ASTRI

Annual Report 2022-23

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Chairman's Foreword

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

Entering my fourth year as Chairman of the Board of Directors, I am optimistic about what the future holds. Although the past few years have been challenging for Hong Kong, the resilience of our citizens and the dedication of our ASTRI team have enabled us to overcome numerous obstacles. Now, it is time to focus on building a city prepared for future challenges. Our country supports the development of Hong Kong as an international innovation and technology (I&T) hub, while the HKSAR Government's "Hong Kong Innovation and Technology Development Blueprint" lays out strategic plans for our city's I&T development over the next five to ten years. These include measures to attract and nurture I&T talents, subsidies designed to foster multi-disciplinary cooperation in technology transfer, and investment aimed at enhancing R&D in fields such as Artificial intelligence, 5G Technology, and FinTech.

ASTRI is playing a part in furthering all these strategic I&T plans, and more. We are especially proud of the contributions we are making through our diverse portfolio of commercially viable technologies, which include Communication Technologies, Trusted and Artificial Intelligence (AI) Technologies, IoT Sensing and AI Technologies, Integrated Circuits and Systems and more. We have committed significant resources to commercialising our R&D outcomes, successfully transferring nearly 1,400 technologies to industry and being granted over 1,000 patents in the Mainland, the US, and other countries.

We are well-positioned to push the boundaries of innovation and explore new opportunities for growth. We are confident that, by leveraging our expertise and cutting-edge technologies, we can help shape a brighter future for our city.

A Roadmap for I&T Development in Hong Kong

In 2022, the HKSAR Government emphasised the importance of I&T development for the city with its "Hong Kong I&T Development Blueprint", which set out eight major strategies under four broad development directions for the next five to ten years. These directions include enhancing Hong Kong's I&T ecosystem and promoting new industrialisation, enlarging the I&T talent pool to

create a stronger impetus for growth, promoting the development of the digital economy and making Hong Kong into a genuine Smart City, and proactively integrating Hong Kong into the overall development of the Nation. Ultimately, these moves will consolidate Hong Kong's role as a bridge connecting Mainland China and the rest of the world.

In the current government's first Budget announcement, the Financial Secretary proposed an array of initiatives designed to support basic research in frontier technology fields, leverage Hong Kong's unique advantage as a platform for international scientific research collaboration, and promote the development of intelligent industries. The Budget included subsidies for universities and research institutes looking to establish thematic research centres that will foster cross-university, cross-institutional, and multi-disciplinary cooperation. It also laid out plans for establishing a Microelectronics Research and Development Institute to expand R&D across various fields and improve industry standards, in preparation for future challenges and opportunities.

ASTRI is thrilled to support the government's various plans and strategies for I&T development. Utilising lessons learnt from the pandemic and social issues in recent years, we have been developing new solutions to strengthen our city's resilience and enable it to tackle future challenges with confidence.

Smart mobility is a key to the sustainable development of any city. To make Hong Kong a world-class smart city, in 2022 ASTRI launched the second phase of our C-V2X (Cellular Vehicle-to-Everything) technology public road tests. In September, we also signed a Memorandum of Understanding (MoU) with Shenzhen SmartCity Technology Development Group (Shenzhen SmartCity). Under the MoU, ASTRI is conducting research on advance connectivity and smart transportation technologies in the Greater Bay Area (GBA), along with R&D, design, standardisation and testing of the C-V2X application in Hong Kong, and research into big data connectivity standards and security systems. Meanwhile, Shenzhen SmartCity is conducting complementary research on the infrastructure of C-V2X in urban scenarios, together with R&D, design, standardisation and testing of the C-V2X application in Shenzhen. The real-time information that C-V2X can transmit connects and coordinates people, vehicles and road infrastructure, with road users receiving reports and warnings in real time to enhance road safety and assist driving. In the long run, C-V2X has much to offer to perfect autonomous driving technology, through its ability to detect hidden dangers and improve road safety.

Artificial Intelligence (AI) has gained increasing public prominence recently, and ASTRI has been integrating AI with various technologies to create solutions that address societal needs. For instance, we have partnered with the Cyber Security and Technology Crime Bureau of the Hong Kong Police Force to create the first HoneyNet - Early Threat Hunting & Analysis Network (ETHAN). This collaboration is supporting proactive cybersecurity measures by law enforcement and raising public awareness of cybersecurity issues. Meanwhile, generative AI has emerged as a groundbreaking technology with the potential to significantly impact a wide range of industries, from arts and entertainment to healthcare and scientific research. ASTRI has developed a chatbot with Natural Language Processing (NLP) optimised for local languages, able to generate human-like text and carry on human-like conversations, and which is ideal for deployment in customer service environments and operations centres.

Given Hong Kong's status as a leading financial centre, the government has taken several initaitives to promote FinTech, including the development of a central bank digital currency (CBDC). We have collaborated with the Bank for International Settlements Innovation Hub (BISIH) and the Hong Kong Monetary Authority (HKMA) to build a CBDC system prototype that emphasises safety, flexibility, and privacy. The e-HKD Pilot Programme commences in 2023, taking some deep dives into potential use cases.

The government attaches great importance to Environmental, Social, and Governance (ESG) issues, while relevant regulators have also promoted new ESG policies and regulations, as well as implementing information disclosure legislation. ASTRI is taking a leading role in these areas. For example, we have launched an "AI ESG Report Analytical Engine" that helps corporations put their sustainability beliefs into action by automatically extracting data from a vast number of complex files and condensing it into a summary ESG report. In cooperation with other organisations, we expect to leverage our AI ESG report analysis technology to develop other regulatory technologies that will support the government's efforts to promote green finance and expedite Hong Kong's carbon neutrality targets.

One of ASTRI's contributions to the government's push for new industrialisation in Hong Kong is our AR/VR Compatible Head-Mounted Display (HMD). Benefitting from our patent-protected display and sensing technology, the AR/VR Compatible HMD enjoys unparalleled image display quality, biometric-based secure data protection, eye gaze tracking and gesture understanding. It is providing a turnkey solution for sectors such as education, training and simulation and operations assistance, and is contributing to Hong Kong's industrialisation transformation. The HMD won a Smart Business (Emerging Technologies) Silver Award at the Hong Kong Information and Communications Technology Awards (ICT Awards) 2022.

Connecting the I&T Community

In line with the goal of promoting the digital economy and transforming Hong Kong into a smart city, ASTRI is taking the lead in developing various technology ecosystems to connect the wider I&T community. We aim to facilitate collaborations among government, industry, academia, and research institutions by creating vibrant ecosystems that foster innovation and talent development. To achieve this, we are forging strong partnerships across the upstream, midstream, and downstream sectors, joining hands with multiple parties to promote the practical implementation of R&D outcomes.

ASTRI enjoys strong relationships with local universities in Hong Kong. In 2022 we signed Memorandums of Understanding (MoUs) with six local universities. Nearly 20 collaborative R&D projects with these universities have been initiated in 2023 to date, all of which are further promoting and expanding the commercialisation of R&D outcomes. In Q4 2023, ASTRI also launched its first-ever Joint Work-Study Programme with the Hong Kong University of Science and Technology, along with new professional diploma programmes in Microelectronics and Communications Technologies with the Vocational Training Council. These will also serve to nurture I&T talents and prepare them for future careers in the industry.

In November 2022, ASTRI led the establishment of the first Microelectronic Technology Consortium (METC) in response to the unprecedented global demand for microelectronics. Since the launch of the consortium, we have established an effective platform that have attracted microelectronics professionals, IT professionals and students, enabling them to stay abreast of developments

across the microelectronics ecosystem and inspiring some to pursue careers in the semiconductor industry.

This was followed by the establishment of the Smart Mobility Technology (C-V2X) Alliance (SMTA), an organisation that is connecting OEM companies, AV and EV companies, services and system providers and industry users from Hong Kong, Mainland China and overseas in the field of smart mobility. This kind of technology ecosystem is helping to expand the talent pool, sharing valuable insights across many stakeholders, and accelerating knowledge transfer and technology commercialisation.

A sustainable talent pool is essential for both I&T and ecosystem development. The government has been supporting this by implementing schemes and policies such as the Top Talent Pass Scheme, and expanding its Technology Talent Admission Scheme. Alongside these, ASTRI offers a Top Technology Programme with a career progression plan for degree holders, and summer internship programmes for local and overseas undergraduates and postgraduates. All these initiatives are supporting young professionals by helping them develop their skills and their careers.

A Golden Opportunity

The growth and integration of the GBA is also bringing many valuable opportunities for Hong Kong's I&T development. The Futian RMB 100 million 1:1 matching fund programme was officially approved in February 2023 with the investment from both ASTRI and the Futian Government, supporting R&D projects to be established in Futian. In addition, ASTRI is expanding its activities in the Mainland, and we expect to open our Hong Kong Science Park Shenzhen Branch in Futian at the end of 2023. Our Shenzhen branch will support our GBA development strategy, which involves advancing technology development, facilitating the direct commercialisation of technology R&D, and contributing to the development of industry standards and new industrialisation roadmaps.

We also aim to strengthen our connections with nearby cities and countries and undertake in-depth exchanges with them, especially those associated with the Belt & Road Initiative. The aim is to achieve international recognition for our R&D initatives and explore new technology commercialisation opportunities overseas.

I strongly believe that we are currently at a pivotal point in time. Using technology and innovation, we can transform the challenging environment we are facing into opportunities for growth and development. There are numerous difficulties facing us in the current global situation, but also many opportunities for those willing to embrace change and adapt to new circumstances. By leveraging the latest technologies and innovative ideas, we really can create a brighter future for Hong Kong and its people.

I would like to take this opportunity to express my sincere gratitude to our board members, and also to our dedicated teams of researchers and staff, who are working tirelessly to make our vision a reality. Together, we are working towards the common goal of making Hong Kong a better and smarter city. I am honoured to be a part of such a talented and dedicated team.

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

Chief Executive Officer's Report

Dr. Denis Yip Shing-fai
Chief Executive Officer

Looking to the future, there is a real sense of optimism as daily routines return to normal. Innovation & Technology (I&T) has emerged as a key driver of economic recovery and societal resurgence, and it represents a golden opportunity for investment and growth. The Government of the Hong Kong Special Administrative Region has introduced favourable I&T policies, and Hong Kong's geographical advantages within the Greater Bay Area (GBA) are providing ample opportunities for growth. Robust support for I&T talent development is further enhancing the potential for I&T success. At ASTRI, we are excited about what the future holds and look forward to leveraging these advantages to drive innovation and growth in the years to come.

ASTRI has been striving for excellence while supporting the growth of Hong Kong's I&T industry for the past 23 years. Our primary goal is to enhance the competitiveness of our city through applied research. ASTRI carries out cutting-edge R&D projects that have broad applications across various industries. By utilising our technological proficiency and transferring the results of our research to different businesses and organisations, ASTRI is helping create new business prospects in the flourishing I&T sector.

Building Hong Kong into an International I&T Hub

I&T is providing a key impetus for Hong Kong's economic development. As one of Hong Kong's leading research institutes, ASTRI is devoted to supporting the city's vision of becoming an international I&T hub through applied research, technology commercialisation, ecosystem development, and the creation of a sustainable talent pool.

Our four technology divisions – Trust and AI Technologies, Communications Technologies, IoT Sensing and AI Technologies, and Integrated Circuits and Systems – each have a focus on specific cutting-edge technological advancements. These divisions work collaboratively on innovative solutions that address a wide range of challenges faced by industries and communities in Hong Kong. To ensure that our research efforts are aligned

with the Government's priorities, we have identified six core areas of focus: Smart City, Financial Technologies, New Industrialisation and Intelligent Manufacturing, Digital Health, Application Specific Integrated Circuits, and Metaverse. These are areas in which our research is creating new opportunities for economic growth and development.

Our key technologies have reached a level of maturity that means they are able to provide robust foundations for a diverse array of industries. They include the "Easy 5G Solution", the C-V2X system, Federated Learning, Natural Language Processing, the Honeynet developed in collaboration with the Hong Kong Police Force: Early Threat Hunting & Anticipation Network (ETHAN), as well as efficient and energy-saving innovative 3D Integrated Circuit Platform technology and Third-generation Semiconductors, Direct Current circuit breakers, IOT Sensing and AI Technologies. All of these are set to play a crucial role in the development of Hong Kong as a truly Smart City.

In the 2022-23 year, our four Technology Divisions launched 45 research projects and transferred 88 technologies to different industries, generating an industry income of HK$110.61 million. At the same time, ASTRI obtained 57 new patents in China, the US and other countries, laying a solid foundation for us to pursue further research and development initiatives and introduce more innovative technologies in Hong Kong in support of digital transformation.

Ecosystem and University Technology Transfer

My own wide experience in the technology industry has highlighted for me the critical need to enhance Hong Kong's I&T ecosystems. In 2022, ASTRI took a bold step by setting up a new department named Ecosystem and University Technology Transfer (EUTT), which is supporting and facilitating the growth of various technology ecosystems. By forging strong partnerships with universities, EUTT aims to accelerate the development of the city's technology industry and help to position Hong Kong as a global I&T hub.

These new ecosystems are enabling us to promote cross-industry initiatives that encourage the exchange of ideas and expertise between industry experts, research institutes, universities, academia, and government. Ecosystem members can use our platforms to connect with stakeholders at all levels and gain access to valuable insights and technology solutions. We are confident that these innovations will help Hong Kong remain at the forefront of technological advancements, and contribute significantly to the global community.

ASTRI has already established strong relationships with local universities in Hong Kong. In addition to partnering to explore cutting-edge technologies and technology transfer opportunities, ASTRI is also collaborating with universities to expand the city's research and development (R&D) talent pool. In February 2022, ASTRI signed a Memorandum of Understanding (MoU) with The Hong Kong University of Science and Technology (HKUST) and has since signed MoUs with The Hong Kong Polytechnic University (PolyU), City University of Hong Kong (CityU), The Chinese University of Hong Kong (CUHK), The University of Hong Kong (HKU), and Hong Kong Baptist University (HKBU).

ASTRI also leveraged its strong ties to industry to establish a new consortium in November 2022. The Microelectronics Technology Consortium (METC) is a networking and knowledge-sharing platform for industry players in the field of microelectronics and semiconductors from Hong Kong and Mainland China (in particular the GBA) and from

overseas, and is specially designed to facilitate collaboration and technology commercialisation opportunities.

Meanwhile, the Smart Mobility Technology (C-V2X) Alliance (SMTA) is another networking and knowledge-sharing platform for smart mobility industry users and ecosystem stakeholders from OEM companies, AV and EV companies, and services and system providers in Hong Kong and Mainland China (in particular the GBA), and overseas.

Creating a Large and Sustainable I&T Talent Pool

Nurturing and retaining I&T talent is essential for Hong Kong to maintain its competitiveness, and ASTRI is playing a major role in doing this. Through a number of talent programmes, which include our “Top Tech Scholar Programme”, “Summer Internship Programme”, and “Fintech Future Leaders Academy”, ASTRI is attracting and supporting young talent and providing future opportunities for them. In 2022, ASTRI’s summer programmes met with an overwhelming response, receiving a total of 2,464 applications from students from over 28 renowned universities in the United States, the United Kingdom and Canada, as well as students from top universities in Hong Kong. We are expecting an equally enthusiastic response to our 2023 summer programmes.

At the beginning of 2023, ASTRI and HKUST joined forces to launch the first-ever Work-Study Programme (PhD), enabling R&D staff at ASTRI to pursue a PhD degree on a part-time basis while continuing to work full-time at ASTRI. We expect this programme to be effective in attracting and retaining I&T talents who wish to pursue PhD studies or conduct research in Hong Kong, while at the same time providing Hong Kong with the high quality I&T talents it needs to develop into a leading Smart City and international I&T hub. Currently, ASTRI is also exploring part-time PhD programme opportunities with other universities as part of its efforts towards creating a sustainable talent pool.

Driving Innovation and Growth in the GBA and Beyond

In China’s process of national modernisation, Hong Kong’s vital role as a truly international metropolis and as a ‘super-connector’ for the GBA is becoming increasingly evident. Our city also boasts many other competitive advantages that make it an obvious leader among other Belt and Road cities. All this means that Hong Kong is well-positioned to play a major role in driving growth and prosperity in the region, which will in turn bring many more opportunities for the I&T industry in Hong Kong.

At the same time, Hong Kong’s important position both in China’s domestic economy

and within the international economy gives it the ability to act as a 'super-connector' between the two. This means taking advantage of opportunities to both deepen and expand cooperation with the GBA, and to consolidate Hong Kong's international advantages.

ASTRI is expanding its presence in Mainland China. Our new Hong Kong Science Park Shenzhen Branch in Futian is scheduled to open by the end of 2023. In February 2023, the Futian 1:1 matching fund programme was officially approved, with investments from both ASTRI and the Futian Government. This programme is set to last for five years and is aimed at supporting the development of innovative technologies in the Futian district. As part of our efforts to expand our activities in Mainland China, ASTRI is actively collaborating with partners in the region on projects to drive innovation and growth, creating new opportunities for businesses and industries in Hong Kong and beyond. We will remain active in collaborating with research institutes, universities, and enterprises in the region.

Hong Kong is a major bridge between China and the rest of the world, including the ASEAN region, and serves as a key node in the Belt and Road Initiative. By leveraging its geographical advantages, ASTRI has the opportunity to act as a unique "super-connector" between the Mainland and global markets. This involves making good use of Hong Kong's well-established international status, advanced research platforms, solid legal system and intellectual property rights to connect Mainland corporates with overseas entities.

Looking Ahead

We realise that, in the goal of enhancing Hong Kong's competitiveness through applied research, we cannot work single-handedly. Our ultimate success will be dependent on the collective efforts of all stakeholders in the Hong Kong I&T ecosystem. This is why we are dedicated to driving ecosystem development, building a strong talent pool, and fostering active collaboration among government, industry, academia, and research institutions in Hong Kong.

The I&T landscape is rapidly evolving. We believe it is essential for all stakeholders in the Hong Kong I&T ecosystem to work together through open dialogue, knowledge-sharing, collaboration and technology commercialisation. Only by doing so can we create a more connected and collaborative ecosystem that will support the long-term growth and success of Hong Kong's I&T sector. Our collective efforts are essential for shaping a bright future for Hong Kong and helping the region's technology industry stride forward to success.

Dr. Denis Yip Shing-fai
Chief Executive Officer

Board of Directors

Composition of the Board

As of 31 March 2023, ASTRI's Board was made up of the Chairman and 19 other members, two of whom were Official members.

Chairman

Ir. Sunny Lee Wai-kwong, BBS, JP
Vice-President (Administration),
City University of Hong Kong

Official Members

Mr. Eddie Mak Tak-wai, JP
Permanent Secretary for Innovation, Technology and Industry, Innovation, Technology and Industry Bureau

Ms. Rebecca Pun Ting-ting, JP
Commissioner for Innovation and Technology, Innovation and Technology Commission

Members (in alphabetical order of surname)

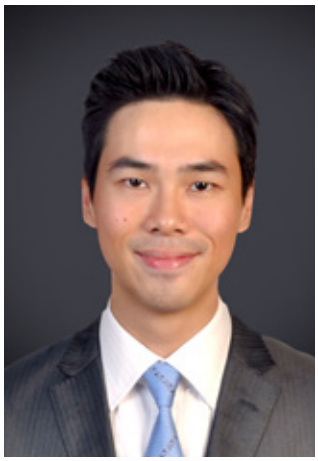
Prof. Chan Chun-kwong
Programme Director, MSc in Financial Technology, Faculty of Engineering,
Professor of Practice in FinTech,
Department of Systems Engineering and Engineering Management,
The Chinese University of Hong Kong

Prof. Christopher Chao Yu-hang
Vice President (Research and Innovation),
Chair Professor of Thermal and Environmental Engineering,
Department of Building Environment and Energy Engineering and Department of Mechanical Engineering,
The Hong Kong Polytechnic University

Members (in alphabetical order of surname)

Mr. Stephen Chau Kam-kun

Executive Director & Chief Technology Officer, SmarTone Telecommunications Holdings Limited



Dr. Felix Chow Bok-hin

Executive Chairman, Niche-tech Semiconductor Materials Limited

Mr. Charles Chow Sai-keung

South China & Hong Kong Assurance Leader, PricewaterhouseCoopers

Mr. Steve Chuang Tzu-hsiung

Chairman and Chief Executive Officer, ProVista Group

Mr. William Ho Tat

Co-Owner & Chief Executive Officer - Enterprise Solutions, HKBN Group

Mr. Stephen Ho Wai-chung

Founder and CEO, n-hop technologies Limited

Members (in alphabetical order of surname)

Mr. Edmund Lee Chi-wai
Chief Executive Officer,
Application Technology Company Limited

Mr. Theodore Ma Heng
Managing Partner,
CoCoon Ignite Ventures

Mr. Peter Ng Hon-yu
Vice President, Technology, Enabling Technology Group, ASM Pacific Technology Ltd.

Ir. Prof. Joseph Ng Kee-yin
Professor, Department of Computer Science,
Hong Kong Baptist University

Dr. Alfred Ng Man-cheuk
Chief Executive Officer,
Suga International Holdings Limited

Ir. Dr. Samson Tai Kin-hon
Professor of Practice,
School of Business,
Hong Kong Baptist University

Mr. Anthony Tong Tat-hay
Managing Partner, Robin Bridge & John Liu

Mr. Wilfred Wong Kam-pui, BBS, JP
Managing Director,
RESOLUTIONS HR & Business Consultancy Co. Ltd.

Ms. Ada Wong Yin-man
Executive Director, Wong's International Holdings Limited

Board Functional Committees

Three functional committees assist the Board in its oversight of ASTRI: the Finance and Administration Committee oversees ASTRI's financial and administrative matters; the Technology Committee oversees ASTRI's research initiatives; and the Audit Committee ensures that internal and external audit processes are properly carried out.

The members of the committees as of 31 March 2023 were as below:

Finance and Administration Committee (FAC)	Technology Committee (TC)	Audit Committee (AC)
Prof. Chan Chun-kwong (Chairman)	Mr. Stephen Ho Wai-chung (Chairman)	Mr. Charles Chow Sai-keung (Chairman)
Ms. Rebecca Pun Ting-ting, JP	Ms. Rebecca Pun Ting-ting, JP	Ms. Rebecca Pun Ting-ting, JP
Mr. Stephen Chau Kam-kun	Prof. Christopher Chao Yu-hang	Mr. William Ho Tat
Dr. Felix Chow Bok-hin	Mr. Steve Chuang Tzu-hsiung	Dr. Alfred Ng Man-cheuk
Mr. Edmund Lee Chi-wai	Mr. William Ho Tat	Ir. Dr. Samson Tai Kin-hon
Mr. Theodore Ma Heng	Mr. Edmund Lee Chi-wai	Ms. Ada Wong Yin-man
Mr. Anthony Tong Tat-hay	Ir. Sunny Lee Wai-kwong, BBS, JP	
Mr. Wilfred Wong Kam-pui, BBS, JP	Mr. Theodore Ma Heng	
	Mr. Peter Ng Hon-yu	
	Ir. Prof. Joseph Ng Kee-yin	
	Dr. Alfred Ng Man-cheuk	

Changes in Board Directors

New Directors	Date of Appointment
Mr. Eddie Mak Tak-wai, JP	20 July 2022
Dr. Felix Chow Bok-hin	21 October 2022
Mr. William Ho Tat	21 October 2022

Retired Directors	Date of Retirement
Ms. Annie Choi Suk-han, GBS, JP	20 July 2022
Prof. Lam Tak-wah	21 October 2022
Prof. Sabrina Lin Man-yee	21 October 2022

Attendance at Meetings

A total of five Board meetings were convened during the year 2022-23. The attendance records of members at Board meetings and meetings of the Board Functional Committees held between 1 April 2022 and 31 March 2023 are as follows:

Board Meetings

	22 Jun 2022	28 Sep 2022	16 Dec 2022	3 Feb 2023 (Special Meeting)	29 Mar 2023
Total number of directors during the period	20	20	20	20	20
Total number of directors present at meeting	18	19	15	18	17
Total number of apologies	2	1	5	2	3
Percentage in attendance	90%	95%	75%	90%	85%

FAC Meetings	18 May 2022	17 Aug 2022	27 Oct 2022 (Special Meeting)	29 Nov 2022	19 Jan 2023 (Special Meeting)	9 Mar 2023
Total number of FAC members during the period	7	7	7	8	8	8
Total number of FAC members present at meeting	5	4	7	6	7	6
Total number of apologies	2	3	0	2	1	2
Percentage in attendance	71%	57%	100%	75%	88%	75%

TC Meetings	1 Jun 2022	27 Jul 2022 (Special Meeting)	2 Sep 2022	1 Dec 2022	10 Mar 2023
Total number of TC members during the period	11	11	11	11	11
Total number of TC members present at meeting	8	10	11	7	7
Total number of apologies	3	1	0	4	4
Percentage in attendance	73%	91%	100%	64%	64%

AC Meetings	27 May 2022	26 Aug 2022	13 Sep 2022 (Special Meeting)	11 Nov 2022	3 Mar 2023
Total number of AC members during the period	7	6	6	6	6
Total number of AC members present at meeting	6	5	6	5	6
Total number of apologies	1	1	0	1	0
Percentage in attendance	86%	83%	100%	83%	100%

The ASTRI story

Connecting the Innovation & Technology Community

The Hong Kong Applied Science and Technology Research Institute (ASTRI) was founded by the Government of the Hong Kong Special Administrative Region in 2000, with the mission of enhancing Hong Kong's competitiveness through applied research.

Over the years, ASTRI has invested considerable effort into building technology ecosystems to connect members of the Innovation & Technology (I&T) community, facilitating cross-collaboration and technology commercialisation among government, industry, academia, and research institutes across technology sectors, fostering constructive connections among ecosystem partners, and ultimately optimising the benefits of I&T for the community.

Achievements at a glance

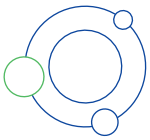
Since 2000, ASTRI has:

- Completed over 1,050+ research projects
- Been granted more than 1,050+ patents for its innovations
- Transferred more than 1,400+ technologies to different industry

Enhancing I&T Ecosystem in line with the "Hong Kong Innovation and Technology Development Blueprint"

In December 2022, the "Hong Kong Innovation and Technology Development Blueprint" was promulgated by the Hong Kong Government; this mapped out an overall direction and key strategies for developing Hong Kong into an international I&T hub.

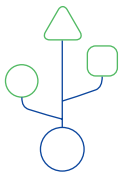
In line with this I&T development blueprint, ASTRI is working to unite all sectors of the I&T community and support them through new initiatives such as:



The establishment of **new technology ecosystem**

The development of technology industries with the **strengths in scientific research**

The expansion of Hong Kong **I&T talent pool**



The reinforcement of Hong Kong's role as a **"Super-connector"**

Establishing a Sustainable Technology Ecosystem

To help facilitate Hong Kong's transformation into a world-class I&T hub, ASTRI is fostering collaboration among different ecosystem partners (including the Government, universities, R&D centres, market users, and other stakeholders) by setting up technology ecosystems to support innovation and sharing. Two examples are the Microelectronic Technology Consortium (METC) and the Smart Mobility Technology (C-V2X) Alliance (SMTA), established in 2022 and 2023 respectively. These are platforms that enable industry stakeholders and members to exchange knowledge, identify industry pain points together, and share best practices. With the centralised resources and consolidated efforts, the established ecosystems enable members to tackle common obstacles and technology demands more efficiently and effectively. ASTRI is actively seeking opportunities to establish other similar ecosystems, thus helping build Hong Kong into a global I&T hub while contributing to I&T development in Hong Kong and the Greater Bay Area (GBA).

Building Closer Connections between I&T Ecosystems

Hong Kong possesses considerable strength in scientific research, with five of its universities ranked in the global top 100. ASTRI is serving as a platform facilitating closer collaboration between upstream and midstream research institutes and downstream enterprises, and in the process promoting the implementation and commercialisation of R&D outcomes. To this end, ASTRI signed a Memorandum of Understanding (MoU) with six universities in Hong Kong in 2022. Through these, we are forging robust collaborations to support universities' research initiatives and start-ups, explore cutting-edge technologies, accelerate technology transfer by leveraging our respective competencies and experiences, and nurture young R&D talents.

Expanding the I&T Talent Pool

One of ASTRI's top priorities is to nurture young I&T talents to meet future demand in R&D and to foster a sustainable I&T ecosystem. Having received commendations for our Top Technology Scholar Programme, we have enhanced the programme with additional benefits to attract Master's and PhD students with STEM backgrounds. We also recognise the importance of promoting STEAM Education, particularly in college-level studies, and have expanded our summer internship programme to overseas universities. The response has been highly positive. In 2022, we received over 2,400 applications from students at over 28 renowned universities in the United States, the United Kingdom, Canada and Hong Kong, and are expecting an even more enthusiastic response to our 2023 summer programme.

ASTRI and The Hong Kong University of Science and Technology (HKUST) introduced their first-ever Work-Study Programme (PhD) in 2023. This programme allows ASTRI's R&D employees to pursue a part-time PhD degree while remaining employed as full-time staff at ASTRI. The initiative is attracting I&T experts who are eager to undertake doctoral studies or research in Hong Kong, further helping to transforming the city into a leading smart city and international I&T hub.

ASTRI is also empowering its existing staff by giving them opportunities to acquire new knowledge and skills. We have invited industry heavyweights to speak at Tech Talk sessions, where their presentations have given ASTRI employees new knowledge and industry insights, as well as broadening their horizons and fostering a mindset of innovation. In such ways, ASTRI is helping talented individuals to realise their full potential.

Connecting with the GBA and Overseas Stakeholders

Hong Kong is strategically positioned to serve as a "Super-connector" between the Mainland and the rest of the world in the technology sector. ASTRI has the unique advantage of being able to act as a bridge between China and global markets, due to our proximity to Shenzhen and other GBA cities alongside our close connections with international innovation hubs.

ASTRI has launched its first-ever partnership with the Southern University of Science and Technology in the GBA to jointly operate a laboratory, and has initiated the Shenzhen-Hong Kong C-V2X Information and Technology Corridor to promote connectivity between Hong Kong and Mainland China. ASTRI expects to establish a new centre in the Shenzhen Branch of the Hong Kong Science Park in Futian in late 2023 or early 2024, when it will be able to deepen partnerships with ecosystem stakeholders and industry partners in Mainland China, and achieve greater integration with China's development plan.

ASTRI has also been actively promoting innovation and technology to the public, industry and corporates overseas. In collaboration with ecosystem partners, ASTRI presented the latest 5G applications and innovations at the Mobile World Congress (MWC) Las Vegas 2022 and Barcelona 2023. Various cost-effective, cutting-edge 5G technologies were demonstrated, enabling corporates to enter the market quickly for rolling out 5G for public, private or vertical market applications using Easy 5G. ASTRI's "5G + Industrial Internet" supports use cases such as smart factories, power grids, mining, smart transportation, which will enable factories in realising Industry 4.0 transformation towards fully 5G connected factories. ASTRI is actively engaging with different local and global partners to commercialise and apply 5G network solutions currently.

Our Technology Roadmap

ASTRI's R&D activities are organised across four Technology Divisions (TDs): Communications Technologies (CT), Integrated Circuits and Systems (ICS), IoT Sensing and AI Technologies (IOTSAI), and Trust and AI Technologies (TAIT).

These deliver leading-edge, market relevant applications in six areas: Smart City, Financial Technologies, New industrialisation and Intelligent Manufacturing, Digital Health, Application Specific Integrated Circuits (through our mandate as the Hong Kong branch of the Chinese National Engineering Research Centre (CNERC)), and Metaverse.

Smart City

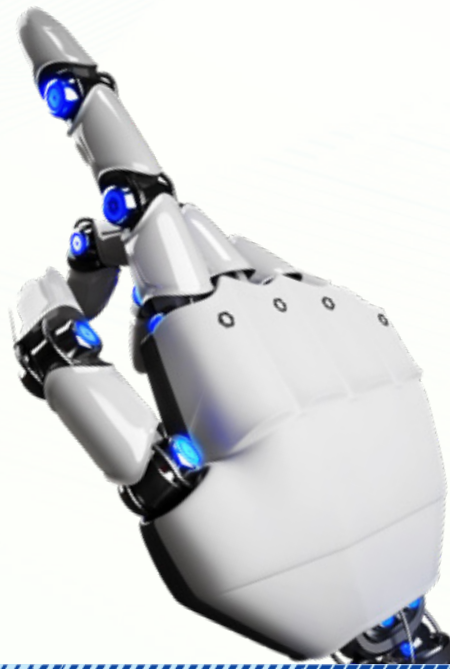
In December 2022, the Hong Kong SAR Government released a detailed blueprint for Hong Kong's I&T development. When fully realised, Hong Kong will be Asia's most technologically advanced 21st century city. Included in the blueprint's four broad directions are digital economy development and the development of Hong Kong into a smart city. ASTRI is supporting the government in these efforts, especially in Smart City which is one of our core areas of expertise and focus. By utilising our 5G capabilities and increasing the functionality of our existing smart technologies, we are developing tools and platforms that enable Smart City technologies to seamlessly communicate with one another.

FinTech

The financial services landscape is changing due to the development of financial technologies, or FinTech. The Fintech Strategy 2025, launched by the Hong Kong Monetary Authority (HKMA), encourages tech-driven innovation in the financial service sector. As one of Hong Kong's strongest FinTech R&D groups, ASTRI is developing solutions leveraging blockchain, strengthening cybersecurity and cryptography technology, improving analysis of big data, and providing valuable proofs-of-concept. We are supporting and spearheading the evolution of FinTech in Hong Kong from the perspective of ecosystem development, with a core industry focus on traditional and virtual banks, regulators and insurance companies.

New Industrialisation and Intelligent Manufacturing

The Hong Kong I&T Development Blueprint released in 2022 emphasised the importance of new industrialisation, and laid out a goal of strengthening R&D and production line development support for strategic industries such as new energy vehicles and semiconductor chips. Hong Kong has the potential to unlock the Industry 4.0 vision by leveraging AI, robotics and data-centric solutions to make manufacturing more reliable and effective, and maintaining remote sites significantly easier. ASTRI is exploring ways of making production processes faster, easier, and more efficient. Our work in these areas involves developing advanced platforms, tools, and solutions for creating interconnected, fully digital smart factories that help businesses streamline their operations, work more efficiently and effectively, and become more environmentally friendly.



Digital Health

ASTRI is 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 and have provided medical professionals with new tools for treating patients and saving lives. ASTRI is applying R&D in ways that are increasing the efficiency of healthcare, enhancing and personalising medical services, and ultimately improving the quality of people's lives. We focus on developing new applications in areas such as elderly care, preventative health monitoring, medical diagnosis, and medical computing.

Application Specific Integrated Circuits

Integrated Circuits (IC) are key components of growth for many high-tech industrial sectors looking to significantly upgrade their capabilities, especially in areas such as telecommunications, Smart City technology and electronics.

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 National 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.

Metaverse

The metaverse represents the next milestone in the development of the Internet, including both hardware and software development, and is opening up business opportunities to enterprises worldwide. ASTRI's experts are actively exploring metaverse applications that harness the power of technology – such as digital twins, AR, VR, AI, and virtual assets – to unlock the full potential of this emerging arena. ASTRI's R&D is focused on such key prospective use cases as 3D mapping, vehicle inspection, remote maintenance, online education, virtual avatar, smart manufacturing, and more.

Our Organisation

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

C-Officers

In 2022-23, the following C-Officers were members of the Senior Management team:

Dr. Denis Yip
Chief Executive Officer

Mr. David Chan*
Chief Operating Officer

Ms. Cammy Yung
Chief Financial Officer

*Mr. David Chan joined as COO on 15 November 2022
Dr. Martin Szeto, Chief Operating Officer, left ASTRI on 3 December 2022
Dr. Lucas Hui, Chief Technology Officer, left ASTRI on 28 January 2023
Mr. Aaron Ho, Chief Administrative Officer, left ASTRI on 20 February 2023

Technology Division Heads

ASTRI's four Technology Divisions are responsible for the development of their respective technologies. Each is headed by an experienced leader in the field. The Division Heads in 2022-23 were as follows:

Dr. Justin Chuang
Vice President,
Communications
Technologies (CT)

Dr. Daniel Shi
Vice President,
Integrated Circuits and
Systems (ICS)

Mr. Alan Cheung
Senior Director,
Trust and AI Technologies
(TAIT)

Dr. Tsai Chen Jung
Senior Director, IoT Sensing
and AI Technologies (IOTSAI)

Core Competence Group Senior Management

Dr. John Koo
Director,
Cyber-Physical Systems

Dr. Lawrence Poon
Head of Innovative Technology
Innovative Mind

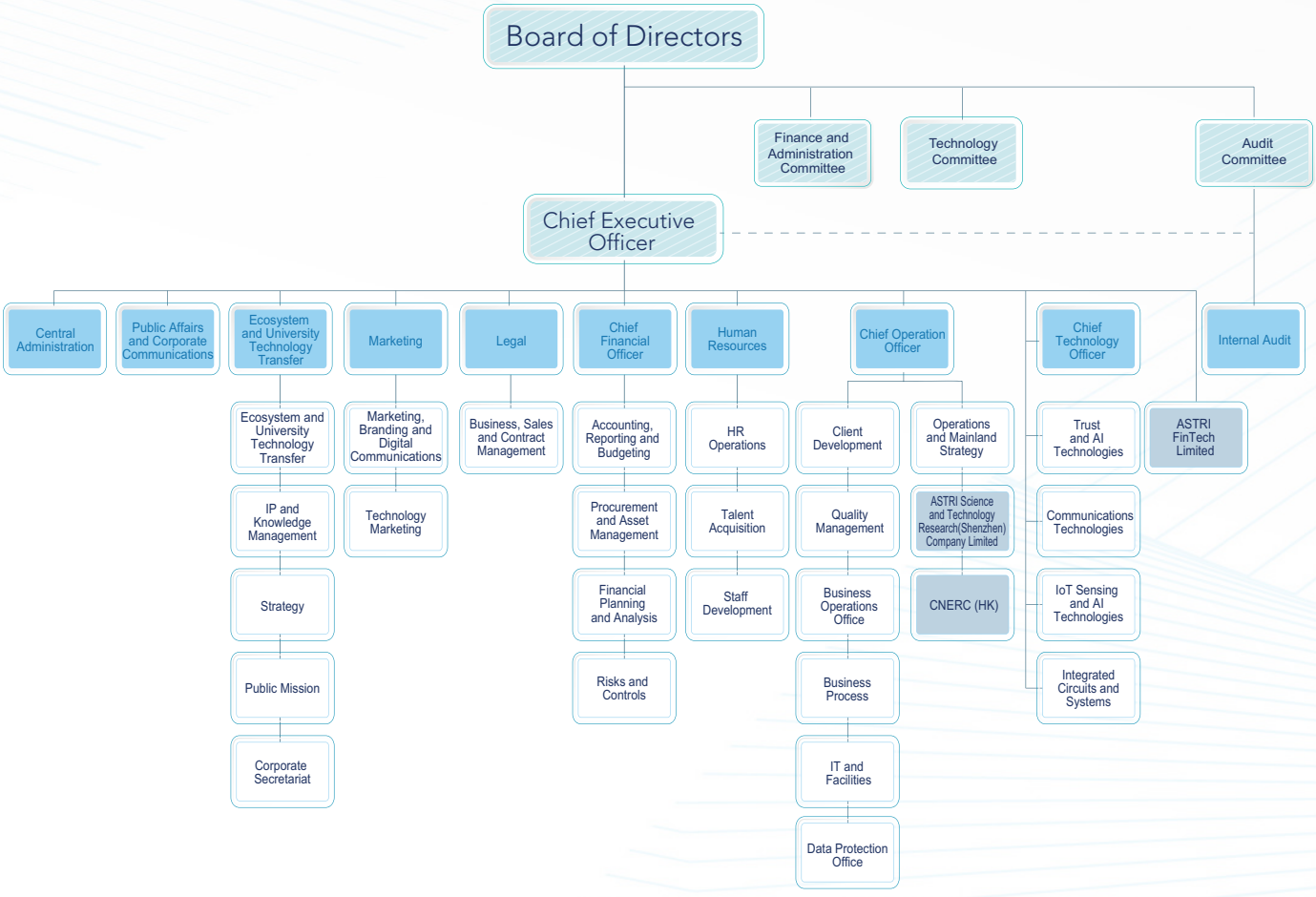
One team, one dream

As of 31 March 2023, ASTRI consisted of a team of approximately 600 dedicated and highly competent individuals, all working towards the common goal of creating a better future for Hong Kong and the nation. We recognise that people are valuable assets to our organisation, and see our success as stemming from combining a highly skilled workforce with the right leadership and guidance, all within a dynamic organisational structure.

Organised under the four Technology Divisions, our R&D teams account for 75% of the total workforce. The remaining 25% is made up of personnel providing various support services and functions. They include teams working in our department of Business Operations, Client Development, Ecosystem and University Technology Transfer, Facilities Management, Finance and Accounts, Human Resources, Information Technology, Intellectual Property and Knowledge Management, Legal, Marketing and Procurement.

ASTRI's organisational structure as of 31 March 2023 is laid out in the chart below:

ASTRI's organisation structure



ASTRI's R&D organisational structure

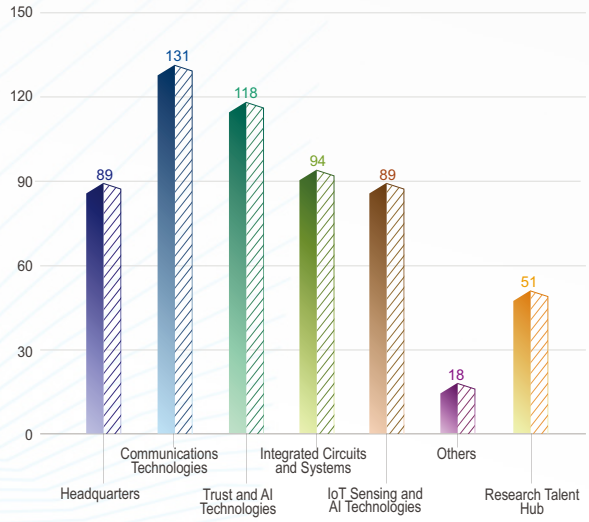
Technology Divisions

- Trust and AI Technologies
- Integrated Circuits and Systems
- Communications Technologies
- IoT Sensing and AI Technologies

Core Competence Groups

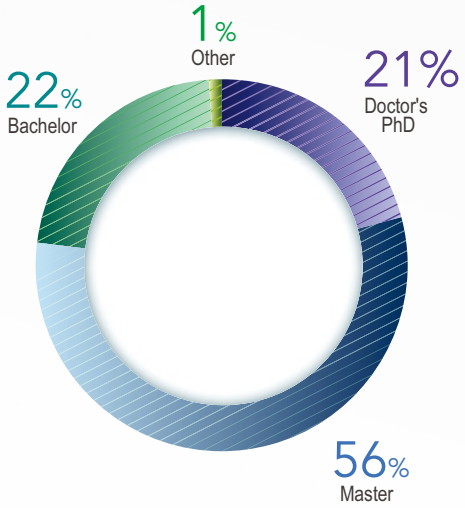
Cyber Security and Analytics	RF Systems	Baseband Solutions	Intelligent Machine Vision	Innovative Mind
Data Analytics	IC Enabling Technologies	Networking Software	Emerging Sensing and Display Technology	Cyber-Physical Systems
Applied Cryptosystems	Machine Learning Platfroms	Emerging Systems	Sensing Devices and Integration	
Secured System Platforms	3D Integration	Mobile and IoT Platforms	Intelligent IoT System	
Multimodal Image Analytics	Smart Power and Energy Systems	Medium Access Control and Intelligent Solutions		
Multimedia Systems and Analytics				
Computational Linguistics and Intelligence				

Employee numbers by functional area



Total:590

Academic qualifications of R&D staff as of 31 March 2023



Governance and Control

As a publicly funded R&D centre, ASTRI is committed to upholding the highest standards of corporate governance. In line with our mission, we work in the best interests of our stakeholders and the taxpayers of Hong Kong.

ASTRI's corporate governance policies and principles are clearly laid out in our Corporate Governance Manual. The Manual guides the efforts of the Board and Senior Management to ensure that ASTRI always operates in a transparent and accountable manner. It includes comprehensive guidelines on:

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

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

Internal audit

ASTRI's Internal Audit Department (IAD) was set up in 2003 under the Audit Committee (AC). Via the AC, the IAD assists the Board with corporate governance matters by providing it with information about and assurance regarding ASTRI's internal controls.

ASTRI's Internal Audit Charter, endorsed by the AC, affirms the IAD's independence, sets out its responsibilities, and defines the scope of its authority.

The IAD conducts internal audit reviews in accordance with a 3-year risk-based rolling plan, approved annually by the AC. In these reviews, the IAD assesses the adequacy and effectiveness of ASTRI's internal control processes and procedures, as well as compliance with them.

During the reporting year, the IAD conducted internal audit reviews on a number of areas of ASTRI's operations. These included health and safety, crisis preparedness, IT security, project management, inventory management and procurement. The audit reviews indicated that appropriate controls were largely in place in all these areas, and identified a number of enhancement opportunities. During the reporting year, the IAD submitted two half-yearly reports on the abovementioned reviews to the AC, together with its recommendations. The IAD periodically follows up the implementation status of the recommendations it makes.

Compliance

Since April 2007, the Board has appointed the Head of Internal Audit to the role of Compliance Officer. The Compliance Officer's role is to assist the Board, via the AC, with compliance matters relating to internal and external procedures and regulations. The Compliance Officer receives reports from departmental compliance officers and submits quarterly compliance reports to the AC.

Safeguards against conflicts of interest

ASTRI has comprehensive internal controls in place designed to safeguard against conflicts of interest. The Code of Conduct is regularly reviewed and updated 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 compliant with the Code.

Workplace policy

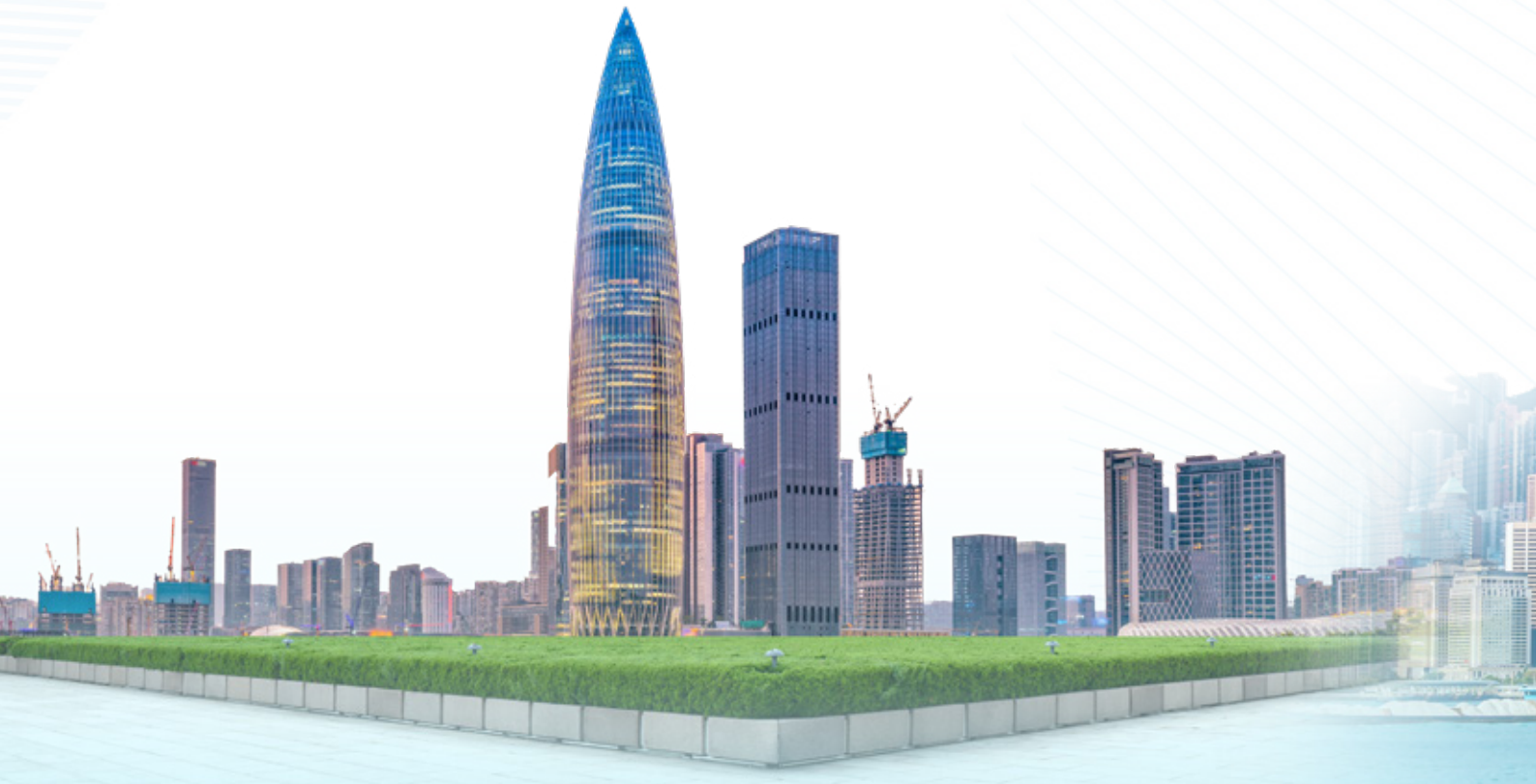
ASTRI has zero tolerance for discrimination and harassment. We organise regular seminars on relevant policies and regulations, with the aim of promoting equal opportunities and preventing discrimination and harassment in the workplace.

Risk management

ASTRI has a Risk Management (RM) process to identify, evaluate and mitigate risks. The process is governed by an RM Policy and is facilitated by the IAD. The RM Policy sets out the roles and responsibilities of different parties, and provides an overview of the RM process. A Risk Register is maintained to keep track of various risks identified, covering 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

Risk updates are reported to the AC on a quarterly basis.



Quality management system

Quality is paramount in all ASTRI's research deliverables. To this end, ASTRI has adopted the ISO 9001 Quality Management standard, which helps us deliver consistently high-quality research to our clients and partners. In June 2022, international quality assurance body Bureau Veritas Certification conducted an ISO 9001 recertification audit on ASTRI's operations. The audit certified that ASTRI's operations were fully compliant with the standards, with zero non-conformance.

Information security management system

ASTRI has adopted the ISO 27001 Information Security Management standard for its R&D activities in Financial Technologies (FinTech) in order to safeguard the confidentiality, integrity and availability of the information it handles. Adoption of the standard is also helping us to mitigate cybersecurity risks and improve our cyber-defence capabilities. Our FinTech R&D professionals regularly attend information security awareness training sessions to learn about the latest cybersecurity risks and the best tools for mitigating them.

An external consultancy company performs vulnerability assessment and penetration tests on ASTRI's Information Technology infrastructure and network equipment every year to ensure our security controls remain effective. In October 2022, certification body SGS Hong Kong Limited conducted an ISO 27001 surveillance audit of ASTRI's operations and found zero non-conformance. ASTRI is continuing to improve and strengthen its data, information and operations security practices, as well as staying abreast of the latest technologies for combatting cybersecurity risks.

ACHIEVEMENTS

Public Recognition and Awards

20 FEB 2023

Hong Kong Green Innovations Awards – Certificate of Merit scooped by ASTRI at 2021 Hong Kong Awards for Environmental Excellence

Dr. River Li, Director of the Smart Power and Energy Systems, Integrated Circuits and Systems Division at ASTRI, received a Hong Kong Green Innovations Awards – Certificate of Merit at the Hong Kong Awards for Environmental Excellence (HKAEE) 2021 for his Carbon Neutral Building Power Supply System.

The Carbon Neutral Building Power Supply System, which incorporates third-generation semiconductor technology, enables buildings to operate on direct current. This results in energy savings of 5% to 20%, along with improved building energy efficiency.

17 FEB 2023

ASTRI wins “Attraction Campaign Award” at 2022/23 Hong Kong HR Awards, organised by JobsDB Hong Kong

To support our employee’s career development, ASTRI has developed several talent development programmes that have garnered the “Attraction Campaign Award” at 2022/23 Hong Kong HR Awards. They include the “Top Technology Scholar Programme (TTSP)” tailored for graduates of research institutes, the “Summer Internship Programme” for undergraduates, and the “Fintech Future Leaders Academy Internship Programme” for college students. These programmes aim to attract more local and international talent to the technology industry and expand the pool of innovative and technological talent available in Hong Kong.

02 DEC 2022

ASTRI wins major prizes at two China-based events for its “Easy 5G-Open 5G end-to-end network solution” and “Cloud-native 5G standalone (SA) core network”

ASTRI’s independently developed “Easy 5G-Open 5G end-to-end network solution” won first prize in the ICT China (2022) Solution - Innovative Application category. The ceremony was organised by the China Association of Communication Enterprises in collaboration with the organiser of PT Expo China.

The “Easy 5G-Open 5G End-to-End setwork Solution” is a cutting-edge network system that incorporates innovative technologies such as a 5G O-RAN (Open Radio Access Network) base station, a 5G core network, an edge computing platform and a network orchestrator. The solution supports industrial Internet, 5G Internet of vehicles, 5G smart city and other applications.

Elsewhere, Communications World Omnimedia published its 2022 Annual ICT Industry Dragon and Tiger List during the year, in which it recognised exceptional companies, influential figures, valuable innovative technologies, as well as outstanding platforms and solutions that have contributed significantly to the development of the ICT industry in the year.

In the list, ASTRI was honoured to be recognised for its 2022 Best 5G Core Network Technology Innovation. This was for ASTRI’s “Cloud-native 5G standalone (SA) core network”, which is facilitating the adaptation and R&D of 5G vertical fields such as machine vision applications, 5G vehicle-to-everything (C-V2X), and cloud robotics. This recognition highlights the potential of ASTRI’s 5G SA core network for promoting new industrialisation and intelligent manufacturing in Hong Kong.

16 NOV 2022

Associate Senior Director Mr. Kenny Chan and Associate Principal Engineer Ms. Wendy Zhang from the Emerging Sensing and Display System Division at the ceremony.

ASTRI snares Smart Business (Emerging Technologies) Silver Award at Hong Kong ICT Awards 2022

At the Hong Kong Information and Communications Technology Awards (ICT Awards) 2022, ASTRI won a Smart Business (Emerging Technologies) Silver Award for its 4K2K AR/VR Compatible Head-Mounted Display. ASTRI was represented at the Presentation Ceremony, held on 16 November 2022, by Associate Senior Director Mr. Kenny Chan and Associate Principal Engineer Ms. Wendy Zhang from the Emerging Sensing and Display System Division and Director Dr. John Koo from the Cyber-Physical Systems Division, who was appointed as a member of the Steering Committee of the award.

Achievements

Leading expos and industry events

InnoCarnival 2022

InnoCarnival 2022, organised by the Innovation and Technology Commission (ITC) of the Hong Kong Special Administrative Region Government, was held from 22 to 30 October 2022 at the Hong Kong Science Park. The event showcased a series of innovative R&D technologies and application projects under the theme of “Smart City”.

At the opening ceremony, ASTRI’s booth was honoured by visits from Prof. Sun Dong, JP, Secretary for Innovation, Technology and Industry; Ms. Rebecca Pun, JP, Commissioner for Innovation and Technology; and Ms. Lillian Cheong, Under Secretary for Innovation, Technology and Industry. Senior ASTRI personnel who visited the booth included Ir. Sunny Lee, BBS, JP, ASTRI Board Chairman and members of the Board of Directors, including Mr. Edmund Lee, Ir. Prof Joseph Ng Kee-yin, Mr. Stephen Ho Wai-chung, Mr. Wilfred Wong Kam-pui, BBS, JP, Mr. Steve Chuang Tzu-hsiung, and other guests.

ASTRI showcased a total of 13 of its most recent research technologies at InnoCarnival 2022, including 5G Cloud Robotics for new industrialisation, its DC Power Supply System, and its AR/VR optical solution, among others. Leading ASTRI figures presenting the technologies included Ir. Sunny Lee, BBS, JP, ASTRI Board Chairman, Dr. Denis Yip, Chief Executive Officer, Dr. Lucas Hui, Chief Technology Officer and Dr. Edward Lor, Director of Intelligent IoT System. Particularly notable was the Student Attentiveness Monitoring System, which is being used in educational technology (EdTech) to detect students’ attention levels by tracking their eye movements, body postures and facial expressions with camera sensors. The data collected can be used to develop personalised learning paths for students with different needs, improving their overall learning experience. The event also featured several fun and engaging interactive experiences for visitors, such as a virtual avatar and a word recognition game utilising OCR technology.

International ICT Expo 2022

During the four-day International ICT Expo 2022 (Physical Fair), ASTRI had the honour of welcoming to its booth Professor SUN Dong, JP, the Secretary for Innovation, Technology, and Industry of the HKSAR Government, where he met with ASTRI's Chief Technology Officer Dr. Lucas Hui and the ASTRI team for group photos.

At the booth, ASTRI showcased a series of its cutting-edge research achievements, including 5G Cloud Robotics Platform, Avatar technology, IoT Blockchain, 3D Face Anti-Spoofing Technology for Smart Home Applications, its edge artificial intelligence Edge AI sensing fusion system, and its AR/VR Compatible Head-Mounted Display.

ASTRI and ecosystem partners share cutting-edge 5G Technologies at Mobile World Congress Barcelona 2023

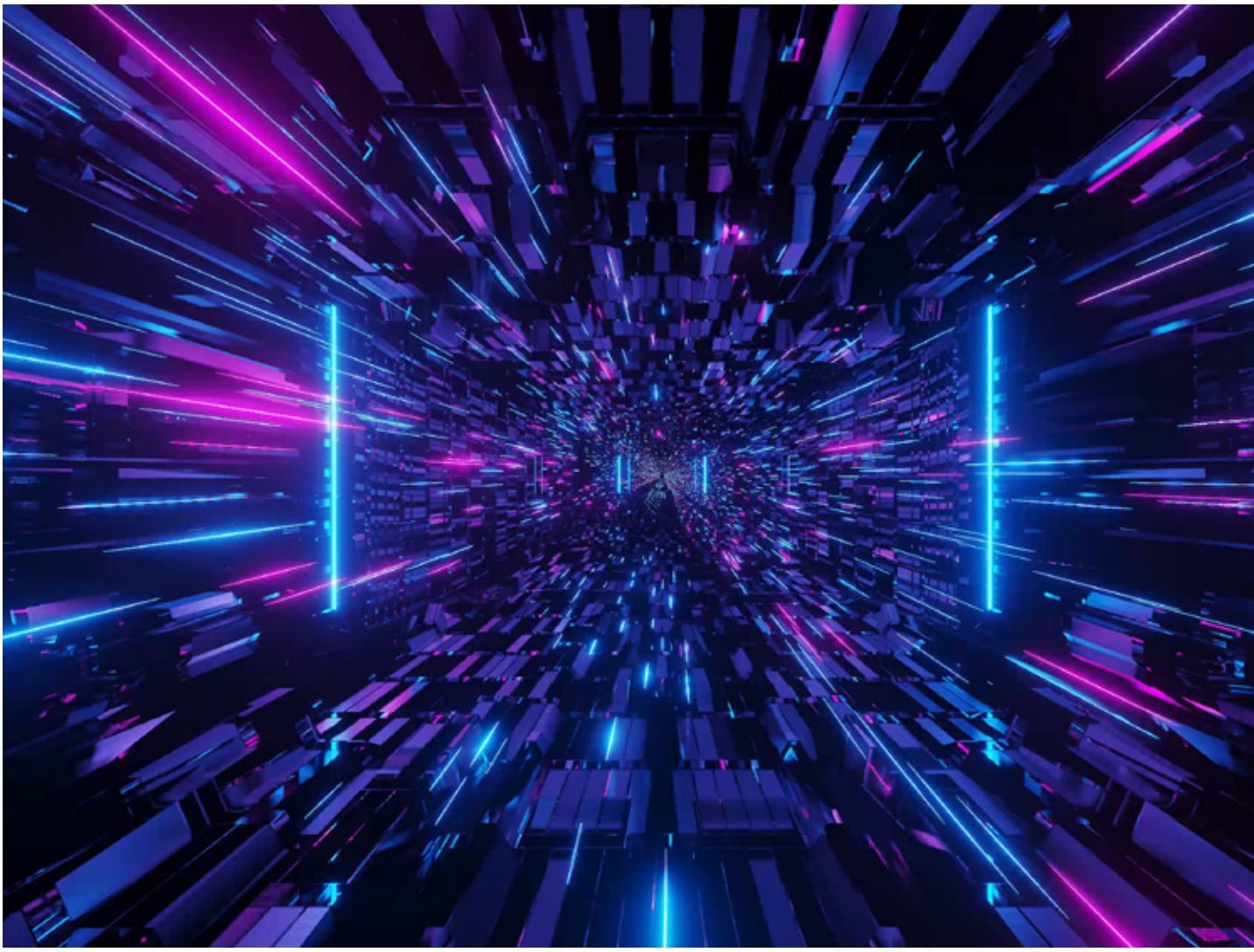
Along with ecosystem partners Anktion (Fujian) Technology Co., Ltd, Astella Technologies Limited, n-hop technologies Limited, and Peng Cheng Laboratory, ASTRI showcased some of the latest of its 5G applications and innovations under the theme “Intelligent 5G, Beyond Connectivity” at the Mobile World Congress (MWC) Barcelona 2023, which ran from 27 February to 2 March.

Prof. Raymond Yeung, Co-founder & Director of n-hop technologies (centre), with his co-founder and CEO Mr. Stephen Ho (second from left), joined by ASTRI’s Dr. Eddy Chiu, Director, Communications Technologies (far left) and Dr. Yolanda Tsang, Director, Communications Technologies (second from right) and a team member, at a booth showcasing the world-first Network Coding enabled 5G IAB network (5G-IAB).

ASTRI and ASTELLA showcase mmWave 5G Integrated Small Cells at MWC Las Vegas 2022

ASTRI and Astella Technologies Limited collaborated with other 5G industry leaders to deliver a live, 5G end-to-end demonstration of 5G integrated small cells at the Mobile World Congress Las Vegas 2022, held in Las Vegas from 28 to 30 September 2022.

Ranging from 5G O-RAN base stations, core networks, MEC and orchestrator, ASTRI's technologies have been licensed to multiple industry partners to enable and accelerate the commercialisation, offering commercial ready, cost competitive and high performance 5G solutions. MWC provided a good platform for us to promote technologies and reach-out for collaboration, working with the ecosystem to develop more market-needed technologies and enable a wider range of emerging applications such as smart cities, industrial IoT, C-V2X, AR/VR etc.



ACHIEVEMENTS

Boosting Innovation through Government, Industry, Academic and Research Institute Collaboration

ASTRI is working to enhance collaboration among the Government, industry, academics and research institutes, as part of its commitment to bolstering the “from 1 to N” transformation of R&D outcomes and fostering I&T development in Hong Kong from various dimensions across the upstream, midstream and downstream sectors.

In line with this goal, ASTRI has established a Department of Ecosystem and University Technology Transfer (EUTT), focused on connecting upstream universities and downstream industry partners in ways that facilitate technology transfer and the commercialisation of research deliverables. Throughout the year, EUTT has been working to build partnerships with different universities and other relevant stakeholders within the I&T ecosystem, as described below.

31 JAN 2023

ASTRI + The Hong Kong University of Science and Technology (HKUST) First Joint Work-Study Programme (PhD)

In January 2023, ASTRI and HKUST signed a Memorandum of Understanding to launch the first Joint Work-Study Programme. Under the agreement, ASTRI and HKUST will jointly perform candidate screening and selection for the programme, with qualifying candidates then being employed by ASTRI as full-time R&D staff while at the same time pursuing a PhD degree at HKUST on a part-time basis. The programme will give candidates the opportunity to participate in frontier research projects in artificial intelligence, big data, wireless communications, smart city and advanced materials, as well as in R&D projects related to their PhD studies. It seeks to nurture talents who can commercialise research findings at the same time as pursuing relevant knowledge and qualifications, while they prepare themselves for a future career in I&T.

22 SEP 2022

ASTRI + Hong Kong Baptist University (HKBU)

With the aim of enhancing research collaboration and promoting the transfer and commercialisation of R&D results, ASTRI and HKBU signed a Memorandum of Understanding in September 2022. The MoU lays out the respective intellectual property rights and ownership of the R&D results of the two institutions. The partnership will see ASTRI and HKBU making concerted efforts to promote the commercialisation of collaborative R&D projects implemented by each party, or by institutions affiliated with HKBU. The partnership also aims to reduce R&D time, improve the utilisation of resources and speed up the application of R&D outcomes.

15 SEP 2022

ASTRI + The Vocational Training Council (VTC)

A Memorandum of Understanding signed in September 2022 by ASTRI and VTC will lead to brand-new jointly designed professional diploma programmes in Microelectronics and Communications Technologies. The programmes will be designed to attract and nurture talented students to feed the huge surge in industry demand for tech-ready talents. ASTRI has also joined VTC's Earn & Learn scheme for students taking Higher Diploma programmes from the Hong Kong Institute of Vocational Education (IVE), a member institution of VTC. Over four semesters, participating students receive on-the-job training to enhance their R&D capabilities, while being provided with classroom learning by IVE.

5 SEP 2022

ASTRI + The Chinese University of Hong Kong (CUHK)

During the year, ASTRI and CUHK signed a first-ever University Technology Transfer and Collaboration Memorandum of Understanding. The MoU lays out collaboration arrangements between CUHK and ASTRI to develop leading technologies, to leverage resources for enhancing research quality, and to facilitate the commercialisation process. The collaboration will help to introduce technology that benefits the government, industry and society at large, supporting Hong Kong's status as an international smart city.

13 JUL 2022

ASTRI + The Centre for Eye and Vision Research (CEVR)

ASTRI has been collaborating with CEVR on projects for treating patients of different ages who suffer from lazy eye and other eye conditions. ASTRI and CEVR are also planning to work together to develop a comprehensive navigation system for people with impaired vision, which will remove mobility barriers and dramatically enhance their wellbeing.

9 JUN 2022

ASTRI + AI Chip Center for Emerging Smart Systems (ACCESS)

In June 2022, ASTRI and ACCESS signed a Memorandum of Understanding to jointly promote the R&D and industrialisation of AI chips. In collaboration with ACCESS, ASTRI will develop emerging AI chip technology and hardware-accelerated AI technology. By bringing together specialist R&D expertise from both parties, the partnership will further promote the transformation of advanced technology into real-life products.

ACHIEVEMENTS

Driving a Richer I&T Ecosystem with Industry Partners

As a key enabler of technology transfer, ASTRI is striving to create a vibrant I&T ecosystem in Hong Kong and optimise the benefits that I&T can bring to society. To achieve this, ASTRI has been orchestrating key I&T connections in order to facilitate closer links between upstream and midstream research institutes and the downstream market, as well as to accelerate industry-academia-research institute collaboration.

Since the launch of its first technology alliance, the Microelectronics Technology Consortium, and with more to come in the near future, ASTRI has been taking the lead in building platforms to explore new business opportunities and share knowledge among different industry players and other stakeholders, all with the aim of bolstering the development of the various technology ecosystems.

9 NOV 2022

Launch of the Microelectronics Technology Consortium (METC)

In November 2022, ASTRI announced the establishment of METC. The aim of METC is to build a microelectronics and semiconductor technology ecosystem and provide a high quality regional and world-renowned platform for microelectronics technology and product development. Assembling to witness the launch of METC were Professor Dong Sun, JP, Secretary for Innovation, Technology and Industry, Ms Rebecca Pun, JP, Commissioner for Innovation and Technology, along with leading experts and key enterprise representatives from the academic and microelectronics sectors.

Developing a microelectronics ecosystem requires creating close ties and cooperative links between different stakeholders that will accelerate Hong Kong's integration into national development. METC is being led by ASTRI and supported by leading organisations from the industry and from academia. It aims to stimulate innovative R&D and promote technological cooperation among different industries, research institutes and academic institutions. Another of its aims is to attract research institutes and enterprises from the Greater Bay Area (GBA) and other parts of the Mainland, and from around the world, to set up branches in Hong Kong, thus expanding the career paths available for local talents. Overall, its goal is to help create a vibrant microelectronics ecosystem, and contribute to Hong Kong's development into an international innovation and technology hub.

Following the launch of the consortium, ASTRI held a seminar in January 2023 giving an overview of the microelectronics ecosystem. The seminar attracted microelectronics professionals, IT professionals and students, who were able to stay abreast of developments in the upstream, midstream and downstream sectors of the microelectronics ecosystem and gain inspiration for pursuing careers in the semiconductor industry.

18 JAN 2023

ASTRI + Shenzhen Unity-Drive Innovation Technology Co., Ltd. (UDI)

ASTRI and UDI signed a strategic partnership agreement in January 2023 that will help drive the development of autonomous driving vehicles in Hong Kong. The collaboration between ASTRI and UDI will lead to further improvements in autonomous driving technologies, and will broaden the application scenarios for these technologies. ASTRI's leading C-V2X infrastructure capabilities will be combined with UDI's strengths in autonomous driving technologies and the mass production of autonomous vehicles, in a partnership that will effectively promote the development of the connected and autonomous vehicle industry.

26 OCT 2022

ASTRI + Deloitte

In October 2022, ASTRI and Deloitte signed a Memorandum of Understanding that formalised their mutual interactions and strengthened the existing relationship between the two parties. This MoU will foster joint long-term efforts by the two partners to develop the technology ecosystem via a combination of technology research, technology commercialisation, talent development and marketing initiatives.

27 SEP 2022

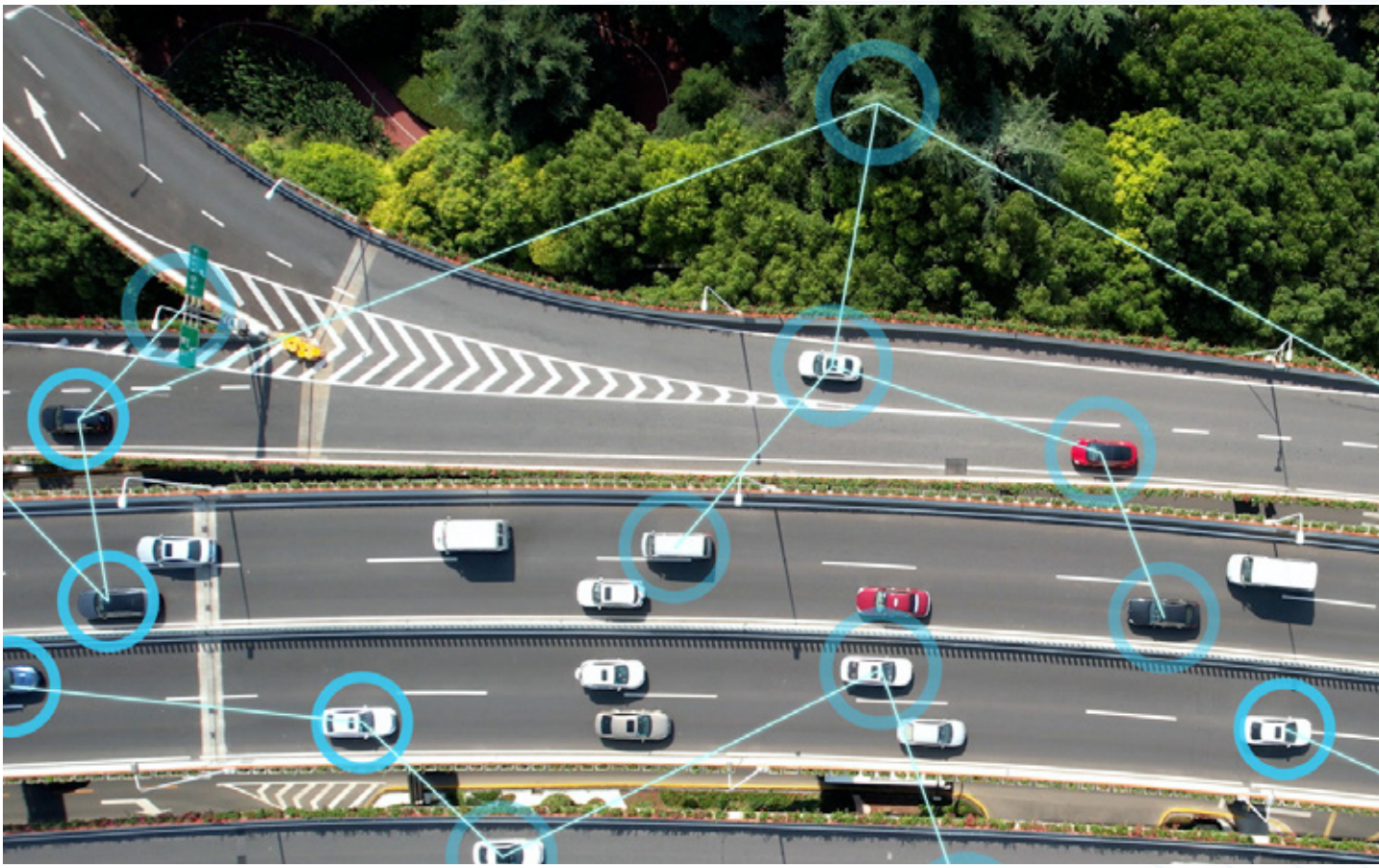
ASTRI + Shenzhen SmartCity

ASTRI and Shenzhen SmartCity signed a Memorandum of Understanding in September 2022 to jointly release the connectivity roadmap for the Greater Bay Area in 2022-23, along with plans for the Shenzhen-Hong Kong C-V2X I&T Corridor. The two partners will carry out connectivity tests and scale applications in specific scenarios. They will also study and develop standard systems, technical innovations, smart infrastructure, application services and other systems for connectivity as they work towards completing the overall design, verification and implementation of C-V2X connectivity in the region.

21 APR 2022

ASTRI + ASM Pacific Technology Limited (ASMPT) + Alpha Power Solutions Co., Ltd. (APS)

During the year, ASTRI announced that it would work jointly with ASMPT and APS on the development of the industry-first “Made in Hong Kong” Silicon Carbide (SiC) Intelligent Power Module for electric vehicles (EVs). The R&D for this project will draw on different technologies, from raw die technology to high precision multiple die integration technology. The project will be conducted at ASTRI’s 3D Systems-in-Package Laboratory and ASMPT’s Power Lab in the Innovation & Technology Centre, with all three partners bringing strong, complementary strengths to the table. This partnership is consistent with the government’s roadmap for the promotion of EVs in Hong Kong, making Hong Kong a smarter and more liveable city.



Communications Technologies

Introduction

The Communications Technologies (CT) Technology Division delivers cutting-edge 5G and beyond network technologies and applications, along with 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 at the level of standards, solutions and infrastructure, especially in 5G-related areas. Its Core Competence Groups (CCGs) are developing open broadband wireless networks and applications, including 5G base stations and core networks, Cellular Vehicle to Everything (C-V2X) & Connected Autonomous Vehicle (CAV) solutions, 5G Non-Terrestrial Network (NTN) and 5G cloud-robotics, and creating new technology infrastructure and platforms for a wide range of sectors and applications. The division also offers end-to-end system solutions (Easy 5G) for various players at different levels of the value chain in the industry ecosystem.

ASTRI begins integrating 5G with satellites for improved connectivity, enhances 5G core for supporting non-terrestrial network (NTN), and develops low earth orbit (LEO) Satellite-based V2X/CAV technologies. ASTRI is looking forward to jointly promoting the development of the global aerospace industry chain with Hong Kong Aerospace Technology Group in the near future.

Core COMPETENCE Groups

Baseband Solutions (BSOL)

BSOL develops industry-leading 5G wireless solutions and reference designs (i.e. technical blueprints for copying) for industry participants. It specialises in baseband algorithms, L1-L3 embedded software, digital signal processing (DSP) and field-programmable gate array (FPGA) reference designs based on open platforms. The team develops low-cost, high quality and cutting-edge 5G and beyond radio communications systems for both public and private telecommunication networks. Its technology competencies 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 radio access technologies for 5G cellular systems, which increase spectrum efficiency while reducing hardware costs and energy consumption. It is also developing forward-looking radio access technologies such as 5G and beyond communications systems including high-mobility communications for applications such as high-speed railways, vehicular ad hoc networks and unmanned aerial vehicles (UAVs), 5G Non-Terrestrial Network (NTN) - including satellite segments in a 5G system, and vehicle-to-everything communication systems. Further, it is exploring digital front-end technologies for sub-6 GHz, millimetre wave frequency and lightweight 5G Base Stations for low-cost/low-power 5G devices

Medium Access Control and Intelligent Solutions (MACI)

MACI develops medium access control technologies and conducts technical cooperation and system integration with other CCGs, providing overall 5G solutions for smart factories, smart mobility, smart cities and 5G enterprise networks. The team has a good track record in commercialising wireless technologies, and its customers have been able to win tenders for small cells based on ASTRI's design. It has engaged in extensive collaborations with industry partners, particularly in Hong Kong and the Greater Bay Area, as well as with Hong Kong Government agencies and public groups.

Networking Software (NSOFT)

NSOFT is involved in the development of end-to-end networks to serve Smart Mobility and Smart City infrastructure and applications, as well as New Industrialisation. Its fully standards-compliant 5G Core and Multi-Access Edge Computing (MEC) technologies, which have been commercially verified, are providing enterprise and commercial markets with reliable, secure, ultra-low latency, high performance, zero-touch deployment networks. NSOFT is continuing to develop new technologies to address market needs, such as Time Sensitive Communication (TSC), Ultra Reliable and Low Latency Communication (URLLC), Location Services (LCS), 5G cloud robotics, and 5G Non-Terrestrial Network (NTN).

NSOFT is developing advanced Intelligent Transportation Infrastructure and Networking solutions, including 5G enabled C-V2X end-to-end infrastructure (in-vehicle, roadside, edge and cloud system), the Connected Autonomous Vehicle System (CAV), 5G ICT infrastructure, the

Smart Mobility Roadside System with advanced sensor and application technologies, and the Advanced Planning and Simulation System for Intelligent Transportation. After launching one of the world's largest C-V2X public road tests in Hong Kong in 2021, the team has continued to carry out research and test projects related to C-V2X technology through various Hong Kong Smart Traffic Fund (STF) projects. The team is also working to expand cross-boundary collaboration within the Greater Bay Area.

Mobile and IoT Platforms (MIP)

MIP develops technologies and total system solutions aimed at realising 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. It 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.

Key Technologies

Easy 5G end-to-end network technologies (5G O-RAN base station, 5G Core, Mobile Edge Computing, and Orchestrator)

5G RAN technologies for Mission Critical Internet of Things

5G NR Spectrum Sharing technologies

Digital front-end for 5G Sub-6 and mmWave Systems

5G Base Station Solution for Integrated Access Link and Multi-Hop Wireless Backhaul Link Using Network Coding Technologies

5G SA Core Network for Virtual and Enterprise Operations

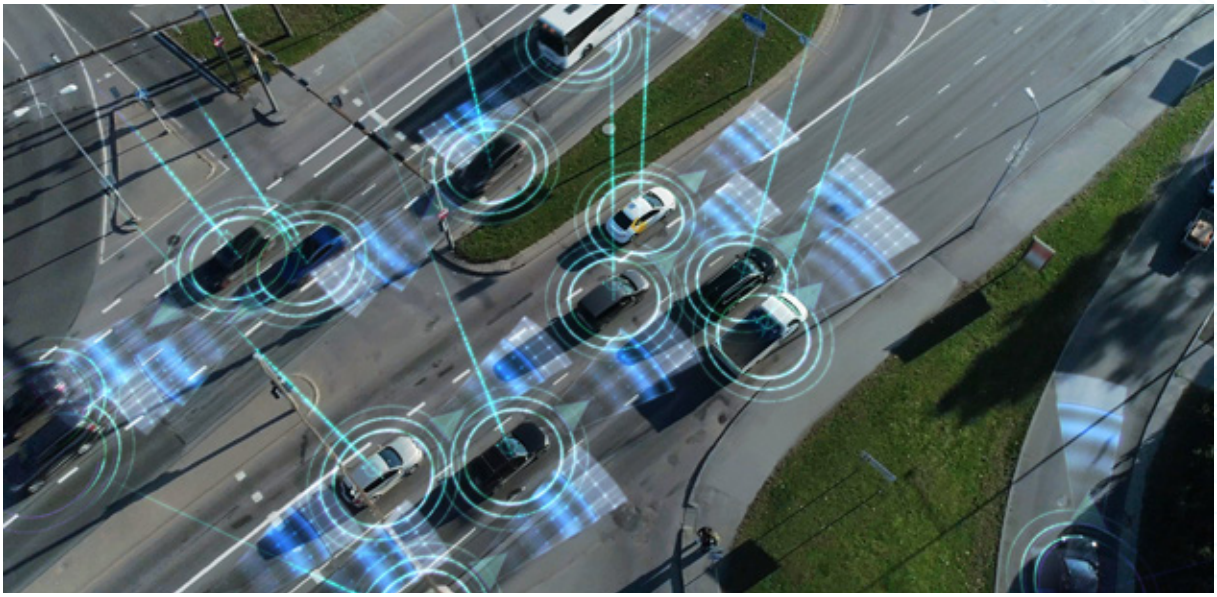
Time Sensitive Network (TSN) enabled 5G System

C-V2X Roadside Infrastructure solution for smart mobility

Advanced C-V2X Applications to Enhance Hong Kong's Mobility Competence and Road Safety

3D GIS Indoor Navigation, and 5G Edge Rendering of 3D Indoor Map

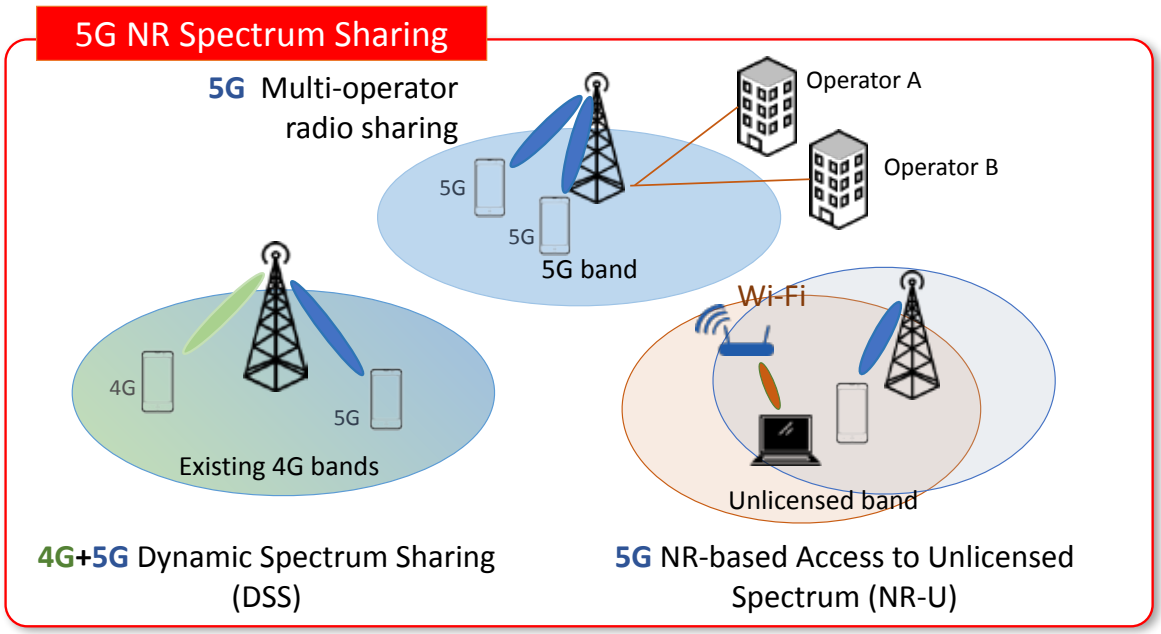
IoT And Distributed Ledger For 5G



R&D highlights

5G NR Spectrum Sharing Technologies (ART/326CP & ART/327CP)

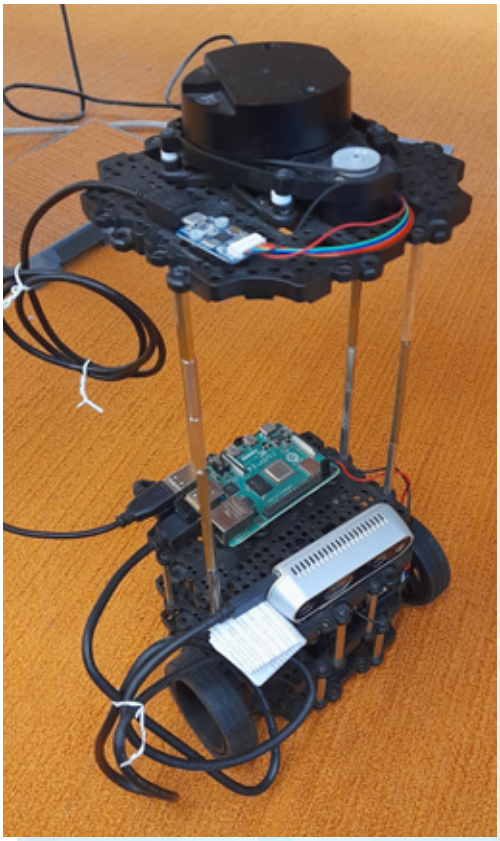
5G NR (New Radio) is designed to enable high data-rate and low latency wireless communications applications, but it does require more spectrum bands. Spectrum sharing is one approach that is proving effective in exploiting new spectrum bands and reducing the technical and financial overheads for 5G network rollout. ASTRI has developed technologies to enhance 5G spectrum utilisation, allowing 5G operators to access a free unlicensed spectrum and share the existing 4G spectrum. This is also enabling multiple operators to share 5G bands and equipment. ASTRI can also provide independent consulting services for private network deployment.



R&D highlights

Evolution of Mission Critical Internet of Things – Technologies and Applications (ART/324CP and ART/321CP)

Mission critical internet of things (IoT) applications include smart industries, cyber physical control, smart grid automation, traffic safety and control, collaborative robotics, and advanced automation and control. These use cases bring enormous challenges in terms of meeting key performance requirements, such as precise clock synchronisation, periodic deterministic communication support, mechanisms for QoS (Quality of Service) flow management, ultra-low end-to-end latency, and very high service availability. ASTRI is developing 5G mission-critical Internet of Things (IoT) solutions based on 3GPP release 16 technologies (including a PHY layer system and MAC Procedures of 5G base stations) for smart manufacturing applications including AGV controls, cyber physical systems, collaborative robotics and others.

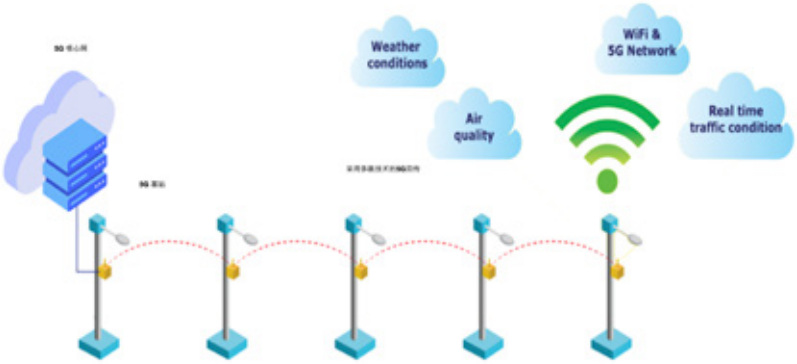


5G mission-critical Internet of Things (IoT) solutions - robot navigation

R&D highlights

5G Base Station Solution for Integrated Access Link and Multi-Hop Wireless Backhaul Link Using Network Coding Technologies (PRP/052/22CI)

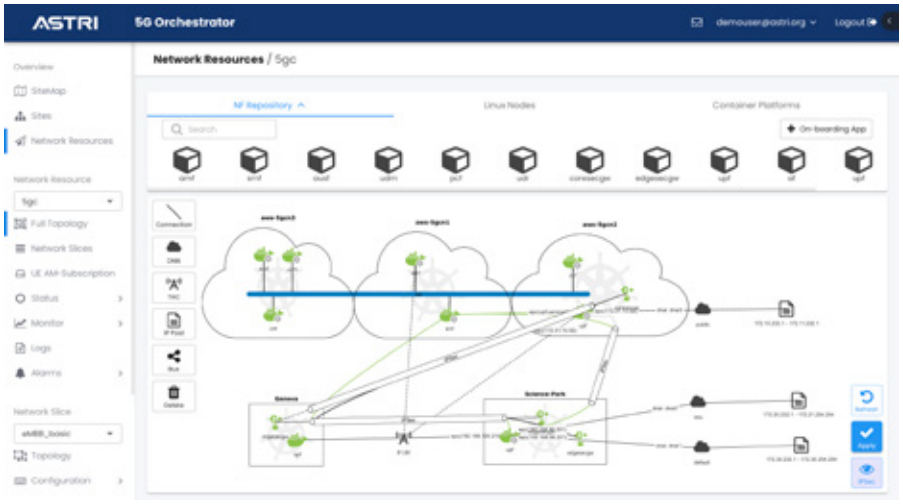
ASTRI and n-hop technologies Ltd. (n-hop) have collaborated to integrate network coding technology into their 5G-IAB solution. Network coding is a new paradigm for conveying information reliably and efficiently via networks. n-hop's invention of BATched Sparse code (BATS) offers a simple and easy way of implementing the network coding technology for the robust and efficient delivery of information. Network coding-enabled 5G-IAB multi-hop wireless networks ensure the reliable, cost-effective and rapid deployment of public, private, rural, and disaster response networks. The solution eliminates the need for fibre cables and provides ubiquitous communication, as well as facilitating the digital economy.



R&D highlights

5G Core for Virtual and Enterprise Operations (ART/338CP)

Virtual and enterprise operations for 5G require edge deployment for user management, and easy for network deployment/management. This project has involved developing a cloud-native 5G SA Core to address these needs. The cloud-native architecture involves having the network functions further broken down into microservices where they are small and independent software components working collectively together. This provides more flexibility in building the networks and customerisation according to the enterprise's needs. The 5G SA core is also enhanced to support not only the IP data connection, but also ethernet data connection for unicast, multicast and broadcast communication.



R&D highlights

IoT and Distributed Ledger for 5G (ART/332CP)

This project involves developing a scalable platform on the 5G network for massive IoT data (static and real-time) publishing and exchange, one which operates in a seamless and secure manner for both data providers and consumers. The platform will tackle the scalability issue of accumulating ledger sizes by using an off-chain approach for data storage, and a specific trimming strategy for ledger records. At the same time, it will use blockchain combined with attributed-based encryption to address challenges relating to data publication and discovery, smart contracts for transaction, data security and integrity, and privacy protection for users and data.

Demo system for IoT and Distributed Ledger for 5G

R&D highlights

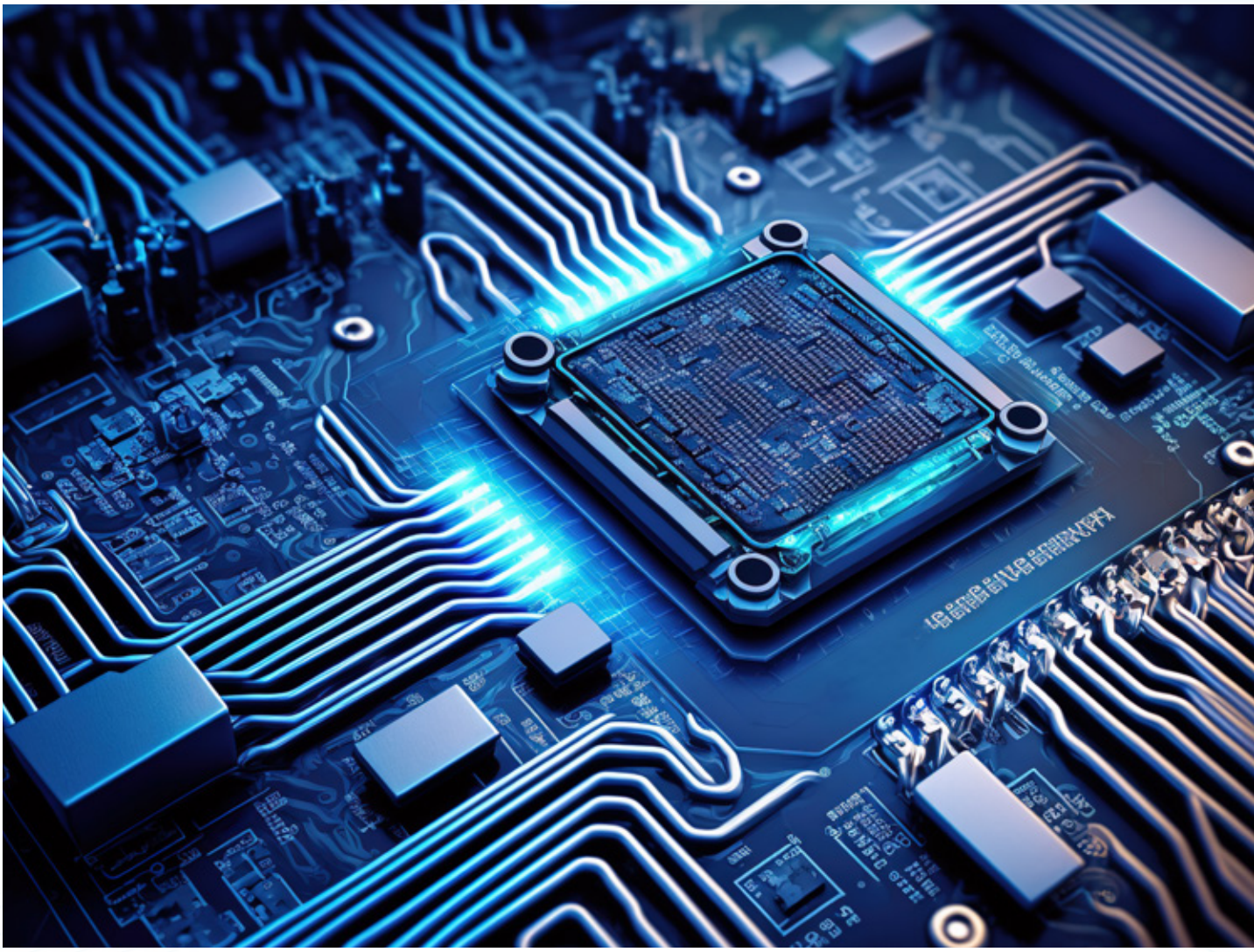
Advanced C-V2X Applications to Enhance Hong Kong's Mobility Competence and Road Safety (Smart Traffic Fund project - PSRI/19/2109/RA)

This project is exploring the application of Cellular Vehicle-to-Everything (C-V2X) technologies and Open C-V2X systems in Hong Kong, with advanced C-V2X use cases. ASTRI's C-V2X system has been deployed on green minibuses and shuttle buses at the Hong Kong Science and Technology Park, and on engineering vehicles, for safety testing. The technology is supporting Smart Mobility & C-V2X trials in Hong Kong, improving road safety and traffic efficiency, and facilitating Smart Mobility services (e.g. In-Vehicle Units, Electronic Road Pricing and smart parking). The project also involves providing recommendations for specifications and reference designs in relation to the deployment of C-V2X in Hong Kong.

A 5G On-Board Unit (OBU) deployed on a green minibus

Other R&D projects

Project	Focus
Adaptation of Cellular Vehicle-to-Everything (C-V2X) Technology in Hong Kong	Smart City
5G NR Optimised Heterogeneous Networks	Smart City
5G Standalone (SA) Core Network	Smart City
Data Packet Handling Mechanisms Study in 5G Core for Deterministic Network	New Industrialisation and Intelligent Manufacturing
5G O-RAN Base Station	Smart City
Intelligent Modelling and Simulation of 3D GIS (IMS3D)	Smart City
Open Distributed Unit and Open Radio Unit Commercialisation for Mobile Operators	Smart City
Cloud Native Open Radio Access Network	Smart City
5G Base Station Solution for Integrated Access Link and Multi-Hop Wireless Backhaul Link Using Network Coding Technologies	Smart City
Digital Front-End Study for 5G Sub-6 and mmWave Systems	Smart City
Study of the fusion of 5G and sensor positioning technologies	Smart City
An End-to-End C-V2X Traffic Simulation and Planning Platform to Optimise the C-V2X Infrastructure Deployment	Smart City



Integrated Circuits and Systems

Introduction

The Integrated Circuits and Systems (ICS) Division develops high value-adding technologies for power and radio frequency (RF) related integrated circuits and 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 3D-IC advanced packaging technologies, 3rd generation semiconductor devices, AI chips, wireless IoT chips, Silicon Carbide (SiC) and Gallium Nitride (GaN) based new power and energy storage systems, and more. ICS is also a key constituent of the first Hong Kong branch of the Chinese National Engineering Research Centre (CNERC). CNERC is located within ASTRI and focuses on research, technology transfer, and talent training relating to Application Specific Integrated Circuits.

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

Core COMPETENCE Groups

3D Integration (3DI)

3DI provides comprehensive advanced solutions for electronics packaging and power electronics products. It specialises in varieties of Silicon, Silicon Carbide (SiC) and Gallium Nitride (GaN) based packages, modules, subsystems and drivers/power management ICs. The application domains served by 3DI include 5G networks and infrastructure, data centres, industrial robots, new energy vehicles, power conversion, energy storage and charging systems, and railway transportation.

IC Enabling Technologies (ICET)

ICET provides solutions for customised I/O libraries, high-speed interface, and SoC design. Its core competencies include virtual fabrication, I/O design, IP migration and ASIC design. The team has developed a comprehensive IP portfolio, including area-efficient ESD structure IPs, IP migration techniques, and process independent scalable I/O libraries. It collaborates closely with IC foundries and design houses in developing fundamental IPs and special devices, and has successfully delivered devices and I/O related fundamental IPs from 0.5um to 16nm FinFET processes.

Machine Learning Platforms (MLP)

MLP develops AI chips for image processing and computer vision applications. The team has very 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 smart devices.

RF Systems (RFS)

RFS provides wireless connectivity chips with state-of-the-art low power integrated circuit design for IoT applications and medical applications. These solutions include Bluetooth Low Energy (BLE) chips supporting audio streaming applications (LE Audio), wireless transmission chips for next generation capsule endoscopy, and 5G Non-Terrestrial Network (NTN) RF transceiver chips. These technologies are enabling a wide range of connectivity solutions for personal, industrial and healthcare applications.

Smart Power and Energy Systems (SPES)

SPES develops innovative SiC- and GaN-based new power and energy storage technologies designed to enhance energy efficiency and optimise power usage in Smart City and industrial applications.

SPES is also developing 3D-IC advanced packaging technologies, including design for manufacturability and design for reliability, and key manufacturing processes such as via formation and via filling, in order to establish these core competencies in Hong Kong.

Key Technologies

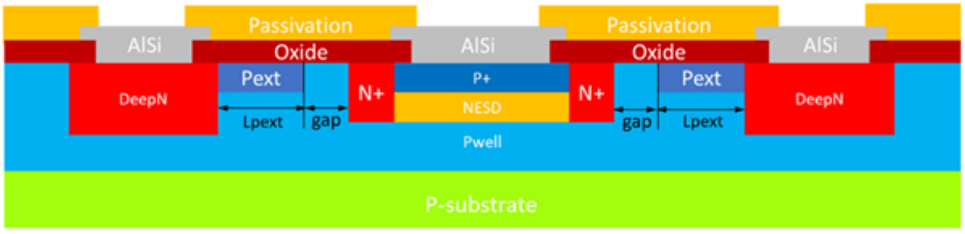
3D integrated circuits	3rd generation semiconductor power packages/modules	DC-DC converters and power management ICs	ESD design
I/O library	ASIC	Neural Network Processing Unit (NPU), AI chips	Deep Neural Networks (DNN) tool chain and optimisation
Compression/ Decompression IP	Bluetooth Low Energy	RF Transceiver	DC power building
Energy storage systems	Smart power hubs	Design for manufacturability & design for reliability	TSV (through-silicon-via) key process & materials

R&D highlights

Customised TVS Fabrication Process for Surge Protection Based on Virtual Fab (PRP/094/21CI)

Failure statistics show that 33% to 50% of all field failures (customer returns) are due to ESD/surges, which damage the input/output pins of IC chips. In order to maintain high reliability in electronic products, it is essential to protect IC chips from ESD/surges. There are two ways to do this. One is on-chip ESD protection, where on-chip ESD devices are placed at each pin against an ESD event. The other is on-board ESD/surge protection, where discrete TVS (transient voltage suppression) devices are applied to ensure reliability. Of these two methods, TVS is the superior one, and as such has been widely investigated and adopted for product reliability. Examples of TVS applications are USB3.1 power and data line protection, digital video interface, high speed ethernet, notebook computers, monitors and flat panel displays.

This project is developing low capacitance TVS devices for high-speed interface applications. Using virtual FAB technology, we have created the TVS structure and completed device simulation, performance optimisation, and device customisation.



Electronic system with RGMII interface

R&D highlights

Hardware enabled Privacy and Security Technology for Smart Home (ART/311CP)

This project is developing a hardware-enabled privacy and security technology solution for smart locks, including a hardware DNN (deep neural network) accelerator, firmware, and application software, to create DNN-based 3D face recognition with anti-spoofing technology and privacy protection.

ASTRI has developed DNN training, optimisation, and anti-spoofing algorithms for 3D Face recognition. Using these DNN training and optimisation algorithms, we optimised the state-of-the-art DNN to create a novel 3D face recognition anti-spoofing algorithm which can effectively distinguish a real face from a fake face image or mannequin.

We have achieved ~99.8% biometric identification accuracy, as verified on the FPGA platform. The solution adopts a low-power design with up to 12 months of battery life (4 AA batteries) for ASIC implementation. The average unlocking time (including face recognition, anti-spoofing, and unlocking) is less than one second.

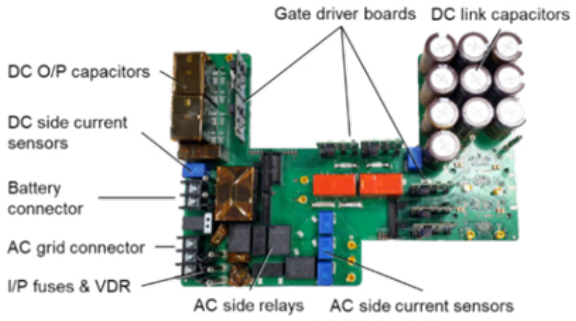
R&D highlights

Next Generation Bluetooth Low Energy for Audio Streaming Applications (ART/319CP)

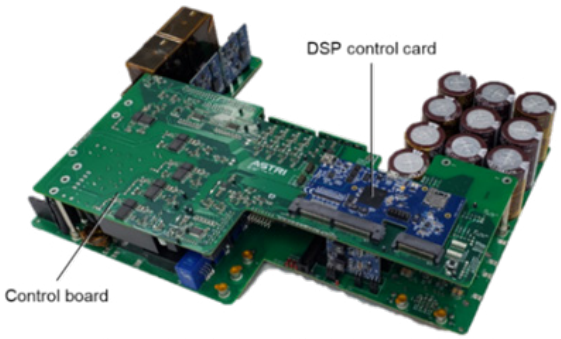
The next generation Bluetooth Low Energy (BLE) chip is designed to deliver optimal power, cost and performance, using critical and innovative technologies such as a direct modulation RF transmitter, low-IF single conversion RF receiver, and high-performance digital modem algorithm and circuit. The project is delivering a silicon-proven IP portfolio and a set of IC solutions to support next-generation Bluetooth LE technology. It is advancing the wireless technology capabilities of Hong Kong and Mainland China, and creating a competitive edge for local IC design houses, wireless connectivity solution vendors, and OEM and ODM manufacturers. Patents for this technology have been filed in the US and China. The technology won a silver medal at the International Exhibition of Inventions Geneva 2023.

Smart Power Hub with Silicon Carbide Module (ART/302CP)

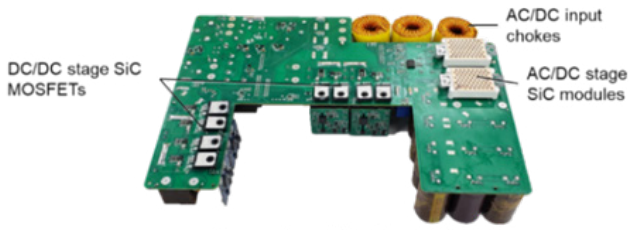
A bidirectional power conversion system with electric vehicle charging and discharging functions simultaneously has been developed in the project namely Smart Power Hub (SPH). Renewable energy such as solar and wind will become the major energy resources of the world to achieve carbon neutrality in ~5 years. However, due to the discontinuity of renewable energies supply, battery storage system is an inevitable component to balance the power supply and demand. SPH is the system which supports EV battery charging for general driving activities as well as discharging to the local area, such as the house, building, etc when there is a power support requirement due to insufficient renewable energies supply. With the silicon carbide power semiconductor technology and advanced power converter control solution, SPH achieved very efficiency power conversion throughout the battery voltage range from 200V to 500V DC. It is suitable for both 1-phase and 3-phase AC grids applications. SPH was selected as one of the products showcase at the Intern ational Technology Roadmap for Wide Bandgap Power Semiconductors (ITRW) 2019. 2 patents for this technology have been filed in the US and China. The technology won a silver medal at the International Exhibition of Inventions Geneva 2023.



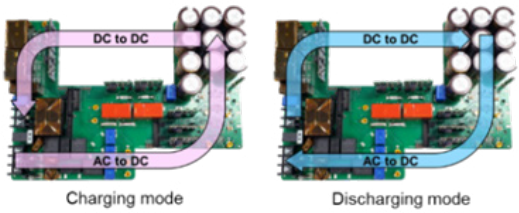
Power board (top side)



Power board and control board integration



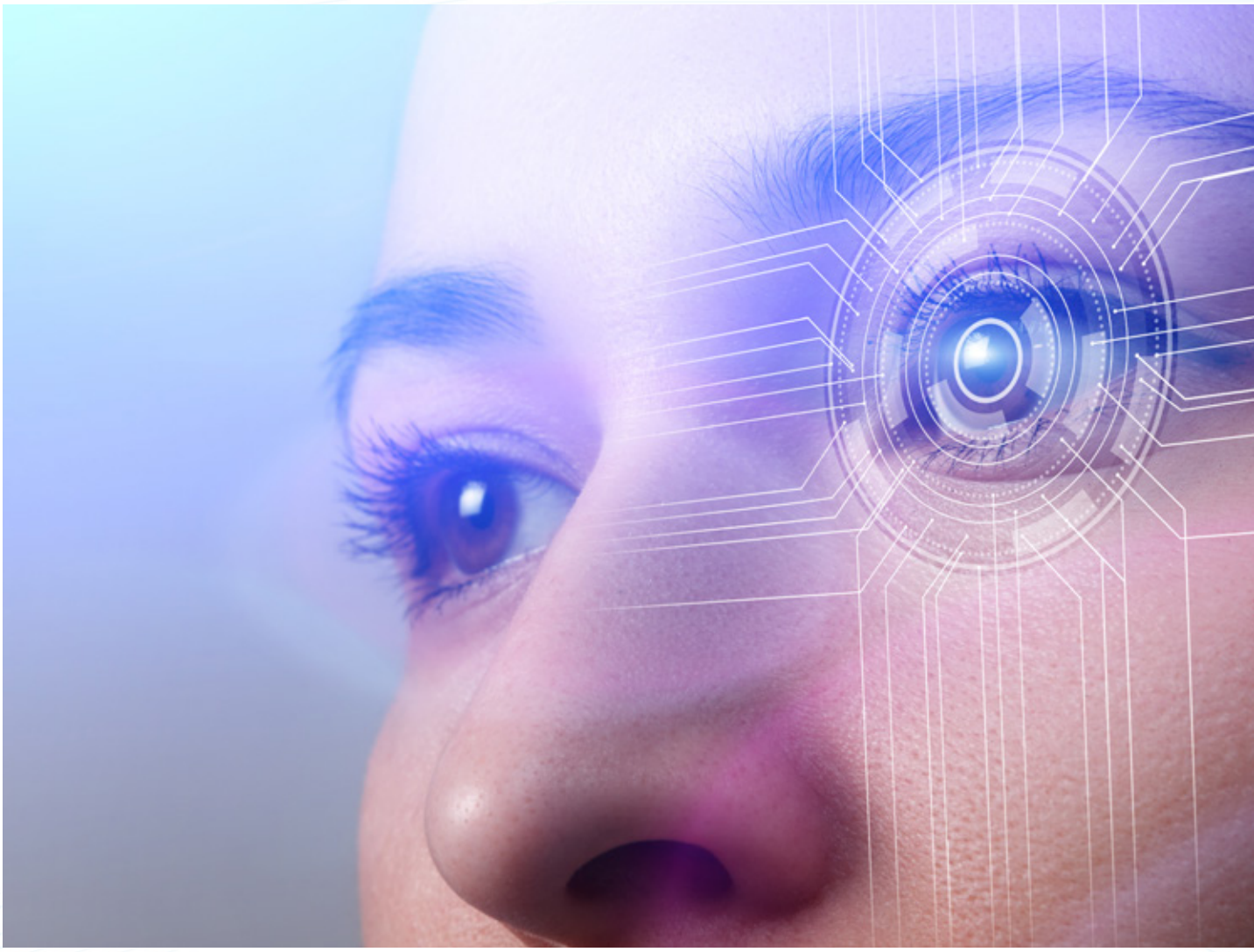
Power board (bottom side)



Charging mode
Discharging mode
Power flow

Other R&D projects

Project	Focus
Minimally Invasive Sentry Platform for Next Generation Power Conversion	ASIC
Digital Arc-less Socket for DC Building Applications	ASIC
Architecture of NTN RF Transceiver towards 5G-A/6G Applications	ASIC
DC Lighting Parking Garage at HKSTP	ASIC
3D Integrated Power Management Modules for Industrial Control	ASIC
3D Integrated Wireless Power Transmission Platform for Robotics Applications	Smart City
Accelerator for Smart AGV Perception	ASIC
Modularised Energy Storage System for Metro Applications	Smarty City
Adapting High-Speed I/O System for EDA Cloud Computing Platform	ASIC
Ultra-Efficient & Reliable High Power SiC Module and the Development Platform for Traction Application	Smart City
System and Chip for High-speed Data Transmission within the Human Body	ASIC



IoT Sensing & AI Technologies

Introduction

The IoT Sensing & AI Technology (IOTSAI) Division has four core competence groups specialising in developing and commercialising market-driven solutions. Between them, they have had over 230 invention patents granted and made 160 technology transfers to industry. In recent years, IOTSAI has moved into a number of new areas. These include automatic optical inspection (AOI) and high precision 3D metrology for quality inspections, AI-based defect detection and classification technology for intelligent manufacturing, AR/VR & human-machine interaction sensing for metaverse applications, dynamic AI vision for construction, logistics and facility inspection-related applications, micro & nano photonics (diffractive optics/metalens) for mobile 3D sensing, security control, mini-spectroscopy technology for applications related to smart living and environmental protection, AI-based video analytics for elderly care and education, and IoT healthcare devices for hospitals.

IOTSAI serves many different industries in Hong Kong, the Greater Bay Area and beyond. Its sophisticated sensing and optical solutions support smart factories and a wide range of Smart City applications by enabling automation and boosting 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, healthcare, elderly care, and smart living. The division has also developed efficiency solutions for local government departments.

Core COMPETENCE Groups

Intelligent Machine Vision (IMV)

Focusing on visual sensing and AI technologies, IMV deals with advanced and miniaturised optical image sensing devices as well as image understanding and deep learning algorithms. Its core technologies include automatic optical inspection (AOI) and high-precision 3D metrology, deep learning-based defect inspection and classification, industry automated AI (AAI) generation systems and small data industry AI, intelligent industry robot vision and cognition, and point-of-care (PoC) medical and healthcare image sensing.

Sensing Devices and Integration (SDI)

SDI develops integrated optical and acoustic sensor modules for industrial, public, and individual applications. The team is exploring three major technological platforms: sensing devices and modules integration for environmental sensing, hyperspectral imaging for industrial inspections, and smartphone-based spectroscopy for personal uses.

Emerging Sensing and Display Technology (ESDT)

ESDT develops smart optics solutions for various applications. It focuses on AR/VR/MR for the metaverse and AR glasses for logistics and retail applications, edge AI sensing fusion systems and event-based behaviour understanding/action recognition, micro and nano optics for anti-counterfeit/data encryption/physical NFTs, and eye trackers for digital health and multifactor identification and authentication.

Intelligent Internet of Things (IoT) System (IIOTS)

IIOTS develops core technologies such as artificial intelligence, IoT/sensors, affective computing and data analytics to support the Hong Kong Government's Smart City initiatives. The technologies are being applied to the fields of health technology/geron-technology, education, public utilities, logistics, and others. Target deployments of the technologies include schools, hospitals, nursing homes, logistics companies and various government bureaus. applications.

Key Technologies

Mid-range high-precision LiDAR

Smart Visual Recognition for e-Armory Management

TrainLite: Small Data AI Learning Platform for Visual Defect Inspection

Multispectral Acoustic Sensor for On-Site Plastic Sorting

Apparatus and method for classifying glass object using acoustic analysis

Intelligent Platform for Smart Hospital Ward

Intelligent Assessment of Elderly Fall Risk

Future Classroom with AIoT System for SEN Students

Flexible Diffractive Optics for Object Authentication

Edge AI Sensing Fusion System for the Construction Industry

R&D highlights

Mid-range high-precision LiDAR

LiDAR (Light Detection and Ranging) technology is an advanced remote sensing system that uses laser light to measure distances. It can generate high-resolution digital maps that can be used to analyse and interpret intricate spatial information. The project team is developing a mid-range high-precision LiDAR that utilises high-speed laser driving techniques and RF level signal process to narrow the laser pulse width to 3.5ns or less for higher laser peak power and an increased signal to noise ratio; novel threshold sampling waveform digitising (TSWFD) technology, which has a higher sampling resolution of up to 10-20 picosecond, for more accurate waveform reconstruction; and a sophisticated optical design, including a 2-axis scanning system for 360° full-dome scanning, and a mems-mirror based solid-state scanning design for a wide range of 3D reconstruction applications.

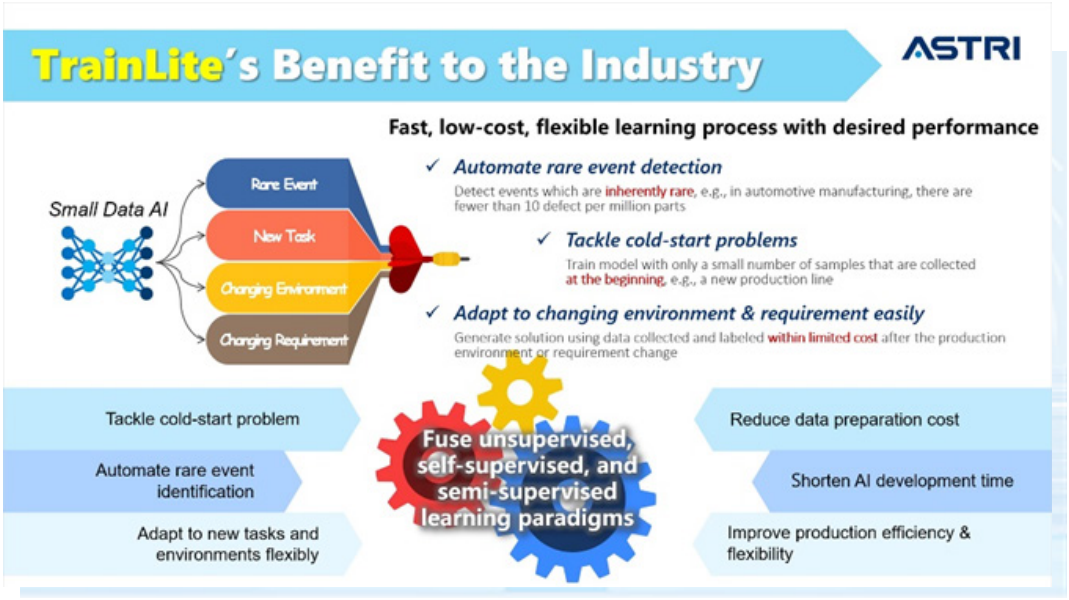
This mid-range, high-precision LiDAR has a scanning range of 50-100m range with sub-centimeter precision. This makes it suitable for a wide variety of applications, including environmental monitoring, building information modelling, high-precision mapping, and more. Its versatility allows professionals from diverse industries to benefit from the technology to drive improvements in their operations. The real-time scanning capability provided by its solid-state stanning design also makes LiDAR suitable for applications such as security surveillance and smart city sensing.

Smart Visual Recognition for e-Armoury Management

ASTRI has developed Smart Visual Recognition technology for e-Armoury management, designed to partially automate the armoury distribution process of the Hong Kong Police Force (HKPF). ASTRI's Smart Visual Recognition system includes imaging sensors, deep-learning-based image recognition algorithm, and a user-friendly software for e-Armoury management. The e-Armoury system replaces the labour-intensive manual logging system. That system had been a slow workflow relying on paper records that are less efficient, error-prone, and time-consuming to review. ASTRI's system has improved the speed and accuracy of the issuing, returning, and stocktaking of equipment while giving HKPF more effective control over equipment distribution. It also provides statistics of historical equipment usage and enables real-time monitoring of the armoury.

Two smart vision devices with advanced lighting and imaging components have enabled accurate recognition of equipment with both non-reflective and highly reflective surfaces. ASTRI's deep-learning-based recognition algorithm allows for equipment and serial numbers to be identified and logged in a fraction of a second. This innovative system is providing operators with a seamless user experience and supporting Hong Kong's Smart Government initiative. It is not only digitalising the armoury distribution process, but also enabling new monitoring capabilities for Police Headquarters.

Smart visual sensing devices



TrainLite's Benefit to the Industry

TrainLite: Small Data AI Learning Platform for Visual Defect Inspection

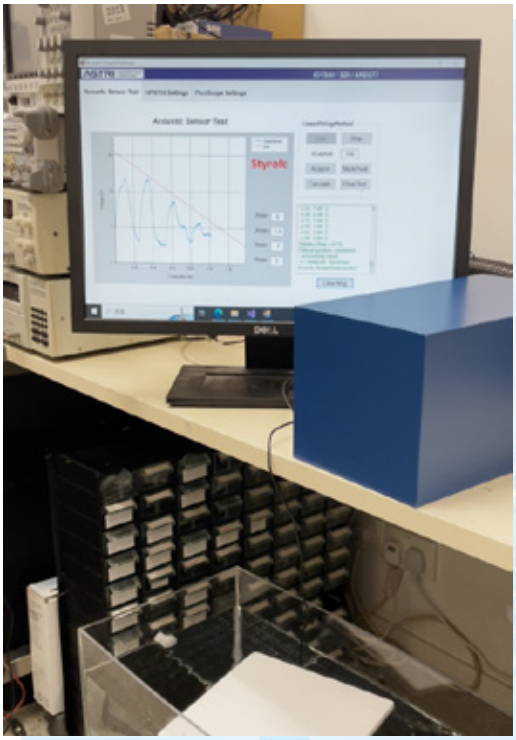
Small data is a major obstacle for manufacturers wishing to deploy AI solutions, due to the high cost of obtaining sufficient training data. To overcome the issue of data scarcity, ASTRI has invented a small data AI platform that manufacturers can use to develop their own quality inspection AI models. The platform enables AI training for defect classification & localisation using unlabelled data and small amounts of categorically labelled data. As a top-level framework for different data-limited applications, this platform can help data-immature companies adopt AI to increase their productivity and significantly reduce their operational costs. In recognition of this groundbreaking innovation, the platform was awarded the King Abdulaziz University - Special Award for Innovation at the Geneva International Exhibition of Inventions 2023.

Performance of TrainLite

R&D highlights

Multispectral Acoustic Sensor for On-Site Plastic Sorting

This project involved developing a multispectral acoustic sensor utilising a number of acoustic sensing techniques for water-mediated material sorting. The sensor can perform acoustic impedance differentiation based on pulse-echo characterisation, and conduct frequency tuning to measure sound speed effectively based on acoustic interference with multiple reflections. Floating samples, especially plastic samples, can be sorted using this acoustic sensor in an upward sensing configuration. The project has also explored implementing a transducer array for sorting samples of irregular shapes, achieving promising results for future sensor development when combined with advanced computational technology.



Floating sample sorting with an acoustic sensor installed beneath a water surface

R&D highlights

Apparatus and method for classifying glass objects using acoustic analysis

Solid acoustic sensing analyser

This project developed a method for classifying glass objects via acoustic analysis by a classifying apparatus. A processor receives sound data generated by knocking a glass object. The processor then performs a knock-sound analysis on the sound data to determine the glass type, including whether it is organic or inorganic glass. If it is determined to be inorganic glass, the processor also applies an ultrasonic-echo operation on the object and analyses the echo data to determine whether the glass is crystal, borosilicate or soda-lime.

R&D highlights

Intelligent Platform for Smart Hospital Wards

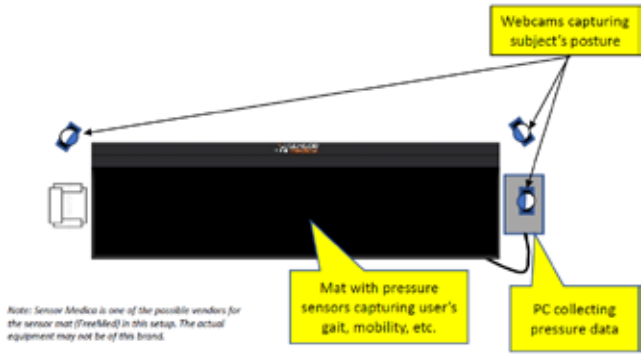
The Hospital Authority (HA) has already kicked off its Smart Hospital initiative, under which it is using Information Technology (IT) and other innovations to enhance the operational efficiency of its hospitals. ASTRI is working in collaboration with the HA to develop technologies for Smart Hospital Wards that will enhance the efficiency of patient care. Its solutions are primarily tackling problems relating to monitoring patients' health and safety. Currently, hospital staff collect data about patients' vital signs to monitor their health and detect problems such as symptoms of cardiac arrest and apnea. A wearable patch chest device collects the electrocardiagram (ECG) data, the motion data and indoor location data of the patient. It thus can help scale up the number of patients being monitored in heart-related and other safety issues, such as detecting accidents or patients' presence in inappropriate locations. The Smart Ward initiative incorporates IT, artificial intelligence, Internet of Things (IoT) and data analytics.

Wearable Patch Chest Device

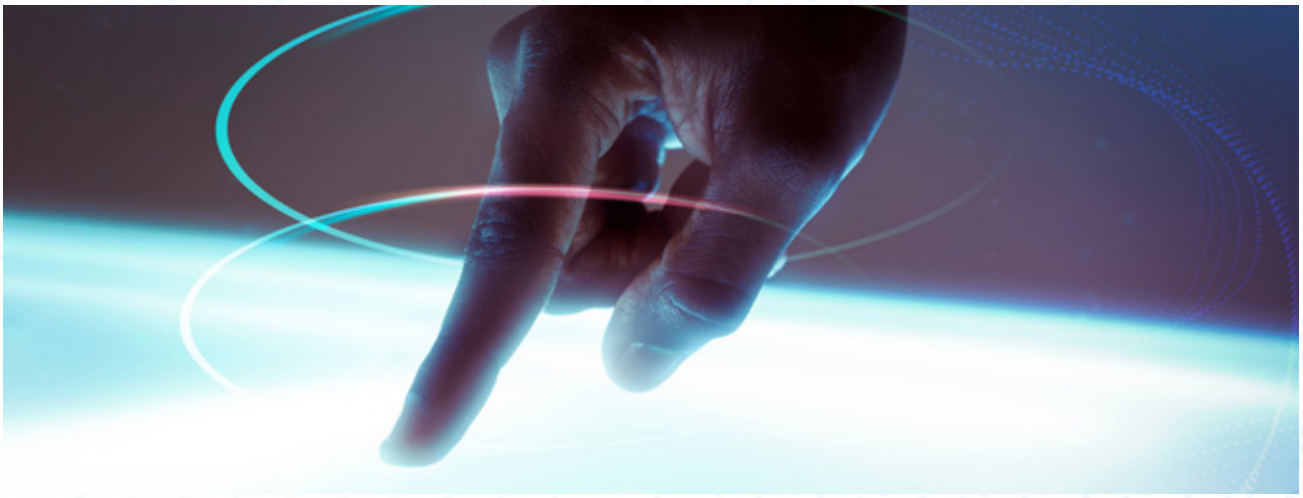
R&D highlights

Intelligent Assessment of Elderly Fall Risk

Artificial intelligence, sensors and video analytics have been adopted to assess features such as gait, posture, and mobility that are relevant to fall risks among the elderly. ASTRI is developing a multi-modal approach for more accurate and consistent assessments, while making these more scalable through automation. The ultimate objective of this project is to provide an intelligent assessment of fall risks that will act as a key part of any fall prevention solution. This technology will target hospitals, district health centres, and nursing homes.



Assessment setup



R&D highlights

Future Classroom with AIoT System for SEN Students

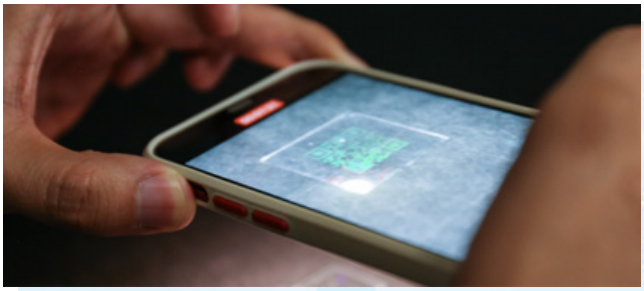
Special Educational Needs (SEN) students often require intensive one-on-one training. However, this can be expensive and unaffordable for many families, especially given the shortage of specialist therapists. This AI system will enable a one-to-many teaching mode by analysing multimodal IoT data collected during class. The engine can assess student performance by analysing classroom video and audio data and auto-detecting students' learning results, so that therapists do not have to record the data manually. Therapists can also adjust the learning task being conducted in real-time based on the system's recommendations, to improve teaching and learning effectiveness. This solution is expected to reduce the cost of therapy by up to 90% by enabling a one-to-many teaching setting.

R&D highlights

Flexible Diffractive Optics for Object Authentication

Despite growing global demand for object authentication and anti-counterfeiting solutions, there is no single anti-counterfeit technology in the market that addresses all the issues of authenticity, copy-proof, cost and user verification. Multi-level authentication is therefore necessary for high security.

ASTRI's flexible diffractive optics-based security label with encrypted data combines both optical and digital security for verifying documents or products and retrieving security information. The authentication QR code containing encrypted confidential and public information is protected against counterfeiting with a transparent diffractive nano structure layer that contains angular multiplexing optical features. The information can be read by a smartphone app, and the optical features can be inspected by the smartphone. This solution can be used to protect products and brands, authenticate documents, and for anticounterfeiting for physical NFTs.



Authentication QR code scanning

R&D highlights

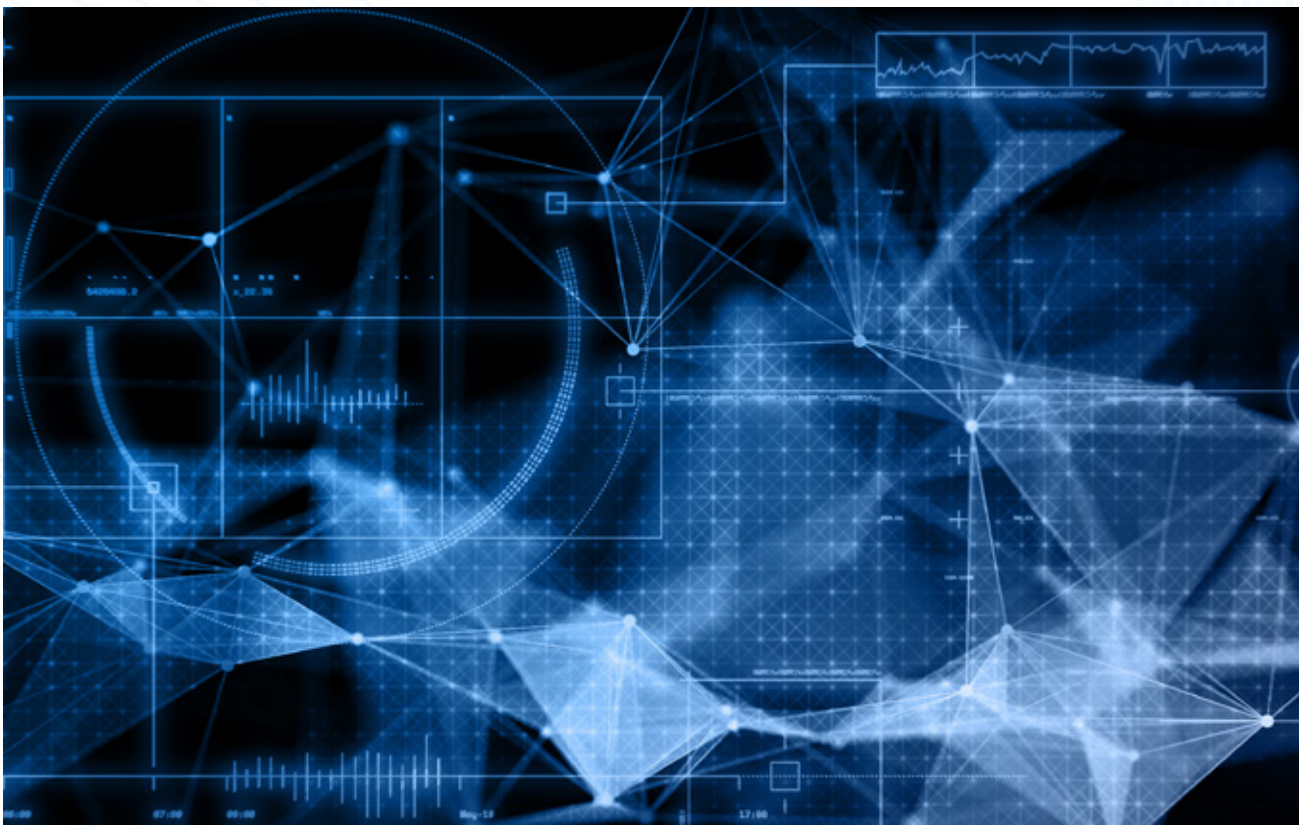
Edge AI Sensing Fusion System for the Construction Industry

Safety and productivity are two major concerns for the construction industry. Safety issues can cause fatal accidents and project delays, and increase production costs. Workforce availability is another problem. Unless signalpersons and safety officers are available on-site at all times, supervisors do not have access to accurate real-time information about site activity.

ASTRI's Edge AI sensing fusion system addresses these issues by leveraging edge computing, deep learning, and object detection with vision-based sensing technology. The system, which provides cost-effective real-time construction site monitoring, supports up to eight cameras simultaneously, providing blind spot-free surround sensing with high quality functionality in video analytics and recording. The system is not only helping prevent accidents at construction sites but also increasing productivity and efficiency.

Other R&D projects

Project	Focus
AI enables façade glass inspection	RIM
All-round Optical System for Smart Jewelry Inspections	Smart city
Multi-Vector Low frequency Acoustic IoT Sensor Array	Smart city
Detecting Early Signs of Dementia through Speech Analysis	Digital Health
Neuromorphic Optical Sensing System	Smart city
Sensing Fusion Platform for Accurate and Smart Dispensing	Smart city
An Unclonable Optical Security Label for Object Authentication	Smart city
Hyperspectral Imaging Optical System for Extreme Environment	Smart city
Sensing Fusion for Event Based Monitoring System	Smart city



Trust and AI Technologies (TAIT)

Introduction

The Trust and AI Technologies (TAIT) Division uses its strong expertise in AI, blockchain, cybersecurity and data analytics to research and develop innovative and robust applications in collaboration with different industry partners. Research under TAIT is conducted by seven core competence groups. Their work is applied across many sectors and industries, including banking, insurance, retail, logistics, law enforcement, public services, and telecommunications. One of TAIT's major goals is to help to position Hong Kong as a premier international FinTech hub.

Core Competence Groups under TAIT:

Applied Cryptosystems (ACS)

The Applied Cryptosystems team explores technologies related to the application of cryptography in different industry sectors. The team's R&D experts are developing trusted technologies for privacy preservation, fintech security, crypto tokens, and multimedia analytics.

Computational Linguistics & Intelligence (CLI)

Leveraging state-of-the-art AI algorithms and machine learning technologies, the CLI team provides machine perception-related speech recognition, natural language processing, image analysis, and pattern recognition solutions to the industry and key stakeholders across various entities.

R&D highlights

AI-based Voicebot System

ASTRI has completed the design and implementation of an AI-based voicebot system that leverages automatic speech recognition (ASR), natural language processing (NLP), knowledge graphs (KG), and Text-to-Speech (TTS) to provide customers with a better and more natural conversational experience in customer service interactions.

It is also developing an ASR-powered video captioning engine. The engine can convert speech to text without human involvement, quickly making massive amounts of video content searchable as well as more engaging for users.

Leveraging NLP technology, we have also developed an online product research engine. This engine collects and extracts product information from e-commerce websites and uses this to automatically compile a product research report.

Cybersecurity & Analytics (CSA)

The Cybersecurity & Analytics (CSA) team unites humans and machines in research relating to 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 pose a major social threat. To help businesses and the community combat cyber threats, the CSA team combines human skills with advanced hardware-software capabilities through the application of data analytics, machine learning and AI-powered tools.

R&D highlights

HK HoneyNet – Early Threat Hunting and Analysis Network (ETHAN)

ASTRI has developed the HK HoneyNet - ETHAN for the Hong Kong Police Force, a system designed to proactively protect Hong Kong against cybercrime. The system hunts cyber threats by scanning a network of "honeypots" installed in various organisations across different industry sectors. Threat data are aggregated, analysed and automatically extracted as actionable intelligence by machine learning, and shared with government departments, critical infrastructures, banks, telcos and the cybersecurity industry. In December 2022, the interim results of the project were announced in a press conference.

Data Analytics (DATA)

The Data Analytics team specialises in developing scalable, real-time big data analytics platforms and advanced AI solutions using deep learning and machine learning technologies, in support of applications for industries such as FinTech, digital marketing and Smart City. The team's recent work is focused on natural language processing (NLP) and document AI, knowledge graph construction and reasoning, predictive analysis, intelligent recommendations and generative AI.

R&D highlights

AI ESG report analysis system

ASTRI has developed an AI ESG report analysis system that uses AI and NLP technologies to extract key information from the ESG reports of more than 2,000 companies listed on the Main Board of the HKEX. This system was used by the Greater Bay Area Carbon Neutrality Association (GBACNA) to prepare the first-ever "Hong Kong Listed Companies Carbon Neutral Top 100 List (CN100)".

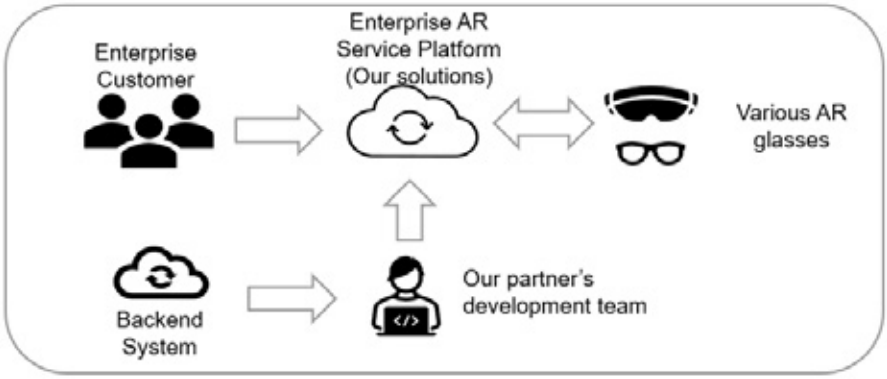
Multimodal Image Analytics (MMIA)

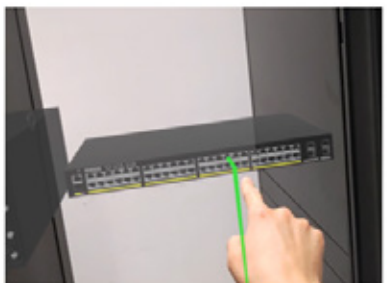
The Multimodal Image Analytics team works with technology relating to the acquisition, analysis and processing of multi-modal images. Development of the technology covers hardware, firmware, software and algorithms, with algorithms focused on image processing, Machine Learning/Deep Learning, Computer Vision and Simultaneous Localisation and Mapping (SLAM). The team's current focus areas include Intelligent Medical Imaging Device and image CAD, Smart Maintenance and Intelligent 3D Metrology. Its wider goal is to provide high-performance and intelligent application solutions for partners in the fields of HealthTech and Smart City.

R&D highlights

Data Visualisation and Computer Vision Framework for Enterprise Augmented Reality (AR) Applications

ASTRI has developed an enterprise AR service platform that is providing our partner CITIC Telecom CPC with real-time AR data visualisation combined with computer vision. ASTRI has also developed several AR apps by integrating content created by the platform with object detection algorithms, for use cases such as data centres and smart maintenance. CITIC Telecom CPC has showcased the apps to its customers, attracting positive media attention. The R&D results from this project have also helped CITIC Telecom CPC win several industrial awards, and seen it file three patents.





AR Data Visualisation

AR Computer Vision

Multimedia Systems and Analytics (MSA)

The Multimedia Systems and Analytics (MSA) team provides multidimensional solutions across different captured media, with current deployments in FinTech, InsurTech and Smart City. Its algorithm development covers the areas of image/video processing, high accuracy handwritten/printed character recognition (ICR), artificial intelligence, computer vision, natural language processing (NLP), document analysis and processing, simultaneous localisation and mapping (SLAM) with GPS for urban navigation, face with voice recognition, generation and synchronisation, biometrics authentication, privacy protection technologies such as Federated Learning (FL) and Synthetic data. The team's output includes federated learning for alternative credit scoring and data valuation, an Automated Form/Document Processing System, an Automated Content Processing Platform, Fraud Detection for insurance claims and banking, Character Recognition Engines and more.

R&D highlights

Privacy Enhancing Platform for alternative credit scoring

In Hong Kong, 40% of the workforce work for micro-, small, and medium-sized enterprises (MSMEs), which make up 98% of all registered companies. Traditionally, MSMEs have different financial needs and face specific difficulties in terms of acquiring funding. Existing credit scoring methods are unable to assess the creditworthiness of MSMEs. The alternative data solutions promoted by ASTRI and the HKMA, coupled with ASTRI's federated learning, can help MSMEs obtain alternative credit scoring while at the same time helping the banking industry to better assess MSME lending risks. The platform's creditworthiness information is transmitted through the HKMA's Commercial Data Interexchange, with customer consent.

Secured System Platforms (SSP)

The Secured System Platforms team develops blockchain system protocols to enhance and optimise blockchain security, performance, and scalability. It also carries out research into hardware accelerators and hardware security for blockchain and IoT systems. The team has helped multiple corporations to build robust blockchain platforms for property mortgages, insurance and supply chains. SSP has also developed open banking solutions for bank systems. The team is currently working on the development of CBDC (Central Bank Digital Currency) in support of the HKMA's eHKD initiative, as well as on research into identity security for online and metaverse businesses.

R&D highlights

Central Bank Digital Currency (CBDC) System PoC and Sandbox Projects

ASTRI has completed the design and implementation of a proof-of-concept Central Bank Digital Currency (CBDC) system for the Bank for International Settlements (BIS) and the Hong Kong Monetary Authority (HKMA). The system incorporates privacy protection that ensures transactions do not disclose a user's personal identity. ASTRI is currently collaborating with the HKMA in the deployment of a CBDC sandbox for trials by local banks, and continuing its research to strengthen privacy protection.

Other R&D projects

Project	Focus
Advanced Federated Learning for Insurance Applications	FinTech
AI agent supporting Contextual Assessment with Reasoning and Decision Visualisation	Smart City
Content Personalisation Framework to Enhance Customer Experience with Efficiency and Accuracy	Smart City
High-Precision and Effective Image Guided Bronchoscopy Navigation System	Digital Health
Secure Metaverse Identity for Businesses	Smart City
Virtual KOL generation and content generation platform	Smart City

Cyber-Physical Systems

The Cyber-Physical Systems (CPS) Group specialises in advanced robotic and automation technologies, covering Digital and Physical Twins, Model-Based Systems Engineering, Collaborative Manipulators and Vehicles, and Advanced Robotic Systems Algorithms, for enabling the Digitalisation for Industry 4.0 and Smart City 2.0. CPS works closely with its industry and government partners to research and develop innovative and robust solutions to enable and/or enhance more autonomous, resilient and collective robotic applications. Their work is applied across many sectors, including electronics, certification, building services, transportation and public services.

Key Technologies

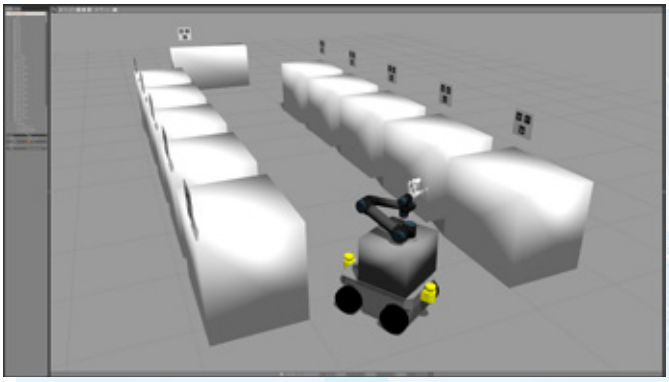
Digital and Physical Twins	Model-Based Systems Engineering	Collaborative Manipulators and Vehicles	Advanced Robotic Systems Algorithms

R&D highlights

Collaborative Mobile Manipulator for Unmanned Factory

ASTRI has developed a more agile development approach for its industry partner to create Collaborative Mobile Manipulator and its Digital Twin by leveraging Model-Based Systems Engineering for enabling autonomous and collaborative operations in Unmanned Factory.

The Digital and Physical Twins approach adopted by ASTRI enables the engineering team to solicit and validate system requirements by using the using the digital twin earlier in the System Development Life Cycle (SDLC) and allows greater agility in handling future design changes. Thus, this results in reducing system integration time by and cutting the total cost of system development of the physical twin.



R&D highlights

Robotic Manipulator for Resilient Operation

ASTRI has developed Digital and Physical Twins for robotic manipulator systems embedded with motion planning, computer vision and machine learning algorithms to enable autonomous and resilient operation in system production. Unlike the conventional approach, the system composed of subcomponents of robotic manipulator, computer vision and AI can be validated and modified separately or collectively at any stage in the System Development Life Cycle (SDLC) via Model/ Software/Hardware-In-the-Loop Simulations. This ASTRI approach achieves not only realising the seamless and agile system integration of robotic, vision and AI technologies but also minimising complexity, cost and time in system production.

Innovative Mind

Introduction

Innovative Mind (INM) Group is newly established in 2023 with a major focus on the development of innovative technologies that align with the Government's policy and address the needs of the industry and community. INM has four core competence groups specialising in Data & Platform, Smart Electronics, Machine Learning and Smart Connectivity. The team possesses significant expertise in technology development, gained through collaborations with government departments, local industries that includes SMEs and associations as well as local universities and R&D Centres. This expertise plays a crucial role in facilitating the sustainable growth of the city. INM strives the balance between deep-tech research and system applications development. INM is currently focusing on several emerging tech R&D including Smart City Tech and PropTech with a core competence in Autonomous Driving, AI-Robotics, Smart Mobility and IoT sensing for a better Smart City's development.

Core Competence Groups:

Smart Infrastructure & Platform (SI&P)

The SI&P group is dedicated to the development and construction of infrastructure and platforms for smart cities and sustainable communities. The group seamlessly integrates ASTRI and industry core technologies, works on developing and delivering innovative solutions, and empowers government and industry stakeholders with digital transformation and the application of cutting-edge technologies.

Smart Electronics

The Smart Electronics group leverages innovative cutting-edge technologies, such as robotics applications, autonomous control, interactive display systems to tackle real-life challenges and transform the way people engaged with the digital world and multimedia.

Machine Learning

The Machine Learning Group develops AI algorithms based on the deep neural network and deep learning technology to extract the structured data from the video, image and audio. Committed to serving the security, construction, transportation and manufacturing industries.

Smart Connectivity

The Smart Connectivity Group addresses industry challenges. Using a wide range of communication standards, such as 4G/5G, LoRA, NB-IoT, UWB technology to provide data access and transmission solutions for various scenarios.

Key Technologies

Autonomous Driving | AI Robotic | Proptech

Delivering Valuable Knowledge Exchange

04 NOV 2022

“Invented and Made in Hong Kong”, world-class “BATS Code” communication technology developed by CUHK’s Professor Raymond Yeung and his team in partnership with ASTRI

n-hop technologies Limited, founded by Professor Raymond Yeung, has been working in partnership with ASTRI on a BATS code-based solution designed to enhance the performance of the Integrated Access & Backhaul (“IAB”) network deployed in the latest 5G technology. The solution is helping to optimise 5G IAB scenarios, greatly increasing the network transmission rate and reducing distortion caused by data loss. This collaboration between ASTRI, the university and a local startup on technology commercialisation is another example of successful cooperation among government, industry, academia, and research institutes. It also reflects the Government’s policy agenda laid out in 2022, which aims to enhance Hong Kong’s 5G infrastructure and encourage the early deployment of 5G technology across industries to improve efficiency, productivity and service quality.

(From left) Five representatives from ASTRI: Mr. Walter Tsui, Principle Engineer, Communications Technologies; Dr. Eddy Chiu, Director, Communications Technologies; Dr. Justin Chuang, Vice President, Communications Technologies; Dr. Denis Yip, Chief Executive Officer; Ir. Sunny Lee, Chairman; alongside five representatives from n-hop technologies: Prof. Raymond Yeung, Co-founder & Director; Mr. Stephen Ho, Co-founder & CEO; Prof. John Zao, Co-founder & Senior Consultant; Dr. Mehrdad Tahernia, CTO; and Mr. Kent Hou, Director of Business Development.

27 SEP 2022

"2022 Shenzhen-Hong Kong C-V2X I&T Corridor" Press Conference marks major step forward in Smart Transportation and Urban C-V2X Platform connectivity

On 27 September 2022, ASTRI signed a Memorandum of Understanding with Shenzhen SmartCity Technology Development Group that saw the two partners agree to cooperate on releasing a cross-border connectivity roadmap for the C-V2X platform. The connectivity roadmap is in full alignment with Smart Mobility, one of the initiatives in the "Smart City Blueprint 2.0" published by HKSAR Government, and will be a further important step in expediting the integration of the Greater Bay Area.

The Kick-Off Ceremony at the "2022 Shenzhen-Hong Kong C-V2X I&T Corridor" press conference

13 JUL 2022

Utilising advanced technologies to help people with eye conditions see clearly again

In July 2022, ASTRI began collaborating with the Centre for Eye and Vision Research (CEVR) on two projects for people suffering from lazy eye and other eye conditions. CEVR was established under the Innovation and Technology Commission's platform for research and innovation, InnoHK.

One of these eye conditions is amblyopia, a common visual impairment that reduces one's vision and ability to see in 3D. To treat it, the brain must be retrained to use information coming from both eyes. This can be hard to achieve in adult patients because neuroplasticity decreases with aging. This collaboration is applying breakthough treatment methods that incorporate ASTRI's AR technologies and CEVR's research into recovering neuroplasticity in the visual cortex. The ultimate goal is to "heal" patients' eyes so they can see clearly again.

ASTRI and the Centre for Eye and Vision Research (CEVR) are cooperating in research and development that can help patients with different ages and degrees of amblyopia and other eye diseases.

09 JUN 2022

Development and commercialisation of AI chips in Hong Kong

In June 2022, ASTRI and the AI Chip Center for Emerging Smart Systems (ACCESS) signed a Memorandum of Understanding under which they would jointly promote the R&D and commercialisation of AI Chips. The MoU aims at raising Hong Kong status as a developer of AI chips to a global cutting-edge level.

Dr. Denis Yip, Chief Executive Officer of ASTRI and Professor Tim Cheng, Vice-President for Research and Development of HKUST and Center Director of ACCESS signed a memorandum of understanding today to jointly promote the R&D and industrialsation of AI Chips.

21 APR 2022

ASTRI, ASM Pacific Technology and Alpha Power Solutions develop first 'Made in Hong Kong' Silicon Carbide Intelligent Power Module for Electric Vehicles

In April 2022, ASTRI, ASM Pacific Technology Limited and Alpha Power Solutions Co., Ltd. announced their joint development of the industry's first 'Made in Hong Kong' Silicon Carbide (SiC) Intelligent Power Module (IPM) for electric vehicles (EVs).

SiC power transistors are replacing their silicon counterparts because of their advantages in voltage resistance, switching speed and thermal performance, all crucial factors for next-generation EVs. Power systems that are significantly smaller in size and weight but have much better efficiency could address EV 'range anxiety' issues while also enabling vehicle design improvements in both aerodynamics and performance.

This development should add further impetus to the Hong Kong Government's drive to promote EVs. It announced in 2021 that by 2035 it would suspend new registrations of carbon fuel-driven private cars (including hybrid vehicles) and require all newly registered private small and medium-sized private cars to be EVs.

Engaging with the Community

KEY VISITS TO ASTRI TECHNOVATION CENTRE

27 MAR 2023

Government officials from Jinhua, Dongyang and Yiwu

17 MAR 2023

Lenovo

13 MAR 2023

Representatives from the Zhuhai National Hi-Tech Industrial Development Zone

10 MAR 2023

China Unicom Group

8 MAR 2023

Office for Attracting Strategic Enterprises (OASES)

7 MAR 2023

The Housing Bureau & the Housing Department

24 FEB 2022

Government officials from Jiangsu Province

19 JAN 2023

Suzhou Industrial Park

13 JAN 2023

Education Employees General Union

1 DEC 2022

Dr Kai-Fu Lee and Sinovation Ventures

22 NOV 2022

BOC Life

24 AUG 2022

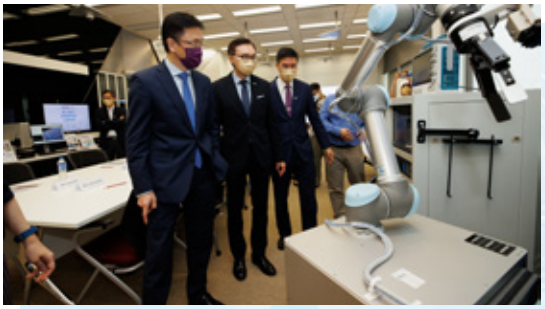
The Transport and Logistics Bureau, Transport Department

21 JUL 2022

The Fire Services Department

19 JUL 2022

Professor Sun Dong, JP, The Secretary for Innovation, Technology and Industry



10 JUN 2022

Deloitte

15 APR 2022

John Lee, then Chief Secretary for Administration

Media Exposure

10 FEB 2023

HoyTV – How ASTRI is practically implementing its R&D results

15 DEC 2022

Ta Kung Pao – Create environment to attract I&T talents

營造良好環境 吸引創科人才

應科院首席執行官：希望加快處理工作簽證

20 OCT 2022

Sky Post – How ASTRI's 5G robot is supporting new industrialisation

創新科技嘉年華2022

5G雲機械人帶領再工業化

一張照片創造數碼代理人

一年一度由創新科技署主辦的「創新科技嘉年華」將於星期六（10月22日）至10月30日在香港科學園舉行。其中香港應用科技研究院（ASTRI）派出5G雲機械人，讓參觀者看見香港再工業化的前景，還邀請大家用一張照片創造自己的數碼代理人，投入元宇宙世界。

5G技術減少機械人成本

ASTRI一直專注於產業智能化的研究工作，其中一項重磅成果是將5G傳送技術結合機械人，不止讓市面常見的清潔機械人再升級，更可推動香港再工業化及智能生產線的發展。根據通訊技術部助理主任工程師鄧皓文（Vincent）介紹，將於「創新科技嘉年華」上展出的5G雲機器人結合多個先進技術，包括自動導航、厘米級高精度定位、機械臂，以及雷射探測與測距等多種環境感應器，讓機械人輕易通過與車身同寬的狹窄過道，偵測逾至100米的物體，並自動避開人與障礙物，成功到達預設目的地完成任務。

Vincent表示，有了以上技術，再加上5G的傳輸優勢，將有助香港在智能生產線及倉存服務上作出突破。他估計機械人的生產成本可降低三至四成，同時節省場地空間成本，讓這項自動化技術更普及，為香港增加競爭優勢。

一張照片帶你走進元宇宙世界

「創新科技嘉年華」還有一些充滿趣味的互動體驗，包括由ASTRI團隊研發的數碼代理人生成系統。參觀者戴著口罩拍一張照片，便可在數分鐘內得到自己的動畫版，並完美講出有趣對白，不再像以往需要大量3D運算及時間才能做到。可信及人工智能技術部主任工程師陳文財（Asa）表示，這幾分鐘的過程中，其實已運用許多領域的先進技術，成功到達預設目的地完成任務。

Vincent表示，有了以上技術，再加上5G的傳輸優勢，將有助香港在智能生產線及倉存服務上作出突破。他估計機械人的生產成本可降低三至四成，同時節省場地空間成本，讓這項自動化技術更普及，為香港增加競爭優勢。

一張照片帶你走進元宇宙世界

「創新科技嘉年華」還有一些充滿趣味的互動體驗，包括由ASTRI團隊研發的數碼代理人生成系統。參觀者戴著口罩拍一張照片，便可在數分鐘內得到自己的動畫版，並完美講出有趣對白，不再像以往需要大量3D運算及時間才能做到。可信及人工智能技術部主任工程師陳文財（Asa）表示，這幾分鐘的過程中，其實已運用許多領域的先進技術，成功到達預設目的地完成任務。

為了讓體驗更好玩，他們準備了多種卡通風格，以及20句常見網絡潮語給參加者選擇，更可即時下載MP4格式的影片在社交平台上分享。Asa透露，團隊正專注提升頭部生成質素，並研發真人版本的數碼代理人，再慢慢開發其他身體部位。他預計相關技術可全面在商業或元宇宙世界中應用，讓數碼世界更貼近現實，更方便交流。

▶5G雲機械人的定位誤差少於5厘米，加上四輪設計，能克服不同地形。

▲Asa表示數碼代理人生成技術可在網上服務、直播推銷及元宇宙中廣泛應用。

▲參加者戴著口罩拍照，即可得到自己個人的動畫影像並會講自選對白。Asa又提示大家佩戴單色口罩，能讓面部生成得更好。

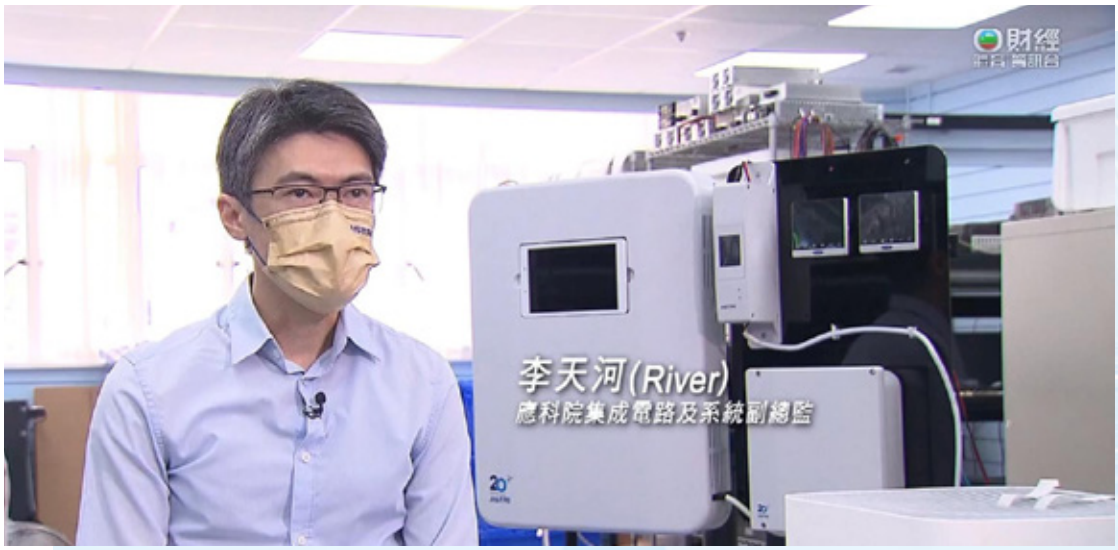
◀Vincent指出5G雲機器人將有助香港再工業化及智能生產線的發展。

主辦機構：創新科技署
夥伴機構：香港青年協會、香港科技園公司
日期/時間：10月22日至30日（周一至五：上午10時至下午5時，周六及日：上午10時至下午6時）
地點：沙田香港科學園（免費穿梭巴士於各數期間往返香港科學園與港鐵大學及大圍站；10月22、23、29及30日加設往返香港科學園與港鐵金鐘及九龍塘站。詳情載於活動網頁。）
網址：innocarnival.hk
查詢電話：2561 6149（香港青年協會）

（資訊）

20 OCT 2022

TVB Channel 85 "Innovation GPS" – Introducing ASTRI's DC power innovations



19 OCT 2022

RTHK "Bay Area Guide" – The I&T ecosystem and I&T development in the GBA

15 OCT 2022

RTHK "Talking to CEOs"

18 OCT 2022

NOW TV – ASTRI's role in Hong Kong, and in attracting more semiconductor professionals to the city

05 OCT 2022

TVB J2 "OpenMind" – Introducing ASTRI's EdTech and C-V2X Technology

23 SEP 2022

AM730 – C-V2X Technology and Smart Energy

27 SEP 2022

HKET – CEO's interview

23 SEP 2022

Hong Kong Economic Times – ASTRI partners with VTC to groom young R&D talents and launch new programmes in Microelectronics and Communications Technologies

30 AUG 2022

Phoenix TV "From Phoenix To The World" – I&T collaboration between Hong Kong and countries of the Belt and Road Initiative

12 AUG 2022

dotdotnews "EyE on U" – ASTRI's achievements in the areas of AI, metaverse and semiconductors

12 AUG 2022

Phoenix TV – How semiconductor technology can be applied to 5G and smart city solutions

09 JUL 2022

EDigest - CEO's interview

07 JUN 2022

RTHK TV "IP New Opportunities" – Commercialisation of ASTRI's DC Power innovations

02 JUN 2022

Hong Kong Entrepreneurs magazine

24 MAY 2022

Metro Radio "Design for Sustainable Community" – Interview on Metaverse and ArtTech

18 APR 2022

RTHK "Under the Sun" – ASTRI's Talent Programme and its technology development (Federated Learning & DC Power Conversion)

08 APR 2022

Hong Kong Economic Journal – Development of 5G technology

02 APR 2022

Sing Tao Daily – ASTRI's Top Technology Talent Programme

Smart People

Talent Initiatives

By identifying talent, training a skilled technology workforce, and partnering with academia and industry, ASTRI acts as a “partnership architect” for the entire I&T ecosystem. To this end, ASTRI has launched a series of diversified initiatives designed to attract, nurture and retain talent, and enlarge the I&T talent pool.

Top Technology Scholar Programme

Since its launch in March 2022, the Top Technology Scholar Programme has welcomed over 70 innovation and technology talents, and is continuing to attract recent Master's and Doctoral graduates. Programme participants get to take part in important research projects at ASTRI and the Greater Bay Area (GBA), while participants who meet their performance targets in the first year receive a promotion and a pay raise. Upon completion of the two-year programme, Master's and Doctoral degree holders will receive scholarships of HK$50,000 and HK$80,000 respectively.

The programme is open to both local and non-local graduate school talents who have graduated within the last two years. Successful applicants get to participate in important research projects at ASTRI, many of which are carried out in collaboration with enterprises and organisations in the GBA. This means that participants are able to visit large industry enterprises in the GBA and gain valuable work experience and new perspectives there. Besides visiting start-up companies to learn more about their operations, participants will also be offered GBA or overseas training and exchange opportunities. Through the programme, ASTRI is looking to provide strong foundations and wider perspectives to future generations of I&T talent, with the goal of boosting the development of innovation and technology in Hong Kong.

ASTRI Work-Study Programme (PhD)

On 31 January 2023, ASTRI signed a Memorandum of Understanding (MoU) with the Hong Kong University of Science and Technology (HKUST) to launch the first-ever Work-Study programme(PhD). Under the agreement, ASTRI and HKUST will screen and select programme candidates, who will be talented professionals looking for flexible study options without interrupting their careers. Programme participants will remain employed as full-time R&D staff at ASTRI while pursuing a PhD at HKUST on a part-time basis.

The programme allows staff to base their PhD studies at HKUST on their own research interests, which may also be relevant to their work at ASTRI. Successful candidates may also have the opportunity to participate in frontier research projects spanning artificial intelligence, big data, wireless communications, smart city, and advanced materials, as well as R&D projects related to their PhD studies. The programme will not only encourage high-calibre talents to develop creativity, critical thinking and a global perspective, but will also enhance their international competitiveness and R&D innovation skills.

ASTRI Summer Internship Programme

As part of its mission of nurturing the next generation of I&T talents, ASTRI runs an annual Summer Internship Programme that offers undergraduate and postgraduate students exciting opportunities to engage in Hong Kong's I&T ecosystem and experience ASTRI's unique research culture. In 2022, ASTRI's eight-week summer programmes met with an overwhelming response. In total, 2,464 applications were received, with 50 candidates being shortlisted, among them students from over 28 renowned universities in United States and the UK (such as Harvard University, Massachusetts Institute of Technology (MIT), the University of Cambridge and the University of Oxford), as well as students from top universities in Hong Kong.

The Summer Internship Programme 2023, which starts in June 2023, has added new dimensions to its schedule, offering a broad spectrum of R&D projects and activities to further engage and motivate the interns. The eight-week internship gives students a golden opportunity to learn from award-winning scientists in a cross-cultural environment and gain valuable R&D hands-on experience in one of ASTRI's six core areas, namely Smart City, Financial Technologies, New Industrialisation and Intelligent Manufacturing, Digital Health, Application Specific Integrated Circuits, and Metaverse. The interns will also have opportunities to partner with ASTRI's senior management and work alongside professionals in ways that will enable them to dive deep into I&T process and technology development, participating in R&D projects that employ Artificial Intelligence, Advanced Analytics, Blockchain, Digital Assets, 5G and IoT to name a few.

Separately, a number of Tech Talks, a Sports Day and a Networking Session will be arranged for interns, at which key industry players, professionals and scholars from large corporations and organisations will be invited to share their journeys and experience.

Fintech Future Leader Academy

Established in 2022, the Fintech Future Leader Academy is ASTRI's flagship talent programme targeted at undergraduates in their second or third year, and postgraduates, who are enthusiastic about financial technologies and innovations. Students are assigned to the FinTech division where they gain exposure to ASTRI's FinTech and Metaverse business and innovation projects.

The Academy offers young participants the chance to work as an intern at ASTRI, with opportunities to gain an in-depth view of FinTech development as well as insights into the FinTech industry. In 2022, participants not only enjoyed on-the-job training and participation in FinTech projects, they were also offered field visits to a variety of prestigious financial and technology services companies, namely Bank of China (Hong Kong), China Life (Overseas), Cyberport, Hewlett Packard Enterprise, the Hong Kong Monetary Authority, the Hong Kong Science and Technology Parks Corporation, IBM, Microsoft Hong Kong, and Ping An OneConnect Bank.

The FinTech Future Leader Academy 2023, starting in June, will again offer students a comprehensive eight-week internship programme with support from ASTRI's FinTech team. Through this programme, participants will also learn the principles of FinTech, gain hands-on experience in handling real-world FinTech projects, and get to know some key FinTech service institutions in Hong Kong. Similar to 2022, participants will also visit to some of the well-known institutions supporting the programme, where they will learn from industry experts about how FinTech is impacting our society.

Staff Engagement Activities

ASTRI's success is built on its highly engaged workforce, so great emphasis is placed on maintaining a positive work environment and fostering a strong sense of community among ASTRI staff. Throughout the year, we organised a variety of staff engagement activities such as Tech Talk, a BBQ night, wellness programmes, a charity bazaar and a Chinese New Year bouquet workshop, all designed to foster collaboration, personal growth, and good work-life balance.

In January 2022, ASTRI invited Dr. Kai-Fu Lee, an internationally renowned expert in artificial intelligence and acclaimed as the father of AI, to give a New Year's speech. This event marked the first seminar of the "ASTRI Seminar 2023" series.

The topic of Dr. Lee's speech was "How Artificial Intelligence Will Change the World". He emphasised the immense potential, vast market, and prospects that China possesses in the development of artificial intelligence.

The speech attracted a full house with enthusiastic responses. It not only provided profound insights into artificial intelligence but also created a strong academic atmosphere for ASTRI at the beginning of the new year. It is hoped that this atmosphere will continue and inspire everyone's passion for AI research and the spirit of innovation.

An integral part of ASTRI's mission is to contribute to our wider community. To this end, we organised a Charity Bazaar where our staff sold a range of items, including accessories, festive decor, books, and more, to raise funds for WWF (World Wide Fund for Nature).

Many ASTRI staff have taken part in yoga sessions as part of our staff wellness programme, enjoying the numerous benefits that this ancient practice offers, including enhanced flexibility, reduced stress, and improved mindfulness.

Led by a talented florist, staff members enjoyed a session learning the art of crafting exquisite floral arrangements. To mark the start of the Year of the Rabbit, the arrangements incorporated traditional Chinese elements such as auspicious red blooms and gold accents.

The BBQ night served as an opportunity for our staff to unwind after work, relax in a convivial atmosphere, and strengthen bonds with one other.

Key Performance Indicators

Level of Industry Income	2022-2023 Target	2022-2023 Actual
Industry Contribution (HK$ Million)	85.74 M (33.2%)	64.37 M[1] (29.5%)
Industry Income (HK$ Million)	47.73 M	42.81 M
Level of Income Received from the Industry[2]	57.9%	58.8% 59.6%δ 54.1%δ
R&D Projects		
Number of ongoing R&D Projects as at end of the reporting period	69	79
Number of ongoing R&D projects as at end of the reporting period involving industry participation[3]	47	40[1]
Number of companies participating in these ongoing R&D projects[4]	87	91
Utilisation of research output of ITF-funded R&D projects		
Number of licensing agreements signed	38	17[5]
Number of contract research projects undertaken[6]	60	51[7]
Public Sector Trial Projects		
Number of ongoing public sector trial projects as at end of the reporting period	3	6
Number of organisations benefitting from these public sector trial projects	3	6
Other performance indicators		
Number of patents filed (no. of inventions)	68 (34)	68 (34)[8]
Number of patents granted	55	57
Number of academic / industry awards received	N.A.	2[9]

1 More customers preferred to have customised solutions through collaborating with ASTRI in the form of non-ITF Contract Research than engaging in the ITF projects especially PRP, therefore affecting the industry contribution and number of on-going R&D projects involving industry participation.

2 Level of income received from the industry (%)

$$\frac{\text{(1) Industry Contribution Pledged ^ + (2) Other Source of Financial Contribution Pledged^ + (3) Commercialisation Income Received*}}{\text{(4) Approved Project Expenditure ^}} \times 100\%$$

* Commercialisation income received refers to income arising from licensing, contract services, royalties and others (e.g. sale of IPs etc.) but excluding those from public sector trial projects, seed projects and public sector platform projects with sponsorship waived by CIT.

^ Excluding public sector trial projects, seed projects and public sector platform projects with sponsorship waived by CIT.

δ 59.6% if sponsorship/industry contribution from other Government funding schemes is calculated;
54.1% if the aforementioned sponsorship/industry contribution and the relevant project cost is calculated.

3 Refer to the number of on-going R&D projects as at 31 March involving industry contribution.

4 Refer to the number of sponsorship companies participating in on-going R&D projects as at 31 March.

5 The target was set with an assumption of 38 industry contribution with licensing. Finally, 17 licensing agreements were signed while others went for cash sponsorship.

6 Referred to projects in which a company pays the full costs for the project.

7 10 contract research projects were completed in FY2021-22 but not in FY2022-23 as estimated.

8 The number of patents granted and filed in HK in FY2022-23 are 7 and 34 respectively.

9 There were 2 awards namely (i) 1 award from Hong Kong ICT Awards 2022 - Smart Business (Emerging Technologies) Silver Award; (ii) 1 award from 2021 Hong Kong Awards for Environmental Excellence (HKAEE) Hong Kong Green Innovations Awards - Certificate of Merit.

Financial Report

Overview

For 2022-23 financial year, the consolidated income and expenditure of ASTRI amounted to HK$562,257,894 and HK$555,163,973 respectively, resulting in a surplus of HK$7,093,921.

The funds from the Government comprised HK$151,634,894 from recurrent subvention, HK$29,703,843 from Innovation and Technology Fund ("ITF") for reimbursement of administrative overheads, HK$208,958,248 from ITF project funds, HK$2,257,397 from ITF General Support Programme ("GSP"), HK$6,055,292 from ITF Public Sector Trial Scheme ("PSTS"), HK$10,836,194 from ITF Research Talent Hub, HK$18,939,299 from ITF for Chinese National Engineering Research Centre for Application Specific Integrated Circuit System (Hong Kong Branch) and HK$6,461,050 from Smart Traffic Fund. In 2022-23 financial year, the income from the industry amounted to HK$125,395,630. The total administrative expenses amounted to HK$180,549,712 (comprised of administrative expenses of HK$179,757,097 and finance cost of HK$486,673 under subvention and administrative expenses of HK$305,942 funded by accumulated surplus from other income), which represented a decrease of HK$8,470,077 (4.5%) 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$304,649,507, of which 74% of the expenditure was spent on manpower and 26% of the expenditure was spent on equipment, other direct costs and administrative overheads.

The total expenditure mainly represented the actual cash outflow incurred during the year for 89 full projects, 32 seed projects, four GSP projects and nine PSTS projects. Meanwhile, the Research Talent Hub expenditure amounted to HK$10,836,194, representing the actual cash outflow of salary payment for research talents engaged in 34 full projects and five seed projects.

The consolidated financial statements of ASTRI for the year ended 31 March 2023 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 105 - 107.

Consolidated Statement of Income and Expenditure and Comprehensive Income		
Year ended 31 March 2023	2023 (HK$)	2022 (HK$)
SUBVENTION		
Income from Government subvention	151,634,894	165,785,565
Administrative expenses	(179,757,097)	(188,366,691)
Finance cost	(486,673)	(264,312)
Deficit on subvention	(28,608,876)	(22,845,438)
FUNDING SUPPORT FROM INNOVATION AND TECHNOLOGY FUND		
Reimbursement of administrative overheads	29,703,843	15,615,060
	1,094,967	(7,230,378)
PROJECT FUNDING FROM INNOVATION AND TECHNOLOGY FUND AND INDUSTRY CONTRIBUTIONS		
Project fund income		
- Innovation and Technology Fund	208,958,248	250,097,768
- Industry contributions	86,824,570	48,588,832
Project expenditure	(295,782,818)	(298,686,600)
Balance on project funding	-	-
Project fund income - General Support Programme		
- Innovation and Technology Fund	2,257,397	1,502,709
- Industry contributions	554,000	606,188
Project expenditure	(2,811,397)	(2,108,897)
Balance on project funding	-	-
Project fund income - Public Sector Trial Scheme		
- Innovation and Technology Fund	6,055,292	6,269,359
Project expenditure	(6,055,292)	(6,269,359)
Balance on project funding	-	-
Project fund income - Research Talent Hub		
- Innovation and Technology Fund	10,836,194	19,648,272
Project expenditure	(10,836,194)	(19,648,272)
Balance on project funding	-	-
PROJECT FUNDING FROM MINISTRY OF SCIENCE AND TECHNOLOGY OF THE PEOPLE'S REPUBLIC OF CHINA		
Project fund income	(500)	-
Project expenditure	500	-
Balance on project funding	-	-

Consolidated Statement of Income and Expenditure and Comprehensive Income (Continued)		
Year ended 31 March 2023	2023 (HK$)	2022 (HK$)
PROJECT FUNDING FROM SMART TRAFFIC FUND AND INDUSTRY CONTRIBUTIONS		
Project fund income		
- Smart Traffic Fund	6,461,050	-
- Industry contributions	1,313,700	-
Project expenditure	(7,774,750)	-
Balance on project funding	-	-
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	(18,939,299)	(9,341,949)
Amount for reimbursement	18,939,299	9,341,949
	-	-
RESERVE FUND		
Reserve Fund - income	2,016,547	1,593,376
Reserve Fund - expenditure	(2,016,547)	(1,593,376)
	-	-
OTHER INCOME, NET		
Other income	36,703,360	25,674,639
Other expenses	(26,625,881)	(14,117,301)
	10,077,479	11,557,338
AMOUNT RETURN TO THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION	(3,985,018)	(9,073,738)
SURPLUS/(DEFICIT) BEFORE TAX	7,187,428	(4,746,778)
INCOME TAX CREDIT/(EXPENSE)	(93,507)	10,415
SURPLUS/(DEFICIT) FOR THE YEAR	**7,093,921**	**(4,736,363)**
OTHER COMPREHENSIVE INCOME/(LOSS) THAT MAY BE RECLASSIFIED TO SURPLUS OR DEFICIT IN SUBSEQUENT PERIODS		
Exchange differences arising on translation of foreign operation	(101,633)	32,709
TOTAL COMPREHENSIVE INCOME/(LOSS) FOR THE YEAR	**6,992,288**	**(4,703,654)**

Consolidated Statement of Financial Position

31 March 2023	2023 (HK$)	2022 (HK$)
NON-CURRENT ASSETS		
Property, plant and equipment	14,413,703	6,424,986
Right-of-use assets	45,757,410	67,457,218
	60,171,113	**73,882,204**
CURRENT ASSETS		
Accounts receivable, contract assets, prepayments and deposits	19,749,855	17,854,099
Amount due from the Government of the Hong Kong Special Administrative Region	59,828,004	46,422,301
Tax recoverable	-	32,765
Cash and cash equivalents	304,607,953	306,476,135
	384,185,812	**370,785,300**
CURRENT LIABILITIES		
Accounts payable, contract liabilities, other payables and accruals	79,867,110	77,221,466
Deferred government grants	20,663,663	18,695,192
Receipts in advance	217,460,030	209,518,608
Amount due to the Government of the Hong Kong Special Administrative Region	1,563,300	1,145,166
Lease liabilities	23,990,364	23,384,688
Tax payable	72,855	-
	343,617,322	**329,965,120**
Net Current Assets	**40,568,490**	**40,820,180**
Total Assets Less Current Liabilities	**100,739,603**	**114,702,384**
NON-CURRENT LIABILITIES		
Lease liabilities	17,693,382	40,852,929
Provision	16,968,125	14,763,647
	34,661,507	**55,616,576**
Net Assets	**66,078,096**	**59,085,808**
EQUITY		
Share capital	2	2
Reserves	66,078,094	59,085,806
Total Equity	**66,078,096**	**59,085,808**

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 2023 and 31 March 2022, included in the Consolidated Statement of Income and Expenditure and Comprehensive Income, and the Consolidated Statement of Financial Position set out on pages 105 - 107, 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.

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

Post	Annual Remuneration* 1 Apr 2022 – 31 Mar 2023 (HK$)
First tier Chief Executive Officer	$4,323,920
Second tier Five senior executives	$10,324,180
Third tier Eight functional leaders/senior technology experts	$17,265,270

Annual Remuneration* (HK$)	Number of staff members
1,000,000 or below	1
1,000,001 to 1,500,000	0
1,500,001 to 2,000,000	3
2,000,001 to 2,500,000	7
2,500,001 to 3,000,000	1
3,000,001 to 3,500,000	1
3,500,001 to 4,000,000	0
4,000,001 to 4,500,000	1

* This information covers actual remuneration (including base salary, salary adjustment, performance-linked pay, variable payment and cash award (Inventor Award)) for 2022-2023 received by staff in the top three tiers who were in service as of 31 March 2023. It also covers the actual remuneration of –

(a) staff appointed during the financial year – two new Chief Technologists were appointed on 1 May 2022 and 1 July 2022 respectively, and a new Chief Operating Officer joined on 15 November 2022; and

(b) staff departed during the financial year – Chief Operating Officer departed on 3 December 2022, Chief Technology Officer departed on 28 January 2023, and Chief Administrative Officer departed on 20 February 2023.

The figures have been rounded to the nearest HK$10.

ASTRI

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