20 YEARS TECH FOR IMPACT

ASTRI

ANNUAL REPORT
2019-2020

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The ASTRI Story

Hong Kong is a city defined by its "Lion Rock Spirit", a core value that has been passed on from generation to generation over the years. It involves a belief that nothing is achieved without hard work, and a tenacity that never knows when it is beaten and that carries on dauntlessly in the face of adversity and hardship. The Hong Kong Applied Science and Technology Research Institute (ASTRI) has celebrated its 20th anniversary at a time when the Lion Rock Spirit has never been more essential. However, this is also a time when innovation and technology is helping humanity push through the challenges towards a brighter future. ASTRI is playing a full part in making this happen.

Established by the Hong Kong SAR Government in 2000, ASTRI strives to enhance the city's global competitiveness in ways that will enable its traditional sectors to thrive, and that will unleash the potential of emerging sectors. ASTRI is doing this by pursuing applied Research and Development (R&D) to deliver innovative and ground-breaking technology that has a resoundingly positive impact on the world around us. We are creating technological solutions that are strengthening our institutions, improving our businesses, and benefiting our communities.

Hong Kong enjoys some distinct strategic advantages. They include strong institutions, solid rule of law, a business-friendly regulatory climate, extremely favourable geographic positioning, as well as seamless regional and international connectivity. ASTRI is leveraging these advantages in its pursuit of vibrant and prolific development in Innovation and Technology (I&T), working in full alignment with the Hong Kong SAR Government's Smart City Blueprint.

Over the past 20 years, ASTRI has helped to drive Hong Kong's success as a dynamic, innovative, global city on multiple fronts, by:

- Training technology talents and generating innovation-centric jobs
- Enabling and attracting investment in technological innovation
- Boosting the contribution of the tech sector to Hong Kong's economy and development
- Creating long-term sustainable value for the I&T ecosystem through active collaborations with the industry and other I&T ecosystem players

Since 2000, ASTRI has:

Completed almost
550
research projects

Been granted more than
850
patents for its innovations

Transferred almost
750
technologies to different industries

Won numerous
AWARDS
for its technological contributions

Connecting information and communication

ASTRI acts as a vital bridge that connects two ends of the Information and Communication Technologies (ICT) spectrum: academics pursuing basic ICT research, and industries that apply ICT technologies. Through this connection, ASTRI creates a positive impact on our society and plays an important role in our city's technology eco-system.

Our R&D strategy

The Hong Kong SAR Government in 2006 set up five R&D Centres to drive and coordinate applied R&D in selected focus areas and to promote commercialisation of R&D results and technology transfer. ASTRI has been designated as the R&D Centre for Information and Communications Technologies. Our R&D endeavours focus on five key areas of applications:

Smart City

Financial Technologies

Intelligent Manufacturing

Health Technologies

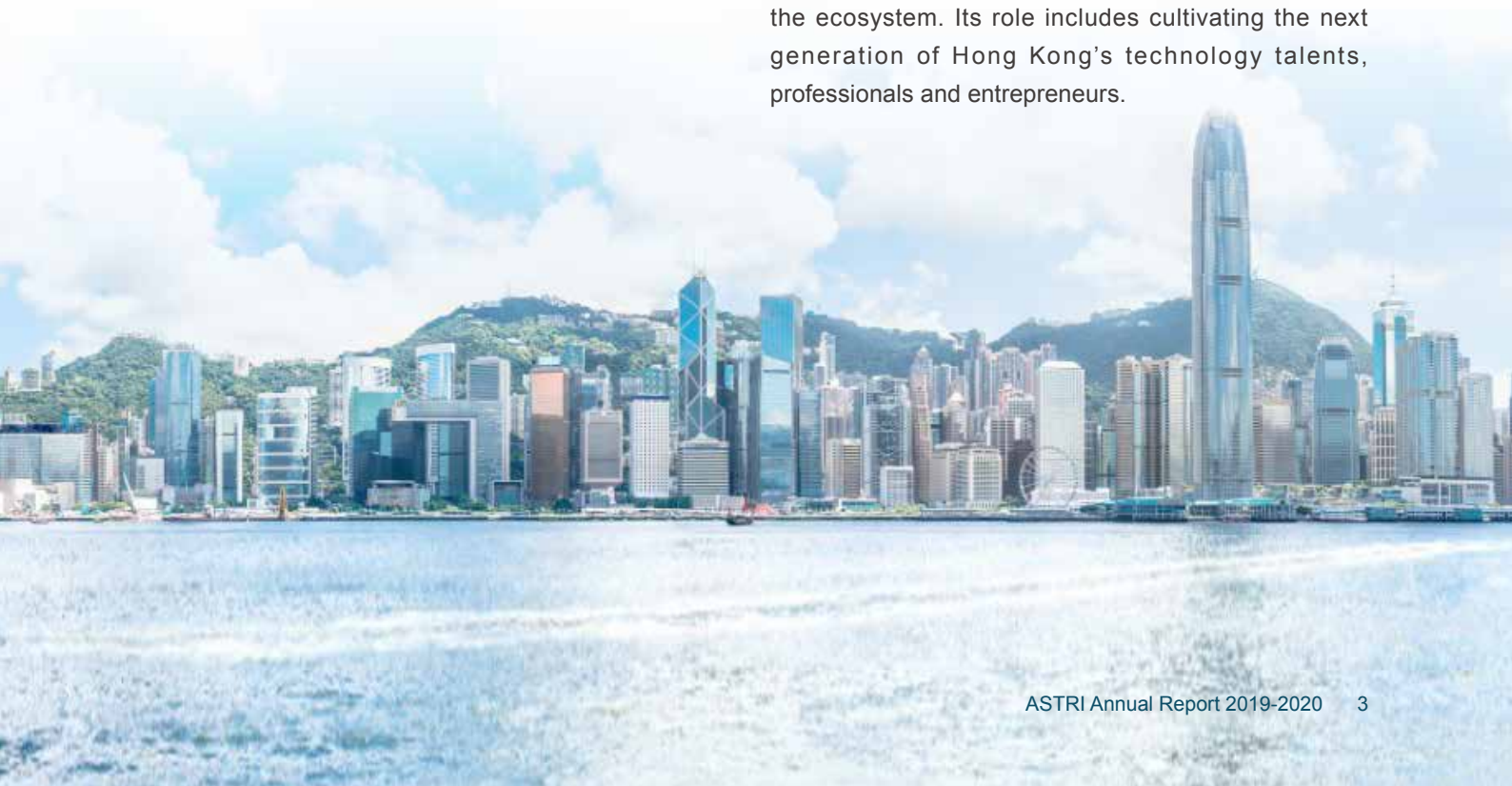
Application Specific Integrated Circuits

Helping Hong Kong thrive

ASTRI's R&D initiatives are powered by collaboration with partners of all shapes and sizes, leading to commercialisation. Working with government agencies, quangos, academia, industry leaders and start-ups, ASTRI creates high-quality, affordable and innovative ICT solutions for both existing and emerging industries.

The aim is to ensure that Hong Kong thrives as a dynamic, global Smart City, able to tap into opportunities across the I&T ecosystem locally, regionally and globally.

By attracting and training a talented technology workforce and partnering with academia and industry, ASTRI also acts as a 'partnerships architect' across the ecosystem. Its role includes cultivating the next generation of Hong Kong's technology talents, professionals and entrepreneurs.



Our guiding principles

Our Vision

To be a world-class technology developer and an enabler to enrich lives

Our Mission

To enhance Hong Kong's competitiveness through applied research

As the largest applied R&D institution in Hong Kong, ASTRI collaborates with multiple players in the I&T ecosystem on projects designed to strengthen Hong Kong's industries through technological innovations. In the process, it is helping the economy to transition into one that is innovation-led and technology-powered.

ASTRI's activities are shaped by the following core values:

Innovation
We innovate to achieve betterment for Hong Kong, our nation and the world.

Accountability
We work in an ethical, honest, open and fair manner and are responsible for our actions.

Respect
We give due respect to all parties, including others and ourselves, to establish and support an environment of teamwork and growth.

Service
We deliver timely and world-class services to our stakeholders.

Tenacity
We strive to overcome all challenges.

Our technology roadmap

In 2019-20, ASTRI's R&D organisation was restructured to work across five Technology Divisions (TDs): Artificial Intelligence and Big Data Analytics (AIBD); Communications (COM); Cybersecurity, Cryptography and Trusted Technologies (CCT); Integrated Circuits and Systems (ICS); and IoT and Sensors(IoTSEN).

These five TDs are delivering market-relevant applications in five areas: Smart City, Financial Technology, Intelligent Manufacturing, Health Technologies, and Application Specific Integrated Circuits (this latter through our mandate as the Hong Kong branch of the Chinese National Engineering Research Centre (CNERC)).

Smart City

ASTRI combines its ICT talents with sensors, intelligence, and next generation network and security technologies to improve how Hong Kong shares information and the operation and efficiency of the city's infrastructure and enhancing the quality of life for its residents.

The Hong Kong SAR Government has a detailed blueprint for Smart City development which, when fully realised, will position Hong Kong as Asia's most advanced 21st century city.

The Smart City revolution will impact every aspect of our lives, our businesses and our communities and create enormous opportunities for sustainable economic growth. We are developing tools and platforms that will enable Smart City technologies to seamlessly communicate with one another. This involves making full use of the upcoming 5G revolution and increasing the functionality of existing smart technologies.

FinTech

Financial Technology (FinTech) is a cornerstone of the financial sector's continued growth. Advanced FinTech solutions are making financial services faster, more reliable, and more secure. They are making it easier for banks, insurers and other financial service providers to cater to the needs of their customers. At the same time, they are enabling customers to access their accounts and information in a more secure and personalised way.

To help Hong Kong maintain its role as a world-class financial hub, our FinTech teams are developing FinTech solutions by leveraging Blockchain technology, strengthening cybersecurity, making sense of big data, and providing valuable proofs-of-concept. As one of Hong Kong's strongest FinTech R&D groups, we are finding ways to benefit the entire financial industry and help drive the sector's growth into a new era.

Intelligent Manufacturing

Our Intelligent Manufacturing R&D is designed to make production processes faster, easier and more efficient. As an emerging Smart City, Hong Kong has the potential to unlock the Industry 4.0 vision by leveraging Artificial Intelligence (AI), robotics and data-centric solutions. The application of AI and robotics is making manufacturing more reliable and effective, while making maintenance significantly easier.

Together, Southern China, Hong Kong and Macau represent a leading centre of advanced manufacturing and modern service industries. Hong Kong stands to gain much by leveraging the transformation taking place in the Guangdong – Hong Kong – Macau Greater Bay Area. Through its R&D work in Intelligent Manufacturing technologies, ASTRI is developing a number of advanced platforms, tools and solutions that are helping to reshape the industrial sector. They are being used to create interconnected, fully digital smart factories, and enabling businesses to streamline their operations, work more efficiently, and become more environmentally friendly.

Health Technologies

ASTRI is fully committed to developing Healthcare Technology solutions that support the medical sector and benefit the community. With support from the Hong Kong SAR Government, we have made breakthroughs in fields such as biomedical imaging and medical data analytics that are enabling medical professionals to better treat patients and even save lives.

ASTRI's Health Technologies strategy involves using R&D to increase the efficiency of healthcare, enhance and personalise medical services, and ultimately improve the quality of people's lives. This involves us developing new applications in areas such as eldercare solutions, preventative health monitoring, medical diagnosis and medical computing.

Application Specific Integrated Circuits

Integrated Circuits (IC) are key components required to achieve innovation-led growth and development for many high-tech industrial sectors. As these sectors strive to significantly upgrade their capabilities – especially in telecommunications, Smart City technology and electronics – reliable and robust IC research is paramount.

Our R&D initiatives in Application Specific Integrated Circuits arise from the mandate given to us in 2012 when the first-ever Hong Kong branch of the Chinese Engineering Research Centre (CNERC) for Application Specific Integrated Circuit Systems was established at ASTRI, in collaboration with Southeast University (SEU) in Nanjing. The branch focuses on microelectronics and integrated circuits applied across various industries.

Chairman's Message

It is a great honour to present ASTRI's Annual Report for 2019-20, a privilege I am enjoying for the first time. This has been a landmark year for Hong Kong's largest research and development centre as we celebrate our 20th anniversary.

Established in 2000 with the mission to make our city and its enterprises more competitive through the application of innovative technology, ASTRI has filed 1,220 patents (of which 866 have been granted and 23 sold), completed 544 research projects and had almost 750 of its in-house-developed technologies transferred to and used in various industries. In 2019-20 alone, we filed 66 patents and had 45 granted.

These accomplishments are thanks in no small part to ASTRI's highly skilled team of professionals to whom I would like to express my most sincere appreciation for all their dedication and diligence.

Celebrating our past, looking to the future

Twenty years is a significant milestone for any organisation. Two decades of relentless pursuit for excellence have earned ASTRI its leadership in 5G communications, FinTech, Intelligent Manufacturing, Health Tech and semiconductors.

I believe ASTRI will continue to create impactful innovations, helping Hong Kong develop as a pioneering Smart City. I see a world where connected devices will run on ASTRI technology, manufactured in factories operating with ASTRI robotics and AGVs; and where consumers will manage their finance and buy properties with confidence, knowing the platform has been made secure by ASTRI. These are just a few examples of the positive changes and lasting value that ASTRI is bringing to our society.

Healthier, happier, more productive

There is no escaping the fact that our outlook has changed dramatically through the 12 months covered by this report. First, our city witnessed considerable social unrest, and then the whole world was disrupted by the Covid-19 pandemic. In the face of these developments our approach has remained unwavering, focused on our mission to make our society a better place.

ASTRI Chairman Ir Sunny Lee Wai-kwong with CEO Hugh Chow (left) and outgoing Chairman Mr Wong Ming-yam SBS JP (centre).

Our recovery from these uncertain times will be driven by digital innovation and inspiration, which will deliver solutions on the national, regional and international levels. It will come through progress in Health Technologies that allow us to detect potential threats to our wellbeing earlier and provide more efficient ways of tackling them.

It will come through the huge opportunities brought about by 5G, which will enhance our ability to work and collaborate remotely, enable us to tap into skills and expertise that may be on the other side of the world, and enhance the efficiency and safety of connected vehicles. It will come through trustable, secure and efficient FinTech that will allow us to carry out many more transactions safely and quickly, wherever we are.

Teamwork drives our every success

At ASTRI, we place great importance on the development of the next generation of technology talent, nurturing our R&D team through industry engagement, university collaborations and creating opportunities for students and graduates. These scientists, engineers and researchers sit behind every inspired idea, successful patent or technology transferred into industry use.

We will continue to develop this bridge that connects the talent and inventions emerging from our world-class educational institutes with the opportunity to create life-changing technology that benefits our society.

Greater role in Greater Bay Area

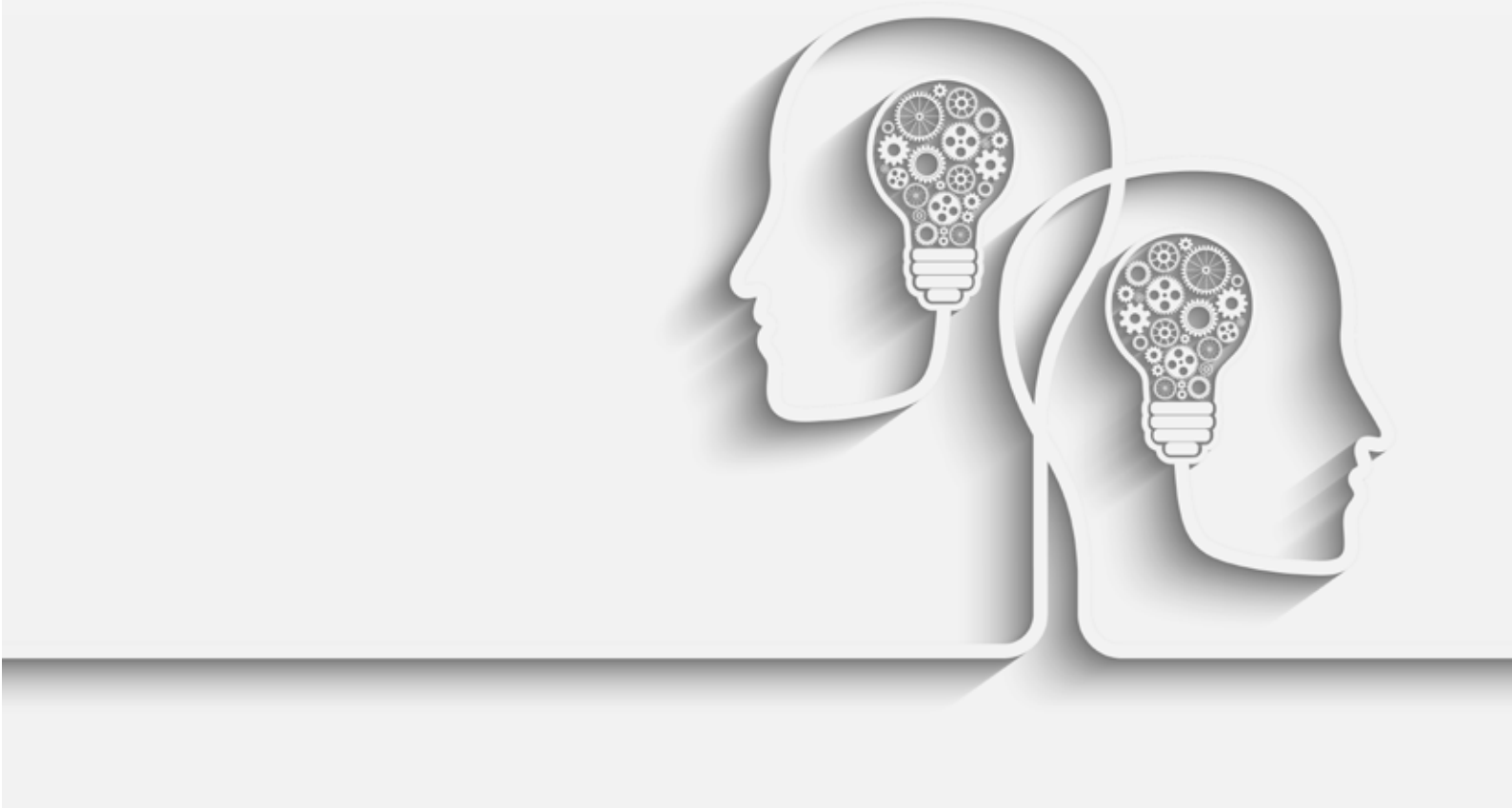
I would like to thank the Innovation and Technology Bureau and the Innovation and Technology Commission for their continued support and guidance to ASTRI and express my deepest gratitude to all the members of ASTRI's Board of Directors for their leadership and shared wisdom.

The HKSAR Government has shown its great commitment to infrastructure and talent development in our city, aiming to make us an international innovation hub. ASTRI strives to be a key player in this innovation and technology ecosystem, not only in our city but nationally.

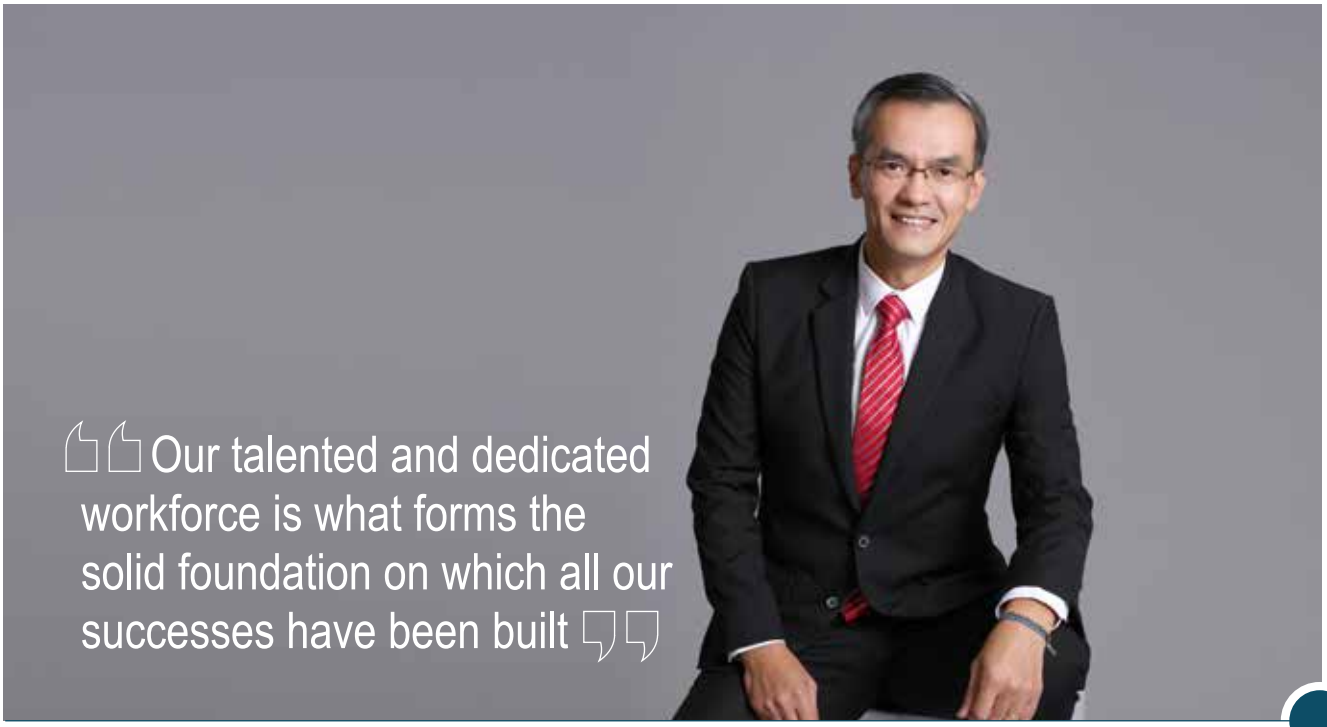
As major initiatives such as the Greater Bay Area development plan and the Belt and Road scheme gather pace, Hong Kong must bring its strengths to the table. Its expertise in financial services, creative design, technology research, flow of information, legal and IP frameworks all make our city uniquely placed to cement its place in this historic moment.

We now live in a world unlike the one we had grown accustomed to. However, it remains one in which technology is shaping every aspect of our lives and providing solutions to many of our biggest challenges. Our city has shown its resilience and its ability to adapt to changing circumstances in the past, and it will do so again. ASTRI will play a vital part in the next stage of Hong Kong's evolution propelling it to even greater technological heights.

Ir Sunny Lee Wai-kwong, JP
Chairman, Board of Directors



Chief Executive Officer's Report



Our landmark anniversary year, celebrating 20 years of successful innovation, is one that will certainly stick in the memory for a long time. Some of this was not necessarily for the reasons we might have hoped. However, many of the "pain points" we have experienced recently are exactly the ones that we at ASTRI are striving to address and for which we are working to create ground-breaking solutions.

Undeterred by the global lockdown caused by the Covid-19 pandemic, our ASTRIANs continued their day-to-day business of creating cutting-edge solutions and promoting a culture of innovation, even though they have had to do it remotely. The success of their research efforts despite having to manage home office inconveniences and only being able to communicate electronically has simply served to confirm my long-held belief: our talented and dedicated workforce is what forms the solid foundation on which all our successes have been built.

In the face of the pandemic, our innovation continued apace. We continued our collaborations with a broad range of partners, ranging from government agencies and quangos, multinationals, small and medium-sized enterprises and academic groups.

We reached a significant milestone in the field of commercial, high-performance 5G core networks when, together with technology giant Intel Corporation and United States-based IT firm Supermicro, ASTRI demonstrated a ground-breaking traffic volume of 1.3 Tbps throughput performance on a 5G core network.

Our work with Intel also included the development of our Roadside Edge AI for Cellular Vehicle-to-Everything (C-V2X) technology, following on from our successful trials and demonstrations last year. The powerful potential of this technology was demonstrated at the Mobile World Congress (MWC) in Shanghai. At the same event, we partnered with China Mobile Hong Kong to showcase our intelligent IoT and Blockchain platform, which stores data collected from vehicles, smart lampposts and car parks.

An ASTRI agreement with CITIC Telecom CPC will bring together talent from both parties to work on next-generation operations and maintenance technologies using Augmented Reality (AR) glasses, improving efficiency and enhancing real-time operations. Meanwhile, a whitepaper authored by a group of our researchers has been published that explores the immense potential of FinTech tools and applications, especially for Treasury professionals across diverse industries. We continue to work closely with a wide variety of stakeholders across our city, uniting talented minds to benefit Hong Kong's technology ecosystem.

This is just a small selection from the many endeavours undertaken over the 12 months covered by this report that demonstrate our commitment to creating a meaningful impact on Hong Kong's economy and community.

Across our five Technology Divisions, we undertook 117 projects in 2019-20, up from 101 in the previous year. In total, 46 technologies were transferred to different industries, generating HK$127.32 million in income from those industries. ASTRI filed over 66 patent applications in China, the US and other countries, while 45 new patents were granted.

Throughout the year, we participated in leading industry events locally, regionally and internationally, promoting and championing our city's growing I&T development. For the second consecutive year, we took part in the world's largest innovation expo in Geneva, the International Exhibition of Inventions, bagging 21 awards – a 50 per cent increase on the 14 we received the year before. We also won multiple awards at other prestigious events, including the Hong Kong ICT Awards, the Hong Kong Awards for Industries and the Asia International Innovative Invention Awards.

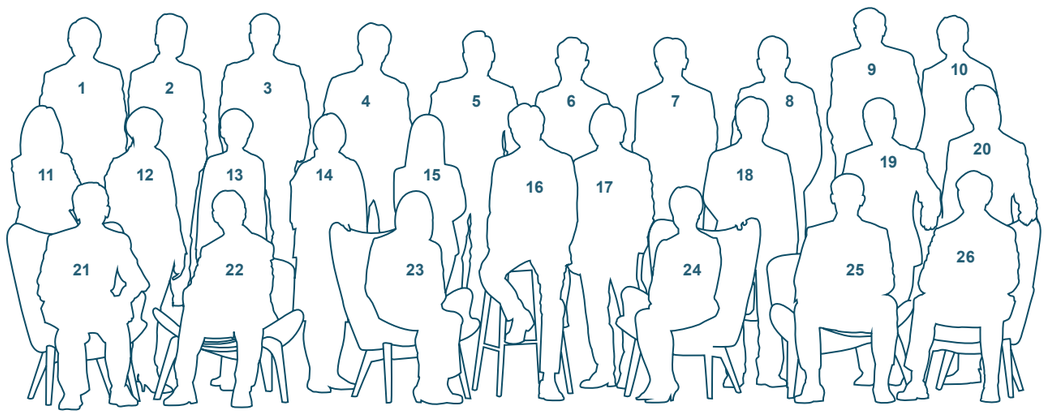
At the second edition of our flagship thought leadership event Technovation Summit, we were honoured to count the then Secretary Innovation and Technology Mr Nicholas W Yang, GBS, JP, among our speakers addressing the theme of Hong Kong's smart future. Our guests enjoyed insights into topical issues and ways we can all contribute to Hong Kong's technology ecosystem. ASTRI experts also contributed insights and views to many other conferences and expos around the world, covering extremely diverse fields of technological advancement.

As we continue to adapt to our unusual new circumstances, I have no doubt that ASTRI and Hong Kong will continue to drive innovation. Time and time again, our city has proven itself as we grew from an Asian Dragon powered by manufacturing to become China's gateway to the world. Now the Hong Kong SAR Government has a blueprint to establish our city as a global I&T hub and a vital part of the Greater Bay Area. ASTRI is working in full alignment with this ambitious goal.

The present might feel unfamiliar, but our future is bright.

Hugh Chow
Chief Executive Officer

Board of Directors



ASTRI Board of Directors and Senior Management

1 Mr Kwong Chi-keung, JP
2 Prof Lam Tak-wah
3 Mr Andy Liu An-ting
4 Mr Charles Chow Sai-keung
5 Mr Duncan Chiu
6 Ir Dr Alan Lam Hiu-fung
7 Mr Stephen Chau Kam-kun
8 Mr Steve Chuang Tzu-hsiung
9 Prof Chan Chun-kwong
10 Mr Peter Ng Hon-yu
11 Prof Sabrina Lin Man-yee
12 Ms Seraphina Wong
13 Ms Cally Chan Shan-shan
14 Ms Cammy Yung
15 Ms Ada Wong Yin-man
16 Ir Sunny Lee Wai-kwong, JP
17 Dr Martin Szeto
18 Dr Lucas Hui
19 Ir Prof Joseph Ng Kee-yin
20 Mr Aaron Ho
21 Mr Ha Yung-kuen, BBS
22 Dr Davy Lo Kwok-wai
23 Ms Rebecca Pun Ting-ting, JP
24 Ms Annie Choi Suk-han, JP
25 Mr Hugh Chow
26 Mr Stephen Ho Wai-chung

Composition of the Board

As of 31 March 2020, the Board was headed by a Chairman and included 19 other members, two of whom were ex-officio members.

Name of Board Member	Title and Company of Board Member
Chairman	
Ir Sunny Lee Wai-kwong, JP	Vice-President (Administration), City University of Hong Kong
Official Members	
Ms Annie Choi Suk-han, JP	Permanent Secretary for Innovation and Technology, Innovation and Technology Bureau
Ms Rebecca Pun Ting-ting, JP	Commissioner for Innovation and Technology, Innovation and Technology Commission
Members (in alphabetical order of surname)	
Professor Chan Chun-kwong	Programme Director, MSc in Financial Technology, Faculty of Engineering,Professor of Practice in FinTech, Department of Systems Engineering and Engineering Management,The Chinese University of Hong Kong
Ms Cally Chan Shan-shan	General Manager, Hong Kong and Macau, Microsoft Hong Kong Limited
Mr Stephen Chau Kam-kun	Executive Director & Chief Technology Officer, SmarTone Telecommunications Holdings Limited
Mr Duncan Chiu	Chairman, Lai Yuen Company Limited
Mr Charles Chow Sai-keung	South China and Hong Kong Assurance Leader, PricewaterhouseCoopers
Mr Steve Chuang Tzu-hsiung	Chairman and Chief Executive Officer, ProVista Group
Mr Ha Yung-kuen, BBS	-
Mr Stephen Ho Wai-chung	-
Mr Kwong Chi-keung, JP	Senior Partner, Sit, Fung, Kwong and Shum Solicitors and Notaries
Ir Dr Alan Lam Hiu-fung	Chief Executive Officer, Sengital Limited
Professor Lam Tak-wah	Head, Department of Computer Science, The University of Hong Kong
Professor Sabrina Lin Man-yee	Senior Advisor to the President, Office of the President, The Hong Kong University of Science and Technology
Mr Andy Liu An-ting	CEO, CW Data Technologies and Vice Chairman, Hong Kong Biotechnology Organization
Dr Davy Lo Kwok-wai	Consultant
Mr Peter Ng Hon-yu	Vice President, Technology, Enabling Technology Group, ASM Pacific Technology Ltd.
Ir Professor Joseph Ng Kee-yin	Professor, Department of Computer Science, Hong Kong Baptist University
Ms Ada Wong Yin-man	Executive Director, Wong's International Holdings Ltd

Board Functional Committees

Three functional committees assist the Board in its oversight of ASTRI: the Finance and Administration Committee (FAC), the Technology Committee (TC), and the Audit Committee (AC). The FAC oversees ASTRI's financial and administrative arrangements; the TC oversees its R&D initiatives; and the AC ensures that internal and external audit processes are properly carried out.

The members of the committees as at 31 March 2020 were as set out below:

Finance and Administration Committee	Technology Committee	Audit Committee
Mr Ha Yung-kuen, BBS (Chairman)	Mr Stephen Ho Wai-chung (Chairman)	Dr Davy Lo Kwok-wai (Chairman)
Ms Cally Chan Shan-shan	Ms Cally Chan Shan-shan	Professor Chan Chun-kwong
Mr Duncan Chiu	Mr Duncan Chiu	Mr Charles Chow Sai-keung
Professor Sabrina Lin Man-yee	Mr Steve Chuang Tzu-hsiung	Mr Kwong Chi-keung, JP
Mr Andy Liu An-ting	Mr Ha Yung-kuen, BBS	Ir Dr Alan Lam Hiu-fung
Dr Davy Lo Kwok-wai	Ir Dr Alan Lam Hiu-fung	Ms Rebecca Pun Ting-ting, JP
Ms Rebecca Pun Ting-ting, JP	Professor Lam Tak-wah	Ms Ada Wong Yin-man
	Ir Sunny Lee Wai-kwong, JP	
	Dr Davy Lo Kwok-wai	
	Mr Peter Ng Hon-yu	
	Ir Professor Joseph Ng Kee-yin	
	Ms Rebecca Pun Ting-ting, JP	

New Directors

	Date of Appointment
Mrs Millie Ng Kiang Mei-nei, JP	12 April 2019
Ms Rebecca Pun Ting-ting, JP	30 July 2019
Professor Chan Chun-kwong	1 March 2020
Mr Stephen Chau Kam-kun	1 March 2020
Mr Peter Ng Hon-yu	1 March 2020
Ir Professor Joseph Ng Kee-yin	1 March 2020

Retired Directors

	Date of Retirement
Mr Cheuk Wing-hing, JP	12 April 2019
Mrs Millie Ng Kiang Mei-nei, JP	30 July 2019
Mr Wong Ming-yam, SBS, JP	21 October 2019
Ms Hera Siu Kit-wan	2 January 2020
Professor Liew Soung-chang	1 March 2020
Dr Archie Yeh Tsuei-chi	1 March 2020

Meeting Attendance

A total of four Board meetings were convened during the 2019-20 year. The attendance records of members at Board meetings as well as Board Functional Committee meetings held between 1 April 2019 and 31 March 2020 are as follows:

Board Meetings				
	26 Jun 2019	24 Sep 2019	11 Dec 2019	1 Apr 2020*
Total number of directors during the period	20	20	19	20
Total number of directors present at meeting	12	15	12	19
Total number of apologies	8	5	7	1
Percentage in attendance	60%	75%	63%	95%

* originally scheduled on 26 March 2020

FAC Meetings				
	21 May 2019	26 Aug 2019	13 Nov 2019	20 Feb 2020
Total number of directors during the period	7	7	7	7
Total number of directors present at meeting	5	5	4	6
Total number of apologies	2	2	3	1
Percentage in attendance	71%	71%	57%	86%

TC Meetings				
	5 Jun 2019	3 Sep 2019	22 Nov 2019	6 Mar 2020
Total number of directors during the period	14	14	12	12
Total number of directors present at meeting	10	10	6	11
Total number of apologies	4	4	6	1
Percentage in attendance	71%	71%	50%	92%

AC Meetings				
	30 May 2019	30 Aug 2019	27 Nov 2019	3 Mar 2020
Total number of directors during the period	6	6	6	6
Total number of directors present at meeting	5	6	5	6
Total number of apologies	1	0	1	0
Percentage in attendance	83%	100%	83%	100%

Our organisation

Operating under the auspices of the Hong Kong SAR Government's Innovation and Technology Commission (ITC), ASTRI is led by the Chief Executive Officer, who is accountable to the Board of Directors. The CEO is responsible for all matters relating to the overall management of the organisation, assisted by a Senior Management team of C-officers – responsible for R&D, operations, finance, marketing, administration and other supporting functions – and Technology Division Heads who lead ASTRI's five R&D teams, overseen by the Chief Technology Officer.

Over the past 20 years, ASTRI has helped to drive Hong Kong's success as a dynamic, innovative, global city on multiple fronts, by:

C-officers

In 2019-20, the following C-officers were members of the Senior Management team:

Mr Aaron Ho
Chief Administrative Officer

Ms Cammy Yung
Chief Financial Officer

Dr Lucas Hui
Chief Technology Officer

Mr Hugh Chow
Chief Executive Officer

Dr Martin Szeto
Chief Operating Officer

Ms Seraphina Wong
Chief Marketing Officer

Annual remuneration of staff in the organisation's top three tiers

Post	Annual Remuneration* 1 Apr 2019 – 31 Mar 2020 (HK$)
First tier Chief Executive Officer	$4,027,500
Second tier Five senior executives	$9,728,620
Third tier Nine functional leaders/senior technology experts	$16,359,010

Annual Remuneration* (HK$)

Annual Remuneration* (HK$)	Number of staff in the top three tiers
1,000,000 or below	2
1,000,001 to 1,500,000	0
1,500,001 to 2,000,000	6
2,000,001 to 2,500,000	4
2,500,001 to 3,000,000	1
3,000,001 to 3,500,000	1
3,500,001 to 4,000,000	0
4,000,000 to 4,500,000	1

Technology Division Heads

ASTRI's five Technology Divisions are responsible for the development of their respective technologies. Each is headed by an experienced leader in the field. The Divisional Heads in 2019-20 were as follows.

Dr Daniel Shi
Senior Director, Integrated Circuits and Systems (ICS)

Dr Tsai Chen Jung
Senior Director, IoT and Sensors (IoTSEN)

Dr Justin Chuang
Vice President, Communications Technologies (COM)

Mr Alan Cheung
Senior Director, Cybersecurity, Cryptography and Trusted Technologies (CCT)

Dr James Lei
Senior Director, Artificial Intelligence and Big Data Analytics (AIBD)

* Annual remuneration includes base salary, salary adjustment, acting allowance, performance-linked payment, variable payment and cash award (Inventor Award). It is rounded to the nearest HK$10. Annual remuneration of staff who are appointed during the financial year were calculated on a prorated basis.

Teamwork makes the dream work

People represent the most important part of our organisation. Our success stems from combining a highly skilled workforce, the right leadership and guidance, and a dynamic organisational structure. With over 600 dedicated and highly competent individuals all working towards a common goal, we operate as a single team helping to create a better, brighter future for Hong Kong and our nation.

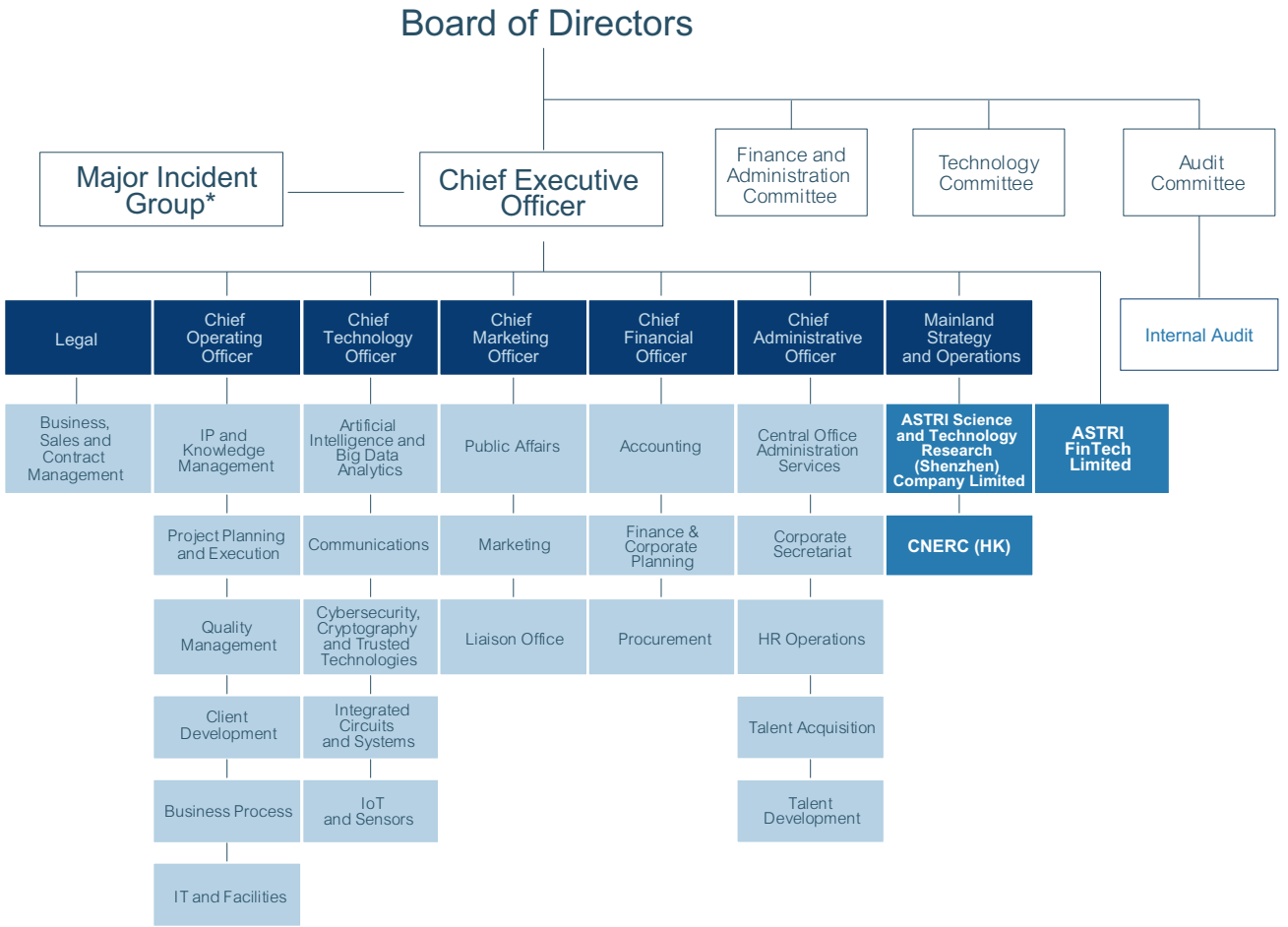
Organised under the five Technology Divisions, our R&D teams account for 73% of the total workforce. The remaining portion is made up of personnel providing various support services and functions. They include teams working in our departments of Finance and Accounts, Marketing, Procurement, Legal, Information Technology, Facilities Management, Human Resources, Client Development, Intellectual Property and Knowledge Management, and Project Management.

Expert focus

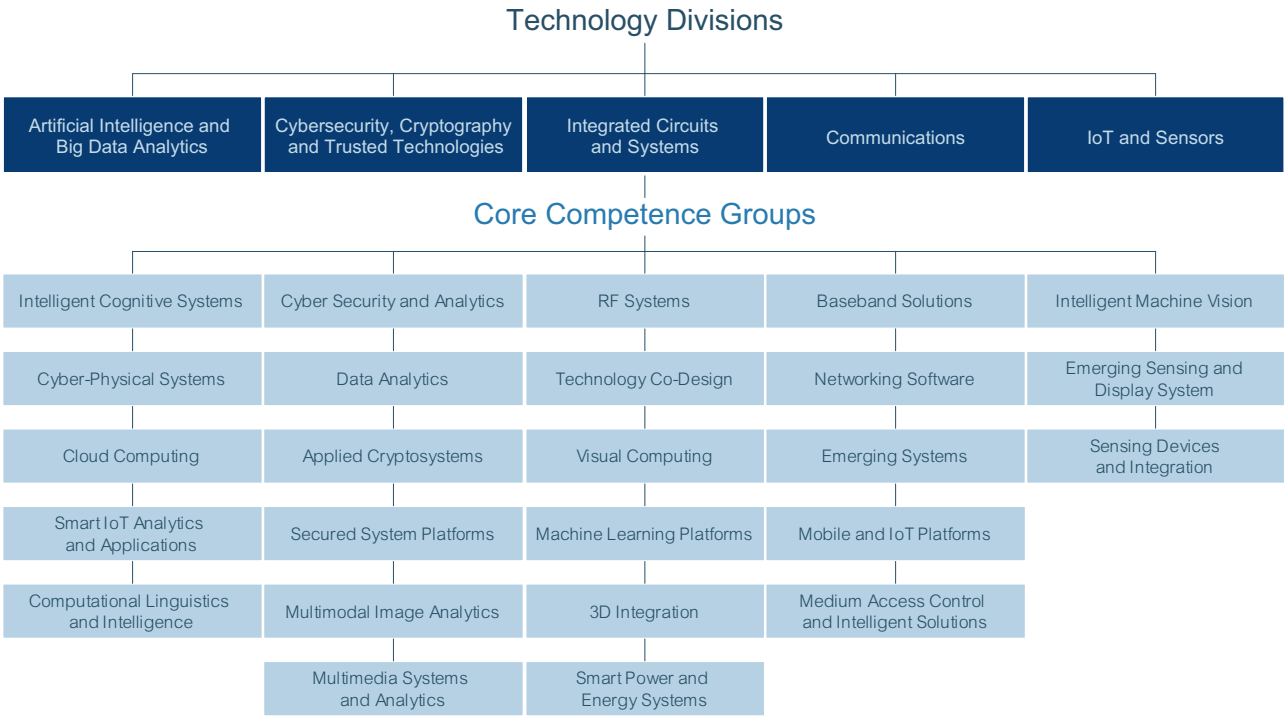
Our Technology Divisions utilise their diverse talent pools and specialised skills to develop innovative tools and technologies. We also work as a synchronised organisation that brings together skills and expertise from across our Technology Divisions, in order to cater to the specific market-oriented needs of particular industries or sector-specific applications.

The following chart represents ASTRI's organisational structure as at 31 March 2020:

ASTRI organisational structure



ASTRI R&D organisational structure

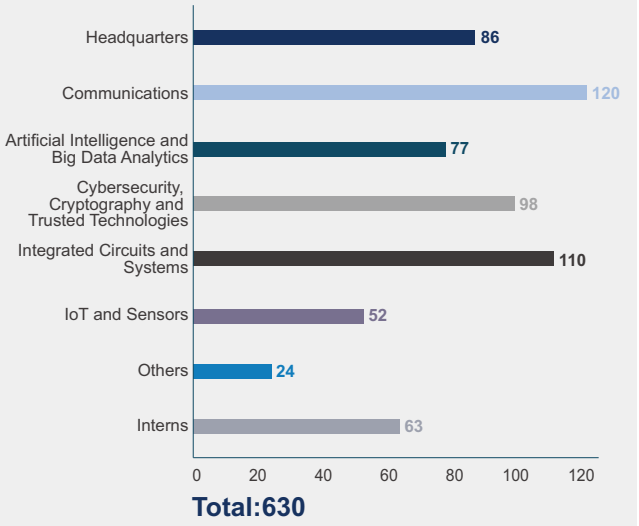


Diverse career options

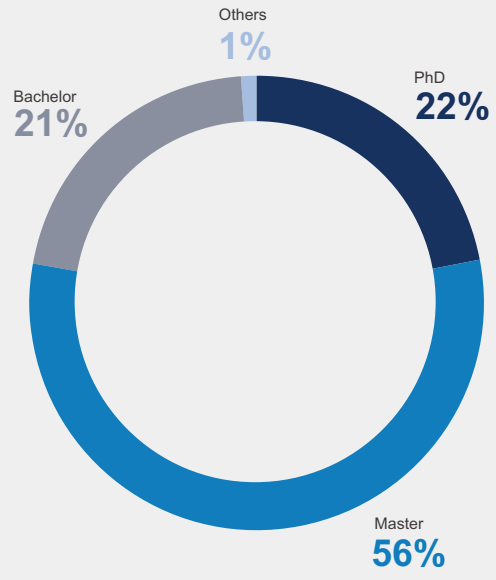
ASTRI offers career paths that suit scientists, researchers, engineers and professionals with diverse skills, backgrounds and aspirations from around the world.

As of 31 March 2020, ASTRI had a total of 630 employees.

Employee numbers by function



Academic qualifications of R&D staff as of 31 March 2020



Governance and Control

As a publicly funded R&D centre, ASTRI adheres to the highest standards of corporate governance. We work in line with our mission, in the interests of our stakeholders and the taxpayers of Hong Kong.

ASTRI operates in accordance with its Corporate Governance Manual, which clearly articulates our policies and principles. The Manual also guides the efforts of the Board and Senior Management to ensure ASTRI always operates in a transparent and accountable manner.

The Manual contains comprehensive guidelines on:

- Organisation and management structure
- HR policies and staff conduct
- Financial management and control
- Internal control and external reporting
- Risk management

The Manual is updated periodically to incorporate any developments needed to improve ASTRI's operations, and to reflect the changing business environment.

Internal audit

In 2003, ASTRI set up an Internal Audit Department (IAD) under the Audit Committee. The role of the IAD is to ensure effective corporate governance and to provide the Board with information about and assurance of the effectiveness of ASTRI's internal controls.

The IAD provides objective reviews and assurances that provide us with a systematic, disciplined approach to evaluating and improving our risk management, control and governance processes.

Over the past year, the IAD has conducted internal audit reviews on various areas of ASTRI's operations in line with the risk-based rolling 3-year Internal Audit Plan approved by the Audit Committee. These areas have included project management, inventory management, intellectual property management, staff recruitment management, insurance management, user education and awareness on cybersecurity, corporate governance, and secretariat support management. While these reviews identified some areas for improvement, they confirmed that ASTRI had significant controls in place and that the existing regulations and procedures were being observed in all material respects. The IAD submitted half-yearly reports of these reviews and their recommendations to the Audit Committee.

Compliance

As the Compliance Officer, the Head of Internal Audit helps the Board to ensure good governance by reporting any significant non-compliance issues identified by a team of Departmental Compliance Officers. The Compliance Officer submits quarterly reports to the Audit Committee on important compliance matters.

Safeguards against conflicts of interest

ASTRI has strict controls and safeguards in place against conflicts of interest. The Code of Conduct is regularly reviewed and updated as necessary to ensure that potential conflicts are always declared and adequately managed. All ASTRI employees are required to make an annual declaration to confirm that they have read, understood and are in compliance. The last update of the Code of Conduct was made in June 2019, and the relevant changes were communicated to everyone in ASTRI.

Workplace policy

ASTRI has zero tolerance for discrimination and harassment. We organise regular seminars on relevant policies and regulations, with the aim of promoting equal opportunities and preventing discrimination and harassment in the workplace.

Risk management

ASTRI has a Risk Management (RM) framework in place to identify, evaluate and mitigate risks. It has been designed based on ASTRI's RM policy, which covers issues such as the roles and responsibilities of different parties, the RM process, and risk communication.

A Risk Register is also maintained to keep track of various risks that ASTRI encounters. The Risk Register covers the following broad thematic categories:

- Strategy and partnership
- Corporate governance and ethics
- Compliance
- Corporate communications and relations
- Research and development
- Human resources
- Finance
- Information technology
- Health and safety, premises and facilities
- Reporting

Updated on a regular basis, the Risk Register is reported periodically to the Board via the Audit Committee.

Quality management system

For ASTRI, quality is paramount for all its research deliverables. The high standard of our research and innovation work in different technology areas is

supported by our organisation-wide adoption of the ISO 9001 Quality Management standard. The ISO 9001 standard helps ASTRI to deliver consistently high-quality products and services that meet the expectations and enhance the satisfaction of our clients and partners. In June 2019, international quality assurance body Bureau Veritas Certification conducted an ISO 9001 certification audit on ASTRI's operations. The Audit certified that ASTRI's operations were fully compliant with the standards, with zero non-conformance.

ASTRI also actively seeks opportunities to improve the quality of its operations through effective communication and exchanges with all its stakeholders.

Information security management system

Cyber-crime poses one of the most serious threats to governments and legitimate businesses worldwide. ASTRI has adopted the ISO 27001 Information Security Management standard for its R&D endeavours in Financial Technologies to safeguard the confidentiality, integrity and accessibility of information. This standard is helping us mitigate cybersecurity risks and improve our cyber-defence capabilities. Our FinTech R&D professionals regularly attend information security awareness training sessions on the latest and most advanced tools for mitigating cyber-risks. Every quarter, an external consultancy company performs vulnerability assessment and penetration tests on ASTRI's Information Technology infrastructure and network equipment to ensure our security controls remain effective. In October 2019, the certification body SGS Hong Kong Limited conducted an ISO 27001 surveillance audit of ASTRI's operations and found no non-conformance. ASTRI is continuing to improve and strengthen its data, information and operations, staying abreast of the latest technologies to combat evolving cybersecurity risks.

Achievements

Awards and recognitions

21 awards for ASTRI at world's largest innovation expo

ASTRI continued its streak of success at the 47th International Exhibition of Inventions of Geneva, winning 21 awards including four Gold Medals with Congratulations of the Jury, seven Gold medals, nine Silver medals and one Bronze medal.

The International Exhibition of Inventions of Geneva, known as the world's most prestigious event for inventors, is organised annually jointly by the World Intellectual Property Organisation (WIPO), the Swiss Federal Government, the State and the City of Geneva. In 2019, around 1,000 new inventions and products were showcased there, created by over 800 exhibitors from 40 countries and territories. Well over 31,000 visitors from all five continents made this the largest innovation expo in the world. The Hong Kong delegation, comprising around 15 institutions and universities, won 117 awards in total.

ASTRI's medal haul at the event made it the most awarded organisation of all the Hong Kong exhibitors. Its award-winning projects were:

Gold Medals with Congratulations of the Jury

- Enhanced Mobile Edge Computing (MEC) with International Mobile Subscriber Identity (IMSI) Acquisition
- Separator Coated with Self Shutdown Layer of High Porosity for Lithium Ion Battery
- Compact Spectrometer Having Reflective Wedge Structure
- Medical Image Data Analytics Platform

Gold Medals

- High accuracy low power time and frequency synchronisation methods for Bluetooth Low Energy wireless communication system
- Nomadic Mobile Base Station for Emergency Service
- Three Dimensional Fully Molded Power Electronics Module for High Power Applications and the Method Thereof
- Intelligent industry robot: 3D vision & cognition
- Integrated Bi-sensing Optical Structure for Head Mounted Display
- Efficient and Robust Human Detection/Tracking Method and System with Video Input
- Mobile Biometrics Authentication Technology

Silver Medals

- Sampling frequency offset tracking based on decision feedback channel estimation
- Bluetooth Low Energy (BLE) Network, Security and Positioning
- Cellular Vehicle-to-Everything (C-V2X) System for Road Safety and Smart Mobility Applications
- 3D Power Device Packages for High Frequency Power Conversion
- Micro-nano Structured Nano-size Aggregate Encapsulated in Micro-size Conglomerate for Conductivity Electrode
- Method for Error Correction for a Multicast Message
- Multi-location Learning Activity State Management for Distance Education
- Machine Learning Artificial Character Generation
- Efficient and Accurate Named Entity Recognition Method and System

Bronze Medal

- Modified Pseudo-Cylindrical Mapping of Spherical Video Using Linear Interpolation of Empty Areas for Compression of Streamed Images

ASTRI honoured for two exceptional innovations

ASTRI received two awards at the prestigious Hong Kong Awards for Industries (HKAI) 2019:

- An Equipment and Machinery Design Award for the Biometrics Optical See Through Head Mounted Display, jointly with ASTRI's industry partner Profit Peak Hong Kong Holdings Limited
- A Design Certificate of Merit for the Fast Multi-Focus Automatic Inspection Equipment for Optical Communication Components, jointly with ASTRI's industry partner O-Net Technologies (Group) Limited

Mr Hugh Chow, Chief Executive Officer, Dr Martin Szeto, Chief Operating Officer, and Dr Chen Jung Tsai, Senior Director of the IoT and Sensors Technology Division, represented ASTRI at the HKAI presentation ceremony, which was officiated over by Dr Bernard Chan, JP, Under Secretary for Commerce and Economic Development, and Ms Salina Yan, JP, Director-General of Trade and Industry.

ASTRI's Cervical Cancer Screening Management System wins Silver at Hong Kong ICT Awards

ASTRI's Cervical Cancer Screening Management System (CCSMS) won the Smart Living (Smart Healthcare) Silver Award at the Hong Kong ICT Awards 2019. Mrs Carrie Lam, Chief Executive of Hong Kong SAR, officiated at the awards presentation ceremony, which took place on 4 April 2019.

The CCSMS is a highly accurate scalable computer-aided diagnostic platform that enables users to process and view medical images from different vendors and in different image formats. It also provides diagnosis recommendations for doctors, and allows healthcare professionals to carry out remote medical diagnoses. CCSMS has been commercialised through one of the largest diagnostic service providers in Mainland China and Hong Kong.

The Hong Kong ICT Awards were established in 2006. They recognise and promote outstanding information and communications technology (ICT) inventions and applications, thereby encouraging innovation and excellence among Hong Kong's ICT talents and enterprises.

ASTRI strikes gold in Asia International Innovative Invention Award

ASTRI's Flexible Integration of Recognition and Semantic project, led by Dr Arvin Tang, won a Gold Award in the Asia International Innovative Invention Award 2019. The Handwritten OCR technology can recognise handwritten traditional and simplified Chinese, Hong Kong colloquial language and special characters, and English block letters and numeric digits. Highly accurate in Chinese character recognition, the application is especially useful for Chinese address correction, saving time and improving reliability for organisations that process a large number of handwritten forms.

In its ninth year, the Asia International Innovative Invention Award recognises the achievements of local companies, research teams and individuals for their patented inventions, and more generally promotes a spirit of creativity and innovation.

Leading expos and industry events

International ICT Expo 2019

ASTRI took part in the International ICT Expo 2019, organised by the Hong Kong Trade Development Council, held from 13 to 16 April 2019 at the Hong Kong Convention and Exhibition Centre. Over 600 organisations participated, and the event attracted more than 30,000 visitors. ASTRI's pavilion showcased a number of innovative R&D projects aligned with the Expo's theme, 'Tech-Forward Ideas for Smart Cities'.

Among a long list of distinguished personalities who visited ASTRI's pavilion were the Honourable Alvin Yeung Ngok-kiu, Legislative Councillor; Mr Victor Lam, Government Chief Information Officer of the Hong Kong SAR Government; Mr Duncan Chiu, Chairman of the HKTDC Information & Communications Technology (ICT) Services Advisory Committee and Member of ASTRI's Board of Directors; and Mr Benjamin Chau, Deputy Executive Director of the Hong Kong Trade Development Council. In addition to local and international VIPs and industry leaders, a large number of students and young people also viewed ASTRI's R&D demonstrations and learned more about its many innovative ventures from R&D experts stationed at the pavilion.

Innovations showcased by ASTRI at the expo included:

- Virtual and Augmented Reality solutions
- Handwritten Chinese form processing system
- Intelligent Activity Tracker for healthy living
- Cellular Vehicle-to-Everything (C-V2X) Software System
- Mixed-language Chatbot
- Wireless Power Transfer Technology
- Palm Fusion Biometric Authentication
- Blockchain-based KYC
- Smart Pole

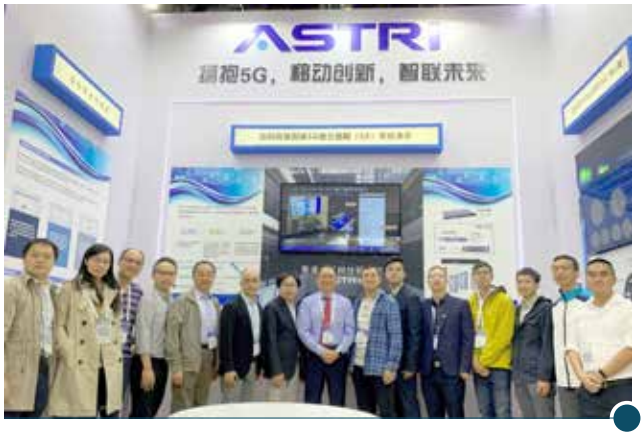
ASTRI technologies showcased at PT Expo China 2019 in Beijing

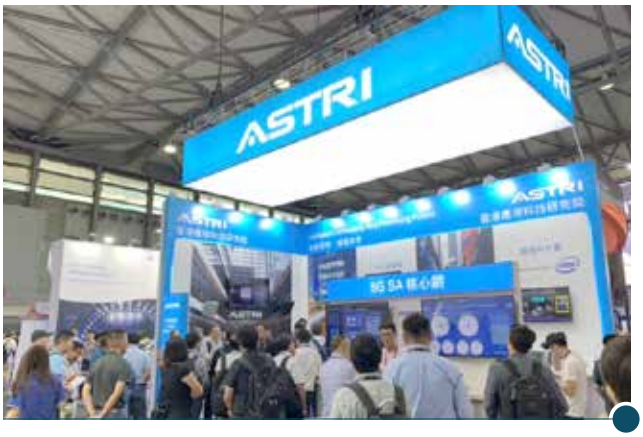
ASTRI showcased several of its new technologies at the PT Expo China 2019 in Beijing. Hosted by the Ministry of Industry and Information Technology, this is one of Asia's leading Information and Communications Technology (ICT) events. It explores the exciting impact of next-generation ICT developments on various industries, as well as tracking trends in the dynamic and fast-growing ICT market.

Under the theme "Embracing 5G for Innovation and Intelligent Connectivity", ASTRI showcased the technologies behind some of its innovative solutions that are enhancing the competitive strengths of enterprises across Hong Kong, the Greater Bay Area and internationally. These included:

- ASTRI end-to-end 5G systems supporting stand-alone (SA) and Non-standalone (NSA) networks
- Smart mobility technologies, including Cellular Vehicle-to-Everything (C-V2X), Electronic Road Pricing (ERP) and other Intelligent Transport System (ITS) services
- Intelligent Blockchain-based IoT Platform
- Narrowband Internet of Things (NB-IoT) Chip
- LoRaWAN Application
- Smartphone Spectrometer
- 4Kx2K UHD Augmented Reality Head Mounted Display

Held from 31 October to 3 November, the PT Expo China 2019 showcased a huge array of 5G and other next-gen ICT solutions. It attracted more than 60,000 attendees from all ICT ecosystem sectors, as well as over 400 leading companies and organisations.





Powering the Smart City revolution: ASTRI presents 5G innovations at Mobile World Congress Shanghai 2019

With the world now stepping into the 5G era, ASTRI showcased a series of 5G-enabling hardware and software solutions it is developing with its ecosystem partners at the Mobile World Congress (MWC) Shanghai 2019, held from 26 to 28 June. In addition, ASTRI jointly performed various technology demonstrations at its partners' booths. The following technologies and solutions were on display at the event:

- 5G end-to-end system (5G C-RAN base station and 5G Core)
- 5G standalone Core Network at 200Gbps (jointly with Intel)
- Edge Computing and AI for road safety (jointly with Intel)
- Smart mobility technologies (jointly with HKT)
- Narrowband Internet of Things (NB-IoT) Chip (jointly with Keysight)
- Biometric Optical See Through (OST) Head Mount Display (HMD)
- Virtual Mobile Core Network auto scaling with ONAP DataLake (jointly with QCT and CMRI)
- Intelligent Blockchain-based IoT Platform (jointly with CMHK at GSMA Innovation City)

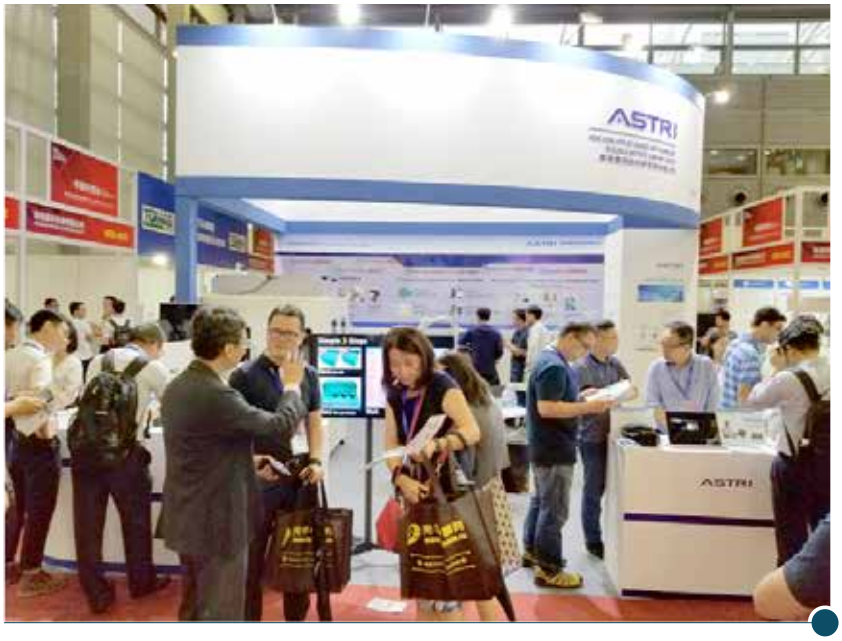
MWC Shanghai is one of the largest telecommunication industry expos in the world, bringing together the latest innovations and leading-edge technology from more than 550 leading companies, for a 60,000-strong business-to-business audience.

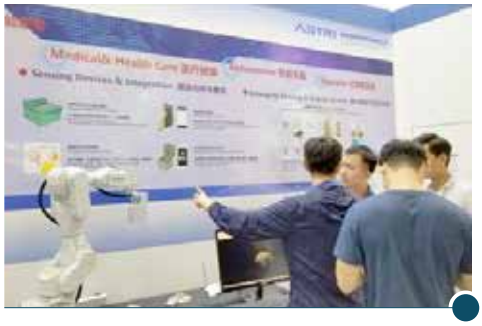
Experts at Cybersecurity Forum organised by ASTRI urge enterprises to 'get stronger cyber-defence not only for survival, but also for growth'

A Cybersecurity Forum titled 'The Next-Gen Defence against Cyber-Threats' was organised by ASTRI to run on the second day of the 4th Internet Economy Summit in April 2019. Cybersecurity is a key concern in the digital era, for individuals and businesses alike. The forum explored tools and strategies for better cyber preparedness, and covered regulatory and compliance issues, professional approaches to cybersecurity, securing cloud and other trusted services, and safeguarding businesses against increasingly sophisticated cyber-crimes.

Dr Lucas Hui, ASTRI's Chief Technology Officer, presented an overview of cybersecurity and shared views and insights on the overall cybersecurity landscape and ecosystem. Other speakers included Mr Stefan Eigler, Practice Leader Mastering Risk & Compliance of TÜV Rheinland; Ms Samantha Alexander, Principal Accreditor of the global cybersecurity certification body CREST; Dr Qingni Shen, Professor and Vice Director of the Department of Cybersecurity in Peking University, and Dr Frank Law, Senior Superintendent of the Cybersecurity and Technology Crime Bureau of the Hong Kong Police Force.

Well over 200 tech experts, public and private sector representatives, entrepreneurs and investors participated in the forum. Hosted by ASTRI, it was one of the thematic forums run during the Internet Economy Summit 2019, organised by the Hong Kong SAR Government and Cyberport.





ASTRI supports the China International Opto-electronic Expo (CIOE) – one of the largest industry shows for Opto-electronics

The China International Opto-electronic Expo (CIOE), one of the sector's largest industry events, took place at the Shenzhen Convention and Exhibition Centre from 4 to 7 September 2019. This was the 21st anniversary of the Expo, which gathered experts and professionals from the Opto-electronic and Sensor sectors and facilitated exchanges and in-depth explorations of future development trends and opportunities.

ASTRI was one of the leading participants in the Expo, where it presented a number of newly developed technologies:

Lighting-on inspection for Mura inspection
Eye-in-Hand Flexible Visual Inspection Technology for Industrial Robots
3D Automatic Optical Inspection system
AR Head Mounted Display with Eye Tracking & Iris Recognition Head-mount display
Head-Up Display Projector
Multi-sensing demo
Wireless Jewellery UV Fluorescence Imaging Analyser
Smartphone spectrometer

Over 3,200 organisations took part, showcasing the latest technologies involving Artificial Intelligence (AI), Intelligent Manufacturing, as well as next-generation display and sensor technologies for Smart City applications.

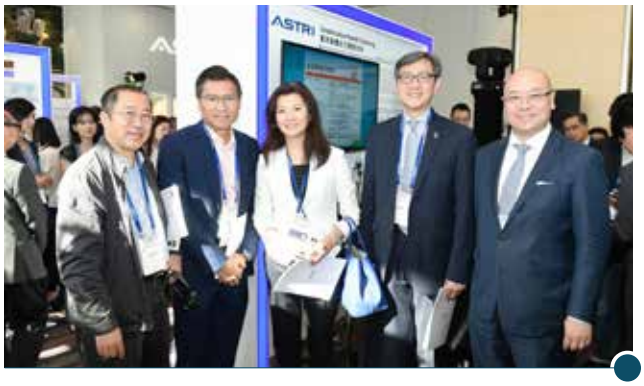
ASTRI Inspires a “Smart Future for All” at the Technovation Summit 2019

Technology experts, entrepreneurs and top-level executives joined Mr Nicholas W Yang, GBS, JP, the then Secretary for Innovation and Technology at ASTRI’s Technovation Summit 2019 in November to explore what a “smart future” means for Hong Kong.

During the summit, industry leaders and government officials focused on applications of the latest technologies across a wide variety of sectors, including in the areas of ‘smart government’, ‘smart mobility’, ‘cybersecurity’ and ‘smart manufacturing’. Speakers also addressed topical issues on innovation and technology, and explored ways of encouraging all stakeholders to leverage new technologies to achieve sustainable and inclusive development.

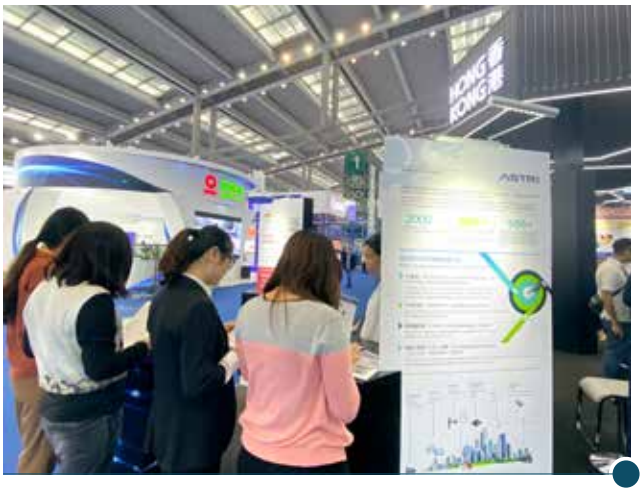
ASTRI also showcased some of its latest technologies and solutions, including:

Biometrics Optical See Through Head Mounted Display
4Kx2K UHD Augmented Reality Head Mounted Display
Diffractive Optics for Anti-Counterfeit
Smart Locker 2.0
Gem Analyser
Unobtrusive Health Checking
Canto-English Recognition Chatbot
ASTRI Proprietary 5G End-to-End Solution
ASTRI C-V2X End to End System
AI Medical Platform



ASTRI showcases its latest technologies at the China Hi-Tech Fair (CHTF) 2019 in Shenzhen

At the China Hi-Tech Fair (CHTF) 2019 in Shenzhen, ASTRI showcased cutting-edge 5G technology that is providing innovative business solutions to help shape the Smart Cities of the future. ASTRI also demonstrated the VR/AR Smart Maintenance system, a great productivity tool for field engineers. CHTF was held from 13 to 17 November 2019 at the Shenzhen Convention & Exhibition Center.



ASTRI unveils optical solution at the largest South Korea expo

At the VR Expo 2019 in October, the largest industry expo in South Korea, ASTRI unveiled a reference design for a production-ready 4Kx2K augmented reality (AR) Head Mounted Display (HMD), with enhanced user experience.

The latest solution is a collaboration with MAY Display Co. Ltd., a key industry player possessing proprietary manufacturing technology and mass volume production capability for LCoS micro displays. The complete AR HMD solution combines MAY's world first true 4Kx2K LCoS panel with ASTRI's reference optical design to provide an industry-leading 70-degree-wide field of view.

VR EXPO 2019 brought together major VR/AR-related industries in areas such as manufacturing, defence, medical, education, architecture, platforms, games, theme parks, and videos using 5G.

Building the tech ecosystem

ASTRI drives forward 5G, C-V2X and AI innovation and transformation with Intel technology

ASTRI revealed its collaboration with Intel on 5G Standalone (SA) Core Network and Roadside Edge AI (Artificial Intelligence) for C-V2X (Cellular Vehicle-to-Everything) at the Mobile World Congress (MWC) Shanghai 2019. This technology will power the new era of network transformation by bringing together the compelling capabilities of 5G, C-V2X and AI.

ASTRI and Intel have collaborated on the research, development and optimisation of a 5G SA Core Network, especially on the User Plane Function (UPF) throughput, to meet 5G requirements. The collaboration makes it possible for over 200Gbps throughput to be processed on a single server by ASTRI's 5G UPF without packet loss. The key features that have helped delivered a breakthrough performance for the 5G Core Network include:

- The UPF of ASTRI's 5G SA Core Network can achieve high per-core performance;
- Dynamic Device Personalisation (DDP) technology on Intel® Ethernet Network Adapters has been utilised to achieve fine-grade load balancing to allow throughput to scale up linearly with additional CPU cores
- ASTRI's 5G SA Core Network can scale down to a single hardware platform for small-scale deployments, or scale out and be distributed in cloud architecture

ASTRI and Intel's R&D collaboration also involved the partners working closely on:

- Support by ASTRI'S 5G SA core network for the N9 interface for mobile edge and additional Service-Based Network Functions, enabling a variety of network topologies to transform the mobile core network to cater for different 5G applications and scenarios.
- Enabling edge AI and visual-sensing capabilities for evolving next-generation smart roadside infrastructure, with an initial focus on enabling real-time object recognition by ASTRI's C-V2X Edge Software solution to detect imminent dangers on the roads and issue real-time alerts to drivers via C-V2X communication between vehicles and roadside infrastructure.

China Mobile Hong Kong and ASTRI announce new partnership on IoT and Blockchain technology, with debut demonstration at MWC Shanghai 2019

ASTRI and China Mobile Hong Kong partnered to introduce Hong Kong's first application of Blockchain-based Internet of Things (IoT) technology. China Mobile Group's OneNET IoT Platform and ASTRI's Blockchain solution came together in a combined application that was demonstrated for the first time at the Mobile World Congress (MWC) Shanghai 2019 from 26 to 28 June.

For the first time, the power of Blockchain technology is being applied to an IoT application whereby data is collected and stored in real-time – making it safer, traceable and verifiable. The solution can significantly help the development of Smart City.

CITIC Telecom CPC and ASTRI announce cooperation to develop Next Generation AR-powered Operations and Maintenance Technology

CITIC Telecom International CPC Limited (CITIC Telecom CPC), a wholly-owned subsidiary of CITIC Telecom International Holdings Limited, and ASTRI announced plans to join forces on research and development for next-generation operations and maintenance technologies using Augmented Reality (AR) glasses.

The agreement will involve ASTRI's world-class software development talents collaborating with CITIC Telecom CPC to provide solutions for an array of complex scenarios based on real-life customer requirements, on-site conditions and technical considerations. The introduction of AR glasses for field engineers will mean that real-time intelligence, troubleshooting logs, graphics and encrypted data from back-end systems can be streamed and made accessible onsite to engineers anytime, anywhere.

In addition to enhancing customer experience, this collaboration is expected to improve the overall quality of operations and maintenance and boost productivity by 40-50%. When mature, the solution is expected to be launched for other industry verticals such as architecture and construction, boosting field work efficiency and effectiveness in those industries.

ASTRI delegation visits important scientific research institutions in Beijing

An ASTRI delegation headed by CEO Mr Hugh Chow, Dr Daniel Shi, Senior Director, and Dr Xie Bin, Principal Engineer, visited several important scientific research institutions in Beijing in September 2019. These included the Institute of Microelectronics of the Chinese Academy of Sciences, the Beijing Collaborative Innovation Institute, and the Strategic Industry Alliance for Third Generation Semiconductor Technology Innovation. In the visits. ASTRI's senior executives explored various applied technology fields and exchanged ideas on future collaboration opportunities in the Guangdong-Hong Kong-Macao Greater Bay Area.

The delegation also met with Ms Wu Ling, Chairperson of the Strategic Industry Alliance for Third Generation Semiconductor Technology Innovation, to discuss topics such as Third Generation Semiconductor applications for 5G communications, electric as well as unmanned vehicles, railways, DC buildings, energy routers, and photovoltaic inverters. The delegation and its counterparts agreed to strengthen collaboration and exchange in the field of Third Generation Semiconductor applications, recognising that the healthy development of this sector in the Guangdong–Hong Kong–Macao Greater Bay Area is an important priority in the context of China's overall national development strategy.

ASTRI joins EMSD's E&M Inno Zone

ASTRI partnered with the Electrical and Mechanical Services Department (EMSD) in June to help the department achieve higher productivity and greater success. At the E&M Inno Zone in the EMSD HQ, ASTRI unveiled two ground-breaking innovations – a smart locker fitted with a Palm Fusion Biometric Authentication system, and an AI-powered handwritten Chinese character recognition system.

ASTRI Whitepaper paves the way for FinTech breakthrough in Treasury operations

A group of ASTRI researchers led by Dr James Lei, Senior Director, Artificial Intelligence and Big Data (AIBD), has authored a whitepaper titled 'Unlock the FinTech Value for Treasurers'. Dr Stephen Leung, Executive Director of Minds Connect, was a co-author of the paper. The whitepaper aims at helping Treasury professionals across different industries explore the immense potential of FinTech tools and applications, particularly Blockchain and Artificial Intelligence. Corporate Treasury is a core financial function of most businesses and institutions, and the application of Blockchain and other information management solutions can greatly boost productivity, information security and transparency. The whitepaper was published in collaboration with Minds Connect and the Asia Treasury Community (ATC).

ASTRI CEO appointed Co-Director of the Guangdong-Hong Kong-Macau Greater Bay Area Committee of the China 3rd Generation Semiconductor Technology Innovation Strategic Alliance

ASTRI's CEO Mr Hugh Chow, Mr Chen Shiyi, scholar of the Chinese Academy of Sciences and President of the Southern University of Science and Technology, and Mr Song Yonghua, Rector of the University of Macau, have been appointed Co-Directors of the Guangdong-Hong Kong-Macau Greater Bay Area Committee of the China 3rd Generation Semiconductor Technology Innovation Strategic Alliance. The Committee was formed to drive development and synergies in the sector and to facilitate innovation and development opportunities. It will lead to more effective collaborations and greater connectivity between innovative players in 3rd Generation Semiconductors in the Guangdong-Hong Kong-Macau Greater Bay Area.

Dr Daniel Shi, ASTRI's Senior Director of Electronic Components, was appointed as a Deputy Director of the Committee. ASTRI will actively participate in the research and development work relating to the 3rd Generation Semiconductor sector, Intellectual Property strategy, and talent development programmes across the Guangdong-Hong Kong-Macau Greater Bay Area.

ASTRI R&D expert shares latest developments in smart manufacturing at Sony's US Research Center

Dr T. John Koo, Director of Cyber-Physical Systems at ASTRI, was invited to speak on the topic 'Digital and Physical Twins for Smart Factory in Industry 4.0' at the US Research Center of Sony Electronics Inc. in San Jose, California.

In his presentation, Dr Koo discussed how the design of Digital and Physical Twins can help create smart factories for the Industry 4.0 era, and presented a successful industry application. He noted that, since Model-Based Systems Engineering (MBSE) has been introduced and adopted in the construction of Digital and Physical Twins, various aspects of the system behaviours can be examined at different levels of complexity.

Blockchain for eco-friendly apparel? ASTRI and WWF partnership aims to make it happen.

ASTRI has partnered with the World Wide Fund For Nature (WWF) Hong Kong to develop a Blockchain-based system that will enable sustainability footprint tracking of textiles and apparel from source down to consumer level, bringing users greater awareness of the sustainability and environmental footprint of the clothes we wear. WWF volunteers are working alongside ASTRI's Blockchain R&D experts on the Low Carbon Manufacturing Program (LCMP) to devise a Blockchain-powered system for the textile and apparel supply chain.

Partnership architect and innovation enabler

Partnering in the Blockchain Accelerator Programme for start-ups

ASTRI is partnering with the Hong Kong Science and Technology Parks Corporation (HKSTP) and Molecular Hub on a Blockchain-focused accelerator programme for start-ups. A key partner in the programme, ASTRI's role is to build up and enhance the technological know-how and capabilities of the participating start-ups by providing them with Blockchain-related training. The start-ups are also able to leverage ASTRI's R&D infrastructure via the facilities available at the Smart City Innovation Centre operated by ASTRI.

Helping to build a FinTech talent pipeline for Hong Kong

The FinTech Career Accelerator Scheme (FCAS) is nurturing Hong Kong's financial and technological talents to meet emerging and evolving needs of the industry. Along with Hong Kong Cyberport and the Hong Kong Science Park, ASTRI is a co-organiser of this scheme, spearheaded by the Hong Kong Monetary Authority. FCAS Participants go through a year-long programme of technical and regulatory training, along with internship placements in Hong Kong and Shenzhen and a gap-year industry placement.

Cultivating students' interest in sport with the help of technology

ASTRI has partnered with the Hong Kong Jockey Club and the Chinese University of Hong Kong in the 'Fun to Move @JC' initiative, a five-year pilot programme that is developing a sustainable model to enhance physical activity among primary students. The programme aims to improve students' motivation to engage in sports and their efficiency in doing so by prompting systemic changes in their lifelong physical activity attitudes and habits. The initiative, now in its third year, aims to serve over 30,000 students from 35 primary schools in Hong Kong is currently on target to meet this goal.

Artificial Intelligence and Big Data Analytics (AIBD)

The Artificial Intelligence and Big Data Analytics (AIBD) Division conducts applied research on Artificial Intelligence (AI) and Big Data (BD) with the aim of solving real-world problems. Its work covers theoretical foundations (data processing, computational models, and reasoning mechanisms), system capabilities (including sensors getting data, networks exchanging data, and interaction with people), and application domain technologies. The AIBD Division focuses on data processing (distributed, edge IoT, blockchain), to computational models (consensus, high performance, quantum computing), to intelligence (analytics, cognitive, linguistics).

Industries served

AIBD contributes to many sectors and industries, including banking, manufacturing, government organisations, disciplined services and the health sector. It provides technology platforms, solutions, designs, and development services so that its partners and customers can focus on their core businesses.

Core Competence Groups

- Cloud Computing (Cloud)
- Computational Linguistics and Intelligence (CLI)
- Intelligent Cognitive System (ICS)
- Smart IoT Analytics & Applications (SIAA)
- Cyber-Physical Systems (CPS)

Cloud Computing (Cloud)

Built on multi-disciplinary research and development in networking, computing, and machine learning, Cloud provides high performance and large scale distributed computational platforms with efficiency, reliability, performance and flexibility for a range of cloud computing applications – including communication systems over LoRaWAN, industrial IoT cloud platforms, IoT data analytics, and blockchain.

Computational Linguistics and Intelligence (CLI)

CLI leverages state-of-the-art AI algorithm and machine learning technologies to provide machine perception related speech recognition, natural language processing, image analysis, and pattern recognition tailored to industries and key stakeholders.

Intelligent Cognitive System (ICS)

ICS applies artificial intelligence, Internet of Things (IoT), sensor technologies and big data analytics to the fields of Health Tech and Smart City. In support of Hong Kong SAR Government initiatives, ICS focuses on developing technologies targeted at domains in the fields of Smart Living (e.g. healthcare and elderly care), Smart People, and Smart Mobility.

Smart IoT Analytics & Applications (SIAA)

The task of IoT analytics & applications is to take in huge volumes of heterogeneous data from IoT, and to process, store, and extract business value from them. SIAA's R&D efforts include data mining, distributed computing, and high-performance communication networks in the service of artificial intelligence.

Cyber-Physical Systems (CPS)

CPS analyses the dynamics of physical processes, providing abstractions and modelling, design, and analysis techniques for the integrated whole. The economic and societal potential of such systems for smart manufacturing and new industrial applications is vast.

Key Technologies

- Speech recognition of Cantonese mixed with English and Mandarin
- Language processing of Cantonese, Mandarin, and English
- Text to speech in Cantonese and Mandarin
- Sentiment analysis of tone and text
- Chatbot and Voicebot
- Edge computing
- Image classification
- Domain specific language programming
- IoT networks simulation/implementation
- Cryptocurrency trading

R&D highlight

A Hong Kong Smart Water Metering Communication Standard and Reference Design

Hong Kong's mountainous landscape and many high-rise buildings mean the city requires a high-pressure water supply, which can pose challenges for foreign-made smart meters. This project involves developing a smart water metering communication standard for Hong Kong adapted to local environmental constraints and frequency band regulations for LoRa (a Long Range, low-power wide area networking technology), as well as a reference design for the Water Supplies Department (WSD).

R&D highlight

Artificial Intelligence Chatbot

Most of the currently available chatbot and speech-to-text solutions can only understand English or Mandarin. Leveraging AI, voice recognition and natural language processing (NLP) – a branch of AI that reads, deciphers, understands, and makes sense of human languages – ASTRI has purpose-built and commercialised an AI chatbot along with speech-to-text solutions that are able to process locally spoken Cantonese (mixing English, Cantonese and slang as well as Mandarin) in Hong Kong. This technology can be applied to transcribe and analyse speech and/or multiparty conversations in different industry domains, including public services, financial and retail sectors.

R&D highlight

Intelligent platform for fleet operations

This project enables vehicle fleet operators to adopt a smart scheduling and routing platform for their operations, along with an integrated safe-driving system that monitors vehicles' operating data and video-records the surrounding scenarios and circumstances. It allows operators to schedule and plan their service routes more effectively, as well as enhancing the safety of fleet operations by enabling the proactive identification of "high-risk" drivers for further professional development.

Other R&D projects

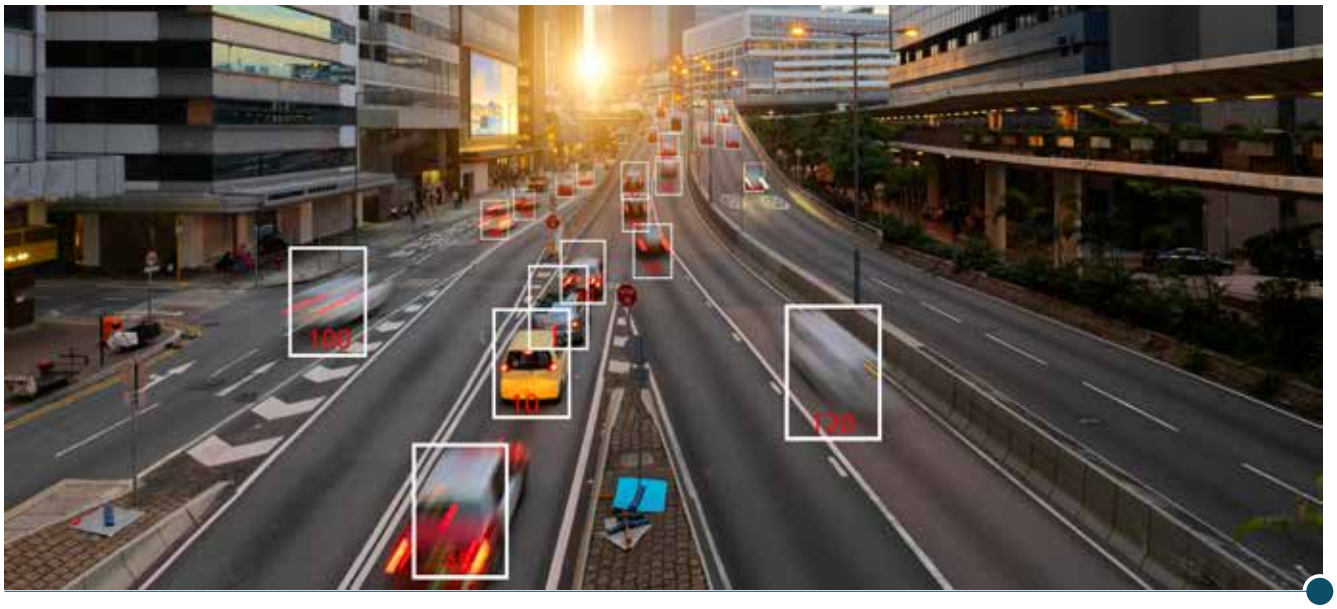
Smart Contract Platform for Fintech Applications	FinTech
Trial: Enhancing facility management security through IoT and smart analytics	Smart City
AI Analytic Engine for providing tailor-made trainings targeting SEN students	Health Technologies
Industrial IoT Platform with DNP3 and LoRa	Smart City
Hierarchical DLT (Distributed Ledger Technology) Platform for FinTech Applications	FinTech
Real-Time Gas Safety Monitoring Platform with Sensor Array	Smart City
Digitalized elderly services platform	Health Technologies

Detainee mood status alert system	Health Technologies
Unobtrusive heart activity monitoring through micro-movement of BCG	Health Technologies
Intelligent Knowledge Management Platform	FinTech
Multidisciplinary Retooling Platform for ASTRI	Smart City
Unobtrusive heart activity monitoring through micromovement of ballistocardiograph	Health Technologies
Model-Based Deep Reinforcement Learning Robotic System	FinTech

Communications (COM)

The Communications (COM) Division delivers cutting-edge tools and applications based on 5G and other next generation network solutions. Its applications are helping equipment manufacturers and operators to introduce faster and more intelligent services for network users, benefiting both industries and the community.

The division is supporting Hong Kong's overall Smart City development in terms of standards, solutions and infrastructure, especially in 5G-related transformations. Its Core Competence Groups (CCGs) are developing open broadband wireless networks and applications, including 5G base stations and core networks, and focusing on creating new technology infrastructure and platforms for a wide range of sectors and applications. The division also offers end-to-end system solutions for various players at different levels of the value chain in the industry ecosystem.



Industries served

COM works closely with agencies of the Hong Kong SAR Government, telecommunication service providers, universities, and R&D institutions. Its partners include the Office of the Communications Authority (OFCA), the Energising East Kowloon Office, as well as leading telecommunications operators HKT and China Mobile Hong Kong. It has also been working closely with various government departments and agencies responsible for transport, electrical and mechanical services, urban renewal and land. In addition, it has helped charitable and social entities concerned with school children, the elderly population and other healthcare recipients. Beyond Hong Kong, it works with government bodies and industry regulators in Mainland China, leading global industry players, as well as international bodies including 3GPP and GSMA.

Core Competence Groups

- Baseband Solutions (BSOL)
- Emerging Systems (ESYS)
- Networking Software (NSOFT)
- Mobile and IoT Platforms (MIP)
- Medium Access Control and Intelligent Solutions (MACI)

Baseband Solutions (BSOL)

BSOL develops industry leading 5G wireless solutions and reference designs for industry players. The team specialises in baseband algorithms, L1-L3 embedded software, and DSP and FPGA reference designs based on open platforms. BSOL is dedicated to developing low-cost, high-quality and cutting-edge 4G and 5G radio communications systems for both public and private telecommunication networks. Specific technology competences include Enhanced Mobile Broadband (eMBB), Ultra-Reliable and Low Latency Communications (URLLC), and massive Machine-Type Communications (mMTC).

Emerging Systems (ESYS)

ESYS develops open platform-based network technologies for 5G cellular systems that are increasing spectrum efficiency, and thus reducing both hardware costs and energy consumption. The CCG also develops forward-looking radio access technologies to address the needs of new and quickly maturing sectors such as 4G/5G C-V2X communications and solutions (e.g. RSU, IVU) in areas such as connected-vehicle applications, wireless technology supporting Unmanned Aerial Systems (drones) connectivity, and mmWave communication for enhanced mobile broadband applications.

Networking Software (NSOFT)

NSOFT enables the development of end-to-end networks that leverage next generation network connectivity, in the service of Smart Mobility and Smart City infrastructure and applications. The team's technology competences include the development of Network Components (4G/5G Core Networks with high throughput packet processing software), and Network Formation (network virtualization, software defined networks, orchestration to allow flexible and manageable 4G/5G - V2X network deployment scenarios). NSOFT is playing a major role in creating smart city infrastructure using 4G/5G/C-V2X networking solutions with software systems and algorithms that enable smart mobility applications, including connecting cars with enhanced road safety, V2X-based traffic management, roadside sensing capabilities, enhancing autonomous vehicle safety, and more.

The NSOFT team enjoyed a technology breakthrough in 2020, achieving over 1.3TGbps throughput on a 5G Core, after the success of demonstrating 17 use cases of C-V2X road safety in Wuxi in 2018, and organising the commercial deployment of a 4G / LTE core network in the industry's first LTE-based subway control signal communication system in 2016.

NSOFT is actively collaborating with various local partners to enable C-V2X deployment for road safety in Hong Kong, and applying 5G to enable the development of future Smart City infrastructure.

Mobile and IoT Platforms (MIP)

MIP develops technologies and total system solutions that are unlocking the potential of mobile applications and IoT. Its innovations are enabling communication systems to accommodate the vast amounts of network traffic triggered by millions of devices and mobile users, while working cohesively with cloud resources that can scale horizontally instead of vertically. MIP focuses on developing and advancing proximity, geographic information, and real time telemetric-related technologies for applications such as positioning, navigation, map rendering, sensor data processing, smart distributed gateways, IoT Blockchain and advanced IoT tracking systems.

Medium Access Control and Intelligent Solutions (MACI)

MACI develops Medium Access Control (MAC) technologies and conducts technical corporation and system integrations with other CCGs, providing 5G overall solutions for such emerging markets as smart factories, smart mobility, smart cities and 5G enterprise networks. The team has an excellent track record in the commercialisation of wireless technologies, and has enabled multiple customer tenders for design commercialisation. Extensive collaborations are being carried out across CCGs and TDs within ASTRI, with industry partners (particularly Hong Kong and Greater Bay Area companies), and with Hong Kong government agents and public groups.

Key Technologies

- 5G O-RAN base station technologies, including wireless technology, baseband algorithm, reference design, and embedded L1/L2/L3 system integration with 5G Core Network
- 5G Core Network and Orchestrator
- Mobile Edge Computing
- Cellular Vehicle-to-Everything (C-V2X) network solution
- IoT Blockchain for data exchange

R&D highlight

Next Generation Ultra-Dense Networks: PHY Core, Procedures and Interworking

The 5G Ultra-Dense Networks (UDN) technologies delivered in this project include a 5G UDN base station with a PHY layer reference design, as well as PHY procedures and interworking on the Cloud-RAN platform. The team has also completed an infrastructure test to validate and verify standards requirements.

R&D highlight

Mobile Core leading to 5G Service-based Architecture

This innovative new 5G core network solution, created in partnership with Intel, supports 5G standalone deployments (AMF, SMF, UPF). It offers a compelling 5G core network performance, with over 1.3Tbps of network traffic using Intel's 4U footprint server.

R&D highlight

C-V2X Networking System for Smart Mobility

This industry-leading C-V2X Networking System supports 17 road safety use cases, including roadside edge gateways, vehicle on-board unit software, and display applications. The system represents a breakthrough innovation for Hong Kong and beyond. The project involved undertaking Hong Kong's first-ever C-V2X trial, in collaboration with HKT, and carrying out the world's first-ever city-wide C-V2X deployment in Wuxi in partnership with leading industry players.

Other R&D projects

Smart IoT Platform for Activity Tracking	Smart City
Evaluation of V2X Edge Architecture and Management	Smart City
Studies of 5G RAN Technologies for Smart Industrial IoT	Smart City
Vehicle-to-Everything (V2X) Communication System	Smart City
Software-Defined Wide Area Network	Smart City
Evolution of Mission Critical and Reliable Communications	Smart City/ Intelligent Manufacturing
Next Generation Mobile Core for Vertical Applications	Smart City
Evolution of Mobile Broadband with 5G	Smart City/ Intelligent Manufacturing
Next Generation NB-IoT Baseband Solution	Smart City
IoT Blockchain for Data Exchange	Smart City
Long-haul IoT and Location Services for Smart Visiting Platform	Smart City
New Radio Enhanced Vehicle-to-Everything Communications	Smart City
Edge Computing Platform for 5G Enterprise	Smart City
5G NR Optimised Heterogeneous Networks	Smart City
Smart City 5G ICT Infrastructure	Smart City
Smart Mobility Roadside Infrastructure	Smart City
5G Mobile Broadband Small Cells	Smart City

Cybersecurity, Cryptography and Trusted Technologies (CCT)

The Cybersecurity, Cryptography and Trusted Technologies (CCT) Division uses advanced applied technologies to enhance the reliability, protection and trustworthiness of data in various domain areas. Its research expertise, applied across many sectors and industries, is supported by six core competency groups.

Industries served

CCT serves a wide variety of sectors and industries, including banking, insurance, retail, logistics, law enforcement, public services and telecommunications. One of the division's major goals is to help to position Hong Kong as a premier international FinTech hub.

Core Competence Groups

- Applied Cryptosystems (ACS)
- Cybersecurity & Analytics (CSA)
- Data Analytics (DATA)
- Multimodal Image Analytics (MMIA)
- Multimedia Systems and Analytics (MSA)
- Secured System Platforms (SSP)

Applied Cryptosystems (ACS)

ACS explores technologies related to the application of cryptography in different industry sectors. Its R&D experts are developing cryptosystems in the areas of FinTech security, privacy preservation, federated learning, and multimedia content analytics.

Cybersecurity & Analytics (CSA)

CSA brings together humans and machines for research into cyber-threat hunting and analysis. In an age where the bulk of business, institutional and personal data is stored online, the increasing frequency and sophistication of cyberattacks poses a major threat. To help businesses and the community, the CSA team is applying data analytics, machine learning and AI-powered tools to combat cyber threats, combining human skills with advanced hardware-software capabilities.

Data Analytics (DATA)

The Data Analytics team develops scalable, real time big data analytics platforms and advanced AI solutions using deep learning / machine learning technologies, in support of a range of different industries. The team develops technologies for the whole data lifecycle, from data acquisition to data storage, data management, data analytics and visualisation. Its current technical focuses include financial risk analytics, fraud detection, time-series data analytics, knowledge graph and graph analytics, carried out in support of industry partners in the fields of FinTech, RegTech, Intelligent Manufacturing and digital marketing.

Multimodal Image Analytics (MMIA)

MMIA works on the technology associated with acquiring, analysing and processing multi-modal images. Its technology development covers hardware, firmware, software and algorithms, where the algorithms focus on image processing, ML/DL, CV and SLAM. The team's current focus areas include Medical Imaging Devices and Intelligent Image Analysis, Smart Maintenance and Intelligent 3D Metrology. Its goal is to provide high-performance and intelligent application solutions for partners in the areas of Health Tech and Smart City.

Multimedia Systems and Analytics (MSA)

MSA provides solutions across different captured media in multiple dimensions, with its solutions currently being deployed in FinTech and InsurTech. Its algorithm development covers image/video processing, handwritten character recognition (ICR), artificial intelligence, computer vision, simultaneous localisation and mapping (SLAM), natural language processing (NLP), behavioural and biometrics authentication and information verification. MSA's output includes an Automated Form Processing System, an Automated Content Processing Platform, an Automated Intelligent Document Processing System, a Fraud Detection solution for insurance claims, and Character Recognition Engines.

Secured System Platforms (SSP)

SSP develops Blockchain system protocols to enhance and optimise Blockchain security, performance and scalability. It also carries out research on hardware accelerators for Blockchain transactions. SSP has built robust blockchain platforms for property mortgage, insurance and supply chain operations for multiple corporations. The team is also working on open data and banking development in support of the Hong Kong Monetary Authority (HKMA)'s initiative of Open Application Programming Interface (API) for the banking sector.

Key Technologies

- Automated content understanding through deep learning
- Blockchain; Knowledge graph; Cybersecurity threat analytics
- Medical image data analytics in capsule endoscopy
- Mobile visual computing with AR/VR, 3D metrology
- Hardware Accelerators in Cryptography

R&D highlight

Heterogeneous Computing Platform for Embedded Vision

Augmented reality (AR) is a technology that superimposes a computer-generated image on a user's perceptions of the real world, and has become one of the top technological trends of the decade. This project applied Enterprise AR to develop an AR field service management solution for CITIC Telecom to carry out on-site installation, maintenance and troubleshooting. Using AR glasses and a visual and depth sensing platform, on-site technicians can access real-time data, a troubleshooting log, and graphics and encrypted data from back-end systems anytime, anywhere. In complex cases, remote support experts can view streamed real-time images transmitted from AR glasses worn by on-site technicians through the AR operation console. For future smart industrial applications, the team will leverage a variety of computing and 3D imaging technologies to develop useful technical features, including simultaneous localisation and mapping (SLAM) algorithms for embedded systems, dense 3D mapping for Enterprise AR and robot applications, and depth and visual sensor fusion.

R&D highlight

AI OCR Software Development

ASTRI's handwritten Chinese Optical Character Recognition (OCR) technology can recognise over 8,000 traditional and simplified handwritten Chinese characters and English typed letters and numbers, with a better-than-human accuracy of up to 97.12%. It is also equipped with contextual intelligence which makes it capable of auto-correcting local addresses. This project involved the development of an Automated Form Processing System (AFPS) and a Digit Recognition module. These systems are in use at a number of companies and organisations to speed up form processing.

R&D highlight

Supply Chain Workflow Blockchain system

This project involves developing a resilient supply chain workflow system using blockchain distributed ledger technology, enables our client to execute the complete process for procuring and receiving vital parts. The system provides full process transparency and immutable transaction recording and enables close interaction between various departments and their suppliers.

Other R&D projects

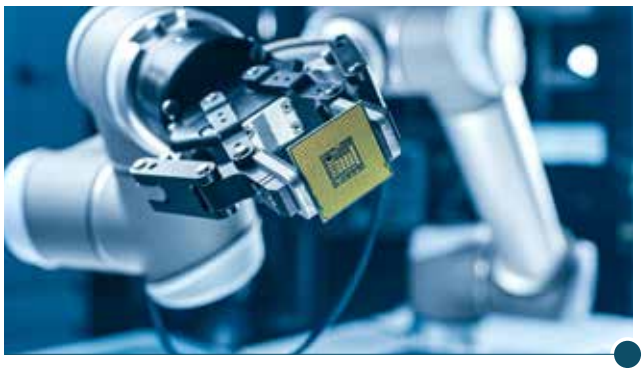
Secure Transaction Acceleration in Cloud Computing	ASIC
Next Generation Cold Food Import Safety Management (CFISM) Platform	Smart City
Smart credit assessment & analytics engines to micro, small & medium-sized enterprises (MSMEs) and lenders for loan applications	FinTech
Dark-web Intelligence Pool - a prototype of the super-sensitive data framework	FinTech
Cyber-attacks simulation for intrusion detection system benchmarking	FinTech
AI Algorithm Optimization Platform for Medical Image Analytics	Health Tech
Collaborative & Intelligent KYC System	FinTech
Intelligent Media Analytics System for Financial Institutions	FinTech
Automated Content Processing Platform through Deep Learning	FinTech
Deep Learning Facilitated Medical Image Analytics	Health Tech
Performance Evaluation and Optimization for Google Ads	Smart City
Automated Form Processing System	FinTech
AI driven Data Analytics Platform for Risk Management	FinTech
Smart Ads: Intelligent Advertising Management System	Smart City
Trial: Intelligent Automated Document Processing	FinTech

Integrated Circuits and Systems (ICS)

The Integrated Circuits and Systems (ICS) Division develops high-value-adding technologies for Power & RF related ICs & Systems, helping to enhance local industrial competitiveness in the areas of Smart City and Industry 4.0. The division specialises in advanced semiconductor technologies, covering 3rd generation semiconductor devices, AI chips, wireless IoT chips, 3D integration, SiC and GaN based new power and energy storage systems, and more. ICS is also a key constituent of the first-ever Hong Kong branch of the Chinese National Engineering Research Centre (CNERC). CNERC is located within ASTRI and focuses on Application Specific Integrated Circuits research, technology transfer, and talent training.

Industries served

ICS caters to various technology-centric industry verticals, which include data centres, robotics, new energy vehicles, power and charging systems and high-speed trains.



Core Competence Groups

- 3D Integration (3DI)
- Machine Learning Platforms (MLP)
- RF Systems
- Smart Power and Energy Systems
- Technology Co-Design
- Vision Computing

3D Integration (3DI)

3DI provides comprehensive advanced solutions for power electronics products, with specialisations in Silicon Carbide (SiC) and Gallium Nitride (GaN) based devices, control/driver ICs, packages, modules, and subsystems. The application domains served by the Group include 5G networks and infrastructure, data centres, industrial robots, new energy vehicles, power and charging systems as well as railway transportation.

Machine Learning Platforms (MLP)

MLP develops AI chips for image processing and computer vision applications. The team has strong specialisations in Deep Neural Network (DNN) optimisation, dataflow neural network processor design, and AI algorithms. It also innovates hardware-enabled solutions for intelligent video production, smart cameras, smart locks and various other smart devices.

RF Systems

The RF Systems group provides wireless connectivity chips with state-of-the-art low power integrated circuit design for IoT applications. These solutions include Bluetooth Low Energy (BLE) supporting audio streaming applications (LE Audio), Narrowband Internet of Things (NB-IoT) and 5G IoT (NR-light). All these technologies are facilitating Smart City and Smart Home development, and enabling a wide range of connectivity solutions for personal, industrial and other systems.

Smart Power and Energy Systems

The Smart Power and Energy Systems team is developing innovative SiC- and GaN-based new power and energy storage technologies. These are enhancing energy efficiency and optimising power usage in the area of Smart City development and for industrial applications.

Technology Co-Design

The Technology Co-Design CCG develops and models advanced semiconductor devices. It provides solutions for ESD protection, semiconductor sensors, and other novel semiconductor devices. Its technological core competences include virtual fabrication and compact model extraction. These technologies make it possible to virtually develop processes and devices in an optimised, efficient manner. The Group has developed comprehensive IP portfolios for device design and modelling, including area-efficient ESD structure IPs, process independent scalable I/O libraries, and BSIM models. It collaborates closely with IC foundries and design houses in the development of unique advanced devices and model IPs using Complementary Metal-Oxide-Semiconductor (CMOS) technologies. It has successfully delivered device, IO library and model IPs from 0.5nm to 14nmFinFET processes.

Vision Computing

The Visual Computing CCG provides software and hardware solutions for 2D and 3D image analysis. The group provides solution for vision based remote photoplethysmography, point cloud clustering and object tracking analysis, and human pose estimation applications. The group also provides 3D display technology and immersive video application technology.

Key Technologies

- DC Building
- Wireless Power Transfer
- Energy storage systems
- Smart power hubs
- High-density power modules
- FinFET
- NB-IoT
- RF Transceiver
- AI chips

R&D highlight

Advanced Ceramic Substrate for High Power & High Frequency Applications

The direct plating copper (DPC) ceramic substrate with feature patterns is suitable for high power and high frequency applications, as it has the advantages of surface flatness and smaller trace alignment error, and lower cost effectively by changing the Ag-plugged hole process to the Cu-filled hole process. However, due to the size and aspect ratio characteristic of through-holes in DPC ceramic substrates, completely filling the through-holes along with the surface circuitry formulation are extremely challenging. This project developed a novel fabrication process and materials to realise void-free through-hole filling in DPC ceramic substrates, meanwhile met the requirement of surface plated thickness and surface flatness for circuitry formulation. The resultant processes and materials equip manufacturers to realize void-free through-hole filling in fabricating high-quality ceramic substrates to compete in the high-end electronics market globally.

R&D highlight

Dual-mode RF Transceiver for Enhanced eMTC and NB-IoT

Enhanced Machine Type Communication (eMTC) and Narrowband Internet of Things (NB-IoT) are key technologies for cellular IoT connectivity. This project involves developing a highly efficient yet cost-effective dual-mode RF transceiver for eMTC / NB-IoT terminals, enabling ubiquitous, reliable and secure wireless connectivity for Smart City applications. This project will help Hong Kong take on a leading role in the IoT field and create a competitive edge for local IC design houses, IoT solution vendors, OEM and ODM manufacturers.

R&D highlight

Next Generation Energy-Saving Solution for Smart City

Energy efficiency is a critical criterion of smart buildings, and of Smart City development generally. Adopting new green technologies to reduce buildings' energy usage is essential. This project is developing a Direct Current (DC) power system platform for smart building applications. The idea is to power a home/building by DC instead of Alternating Current (AC), bringing significant power savings. The system is flexible in DC voltage levels, from 375V to 400V controllable, which makes it suitable for markets in Hong Kong, China, Europe and the US. Advanced technologies including a Silicon-carbide (SiC) based efficient power conversion solution, ultra-fast DC protection devices, real-time monitoring and online capacitor preventive maintenance will be developed in this project.

Other R&D projects

Next Generation SiC-based Matrix Converters	ASIC
GaN-based High-density Power Module for Next Generation Power Conversions	ASIC
Next Generation Power Delivery Solution for Smart City Applications	ASIC
Sensor Hub SoC Embedded with NB-IoT Connectivity	ASIC
Cross Platform IO Design for FinFET Technology	ASIC
Dedicated Visual Intelligence Platform	ASIC
Hardware Acceleration for VR Video Streaming	Smart City
Silicon Carbide (SiC) Compact Module (SCM) for Electric Vehicle	ASIC
Next Generation Power Electronics as an Enabler for Electric Vehicles and Robots	ASIC
Fast Charge Automated Guided Vehicle	Intelligent Manufacturing
Immersive Audio Technologies	ASIC

Internet of Things and Sensors (IoTSEN)

The Internet of Things and Sensors (IoTSEN) Division has three core competence groups that specialise in developing and commercialising market-driven solutions. Over the years, IoTSEN has been granted over 200 invention patents and made 160 technology transfers to the industry. In recent years the division has also stepped into new areas such as deep learning-based defects classification technology for intelligent manufacturing, palm fusion biometric sensing technology for security control, and mini-spectroscopy technology for smart living.

Industries served

IoTSEN serves many different industries in Hong Kong, the Greater Bay Area and beyond. It supports smart factories and a wide range of smart city applications with its sophisticated sensing and optical solutions that enable automation and boost productivity. Its industrial business partners include tier-1 manufacturers of mobile phones, electrical and optical components, and head-mounted display products, along with Mainland and local enterprise companies and new start-ups looking for sensing solutions for smart security control, smart education and smart living. The division has also brought efficient solutions to some local government departments.

Core Competence Groups

- Intelligent Machine Vision (IMV)
- Emerging Sensing & Display System (ESDS)
- Sensing Devices & Integration (SDI)

Intelligent Machine Vision (IMV)

IMV focuses on vision technology, and deals with advanced and miniaturised optical engines as well as image understanding and deep learning algorithms. It works in particular with technologies such as Automatic Optical Inspection (AOI) and High-precision 3D Metrology, Automated AI generation systems, intelligent industry robot vision and cognition, and medical and healthcare image sensing.

Emerging Sensing & Display System (ESDS)

ESDS develops smart devices for various applications. It focuses on Diffractive and Holographic Optics for display and sensing, Human Centric Sensing Fusion for biometrics and human machine interaction (HMI), and Next Generation Mixed Reality (MR) Displays.

Sensing Devices & Integration (SDI)

SDI develops integrated optical modules for environmental sensing and for use in manufacturing. Three major technological platforms are being explored by this team: Sensing devices and modules integration for environment sensing, Hyperspectral imaging for industrial inspections, and Smartphone-based spectroscopy.

Key Technologies

- Biometric sensing device for access & security control
- Diffractive nanostructures for anti-counterfeit solutions
- Augmented reality (AR) display technologies for head-mounted displays (HMDs)
- Human Centric Sensing Fusion platform
- Hardware Accelerators in Cryptography
- Mobile spectroscopy for environmental sensing and personal everyday applications
- High-resolution and high-speed area confocal technology for biomedical uses (such as dental classification, tumour detection, eye examinations, new material classification, initial diagnosis of Alzheimer's disease, etc.)
- Deep-learning-based software platform for defect detection and classification
- Flexible display inspection system for OLED/Miro-LED lighting-on test
- Intelligent 2D/3D Eye-in-Hand (EiH) visual sensing module for industry robots
- Automated AI generation system for quality inspection & automatic pick-&-place

R&D highlight

Deep Machine Vision Platform (DMVP)

This project has developed a deep machine vision platform enabling a wide range of applications for industrial measurements and advanced defect analysis. These include vision-based measurement software, customer-specific deep-learning based defect-detection rule discovery, advanced defect analysis using deep-learning classification, as well as 2.5D/3D glass inspection illumination and capturing technologies. The platform replaces the need for humans to manually design applications. It has enhanced the throughput of inspections in manufacturing, and boosted overall product quality. One developed application helped a client increase its image processing speed more than twenty-fold, saving as much as HK$288,000 per month in operating costs.

R&D highlight

Biometric Sensing Fusion (BSF) for AR/VR Display

Head mount displays (HMDs) will act as next generation information providers, making it easier and more effective to acquire information by changing the data format from digital to virtual. Using eye-gazing and iris identification technology, this project delivered a large field of view (FOV) see-through HMD solution to a tier-1 communication device manufacturer and a local STEM education company. The solution enables users to "point and click" with their eyes, freeing up both hands for other tasks such as driving or operating industrial machinery. This technology can be implanted in wearable display devices intended for a wide variety of markets, including education, training and design. A large FOV see-through HMD with internal and external sensing could also be used in public places such as airports, exhibition centres and museums, greatly supporting the development of Hong Kong's tourism and exhibition industries.

Other R&D projects

Flexible Display Inspection System (FDIS)	Intelligent Manufacturing
Eye-in-hand Flexible Visual Inspection System (EiH)	Intelligent Manufacturing
Confocal spectral image sensing technology	Intelligent Manufacturing
Feasibility study on Diffractive Optical System for Anti-Counterfeit	Smart City

Diffractive & Holographic Optics for See Through AR Display (DHOD)	Smart City
Portable Remote-gas-sensing Device for Firefighters	Smart City
Integrated Smart Inspection and Identification System for Jewellery and Antiques	Smart City
Feasibility Study of Active Illumination Enhanced Hyperspectral Imaging Platform	Smart City

Engaging with the Community

Civil Service Bureau 29 May, 2019

Visitors from the Civil Service Bureau at a talk

Kum Shing Group 16 July, 2019

Kum Shing Group's Executive Director Ir BK Mak (right) met with our CEO Hugh Chow during a visit to ASTRI

Commissioner of Innovation and Technology 15 August, 2019

ASTRI welcomed Commissioner for Innovation and Technology Rebecca Pun Ting-ting JP (left) to the Smart City Innovation Centre

Intellectual Property Department 11 December, 2019

Director of Intellectual Property David Wong Fuk-loi JP (fourth left) viewed our autonomous car in action

Hong Kong Institute of Certified Public Accountants 14 January, 2020

A delegation from the Hong Kong Institute of Public Accountants viewed a demonstration of our technology during a visit

SmarTone 12 March, 2020

Mr Stephen Chau (fifth right), SmarTone Chief Technology Officer, visited ASTRI

Commerce and Economic Development Bureau

9 May, 2019

The Honourable Edward Yau Tang-wah, GBS JP, Secretary for Commerce and Economic Development (fourth right), visited ASTRI with a delegation from his bureau

Executive Councillor

18 July, 2019

New People's Party Chairwoman and Executive Councillor Regina Ip Lau Suk-yee GBS JP (third right) is shown ASTRI's autonomous car during a visit

ASTRI's innovations win 21 international accolades in Geneva

ASTRI scooped 21 awards, including four Gold Medals with Congratulations of the Jury, at the International Exhibition of Inventions Geneva

ASTRI wins two Awards at Prestigious Hong Kong Awards for Industries 2019

ASTRI received two awards at the Hong Kong Awards for Industries (HKAI) 2019. The winning technologies were ASTRI's Biometrics Optical See Through Head Mounted Display and its Fast Multi-Focus Automatic Inspection Equipment for Optical Communication Components

ASTRI strikes gold in Asia International Innovative Invention Award

The Flexible Integration of Recognition and Semantic project, led by ASTRI's Dr Arvin Tang, won a Gold Award in the Asia International Innovative Invention Award 2019

Silver Awards in HK ITC Awards

ASTRI's Cervical Cancer Screening Management System (CCSMS) won the Smart Living (Smart Healthcare) Silver Award at the Hong Kong ICT Awards 2019

Performance

ASTRI is dedicated to developing innovative technologies that have an impact on society and increase competitiveness in Hong Kong. Our success can be measured through the scale of our innovations, the economic impact of our solutions, and the tangible improvements brought to people's lives. To address the unique needs of customers and communities in meaningful and tangible ways, ASTRI has placed the commercialisation of its technologies as its central focus.

ASTRI measures its performance annually against three quantitative benchmarks:

Number of patent applications filed and granted

Number of technologies transferred to industry

Income generated from industry

Patents

Patents reflect the originality and value of our innovations.They also serve as a foundation for technology transfers to industry. In the year 2019-20, ASTRI filed 66 innovative patents in the US, Mainland China, and other territories.

Number of patents filed by Technology Division	
Technology Division	**2019-20**
Artificial Intelligence and Big Data Analytics (AIBD)	9
Cybersecurity, Cryptography and Trusted Technologies (CCT)	13
Communications (COM)	11
Integrated Circuits and Systems (ICS)	25
IoT/Sensors (IoTSEN)	8
Total	**66**

Note that in 2019-2020, ASTRI restructured its seven technical divisions into five.

Number of patents filed by Technology Division			
Technology Division	**2018-19**	**2017-18**	**2016-17**
Advanced Digital Systems	6	4	8
Communications Technologies	18	16	10
Electronics Components	14	11	14
Intelligent Software and Systems	7	9	11
Mixed Signal Systems IC	6	8	6
Intelligent Sensing Technology Systems	11	16	11
Security and Data Sciences	4	0	0
Total	**66**	**64**	**60**

Number of patents granted by Technology Division	
Technology Division	**2019-20**
Artificial Intelligence and Big Data Analytics (AIBD)	5
Cybersecurity, Cryptography and Trusted Technologies (CCT)	2
Communications (COM)	10
Integrated Circuits and Systems (ICS)	21
IoT/Sensors (IoTSEN)	7
Total	**45**

Number of patents granted by Technology Division			
Technology Division	**2018-19**	**2017-18**	**2016-17**
Advanced Digital Systems	3	1	4
Communications Technologies	15	10	7
Electronics Components	9	8	7
Intelligent Software and Systems	6	4	4
Mixed Signal Systems IC	8	13	9
Intelligent Sensing Technology Systems	12	13	26
Security and Data Sciences	1	4	2
Total	**54**	**53**	**59**

Number of patents granted by territory			
Territory	**2019-20**	**2018-19**	**2017-18**
US	27	35	26
Mainland China	18	17	27
Others	0	2	0
Total	**45**	**54**	**53**

Technology Transfers

The commercialisation of cost-effective, innovative, and market-compatible technologies is one of ASTRI's most important objectives. Our technologies are transferred to industry through technology licensing, Industry Collaborative Projects, contract services, and other legal arrangements.

Number of technology transfers by Technology Division	
Technology Division	**2019-20**
Artificial Intelligence and Big Data Analytics (AIBD)	10
Cybersecurity, Cryptography and Trusted Technologies (CCT)	9
Communications (COM)	18
Integrated Circuits and Systems (ICS)	5
IoT/Sensors (IoTSEN)	4
Total	**46**

Number of technology transfers by Technology Division			
Technology Division	**2018-19**	**2017-18**	**2016-17**
Advanced Digital Systems	8	9	9
Communications Technologies	10	18	11
Electronics Components	6	7	7
Intelligent Software and Systems	7	20	9
Mixed Signal Systems IC	3	5	2
Intelligent Sensing Technology Systems	7	8	11
Security and Data Sciences	10	5	11
Total	**51**	**72**	**60**

Number of technology transfers by channel			
Channel	**2019-20**	**2018-19**	**2017-18**
Industry Collaboration Projects	1	-	3
Contract Research	29	32	43
Licensing Agreements	16	19	26
Total	**46**	**51**	**72**

Certain licensing agreements consist of contract research services provided by ASTRI

Number of projects undertaken by Technology Division	
Technology Division	**2019-20**
Artificial Intelligence and Big Data Analytics (AIBD)	27
Cybersecurity, Cryptography and Trusted Technologies (CCT)	25
Communications (COM)	26
Integrated Circuits and Systems (ICS)	27
IoT/Sensors (IoTSEN)	12
Total	**117**

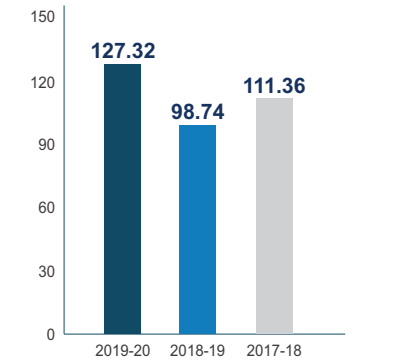
Number of projects undertaken by Technology Division			
Technology Division	**2018-19**	**2017-18**	**2016-17**
Advanced Digital Systems	13	17	17
Communications Technologies	21	21	17
Electronics Components	9	9	10
Intelligent Software and Systems	25	25	26
Mixed Signal Systems IC	6	9	10
Intelligent Sensing Technology Systems	13	13	14
Security and Data Sciences	14	13	13
Total	**101**	**107**	**107**

Number of projects undertaken by project type			
Technology Division	**2019-20**	**2018-19**	**2017-18**
Platform Projects	73	54	52
Seed Projects	39	40	44
Industry Collaboration Projects	2	5	9
Public Sector Trial Scheme Projects	3	2	2
Total	**117**	**101**	**107**

Income from Industry

Projects undertaken by ASTRI generated income amounting to HK$127.32 million in 2019-20. The income received from industry in the past three years is shown below.

Income from Industry (HK$M)



Including cash and in-kind contributions

Income from Industry (HK$M) by Technology Division	
Technology Division	**2019-20**
Artificial Intelligence and Big Data Analytics (AIBD)	9.21
Cybersecurity, Cryptography and Trusted Technologies (CCT)	24.69
Communications (COM)	60.10
Integrated Circuits and Systems (ICS)	26.43
IoT/Sensors (IoTSEN)	6.89
Headquarters	-
General Support Programme	-
Total	**127.32**

Income from Industry (HK$M) by Technology Division			
Division	**2018-19**	**2017-18**	**2016-17**
Advanced Digital Systems	8.11	21.74	10.98
Communications Technologies	29.00	22.96	15.59
Electronics Components	13.51	9.39	8.4
Intelligent Software and Systems	10.24	16.23	10.41
Mixed Signal Systems IC	11.41	18.29	10.94
Intelligent Sensing Technology Systems	14.29	9.75	12.57
Security and Data Sciences	12.18	12.98	6.65
Headquarters	-	0.02	2.46
General Support Programme	-	-	-
Total	**98.74**	**111.36**	**78.00**

Including cash and in-kind contributions

Financial Report

Overview

For 2019-20 financial year, the consolidated income and expenditure of ASTRI amounted to HK$560,700,121 and HK$585,646,585 respectively, resulting in a deficit of HK$24,946,464.

The funds from the Government comprised HK$146,215,191 from recurrent subvention, HK$269,001,346 from ITF project funds ("ITF"), HK$1,284,165 from ITF General Support Programme ("GSP"), HK$3,661,969 from ITF Public Sector Trial Scheme ("PSTS"), HK$535,396 from the Ministry of Science and Technology of the People's Republic of China, HK$17,092,030 from ITF Internship/Researcher Programme and Postdoctoral Hub and HK$9,349,478 from ITF for Chinese National Engineering Research Centre for Application Specific Integrated Circuit System (Hong Kong Branch). In 2019-20 financial year, the income from the industry amounted to HK$112,272,831. The total administrative expenses amounted to HK$177,115,093 (comprised of administrative expenses of HK$166,527,764 and finance cost of HK$736,571 under subvention and administrative expenses of HK$9,850,758 funded by accumulated surplus from other income), which represented an increase of HK$18,597,948 (12%) compared with the previous year.

ASTRI's operation remained steady with prudent financial management throughout the year. The total expenditure of the ITF, GSP and PSTS projects amounted to HK$362,313,505, of which 73% of the expenditure was spent on manpower and 27% of the expenditure was spent on equipment and other direct costs.

The total expenditure mainly represented the actual cash outflow incurred during the year for 82 full projects, 43 seed projects, two GSP projects and three PSTS projects. Meanwhile, the expenditure relating to Internship/Researcher Programme and Postdoctoral Hub amounted to HK$17,092,030, which represented the actual cash outflow of salary payment for interns/researchers and postdoctoral talent engaged in 40 full projects and 18 seed projects.

The consolidated financial statements of ASTRI for the year ended 31 March 2020 have been audited by independent auditors with unqualified audit opinion, an extract of the Consolidated Statement of Income and Expenditure, Consolidated Statement of Comprehensive Income and Consolidated Statement of Financial Position are set out on pages 67-69.

Consolidated Statement of Income and Expenditure and Comprehensive Income		
Year ended 31 March 2020	**2020 (HK$)**	**2019 (HK$)**
SUBVENTION		
Income from Government subvention	146,215,191	155,994,758
Administrative expenses	(166,527,764)	(158,517,145)
Finance cost	(736,571)	-
Deficit on subvention	(21,049,144)	(2,522,387)
PROJECT FUNDING FROM INNOVATION AND TECHNOLOGY FUND AND INDUSTRY CONTRIBUTIONS		
Project fund income		
- Innovation and Technology Fund	269,001,346	265,748,569
- Industry contributions	85,966,025	79,607,732
Project expenditure	(354,967,371)	(345,356,301)
Balance on project funding	-	-
Project fund income - General Support Programme		
- Innovation and Technology Fund	1,284,165	1,920,409
- Industry contributions	2,400,000	48,000
Project expenditure	(3,684,165)	(1,968,409)
Balance on project funding	-	-
Project fund income - Public Sector Trial Scheme		
- Innovation and Technology Fund	3,661,969	1,520,255
Project expenditure	(3,661,969)	(1,520,255)
Balance on project funding	-	-
PROJECT FUNDING FROM MINISTRY OF SCIENCE AND TECHNOLOGY OF THE PEOPLE'S REPUBLIC OF CHINA		
Project fund income	535,396	529,710
Project expenditure	(535,396)	(529,710)
Balance on project funding	-	-
INTERNSHIP/RESEARCHER PROGRAMME AND POSTDOCTORAL HUB FUNDING FROM INNOVATION AND TECHNOLOGY FUND		
Internship/Researcher Programme and Postdoctoral Hub fund income	17,092,030	8,400,841
Internship/Researcher Programme and Postdoctoral Hub expenditure	(17,092,030)	(8,400,841)
Balance on Internship/Researcher Programme and Postdoctoral Hub funding	-	-

Consolidated Statement of Income and Expenditure and Comprehensive Income (continued)		
Year ended 31 March 2020	**2020 (HK$)**	**2019 (HK$)**
FUNDING SUPPORT FROM INNOVATION AND TECHNOLOGY FUND FOR CHINESE NATIONAL ENGINEERING RESEARCH CENTRE FOR APPLICATION SPECIFIC INTEGRATED CIRCUIT SYSTEM (HONG KONG BRANCH) ("CNERC-ASIC")		
Expenditure incurred in relation to Funding Support from Innovation and Technology Fund	(9,349,478)	(4,780,162)
Amount for reimbursement	9,349,478	4,780,162
	-	-
RESERVE FUND		
Reserve Fund - income	1,287,715	-
Reserve Fund - expenditure	(1,287,715)	-
	-	-
OTHER INCOME/(EXPENSES), NET		
Other income	23,906,806	21,310,186
Other expenses	(24,376,805)	(16,654,639)
Other income/(expenses), net	(469,999)	4,655,547
AMOUNT RETURN TO THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION	**(3,412,961)**	**(1,297,209)**
SURPLUS/(DEFICIT) BEFORE TAX	(24,932,104)	835,951
INCOME TAX EXPENSE	(14,360)	-
SURPLUS/(DEFICIT) FOR THE YEAR	**(24,946,464)**	**835,951**
OTHER COMPREHENSIVE LOSS THAT MAY BE RECLASSIFIED TO SURPLUS OR DEFICIT IN SUBSEQUENT PERIODS		
Exchange differences arising on translation of foreign operations	**(62,821)**	**(39,564)**
TOTAL COMPREHENSIVE INCOME/(DEFICIT) FOR THE YEAR	**(25,009,285)**	**796,387**

Consolidated Statement of Financial Position		
31 March 2020	**2020 (HK$)**	**2019 (HK$)**
NON-CURRENT ASSETS		
Property, plant and equipment	15,755,378	26,154,890
Right-of-use assets	43,986,131	-
	59,741,509	**26,154,890**
CURRENT ASSETS		
Accounts receivable, contract assets, prepayments and deposits	32,870,291	33,766,201
Amount due from the Government of the Hong Kong Special Administrative Region	25,984,036	4,527,231
Tax recoverable	1,215,326	1,215,326
Cash and cash equivalents	260,094,956	224,911,696
	320,164,609	**264,420,454**
CURRENT LIABILITIES		
Accounts payable, other payables and accruals	86,757,923	77,869,568
Deferred government grants	10,826,673	8,701,427
Receipts in advance	158,538,317	94,119,927
Amount due to the Government of the Hong Kong Special Administrative Region	1,257,708	802,688
Lease liabilities	22,100,460	-
Tax payable	13,983	14,018
	279,495,064	**181,507,628**
NET CURRENT ASSETS	**40,669,545**	**82,912,826**
TOTAL ASSETS LESS CURRENT LIABILITIES	**100,411,054**	**109,067,716**
NON-CURRENT LIABILITIES		
Lease liabilities	16,352,623	-
Provision	11,460,469	11,460,469
	27,813,092	**11,460,469**
Net assets	**72,597,962**	**97,607,247**
EQUITY		
Share capital	2	2
Reserves	72,597,960	97,607,245
Total equity	**72,597,962**	**97,607,247**

Note:

These financial statements have been prepared in accordance with Hong Kong Financial Reporting Standards (which include all Hong Kong Financial Reporting Standards, Hong Kong Accounting Standards and Interpretations) issued by the Hong Kong Institute of Certified Public Accountants, accounting principles generally accepted in Hong Kong and the Hong Kong Companies Ordinance. They have been prepared under the historical cost convention and are presented in Hong Kong dollars ("HK$").

The financial information relating to the years ended 31 March 2020 and 31 March 2019, included in the Consolidated Statement of Income and Expenditure and Comprehensive Income, and the Consolidated Statement of Financial Position set out on pages 67-69, is not part of the Company's statutory consolidated financial statements for those years but is derived from them. Further information relating to those statutory financial statements required to be disclosed in accordance with section 436 of the Hong Kong Companies Ordinance is as follows:

As the Company is a private company, the Company is not required to deliver its financial statements to the Registrar of Companies and has not done so.

The Company's auditor has reported on the consolidated financial statements of the Group for both years. The auditor's reports were unqualified; did not include a reference to any matters to which the auditor drew attention by way of emphasis without qualifying its reports; and did not contain a statement under sections 406(2), 407(2) or (3) of the Hong Kong Companies Ordinance.

Hong Kong Applied Science and Technology Research Institute Company Limited

www.astri.org

5/F, Photonics Centre, 2 Science Park East Avenue,
Hong Kong Science Park, Shatin, Hong Kong

(852) 3406 2800 (852) 3406 2801 corporate@astri.org

Room 220, 2/F, Chinese Overseas Scholars Venture
Building, Shenzhen Hi-tech Industrial Park, Nanshan,
Shenzhen (PRC 518057)

(86 755) 8632 9394 (86 755) 8632 9394 corporate@astri.org