipment has to work within tight head room and area. Accurate GPS measurements can reduce safety margin and maximize the workable head room.

Third, the machinery operates on reclaimed land with rough terrain. The altitude of the land where the machinery is located is often uncertain. Therefore, the location of the machinery must be obtained by a highly-accurate GPS receiver, not be determined by adding up the machinery's physical dimensions and the altitude of the land.

Swift Navigation's Piksi Multi RTK GNSS receiver was just the receiver mSolution required. The Piksi Multi module proved to be a better choice for mSolution's application due to its ability to be integrated into its system at board-level, enabling mSolution to deploy its system as a single compact unit. Piksi Multi provided the accuracy required by mSolution at an affordable price. mSolution has set up its own RTK network using a 4G LTE mobile network that allows for stable and effective communication between Piksi Multi and the RTK network.

Results

Before mSolution introduced its automatic AHR monitoring system, altitude of equipment was either monitored by people onsite (not reliable and costly) or inclination of the boom on the crane was restricted mechanically (not flexible nor effective). mSolution's AHR monitoring system has been implemented across construction sites in Hong Kong and computes both the position and orientation of cranes in real-time as they work in constrained areas and detects a potential crash in advance alerting operators so a change can be made in real-time to avoid a collision.

There is no similar solution deployed around the world, likely due to the unique environment in Hong Kong where land reclamations must take place next to a busy international airport. See how mSolution's automatic AHR monitoring systems works [here](#).

Contact [Swift Navigation](#) for GNSS solutions to benefit your unique application.