



**SUTD 10<sup>TH</sup> ANNIVERSARY:  
TIME CAPSULE ARTEFACTS**

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**SUTD**  
SINGAPORE UNIVERSITY OF  
TECHNOLOGY AND DESIGN

**10x**  
YEARS IGNITING  
INNOVATION  
BY DESIGN



# COLLABORATION WITH THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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The Singapore University of Technology and Design (SUTD) was established in collaboration with the Massachusetts Institute of Technology (MIT).

Our 7-year education collaboration with MIT from 2010 to 2017, focused on the development, collaborative offering and transfer of key areas and subjects to be taught in the undergraduate curriculum. MIT played a significant role in developing a blueprint for the curriculum, including a curriculum structure and the degrees to be offered. More than 90% of our undergraduate curriculum was originally developed by MIT.

The collaboration also involved co-teaching of subjects at SUTD by faculty from both universities and exchange opportunities between students at MIT and SUTD.

SUTD also has a research collaboration with MIT. A key feature of this is the establishment of the SUTD-MIT International Design Centre (IDC), a world premier hub for technologically intensive design, research and practice.



The photo was taken when both universities signed the agreement in 2010, with former SUTD President Thomas Magnanti and former MIT President Susan Hockfield representing the two universities.



# COLLABORATION WITH THE ZHEJIANG UNIVERSITY

2010

On 26 August 2010, the Singapore University of Technology and Design (SUTD) signed an agreement with China's Zhejiang University (ZJU). This collaboration saw ZJU helping to develop and teach courses aimed at giving SUTD students perspectives on the rich Chinese culture and history as well as its entrepreneurial culture, urban planning, and architectural and product design, while on SUTD campus.

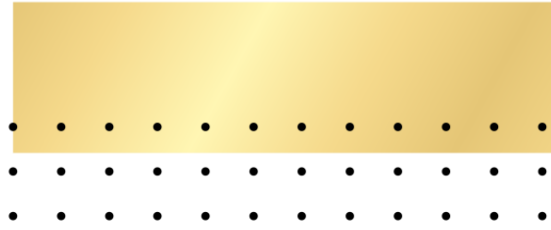
Both institutions jointly partake in research collaborations and competitions to address exciting challenges associated with the world in the areas of healthcare, transportation, clean energy, environment, etc.

In this collaboration, the two universities also facilitate a mutual student exchange programme - The SUTD-ZJU Exchange. Every year, SUTD will send students to ZJU in summer (from May to August) and they will be hosted by the International Design Institute (IDI) in ZJU.

Through our collaboration with ZJU and MIT, SUTD has harnessed the best practices and values of the East and the West.



The photo was taken when both universities signed the agreement in 2010, with former SUTD President Thomas Magnanti and former ZJU President Yang Wei representing the two universities.



# SUTD PIONEER T-SHIRT

2012

The SUTD Pioneer t-shirts were distributed to the pioneer batch of 340 SUTD students during the university's first matriculation exercise on 27 April 2012.

This marked a significant milestone as the start for SUTD to nurture and develop its very first batch of students into the next generation of technical leaders and innovators through technology and design.

For the inaugural student intake, the university exceeded its target and enrolled 47% female students. Compared to the average 20% of engineering students in institutions who are female, SUTD offers a more balanced environment which enriches learning through the different perspective female students bring.

The pioneer batch of SUTD students graduated in 2015 and was well received by industry, enjoying good overall employment rates and competitive salaries, with 85% employed within six months of completing their final examinations.



# “SUTD TO THE EAST” T-SHIRTS

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SUTD celebrated its move, from its interim campus of three years at Dover Drive, to its brand new campus at 8 Somapah Road on 23 January 2015.

SUTD students and staff brought convoys of buses and customised pop-up trucks to various pre-university institutions across the island. This was to celebrate the move and provide prospective students the opportunity to experience what the university is about through a unique mobile showcase of our students’ innovations, workshops and performances.

This celebratory move culminated with an inaugural Music Night Festival at the new campus in the evening with invited guests and neighbours, where SUTD students performed and partied, amidst a carnival in the new campus.

These black and white t-shirts were designed by our students and donned by all staff and students during this significant milestone.



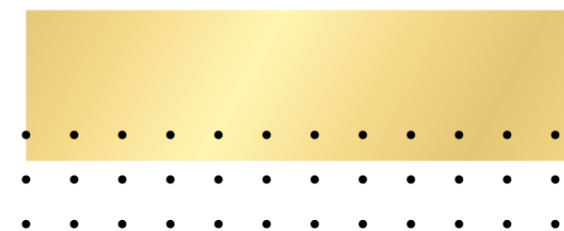
# COLLATERALS WITH SUTD CORE VALUES

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SUTD's culture journey started in 2011 when we conducted the culture values assessment with the senior management and all staff. World café sessions were also held with our campus builders\* to identify what our core values would be.

In 2012, the core values were developed and communicated to the SUTD family of staff and students. These items were collaterals designed to constantly remind our staff about the SUTD core values - Leadership, Integrity, Passion, Collaboration and Creativity.

\*Campus builders are SUTD's enrolled students who participate in the Campus Builder Programme. They are involved in key SUTD programmes and initiatives to help shape and build the SUTD campus and its culture while waiting for school to start.



# THE FUTURE OF US PAVILION

2015

Located between Marina Bay Sands and Gardens by the Bay, *The Future of Us Pavilion*, designed by the SUTD Advanced Architecture Laboratory (AAL) led by Professor Thomas Schroepfer, follows the grand tradition of demonstrative expo structures by presenting a new dialogue between built form and nature for the Tropics. Originally built to house an exhibition to commemorate Singapore's golden jubilee in 2015, it has since become a permanent landmark that contributes delightfully to the Gardens' mission of making Singapore a vibrant place to live, work and play.

The Pavilion is an extension of an investigation that AAL started in 2013 with its first-prize project for a Singapore Institute of Architects ideas competition that focused on parametric design applications. *The Future of Us Pavilion* received the President's Design Award (Design of the Year), Singapore's highest honour accorded to designers and designs across all disciplines, in 2018.

*The Future of Us Pavilion* testifies to the great potential of advanced architecture and engineering technologies not only to achieve innovative aesthetics but also better environmental performance, resource-efficiency and structural solutions that open up new and exciting realms of design.



# HERITAGE BUILDINGS & DIGITAL TECTONIC

2014

A project by the SUTD Architectural Conservation Lab and the SUTD Digital Design and Fabrication Lab, led by SUTD Associate Professor Yeo Kang Shua and Assistant Professor Stylianos Dritsas, the Heritage Buildings & Digital Tectonic is a replica of the dragon wall panel at the Yueh Hai Ching temple, produced through sensor based method digitalisation and digital fabrication, a novel process used in Singapore for the first time.

The project details the process of historical building conservation via a complete start-to-end digital design process.

The significance of this project is the investigation into the impact of mass sensing, parallel processing and additive manufacturing technologies in conserving architectural artefacts of cultural value, which often lies within a domain of undrawable architecture - a process of tacit knowledge passed along generations but never formalised.





# 3D PRINTING ARCHITECTURE

2016



The SUTD Architectural Intelligence Research Lab (AIRLAB) has innovated and developed the first-of-its-kind 3D printed architectural system, creating unique architectural structures and spaces using metal additive manufacturing.

Designed by SUTD Assistant Professors Carlos Banon and Felix Raspall, these metal connectors were printed at SUTD and used to build the first-in-the-world 3D printed metal pavilion featured at Gardens by the Bay. The pavilion captures the main views of its immediate environment, filters the light, and forms a landmark lantern in the garden. A similar design methodology was first presented as the vMesh Pavilion at SUTD Open House 2016.

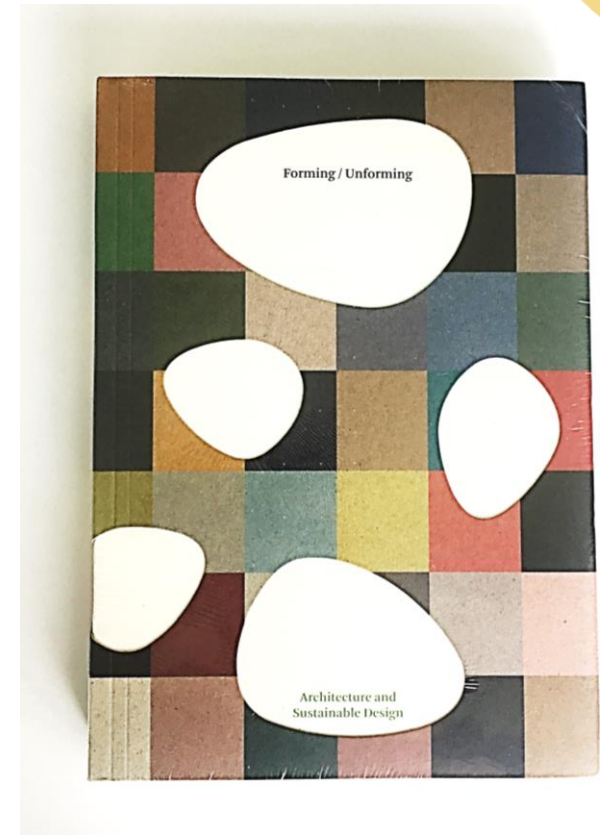


# FORMING/UNFORMING: ASD'S FIRST PUBLICATION OF STUDENT WORKS

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“Forming/Unforming” is the first publication of student works to emerge from SUTD’s ASD pillar. This book documents the ideas and thought experiments of the university at the present time - the trending intellectual preoccupations, the formal and informal hypotheses being challenged, and the general “Zeitgeist” at the university.

For a young university, this publication signifies more than just an archiving or documentation exercise, it also denotes a mirroring act, a moment for self-reflection and an opportunity for revisiting one’s own past, in order to learn from and project into the future.



# CROSS-SECTION-CONTOUR PROTOTYPING - DUCK

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The rapid prototyping project is the first collaborative project between SUTD faculty Dr Chen Lujie and MIT faculty Associate Professor Lawrence Sass.

It explored the feasibility of using a computational method to recreate a physical structure from a digital scan. The duck model consists of many interlocking contours, which are generated by a computer algorithm. The algorithm also generates slots for interlocking.

This work demonstrates that prototypes of a physical model can be directly made from a digital source. Little human intervention is needed in the process. EPD's Founding Head of Pillar, Professor Kristin Wood, always relied on this duck model to impress visitors and guests during his outreach events.



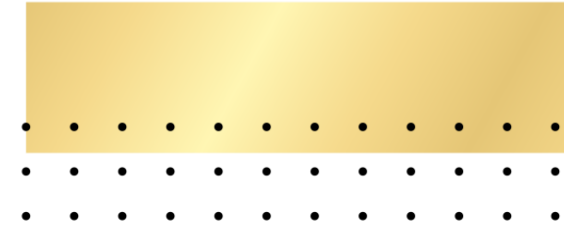
# MAVERICKS DRONE

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Mavericks is a quadcopter platform designed for and used in the Autonomous Aerial Vehicle Challenge, held in Thailand, in 2014.

It is capable of carrying a light payload, travelling autonomously through defined waypoints, taking aerial images and releasing the payload on target with dependable accuracy. The structure is designed to be light and rigid, seen from features such as a waterjetted unibody aluminium frame.

Mavericks was one of the fastest multi-rotor type entrants in the competition and the team comprising Dr Foong Shaohui, Tan Enyi (ISTD, Class of 2015), Shane Kyi Hla Win (EPD, Class of 2015), Danial Sufiyan (EPD, Class of 2016) and Pheh Ying Hong (EPD, Class of 2017) finished in fourth place.



# HELIOS: A ROLLING ROBOT

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Helios is a rolling robot that features a wireless charging system and a pendulum system to minimise oscillation caused by staggering effect, a camera and LED system as well as side arms with ball casters to prevent flipping.

It was designed for the 30.007 Engineering Design Innovation course, one of EPD's signature courses, and was presented at the 30.007 Design Project Exhibition in 2015.



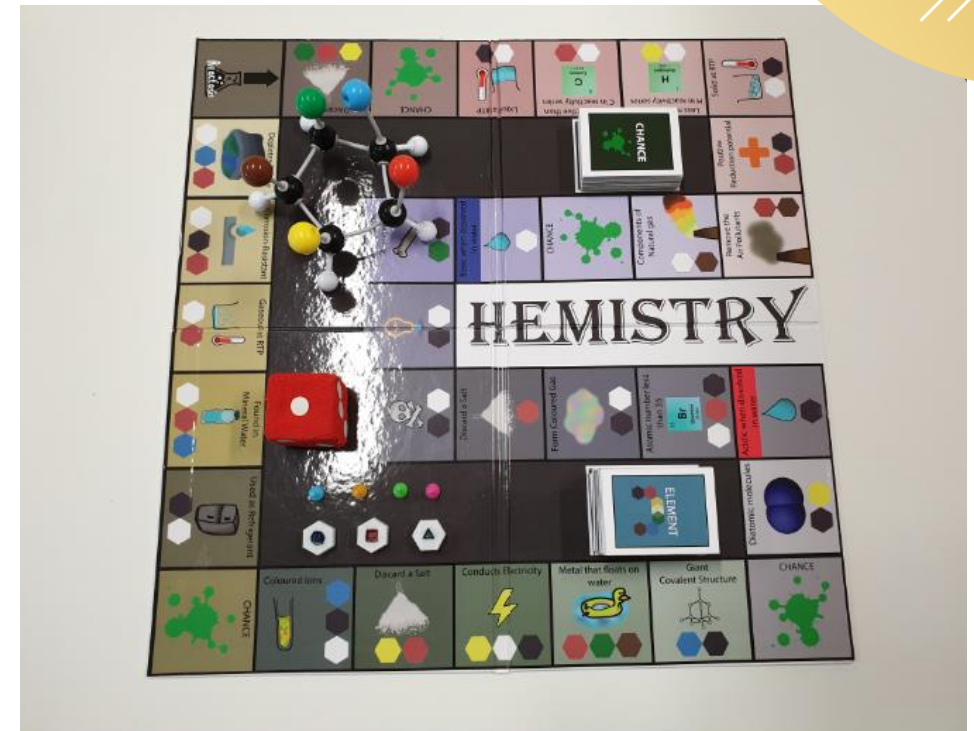
# REACTOSIS GAME

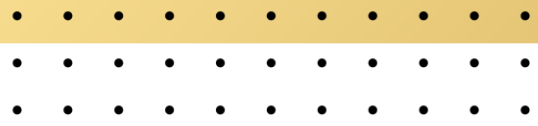
2018

The Reactosis Game was designed by the ESD students in the first run of the ESD core design course, Engineering Systems Architecture. Students were challenged to design and prototype an educational game following formal systems architecture processes.

The students (from Class of 2019) on this project - Justin Ang, Huang Qihong, Laura Lee, Justinian Siah, and Wu Shangjing, came up with the idea to teach both physical and organic chemistry by means of a board game.

In their novel concept, players earn “atoms” of different elements by correctly answering basic questions in physical chemistry. The first player to collect the necessary atoms for an assigned organic molecule and assemble his or her atoms into the correct molecular arrangement wins the game. In addition to constructing this prototype, the team submitted an extensive portfolio of system definition documents.

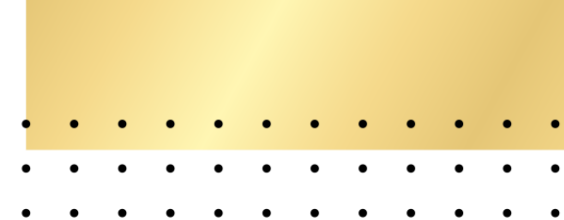
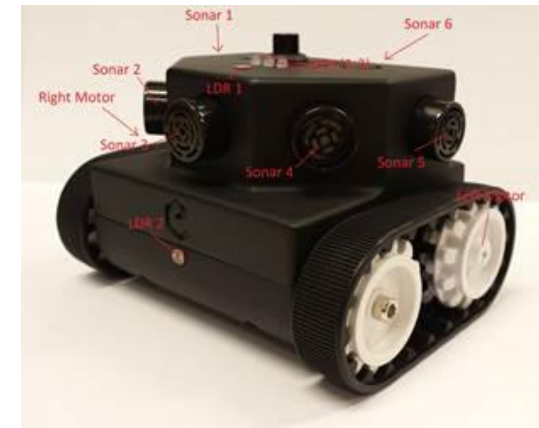




The eBot is a robust, 3D printed versatile STEM learning robotics platform that provides modularity and customisation options.

It aims to bridge the link between theory and practice by providing the ideal platform for students to collaborate and use their combined knowledge to build the best solution to a task.

The eBot was developed by SUTD researchers in 2015 for ISTD faculty to teach Python programming to freshmen students in their Digital World course. It was also used in ISTD's outreach workshops where prospective students learnt computational thinking skills by designing codes to control the movement of the eBot.

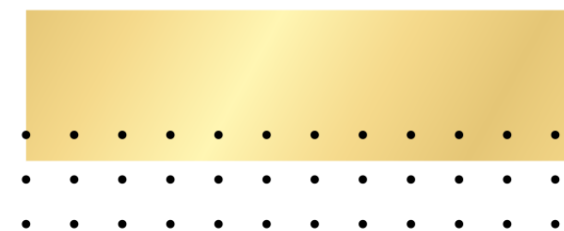


# FIRST CURRICULUM STRUCTURE

2010

This is the curriculum deck that the Massachusetts Institute of Technology (MIT) sent to the Singapore University of Technology and Design (SUTD) in 2010. It details the courses in each term, from Term 1 to Term 8.

The curriculum deck was used in the early student recruitment exercises. EPD had 2 tracks then - mechanical devices and electronic devices. It was the only pillar that had tracks at that time.





# SUGAR ROCKET

2016



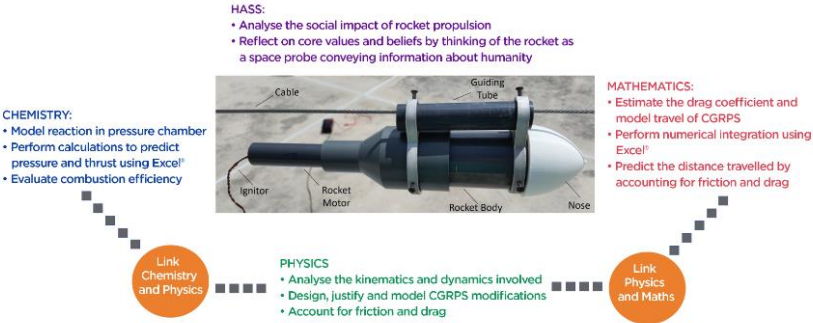
SUTD has embarked on a unique multi-disciplinary pedagogy approach since its inception. This has materialised through a multi-disciplinary, design-centric curriculum and courses with interdisciplinary design projects such as the Design 2D course during Term 1 of the freshmore year.

The Design 2D course highlights the application of chemistry, physics, mathematics, humanities, arts and social sciences in an engineering product design. For example, students working in teams of four or five, are tasked to design a scaled-down model of a sugar rocket that involves the use of a chemical reaction between sugar (a solid fuel) and potassium nitrate (an oxidiser). Upon ignition, this reaction generates a sudden large increase in gas pressure built up in a closed chamber, resulting in rapid gas expansion and propulsion that allows the rocket to achieve a target distance of up to 18 metres.



## The Design 2D course

### Application of Chemistry, Physics, Mathematics and Humanities, Arts and Social Sciences (HASS)



# HANDMADE ELECTRIC GUITAR

2017

During Minister Ong Ye Kung's visit to SUTD in October 2018, he expressed keen interest and played the chromatic scale on the handmade electric guitar that was designed by SUTD student, Leong Kei Sheng, as part of the Term 2's Physics project during his freshman year.

To prove that Faraday's Law, a concept taught in the Physics course, is responsible for the sound reproduction of the electric guitar, a pickup was hand-coiled about 4000 turns (typical pickups > 10,000 turns) with 0.055mm diameter wire, to simulate an infinitely thin wire coil required for the simplified Faraday's Law to hold.



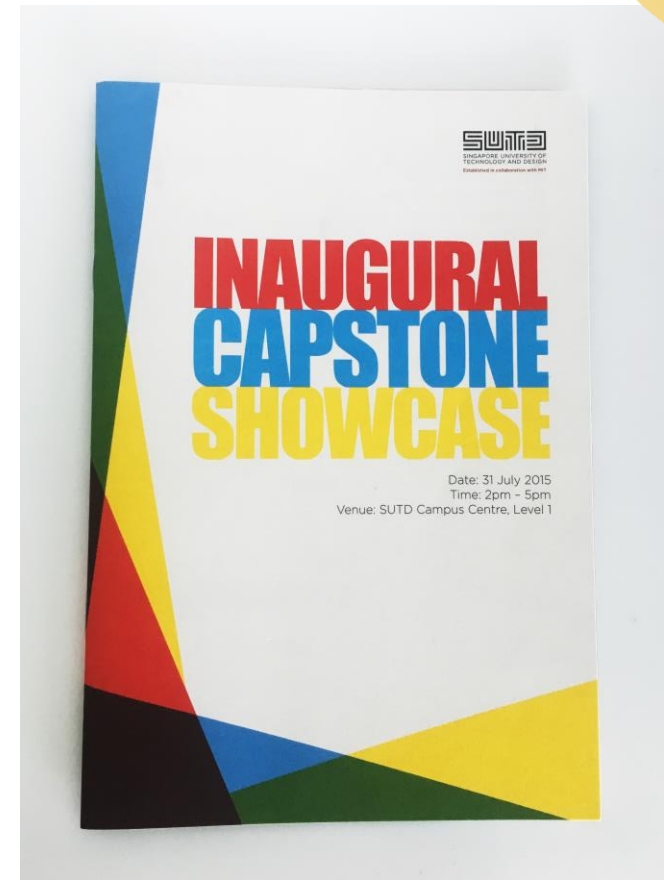
# FIRST CAPSTONE DESIGN SHOWCASE BOOKLET

2015

The Capstone Programme is specially designed to bring together final-year undergraduate students from different pillars to work in design teams, contributing their respective expertise learned over the three and a half years to the development of multi-disciplinary design solutions for industry-sponsored projects.

To commemorate the end of the capstone terms, a public showcase will be put up with an accompanying showcase booklet. The Capstone Design Showcase booklet details the showcase layout and the list of participating capstone projects, final-year students, and industry partners.

The inaugural Capstone Design Showcase was held on 31 July 2015 and the first showcase booklet was printed in that year.

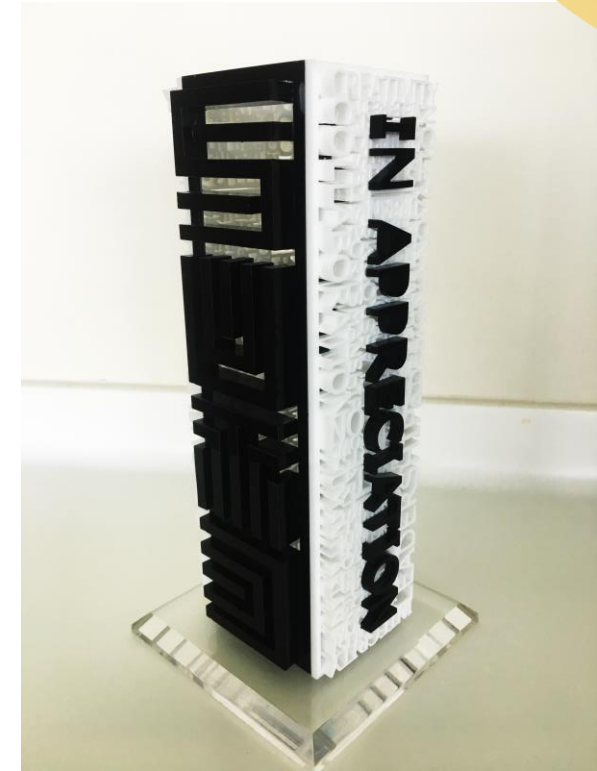


# STUDENT ACHIEVEMENT AWARDS TROPHY

2015

Organised by the Office of Student Life, the Student Achievement Awards (SAA) recognises the fifth row and academic achievements of all our students who brought honour to the university, and contributed positively towards the quality and vibrancy of campus life.

The ceremony, first hosted in 2015, is held annually and reflects the university's commitment to the nurturing of a holistic education for its students.



# THE SUTD RING

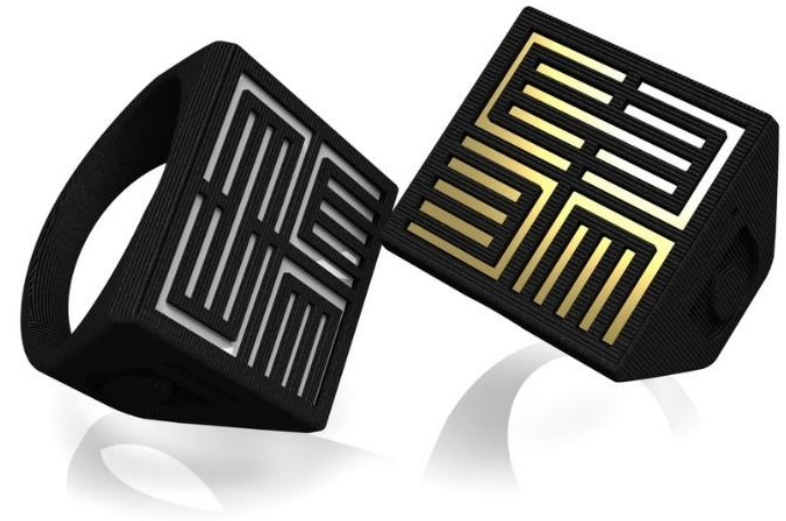
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“This ring honours the courage, passion and conviction in each SUTD pioneer.” – Professor Chong Tow Chong, President and Founding Provost, SUTD.

The first SUTD Ring was made on a desktop 3D printer in a freshman classroom. It leverages NFC technology to give users access to campus facilities with a simple fist bump.

Given to every student as a symbol of the SUTD family, the SUTD Ring embodies the spirit of technology innovation and entrepreneurship for a budding and bold university.

SUTD Ring was the brainchild of pioneer students Olivia Seow and Edward Tiong (founders of Ring Theory); developed with the unwavering support of SUTD faculty and staff.



# MOUNT SUTD

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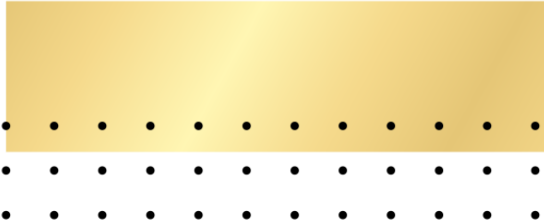


On 31 August 2014, a team of young climbers from SUTD Mountaineering Club, led by veteran mountaineer and consultant Edwin Siew, is the first in the region to have summited an unnamed and unclimbed mountain to christen it Mount SUTD. The 6,056m high peak sits in India and literally placed SUTD on the world map. In order to succeed in this daunting expedition, the team had to undergo a lengthy training period and also participate in two preparatory climbs.



The photobook documents the entire expedition on their climb to the unexplored territory of the Great Himalayas; the bottle contains the water that the team collected from the glacier at Mount SUTD.

Overcoming all obstacles and uncertainties to complete the quest of climbing a virgin peak, this team of passionate and risk-taking SUTD mountaineers marked down a historical achievement for SUTD that paved the way for many firsts achieved by SUTD students.



# CHINATOWN LIGHT-UPS

SINCE  
2012

Since 2012, SUTD has been an intrinsic part of the Chinese New Year Light-up along the streets of Chinatown every year.

In collaboration with the Kreta Ayer-Kim Seng Citizens' Consultative Committee and the Singapore Tourism Board, a group of SUTD students works on the design concept of the light-up, under the guidance of a faculty mentor from SUTD's ASD pillar.



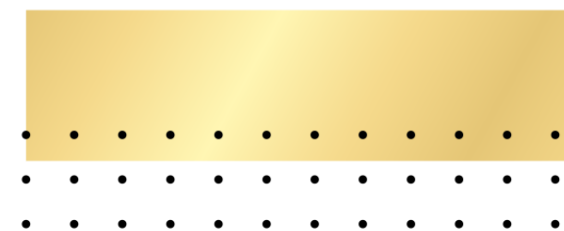
# 6° SofART

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SUTD opened its doors to the first batch of students in 2012. Back then, the students were housed at an old HDB flat next to the interim campus along Dover Road. Block 36 - the site of the first SUTD student residence - was fondly referred to, then, as 6IXDEGREES (6°), a name intended to complement the four academic Pillars and the Fifth Rows at SUTD.

When the permanent campus in the East was completed two years later, the students decided to bring a piece of 6° along with them, literally. They made an art installation out of two existing sofas by palm-printing and hand-writing messages on them. Today, these sofas (6° SofART) not only memorialise the fun times and reminiscences at 6°, but also underscore the significance of hostel life in the overall experience of every SUTD student.





# THE MASCOT FOR SUTD ACADEMY

X18: 2018

Eight students from the SUTD Electric Vehicles Club submitted the E18, an internal-combustion-engine powered UrbanConcept eco car as SUTD's second participation in the Shell Eco-marathon Asia that was held at Changi Exhibition Centre, Singapore, from 7 to 12 March 2018. The club won the Shell Eco-marathon Asia Communications Off-Track Award that year.

This scale model - the X18, was modelled after E18 but has additional features which will enhance the performance of the actual vehicle when incorporated.

The X18 scale model was specially constructed as the mascot for the SUTD Academy that was officially launched on 10 January 2018. The SUTD Academy was established to up-skill and re-skill our working population to stay relevant in the fast evolving job market due to the fast-and-furious advent of advanced technologies.

An eco car designed for optimal performance, accompanied by the tagline "Join us and get ahead!", it signifies how SUTD Academy is set to offer high value-add training courses in a timely manner to help those who take a ride with us (metaphorically) to get far ahead in their careers.

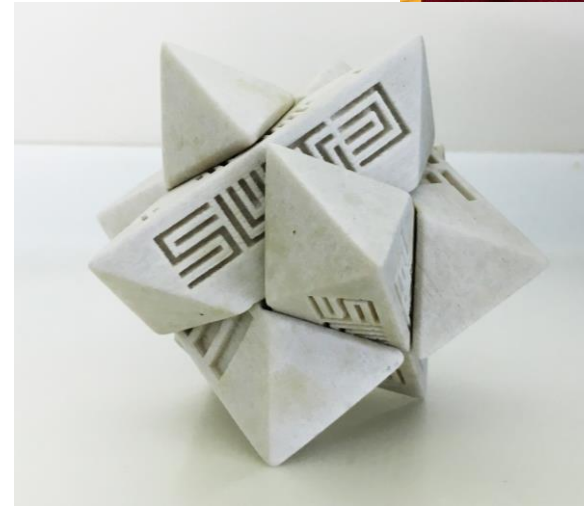


# STAR: A BRAIN TEASER PUZZLE

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The pioneer batch of SUTD undergraduates exhibited their design thinking potential and designed this brain teaser puzzle, called STAR. Equipped with 3D printing fundamentals, they fabricated the STAR with powder bed and inkjet head 3D printing.

It became a popular souvenir that was given to the visitors of SUTD Fabrication Laboratory. Among the dignitaries who had received the STAR was Singapore's Emeritus Senior Minister Goh Chok Tong.



# ORION: THE WORLD'S UNIQUE SWARM ROBOTICS SYSTEM

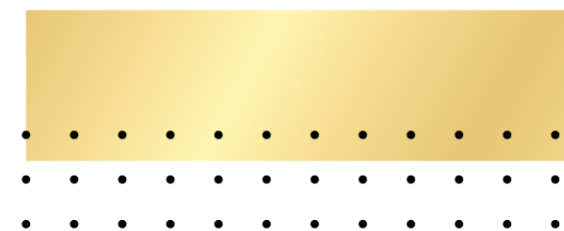
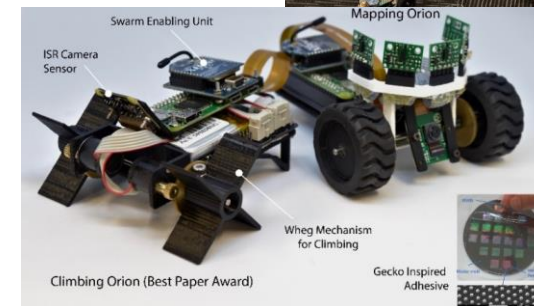
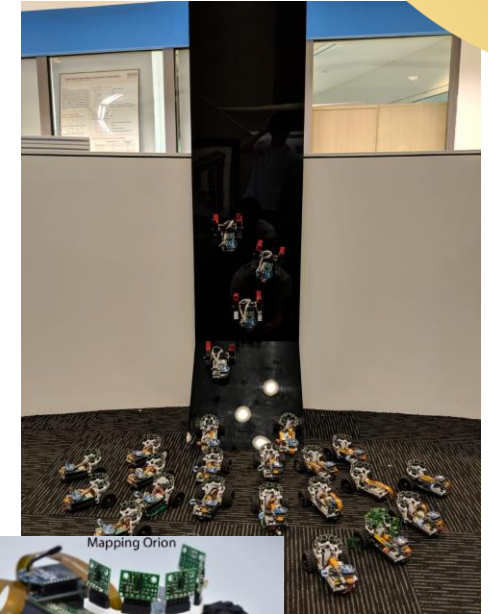
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ORION is an unmanned collaborative robotic system that mimics swarming behaviours commonly encountered in schools of fish and bird flocks. Its design enables multi-agent intelligent surveillance and reconnaissance in urban settings.

ORION's constituting robots act in concert, and through decentralised communication, allows it to perform versatile collective actions. An artificial superorganism, ORION is a unique swarm robotics system comprising two types of micro-robotic units: a wall-climbing variant and a floor-mapping variant. Both variants, which are based on the same core hardware and software designs, allow for flexible installation of sensors and mobility devices such as motion sensors and wheels to cater for different tasks and navigate through the different terrains.

This project reflects SUTD's multi-disciplinary DNA where faculties from different fields collaborate, pushing the boundaries of innovation in design, robotics and materials.

*Key Faculty Team: Roland Bouffanais, Soh Gim Song, Foong Shaohui, Low Hong Yee and Kristin Wood*



# VIRGO: THE WORLD'S SMALLEST SPHERICAL ISR ROBOT

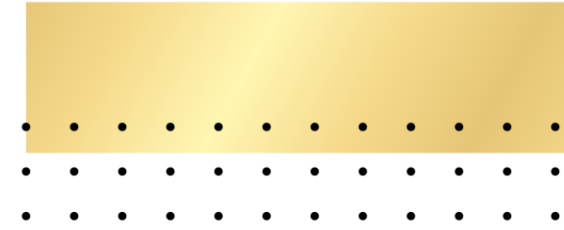
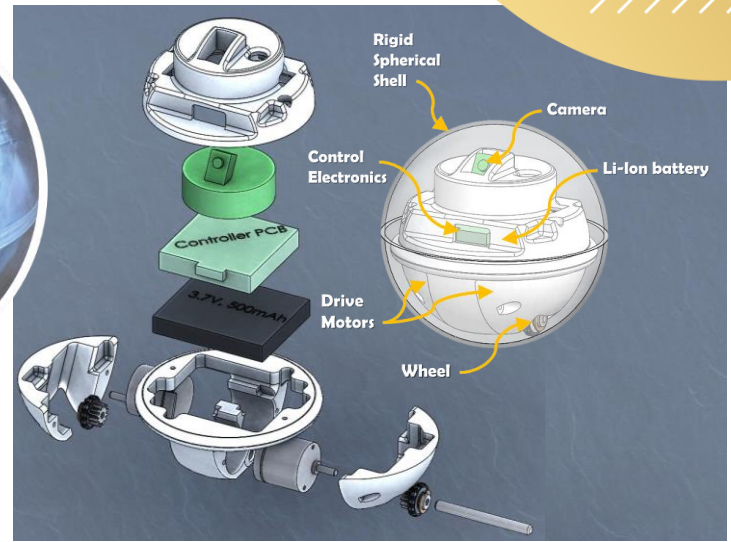
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Virgo is the smallest bio-inspired spherical rolling miniature robot, designed for multi-agent Intelligent Surveillance and Reconnaissance (ISR) in urban environments.

Its development seeks to advance miniaturisation of robotic base technologies to support locomotion, sensing and adaptive autonomy. This is achieved through a novel mechatronic design that allows for seamless integration of modules in a complex multi-modal structural and functional system. The current system is fully 3D printed, has a diameter of 6 cm, weighs 80 grams and comes with vision, inertial, odometry, and magnetic sensing capability.

This project reflects SUTD's design-centric and system level thinking DNA to push the boundaries of miniaturisation.

*Key Faculty Team: Soh Gim Song, Foong Shaohui and Kristin Wood*



# SCORPIO: A FIRST OF ITS KIND BIO-INSPIRED SELF-RECONFIGURABLE ROBOT FOR URBAN RECONNAISSANCE MISSIONS

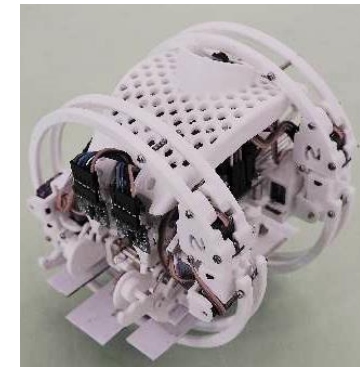
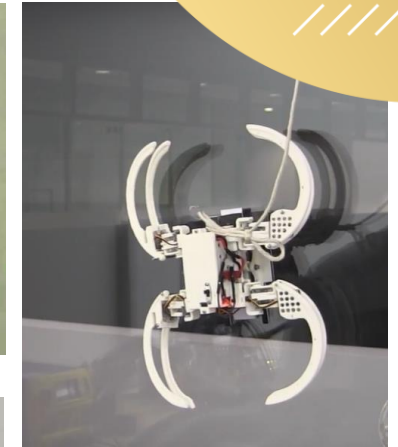
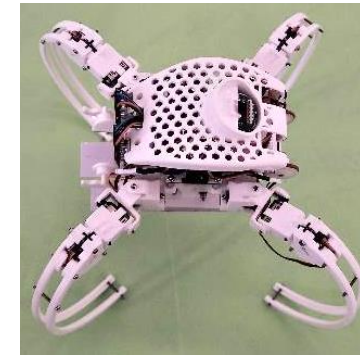
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Urban reconnaissance scenarios are extremely dangerous, particularly when entering buildings where no prior intelligence information is available. However, the fixed morphologies of current adopted robotic platforms highly restrict the types of terrain that these robots can navigate.

To improve the navigation process, our research group at Temasek Laboratories@SUTD (TL@SUTD) looked to nature to help realise mechanisms that would overcome these restrictions. Using the *Cebrennus Rechenbergi*, a species of huntsman spider for inspiration, the research group developed a spider-like transformer robot called Scorpio which is capable of rolling, crawling using a flic-flac somersault motion, as well as wall climbing and transitioning.

With its nature-inspired design and significant intellectual research contributions, Scorpio symbolises the core design and technological spirit of SUTD.

*Key Faculty Team: Karthikeyan Elangovan, Takuma Nemoto, Masataka Fuchida, Veerajagadeshwar, Ning Tan, Mohan Rajesh Elara and Kristin Wood*



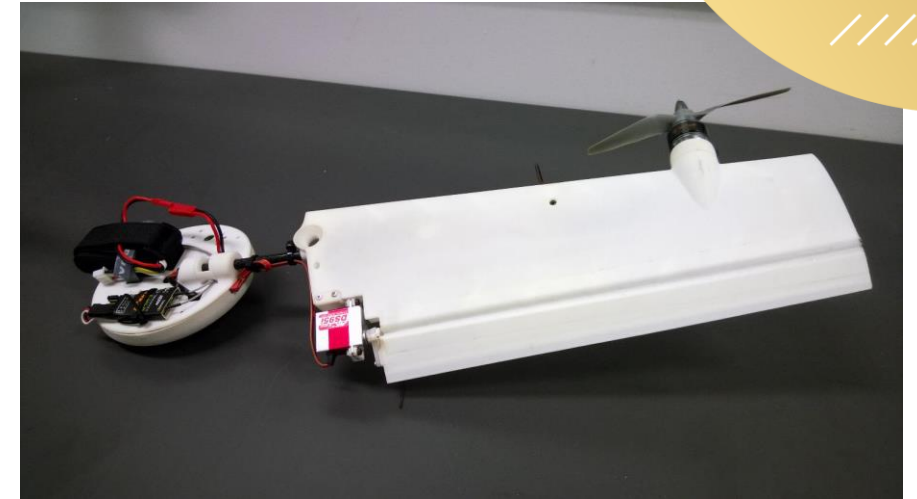
# NATURE INSPIRED SINGLE ROTOR AERIAL CRAFT (MONOCOPTER)

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Monocopters are a class of rotorcrafts known as free rotors where the entire airframe is continuously rotated to provide lift during flight. In the natural world, this mode of flight is employed by the samara of maple trees to cover extended distances through unpowered stable autorotation. It can be adapted for controlled powered flight with the same manoeuvrability and degrees of freedom as a conventional helicopter.

The monocopter possesses an inherent gyroscopic stability and is mechanically robust. This is due to its few moving parts and the absence of intricate or fragile swashplate and linkage mechanisms that are present in helicopters and flapping wing systems. It is also fundamentally more efficient, requiring just half as much power as a flapping wing system to achieve a comparable level of flight performance.

This innovation started off as an SUTD undergraduate research project and was an award-winning entry at the Singapore Amazing Flying Machine Competition (SAFMC) in 2014. Its unique blend of design and engineering saw it become a fully funded research project under the Defence Innovative Research Programme (DIRP).



Key Faculty Team: Foong Shaohui and Soh Gim Song



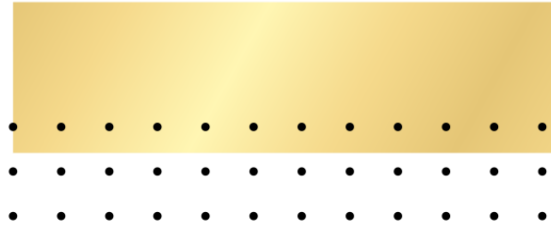
# INTERNATIONAL DESIGN CENTRE DESIGN METHOD CARDS

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The SUTD-MIT International Design Centre (IDC) Design Method Cards were the first designer capability development product to receive the Singapore Good Design award, SG Mark, in 2017. The first iteration was developed earlier, in 2013 by the SUTD-MIT IDC.

Each card includes a method process, a template and a case study. The cards provide a discipline agnostic platform for easy access to design methods.

The Design Innovation (DI) Cards have been used in training over 14,000 design workshop participants. Design training courses are contributions to Singapore by the SUTD-MIT IDC, enabling broader awareness of design and design skill sets.



# UV WHISTLE COLLAR PIN

2018

The UV Whistle Collar Pin is a mixed material accessory that can be worn with any outfit where the design on the surface of the pin transforms in colour under UV light as a reminder of the dynamic story about climate and UV exposure awareness.

Hidden within the pin is a whistle which can be used as a call for help in times of emergency. This resiliency artefact was fabricated in-house at SUTD with novel materials and the latest 3D printing technology. It was designed by the SUTD-MIT International Design Centre (IDC) and is part of an ongoing project with the Urban Risk Lab at MIT.

The UV Whistle Collar Pin was presented as a token of appreciation to Singapore's Prime Minister Lee Hsien Loong during the SUTD Ministerial Forum in 2018.





# THE LEE KUAN YEW CENTRE FOR INNOVATIVE CITIES

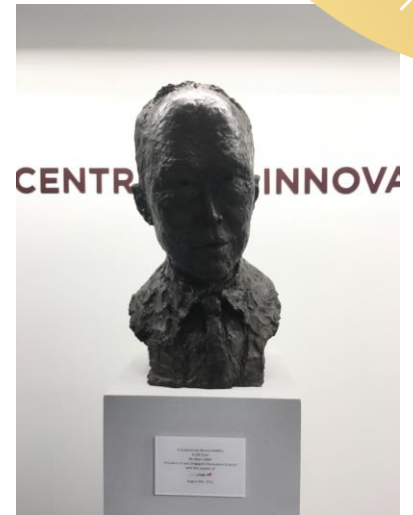
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The Lee Kuan Yew Centre for Innovative Cities has a multi-disciplinary focus on research into urban development, societal issues, their policy implications and implementable solutions.

In keeping with this vision, the Centre has multi-faceted research teams consisting of urban planners, geographers, sociologists, economists, political scientists, engineers, and anthropologists working on a variety of challenging future-oriented policy agendas.

The Centre has published research on ageing society and its demands, the future of living in a digital world, the nature of technological disruption on the economy, the onset and implications of the data economy, and the changing morphology of a diverse society in Singapore.

The Centre continues to engage the academic community and policy-makers to ensure that research remains relevant to the discourses of the day and envisions itself as an integral part of the SUTD research community.



# 4D-PRINTED SUTD LOGO

2015

The 4D-Printed SUTD Logo, contributed by the SUTD Digital Manufacturing and Design Centre (DManD), involves 3D printing of hinges from digital shape memory polymers (SMPs) that can self-fold and return to its original shape upon exposure to an external stimulus, such as heat.

The digital SMPs are digital materials that are formed by mixing two base materials at specific ratios on a digital voxelised (like a pixel, with an added dimension to confer volume) domain to achieve prescribed thermomechanical and shape memory behaviours.

The multi-disciplinary work needed to achieve the self-actuating artefact encapsulates the mission of DManD to create frontiers in design and future of manufacturing, and SUTD's positioning as a leading research-intensive global university focused on all elements of technology-based design and multi-disciplinary approach.





**SUTD 10<sup>TH</sup> ANNIVERSARY:  
TIME CAPSULE ARTEFACTS**

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**SUTD**  
SINGAPORE UNIVERSITY OF  
TECHNOLOGY AND DESIGN

**10x**  
YEARS IGNITING  
INNOVATION  
BY DESIGN

