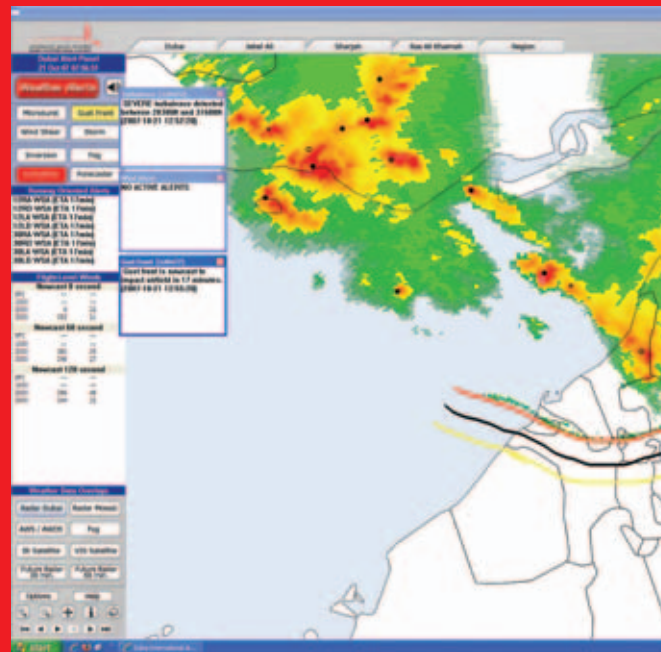


A positive outlook

➔ DUBAI INTERNATIONAL AIRPORT IS ABOUT TO TAKE DELIVERY OF A STATE-OF-THE-ART METEOROLOGICAL SYSTEM THAT PROMISES TO PROVIDE A DETAILED PICTURE OF THE AREA'S UNUSUAL WEATHER. DAVE THOMAS, SENIOR MANAGER OF METEOROLOGICAL SERVICES, SPEAKS TO NIGEL ASH.



KEY FACTS

- ➔ The new system will simplify forecasting by assimilating data from many different sources.
- ➔ Dubai's system upgrade has drawn great interest from aviation meteorologists around the globe.
- ➔ Although none of the technology is unique, it is the first time it has been used as part of a consolidated package.

Log into a satellite picture of Dubai International Airport (OMDB) most days and there is a consistently clear weather pattern over the airport. Exceptions to this prevailing meteorological picture are what prove challenging and are the reason why Dubai has chosen to invest in a unique package of data-gathering and weather forecasting software and hardware – the installation of which is being scrutinised worldwide.

Dubai has firmly established its position as an international transit hub, first by becoming a major duty free shopping centre and now a highly successful resort destination. When the ambitious Al Maktoum International Airport project, located in Dubai World Central, is completed (with no less than six parallel runways and spanning a site larger than Hong Kong) the Emirate will then bid to become a freight hub, linking to the container port at Jebel Ali.

'When you look at weather patterns in the UAE, particularly rainfall patterns, you see a very random picture,' says Thomas. 'We have experienced the maximum and minimum annual rainfall, 272mm and nine millimetres respectively, within a five-year period. In the recent past, December 2006 was a

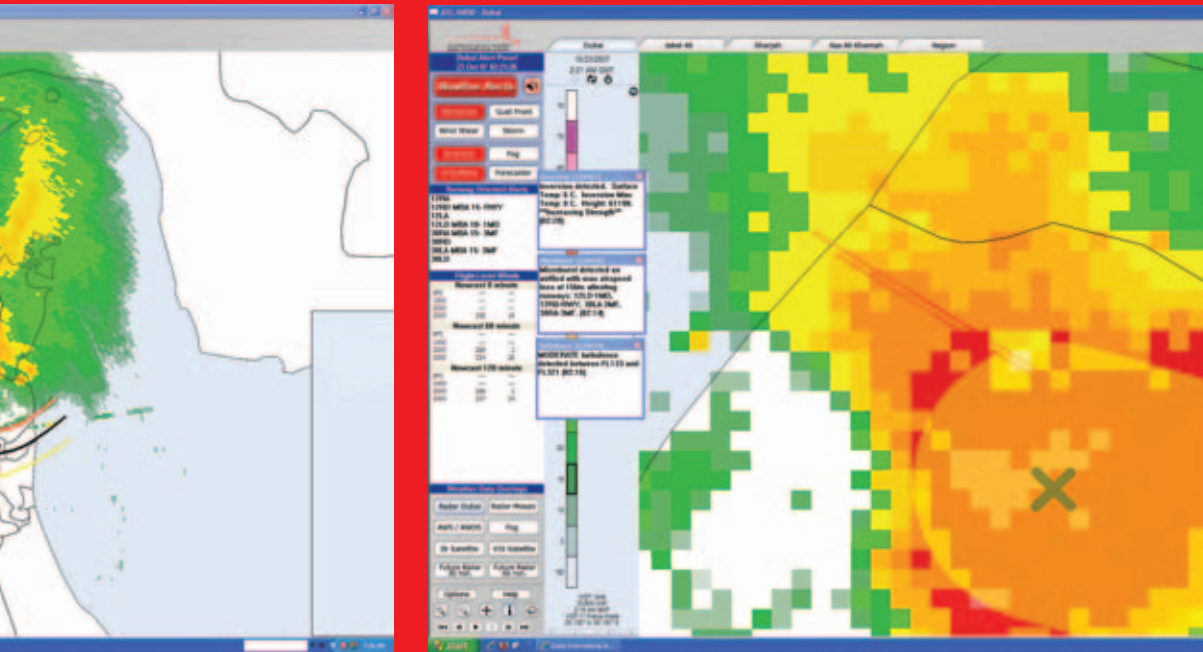
wet month, with heavy rainfall causing extensive flooding. However, the rain for the year as a whole barely reached the annual norm. Yet, 2006 was a wet year compared to previous years when the Emirate suffered a prolonged period of drought. In the four year period from 2000 to 2003 the total rainfall just reached the expected precipitation for a single year.'

Weather data collection in Dubai began in the late 1960s with a detailed database only beginning in 1984, so there is no extended historic database such as those that exist in Europe, where meteorological trends can be plotted over centuries. According to Thomas, such data therefore only exists to give a snapshot of the way weather patterns have been evolving over a few decades.

Challenging conditions

There are several phenomena that represent a particular challenge to both forecasters and the aviation industry. Fog is the most challenging weather element from a forecasting point of view, explains Thomas, with a long-term mean of 20 fog occurrences each year.

'We are located on the edge of a very warm sea and a hot, dry desert. The afternoon sea breeze, which is pretty much a daily event, transports moisture inland. During the night, under clear skies, the desert environment radiates heat very



The AWDSS takes all available data and uses a set of complex algorithms and forecasting techniques to produce 'nowcasting' products, presented on a single situation display.

efficiently and temperatures fall quickly. Where you have this moist air cooling rapidly, radiation fog develops.'

Noting that to the south Abu Dhabi tends to suffer more from fog, Thomas says the situation in Dubai is improving.

Fog has been a major driver for the installation of new meteorological systems.

'There has been a trend for less fog to affect the airport here, although satellite imagery shows that there is still a considerable amount of fog forming in the country, especially inland.' In 2006 there was a marked reduction that Thomas ascribes in part to the heat island effect created by urban development, especially around the airport itself.

Nevertheless, as Thomas explains, fog has been a major driver for the installation of new meteorological systems. 'Obviously Emirates Airline is our biggest customer and the fog threat is a major issue for them. While there are not too many fog days there is a lot of fog potential. So, we aim to minimise the miss rates and maximise the accuracy of our forecasts.'

Whenever fog is forecast to affect the airport, Emirates' fuel provision goes up and there are substantial financial implications.

Other phenomena affecting Dubai are temperature inversions and low level wind-shear. Strong temperature inversions develop during the night in spring and autumn, due to radiation cooling – ground temperatures become relatively cool while lower levels of the atmosphere retain the day-time warmth. A 12°C temperature inversion in the lowest few hundred feet is not uncommon. Just above this temperature inversion, a low level jet can develop with wind strengths of 30-40 knots compared to very light, or even calm, surface winds. This introduces the double effect of wind shear combined with a marked temperature inversion for aircraft on approach and during take off.

Dust storms producing hazy conditions with visibility of between one and five kilometres are not infrequent but statistically there are only about three true sand storm events each year when the visibility falls below one kilometre. 'Such conditions are usually short lived and are not therefore a major problem for traffic,' he explains.

According to Thomas, upgrading Dubai International's meteorological technology is one of the biggest projects meteorological services has undertaken and has attracted considerable interest from aviation meteorologists around the

world. While none of the technology is in itself unique, it is the first time it has been deployed as part of a consolidated package.

'We already had a lot of remote sensing equipment, weather radar, two different satellite receivers, automatic sensors around the airfield and remote automatic weather stations. These systems provide very useful information but the system we are buying will add critical vertical profiles of temperature, humidity and wind. This is one area in which data has been lacking – there is only one daily balloon ascent in the UAE, launched from Abu Dhabi airport. The radiometer and wind profiler will fill this data void in spectacular fashion, generating vertical profiles every few minutes and providing valuable information for the WRF model, the Nowcast product generator and situation display.'

The aviation weather decision support system (AWDSS) will ingest all available data and then, using a set of complex algorithms and forecasting techniques, will produce 'nowcasting' products and present them to the forecaster in a single situation display. Alerts and warnings will be issued for wind shear, temperature inversions, storms, squalls and microbursts associated with thunderstorms. 'We don't get very many of these extremely hazardous microbursts but when we do they can be violent.'

According to Thomas, 'One of the issues for forecasters is that, as technology has improved they have to try and assimilate more and more data inputs to create an image of the weather situation.' The AWDSS will simplify the forecasters' task by undertaking this assimilation of data from many different sources. Mohammed Ahli, the director general of Dubai civil aviation authority and the CEO of air traffic services, has been

DUBAI WORLD CENTRAL AIRPORT

The first of the six parallel runways located within the 140 square kilometre Dubai World Central (DWC), is 4,500 metres long (four aircraft will be able to land simultaneously when all runways are completed) and is due to become operational during 2009. Thomas explains, 'The contract for the meteorological system has been awarded to Vaisala for the provision of their AviMet AWOS. The initial installation will consist of standard components – RVR, cloud base, wind, temperature, humidity, pressure, radiation and rain.'

'Secondary sensors will be installed in a met enclosure providing data to emergency displays in Met and ATC via an independent communications network. Initially, forecast services for DWC will be provided from Dubai International. The DWC AWOS will therefore be linked to the DIA AWOS to share information and provide services. Once Al Maktoum International opens we will have weather observers and briefing staff on site, but all the forecast services will continue to be supplied from Dubai in the first instance.'



Meteorology has a key role in maintaining the runway management and capacity.

TECHNICAL DATA

Dubai International's new equipment is part of a project carried out with the Republic Group in the US, headed by Weather Decision Technologies (WDT), through their local UAE agent, Global environmental solutions (GES).

Thomas says, 'The project includes the installation of new remote sensing equipment, namely a wind profiler from Degreane horizon and a Radiometer from Radiometrics Inc. Software components include a Weather Research and Forecasting (WRF) numerical forecast model and an Aviation Weather Decision Support System (AWDSS), both provided by WDT.'

one of the driving forces behind the air traffic services unit, of which meteorological services is a part. He is keen to use the latest technology to produce forecasting capabilities that are far more specific to the UAE than has been possible in the past. In 2007, Dubai saw over 260,000 aircraft movements and received over 34 million passengers (a figure that was expected to reach 40 million in 2008). Increasing capacity demands have led to the construction of a third terminal and second concourse. The airport's busiest period is overnight and during the early morning, which coincides with the peak fog risk and maximum temperature inversion period. As Thomas explains, meteorology has a key role in maintaining the runway management and capacity, hence maximising the use of its dual 4,000-metre runways.

'Just routinely measuring the conditions at the airport and having actual and forecast data available for ATC is extremely important,' he says. 'With our routine land-sea breeze regime, daily runway changes are inevitable.'

Monitoring the vertical wind profile every ten minutes allows runway changes to be more efficiently managed, enhancing airport capacity. By providing low-level wind information on the ATIS it is hoped that the occurrence of high energy approaches and go-rounds can also be reduced. ○

FUTURE
ATC



DAVE THOMAS

➔ Since 2003, Thomas has been manager of meteorological services at the department of civil aviation, Dubai International Airport. Recruited by IAL (now Serc-IAL) as an aviation meteorologist for Abu Dhabi International Airport in 1983, he was accredited as a chartered meteorologist by the Royal Meteorological Society in 1994. From 1999 to 2003, he held the post of deputy manager at Dubai Airport.