THIRTY YEARS HUNDRED STORIES

What Some Practising Engineers Say about This Book …

As this book is about practising engineers, we have specially invited the Chairpersons of the various Technical Committees of the Institution of Engineers, Singapore (IES) to review the book and give their comments.

IES mission is to advance and promote the science, art and profession of engineering for the well-being of mankind. It aims to be the heart and voice of engineers and to be the national body and home for engineers in Singapore.

"It took many engineering feats for our nation to reach First World status and more will be needed to further our growth."

Er Seow Kang Seng
Chairman
Education & Certification Group
Institution of Engineers Singapore

[Er Seow Kang Seng has been in the electricity industry for 40 years working for PUB, Singapore Power Group and Energy Market Authority. In January this year, he joined DNV GL, an international consulting firm, as the Principal Consultant on energy related areas. He graduated from NUS in 1975 with a degree in Electrical & Electronic Engineering.]

"Engineers made Singapore a global centre for water treatment, and are developing our nation into a clean energy and waste management centre."

Er Edwin Tf Khew
Chairman
Chemical & Process Engineering Technical Committee
Institution of Engineers Singapore

[Er Edwin Khew has been in the environment and waste management industry for 38 years. He began his career with SISIR in 1975 and later helmed a number of MNCs and SMEs. His focus is on waste water treatment and waste to energy technologies. In 2008, he filed a joint patent on a waste management system that uses microorganisms to break down biodegradable material to reduce the emission of landfill gas into the atmosphere. He graduated from the University of Queensland in 1972 with a degree in Chemical Engineering.]

"May the vibrant spirit of the NTI Pioneers be passed on to our future engineers."

Wan Siew Ping
Chairman
Precision Engineering Technical Committee
Institution of Engineers Singapore

*[Ms Wan Siew Ping has been in the precision engineering field for 30 years. She began her career with Fairchild Semiconductors' Singapore plant in 1982. She joined the Singapore Institute of Manufacturing Technology under A*STAR in 2007 where she led the industry outreach in equipment design, automation and systems conceptualisation. She received her Bachelor and Masters in Mechanical Engineering from NUS in 1982 and 1989 respectively and her Masters in Precision Engineering from NTU in 1999.]*

"A rich journey across the broad spectrum of engineering fields with a unique Singapore flavour."

David So
Past Chairman
Aerospace Engineering Technical Committee
Institution of Engineers Singapore

[David So has been in the aerospace industry for 10 years working for SIA Engineering Company. He heads an aircraft design organisation with Civil Aviation Authority of Singapore approval. His experience is in cabin interior retrofit, passenger to freighter conversion and aircraft fleet technical management. He graduated from NUS in 2005 with a degree in Mechanical Engineering.]

"Engineers were, are and will be the pillars of Singapore's development."

Lim Horng Leong
Past Chairman
Systems Engineering Technical Committee
Institution of Engineers Singapore

[Lim Horng Leong has been in the systems engineering field for 19 years. He began his career with MINDEF's Command, Control and Communications Systems Organisation in 1996. He joined DSTA in 2000 where he led the development of several large-scale command and control systems. He successfully fielded the systems for the Republic of Singapore Navy. Since 2015 he became the Deputy Director of the Energy and Environment Directorate with the National Research Foundation. He received his Master of Science in Systems Engineering from the Naval Postgraduate School in USA in 2007.]

"Meaningful stories behind Singapore's success to inspire the next generation to continue '自强不息，力争上游'."

Dr Zhou Yi
Past Chairman
Electrical, Electronic and Computer Engineering Technical Committee
Institution of Engineers Singapore

[Dr Zhou Yi has been in the electrical, electronic and computer engineering field for 8 years. He began his career as a lecturer with Singapore Polytechnic in 2007and has been an Assistant Professor at the Singapore Institute of Technology since 2014. His passion is in artificial intelligence, machine learning and autonomous systems. His recent work involved various robotics projects and RFID-based Autonomous Navigation of Automatic Guided Vehicles for Port Automation. He graduated in Electrical and Electronic Engineering (First Class) in 2004 and received his PhD in 2008, both from NTU.]

NANYANG TECHNOLOGICAL UNIVERSITY

Nanyang Technological University, Singapore (NTU Singapore) has undertaken an extraordinary journey of excellence to become one of the world's top young universities known for producing highly-cited research. Home to some of the world's best scientists, NTU offers engineering, science, business, humanities, arts, social sciences, education and medicine. Its research covers high-impact areas such as sustainability, healthcare and new media. Globally connected, NTU has more than 400 international partnerships, including joint research centres with industry leaders on its campus.

ISEAS-YUSOF ISHAK INSTITUTE

The **ISEAS–Yusof Ishak Institute** (formerly Institute of Southeast Asian Studies) was established as an autonomous organization in 1968. It is a regional centre dedicated to the study of socio-political, security and economic trends and developments in Southeast Asia and its wider geostrategic and economic environment. The Institute's research programmes are the Regional Economic Studies (RES, including ASEAN and APEC), Regional Strategic and Political Studies (RSPS), and Regional Social and Cultural Studies (RSCS).

ISEAS Publishing, an established academic press, has issued more than 2,000 books and journals. It is the largest scholarly publisher of research about Southeast Asia from within the region. ISEAS Publishing works with many other academic and trade publishers and distributors to disseminate important research and analyses from and about Southeast Asia to the rest of the world.

THIRTY YEARS HUNDRED STORIES

Engineering Accomplishments
in Singapore as told by the
NTI Pioneer Engineering Class of 85

LIU FOOK THIM

NANYANG TECHNOLOGICAL UNIVERSITY

ISEAS YUSOF ISHAK INSTITUTE

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Foreword

THIS IS A SPECIAL YEAR, both for our nation and the NTI Pioneer Engineering Class of 85. It is Singapore's jubilee year since independence, and the 30th anniversary of the first batch of engineers from NTI (now NTU).

When we first became independent, engineers were in short supply. The School of Engineering in the University of Singapore was only into its second year. Before that Singapore students did their engineering courses in Kuala Lumpur. In 1968, there were only 37 "Made in Singapore" engineering graduates.

But as Singapore progressed, engineering thrived. The country was industrialising, and our economy was taking off. The government and private sector needed many engineers. In 1981, the Government started NTI to train practice-oriented engineers. Today NTU Engineering courses stand shoulder-to-shoulder with top engineering courses in the world.

I thank the Class of 85 Engineering Pioneers for leading the way and playing a role in building Singapore. This book collects 100 stories of engineering accomplishments in Singapore over the past 30 years. They tell the story of Singapore – how an island and a people with limited resources turned vulnerability into strength, with human ingenuity and good engineering. May the same spirit of derring-do endure, as we take on new challenges. May this book inspire young readers to become engineers and work on building Singapore for the next generation.

Lee Hsien Loong
Prime Minister
Republic of Singapore

Acknowledgements

WE ARE GRATEFUL to our classmates who have taken time to reflect on their careers over the past 30 years and to share nuggets of their engineering experience and observations of the industries in which they played a part in influencing.

It is easy for such recounting to be misunderstood as self-serving. Most engineers are part of a team and claiming specific credit for a particular engineering accomplishment might arouse resentment. To minimise such misunderstandings, we have focused on what engineers do rather than what the contributor did. We adopted the third person narrative form. So instead of "Mr Tan came up with the idea of …" we adopted "The engineers came up with the idea of …". Writing in the third person allows us to see and understand what and who else were involved in the story, and show the story from more than one set of eyes.

In order to keep the book readable, the book committee accepted only 100 stories that reflect the breadth and depth of engineering accomplishments in Singapore. We apologise to classmates whose stories we may have left out.

Special mention goes to the Founding President of NTU, Professor Cham Tao Soon, who is a supporter of this project from its inception. He understands the challenges that engineers face in divulging details of engineering accomplishments, and agreed to pen a letter addressed to the various organisations to solicit their support for this meaningful project.

Our classmates work in these organisations. We are grateful for the support of these organisations. Some of the details of their engineers' accomplishments have not been made public before.

A number of people have taken precious time to review the

book. We deeply appreciate their kind words and encouragement. They all have demonstrated great commitment to the field of engineering. Mr Tan Gee Paw, Chairman of PUB, The National Water Agency, is a great example. He graduated in Civil Engineering (First Class) from the University of Malaya in 1967. He started his career as a civil engineer in the Drainage Department of the then Public Works Department. His early years maintaining drains allowed him to acquire an intimate knowledge of every drain and canal in Singapore. This proved useful 25 years later when he was put in charge of PUB, which was responsible to ensure adequate water resources for all Singaporeans. In July this year, he was recognised with the Institution of Engineers Lifetime Engineering Achievement Award for his leadership in cleaning up the Singapore River and diversifying our water sources.

We put on record our deep appreciation to Prime Minister Lee Hsien Loong for penning the Foreword. We would also like to record our appreciation to the National Archives of Singapore for the use of the photograph featuring Mr Lee Kuan Yew on page 4. Finally, we thank NTU for supporting this project.

BOOK COMMITTEE

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[1] In 1985, there were only three engineering schools in NTU (formerly NTI) – Mechanical & Production Engineering (MPE), Civil & Structural Engineering (CSE) and Electrical & Electronic Engineering (EEE).

What This Book is About

There is a need to remind people of the important role that engineers play.

IN 2010, the Nanyang Technological Institute (NTI) Pioneer Engineering Class of 1985 celebrated its 25th year of graduation with a gala dinner. That event triggered the launch of the book *One Degree, Many Choices*, which captured the career choices of these graduates. We wanted our stories to stir the curiosity and imagination of the young, especially those good at maths and science, and inspire them to study engineering.

Five years zipped past and 2015 marks our 30th year of graduation. Spurred by the success of our earlier book, we decided to have a sequel. The words of Founding President of NTI, Professor Cham Tao Soon in the earlier book — "Singapore's rise from colonial port to global city is due in large part to the efforts of its engineers. There is a need to remind people of the important role that engineers play." — encapsulated the purpose of this sequel.

Thirty Years, Hundred Stories is a collection of stories that we share with each other every time we meet. They include engineering accomplishments that only we would know because we worked in these industries, and were involved directly or indirectly. Many of these stories would never have been known if not for our efforts in compiling them into a book for public consumption. This project is not meant to be an academic work, nor does it claim to be exhaustive. For easy reading, we have kept each chapter to two pages, even though the engineering work would warrant a longer essay. Our hope is that these stories will give readers a snapshot of how diverse the field of engineering is and how it underpins major developments in Singapore.

There are four parts to this book. Part One showcases the work of engineers in building the infrastructure for the nation. Part Two covers the work of engineers in providing professional services. In Part Three we highlight the work of engineers in the various industries, many of which are no longer in Singapore. Finally, in Part Four, we offer some closing thoughts on the prevailing issues in the engineering profession.

This year also marks the passing of Singapore's founding father, Mr Lee Kuan Yew, in March. There was an outpouring of reports on Singapore's rise from Third World to First within a generation. While Mr Lee and his team were the architect behind the nation's success, the work of building the infrastructure, providing the services and running the factories were done by engineers, including those from the NTI Pioneer Engineering Class of 85. To build upon this legacy and ensure Singapore's continual prosperity, there is a pressing need to inspire future generations to practise engineering. They will be inheriting a complex world with a greater demand for engineering expertise. One of the more penetrating insights in this book is that most of our nation's top projects depend on engineering support.

If this book inspires some to take up engineering as a career, it will have achieved its purpose.

Engineers' Role in Nation Building

There are many things we can do using our imagination and engineering.

ENGINEERS ARE IMPORTANT assets of a nation. They have the skills and abilities required in nation building. They create wealth by putting in place the infrastructure for economic development. They build factories. They construct roads that facilitate the transportation of goods. They design and facilitate the very goods manufactured for sale. Their work impacts the socio-economic well-being of a nation. Their efforts touch the lives of people at home, at work and at play — past, present and future.

No nation, past or present, advances beyond its engineering sophistication. We talk of nation building in terms of engineering output — roads, bridges, buildings, power networks, telecommunications, factories, etc. On this basis, discourses on Singapore's transformation from Third to First World is not complete without an appreciation of the role that engineers have played.

This year, Singapore celebrates 50 years of independence and prides itself as a miracle, given the constraints. Engineers played an important role in overcoming these limitations with cost-effective solutions and paved the way for a strong, stable and prosperous Singapore with a seat among the world's richest[2].

Engineers in Singapore started public utility and infrastructure projects during the colonial period. When Singapore became independent in 1965, there was not much of an economy. Engineers played a key role in creating a platform to stimulate and sustain the

[2] In 2014, our GDP per capita was US$56,287. According to the International Monetary Fund, Singapore ranks third after Qatar and Luxembourg.

economy. Over the years, we witnessed tremendous development in infrastructure, manufacturing, telecommunications, construction, marine and information technology. Today, engineering is a well-established profession that continues to shape the socio-economic landscape of the nation. Engineers are working to bring the nation closer to an environmentally sustainable and economically viable future.

In this book, the NTI Pioneer Engineering Class of 85 described some engineering accomplishments that they had witnessed first-hand in the past 30 years. These feats generated wealth and enhanced our quality of life. It is an indisputable fact that Singapore needs engineers!

PHOTO SOURCE: MINISTRY OF INFORMATION AND THE ARTS COLLECTION, COURTESY OF NATIONAL ARCHIVES OF SINGAPORE

Then Prime Minister Lee Kuan Yew discussing with PUB engineers on how to resolve Singapore's water needs in the 1960s.