Constructing a multi-billion dollar airport

Thailand opens the Second Bangkok International Airport

Timo Rytövuori
Project Manager
and
Marikka Metso
Editor-in-Chief
Vaisala
Helsinki, Finland

The Second Bangkok International Airport (SBIA), also known as Suvarnabhumi Airport, opened for all commercial flights on September 28, 2006. It currently handles 45 million passengers and 3 million tons of cargo per year, but further expansions are already being planned. SBIA replaced Don Muang as the hub for Thai Airways International, the national air carrier of Thailand.

SBIA is located at Racha Thewa in the Bang Phli district of Samut Prakan province, about 30 kilometers east of Bangkok. The name Suvarnabhumi, given by His Majesty the King, means "the golden land", and refers to continental Indochina.

The futuristic structure of the airport, designed by German architect Helmut Jahn, has drawn hundreds of thousands of sightseers to the airport. People want to witness the airy, oval-shaped concourse, and the overall atmosphere of high technology.

World's tallest control tower and extensive facilities

The airport has the world's tallest control tower (132.2 m) and the world's second largest single building and airport terminal (563,000 sq m), just a little smaller than Hong Kong International Airport (570,000 sq m).

Costing 125 billion baht (approximately 3.3 billion dollars), the airport has two parallel runways (60 m wide, and 4,000 m and 3,700 m long) and

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two parallel taxiways to accommodate simultaneous departures and arrivals. It has a total of 120 parking bays (51 with contact gates and 69 remote gates). Five of them are capable of accommodating the Airbus A380, the new double-deck, four-engine airliner.

The main passenger terminal building can handle up to 76 flight operations per hour. Above the future underground rail link station and in front of the passenger terminal building is a 600-room hotel. Between the airport hotel and the terminal building are two five-storey car parks with a combined capacity of 5,000 cars.

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The SBIA Aeronautical Meteorology Project

The SBIA Aeronautical Meteorology Project was part of Thailand's national development plan for the airport. As a standard for all modern international airports, meteorological data and weather forecasts must be available for airlines, ground services providers as well as tourists and business entities utilizing the airport. As an organization responsible for meteorological data, the Thai Meteorological Department (TMD) has designed the project according to the World Meteorological Organization (WMO) and International Civil Aviation Organization (ICAO) standards in order to provide world-class accurate weather data for public services.

Selecting a meteorological measurement system

"There are several factors involved when selecting a meteorological system for an airport. The most crucial one is that the system must provide accurate data in a timely manner. Also, the system downtime and maintenance must be minimal. Reliability is an important factor. Moreover, the equipment must provide data in standard WMO format for sharing among member countries," explains Mr. Suparerk Tansriratanawong, Director General of the Thai Meteorological Department.

The process of choosing the equipment provider depends partly on local procurement regulations and partly on the manufacturer's product specifications.

"The TMD always strives for the best equipment but sometimes the procurement process only allows for the lowest price bidder to win the contract. For the SBIA project, we are glad that Vaisala is the winning contractor since we are aware that Vaisala produces some of the most high quality and reliable meteorological equipment available," Mr. Tansriratanawong says. "Since the airport's opening, there have been only minor problems associated with the Vaisala system. There are few items regarding the way to present data to the operators and they have been adjusted to suit local operations."

Vaisala's transmissometers provide accurate data for Runway Visual Range (RVR) assessment at the Second Bangkok International Airport.

Highly automated visibility measurement

The SBIA Automated Weather Observing System (AWOS) was designed to ›››

The futuristic design has drawn hundreds of thousands of sightseers to the SBIA airport.

From left: Dhiraphat Kasempunnarai, System Analyst of International Meteorological Telecommunication Sub-division; Suparerk Tansriratanawong, Director-General; Kulchitt Sungwaranond, Director, Bureau of Meteorology for Transportation; Kumpol Luengpetngam, Head of International Meteorological Telecommunication Sub-division; Yaovapa Tanadchangsaeng, Senior Meteorologist, Bureau of Meteorology for Transportation; Vivat Masaovapak, Senior Meteorologist.

Even though SBIA is already in the top ten of the world's biggest airports, there are plans for future expansions.

provide as much automated data as possible. Basic variables like pressure, temperature, humidity and rain are measured at five different locations to ensure the quality of data all around the airport area. The runways are equipped with an extensive set of wind and visibility sensors. As the runways are among the longest in the world (3,700 to 4,000 meters), there are measurement stations at both ends and in the middle of the runways.

Two different techniques are used for visibility measurement: Transmissometers provide the most accurate data for Runway Visual Range (RVR) assessment purposes, and forward scatter sensors provide visibility measurements up to 75 km.

The forward scatter sensors are equipped with present weather detection software to automatically insert the correct weather codes for observers to be used in METAR messages.

Clouds are measured at the ends of both runways. The cloud data from the four sensors is combined in the main computers where the cloud height, amount and coverage are automatically calculated based on the latest 20-minute history. This sky condition information is used in the METAR template to help observers by automatically proposing prevailing cloud coverage codes.

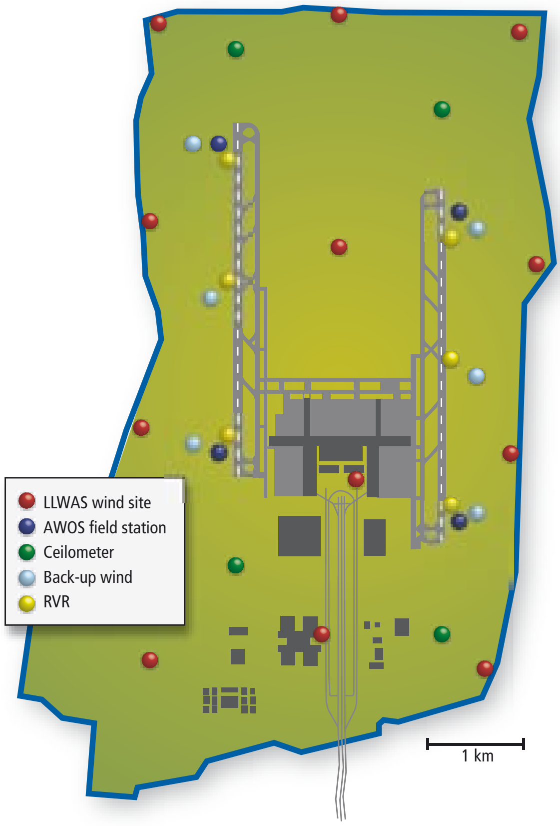
Prevailing visibility measurement was recently introduced by ICAO. The issue is a challenge for large airports like the SBIA where the observation area is vast and blocked by multiple wide and tall buildings. The design criteria for the AWOS included the condition that visibility must be observed automatically not only in the vicinity of the meteorological station but on both runways as well. Therefore five separate visibility sensors were installed. The system software automatically proposes prevailing visibility, minimum visibility and the directions of those variables. This is a useful aid for the observers as the met station is geographically located east of the airport, where visibility toward the western runway is limited.

Extensive set of wind sensors

The AWOS includes wind sensors not only at the end of the runways but in the middle as well. The wind sites are duplicated to provide accurate wind data in case of malfunction or regular maintenance. There are a total of 11 wind stations along the runways and met station so that air traffic control never lacks correct and accurate wind data.

The windshear alert system wind data is also available to all users of the system. This includes wind data from 19 different locations around the airport, to determine safe landing and take-off conditions. The project included a full-scale US National Center of Atmospheric Research (NCAR) Phase 3 windshear alert system. The system design and software algorithm is licensed to Vaisala by the NCAR.

The Second Bangkok International Airport (SBIA) has the world's tallest control tower (132.2 m). Copyright: Tourism Authority of Thailand News Room, www.TATnews.org.



The SBIA Automated Weather Observing System (AWOS).

Unique to the Vaisala Low Level Windshear Alert System (LLWAS) is the usage of accurate and maintenance-free ultrasonic wind sensors. The sensor is ideally suitable for LLWAS where accuracy is crucial and masts are tall, making regular maintenance rather difficult.

Ultra low-power sensors and communication equipment ensure operation even during the longest rainy periods. The LLWAS field stations are totally independent units and no cabling is needed for their full operation: power is provided by solar panels with batteries to ensure power for approximately 6 days. Data transfer is carried out by a radio link using UHF radio modems.

Challenging installations

A system of this scale is not easy to install. Most LLWAS sites are spread outside the near vicinity of runways. The LLWAS masts are typically tall, from 10 to 40 meters. The installation requires trucks and big cranes and the local roads are not necessarily designed to carry vehicles of this size.

The optical sensors should be installed and calibrated during good weather conditions. If the equipment is installed during the wrong season there might be periods of several days when heavy rain prevents any outdoor activities. Full-scale operations at SBIA started at the end of September, which is in the middle of the rainy season. Luckily the installations were started well in advance, around six months earlier, and were finished on time.

Duplication for safety

In large-scale systems like this one for SBIA, the most important components are duplicated. The system must run continuously 24 hours-a-day without interruptions, even during normal maintenance. This is possible due to the system's modular design and flexibility. The user can choose data from a primary or backup source at any time, and in most cases the data availability is automatically guaranteed.

Enabling easy maintenance

Any AWOS needs regular maintenance. When the number of sensors increases there is a point when weekly cleaning and calibration activities are needed. The systems were designed for low maintenance requirements but seamless operation necessitates good maintenance plans and easy access to sensor sites. This was one of the design criteria for the SBIA project. Paved maintenance roads enable easy access to all the technical equipment outside the runways.

Thunderstorm monitoring

In addition to surface, visibility and wind shear measurements, SBIA is also concerned with the threat of thunderstorms on its airport operations. Bangkok's tropical climate produces numerous thunderstorms during the May-October wet season. A four-sensor Vaisala IMPACT ESP lightning detection network was installed in the Samut Prakan province in 2005. The sensors are positioned to provide optimal performance in the vicinity of SBIA. Three electric field mills (EFMs) were also installed on SBIA property to monitor the potential for lightning to develop overhead. Vaisala Thunderstorm Warning System TWX1200 is being utilized in the airport's operations center to combine the lightning network and EFM data into a comprehensive solution. Over 20 commercial airports across the world are now using TWX1200 to improve ground safety, while maintaining operational efficiency in their baggage handling, refueling, and flight operations.

Ambitious long-term plans

Even though SBIA is already in the top ten of the world's biggest airports, there are plans for future expansions. These include third and fourth runways and a second terminal building of the same size. This will put the airport in a class of its own.

The Vaisala system is modular and easy to expand by just increasing the number of sensor sites. ■