

# T4 KING FLIGHT

THE CHANGI AIRPORT TERMINAL 4 STORY



Terminal



4



MON PARIS  
MON PARIS  
MON PARIS

MON PARIS  
MON PARIS  
MON PARIS

MON PARIS  
MON PARIS  
MON PARIS

6

7

↑ P Car Park

← P Car Park

← Baby

Swire World's  
Best Airport  
2013-2018  
Your support makes it possible  
Thank you



Departure

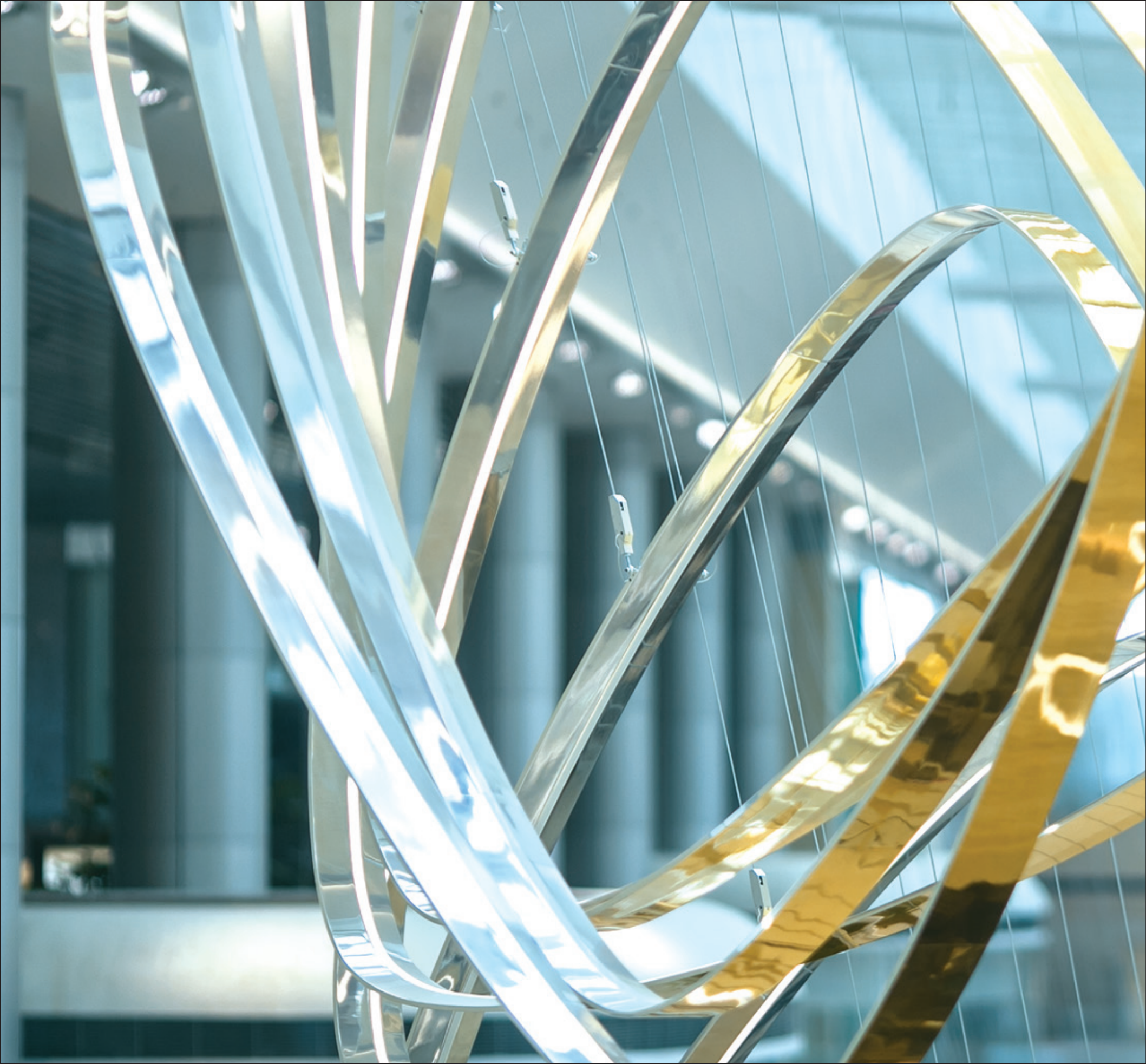
Departure

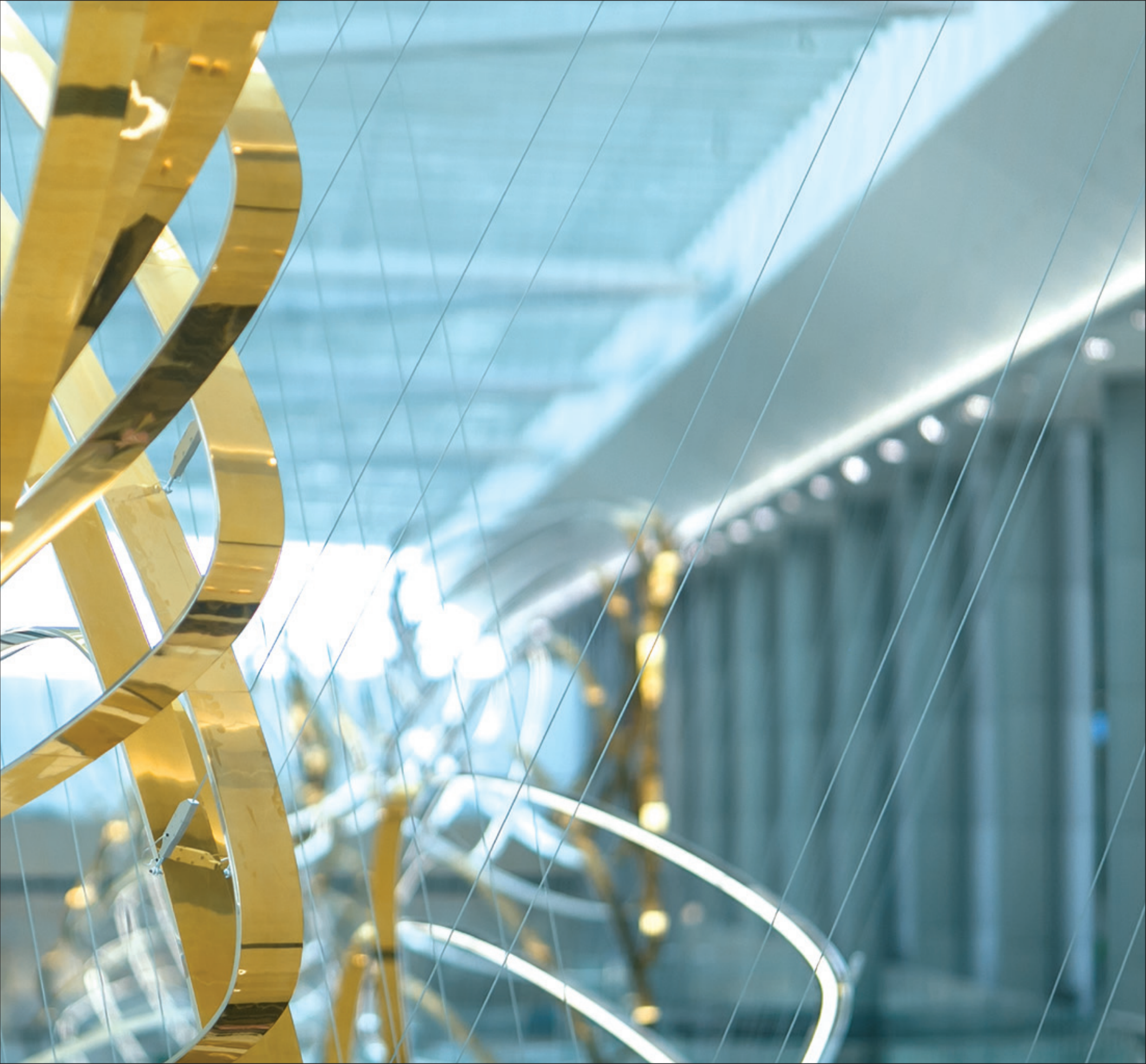
ark 4B  
ark 4A  
Care Room

4B 停车场  
Tempat Meletak Kereta 4B  
காரை நிறுத்திடம் 4B  
駐車場 4B

4A 停车场  
Tempat Meletak Kereta 4A  
காரை நிறுத்திடம் 4A  
駐車場 4A

育嬰室  
Bilik Persalinan Bayi  
சுழந்தைப் பராமரிப்பு அறை  
授乳室









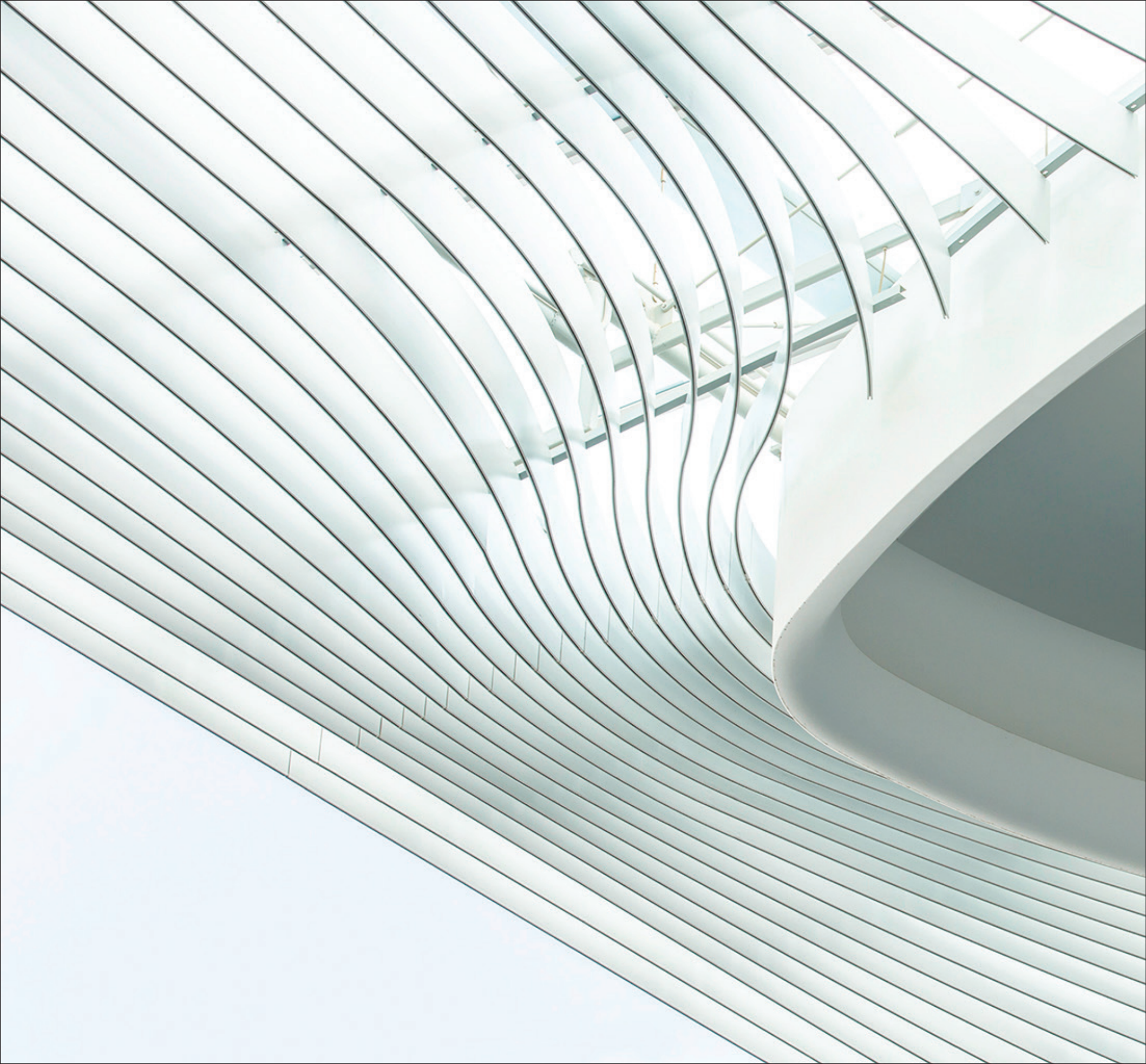












## RAISING THE BAR

Fun. Vibrant. Positively surprising. In aiming high, Changi Airport's passenger terminals have built a reputation for offering the highest standards of service. This has been its DNA since its inception in 1981. Passengers have come to expect no less from one of the world's busiest and most awarded airports.

Now, Changi's latest addition, Terminal 4 (T4), raises the bar and sets a new benchmark. It is built on the foundation of seamless service from the moment the passenger arrives at the terminal until it is time to board the aircraft. In between, checking in and clearing customs are automated and swift because T4 is designed to offer greater convenience and increased productivity.

The time shaved allows passengers to shop and dine leisurely after they clear departure immigration. Created with an ambience to entertain, retail and F&B outlets dot the departure transit area.

It is an entirely new experience for passengers at Changi's newest terminal.

At the heart of T4 is the Fast And Seamless Travel (FAST) system, which enables the smooth movement of passengers from check-in and immigration to aircraft.

Travelling has never been this seamless at Changi Airport.

Published by  
**Changi Airport Group**  
**(Singapore) Pte Ltd**  
Copyright ©2018

Singapore Changi Airport  
PO Box 168  
Singapore 918146

[www.changiairportgroup.com](http://www.changiairportgroup.com)

**TAKING FLIGHT**  
The Changi Airport Terminal 4 Story

Designed and produced by  
Tuber Productions Pte Ltd  
(A Potato Productions Company)  
[www.tuber.sg](http://www.tuber.sg)

Editorial consultant: Penman LP  
Editor: Ian De Cotta  
[www.penman.sg](http://www.penman.sg)

Commissioned photography by  
Kevin Yang and Chuck Tham

ISBN: 978-981-11-7719-4

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the copyright owner.

All information correct at time of printing.

Printed in Singapore.



# T4KING FLIGHT

THE CHANGI AIRPORT TERMINAL 4 STORY



Dedicated to the late  
**Somkiat Lertrpanyavit**  
&  
**Foo Sek Min**

For devoting their lives to moulding  
Changi Airport into the world's best.

### **Somkiat Lertpanyavit**

(1944-2015)

Former Managing Director of  
Changi Airport Planners and Engineers

An outstanding engineer from Thailand, the late Somkiat Lertpanyavit was recruited by the Singapore government for national development in the early 1970s, at a time when Singapore was critically short of engineers. As an airport engineer, he first worked on airfield projects in Paya Lebar Airport. Somkiat eventually became a Singapore citizen and continued to serve the airport with passion as a key master planner and designer, after the government decided to move Singapore's international airport operations from Paya Lebar to Changi in 1975.

Dedicating 43 years of his life to Singapore's airport development works, Somkiat is most remembered for single-handedly designing the airfield layout of Changi Airport's two runways. His expertise and deep airport master planning knowledge is highly regarded by airport planners worldwide. Somkiat figured prominently in Changi's growth. He groomed and mentored many of the airport's outstanding performers in both the executive management, and rank and file.

Under his leadership at Changi Airport Professional Engineers, a Changi Airport Group subsidiary, the Changi brand spread far and wide around the world. Although Somkiat intended to retire in 2011, he was persuaded to help with the planning of Chang East, the next phase of the airport's expansion. And he did so with great pride and commitment.

### **Foo Sek Min**

(1971-2018)

Former Advisor to Chief Executive Officer,  
Changi Airport Group

The late Foo Sek Min was behind many of Changi's creative innovations, especially when he was head of airport operations from 2005 to 2013. Under his direction, the airport became the first in the world to introduce an Internet centre, a Butterfly Garden and an airport game show that lifted the travel experience of passengers to new levels. He was deeply involved in Changi Airport's Quality Service Management initiatives, working with the team to deliver the special Changi Experience which passengers enjoy today.

Sek Min started working in Changi Airport right after graduating from university in 1993 and dedicated his whole career to the airport's growth and development. He undertook leadership roles across various airport operations functions and contributed to many of the milestones achieved. Among them were the extension of Terminal 2's finger piers in 1995, and its upgrading between 2003 and 2006, as well as the refresh of Terminal 1 from 2009 to 2012. Sek Min also figured prominently in the building of the Airport Logistics Park of Singapore in 2003, and he led the airport's Severe Acute Respiratory Syndrome screening task force that same year. He played a key role in the development of Budget Terminal three years later and Terminal 3 in 2008. He was among the core leaders who drove the corporatisation of Changi Airport in 2009.

For 25 years of his life, Sek Min lived and breathed Changi, dedicating himself tirelessly to keep our world-class airport at its best. His humour, intellect and energy, coupled with his consummate desire for excellence were palpable and infectious for everyone who had a chance to work with him.

# CONTENTS

18

## Chapter 1

### **GROWING EXPECTATIONS**

20

**Changi's expansion**

24

**Investing in the future**

26

**Changi: Growing and staying ahead**

28

**Behind the scenes**

32

**Inspiring innovation**

34

## Chapter 2

### **A BOLD MOVE**

36

**Embracing change**

38

**Ink on paper, but art nonetheless**

40

**Metamorphosis in motion**

44

**Method in the madness**

46

**Glide: Cruising from kerbside  
to aircraft**

48

**From kerbside to gate with FAST**

50

**The T4 magic and sepia tints**

52  
**Chapter 3**  
**A THEATRE OF  
EXPERIENCE**

54  
**The space between**

56  
**Gliding right through**

58  
**Changi's wonderwall**

60  
**Seamless security**

62  
**Shop and saunter to your seat**

69  
**Into another world**

70  
**Delight in the details**

74  
**A green line into the horizon**

76  
**The art of perfection**

80  
**10 things to do at T4**

82  
**Chapter 4**  
**THE HUMAN  
SOFTWARE**

84  
**For the family**

88  
**Chapter 5**  
**A FAMILY  
AFFAIR**

92  
**Open doors, open minds**

96  
**One final push**

98  
**Taking flight**

102  
**Thank you**





## Chapter 1

---

# GROWING EXPECTATIONS

It was borne out of necessity.

This was 1970s Singapore, and Paya Lebar Airport was buckling under the weight of a rapidly increasing demand for air travel. Despite extensions, Paya Lebar was handling four times the one million annual passenger movement it was designed for.

Changi was made to meet those increasing demands, but Singapore's new airport went much further, right from the moment its doors opened in 1981. It moved beyond a functional waypoint of travel to one that was pleasant and wildly efficient.

That approach of looking far into the future became a mantra.



1

1. Singapore moved its international airport operations to Changi in 1981.

## CHANGI'S EXPANSION

### Demands and desires

There was much to learn from the Paya Lebar experience, and Changi took it all on board. Eyes were now focused on the horizon, and from the moment Terminal 1 (T1) rose from the ground, there was to be no resting on laurels.

T1 broke from international airport norms at the time. It coupled Singaporean efficiency with a friendly disposition:

big airy halls and glass walls to allow arriving passengers to exchange joyful glances with their loved ones waiting eagerly beyond. Passengers got an efficient travel transit facility, and also amenities and a pleasing environment that they did not know an airport could provide – the *Changi Experience* was taking shape.

### Growing into the Changi identity

As a testament to Changi's foresight, construction of Terminal 2 (T2) began in 1986. It opened in 1990 and doubled Changi's passenger capacity to 44 million a year.





2

2. 3. 4.

Changi was built with expansion in mind. After T1 began operations, T2 opened its doors in 1990, followed by T3 in 2008.



4



3

Between 1995 and 1996, improvement works were carried out at both terminals, with T1 receiving a S\$170 million refurbishment and T2 adding two new finger piers and 22 new aerobridges. T2 also needed to be updated and it received a S\$240 million facelift in 2003.

In 2002, connectivity received a massive boost with the opening of the Changi Airport MRT Station.

Staying ahead of the competition takes a monastic commitment that Changi clearly espoused, and in 2008, Terminal 3 (T3) opened its gates. T3 sprouted from the ground and grew into a colossus of green leaves, glass and steel. It offered warm, efficient service, and with the MRT station, was immediately convenient. At T3, the *Changi Experience* was taken to a new level: its spaces were functional, but also evoked emotion.

“Only when the fundamental prerequisites are fulfilled, can we go on to provide for the needs and comfort of passengers to the last detail,” says Tan Lye Teck, Executive Vice President for Airport Management, Changi Airport Group (CAG), ahead of T3’s opening in 2008. “And we need to continue to provide capacity ahead of demand.”

1.  
T3 takes the *Changi Experience* to a new level, with spaces that were functional and evoked emotion.



1

Timely expansion of infrastructure was critical for Changi to stay ahead of the game – and that remains true today.

### Evolving expectations

As average ticket prices fell in the years that followed, more passengers took to the skies. Airports needed to upsize, but bigger was just not enough. Comfort and convenience were still key factors, as passengers wanted an experience, and airports were expected to kick-start their holiday. The airport responded.

In 2006, the airport embraced the rise of low-cost carriers (LCCs) and opened Budget Terminal (BT). It put Changi's finger directly on the pulse of the industry's fastest-growing segment. The terminal had a handling capacity of seven million passengers per annum, but again Changi had its eye on the horizon.

### The budget terminal challenge

LCCs grew rapidly and introduced a new set of passengers – the young and tech-savvy. Within a few years of its opening, BT felt the heat of capacity pressures. Nevertheless, Changi's drive to stay ahead of the curve meant that it had capacity to spare because collectively, its three main terminals could handle 66 million passengers a year. That was 20 million more than what it was handling at the time.

“When we built BT, we intended to keep it low-frills and low-maintenance, but aviation growth trends, coupled with weak retail demands, soon drove us to rethink the BT proposition,” says Poh Li San, who was BT's Head of Airport Operations before taking on the mantle of Vice President, T4 Programme Management Office.



2

“We were seeing double-digit growth for the airlines operating at BT, which was a good thing, but this was eating up the terminal’s capacity very quickly. We knew we really needed a much bigger terminal.”

With confidence that Changi Airport had capacity to spare, the management decided it could tear down BT to build in its place a more future-ready facility, one that was in closer alignment with the airport’s philosophy.

The signs were clear.

“I was hosting a chief executive of an Indian LCC, a very successful one that was trying to connect to Singapore for the first time,” recalls Lee Seow Hiang, CAG’s Chief Executive Officer (CEO). “We presented BT to him thinking that the carrier would want a low-frills terminal, but after sizing it up, he felt it did not meet his passengers’ expectations. For me, this affirmed our hunch that trends were changing.”

Changi hedged its bet on a full-service T4, and it turned out to be right.

In 2011, BT’s anchor airline, Tigerair (then Tiger Airways), had ordered 50 aircraft, and T4 was planned with the airline’s

fleet expansion in mind. But after Singapore Airlines took over Tigerair in 2016, it decided to operate the LCC out of Changi’s other terminals instead of T4.

“Fortunately, T4 eventually went the full-service way to attract the likes of Cathay Pacific and Korean Air, or we’d have been stuck,” says Seow Hiang. “The thinking is that if your terminal is suited for only one type of airline, the flexibility to spread airlines around isn’t there.”

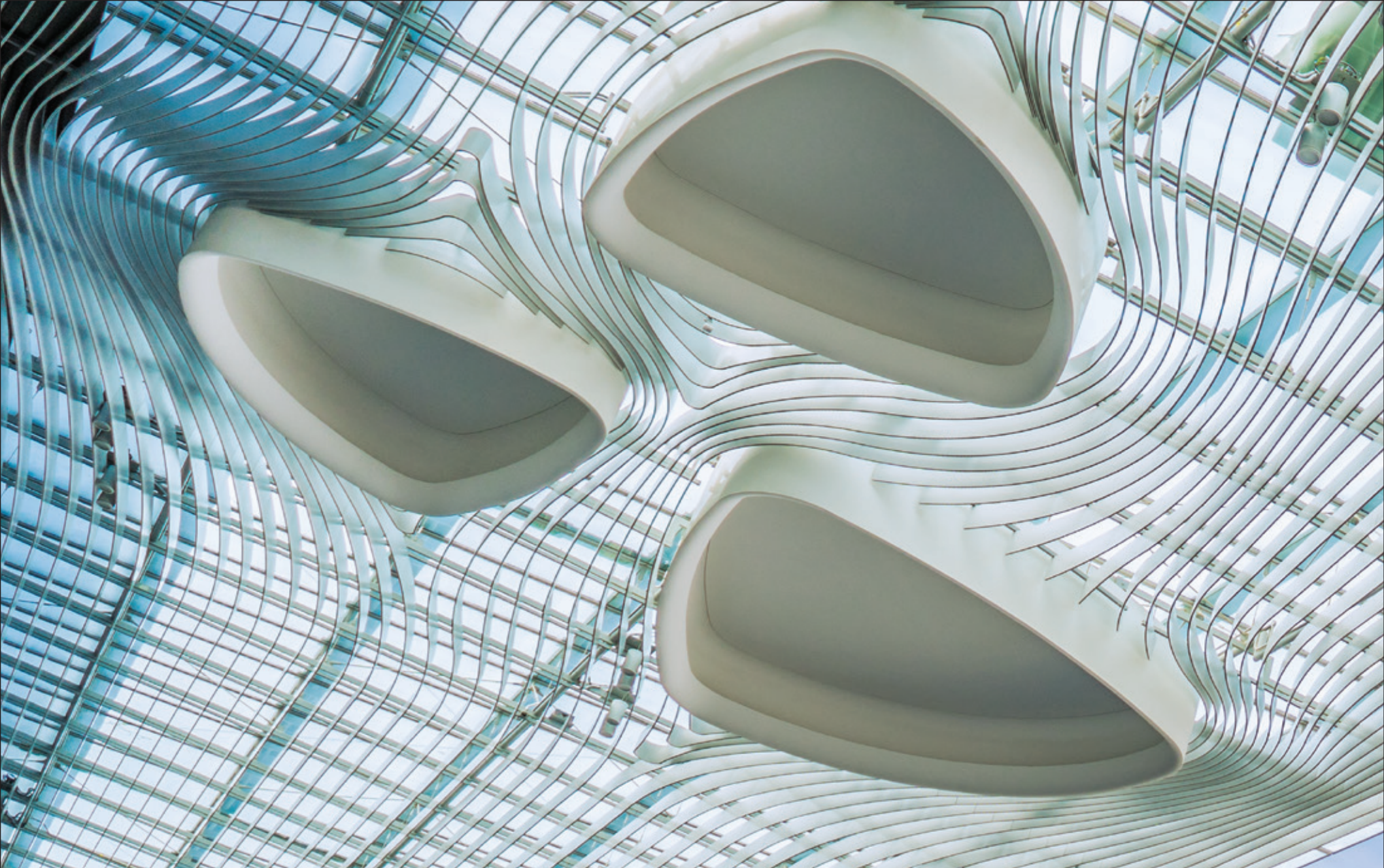
But rebranding was not just about that. T4 had to be worthy of the Changi brand – and future-proof.

“Retail was our secret to keep charges low and if we had stuck with a ‘budget’ image, the brands wouldn’t have come to BT. For businesses, brand equity is everything,” explains Seow Hiang. “The whole system needed to be rebranded because of our retail partners. Every terminal is a labour of love for us, but we were convinced it was the right thing to do. I knew we were creating something better.”

2. With air traffic growing, Budget Terminal was rapidly reaching full capacity and had to be replaced.
3. The new T4 is future-proof and aligned with the Changi brand.



3



## INVESTING IN THE FUTURE

### Changing mindsets

T4 was no cursory effort. It provided an opportunity to launch a futuristic idea that would be a test bed for Changi's upcoming mega development project, Terminal 5 (T5), which would be unsurpassed in size and complexity.

"We challenged our limits, we knew there were constraints of budget and time, but we knew we had to do more because Singaporeans judge us at the highest level," says Seow Hiang.

"So we had to hold ourselves to the highest standards."

Between its birth in 1981 and 2018, Changi had won more than 560 best airport awards. But this was not just the Changi brand. Technological advancements could see the air travel paradigm shifting again, and T4 would be an operational test bed of these.



T4 personifies a bold change and one that heralds the coming of T5.

Previously managed by the Civil Aviation Authority of Singapore (CAAS), Changi Airport was corporatised and CAG was formed in 2009. Its CEO saw another opportunity to unearth in the new T4 – an intangible but valuable one that should not be missed.

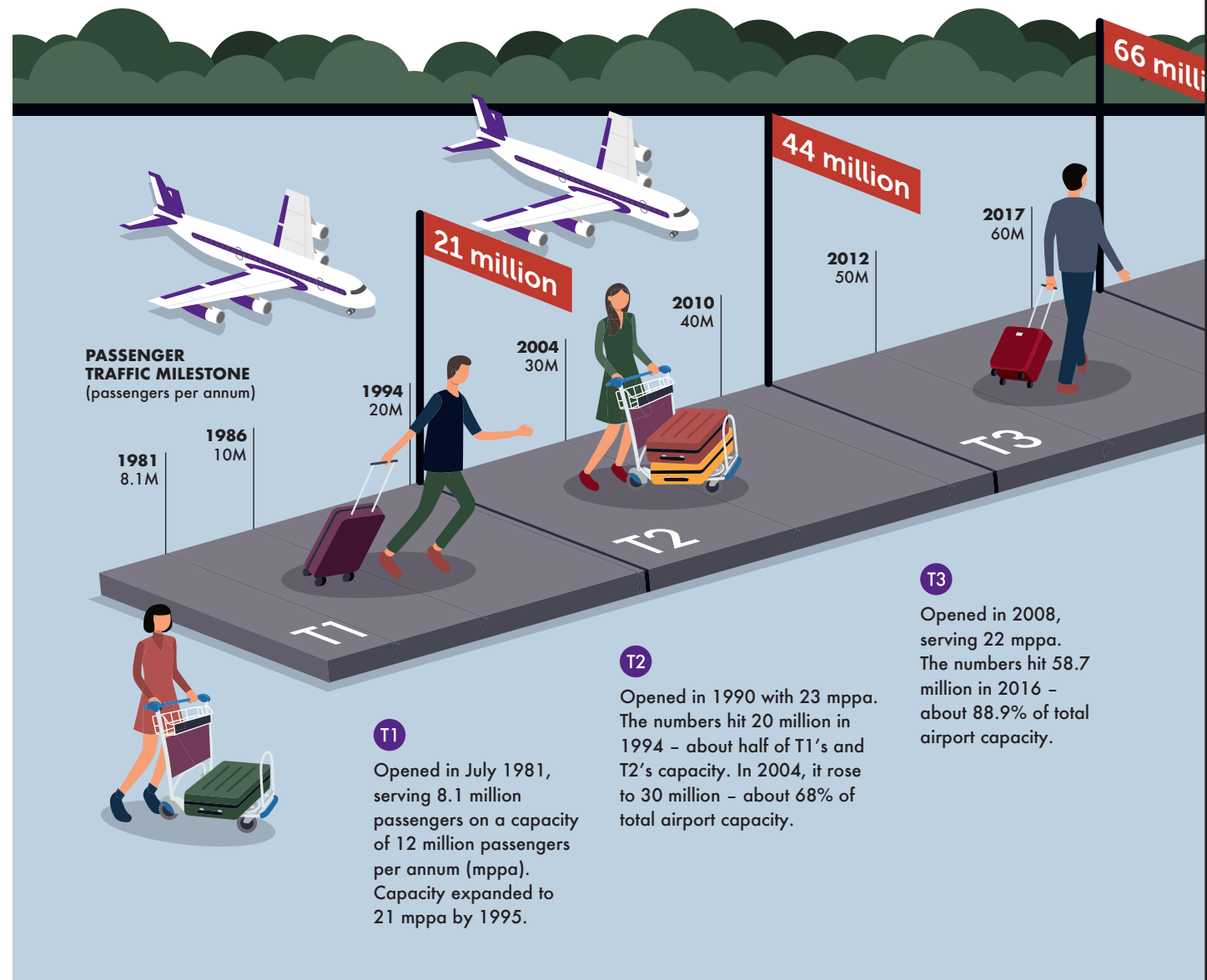
“I had another greedy objective behind this – I wanted the new T4 to change a bit of us,” says Seow Hiang.

“We can talk about change, but sometimes you need context to personify that change, to create the culture of working together as one community.

“This was the community coming together, but not to apply a standard formula – everyone had to change their views.”

## CHANGI: GROWING AND STAYING AHEAD

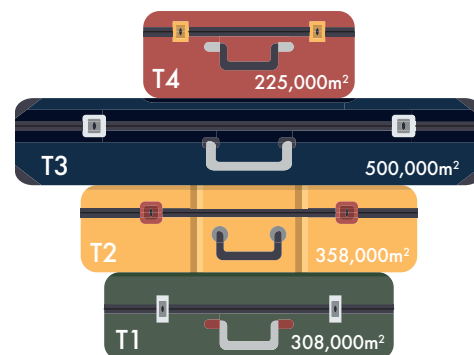
Global air travel trends indicate increasing demand and there is no standing still as Changi prepares for growth. Airport master planning is a complex process that can take years to realise, so the strategy has been to develop infrastructure projects ahead of capacity needs. This keeps Changi at the forefront of air travel and secures its position as a premier, world-class air hub.



1

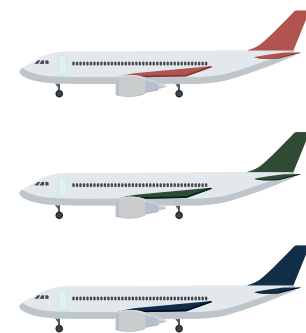
### BEST IN CLASS

With over 560 Best Airport awards, Changi is today, the world's most awarded airport.



### Larger footprint

Improvements never stop at Changi Airport. Even as new terminals are built, Changi makes sure that older terminals are continually upgraded and expanded to meet the growing demands of air travel.

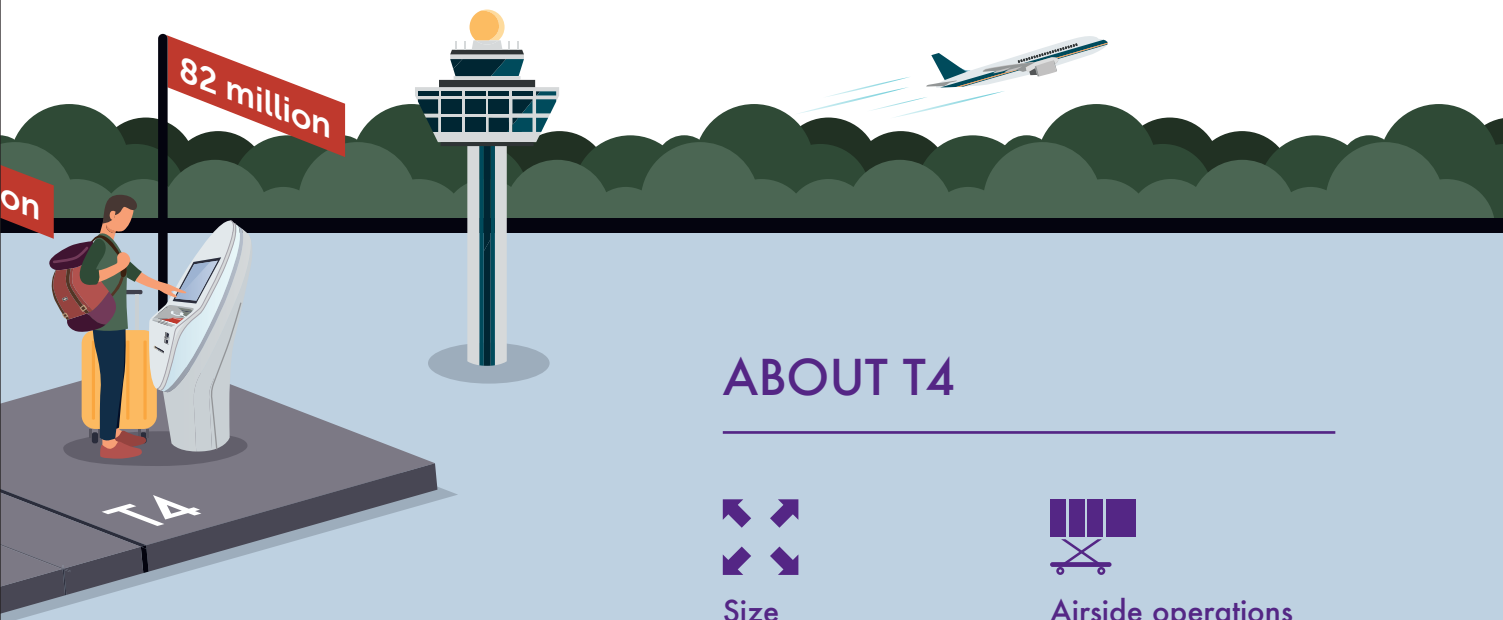


### More airlines

**3X**  
more

1981  
34 airlines

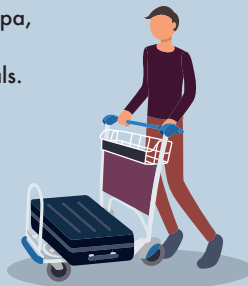
2017  
more than  
100 airlines



## ABOUT T4

T4

Changi Airport's newest terminal opened in 2017 with a capacity of 16 mppa, making room for airline growth across all terminals.



### Size

25-metre-high building with gross floor area of 225,000 square metres (about 27 football pitches).



### Airside operations

21 contact stands, comprising four widebody and 17 narrow body stands, all connected by aerobridges.



### Connectivity

11 airlines serving over 20 regional destinations.



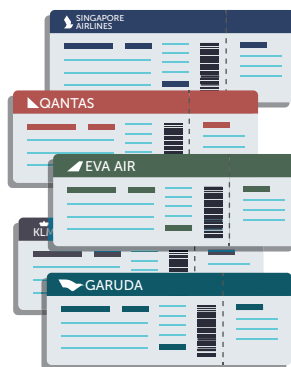
### Flights & passengers

800 flights a week serving more than eight million passengers per annum.

### More flights

**5X**  
increase

1981  
1,461 per week  
2017  
7,000 per week



### A connected world

Today, with airlines flying to more places than before, it seems as if the world has become smaller. Far-flung places are not so remote anymore. Changi, too, is connected to six times as many cities as when T1 first opened in 1981.



**400**  
city links  
in 2017

**66** city links in 1981



## BEYOND FLYING

Changi Airport is not simply a transport hub where passengers fly in and out of Singapore. What is key is the emotional connection it forges with those who fly through Singapore. Together, Changi's clockwork efficiency, thoughtful amenities and dedicated service deliver an unforgettable encounter. Here is a look at how the airport has grown since T1 opened in 1981.

### Retail outlets

More than  
**33X**  
increase

1981: 12  
2017: 405

### F&B

More than  
**22X**  
increase

1981: 7  
2017: 160

### Airport community

**50,000**  
people

More than 200 organisations at Changi Airport work together to deliver the *ONE Changi* experience.

## BEHIND THE SCENES

Three CAG executives who were closely involved in T4's development discuss their journey of creating "a terminal like no other".



From left: **YAM KUM WENG**  
Executive Vice President,  
Airport Development

**LEE SEOW HIANG**  
Chief Executive Officer

**POH LI SAN**  
Vice President,  
T4 Programme Management Office

**BRIDGETTE SEE**  
Facilitator,  
Tuber Productions Pte Ltd



**Q: Who decided on the deadline of building T4 in a record three years?**

**Seow Hiang:** The world decided for us. Users of Budget Terminal were growing fast; we were also reaching full capacity at T1, T2 and T3. Any later and it would be too late because it would have meant cramming the other terminals or stopping flights. So, it was a bit of a no-brainer – circumstances forced the urgency on us.

**Q: The T4 project management team was a relatively young one.**

**Li San:** Yes, a few in our team were rookies. We had never built a terminal before.

**Q: What gave CAG’s management the faith to entrust the building of T4 to them?**

**Seow Hiang:** That’s why we have a tagline “A terminal like no other”. It’s okay if they had not built any other terminal. (laughs) Jokes aside, I would say we had the best of both worlds.

We had the deep experience – the best experts from Changi Airports International like the late Somkiat Lertpanyavit – in the initial stages, and our advisors Wong Woon Liong and Ho Beng Huat. At the same time, we also had the freshness of insight from the younger project management team. The architects and design consortium (SAA and Benoy) didn’t have experience working on airports before. We knew that but chose them because they’re good in particular areas that suited the design vision.

**Q: What was the process like in deciding what T4 would look like?**

**Seow Hiang:** It was a challenging piece of land. At first, we thought there were not many options, but as we pondered



Lee Seow Hiang

over it, quite a number of viable options emerged. That was fun because we were trying to break out of the constraints.

**Kum Weng:** We took a consultative and collaborative approach in ideation and decision-making. Right from the start, we gathered inputs from stakeholders of senior as well as junior levels across various airport agencies and integrated them into T4’s functional design plans. For some of the more strategic decisions that would shape how T4 would look like, it took many rounds of deliberation before a decision was made. For instance, we asked ourselves what would be T4’s “personality” and finally decided it should be a terminal that would give passengers a “fun, vibrant and positively surprising” experience.

### Q: Were there misgivings?

**Kum Weng:** Of course. Some felt that since the configurations of existing terminals worked, why not continue with them, why take up that challenge?

**Li San:** This made us go back to our basic principles – to dig up what we understood of our operations and our passengers, and how our airlines work, to make our decisions.

**Seow Hiang:** One big tension surrounded the idea of creating a seamless walkthrough experience in the integrated duty-free zone. In the past, we never used it because we didn't want retail to be foisted upon passengers. Are we able to slay this "sacred cow" without losing the fundamental principle of "not foisting retail on you"? It was a great mental exercise because what was not doable in the past was overcome and reinvented without compromising core principles.

### Q: What were the other new approaches?

**Li San:** One was the Develop and Construct (D&C) approach, which is typically used in modular buildings like hotels. But for an airport, which is complex and mixed-use, it was quite a challenge. For T4's scale, we felt it could work.

T4 was also subjected to new security design requirements to improve security. That underpinned a lot of the design considerations and we had to work around all these. That added another layer of requirements for our D&C process.

### Q: Considering the timeline, one would have expected CAG to go for the safer, tried and tested methods instead of heavy experimentation.

**Kum Weng:** One big change was having our own project management team. When we built T1, T2 and T3, project management was outsourced. For T4, we decided to take over as project manager because we knew that when we undertake

T5, it'll be such a big, challenging project that we'll need in hand a deep understanding of getting value out of good project management.

### Q: It seems that CAG took some leaps of faith in building T4.

**Kum Weng:** We took many bets right from the beginning. We knew that if we missed this opportunity, we wouldn't have another "live" platform for us to test new concepts for T5.

**Seow Hiang:** We looked at how start-ups manage risks. It was a careful concept of building experiments that gave us confidence. We needed to learn to be comfortable with ambiguity. We don't like to take unnecessary risks, but in an ambiguous situation of introducing new technologies, how



Yam Kum Weng



Poh Li San

can we create rapid prototypes so that even if we fail, we fail fast and safe, and can quickly change and adapt?

**Q: How did you get everyone onboard to learn and cope with ambiguity?**

**Seow Hiang:** It's not often that we are given a chance to build a new terminal, so we weren't about to let this opportunity go to waste. Everyone wanted to make it happen. Without the deep passion, the fear would get bigger. But when you have a clear passion, fears and risks can be managed.

**Kum Weng:** One of the challenges we posed to our people was to make every touch point better than what we had. So nobody wanted to keep to the status quo.

**Li San:** There's this trust from management. Of course, we had the due processes to make decisions, present the facts and recommendations.

**Q: Were there any particularly challenging moments?**

**Li San:** About seven to eight months into the project, most of the senior people from one of the design consultant teams left the company. We had to take over a fair bit of their work to manage the progress of the design development. It was a disruption, but we took it in our stride and managed to overcome that crisis.

**Seow Hiang:** It was a disruption because it was almost the entire Asia team suddenly disappearing. So I would say, kudos to the T4 team because they responded to the best of their abilities.

**Q: What has been your favourite moment so far?**

**Kum Weng:** When this project started to wind down, I was told by some of our partners working on this project that they really missed it, and they asked me: "When's the next one?" (laughs) For me, this speaks well of the whole process.

**Li San:** There were so many changes and risks; at many junctures, we could have totally messed up but I think it was the people who kept everything together, given the speed we did this.

**Seow Hiang:** We hosted many guests, and as usual, ended the tour with the Heritage Zone, where we played the *Peranakan Love Story*. I would turn and look at their faces, which told me they understood the labour of love.

## INSPIRING INNOVATION

The Changi Airport story is an intimate one for Mr Liew Mun Leong. It began in the 1970s, when as a young engineer with the Public Works Department (PWD), Changi was his university site – a life-long journey of growth. It was where he learnt the ropes and honed his professional skills. The emotional imprint was cast then, leading to his decades-long commitment to Changi.

Mr Liew has come full circle, from an engineer who built the first runway to becoming CAG's Chairman. He has witnessed the raising of Changi's iconic control tower and contributed to its growth as an admired global air hub.

Today's Changi is grander and more passenger-friendly than when he laid eyes on its first completed terminal in 1981. Changi has changed, but much of the spirit behind it remains the same as it was when Singapore rallied to move its airport out of Paya Lebar.

### Change is not the only Changi constant

“No one believed the PWD could do it,” recalls the engineer of the general scepticism that the new Changi Airport could be delivered on time. “But our mindset was one of passion and commitment – we just had to do it.”



CAG staff and consultants kept Mr Liew and the Executive Committee of Airport Development members updated on the progress of T4, even on details of the selection of carpets.

Parallels to the T4 project – with its tight timeline and numerous other constraints – are easily drawn. And the similarities do not stop at the drive behind the project. Mr Liew recalls how the various government bodies rallied behind the national project, and the Changi spirit of innovation that shone through then still rings true today. “Innovation need not be in technology per se, but there needs to be innovation in thinking: What is the best way to get things done?” he points out.

“There were times when I had to break out of the norms to get the job done. For example, our workers were marooned in a sea of earth on the T1 worksite, and we needed an hour just to ferry people in and out – we couldn't afford a Land Rover or minibus.”

Mr Liew's solution, which was to include a vehicle in the contractual requirements of the vendor, was unusual then but is today a common practice. And he brims with pride at the similar innovative approaches the T4 project took at various stages, such as the D&C method to build the terminal – one that saw plans changing fluidly, even as the building rose from the ground.

“As we got to know the project, we were very impressed. There was really some outside-the-box thinking,” says Mr Liew. “Even back in the 1970s and 1980s, there was the same thought of innovation, guided by the principle of pleasing passengers, of integrity.”

### Right from the top

Changi's secret could well be the consistency in the deep commitment of its leadership.

“I think Sim Kee Boon's approach to managing the initial project (T1) was key to the framework of Changi,” Mr Liew says of the former CAAS Chairman who never stopped displaying a deep commitment and whose consultative approach to management inspires employees to take ownership of their work.

“Even up to the last few weeks before he passed away, he visited T3 in 2007, when it was still under construction. That was the kind of commitment he had. Getting the right technical people is one thing, but getting the right leaders is key.”

Mr Liew has adopted a similar approach to his own leadership style. A roll-up-your-sleeves type of chairman, he is more than willing to get his hands dirty rather than serve as a rubber-stamper in his role as Chairman of CAG’s Executive Committee of Airport Development (ECAD).

ECAD comprises some of CAG’s board of directors and external members with deep knowledge of construction and infrastructure, and counts among its responsibilities the oversight of major development projects at Changi, its selection of consultants and the approval of collaborations.

It draws on the experience of several CAG and government veterans who have worked with Mr Liew over the years – some were engineers who signed up when the ink on their degree scrolls was “still wet”. It is a source of pride for Mr Liew, who believes this “unique gelling of people”, who have embraced that deep sense of commitment now synonymous with Changi, will propel the organisation to greater heights.

### Changi’s unsung hero

Learning from his predecessors’ years of mastery is something that Mr Liew takes seriously. He recalls the mentorship of the late Mr Somkiat Lertpanyavit who had dedicated 43 years of his life to Changi, right up to his passing in November 2015.

Mr Somkiat was recruited by the Singapore government in the 1970s, at a time when the Republic was critically short of engineers, to accelerate its national development. A master planner and designer, he was heavily involved in the development and history of Changi Airport.

“He taught me things I did not know. And his commitment was inspirational.” says Mr Liew of Mr Somkiat, with whom he shared an office in 1974.



Liew Mun Leong

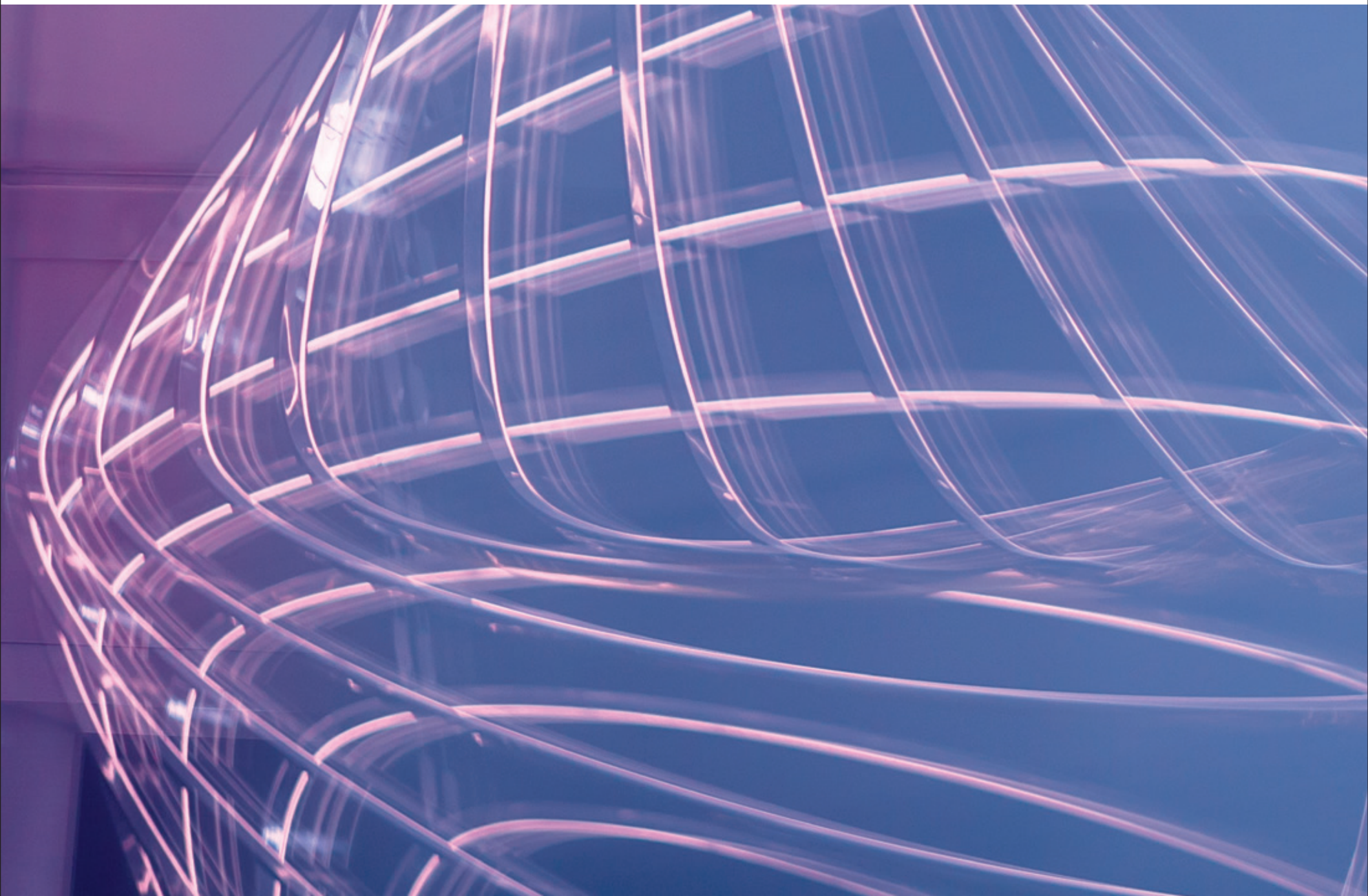
Mr Liew credits Mr Somkiat as the man who single-handedly planned and designed the airfield layout of two runways when the decision was made to move the Singapore airport project from Paya Lebar to Changi.

“No one then – and now – would know anything more than him on the Changi Airport master plans,” says Mr Liew. “Airport planners and experts from all over the world would not argue with him when he took a view on some matters of importance.”

Even when Mr Somkiat had declared his intention to retire in 2011, Mr Liew managed to convince him to help with the planning for Changi East (development of T5 and other infrastructure).

“He told me that Changi was his life’s passion and he would love to work on that final phase of expansion. It is this kind of leadership and spirit, when added to the unity and the innovativeness of Changi, that will take the airport into the future,” says Mr Liew, who hopes Changi continues to extol such virtue.

“I don’t believe in dreams, those are hallucinations. I believe in aspirations and actions, and my aspiration for Changi is that it continues to grow as an air hub.”



## Chapter 2

---

# A BOLD MOVE

It was going to be different, that much was clear.

On a plot hemmed in by roads and other facilities, the T4 project was set on a race against the clock to meet rapidly growing demands of Changi Airport. T4 had to break new ground.

“We knew this was not business as usual and we couldn’t take the normal approach,” says Seow Hiang. “T4 had to change how we deal with risks and we had to be smarter.”

The project presented a unique opportunity to innovate and test new approaches and technologies ahead of the construction of Changi’s new T5.



1

1.  
(Artist impression) In taking a big step forward, T4 embarked on a journey to deliver an even better Changi product for passengers.

## EMBRACING CHANGE

It is both the welcome banner for homeward bound Singaporeans and the proverbial red carpet rolled out for international passengers. The *Changi Experience*, simply put, is quality service with the passenger at the heart of it all, and it is driven by improvement and creativity.

The concept of change was at the core of Changi when it came into existence as Singapore moved its airport from Paya Lebar to its present location. The same ethos was applied to all of Changi's terminals, but T4 would test Changi a little more. Calculated risks were taken from the get-go. A core group, made up of a mix of old hands and an in-house project management team with little background in building a terminal, was put in charge of pushing the envelope.

“We didn't have any experience, but we just hit the ground running. We had only bits and pieces of an idea about what T4 would look like when we first started – it wasn't clear in the beginning,” says Li San.

“It was a process of morphing, of fine-tuning, and it was initially difficult to bring everyone together, but there was a sense of trust from the management. We felt empowered and this propelled us to press on and put out the best possible product.”

The management's faith boosted the team's confidence to make the best and most practical decisions for T4, without fear they would not pass muster with their superiors. Empowered, they were able to decide if their choices of design, materials and products met rigorous standards. They teamed up with architects and designers with similarly little experience because Changi wanted them to step outside the box to build a truly unique terminal.



In building T4, the objective for Li San's team was not only to build on the success of Changi Airport, but also to make it an even better product.

Data showed that Changi was fast reaching its maximum capacity and if it did not expand in time, the *Changi Experience* would be hurt.

The T4 project, then, was a great opportunity for Changi.

Advancements in technology presented the possibility of redefining the airport experience, and it came with manpower savings. This could benefit the massive T5 on the horizon, but implementing new technology required that the Immigration & Checkpoints Authority of Singapore (ICA) and other government agencies came on board as well.

It was a step onto the path less trodden, and T4 required boldness from everyone at Changi: its leaders, employees, even partners and stakeholders at the airport. But the Changi



2



3

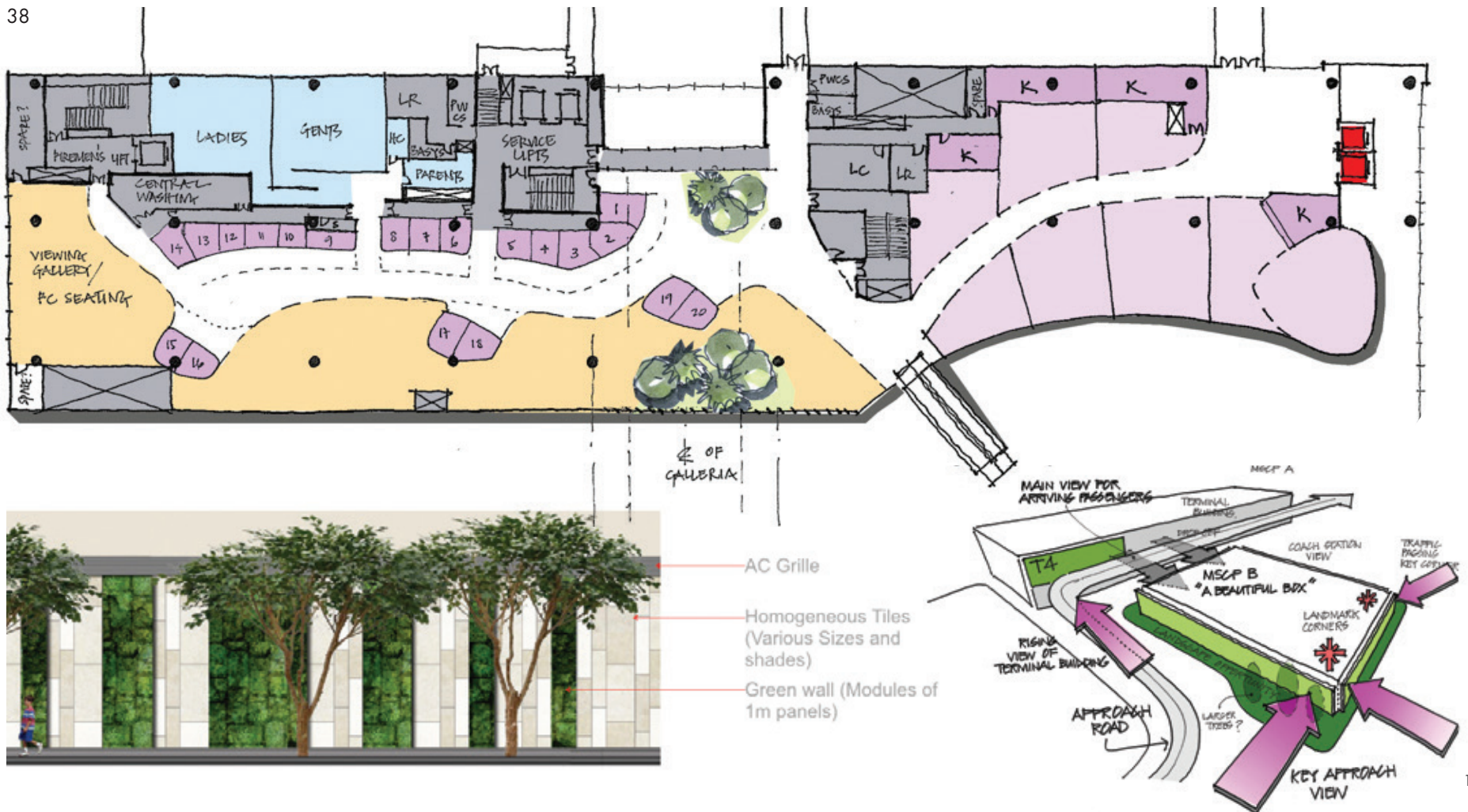
spirit of innovation, set in motion all those years ago when it first came into being, has clearly taken root.

It was also the only chance to test new ideas that eventually could be employed for T5, an opportunity the team was well aware would not come their way again. It was in this frame of mind they embarked on innovative, bold concepts for T4.

Emboldened, and with partners in tow, Changi threw caution to the wind and braved into uncharted territory, to aspire and build a terminal like no other.

2.  
(Artist impression) At the terminal's airside, passengers are given a whole new retail and F&B experience.

3.  
(Artist impression) T4 exudes an air of calm in the midst of a busy airport.



1. Faced with several challenges, the T4 team and consultants had to think out of the box to pen a design that is unique at Changi.

## INK ON PAPER, BUT ART NONETHELESS

His eyes widened as a finger was raised into the air, for added gravity. But Fong Kok Wai did not need either of those actions, his words had already made the point, and emphatically so.

“We drew up 70 plans for T4 before we came up with the final version of the terminal you see today,” says the Executive Vice President of CAG’s Engineering & Development Group (EDG).

“We went above ground, underground, across the road, and even tried to dig up the road and the flyover. Some said we should put the terminal where the reservoir is now, but we

couldn’t do that because of the timing in which the project needed to be completed.”

Hemmed in by a road, the Tanah Merah Country Club, an in-flight catering centre and existing aircraft parking spaces, the plot allotted for the T4 project was a geographical challenge for planners.

But those were not the only constraints Kok Wai and team had to contend with.

Height limits were imposed on the T4 structure because air traffic controllers from Changi Tower needed a direct line of sight to Runway 2 over T4. And with T4 needing to be operational by 2017, there was no time to dig deep into the ground to create a basement for the terminal. There was also the need to implement new technologies, such as self-service



2

2. Space was a premium in building a terminal that had to be big in stature compared to what the best airports had to offer.

3. The goal is for T4 to be a step into the future.

check-in, bag drop and even immigration clearance, as a test bed for Changi's massive T5.

And these needed to be infused with the *Changi Experience* – this was no budget terminal.

The vision was a five-star terminal worthy of the Changi brand, but put together at a three-star cost.

“Generating 70 versions of blueprints is a lot more than what other airports would do. But this was because we wanted to optimise use of the challenging site,” says Koh Ming Sue, Managing Director of Master Planning & Development, EDG. “We needed to fulfil the requirements of many agencies, keep within the height limit, and still make it convenient for passengers, visitors, staff and ground transport service providers going in and out of the terminal. We had to maximise the potential traffic throughput despite the land constraint – and this was the late Somkiat’s masterpiece.”

Planners spared no efforts in learning from existing methods at similar terminals across the world. From Munich to Hong Kong, they travelled to go through the travel experience for themselves.

And despite the various constraints, they even managed to leave a corridor of land for T4's connectivity to T2 that could be upgraded in the future.

T4 is now connected to other terminals via buses. During the planning stage, a cable-car system and self-driving vehicles were considered but these ideas were impractical or not sufficiently mature to implement at the time. The reserved corridor means that a more convenient under-and-above ground light rail connection could be added on, if necessary, in future.

“In an airport, although you can plan many years ahead, things are highly dynamic. You need flexibility, you need to be able to respond to changing needs,” says Ming Sue.

“T4 is our response to enabling Changi to grow, while T5 and the entire Changi East airport site will take some time to develop. T4 is our baby. We've seen it grow from an idea to another hallmark terminal that Changi and Singaporeans can be proud of.”



3



1



2



3

## METAMORPHOSIS IN MOTION

The T4 project saw a unique concept coupled with unusual requirements and a myriad of constraints, but it stood out in more ways than one – it inspired a sense of ownership from everyone involved.

This was especially so in the group of experienced Changi heads working alongside team members who were uninitiated in the art and science of creating a new terminal. But even among the old guard, the D&C method – an approach that saw construction work go on concurrently, as detailed design for the structure was fine-tuned – was unfamiliar.

“We took a big risk,” says Li San, referring to some of her team members’ level of experience as well as the limited airport expertise that external architects and designers brought to the table. “It probably took up to two years for things to come together.”

Benoy, an architecture and design firm with no experience in the creation of an airport but with a rich history in mall design, was hired for its refreshingly vibrant take on T4’s interior.

Functional requirements were set in stone, with Changi having already drawn up immutable specifications for security and technical aspects of the facility, but the brief was simple – create a terminal that would stand head and shoulders above others.



4

1. 2. Despite the space constraint, CAG pressed on to build a terminal that would be the pride of Changi.
3. 4. As work went full-speed ahead, CAG invited its airport partners to tour the site where they were given an update on construction.
5. The Ramp Tower is a key infrastructure that gives air traffic controllers from Changi Tower a direct line of sight over T4 to Runway 2.



5

1.  
Every detail is given attention to at T4, even the baggage conveyor belt cover at the Departure Hall.



1

The team at Benoy recognised the task ahead, and embraced the challenge.

“We asked ourselves, what aspects of Benoy’s award-winning retail projects make them stand out?” says Benoy’s Director Neil Kee. “With this, we have been able to evolve design concepts and seamlessly introduce them to T4 to create a passenger-focused experience that moves the passenger experience towards a guest experience.”

The idea of a boutique terminal centred on the passenger experience was at the heart of it all. And with cost constraints a factor, “smart premium” fittings became key: manufacture magic, but at prudent cost.

“This approach did come with a certain level of opposition but that is completely normal,” adds Neil. “Terminal design

is very much an aviation operations-driven process. So, when we suggested design directions moving away from the norm, we expected to be challenged. But I found this challenge to be healthy as it allowed Benoy and CAG to merge our experiences and create a terminal like no other.”

Changi’s radical approach to its new terminal was seriously tested, but the team were emboldened by the trust vested in them.

Benoy’s Managing Director of Global Design, Simon Bee, asserts that the T4 experience will remain a positive memory. “Our inaugural foray into the world of aviation has proven to be such a fulfilling experience and given us all a unique and different outcome. It will be a pleasure to see this building as we fly in and out of Singapore.”



2

#### 2. 3. 4.

While construction was under way, consultants were able to brief CAG's senior management on how the T4 finished product would look like at a mock-up of the new terminal that was built off-site.



3



4



## METHOD IN THE MADNESS

It is intuitive even to a child playing with wooden blocks: start from the bottom and put pieces together, building upwards – preferably armed with a firm concept of the final product.

But that was not the T4 story.

Changi embraced change, taking risks to bring about a standout terminal. But even against that backdrop, T4's construction story was wild: its roof was raised first, even while the blueprint was still being modified.

“We needed our baggage handling systems in early because a lot of time was needed for installation, testing and trials. And for that, the place had to be dry,” explains Cindy Koh, Assistant General Manager of the T4 Projects Team.

Main contractor Takenaka Corporation's suggestion to build columns, then a roof before installing intermediate floors – a hat-first method – promised to make the idea work. Because the baggage handling area was located in the middle of the facility, T4 was built roof-first, with construction progressing outwards, from the centre.

“We were wowed by Takenaka's presentation, it was something we never thought about: You don't even start doing anything at the bottom, you just go columns up and then you build a hat,” recalls Stuart Ralls, Assistant General Manager of the T4 Projects Team.

“Rightfully, we'd always get the centre of the facility handed back to us last, but this was an innovation they introduced. Wow!”

The T4 spirit of innovation, while taking calculated risks, rang true.

The D&C approach met the tight timeline and the need for a fluid platform on which ideas could flourish. This allowed construction work to go on concurrently while detailed design for the structure was fine-tuned. It was taken with an eye on speed to meet T4's completion deadline. The timeline and the project's several stakeholders – all with different requirements – were, according to Takenaka's Project Manager Leslie Teng, one of the construction firm's biggest challenges in the project.

“With many stakeholders involved, it wasn't easy, but we had to take it in our stride in terms of timeline and progress. It wasn't easy but certainly not impossible,” says Leslie, who took pride in the innovative construction approaches that Takenaka conceived.

Cindy agrees, pointing to the example of raising the pedestrian link bridge over the Airport Boulevard, Changi's main roadway.





2

“We couldn’t interrupt ‘live’ airport operations and had to coordinate the diversions of all incoming and outgoing traffic onto one carriageway, so that we could raise the structure. This was done within a time-frame of four hours each night, over eight nights,” she recalls.

“This needed clockwork precision, including moving cranes in and out.”

The coordination challenge also fell on the shoulders of SAA Group Architects (SAA). “We had to hit the ground sprinting, and it was a four-year sprint,” says SAA’s Executive Director Toh Kok Kin.

SAA’s role was to safeguard CAG’s design intent and manage technical considerations for construction, and that was no easy task. Even the seemingly uncomplicated departure drop-off canopy – passengers’ first touch point at T4 – proved challenging, as implementing the design could be achieved only by substantially increasing the structural elements.

“This design was a bespoke lightweight steel-and-glass canopy which serves as a departure drop-off showpiece,” he adds, drawing pride from the finished product that



3

1. Employing the hat-first method, this paved the way for the early installation of the baggage handling systems and hence accelerated construction.

2. Raising the pedestrian link bridge without interrupting the flow of traffic and disrupting airport operations entailed precision planning between CAG and several parties.

3. Efforts were also made to prevent unnecessary destruction. A tree that was in the way of construction was uprooted and relocated across the road.

stayed true to its original intent, with the problem solved through collaboration.

The end product brought much pride to all, including Takenaka’s Project Manager Yamamoto Hiroyuki.

“It was a mega project, very complicated and quite exciting,” he says, smiling. “There were various issues that we didn’t always know how to solve, but we did. We can’t help but smile when we look at the terminal now.”



T4's game changer is a Fast And Seamless Travel system that employs facial recognition technology.

## GLIDE: CRUISING FROM KERBSIDE TO AIRCRAFT

Nobody likes to be in a queue, whether for dinner at restaurants or to gain entry into clubs, events, cinemas and, yes, airport check-ins.

Minimising queues to usher passengers past check-ins and immigration is what T4 offers. Its new end-to-end Fast And

Seamless Travel (FAST) system allows passengers to virtually glide from kerbside to the aircraft.

Every passenger's face is the token that gets them through checkpoints. Its facial recognition technology is used at key departure touch points – bag drop, immigration and boarding.

“We are not the first to the FAST party, but we want to be the best! And here's the game changer: our facial recognition technology is implemented from end to end. The security checks are now all automated,” explains Chua Ching Hock, Senior Manager, T4 Operational Readiness Airport Transfer (ORAT) Team.

Simply put, once a passenger's passport is scanned at the check-in kiosk, his face will be the one common denominator at all other touch points until he boards the aircraft – without compromising security.

“Conventionally, automated gates at immigration are fully managed by the immigration authorities,” says Goh Qian Yi, then Manager, T4 ORAT Team. “To simplify the passenger process flow through departure access and border controls, we combined both checks into the new Automated Immigration Gates, and removed the need for manual security checks in this area. This was a big change for us.”

Implementation did not come easy because Changi had set lofty aspirations for T4. The nation's security is at stake here, and these features could be implemented only with the authorities' backing of the airport's drive towards innovation, which is premised upon the assurance of an equivalent, if not superior, security outcome.

But its staff had to hunker down with immigration authorities, from designing the gates, working out how Changi's systems interact with those of ICA's, procuring equipment, and testing the final product to iron out kinks.

They also built mock-ups and prototypes of various equipment and process flows in the T2 transit FAST lab to give ICA the assurance that the new system would not compromise security.

“We knew, as difficult as it was, it was just persistent engagement and explaining to the authorities the whys behind our moves, while understanding their core concerns,” recalls Seow Hiang.

“It was about running with them, being creative in addressing their concerns, without compromising the aspiration we had.”

As a result of this partnership, a T4 passenger needs to come face-to-face with service staff only at the Centralised Security Screening. And even there, the process has been improved.

But not every passenger will glide through T4 with the same ease. Ching Hock and Qian Yi witnessed some exceptions. There were passengers who scanned wrong documents at wrong input points, and persisted despite the machines instructing them otherwise. On the other hand, some new features were unexpectedly well-received and intuitive to passengers. For instance, passengers kept still and positioned their faces within the frame when their image appeared on the screen.

But Ching Hock believes this is just part of the process. “We always knew there would be a learning curve at the start. It takes time for passengers and even staff to learn,” he says.

“Almost every major airport hub is moving towards self-service – it is the way to go.”

## FROM KERBSIDE TO GATE WITH FAST

For the first time at Changi, a suite of FAST initiatives with facial recognition technology has been rolled out to make travelling swift and fuss-free. T4 is the first terminal in Changi Airport to embrace self-service options from the start to the end of a passenger's departure journey.



### MORE TIME FOR FUN

At T4, passengers get a "straight-to-gate from kerbside" experience as they sail through check-in, bag drop, immigration, security screening, and boarding gate clearance by using FAST. Not only do they save time on queueing, passengers can also check in without waiting for check-in counters to open.



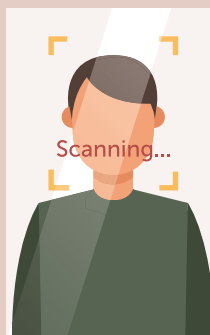
### CHECK-IN

At the Automated Check-in Kiosk, the passenger scans his passport or enters the booking reference, and receives the boarding pass and luggage tag. He then tags his check-in luggage.



### BAG DROP

The passenger places his luggage on the Automated Bag Drop machine, where his bag is weighed and its dimensions assessed. He then scans his boarding pass and passport. A camera captures his photo and compares that against his passport photo using facial recognition technology. Once his identity is verified, his bag is accepted into the baggage handling system.



### Putting your best face forward

Facial recognition eliminates the need for manual identity verification by staff. It enables the full automation of processing and checks from departure check-in to boarding.



### Ready to serve you

Self-service and automated features take over mundane check-in duties, freeing up passenger service agents so they can help passengers with more specific needs. There is one member of the staff to every four bag drop counters, which also reduces the demand on manpower.



## IMMIGRATION

At departure immigration, he scans his passport at the Automated Immigration Gate, which uses both facial recognition and fingerprint verification technology. His boarding pass is also scanned for validation.

### Security screening



The passenger places his bag on a tray that goes through the new 3D CT X-ray machine. An automated system speeds up tray return and reduces waiting time. The passenger then walks through a metal detector or steps into the whole body scanner for final screening.

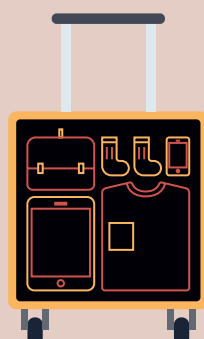
### Rest & relax

Once the passenger is screened, he enters the transit area where he has time to shop, dine or relax before his flight.



## ALL ABOARD

Once the flight is ready for boarding, the passenger goes to the Automated Boarding Gate where he scans his boarding pass and has his photo taken. The photo is verified against the photo taken earlier at immigration for a final identity check.



### Nothing escapes it

T4 uses high-definition, 3D CT X-ray machines to scan hand-carry baggage. This means there is no longer a need to remove electronic gadgets to be scanned separately – making security clearance a breeze.

## ARRIVAL



## DEPARTURE

### Never the twain shall meet

There are no gatehold rooms that corral passengers up to an hour before their flight. This gives them freedom to shop or dine before boarding. To ensure security, arriving passengers are separated from departing passengers to maintain a sterile zone.



1. Double-volume shopfronts give stores, such as The Cocoa Trees and TWG Tea, the ability to express their brands optimally in premium settings.

## THE T4 MAGIC AND SEPIA TINTS

It has never been seen at any of Changi's terminals, but T4 was conceived with the spirit of breaking away from the norm.

"It is not something you would normally want to do in an airport," says Lim Peck Hoon, CAG's Executive Vice President, Commercial, of having a walkthrough duty-free zone right after departure immigration and security areas, a concept that allows passengers to walk through duty-free shops before they head to the boarding gates.

But in the spirit of change, T4 pressed on with this idea.

"With an eye on T5, we began to consider the concept of an integrated duty-free zone. We felt maybe there was a new combination that could present passengers with the excitement and value of our commercial offerings without feeling like it was foisted on them," says Peck Hoon.

The T4 magic is a marriage of careful space management and a seamless shopping experience in the single integrated duty-free zone. And to the CAG team, comfort is of utmost importance, where passengers would not feel like shops were closing in on them from both sides. The solution was a walkway generous enough to fit about five trolleys abreast.

"We were quite conscious about this," says Peck Hoon.

"The walkthrough had to have a path wide enough for passengers to comfortably walk on. Since there are no barriers, they can also see all the retail offers lined up, as they walk past them. This, we hope, will compel passengers to enter and explore since it is so convenient."

Another new idea was to take the barrier-free shopping concept a step further by doing away with the separation between wines and spirits, and perfumes and cosmetics – an ambitious endeavour given that the two categories are operated by different tenants. To accomplish this, the team

had to first secure commitment from both retail operators to work with CAG to integrate their shop designs and operations, and cross-train their shop staff.

“The aim is to deliver a seamless experience for T4 passengers, making it easier for them to browse and shop,” says Peck Hoon. “Although we have two operators, we got them to work together so that passengers can approach any staff from the two retail operators, as though they are in a single outlet and be served equally well.”

The seamless experience is not the only shopping advantage at T4, which underscored the CAG team’s efforts to shake off the “budget” perception of its predecessor.

A grand promenade, lined with retailers featuring impressive double-volume shopfronts, feature popular and established brands such as Charles & Keith, Coach, Furla, Gassan Watches, Michael Kors, The Cocoa Trees and TWG Tea.

“For the first time, we are trying out a cluster of double-volume façade shops,” explains Peck Hoon. “For T4, we asked the retail operators to dress up the 11-metre-high façade. The shops are on the lower floors, but we wanted them to have a grand facade so that passengers get a visual treat of the brands. This was a challenge for the retail operators as many had not done such designs before, but they put their hearts and souls into the effort. They now have shops that befit the grandeur of the place.”

While taking bold steps into the future, the CAG team also wanted room for nostalgia and a sense of place. Peranakan shophouse façades take centre stage near the end of T4, with established local brands such as Bee Cheng Hiang, Bengawan Solo, Curry Times, Eu Yan Sang and Heavenly Wang embodying the theme wholeheartedly in their store designs.

For example, traditional Chinese medicine retailer Eu Yan Sang has done up its T4 outlet in the style of an old medicine

hall that invokes the feeling of walking into an old sepia-tinted photograph.

“We have quite a good mix of local shops and restaurants at this zone, and from the look and feel of Eu Yan Sang’s store and staff, the aim was to invoke nostalgia,” says Peck Hoon. “We have other classics like Bee Cheng Hiang and Bengawan Solo, but it is about putting these brands together and allowing them to experience it first-hand in the entire shophouse zone.

“T4 is vibrant and immersive,” she adds. “It’s a concept that encourages people to flow into the whole zone, not just retail. You get to enjoy art, landscaping and food, and you are surrounded by all things enjoyable.”



2



3

2. Lim Pek Hoon, CAG's EVP, Commercial (right), and Lee Seow Hiang, CAG's CEO (centre), checking out the double-volume shopfront.

3. Heritage is also prized at T4 and Eu Yan Sang is among some of Singapore's most familiar household names that take the spotlight at the terminal.







## Chapter 3

---

# A THEATRE OF EXPERIENCE

Changi broke away from the norm in conceptualising and building T4, but in all efforts, there was one immutable point: at the heart of it was the passenger.

Every design detail of T4 is made to delight: ergonomically designed kerbsides and baggage-drop carousels mean minimal effort is needed to lift heavy luggage at any touch point. Passengers can breeze through the terminal. Check-in islands are all angled towards the centralised immigration and security screening area that flows into T4's integrated duty-free zone, with the departure gates beyond it.

Above all, T4 evokes emotion.



## THE SPACE BETWEEN

All six of them are suspended overhead, in a mesmerising dance to music. *Petalclouds*, T4's signature kinetic art piece, spans over 200 metres across the Central Galleria, and their dance is hypnotic. Li San describes it as heavenly.

It is impossible to miss *Petalclouds* or the massive, sun-lit, tree-lined space in which they hang. Regardless of the thoughts and emotions evoked, T4's massive space separating public and transit areas is bound to impress.

"*Petalclouds* is my favourite thing in T4, because they are so graceful and yet so complex," says Li San. She vividly remembers how much Changi puts into what is, at the time of writing, the biggest kinetic sculpture in the world.

Recounting her multiple trips to Germany to oversee the design and construction of *Petalclouds*, Li San spoke of the minus 10 degrees Celsius cold of one trip, and how progress almost came to a stop.

*Petalclouds* was a mere two micrometres – a human hair is 80 micrometres thick – away from being turned into clunky sledgehammers hanging ominously overhead.

"We were going to ship all the parts from Germany to Singapore, when we realised through endurance tests that winches hoisting the petal elements in the structure were built two micrometres off. So we had to re-machine the parts, put them together and run tests all over again," she recalls. "*Petalclouds* hang high above without safety nets, so we put in extra conscious effort to ensure the system is robust and fault-free. Looking at the completed installation now, they are mesmerising and absolutely worth all the effort."

The hope is that *Petalclouds* will tug at passengers' heartstrings, but they are not everything the Central Galleria has to offer.



T4 spared no effort to wow passengers and *Petalclouds*, a grand-scale kinetic sculpture that combines art and technology, is just one of them.

The Central Galleria evokes a sense of grandeur, standing alongside the tallest trees in the terminal. It can even be enjoyed from the Departure Hall, by looking across into the transit area. Plush chairs in the transit area provide a quiet vantage point from which eyes can swim through the rays of sunlight that bathe the Central Galleria, and waltz with *Petalclouds*.

“This is the most emotional terminal we’ve designed. Choosing texture of tiles or colours of carpets was no more an intellectual exercise – you’ve got to feel it,” says Seow Hiang.

The trees in the canyon-like space and the dancing *Petalclouds* are bound to make passengers smile. Their gaze is also drawn to the Central Galleria, and follow its perimeter to T4’s centralised security screening area. It is a visually pleasing spatial guide that provides the perfect setting for long farewells.

“You can check in, clear your passport, go into the transit area, that’s where goodbyes are bade. But now – because of the Central Galleria – you can walk the entire way in, sip coffee and still see your family on the other side,” says Cindy.

Words cannot do justice to the ballerina’s grace of T4’s *Petalclouds*. When they are blended with sunlight, trees and a sense of grandeur to create glowing smiles on familiar faces, Changi knew it was a formula that could not go wrong.

“The key element of this was how all key spaces made the Central Galleria feel like one space,” says Stuart. “It resonated with our aim of creating a terminal with passenger experience at the heart of it all.”





2

## GLIDING RIGHT THROUGH

It is named FAST, and aptly so. The suite of self-service options installed at T4 is designed to eradicate queues, with passengers checking themselves in and even tagging their own luggage before sending it on its way.

It sounds simple: Head to one of several Automated Check-in Kiosks, scan passport and print boarding pass as well as bag tags. Then pop over to the Automated Bag Drop, scan boarding pass and passport while the machine captures an image of your face for your token of travel. Stick on bag tags, load them onto the bag drop machine, and you are all set.

T4 provides the full *Changi Experience*, with trained staff on hand – wearing the warm Changi smile, of course – to assist.

But the passenger experience of the sheer speed – and convenience – of FAST does not stop there.

You scan your passport at the Automated Immigration Gate at T4's centralised departure immigration. A dual facial and thumbprint recognition confirms your identity, and you skip right through.

The magic of FAST kicks in one last time – once the flight is ready for boarding. When you scan your boarding pass at the Automated Boarding Gate, your identity is again cross-checked against your photo as token of travel.

FAST promises speed, flexibility and convenience, without losing any of the Changi magic.

1. The Automated Check-in Kiosk kick-starts the T4 FAST experience and takes passengers to their aircraft with impressive speed.
2. The Automated Bag Drop adds to their seamless journey at this terminal.



## CHANGI'S WONDER- WALL

A large group of visitors had gathered at the Central Security Screening area in T4. Their heads were raised, admiring the stone carvings overhead. Jayson Goh, CAG's Managing Director, Airport Operations Management, stood a little to the side, observing their faces. This was to be the punchline – the prestige of a magic act – and Jayson wanted to catch his audience's expressions as it happened.

Suddenly, the massive stone carvings came “alive” and a butterfly flapped its wings and took flight to reveal the wall to be a giant LED screen.

Standing in the centre was Singapore's Prime Minister Lee Hsien Loong. “PM Lee was positively surprised and smiled when he saw it, and I remember him saying, ‘Ah, what have you guys done here?’”, recounts Jayson.

“We had a lot of fun conceiving some of the things you see in T4, and I love seeing the smiles of people when they look at the immersive screen, especially the scene with the butterfly.”

Soon, the stone carvings transitioned into shimmering copper petals, followed by scenes of Singapore and a whimsical



animated clip depicting little robots working in the baggage system of an airport.

But there was nothing whimsical about the thinking behind this magical experience – the creativity and positive wow factors are critical elements of the *Changi Experience*.

“Security is the most stressful of touch points at any airport. So from day one, we decided to transform the entire place into a theatre of experience to engage passengers,” says Jayson.

“We want to give them a stress-free environment with this Immersive Wall, so they forget they are going through security, but without compromising security.”

Fifty minutes of high definition content, commissioned to fit the 70-metre-wide Immersive Wall, entertains passengers who are passing through.

It is not all about speed at Changi’s newest terminal. Entertaining passengers is a key part of the journey.





## SEAMLESS SECURITY

T4 is Changi's first foray into the next generation of Centralised Security Screening system focusing on using better security technology and processes to enhance security and passenger experience. T4 is Changi's first security checkpoint that deploys 100 per cent computed tomography-based X-ray screening machines at all security lanes to scan carry-on luggage. The ability to have a 3D bag image with auto-threat detection capabilities greatly enhances the security performance of the screening staff. With such capability, it also eliminates the need for passengers to remove laptops and other electronic items from their bags. This improves checkpoint efficiency and passenger experience.

An automatic tray-return system with parallel divestment stations has also been installed, with two clear advantages. The system no longer requires security staff to manually return trays, freeing them up to pay closer attention to passengers. It also allows two passengers to present their belongings for screening simultaneously, speeding up the entire process.

Taking mere seconds to do its work, T4's non-invasive body scanners can detect both metallic and non-metallic objects, right down to pin-pointing exactly where the item is on the body.

"This means staff only need to conduct targeted search in the event of any security alarm. It enables them to pay more attention to the behaviour of passengers during the screening process, making this a safer and more efficient process. Furthermore, we have trained our staff to provide assistance to passengers, who are new to this screening process, to enhance their checkpoint experience," says Alan Tan, CAG's Vice President of Aviation Security.

Alan points to the use of facial recognition in T4's FAST system as complementary to the other technological improvements at T4's Centralised Security Screening area. All Singaporeans above the age of six, as well as other nationalities who have pre-enrolled, can use the automated immigration system. T4 has also deployed an array of technologies as part of its security-by-design process to improve the safety and security of the terminal.

With an automatic tray-return system, security staff no longer need to manually return trays to the front and this frees them up to pay closer attention to passengers.



## SHOP AND SAUNTER TO YOUR SEAT

T4 has put a Changi spin on the old cliché “it is about the journey, not the destination”. The magic intensifies as a passenger goes through immigration and turns the corner into the transit area.

The terminal’s integrated duty-free zone features two separate retailers for wines and spirits, and perfumes and cosmetics, both flanking a walkway leading to the boarding gates. What stands out is the generosity of space, which allows passengers to shop and stroll in comfort.

The idea is to give them an airport retail experience that wows and is unique to Changi. It was a vision that Chandra Mahtani, CAG's Vice President, Airside Planning and Leasing, and her team had to execute and they raised the bar in experiential retail.

The energetic integrated duty-free zone features retail-tainment hotspots, such as an interactive Cocktail Bar for passengers to taste a range of concoctions for free. The Whiskey House is another, with a wide assortment of whiskeys from all over the world. Capitalising on a small but growing trend in craft beer and spirits are even featured in a space of its own.

1. 2. 3.  
A F&B and retail experience unlike any other airport greets passengers the moment they arrive at T4.



2



3



1

### 1. 2. 3.

With T4 offering more time for leisure, there is plenty to do. A cocktail bar, among others, offers sample drinks at no charge and high-fashion stores displaying merchandise tease discerning shoppers.

“With the cocktails, the tenant works with various brands to offer different concoctions every two months for passengers to sample,” says Chandra. “Passengers can even make their own cocktails with the bartender, if they want to. If they prefer whiskey, there’s a good range for them to taste before they decide what to buy. For craft beer, it is the first time we are offering this at Changi.”

Coming up with “firsts” is what her team strove for. And central to the seamless experience at the integrated duty-free zone is an integrated point-of-sales system that allows passengers to pick items from wines and spirits to perfumes and cosmetics, and pay at any cashier even though they are operated by different retailers. This was a remarkable feat, and established a new operational concept for walkthrough stores in airports.



2

“What we have at T4, with two different operators working together, is unique in the world,” Chandra emphasises. “Usually, at Changi, passengers have to pay for wines and spirits at one outlet, and perfumes and cosmetics at another.”

Beyond the integrated point-of-sales system, the two operators at T4 continue to work together to ensure their staff are well-versed with all products promoted across the walkthrough for the all-under-one-roof shopping.

After leaving the duty-free zone, the passenger’s journey takes an exciting turn with more shops that dazzle. With an 11-metre floor-to-ceiling space to work with, the creative juices flowed in Chandra’s team. The result is a cluster of six spectacular, double-volume façade shops.







2



3

## 1. 2.

The sheer volume of space inspired T4 shops to create stores that are special at Changi. TWG Tea used 2,000 tea tins as the focus of its décor, while The Cocoa Trees turned the space it had into the chain's flagship store.

## 3.

Even with a single-volume space, Zakka did an impressive job to rouse the curiosity of passengers.

“The high ceilings gave us plenty of room to dream up wild concepts, which we couldn't do for the other terminals as the shops there had a maximum height of only 2.9 metres,” says Chandra. “Within the double-volume façade shops in T4, tenants had between six and 10 metres to play around with.”

Two home-grown shops stand out.

The Cocoa Trees worked with various confectionery brands to create exclusive fixtures, in line with a carnival theme, complete with interactive elements at their shop. For example, Mondelez made a castle, Hershey's had a game booth and dispenser machine, while M&M's crafted a Ferris wheel. The entire store is immersive and vibrant, chock-full of delightful experiences for passengers.

TWG Tea developed a stunning store, with about 2,000 of its trademark yellow tea tins covering an entire wall from floor to ceiling. The shop has since become an Instagram hit with passengers. Also, in a first for the brand, the T4 store offers tea tasting to engage passengers.

“We worked with these brands and operators to punch higher than what we had ever done. Everyone upped their game, and T4 has broken boundaries,” says Chandra.

In another bold move, CAG took a different spin on the concept of double-volume façade shops: The star is the Heritage Zone where three-storey shophouses, rich in Peranakan overtones, take passengers on a nostalgic ride into 1960s Singapore.



1

T4 is a package of concepts that celebrates heritage (1) and encourages dreams to flourish (2).

“We wanted to bring back that old-world feel to distinguish us from other airports,” explains Chandra. “We visited Katong and Chinatown, and even went all the way to Penang, to see first-hand how the old shophouses look like.”

Armed with ideas for every aspect of the design, from floor tiles to shutters, Chandra’s team shared CAG’s vision for this zone with tenants who would be a part of this anchor space.

“We worked with the retail operators to recreate the old shophouses. These collaborations and the synergy we had helped us present unique stores that tell stories of what they were like in Singapore decades ago.”

The final T4 product is a package of concepts that has turned it into an immersive, interactive airport terminal that is in a class of its own.

“We have seen how passengers feel and behave when they walk into airport terminals. Some are anxious about the time, get in early and just wait at the gatehold rooms. But T4 is different, it takes passengers on an immersive and emotive journey that has set a new standard for airports.”





2

## INTO ANOTHER WORLD

Just a few steps from the walkway, you are taken from T4 into a fantasy world – it does not take much suspension of belief.

*Steel in Bloom* is T4's signature garden, and its mesmerising lights create a gateway, seemingly into another universe. The garden's six-metre steel centrepiece of botanical motifs envelops you, and with its lights morphing from one point on the visible spectrum to another, an other-worldly effect is created.

You walk above water, with koi swimming under your feet and giant terrariums set a futuristic scene where nature and technology are seamlessly intertwined. The final steel-and-green sculpture includes a complex misting network to support the growth of plants on its surface, which only adds to the ethereal nature of the garden.

You may well be seduced by the bright blooms that surround, and the wispy airplants dangling off colour-changing steel, and not want to leave at all.



## DELIGHT IN THE DETAILS

At the end of T4's Departure Hall, hues of pink and blue appear, bright lights pop, and evocative strains of violin and vocals greet passengers. But be warned, this is merely a hint of the elaborate setup that Changi has created for the senses.

This is the terminal's iconic Heritage Zone located before the boarding gates – a space designed to give passengers a final taste of the Lion City.

There are façades of nine archetypal shophouses of Singapore, chronologically depicting the architectural evolution of an integral facet of Singapore culture. Established local stores selling traditional food, drinks and medicines occupy the first level of the shophouses – a sharp contrast to the slick, modern retail stores in the front end of the terminal. The shophouses are designed to evoke a sense of nostalgia, and to play up Singapore's colourful traditions.

Even as passengers rest on the assortment of modern novelty chairs in front of the shophouses, their eyes are drawn to Eu Yan Sang's shop designed like a traditional Chinese medicine



hall that transports them to old Singapore. Nearby, a cook is stretching and slapping a ball of dough into *roti prata*, a local Indian fried flatbread, before frying it on a sizzling grill. The mixed aroma of barbecued meats and traditional cakes wafts over in a heady blend of a sweet-savoury Singapore send-off that Changi has put together for passengers.

It is a nostalgic scene that would not have been possible without the stores' commitment to the zone's heritage theme. "From the design to the way retailers executed things with the look and feel of the whole zone, even down to their staff, the aim was to bring back nostalgia," says Peck Hoon.

#### A love story for the ages

There are more surprises at the Heritage Zone. If anyone lingers here for long enough – and many will – two of the nine shophouses' façades reveal themselves as a 10-metre-wide digital screen where a musical love story unfolds.

This six-minute mini-musical – *Peranakan Love Story* – gives passengers a taste of the history and culture of Singapore-born descendants of Chinese immigrants and local Malays.

T4's centrepiece is the Heritage Zone where shophouses offering local fare and merchandise replicate Peranakan architecture with its distinctive motifs.



1. A six-minute *Peranakan Love Story* musical gives passengers a special memory of Singapore.

2. 3. The cultural theme is even extended to the nearby restroom with its exquisite tiles and trimmings.

“It is really a one-of-a-kind opportunity for us to present the Peranakan culture and colour to the world. I must say I am very grateful that Dick Lee was willing to join us in making this production,” says Jayson.

The musical, written and produced by the Singapore composer and artiste, is held together by his moving 1995 song *Bunga Sayang*. It tells the story of two bickering neighbours who fall in love after they discover a common interest in music.

The poignant musical works in tandem with the rest of the Heritage Zone to present a multi-sensory experience for passengers. “If I were a tourist, it’s not just the screen I’d be watching. The sight, sound, smell, taste – together, they give a surreal experience of Singapore’s rich heritage to our passengers,” says Jayson.



2



3

The nostalgia is not limited to the screen or the shops, it even extends to the nearby toilet that sports a British colonial-style heritage design with exquisite tiles and trimmings. It is like walking into a Peranakan home.

“We wanted to create a very beautiful terminal, but more than that – to inject a soul,” says Kum Weng.



Throughout T4, an assortment of novelty chairs adds to the colourful fun of the terminal.

## A GREEN LINE INTO THE HORIZON

Sunrays streak through a light mist hanging over the trees that form a green line stretching as far as the eye can see. This could be a scene from Paris' Jardin des Tuileries, a stone's throw from the famed Louvre Museum. But these words could just as well describe T4's Boarding Corridor.

There is no need for gatehold rooms, unlike the rest of Changi's terminals, thanks to T4's centralised screening, with trees now acting as natural barriers.

There are 160 Ficus trees of three species originating from China, India and South-east Asia, and installing this Boulevard of Trees was no mean feat. Learning from their experience of bringing large trees into T3, Changi's Horticulture team was more efficient this time.

"We learnt a lot from our T3 experience, and we have phased the works better – from sourcing more suitable species of trees and pre-growing them in correct sized containers, to using special moving equipment. We also made sure the planting works were done when construction works were completed and indoor conditions were just right for the trees to grow," says Ashraf Ali, CAG's Manager, Airport Operations (Horticulture).

"We were also *kiasu* (extra prudent). We were involved in the entire process, from having the vendor grow the trees to specific requirements two years ahead of planting in the project nursery to monthly checks on the progress of growth. We then safely transported and planted them inside the terminal." This attention to detail with ideal growth lighting produced condition that will help the plants grow inside the building for at least the next 10 years.

No detail was too small, not even that almost unnoticeable factor of dust on the leaves.

Every two hours, a light mist sprays over the trees, hanging there for a while before dissipating. This, explains Ashraf, is "fogging" – a process to dispel dust in the air so it does not build up on the leaves and hamper photosynthesis and the natural functions of the trees.

"No, passengers won't get wet from this," he says, smiling. "The water is atomised. It can be quite nice because if you are under the mist, it'll feel like a cool breeze."

"The plant features in T4 are unlike what we've done at other terminals. There was a lot of attention to detail."

Another example of Changi's meticulousness is the installation of an automated underground watering system for every tree in the terminal – a feat, considering that T4 has more trees than all other terminals combined.

The tree-lined departure transit area is Stuart's favourite spot in T4.

"Each time I enter the terminal, this is the one space I head to. We have been able to create these light-filled seating spaces under a boulevard of trees, where you have an unobstructed view out across Runway 2," says Stuart, who has poured his heart into the terminal.

Arrival at T4 has also been designed to give a warm Changi welcome to passengers passing through its halls.

"We wanted to welcome passengers with lush greenery at arrival, so we've planted the tallest trees in the terminal there," says Ashraf.

"Our CEO's vision of an avenue of trees at the Boarding Corridor leading to giant tall trees welcoming passengers at arrival, was a huge inspiration for us to make T4 an indoor verdant forest."

EXIT

↑ ✈️ G1-G9 Up to 7 mins



G9



G8

↑ ✈️ G1-G7 Up to 7 mins





## THE ART OF PERFECTION

They hang overhead at T4's massive Central Galleria, a picture of elegant exactitude. *Petalclouds* is a work that blends lights with music into a heady concoction rounded off with delicate movements.

The crown jewel of T4's art programme presents itself to passengers simply as artistic perfection, but behind the graceful movements of *Petalclouds* is a precision engine of winches, motors and a two-tier safety mechanism.

There is much that goes into crafting the piece as well as three other major art pieces in T4 – a testament to the commitment that has gone into touching hearts at T4.



## Blood

Swiss sculptor Kurt Metzler's *Travelling Family* similarly fits seamlessly into T4, with Singapore daily *The Straits Times* weaved into the work of seven aluminium figures standing in the transit area, seemingly en route to boarding their flights. But at one stage, the piece was in danger of becoming an uncompleted work of art.

“Kurt was uncontactable for a few months, and obviously we were really worried,” recalls Daniel Foo, CAG's Senior Manager, T4 Programme Management Office. “When we eventually got in touch with his son, we found out that Kurt had to undergo heart bypass surgery and was recovering from it. He also said the thought of the project kept his dad going, and the artist even wanted to escape from hospital to complete the job.”



## Sweat

Cultural Medallion award recipient Chong Fah Cheong's *Hey, Ah Chek!* sits alongside check-in kiosks in the Departure Hall. The modern self-service kiosks are a foil to the trishaw, Singapore's preferred transport mode of old. But that juxtaposition almost failed to materialise.

"We moved the artwork within the terminal building four times just to anchor it at the perfect spot. The sculpture weighed about 500kg and with each move, we required an A-frame and four strong men to lift the artwork with a

mechanical hoist," reveals Daniel, admitting that it did feel like an exercise akin to playing with building blocks. The piece features the artist's own mother hailing a ride at the market, with his younger self in tow.

"I'm glad we were able to move the artwork to its final location, which gets more eyeballs."

The sculpture is designed to allow passengers to board the trishaw for photographs.





## Tears

While Kurt quite literally bled for his piece, Cedric Le Borgne, the Toulouse-based artist responsible for *Les Oiseaux* (The Birds), shed tears.

The piece features three giant birds constructed from wire, set in a garden space that is visible from both T4's Departure and Arrival Halls. But like Kurt's larger-than-life figures, one bird almost did not make it to Singapore.

"Moments before they were shipped to Singapore, I received a call from Cedric, informing me that he had to redo one bird," says Daniel, recalling the heart-sinking moment. Cedric had

evidently added a layer of lacquer onto that particular bird to prevent rusting, but a chemical reaction had instead ruined the piece.

"I was fuming mad, but Cedric was apologetic and almost in tears," says Daniel. He eventually accepted a one-month delay in delivery.

"The airport isn't trying to be a destination for the arts. We wanted artworks at the airport to give passengers an all-round positive experience at T4."

## 10 THINGS TO DO AT T4

Changi Airport's newest terminal offers much more than just speed and convenience for passengers; it is where art, design, nature and retail come together to create unforgettable journeys. Try these recommendations for a truly T4 experience!



### ORCHIDS EVERYWHERE

You cannot miss the orchid-inspired designs throughout T4. Look up and you can count 67 petal-shaped skylights. Look down and you will spot countless purple outlines on the carpet. There are even motifs on air-con vents, plant pods, side tables and fire extinguisher holders!

### Say a long goodbye

Farewells do not have to end at the immigration counters, with the 300-metre Central Galleria offering a clear view of both the public and transit areas. Before you enter immigration, ask your loved ones to head to the opposite end of the Departure Hall (near Row 1) so you can catch another glimpse of them while in transit.



### Shop till you board

Be spoiled for choice with the range of retailers from fashion and beauty to technology and snacks. The integrated duty-free zone saves you the trouble of queuing twice for your beauty and alcohol products, while standalone double-volume façade shops in the transit area offer specially curated products.



### Have a drink on us

Stop by the tasting bars at DFS Wines & Spirits to sample an array of alcoholic drinks on the house – from cocktails and premium whiskies to even craft beer on tap.

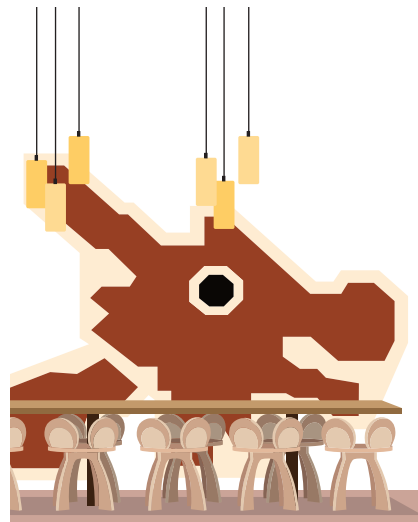
### A walk in the park

Breathe in as you stroll along the Boulevard of Trees to your departure gate. If you're lucky, you might even get a refreshing spritz of mist to prepare you for the dry cabin air – just thank the automatic system that waters the trees every two hours.



### Time for selfies in Changi's prettiest loo

T4's colonial-styled toilet at the Heritage Zone has got to be the prettiest one in Changi Airport. Spacious and sophisticated, it has a huge mirror for an #OOTD shot, and ornate floor tiles for that shoe selfie.

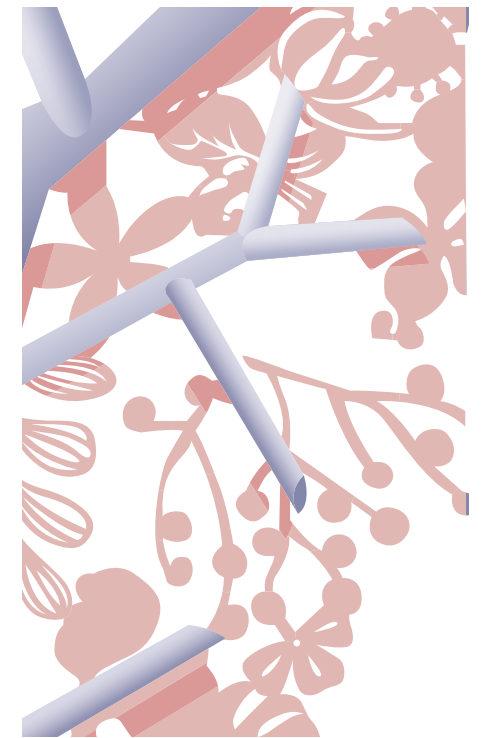
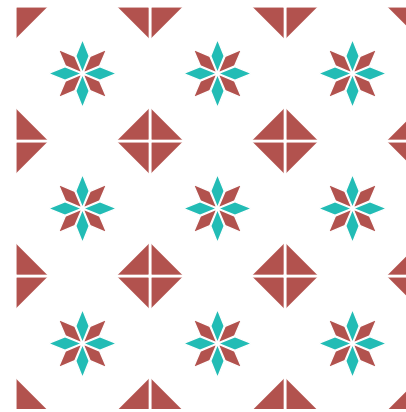


### Travel back in time

Recall the good old times with retro décor, old-school kiddy rides and timeless local eats such as *roti prata* and *kueh*. Even if you're not flying off, get a dose of nostalgia at Food Emporium in the public area – its children's corner features murals of old-school mosaic playgrounds and games such as hopscotch.

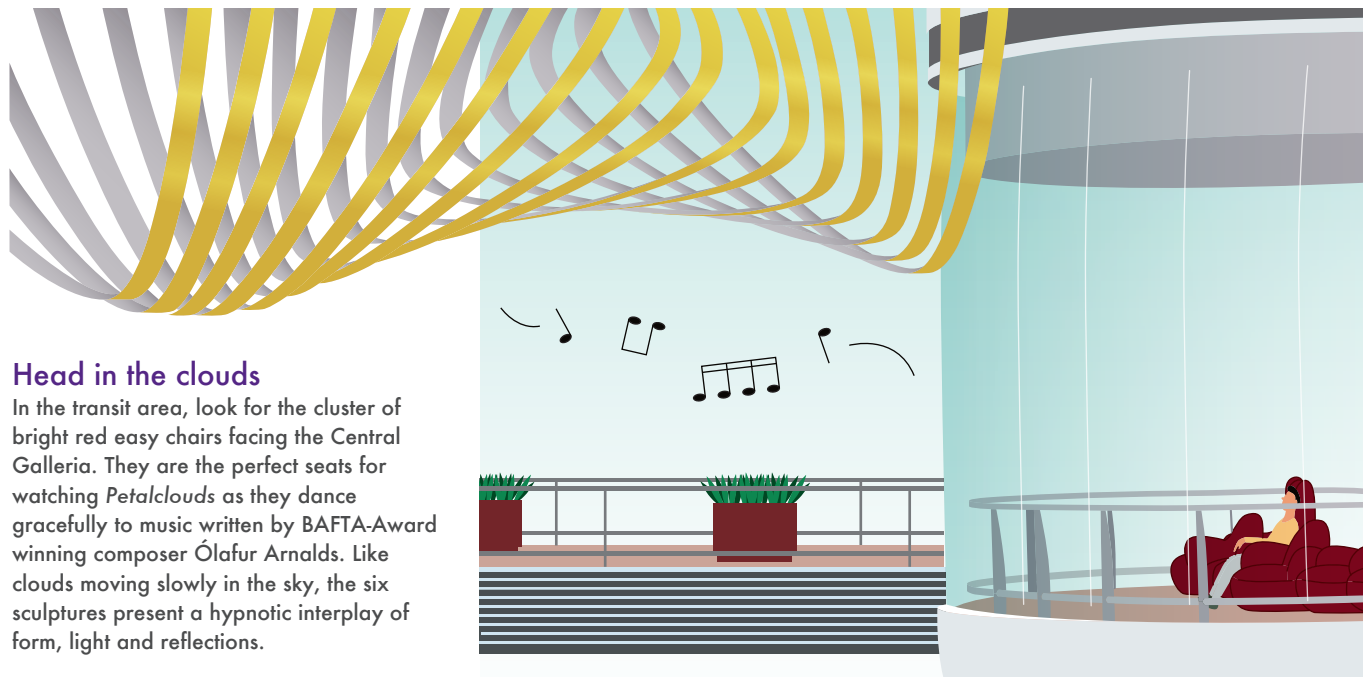
### Immerse in Peranakan culture

Relax at the Heritage Zone as you enjoy the *Peranakan Love Story*, a lovely six-minute musical, which plays twice every hour. Also visit the Peranakan Gallery nearby to discover more about the unique culture through photos and artefacts, including blackwood furniture that you can pose with for a #throwback photo.



### Walk over water

At the transit area's *Steel in Bloom* garden, walk over a koi pond and admire a six-metre centrepiece featuring intricate botanical motifs modelled in steel. Living plants thrive on the man-made structure, reflecting the delicate balance between humans and the natural world.



### Head in the clouds

In the transit area, look for the cluster of bright red easy chairs facing the Central Galleria. They are the perfect seats for watching *Petalclouds* as they dance gracefully to music written by BAFTA-Award winning composer Ólafur Arnalds. Like clouds moving slowly in the sky, the six sculptures present a hypnotic interplay of form, light and reflections.



### Have T4 two

Just for pun, have "T4" (tea for) two before flying off. There are plenty of choices in the public and transit areas for a cuppa. Some even have great vantage points for people- and *Petalclouds*-watching.





## Chapter 4

---

# THE HUMAN SOFTWARE

There is little doubt that T4 was set up to be distinctly different from Changi Airport's earlier terminals. Technology and innovation have given a new meaning to "efficiency" at Changi Airport's latest state-of-the-art terminal.

But Changi is clear on this – no matter how high-tech the hardware in hand is, the heartware matters.

"The magic of Changi Airport and its terminals is not found in the hardware alone. People matter. Magic is collectively created by individual commitment as well as teamwork," says Seow Hiang.



1

1. Changi's world-class reputation is due to the work of its staff. Catering to their well-being is integral to keeping this high standard and at T4's four staff lounges.

## FOR THE FAMILY

Seow Hiang pointed to the positive energy generated by staff united in their aspiration to provide world-class service. To that end, CAG had canvassed for ideas from its staff in the creation of T4, or what Seow Hiang describes as “the most staff-centric terminal ever built at Changi”.

“Some wanted a place to eat, charge their phones and rest, while others wanted smoking zones, shower areas and even

foot massage machines,” says Kenneth Ho, Senior Manager, Facilities Management for T4.

“In 2012 and 2013, we did a comprehensive survey of what our different stakeholders wanted. Of course, we couldn't provide everything, but we did so for what most people wanted, and I think they appreciated what we have done.”

T4 has four staff lounges – the most among Changi's terminals – two on the airside, and one each in transit and in the public area.





2

It was not just for the rest areas that staff was consulted on. T4 features customised workstations, with input sought at the design stage.

“We brought in the ground handlers who use the counters every day. So, even before we constructed all these, we built mock-ups in the lab in T2 and brought in staff to give us their feedback on the ergonomics,” reveals Ching Hock.

“We even went into details, such as what is the best angle for this, how big should the screen be, that sort of stuff.”

### The dungeon renaissance

Safety is of paramount importance at the Baggage Handling Area (BHA), so it was only natural that it was given massive improvements.

“Staff call the BHA The Dungeon Renaissance, and it really is an accurate description,” says Hamon Shen, chuckling. The



3

Manager of Airside Operations points to dim lighting, low ceilings and poor air quality as the bugbears of staff at older terminals’ BHAs. All these issues were addressed at T4.

More lights, anti-slip flooring and seats for staff to rest between flights were installed, along with higher ceilings and wider roadways. For the first time, Changi employed electric tractors to ply the roadways in T4’s BHA to improve its air quality.

CAG’s former Apron Chief, Mary Tan, who now serves as a senior consultant, reveals that while meetings were held with staff during T4’s planning stage, engagement with those who would be on the ground did not stop there.

“After installation works, we took them to the various sites to get their input again to help us in fine-tuning what we have put in place,” she says.

2. A T4 mock-up was also built to canvass staff input at the design stage in areas such as workstations to deliver a product that meets their expectations.

3. The Baggage Handling Area received massive improvements as a result of consultations with ground handlers.

1. With dumbwaiters, workers at T4 no longer have to carry heavy items to and from the aircraft.
2. With higher ceilings, more lights and improved air ventilation, the working condition at the Baggage Handling Area is a contributing factor to T4's improved environment for airport staff.



1



2

Dumbwaiters – motorised lifts that help transfer bulky items on aerobridges – were installed at the apron. Workers at T4 now do not have to physically carry heavy items such as wheelchairs and prams up and down the stairs.

“We have older employees working in the apron, and they’re grateful for the dumbwaiters. They also provided valuable feedback that helped us make modifications to improve the dumbwaiters,” says Mary, pointing to the importance of employee feedback.

## Innovating for efficiency

Changi knows how to run an airport – its long list of accolades affirms that. And the airport is already tapping on its 37 years of experience to develop efficiencies of its own, some of which have been implemented at T4. One is reducing the workload of toilet attendants, who previously had to refill every soap dispenser manually. Behind the mirror of every toilet, a single container with tubes linking to all dispensers now refills the soap automatically.

Kenneth, who helped design the system, says: “It’s quite painful to see attendants working on every soap dispenser in our toilets. This centralised reservoir means they have to top up a single container only once every three days.”

This approach has seen similar efficient systems applied to toilet paper – Changi has developed sensors that track how much is left in each roll of paper, alerting staff when it is time to replenish.

CAG has also invested much time and effort to introduce autonomous cleaning machines, with each type specifically modified to handle different areas, such as the tiled check-in facility, carpeted transit area and even T4’s car park.

Again, there is that attention to detail. Smart bins alert cleaners when they are full and trash does not have to be carted across the terminal. Work is made more efficient with 12 disposal-points across T4, all fitted with a pneumatic system that transfers trash to a central bin in the basement.

“The Facilities Manager’s job can be mundane. How interesting can cleaning be?” muses Kenneth. “So I like to think about how we can improve things ourselves.”

His musings played a big part in the conception of a customised all-in-one cleaning solution to replace the basket of chemicals that cleaners used to lug around, as well as mechanised mops and brooms for them. A smiley face flush



3

has also been installed in toilets, something that Kenneth hopes can brighten the day for cleaners and passengers alike.

“T4 is supposed to be a happy terminal. The light flashes when you flush, and it’s like someone smiling at you when you move away – so you’ll feel happy,” he says.

An upside to these staff-focused efforts is a major boost to productivity.

“T4 is 70 per cent the size of T1, and would theoretically need 210 cleaners, but with all the things that we’ve implemented, we are working with just 150,” says Kenneth.

“Traditional cleaning is labour-intensive, and is unsustainable both in terms of cost and effort. And all this came about from us thinking about how to optimise work with technology and improved processes – funny stuff.”

3. Autonomous cleaning machines keep T4 spanking clean.





## Chapter 5

---

# A FAMILY AFFAIR

From the personnel manning the information counters to the behind-the-scenes crew overseeing the upkeep of the airport, the *ONE Changi* family is a well-oiled machine. From airlines and immigration authorities to support companies, every single member plays an integral part to make the airport tick.

“All of us grew up coming through Changi Airport, remembering our first flight. This is important, we must never lose the trust that Singaporeans have placed in us. Our *raison d’être* is to deliver the best possible customer experience,” says Lye Teck.

“We never lose sight of the fact that Singaporeans feel a sense of pride and belonging for Changi Airport.”

1.  
It was a family affair when *ONE Changi* leaders came together for a tree-planting event at the Arrival Hall.



And the sentiments are echoed in the way things are done at Changi – an all-inclusive family working as one.

Li San recounts: “We had a small team working on the project, but we reached out to the rest of the company, including those involved in running flight and commercial operations. We pulled in expertise from different teams and got everybody to chip in, so it was really a whole company approach from the beginning.”

Lye Teck asserts that this process of getting everybody on the same page was much more complex than it first appeared – but getting it right was vital. He speaks of the integration of three key pillars – systems, processes and people – that need to come together to ensure that everything runs smoothly at an airport.

“We did more than dry runs. The complexity is in getting ourselves – systems, processes and people – ready to handle the flights. If one is weak, it would mess up the others, so all three are equally important.”

“When you come for a flight, you assume that you will fly. My colleagues and I assume someone will come at 5am to clean the terminal, start the check-in machines, prepare the security screening equipment – all proactively. We assume that things will run smoothly. But unless you make preparations, all these will not happen,” adds Lye Teck, relating the example of security that laid the foundation for T4.

ICA had to come on board in a big way to allow T4 to integrate its biometrics system with ICA’s automated immigration system. This included planning and designing of the FAST interface, as well as Automated Check-in Kiosks. The authorities also stepped outside the box in critical trials with T4.

“ICA really stepped up to it,” says Lye Teck of the security system integration trials, when volunteers went through the check-in and immigration processes. While the immigration system requires all individuals who have passed through security clearance to physically leave the country, ICA made an exception for the trials.

“It had to grant us access to its software to enable us to practise scanning passports,” adds Lye Teck. The security clearance trials were coupled with T4’s even tighter security to ensure that the trials were completed without a hitch.

With the opportunity to revolutionise the way passengers travel, ICA worked closely with CAG in the planning of T4. Julia Sng, ICA’s Commander (Airport), Integrated Checkpoints Command (Air), says the work to get everything right was an exciting and fulfilling journey for the ICA team because they pushed boundaries to create a new chapter in checkpoint operations.

“We now see new operating concepts in T4, including centralised immigration halls to improve productivity and the

Automated Immigration Gates, which are part of CAG's FAST concept. The automated gates are a first in many ways that presented numerous challenges to both ICA and CAG.

“Having the ICA system ‘talk’ to the CAG system was challenging at several levels. Nevertheless, with a common vision of providing a secure and seamless departure clearance experience for passengers, ICA and CAG teams came together to overcome these challenges. As we worked towards getting ready for Day 1, our officers participated in almost 50 Operational Readiness, Activation and Transition trials and 11 ‘live’ flights to ensure that we were fully prepared. ICA is proud to be a member of Team Changi!”

But it was not just the immigration and security authorities who needed to come on board. The *ONE Changi* approach involved Changi's airport partners and other service providers, from logistics to cleaning. Needless to say, the management of these companies needed to buy into the idea that they, too, were critical to Changi remaining at the top of its game.

This included the landside area, which is also opened to the public who are not travelling passengers, to meet Changi's highest standards.

James Fong, CAG's Vice President, Landside Concessions, worked with commercial partners, such as Astons, E-Gadget Mini, Kaboom, London Fat Duck and Old Street, to present a good selection of F&B and shops for T4 visitors.

“From ensuring the optimal trade mix to curating a variety of dining experiences for Singaporeans and tourists alike, the journey on the landside of T4 was truly memorable and fulfilling,” says James.

“And as opening day drew nearer, the *ONE Changi* spirit really shone through, as everyone worked closely together to overcome numerous challenges to make sure tenants were ready to serve passengers and visitors. It is not every day we get to witness the opening of a new terminal. What an honour and privilege to be involved in such an important milestone for Changi Airport.”

The FAST trials were just part of a larger ORAT, a systematic way of preparing for the smooth opening of an airport. And

getting such a huge family to work together on T4 was no mean feat, especially given the tight deadline of getting the terminal ready in just 12 months.

Systems were tested individually, then together. The Changi family came together to make sure that in T4, the magic of the *Changi Experience* continues. And new systems like FAST, which require new processes, were tried and tested.

“At CAG, we don't do everything ourselves, we work with and through our partners,” says Lye Teck.

“Anything that is new is a risk factor. Small things can trip people up, such as doors that have to be pushed instead of pulled – so why don't we put signs on them? No employee on opening day should be doing something new for the first time – we didn't want them to improvise or invent a process on the first day.”

Nothing that could be helped was left to chance, and this would not have been possible without the united belief that everyone at Changi is part of one big family.

“Our bond got stronger, we grew closer, and these are precious to us. We needed that for running the terminals and eventually even more so for T5. This was the community coming together not to apply a standard formula, but to venture into new territories together. Even the Ministry of Home Affairs had to rethink their processes to take a chance with us,” says Seow Hiang.

“I am glad our airport partners ran along with us towards making T4, with its cutting-edge capabilities, a reality.”



2. Tan Lye Teck, CAG's EVP Airport Management leads discussion on T4 with *ONE Changi* leaders.



1

## OPEN DOORS, OPEN MINDS

T4 is no budget terminal, nothing at all like its predecessor. Washing away the stigma of the budget label was one of the trickiest obstacles that stood before Neo Su Yin, General Manager of T4 Programme Management Office, and her team. That is why the reaction of a Korean Air manager stuck in her mind – it was a key moment in the progress of T4 that saw ambivalence towards the newest member of the Changi family turn into palpable excitement.

“Initially, Korean Air wasn’t going to adopt FAST, but when their regional manager came to see the terminal, he was so impressed with how seamless and efficient it was that he told us he wanted to *chope* (reserve) one of the check-in rows and come on board as soon as possible,” recalls Su Yin.

Her challenge was not just with the partners of Changi. She and her team faced similar challenges with colleagues who could not shed their old perceptions of the terminal. This was why engagement with both internal and external stakeholders on the new image of T4 was important to CAG.

### Embracing change

Su Yin admits there was initial apprehension from CAG staff about the launch of T4, with many concerned about accessibility issues and changes to their scope of work at a terminal that was highly reliant on automation. Unlike Changi’s other three terminals, T4 also had no inter-terminal Skytrain connection or MRT link to the city. This





2



3

apprehensive mindset was exacerbated by fears the self-service kiosks would render staff redundant.

“We wanted to give them a sense of ownership of T4, and to change their perception that it was more than just an upgraded budget terminal,” Su Yin says of her team’s decision to conduct workshops and roadshows specifically for CAG employees. “We wanted our colleagues to be the first to see T4 and be proud of it.”

Beyond the charm offensive, her team adopted a serious consultative approach that put consideration for staff at the forefront in the new terminal’s operations.

“We implemented bus services to and from T4 to resolve the accessibility issue. It was key for us to convey the message that staff were not going to be displaced. We needed to help them understand that the main change was in their roles and the way they interacted with passengers,” says Su Yin.

### 1. 2. 3.

In August 2017, Changi held a two-week Open House to give Singaporeans a glimpse of their newest terminal.

Her team worked to “bring as much of the terminal to staff” as they could, ahead of its opening. This meant putting together videos, building mock-ups of key areas they were involved in, and designing workshops to deepen their understanding of the changing work processes in T4.

“We took on board their feedback in designing lounges and ergonomic workstations, and I must say I am very proud of our efforts.”

The efficacy of these internal engagements came to the fore as Su Yin and her team prepared to open T4’s doors to Singaporeans.

“From the start of 2017, leading up to the public open house in August, many of our employees came forward to volunteer their services as ambassadors.”

Among those who answered Su Yin’s call was Usharani Murugiayan, a public service announcer based at T2.

“I think T4 is absolutely beautiful! It’s a cosy, comfortable terminal and they made sure they got feedback from us in some of the designs here. We appreciate what they’ve done, like the staff lounges,” says Usharani.



2

Such reactions warmed Su Yin’s heart.

“There was a real evolution of perception among our colleagues,” she says, her eyes lighting up. “Initially, we were worried that no one would want to work at T4 because many of them felt it was more difficult to get to.”

“But they were blown away by the beauty of the terminal and came of their own accord to be part of it.”

The pride in Su Yin’s broad smile says it all.

### Singapore, this is T4

In August 2017, CAG gave Singapore its first glimpse of T4 in a public open house. Over 100,000 people came through the doors during T4’s two-week long introduction to visitors, who were amazed by what they saw.

“There were senior citizens who were grateful to be given a chance to see the transit area of the terminal without first having to buy a ticket – some of them said they did not even

1



3

have passports, so this was really an experience for them. There were also other visitors who wanted to sit on every single chair in the terminal,” says Su Yin.

She reveals there were initial fears her team would struggle to attract visitors to the open house, but those apprehensions were totally unfounded. Every single open house ticket was snapped up, and the public lapped up what T4 had to offer.

“My son kept saying he thought this was supposed to be a cheap terminal, and if so, this was the grandest ‘cheap’ terminal he has ever seen,” says Yazeed Said who works in the education field. “We were expecting less, but were really impressed by the quality here. Flow-wise, it’s intuitive, and there are several rest areas, which travellers always look for.”



4

His sentiments were echoed by frequent traveller Lim Ee Hou.

“There’s technology, art installations, even the seats are stylish – and then you have this unique Heritage Zone,” says the 42-year-old technology consultant.

“My attention was caught by this – it’s like a time-space jump between the future and the past – it’s really unique – and the theme is carried forward into the toilets as well. I travel almost every week, and when my wife said to me, ‘Let’s go to T4,’ I thought she must be kidding. But I’m glad I came.”

1. 2. 3. 4.

Over 100,000 people, from senior citizens to young children, had a field day during the Open House and were impressed with what T4 has to offer passengers.



1

1. Months before the terminal opened, Changi worked with its various partners to put its systems through robust tests with “live” flights.

## ONE FINAL PUSH

Building a spanking new airport terminal with all the bells and whistles and the latest technologies is the easy part. Making sure every moving part works the way they are supposed to is not so and can test the most steely of nerves.

A lot was at stake for T4. Ang Siew Min, CAG’s Vice President of Airport Operations Management, knows only too well any hiccup can dent the Changi brand as the world’s leading airport, where everything always runs smoothly. The accolades speak for the airport’s achievements.

And Siew Min was keenly aware of how failures had plagued new terminals of some well-respected international airports and damaged their reputations.

Changi cannot afford this. It took decades to raise its standing among international passengers and even a tiny glitch can undo this. T4, simply, cannot disappoint.

Not that Siew Min and his team thought anything would go wrong. They were confident nothing would after running over 150 rigorous trials involving more than 10,000 volunteers and airport employees, and 11 “live” flights before the operational opening.

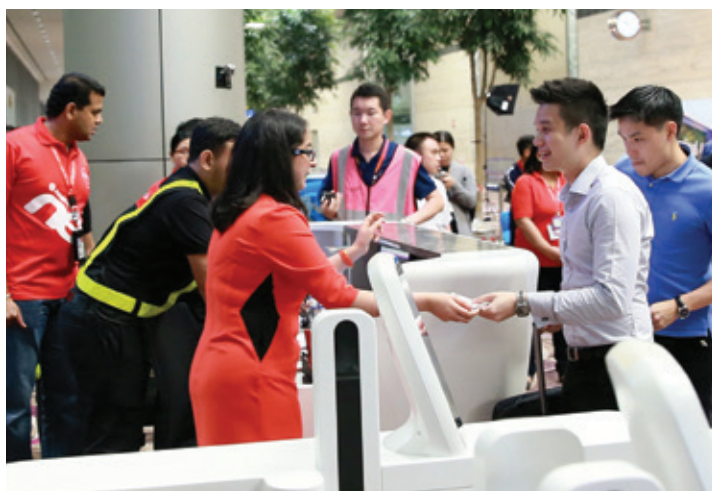
“We worked closely with the airlines that would be operating out of T4, including Cathay Pacific and AirAsia, to test the systems from start to end. It enabled us to calibrate and make them faster and smarter,” says Siew Min. “The ‘live’ flights carried out during ORAT also allowed us to identify areas for improvement. Without running these ‘live’ flights, we would not have been able to put our hands on the table and declare, ‘We are ready to open T4.’”

The FAST systems are able to function seamlessly as they are well-integrated with the external systems managed by the airport partners. For instance, apart from working with ICA to embed facial recognition technology into the Automated Immigration Gates, CAG also involved the T4 airlines in ensuring interoperability across different systems. Despite the pressures on all sides to deliver, CAG and its partners overcame the technical hurdles.

“For example, we wanted passengers from every airline to be able to get past all 18 Automated Immigration Gates simultaneously without experiencing any system lag,” says Siew Min. “To do so, the T4 airlines had to make changes to their systems while we tailored the software to suit each airline.”

Logan Velaitham, AirAsia Singapore CEO and AirAsia Philippines Chief Executive Advisor, says that the airline started digitalising their passenger operations at Changi in 2015. It made their work with T4 during the trials more efficient.

“We have been introducing our guests to various digital technology in an effort to allow them to take full control of their journey,” adds Logan.



2



3

“We started by introducing the Passenger Reconciliation System, followed by mobile check-in, self-service kiosks, auto bag drop facilities and finally auto boarding gates. The trial flight saw our efforts come together as passengers eased into the fully automated terminal without any hassle.”

### Overcoming challenges

Siew Min says it was a tremendous challenge from the get-go. “Right from the start, we knew that delivering a full-suite FAST was going to be complex because it had to have speed, accuracy and be user-friendly,” he emphasises. “Nobody at Changi Airport had done this before and we did not have a reference point to work with. I am glad the team took on the challenge and delivered a groundbreaking product that had no precedence.”

2. 3.  
Over 10,000 volunteers and airport staff were involved during the 150 trials that included 11 "live" flights.



## TAKING FLIGHT

The day of reckoning finally came. At 2am, October 31, 2017, Siew Min and his team were pleasantly surprised when two passengers checked in at T4's Automated Check-in Kiosks, printed their baggage tags and boarding passes before dropping off their luggage at the Automated Bag Drop machines.

Recalling that moment, he says the passengers had arrived too early. They were supposed to check in only three hours ahead of their Cathay Pacific flight, CX650, which was scheduled to depart for Hong Kong at 6.50am.

But it was opening day for Changi Airport's newest terminal and the two eager passengers of the first official flight out of T4 validated that T4's FAST system was ready to roll.

"The early birds did us a favour because they tested the system before the main bulk of passengers arrived and they did it without any glitches!" muses Siew Min.

T4, though, was ready to tackle all imaginable issues that might throw a wrench into its works. Well before the first flights touched down and took off, CAG's ORAT team was in position – warm smiles worn over their distinctive blue T-shirts, with bright and sharp eyes keenly trained on every single passenger touch point throughout T4. They were out in force on the day T4 would welcome its first passengers. The first flight to arrive at 5.40am was also operated by Cathay Pacific, CX659, from Hong Kong.



### Hard work finally pays off

As passengers disembarked and another group waited to board the same aircraft there was a sense of relief among the CAG family. Everything had been running without a hitch, especially for those who went through the departure system. T4, after all, had gone through rigorous tests.

“Their system is called FAST, but it was way faster than I imagined,” says Pryntha Goldsmith, a Florida resident who was in Asia for the first time with her husband, Jim. T4’s automated systems, from check-in to bag drop and immigration, had worked like a charm for them.

“We got to the airport thinking it was going to take us forever this morning, but it was super fast – we could have stayed at the hotel for another hour-and-a-half,” she adds. “I don’t think T4 could have done any better today.”

Like Pryntha, Japanese businessman Shinji Fujino took less than 10 minutes to get from check-in, through immigration, security screening and into the transit area where T4 continued to impress.

“T4 is an amazing terminal, and Changi is an amazing airport – it is just so beautiful,” he says, adding he was stunned by its beauty.

T4 received its first flight at 5.40am on October 31, 2017 with the arrival of Cathay Pacific’s CX659 from Hong Kong. The Cathay Pacific aircraft, re-designated CX650, was also the first flight to depart from T4.



1



2



3



Maggie Yeung, Cathay Pacific's General Manager, Southeast Asia, says the commitment from CAG, its stakeholders, and airline and commercial partners in preparing T4 for operations paid off well for everyone.

“Our successful move to T4 represents a culmination of many months of hard work among our colleagues and collaboration with various stakeholders and authorities,” adds Maggie.

“We are excited to be able to provide a better airport experience for our customers departing or arriving Singapore, and we are glad that the self-service facilities and our extremely comfortable brand new lounge, featuring great dining options, have been well-received by our passengers.”

### A sensory experience of the Lion City

A well-lit integrated duty-free zone greeted passengers as they walked along a winding path that opened up to a vast space lined by shops with double-volume façades.

And beyond that, past T4's mesmerising feature garden, passengers got one last look of Singapore at the Heritage Zone.

As wide-eyed passengers took in the exquisite architectural detail in the façades of local shophouses that lined here, their noses were given a Singapore send-off. Smells of fresh *roti prata* wafted over the air, intertwined with barbecued pork slices and pandan cake, giving passengers a final sweet-savoury taste of the Lion City.

Lazing on the comfortable chairs placed across the Heritage Zone, they were lapping up everything T4 had to offer. “The terminal is very nice, I can't say just how much I'm enjoying this,” says Geraldine Tongco, who was returning home to the Philippines via Hong Kong.



4



5

“It's absolutely beautiful, but my favourite thing about T4 is the convenience. It's easy and fast to check in, and get through immigration.” She waves her hands around before adding: “You should come to T4 and enjoy all this.”

Flight CX659 departed in what was a successful roll-out for FAST, but Siew Min's team skipped the celebratory drinks. “After we opened T4 for operations, we went into a period of enhanced care, which meant we were on roster 24/7 to make sure the terminal continued to hum during peak periods, as well as to address and close any gap that surfaced after opening day.”

1. It was a breeze for passengers who went through T4's FAST system and they arrived at the departure gate with airport staff ready to tend to any queries they had.
2. Cathay Pacific's staff was also on hand to give departing passengers that extra help.
3. The first passenger to disembark from Cathay Pacific's flight CX659 was warmly welcomed by CAG's CEO Lee Seow Hiang.
4. 5. The auspicious occasion was celebrated with great fanfare for passengers on the first flights in and out of T4.

Daniel Foo

Tan Haijije

Gerrmitte Ang

Teresa Goh

Art Ralls

Cindy Koh

Willy Ng

Eileen Tan

Elsie Tan

Janet Wan

Kelvin Teo

Teng Hwee Onn

Ng Hoe Seng

Lim Hon Wei

Lee Kian Wei

Seoh Zhi Wen

Kevin Lim

Kenny Lim

Lee Wei Xian

Latipah A Wahab

Oun Chuan Teck

Bobby Chua

Chew Wessen

Murul

Winnifred Ong

Ahmad Razak

Oun Chuan Teck

Bobby Chua

Chew Wessen

Murul

# THANK YOU

---

This book celebrates the significant contributions from the T4 Team. The Creators of T4, listed below, comprise members from Changi Airport Group, Consultants and Contractors who have worked hand-in-glove to complete T4 in five years. T4, with many innovations of its time, is a labour of love and the pride of all involved.

## CAG

Liew Mun Leong  
 Lee Seow Hiang  
 Yam Kum Weng  
 (Programme Director)  
 Tan Lye Teck  
 Foo Sek Min  
 Lim Peck Hoon  
 Fong Kok Wai  
 Ng Lai Leng  
 Wong Woon Liong  
 Ho Beng Huat  
 Somkiat Lertpanyavit  
 Poh Li San  
 Neo Su Yin  
 Daniel Foo  
 Tan Hanjie  
 Germite Ang  
 Teresa Goh  
 Herman Ng  
 Stuart Ralls  
 Cindy Koh  
 Willy Ng  
 Eileen Tan  
 Chew We-sen  
 Nurul Ain Sumardi  
 Elsie Tan

Janet Wan  
 Kelvin Teo  
 Latipah A Wahab  
 Teng Hwee Onn  
 Ng Hoe Seng  
 Seoh Zhi Wen  
 Bobby Chua  
 Gabriel Lim  
 Lee Wei Xian  
 Oun Chuan Teck  
 Clarkson Doan  
 Li Jiancheng  
 Kenny Lim  
 Lim Hon Wei  
 Lee Kian Wei  
 Kevin Lim  
 Ahmad Razali  
 Mohamad Izhar Bin Mohamad  
 Kusnin  
 Yeo Tiong Lip  
 Vincent Ong  
 Calvin Nah  
 Elanggo Kannaiyan  
 Tan Eng Kim  
 Ching Chin Yong  
 Chia Teck Kuea  
 Lee Seoh Cheng  
 Koh Ming Sue  
 Chee Kay Hyang

Yong Swee Ying  
 Leong Kok Hoong  
 Jacqueline Lim  
 Xylia Ong  
 Ngow Wei Juan  
 Jayson Goh  
 Ang Siew Min  
 Kelvin Tan  
 Chua Ching Hock  
 Jaeden Lim  
 Jasmine Lim  
 Lim Qiuling  
 Kenneth Seet  
 Goh Qian Yi  
 Lee Siew Fong  
 Jyn Tan  
 Lucas Lee  
 Keri Low  
 Zhang Shuyi  
 Melissa Ang  
 Aaron Wong  
 Keith Lim  
 Ng Ding Geng  
 Gareth Chua  
 Donovan Chan  
 Ben Lee  
 Kenneth Ho  
 Winne Ng

James Nai	Hamon Shen	Genevieve Heng	Tan Yeow Leong	Fiona Ng
Amanda Giam	Md Tajuddin Abdullah	Tricia Ng	Mohd Shadiq	Liu Sern Yang
Lim Yong Ken	Gabriel Tan	Verlyn Tan	Vanganuru Sagarika	Nicholas Poa
Joanna Cheng	Kalamuddin Bin Tibrani	Steve Tay	Lim Ching Kiat	Jean Tan
Khaja Nazimuddeen Abdul Hameed	Amelia Amari	Chua Poh Hong	Donald Tan	Lim Wee Ping
Ashraf Ali	Lim Seng Kee	Raymond Low	Damon Wong	Lim Wei Wei
Chiam-Ling Hua Choo	Lim Ming Jian	Sharon Liew	Tan Shu Yee	Shawna Chua
Shaiful Bin Sulaiman	Rolando Delfin	Cassandra Chng	Toh Ern Chong	Charis Teddy
Lee Qian Yi	Clarence Chng	Angeline Chia	Samantha Yuan	Audrey Lee
Nisrin Abdul Rahman	Joseph Lim	Jeffrey Loke	Pang Yee Huat	Goh Dan Yang
Bernard Siew	Mary Tan	Low Tze Lee	Jeffrey Ng	Mark Tiong
Liew Yi Ling	Lenny Chan	Ong Si Yun	Liew Zhong Yao	Leck Siew Leng
Natalie Oh	Teo Chew Hoon	Steve Lee	Victor Liu	Michelle Lim
Delfine Ong	Ivy Wong	Leong Yuh Khee	Ivan Tan	Serene Lee
Gallan Ong	Chandra Mahtani	Jeffrey Gwee	Dennis Yim	Mak Mun Wai
Puspa Parikh	Maritonet Aluquin	Jennifer Lin	Ng Koon Ling	Chua Lay Ling
Angel Tan	Sherry Jew	Cheah Ai Lin	Low Shueh Li	Wendy Heng
Alan Xavier Tan	Leow Pey Shan	Lim Swee Teck	Kelvin Ng	Margaret Tan
Gobinath Thangaveloo	Jane Lim	Alex Tey	Ryann Tan	Phoon Yen Peng
Krist Lim	Wendy Lim	Kenny Chia	Eunice Yeo	Justina Tan
Hurul'Ain Ibrahim	Joyce Poh	Janet Ang	Anthea Tan	Jane Ong
Cletus M J Packiam	Alicia Wong	Ong Kok Liang	Julia Jemangin	Debbie Koh
Ng Chak Hwee	Michelle Foo	Tan Wei Hao	Claudia Wong	Janice Lim
Yew Chee Chien	Farley Lim	Spencer Lim	Melvin Leong	Lee Chong Hee
Shahrir Idham B Mohd	Nicole Foo	Song Wei	Jiang KeJia	Sim Lee Hua
Muhd Zarirnaziz Roslee	Li Bona	Wang Chaohe	Christopher Teo	John Petselis
Muzhafar B Maarof	Lim Jun Jie	Li Zijing	Melina Khong	Shi Shuangxi
Yeo Kia Thye	Edwin Lim	Bernie Xie	Ang Kai Fong	Soe Minn Sett
Oliver Kiesewetter	Grace Tai	Lynnette Lim	Lee Khai Yan	Goh Kai Xiong
Gan Heng	Grace Marie Ho	Tan Chinn Woan	Linette Tan	Wu Zhen Hong
Zhao Fu Cai	Nicole Loy	Jeff Ho	Ong Sim Lian	Saiyed Noor
Syed Ibrahim	Eugenia Ong	Tan Kiang Huat	Lau Siong Weng	Maung Hla Min
Norshidah Arshad	Sharlene Ng	How Lee Kiau	Jessie Loong	Chee Xiang Min
Jacqueline Seah	James Fong	Ong Si Yi	Edward Lam	Angeline Quah
	Nigel Chia	Natalie Lee	Adrian Huang	

## CONTRACTORS

Toichi Takenaka  
 Yuiichiro Hugh Takenaka  
 Keiji Hayashi  
 Nakao Seiichiro  
 Hirotugu Yamaguchi  
 Kazumi Suzuki  
 Haruhiko Sawada  
 Hiroyuki Yamamoto  
 Leslie Teng  
 Shoichi Sato  
 Shoji Tanaka  
 Fumiaki Kishida  
 Toshiharu Umetsu  
 Kosuke Fukumoto  
 Masataka Sugiwaka  
 Isao Shinjo  
 Ichiro Takazaki  
 Keisuke Suzuki  
 Atsushi Yakushijin  
 Nobuyuki Odajima  
 Wataru Yoshii  
 Hisanori Tanaka  
 Asai Naoyuki  
 Nagai Michito  
 Hiroyuki Miyasaka  
 Takayuki Miyamoto  
 Hitoshi Yamamura  
 Kazumasa Takahashi  
 Yasuyuki Kanebako  
 William Heng  
 Kelvin Sim  
 Yeo Kim Kiat

Robin Neo  
 John Chong  
 Ahamadi B. Kamsidin  
 Wedhasmari B. Mohd.  
 SM Nuruzzaman  
 Uddin Mohd. Reaz  
 Faye Fong  
 Lisa Chay  
 Chong Mee Lan  
 Tong Boon Sang  
 Tan Chew Bong  
 Tan Siow Huat  
 Lu Leong Pin  
 Loong Shey Hock  
 Ang Kar Yeong  
 Lim Tian Seng  
 Tham Kong Choong  
 Steven Lian  
 Ismail B. Kasmani  
 Roslan B. Kloning  
 Soon Kim Swee  
 Cheah Chin Teong  
 Beumer Group  
 CS Bored Pile System  
 Fuji Signcrafts Industries  
 Gleason Advertising  
 O' Connor's Singapore  
 Schindler Lifts (SG)  
 ShinMaywa (Asia)  
 TEHC International  
 Trittech Engineering and  
 Testing (SG)

## CONSULTANTS

Yeo Siew Haip  
 Toh Kok Kin  
 Ye Minyu  
 Mustakim Ismail  
 James See  
 Christopher Chong  
 Lee Jia Xian  
 Linda Lee  
 Clarence Foo  
 Isaac Tan  
 Jamaludin Bin Rahamat  
 Alan Sin  
 Ku Ler Wai  
 Eileen Lee  
 Low Xingjun  
 Peter McCaffery  
 Neil Kee  
 Luther Seet  
 Francis Walker  
 Denise Gan  
 Phil Russell  
 Janka Podbielski  
 Raymond Fok  
 Liew Choong San  
 Wendy Chan  
 Stuart Mackay  
 Andrew Moraes  
 Huang Gim Seng  
 Lek Juay Chor  
 Zhang Haoran  
 Darrell Barker  
 Chris LeBoeuf

Lim Chiak Hwee  
 Tony Ang  
 Seah Choo Meng  
 Khoo Sze Boon  
 Josephine Lee  
 Fion Lim  
 Chen Yiwen  
 Ong Hong Yi  
 Benedict Oon  
 Raymond Liow  
 Richard Tai  
 S.Gunasegar  
 Jasbir Singh  
 Anthony Cheng  
 Yong Ping Quen  
 Terrence Ferando  
 Lien Kar Kiat  
 Henry Ho  
 Meike Gossling  
 Peter Teo  
 Yee Poh Kin  
 Tan Keh Mui  
 Elvio Lim  
 Jim Tan



Arrival





**CHANGI**  
airport group