

# S'pore Poly builds quick-change simulator

By Derrick Ho

**I**t may not be the same as fixing up a supersonic jet, but having a hand in building a flight simulator from scratch was something beyond aircraft engineer Tan Jun Heng's wildest dreams.

The simulator is not a regular one. Housed at the Singapore Polytechnic (SP) campus in Dover Road, it is believed to be the first full-motion simulator with an interchangeable cockpit built by an institute of higher learning.

The \$500,000 machine, which measures 3m by 3.4m and is 3.5m tall, can be fitted with the cockpit of an F16 fighter jet, a Boeing 737 plane or an F1 racing car in under 10 minutes each.

Back in 2009, Mr Tan, now 30, was part of the first of three batches of SP students selected to work on the project as part of their diploma's final-year course.

His team of five was tasked to design and build the simulator's dome. They also had to create a special forklift system that would help mount the cockpits in it.

The team members, who were all pursuing a diploma in aeronautical engineering, were given nine months to complete the project, but they completed it in just under seven.

At the same time, another 12 students – some also studying aeronautical engineering, others avionics and computer programming – were putting together the F16 cockpit, the graphics and the imaging system of the simulator.

For Mr Tan, who had flunked his N-levels and spent four years at the Institute of Technical Education, the project was a major stepping stone in helping him to fulfil his ambition of joining the aerospace industry.

"I've always dreamt of flying on a Concorde, but as I have no money to do so and it is out of service, why not get a job to repair other planes," said Mr Tan, who now works at ST Aerospace and is aiming to become a licensed aircraft engineer.

In 2010, the second batch of SP students added the Boeing 737 cockpit and a force feedback system, which is a response mechanism that causes the control column to simulate turbulence. A year later, the third batch of SP students built the cockpit for the F1 car.

Despite the simulator's plus points, it is not the same as the professionally made ones which are used to train pilots or drivers, and it was never intended to be. For one thing, it does not have every single instrument panel found in the real



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Ten minutes is all that is needed to refit the simulator with the cockpit of an F16 fighter jet, a Boeing 737 plane or an F1 racing car.

cockpits. Also, the motion it simulates is only an approximation. Commercial simulators rely on proprietary data collected from actual test flights, which the school does not have access to.

Instead, the simulator is for training the crew looking after the vehicles, said Mr Liew Hui Sing, who is course chair at SP's school of mechanical and aeronautical engineering, and the man behind the project.

"We're not training or certifying pilots or drivers, but teaching engineers how to apply what they have learnt and how systems can be built and integrated," he explained.

An interchangeable system helps save space as the two other cockpits can be stacked on a custom rack when they are not in use.

Already, the school has been commissioned to build two

interconnected simulators that will be placed side-by-side for interactive combat simulation. It declined to reveal further details.

Said Mr Tan: "There is nothing more satisfying than when you see only the teeth of people when they come out from the simulator, because they are smiling so widely."

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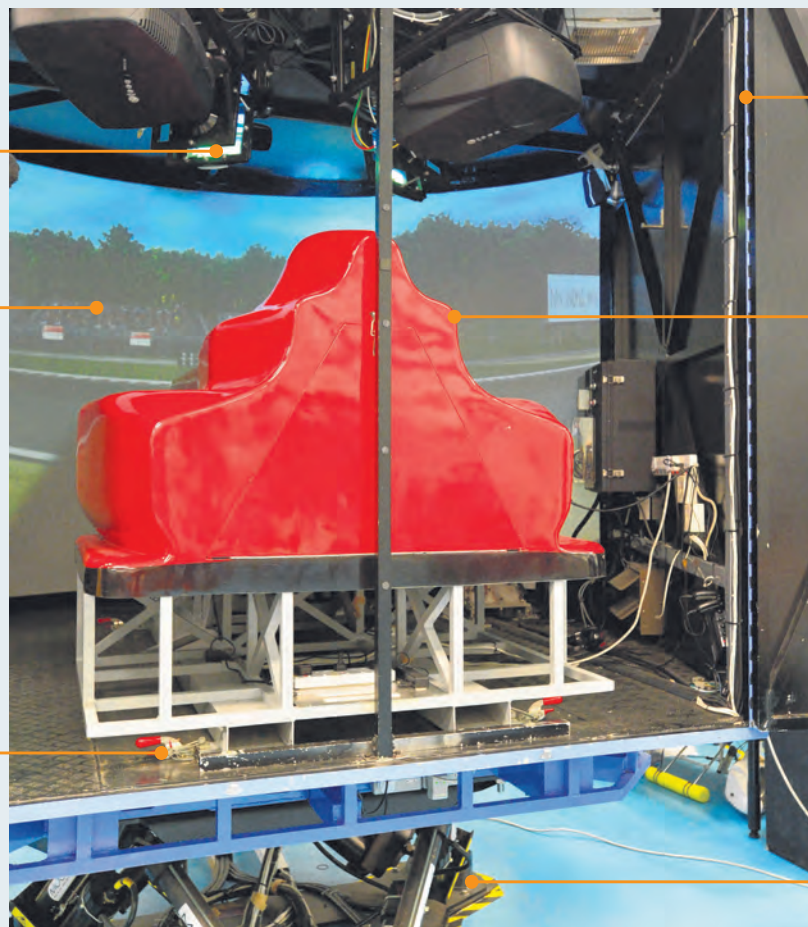
## Inside the \$500,000 machine

Images are projected by two wide-angle simulator projectors with image blending and distortion capabilities.

Images are projected onto an arc-shaped screen that provides a 140-degree field of view. The user sits at a distance of approximately 1.8m from the centre of the screen for the best experience.

A 3.1 speaker system provides the sound effects for a realistic experience. Users can also wear a headset, from which they can receive instructions from the simulator operators outside.

The interchangeable vehicle chassis is mounted and locked down onto the dome by four quick-release toggle clamps.



The four-sided simulator dome is made from an aluminium alloy to ensure the structure is lightweight but sturdy.

The F1 car cockpit chassis has an aluminium-alloy structure with a fibreglass skin. The base of the chassis is constructed such that a special forklift can easily exchange the F1 car cockpit chassis for an F16 or Boeing 737 cockpit chassis within minutes.

Three pairs of electrical ball linear ball screw actuators at the dome's base help create the realistic motion of the simulator. They work together to allow the dome to move with six degrees of freedom – forward, backwards, up, down, left and right. In all, they can hold a one-tonne load.