

the future of us

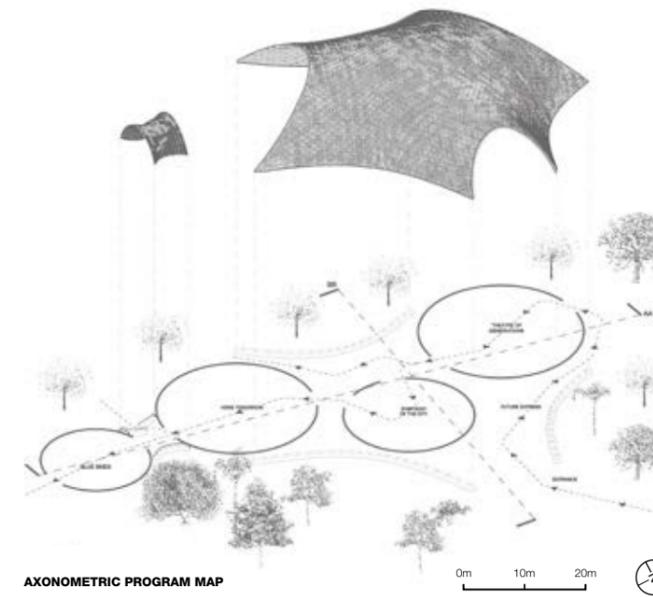
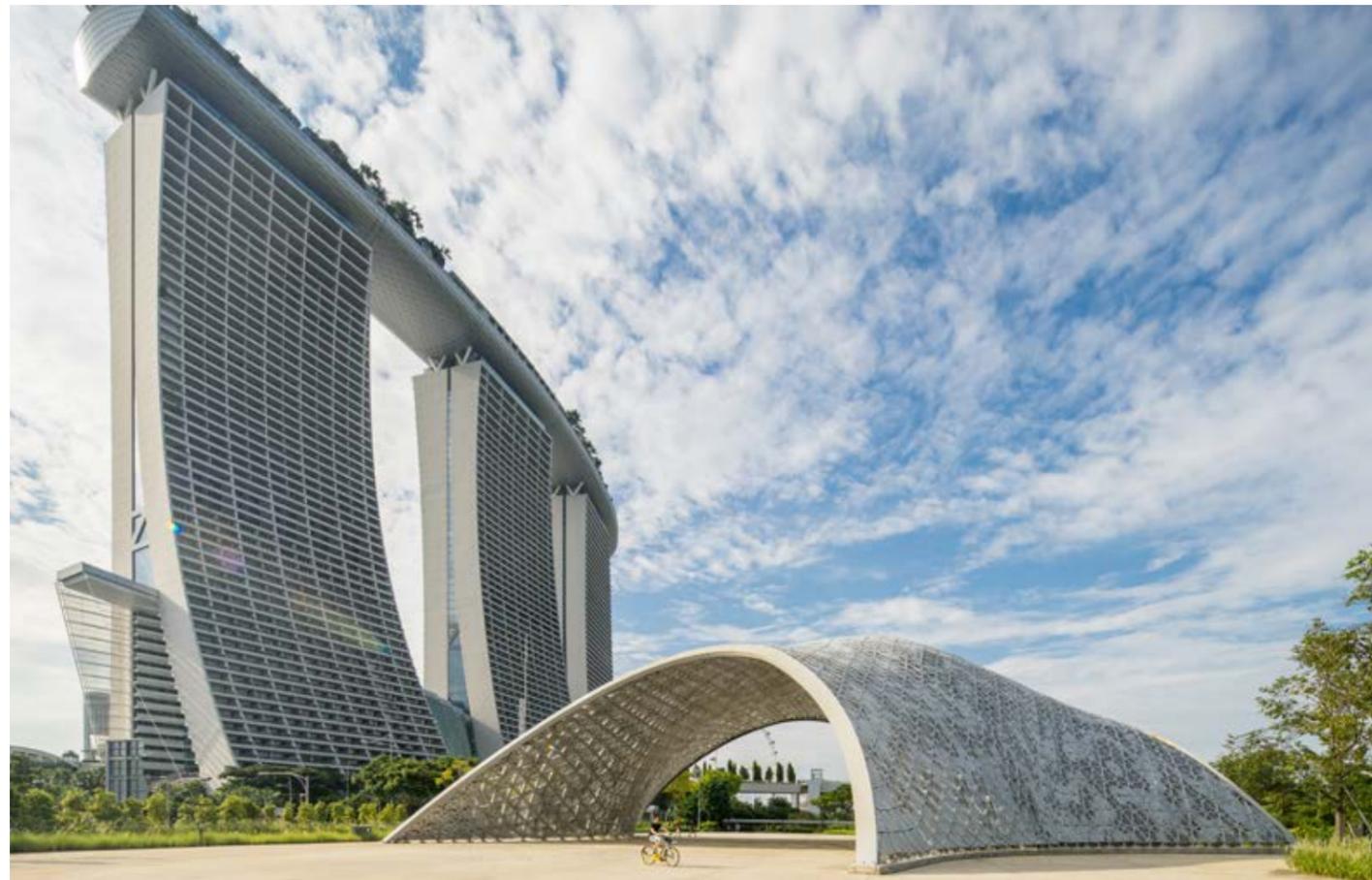
Located between Singapore's Marina Bay Sands and Gardens by the Bay,

The Future of Us Pavilion aspires to follow in the grand tradition of demonstrative expo structures
by presenting a new dialogue between built form and nature

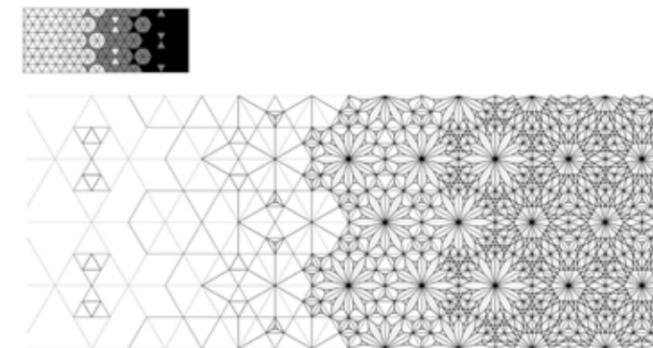


The roof now remains as a sculpture in the park

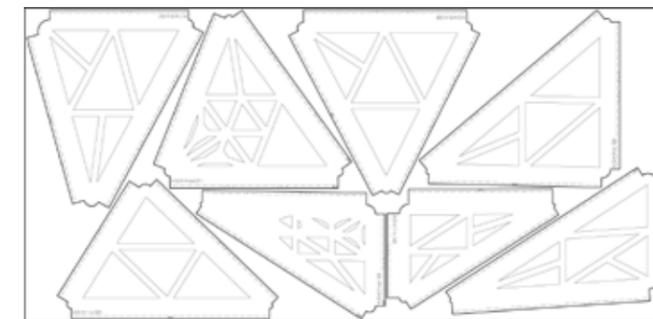
Overall view of the pavilion



AXONOMETRIC PROGRAM MAP



Panel triangulation and pattern generation



Drawing of aluminum cut sheet with individual panels

THE FUTURE OF US Pavilion housed the capstone event for Singapore's 50th anniversary celebrations. The objective of this event was to ensure visitors experience an exciting immersive multi-sensory treatment of its narrative content, and to have a more permanent functional structure that would stand beyond 2015 to symbolise hope, optimism energy and passion of Singaporeans.

The design of the pavilion aspires to follow in the grand tradition of demonstrative expo structures, by presenting a new dialogue between built form and nature for the tropics based on advanced design technology. Blending the structure's intricate form and perforated skin fluidly with the adjacent environments of Gardens by the Bay, the team sought to establish a close relationship between landscape and building based on highly integrated design processes. For visitors, the Pavilion offers a climatically comfortable outdoor environment and a stunning visual experience akin to walking under the foliage of lush tropical trees - an idea of 'future' nature.

Reflecting on the team's approach, Tan Wee Kiat, CEO of Gardens by the Bay that now owns the project, states, "The success factors of the Silver Pavilion are obvious. The hot and humid climate often dissuades people from visiting parks and gardens during a large part of the day. To enhance visitor comfort in the Gardens, its landforms were designed with wind direction in mind, while foliage and shelter provide as much shade as possible. The Pavilion is based on similar ideas. These are beautifully translated into a contemporary aesthetic and functional form that few may know is determined by thorough environmental analyses and simulations. The Pavilion is a comfortable fit with the Gardens Supertrees, Domes and canopies. An enthralling vision for a garden of the future is thus encapsulated by its inclusion".

There is a clear mathematical logic to the design of the Pavilion, determined by extensive environ-

mental simulations and structural optimisations. The analysis and its application to a detailed computational model led to an optimum solution for the Pavilion's structural form and pattern. The latter was produced with an algorithm based on triangulation, which allowed each panel to be filled as required by the assigned environmental performance up to a level that is almost solid. The use of advanced design and fabrication methods throughout the project allowed for the pre-fabrication of most of its parts and the efficient, cost-effective and accurate construction of its geometrically complex form.

Despite the Pavilion's complexity and the resulting uniqueness of most of its parts, the design team was able to realise it in less than six months from start to completion. This was largely due to its innovative and novel use of technology, including advanced computational methods that allowed for the parallel design of the project's structure and skin as well as the pre-fabrication of most of its components.

By way of numbers, the Pavilion incorporates a phenomenal 11,000 unique perforated aluminium panels, 12,040 bolts, 11,188 plates, and 4,620 elements for the main steel structure. The roof spans a width of almost 50 metres and reaches a height of 16 metres. In terms of thickness, it is a very slight 20 centimetres. The design, pre-fabrication, construction efficiency and effectiveness, as well as the accuracy achieved in the realisation of the Pavilion, testifies to the potential of advanced technology for the architecture and engineering design. This allowed for whole new paradigms of exploration, not only to achieve innovative aesthetics and better environmental performance, but also resource-efficiency, precision and structural solutions that open up new possibilities in design.

Since the end of the anniversary celebrations, the prominent location and practical performance of pavilion have allowed for its use to accommodate a range of important community and cultural

LOCATION
Gardens by the Bay
Singapore

PRINCIPAL USE
Exhibition Pavilion

ARCHITECT FIRM
SUTD Advanced
Architecture
Laboratory

PROJECT PRINCIPAL
Prof Thomas
Schroepfer

PROJECT TEAM
Alex Cornelius,
Aloysius Lian,
Thomas Wortman,
Amanda Yeo Qian
Yu, Joel Yap Kar
Ying, Yehezkiel
Willardy Manik,
Christyasto
Priyonggo Pambudi

DESIGN PERIOD
March - June 2015

CONSTRUCTION PERIOD
July - October 2015

DATE OF COMPLETION
28 November 2015

FLOOR AREA
2,000 sqm

CONTRACTORS
Pico Art
International Pte
Ltd, Prottag Tetra
Pte Ltd

CIVIL ENGINEERING
S.H. Ng Consultants
Pte Ltd, Passage
Projects

M&E ENGINEER
Engineering
Management
Solutions Platform
Pte Ltd

QUANTITY SURVEYOR
Pico Art
International Pte Ltd

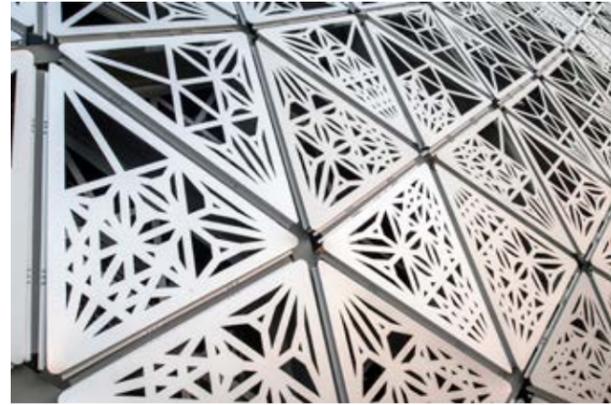
LIGHTING
Pico Art
International Pte Ltd

OTHER BUILDING CONSULTANTS
Wind Tunnel
Consultant:
Applied Research
Consultants Pte Ltd

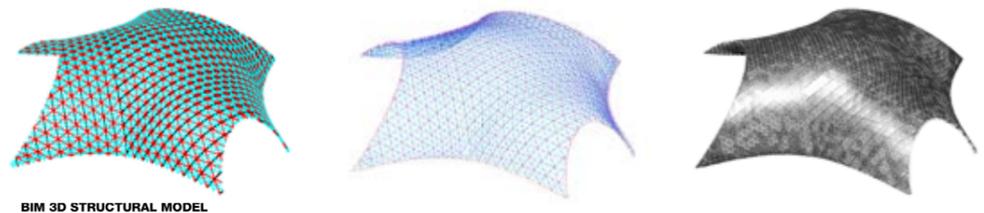
PHOTOGRAPHY
Abel Art, Koh Sze
Kiat, Thomas
Schroepfer,
Guadalupe Polito,
Miew S, Ng Zheng
Hui, Fahrulazmi,
Adrian Baker

events, including the Singapore Garden Festival 2016, and ensures the continuing role of the pavilion as a public asset of Singapore.

Professor Dunn, Associate Provost of Research at SUTD, states, "The design technology and process created by the SUTD AAL is a transdisciplinary one that brings together cutting-edge advances in architecture, multiphysics structures technology, and computational design optimisation algorithms. Only with this novel design technology could the complex structure with its intricate form and perforated skin be beautifully and functionally blended with the adjacent tropical environment to create a stunning user experience. The Pavilion is exemplary as it advances the spirit and future of design in Singapore, and this is reflected in the unusually long list of national and international awards won to date in multiple fields including architectural design, structural engineering, and mathematical optimisation. This is a remarkable testament to the value and importance of the novel design technology as it not only resulted in the creation of the pavilion, but provided world-class contributions to the various fields that came together to form the novel design technology." 



The light-filtering effect of the project is based on about 11,000 triangular aluminium panels of differing perforations



BIM 3D STRUCTURAL MODEL



Aerial view

The roof structure spans about 50m and rises to about 16m with a structural depth of no more than 20cm

