

# FUTURARC

The Voice of Green Architecture in Asia

Jul-Aug 2013 | volume 31

MCI (P) 128/11/2012 PPS 1786/04/2013(022947)

## THE FACTORY

Designing for Industrial Processes



SCAN HERE FOR A FREE GIFT!

Hong Kong HKD72

Indonesia IDR83,000

Malaysia MYR37

Philippines PHP500

Singapore SGD15

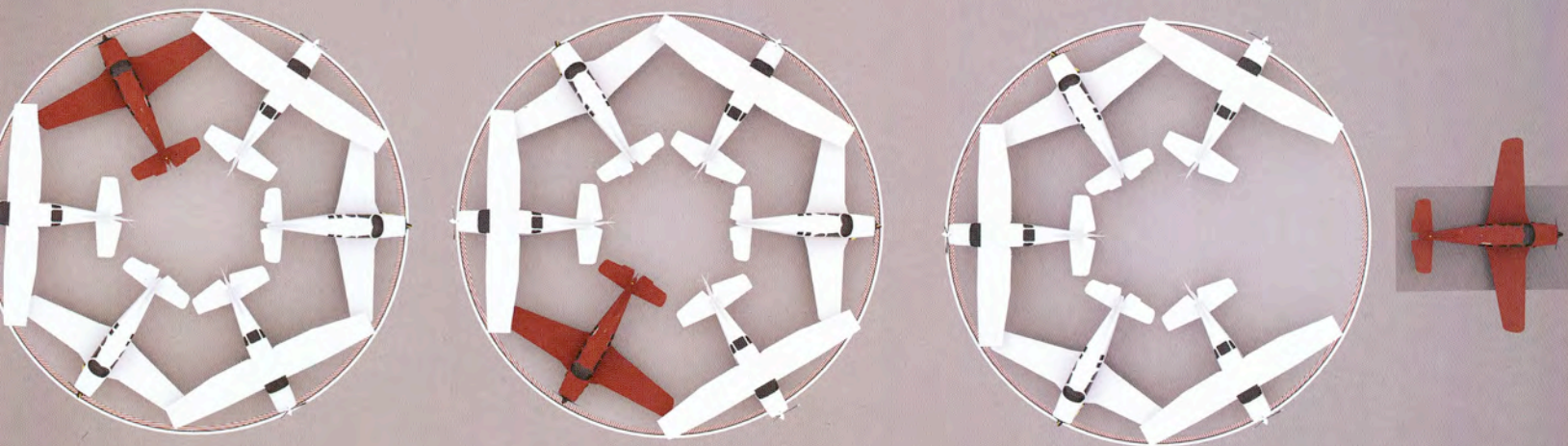
Thailand THB290

Vietnam 190,000

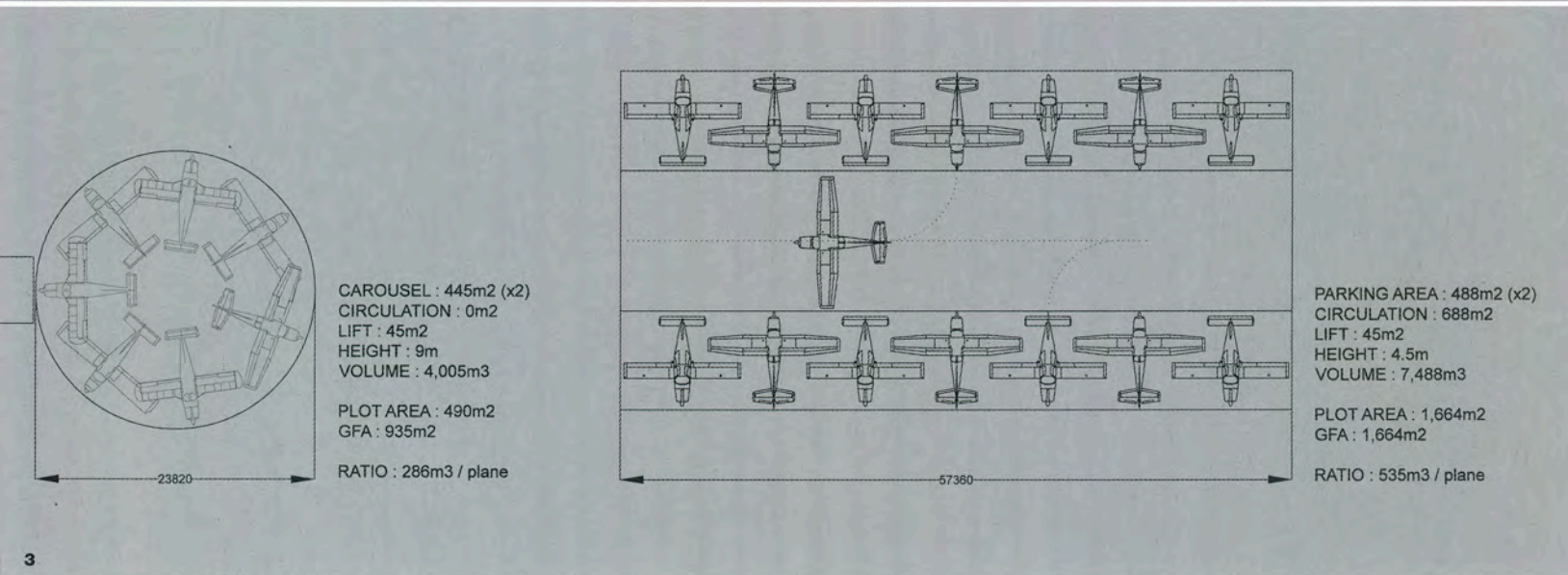
# SELETAR AEROSPACE PARK DOUBLE-STOREY AIRCRAFT CAROUSEL HANGAR

by Florian Schätz





2



3

Singapore's first international airport and subsequent military airbase, after a period of disuse, is undergoing redevelopment into an integrated aerospace park, in line with the country's plans to grow into a hub for the aerospace industries. The Seletar Aerospace Park, spanning an area of 320 hectares in northeastern Singapore, commenced infrastructure development in 2007. It will be home to the Seletar Airport—an airport for business and general aviation activities for flying clubs, flight schools, charter passenger aircraft, business corporate jets, specialised cargo and medical evacuation services—as well as aerospace manufacturing industries and designated service industries at its periphery, including MRO (Maintenance, Repair and Overhaul), FBO (Fixed Based Operation), and aircraft research technologies and modifications.

According to the Economic Development Board (EDB), Singapore's aerospace industry achieved a record output of over S\$7 billion and employed over 18,000 workers in 2010. The aerospace and aviation industries look set to continue growing, with regional developments such as the recent opening of low-altitude airspace (below 13,123 feet) in China. Seletar Airport has extended its runway to 1,836 metres, enabling large jumbo jets such as the Boeing 737 and the Airbus A320 to land.

In order for airline companies to have their fleet up in the air, MRO and FBO operators have to secure enough facilities to house their services on the airside of the runway. For both parking and servicing, aircraft are usually aligned wing to wing in a linear system. The bulky weight and capacity renders aircraft parking difficult vertically and in high-rise. Hangars typically have one wide, direct gate access to the tarmac. To retrieve an aircraft from a parking position involves time-intensive removal and rearrangement in the hangar. Jockeying for position causes delays, damage and high costs in manpower and operations. In Singapore, land is scarce and extremely valuable. The solution is to increase the innovative use of land and airspace to enable increased operations on a smaller footprint.

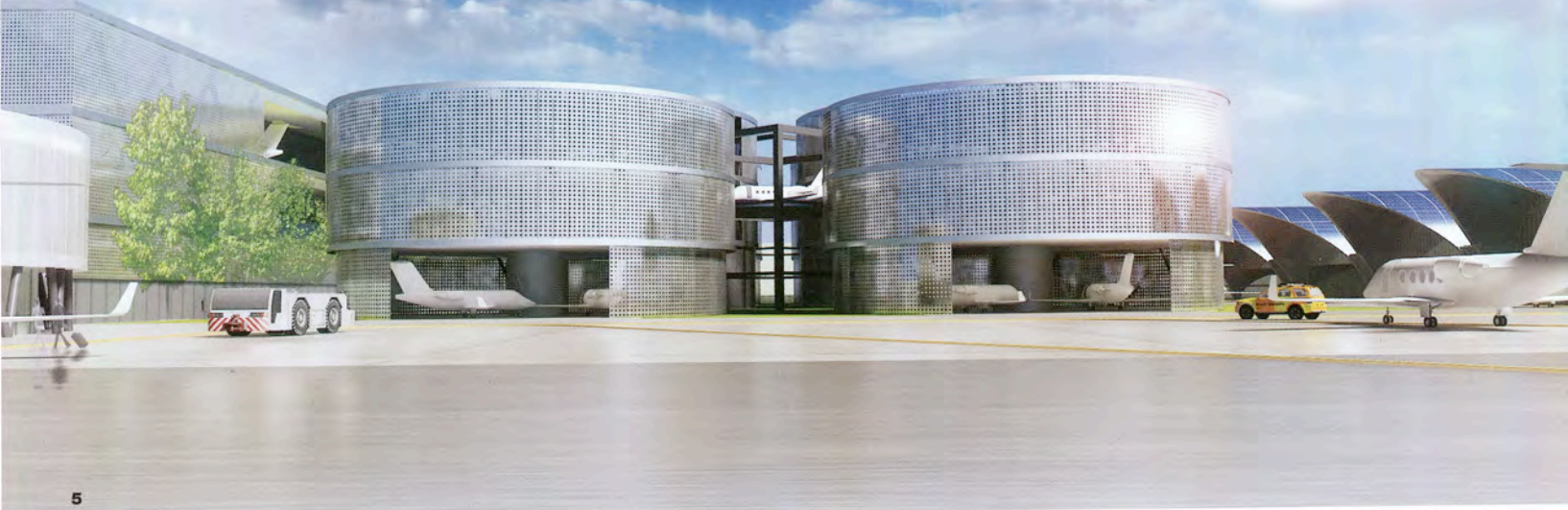
## WORLD'S FIRST DOUBLE-STOREY AIRCRAFT CAROUSEL HANGAR

MAJ Aviation is one of the new operators in the MRO business at Seletar Aerospace Park, providing support services and aircraft storage for aircraft owners and flying clubs. The company wanted to construct a facility in their new General Aviation Centre building where aircraft could be parked more efficiently and with optimal land use. The parking of the aircraft also needed to be as close as possible to the tarmac for direct access to the runway. The team at Schaez Design & Construction introduced their solution for compact and safer aircraft carousel parking—the Schätz Aircraft Carousel, a design developed in Germany, and already installed in more than 50 airports in Germany, Austria, Switzerland and Italy.

With aircraft parked in a circular arrangement on a rotating disc, the carousel system optimises space and operations in land-scarce areas. In view of the space constraints at Seletar Airport, the team decided to go beyond the norms of compact parking elsewhere in the world to design a stacked carousel system—one that could hold the maximum vertical loads and transfer its rotation in moments within the structure—targeting to triple the number of aircraft that can be accommodated within a given footprint. The result is a two-storey aircraft carousel—the world's first stacked aircraft carousel system—measuring 22 metres in diameter, able to hold up to 14 aircraft. Resembling a horizontal bicycle wheel overlaid with a see-through galvanised metal mesh, the carousel operates like a large "Lazy Susan", allowing aircraft parked on the surface to be extracted as needed. A hydraulic scissor-lift moves the aircraft 5 metres vertically back and forth between the mezzanine and the ground level. A pre-stressed concrete filigree framework capable of carrying 54 tonnes on a fully mechanised system, the

1 The two-storey aircraft carousel at Seletar General Aviation Centre 2 Concept of a aircraft carousel system 3 70 percent land savings in multi-storey aircraft parking





structure caters for light general aviation aircraft, helicopters and small business jets up to 14.5 metres in wingspan width and 3.5 tonnes of takeoff weight.

The system has enabled MAJ Aviation to achieve higher operational efficiencies and improve safety. In a conventional hangar, it usually takes eight man hours—four men working over two hours—to retrieve an aircraft. With the carousel system just one worker is needed—retrieving an aircraft from the lower deck takes 1 minute 26 seconds, with a 3-kilowatt motor, while retrieving it from the upper deck takes 6 minutes 18 seconds, with a 5-metre hydraulic scissor lift. Accident rates and damages from aircraft handling have reduced, resulting in a 20 percent fall in insurance loading premiums for the hangar operator.

The structure, which received the 2012 Singapore Concrete Institute Excellence Award, was patented the same year in Singapore.

**SPACE, MATERIAL AND ENERGY SAVINGS**

The design has returned significant space savings, reducing hangar plot area from 1,664 square metres to 490 square metres (with the carousel parking system itself taking up just 445 square metres)—a 70 percent reduction in gross floor area. While the MAJ General Aviation Centre carousel is set in natural ventilation, in cases where the compact system is installed in mechanically-heated or cooled spaces there can be energy savings from the reduced space requirements.

Compared to conventional hangar parking facilities, the filigree concrete structure reduces the amount of construction material used by 60 percent. Most parts were pre-constructed in the factory while the concrete framework was cast in situ. Pre-fabrication coupled with the precision in engineering enabled the on-site installation to complete in just over 12 days—shorter than the usual seven days required for each level—with consequent energy savings.

With the Seletar General Aviation Centre carousel system as a model, Schätz Design & Construction is working on a new design to fully automatise the lifting and rotating system in order to serve a carousel disc up to 56 metres in diameter and on three levels. The intention is to mix Category A, Category B and Category C aircraft up to 25 tonnes in takeoff weight and with a wingspan up to 28 metres. Besides the optimisation of land usage, the fully automated functionality and operations of these parking facilities will give space to integrate about 1,300 square metres of polycrystalline silicon PV cells on the metal roof and louvre façade systems, with an estimated peak power of 182 kWp and energy output of 210,000 kWh/year.

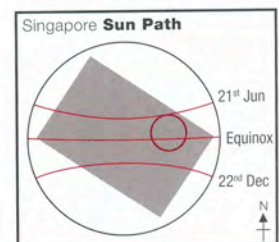
*Florian Schätz, Dipl. Arch. ETH, Lead Consultant at Schaeetz Design & Construction GmbH, is a German architect, author, urbanist and builder. Prior to his appointment as Assistant Professor at the National University of Singapore in 2009, Schätz studied architecture at ETH Zurich and practiced in Los Angeles, Rotterdam and Vienna. He was curator of the Singapore Pavilion at the Venice Biennale 2010, won the President's Design Award in 2011 and the Singapore Concrete Institute Excellence Award in 2012. Schätz provides innovative solutions for aviation infrastructure, future urban mobility and sustainable living off the grid, stacking houses, airplanes and modules for efficient building solutions. He recently published a book on casting architecture with the title "Ventilation Blocks".*

*Schaeetz Design & Construction GmbH is a design and building company whose main focus is on the aviation industries. As the leading global specialist for rotating aircraft systems, Schätz has been recognised for innovative design, and efficient and cost-effective solutions. The company provides customised hangar solutions, parking decks and airport planning consultancy for new construction or refurbishments. Schätz uses an integrated nested solution for business jet parking, MRO (Maintenance, Repair and Overhaul) services and FBO (Fixed Based Operator)/CIQ (Customs, Immigration and Quarantine). His highly innovative solutions and compact designs are constructed using lightweight filigree concrete and steel structural materials.*

**PROJECT DATA**

**Project Name**  
Double-Storey Aircraft Carousel Hangar  
**Location**  
MAJ General Aviation Centre, Seletar Airport, Singapore  
**Completion Date**  
February 2012  
**Site Area**  
490 square metres  
**Gross Floor Area**  
935 square metres  
**Building Height**  
10.62 metres  
**Client/Owner**  
MAJ Aviation Pte Ltd  
**Architecture Firm**  
Schaeetz Design & Construction GmbH (Germany)  
**Principal Architect**  
Florian Schätz  
**Main Contractor**  
Chong Fong Engineering Pte Ltd

**Mechanical & Electrical Engineer**  
Prölss Stahltechnik e.K. (Germany)  
**Civil & Structural Engineers**  
Schaeetz Design & Construction GmbH; JHA Partnership  
**Images/Photos**  
Schaeetz Design & Construction GmbH; Aaron Pocock



**4** Aircraft parked on the rotating disc  
**5** Rendering of a concept plan for a multi-storey business jet parking system