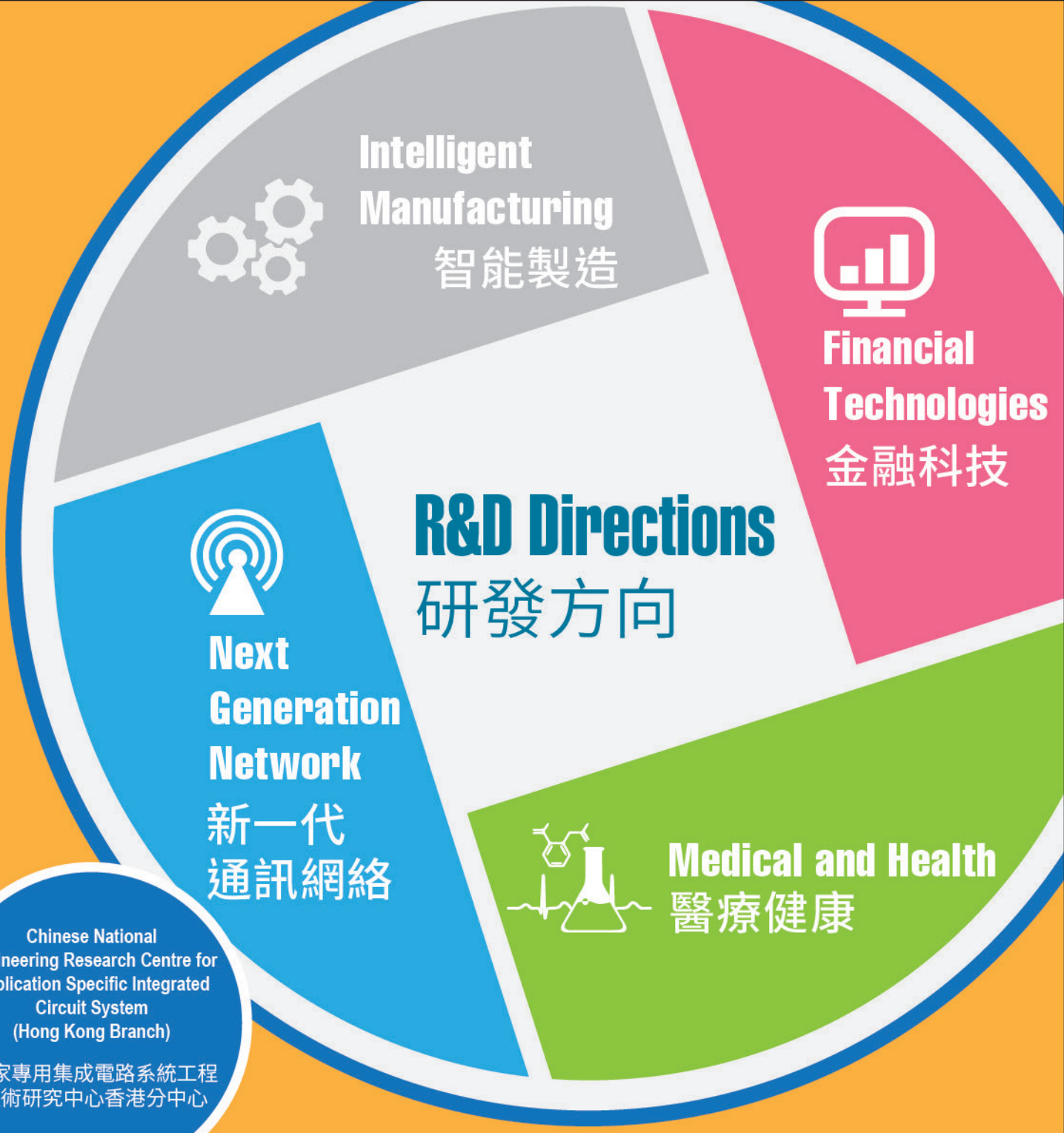



Chinese National Engineering Research Centre for Application Specific Integrated Circuit System (Hong Kong Branch)

國家專用集成電路系統工程技術研究中心香港分中心

# ASTRI Annual Report
# 香港應用科技研究院年度報告

2014 - 2015

ASTRI™

香港應用科技研究院
Hong Kong Applied Science and Technology Research Institute

# Contents 目錄

## About ASTRI

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 in technology-based industries through applied research.

ASTRI's core R&D competences in various areas are grouped under seven Technology Divisions, namely Communications Technologies, Electronics Components, IC Design Analog, IC Design Digital, Opto-electronics, Security and Data Sciences, and Software and Systems. Four areas of applications including financial technologies, intelligent manufacturing, next generation network, and medical and health are identified for major pursuit.

In 2006, ASTRI was designated the Hong Kong Research and Development Centre for Information and Communications Technologies by the Innovation and Technology Commission. In 2012, ASTRI was given an approval from the Ministry of Science and Technology (MOST) under the Chinese State Council to establish the first Hong Kong Branch of Chinese National Engineering Research Centre (CNERC) for Application Specific Integrated Circuit System in collaboration with Southeast University (SEU) in Nanjing.

## 關於應科院

香港應用科技研究院(應科院)由香港特別行政區政府於二零零零年成立，其使命是要透過應用科技研究，協助發展以科技為基礎的產業，藉此提升香港的競爭力。

應科院設立七個技術部，把其在多個領域的核心研發能力組織起來，包括：通訊技術、電子元件、集成電路設計 類比、集成電路設計 數碼、光電子、信息安全與數據科學，及軟件與系統。研發力量主要針對金融科技、智能製造、新一代通訊網絡和醫療健康等四個應用範疇。

二零零六年，應科院獲創新科技署委託，承辦「香港資訊及通訊技術研發中心」。二零一二年，應科院獲國家科學技術部批准，與南京東南大學合作，成立本港第一所「國家專用集成電路系統工程技術研究中心香港分中心」。

## Our Vision

A world-class technology developer and enabler to enrich life.

## 我們的願景

引領世界創新，締造豐盛人生。

## Our Mission

To enhance Hong Kong's competitiveness through applied research.

## 我們的使命

科技產業化，產業智能化。開創香港競爭新世代。

## Our Goals

- Perform innovative R&D for greater technological applications in industries
- Nurture technology entrepreneurs and talents
- Anchor and enhance collaborations among universities, R&D institutions and industries

## 我們的目標

- 領航科技創新，擴大產業應用
- 培育專才，推動創業
- 促進產學研互動協作，創造共贏

## Our Values

## 我們的核心價值


**Innovation 創新**

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

我們致力創新，造福香港、國家和世界。

**Accountability 問責**

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

我們恪守專業操守，以誠實的態度和公開公平的原則處事，並承擔責任。

**Respect 尊重**

We give due respect to self and others to establish and support an environment of teamwork and growth.

我們律己敬人，以建立團體精神，促進個人成長。

**Service 服務**

We render timely and world-class services to our stakeholders.

我們為不同的持份者提供適時並達世界水準的服務。

**Tenacity 堅毅**

We strive to overcome all challenges to the best of our ability.

我們百折不撓，竭盡所能，克服挑戰。

# Chairman's Foreword

# 主席序言

*"ASTRI will follow two core principles: adhere*

*應科院未來發展將遵循兩大戰略：配合國家*

With great pride and honour, I present to you the ASTRI Annual Report for the second time in my capacity as Chairman of the Board of Directors of the largest government-funded applied R&D centre in Hong Kong.

With remarkable achievements in research, entrepreneurship, and rich experience in management, Dr. Frank Tong took the helm of ASTRI in September 2014. As our CEO, he has brought in new insights and inspiration to ASTRI as we strive to shine in our areas of excellence. I have no doubt Frank will continue to do so.

In renewing our commitments to our community, we have set new R&D strategies and directions relevant to our industries and to our nation, aiming to establish co-operation among the Government, industry, academia and the research sector, transferring our technologies to the industries, and building up talents. We have high hopes that our growth strategy and newly-set directions will create and strengthen our industry base, induce more start-ups, and lure more multi-national companies to conduct their research in Hong Kong. All these activities will translate into more high-value-added jobs, that in turns excite many more of our younger generations into high tech arena, diversifying our economy structure and contributing to our GDP growth. At a time when every major city is chasing after high-tech talents to boost their competitiveness in their specific strategic areas of interests and roadmaps, we will lead ASTRI to serve as one of the future growth engines for Hong Kong in our focused R&D area in information and communications technologies (ICT).

Our technology transfer covers a wide range of areas including finance, manufacturing, communications, and health, to name but a few, thereby elevating Hong Kong towards a world-class smart city. By fostering close collaborations with our industry partners, we aim to resolve the technology challenges they face in the short, medium, and long term.

本人以應科院董事局主席的身份，第二次與各位分享作為全港最大、特區政府資助的應用研發機構，香港應科院，的年終報告，我感到自豪和欣悅。

首先，我們承蒙湯復基博士，從二零一四年九月開始，蒞任應科院新一任的行政總裁。他在科研、創業、和管理方面均取得顯赫成就。本人深信，湯博士會為我院注入新思維和發展動力；應科院未來在湯博士的帶領下將更上一層樓，在當前我們已取得卓越的研究領域上繼續發光發亮。

在更新應科院對社會承諾的同時，我們訂立了與香港業界和國家相關的新科研戰略和方向，旨在官、產、學、研建立合作夥伴，把高端所研發的應用技術，轉移給業界，另一方面，大力培育人才。我對本院的發展策略和新制訂的研發方向寄予厚望，期望能創造和加強我們的產業、吸引更多初創及跨國企業在香港開展科研。這些活動有助於創造高增值的工作職位，從而激發更多年青一代踏進高科技界，使我們比較單一的經濟結構變得多元化，並能推動本地生產總值的增長。當世界各地正努力尋求高科技專才以提升其競爭力同時，我們會帶領應科院，集中發展資訊及通訊科技方面的研究，讓本院成為推動本港未來發展的主要動力之一。

我們的技術轉移，所涵蓋領域甚廣，包括金融、製造、通訊、健康等，從而加快香港邁向世界級智慧城市的步伐。並透過與業界合作夥伴緊密合作，解決業界面臨的短、中、長遠科技問題。

*to the R&D directions of our nation and adopt a market-oriented approach.*

*各種科技策略;及以市場主導。”*

ASTRI will follow two core principles. First, we will adhere to the R&D directions of our nation. Second, we will adopt a market-oriented approach to solve the difficulties faced by the enterprises in Hong Kong. Our strategies are clear. We have restructured ourselves to resolve the complex problems faced by our industries, which are often cross-disciplines in nature.

Another key imperative close to my heart is to reach out to our younger generations in our tertiary, secondary and even to the primary level. I hope we could influence our younger generations in their interests in science, technology, engineering and mathematics, which are hotly pursued by all others.

Lastly, I am grateful to my fellow ASTRI Board members, who have devoted tremendously of their private time for the growth and betterment of the research institute. I am also thankful to the Innovation and Technology Commission, the ASTRI staff and management, and community at large for their unfailing support over the years. Thank you.

應科院未來發展將遵循兩大戰略。第一，我們會配合國家各種科技策略；第二，我們會以市場主導，解決香港企業面對的科技問題。應科院發展策略清晰明確，我們已重整架構，為業界所面臨的複雜及跨技術領域範疇問題尋找解決方案。

另一項本人認為應科院必須發展的事項就是與大學、中學、以至小學的學生接觸交流。本人期望本院能給下一代帶來深遠影響，提升他們在科學、技術、工程和數學方面的興趣，培育人才。

最後，本人衷心感謝應科院董事會成員的無私奉獻，他們付出寶貴時間領導本科研機構的發展。我亦感謝創新科技署，應科院管理層乃至全體人員，和整個香港社會的長期支持。謝謝。

Wong Ming-yam

王明鑫

Chairman of the Board

董事局主席

# Chief Executive Officer's Review

# 行政總裁回顧

*"Looking ahead, ASTRI will spare no efforts global industries in the area of information and*

*展望未來，應科院將會全力以赴，積極開拓各項*

I present my 2014/15 work review, my first as the Chief Executive Officer of ASTRI, to you with immense pride and honour.

Thanks to the hard work of my predecessors, ASTRI has established itself a world-class technology developer, and built itself a collaboration platform for enterprises, both large and small, to enhance their competitiveness through our applied research. Our goals are:

1. Perform innovative R&D for greater technological applications in industries
2. Nurture technology entrepreneurs and talents
3. Anchor and promote collaborations among universities, R&D institutions and industries

Since September 2014, we have started streamlining our organisational structure to optimise output and efficiency. In the R&D areas, our core competences are reorganised into more than 20 groups under seven technology divisions, covering in a wide range of areas from IC design, optical and electronic components, 3D and high power electronics packaging, embedded and cloud-based software development, to wireless communications technologies.

On the applications side, we have identified the "4 + 1" strategic areas, namely, financial technologies or fintech, intelligent manufacturing (IMI), next generation network (NGN), and medical and health initiative (MHI). Each of the "4" application areas fully utilises our core competences under our new matrix management. The "+1" area refers to the Hong Kong branch under the Chinese National Engineering Research Centre (CNERC) on IC design, the first of its kind in Hong Kong and with the main centre at Southeast University in Nanjing. Through this platform, we hope to cater a bigger technology needs and create a larger impact at national level.

Over the past year, we have made significant progress in developing focused collaborations, such as through establishing consortium and joint R&D centres and laboratories, with various industry partners tailoring to

這份報告是本人上任應科院行政總裁以來所做的第一次職務彙報。對此，我感到萬分自豪和榮幸。

仰仗各前任行政總裁的努力，應科院如今已發展成為世界一流的科技開發機構，並致力於建立合作平臺，讓大小企業透過我們的應用研究提升競爭力。我們的目標為：

1. 領航科技創新，擴大產業應用
2. 培育專才，推動創業
3. 促進產學研互動協作，創造共贏

內涵發展方面，自二零一四年九月起，我們在研發和應用領域做出了顯著改組，藉以提升效能。在研發領域，我們將本院的核心研發能力，歸類為七個技術部門，合計二十餘個核心群組，涵蓋由積體電路設計、光學及電子元件、三維及高功率電子包裝、內嵌及雲端軟體發展至無線通訊技術的廣闊領域。

在應用方面，我們亦確立出「4+1」的策略。「4」意指「金融科技、智慧製造、新一代通訊網路及醫療健康」四大應用項目。我們希望充分發揮核心群組的技術優勢，以實施上述策略並作出貢獻。「+1」則代表「國家專用積體電路系統工程技術研究中心香港分中心」，是香港首個專門從事積體電路設計的院所，其主中心設在南京東南大學。通過這個平臺，我們期望能夠於國家層面上更好地滿足大規模的技術需求，帶來更深遠影響。

外延拓展方面，在過去一年，我們與合作夥伴建立重點合作取得了重大進展，包括為業界多個合作夥伴量體裁衣地建立合作聯盟聯合研發中心及實

*in advancing technologies to address the needs of local, national and communications technologies.*

*技術，迎合本地、國家以及國際社會在資訊及通訊科技方面的需要。"*

their needs and interests. For instance, through ASTRI-HP Information Technology Research Centre, we are focusing on developing big data technologies. We are also moving full steam forward in establishing ASTRI-Shanghai Huahong Joint Laboratory of Wireless IoT Technologies and Applications, the ASTRI Security Lab, the Shenzhen-Hong Kong Microelectronics Consortium, the ASTRI-Truly Joint Research and Development Centre on manufacturing technologies, and with the Beijing Institute on Collaborative Innovation on financial technologies development.

Apart from building up joint R&D centres and laboratories, we have also forged closer collaborations with multiple industry partners. For example, Infineon has teamed up with us on solving thermal management issues on packaging, and OmniVision with us on heads-up display for future automobile applications. We have also formed a long-term strategic partnership with TCL on IoT gateway software for smart-home application. These projects will bring commercial values to our partners. Through those projects, we have helped nurturing a large quantity of talents badly needed in our industries.

Significant achievements have also been made in technology transfers and patent applications. Overall, we have signed a total of 80 technology transfer contracts and filed 50 patent applications. The total number of patents granted in the year 2014/15 is more than 100, making ASTRI one of the top R&D institutes with the highest number of patents in the Hong Kong SAR.

Looking ahead, ASTRI will spare no efforts in advancing technologies to address the needs of local, national and global industries in the area of information and communications technologies. Under the leadership of the newly-set up Innovation and Technology Bureau, we are confident that we will continue to grow and prosper.

Finally, I would like to express my heartfelt gratitude to our Chairman Mr. Mingyam Wong, members of the Board of Directors, the Innovation and Technology Commission, our senior management team and colleagues for their unfailing support in taking ASTRI to a new height.

驗室等。例如透過應科院－HP資訊科技研究中心，我們積極開發大資料技術。我們亦致力與業界合作，成立應科院－華虹設計無線物聯網技術及應用聯合研發中心、應科院網路保安研究所、深港微電子協同創新聯盟、應科院－信利聯合研發中心，專門研發生產技術；並與北京協同創新研究院合作組建金融科技協同創新中心，致力於開發金融科技。

除了建立聯合研發中心及實驗室外，我們亦與多個合作夥伴建立了緊密的合作關係，例如我們與英飛凌攜手解決適用于封裝的熱能管理、與豪威科技合作開發未來汽車的平視顯示裝置、與TCL共同開發的智慧家居應用的物聯網關軟體。這些項目不但可為我們的合作夥伴帶來龐大的商業價值，亦能幫助業界培育出大量緊缺的優秀人才。

在技術轉移及專利應用方面，我們亦取得卓越成績。整體來說，我們簽訂了八十張技術轉移合約，申請了五十項專利。本院在二零一四/一五年度獲批超過一百項專利，是香港特區政府最多的機構之一。

展望未來，應科院將會全力以赴，積極開拓各項技術，迎合本地、國家以及國際社會在資訊及通訊科技方面的需要。在新成立的創新及科技局的帶領下，我們將會繼續開拓和發展。

最後，衷心感謝王明鑫主席、董事會成員、創新科技署、管理團隊及本院同事一直給予的支援，本人將會秉承歷史使命，引領應科院再創高峰。

Frank Tong
湯復基
Chief Executive Officer
行政總裁

# Corporate Governance

# 企業管治

## Board of Directors

ASTRI is governed by a Board of Directors comprising representatives from the industrial and commercial sectors, the academia and the HKSAR Government. Directors are appointed by the Government and have collective responsibility for ASTRI's leadership, policy and strategic directions.

To achieve good governance, the Board with the support of Management, responds flexibly to, and reflects on, the changing terms and conditions of the business environment in which ASTRI operates, with key focus on the needs of the industrial sector.

The Board and Management adhere to the four key management objectives of ASTRI: Transparency, Speed, User-friendliness and Governance.

## 董事會

董事局是應科院的管治組織，成員包括來自工商界、學術界及香港特區政府的代表。董事是由特區政府委任，負責制訂應科院的發展政策和路向。

為實施良好的管治，應科院董事局指示管理層須因應應科院的營商環境和條件的改變作出靈活應變，並以配合工業界需要為主要工作目標。

董事局和管理層堅持四個主要管理原則：透明度、效率、切合需要和管治。

## Board Composition

As at 31 March 2015, the Board is comprised of the Chairman, two official members, and 16 members.

### Chairman

**Mr. Wong Ming-yam, BBS, JP**
Director, eSPOT Company Limited

### Official Members

**Miss Susie Ho Shuk-yee, JP**
Permanent Secretary for Commerce and Economic Development (Communications and Technology), Commerce and Economic Development Bureau

**Miss Janet Wong Wing-chen, JP**
Commissioner for Innovation and Technology, Innovation and Technology Commission

### Members (In alphabetical order according to surname)

**Prof. Andrew Chan Chi-fai, SBS, JP**
Director, Executive MBA Program, The Chinese University of Hong Kong

**Prof. Philip Chan Ching-ho, BBS**
Deputy President and Provost, The Hong Kong Polytechnic University

**Ms. Cally Chan Shan-shan**
Managing Director, Hewlett-Packard Hong Kong SAR Limited

**Mr. Chuck Cheng Cheuk-wing**
CEO & President, Appotech Limited

**Prof. Roland Chin Tai-hong, BBS, JP**
Provost and Deputy Vice-Chancellor, The University of Hong Kong

## 董事局的組成

截至二零一五年三月三十一日，董事局成員包括主席、兩位官守董事及十六位董事。

### 主席

**王明鑫先生，BBS，JP**
易捕有限公司董事

### 官守董事

**何淑兒女士，JP**
商務及經濟發展局常任秘書長
(通訊及科技)

**王榮珍女士，JP**
創新科技署署長

### 董事 (以英文姓氏順序排列)

**陳志輝教授，SBS，JP**
香港中文大學行政人員工商管理碩士課程主任

**陳正豪教授，BBS**
香港理工大學常務及學務副校長

**陳珊珊女士**
惠普香港公司董事總經理

**鄭灼榮先生**
卓榮集成電路科技有限公司總裁

**錢大康教授，BBS，JP**
香港大學首席副校長

**Prof. Ching Pak-chung, BBS**
Choh-ming Li Professor of Electronic Engineering, Director of Shun Hing Institute of Advanced Engineering, The Chinese University of Hong Kong

**Mr. Humphrey Choi Chor-ching, JP**
Partner, PricewaterhouseCoopers

**Mr. Tony Choi Siu-chow**
Executive Director, Hong Kong Garment Manufacturing Co. Ltd.

**Mr. Ha Yung-kuen, BBS**

**Mr. Kwong Chi-keung, JP**
Senior Partner, Sit, Fung, Kwong & Shum Solicitors & Notaries

**Dr. Alan Lam Hiu-fung**
Chief Executive Officer, Sengital Limited

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

**Dr. Tiger Lin Zhenhui**
Executive Director & Chief Executive Officer,
CITIC Telecom International Holdings Limited

**Dr. Davy Lo Kwok-wai**
Consultant

**Ms. Agnes Nardi Kar-wai**
Chief Executive Officer, Business Environment Council Limited

**Mr. Denis Tse Tik-yang**
Head of Asia - Private Investments,
Lockheed Martin Investment Management Company

**程伯中教授，BBS**
香港中文大學卓敏電子工程學系講座教授，
香港中文大學信興高等工程研究所所長

**蔡楚清先生，JP**
羅兵咸永道會計師事務所合夥人

**蔡少洲先生**
百達製衣有限公司執行董事

**夏勇權先生，BBS**

**鄺志強先生，JP**
薛馮鄺岑律師行高級合夥人

**林曉鋒博士**
港科研有限公司行政總裁

**李惠光先生，JP**
香港城市大學副校長(行政)

**林振輝博士**
中信國際電訊集團有限公司
執行董事及行政總裁

**羅國威博士**
顧問

**李家慧女士**
商界環保協會有限公司行政總裁

**謝迪洋先生**
洛克希德馬汀投資管理亞洲私募投資主管

# Corporate Governance

# 企業管治

## Functional Committees

Three functional committees, namely Finance and Administration Committee (FAC), Technology Committee (TC) and Audit Committee (AC), were formed to assist the Board in managing ASTRI. FAC oversees ASTRI's financial and administrative matters; TC oversees research initiatives; and AC ensures both internal and external audit processes are properly carried out.

Below are the committee membership as at 31 March 2015.

### Finance and Administration Committee

**Mr. Wong Ming-yam, BBS, JP (Chairman)**
**Ms. Cally Chan Shan-shan**
**Mr. Ha Yung-kuen, BBS**
**Dr. Davy Lo Kwok-wai**
**Ms. Agnes Nardi Kar-wai**
**Mr. Denis Tse Tik-yang**
**Miss Janet Wong Wing-chen, JP**

### Technology Committee

**Prof. Philip Chan Ching-ho, BBS (Chairman)**
**Ms. Cally Chan Shan-shan**
**Mr. Chuck Cheng Cheuk-wing**
**Prof. Roland Chin Tai-hong, BBS, JP**
**Prof. Ching Pak-chung, BBS**
**Mr. Tony Choi Siu-chow**
**Mr. Ha Yung-kuen, BBS**
**Dr. Alan Lam Hiu-fung**
**Mr. Sunny Lee Wai-kwong, JP**
**Dr. Tiger Lin Zhenhui**
**Dr. Davy Lo Kwok-wai**
**Ms. Agnes Nardi Kar-wai**
**Mr. Denise Tse Tik-yang**
**Mr. Wong Ming-yam, BBS, JP**
**Miss Janet Wong Wing-chen, JP**

### Audit Committee

**Mr. Humphrey Choi Chor-ching, JP (Chairman)**
**Prof. Ching Pak-chung, BBS**
**Mr. Kwong Chi-keung, JP**
**Dr. Alan Lam Hiu-fung**
**Miss Janet Wong Wing-chen, JP**

## 功能委員會

董事也出任三個功能委員會，即財務與行政委員會、科技委員會及審計委員會的成員，以協助董事局管治應科院。財務與行政委員會監察應科院財務及行政事宜；科技委員會監察應科院的研究項目；審計委員會則確保適當執行內部及外部審計程序。

以下是截至二零一五年三月三十一日的委員會成員名單。

### 財務與行政委員會

**王明鑫先生，BBS，JP (主席)**
**陳珊珊女士**
**夏勇權先生，BBS**
**羅國威博士**
**李家慧女士**
**謝迪洋先生**
**王榮珍女士，JP**

### 科技委員會

**陳正豪教授，BBS (主席)**
**陳珊珊女士**
**鄭灼榮先生**
**錢大康教授，BBS，JP**
**程伯中教授，BBS**
**蔡少洲先生**
**夏勇權先生，BBS**
**林曉鋒博士**
**李惠光先生，JP**
**林振輝博士**
**羅國威博士**
**李家慧女士**
**謝廸洋先生**
**王明鑫先生，BBS，JP**
**王榮珍女士，JP**

### 審計委員會

**蔡楚清先生，JP (主席)**
**程伯中教授，BBS**
**鄺志強先生，JP**
**林曉鋒博士**
**王榮珍女士，JP**

## Movements of Directors 董事局成員變動

| New Directors<br>新委任董事 | Appointed Date<br>委任日期 |
|---|---|
| Ms. Cally Chan Shan-shan<br>陳珊珊女士 | 21 October 2014<br>二零一四年十月二十一日 |
| Mr. Tony Choi Siu-chow<br>蔡少洲先生 | 21 October 2014<br>二零一四年十月二十一日 |
| Dr. Alan Lam Hiu-fung<br>林曉鋒博士 | 21 October 2014<br>二零一四年十月二十一日 |
| Dr. Davy Lo Kwok-wai<br>羅國威博士 | 21 October 2014<br>二零一四年十月二十一日 |
| Mr. Kwong Chi-keung, JP<br>鄺志強先生，JP | 13 November 2014<br>二零一四年十一月十三日 |

| Retired Directors<br>退任董事 | Date of Retirement<br>退任日期 |
|---|---|
| Dr. Frank Tong Fuk-kay<br>湯復基博士 | 19 May 2014<br>二零一四年五月十九日 |
| Mr. Anthony Au Wai-hung, BBS<br>區煒洪先生，BBS | 21 October 2014<br>二零一四年十月二十一日 |
| Mr. Christopher William Britton<br>貝敦先生 | 21 October 2014<br>二零一四年十月二十一日 |
| Mr. Victor Ng Kwok-ho<br>吳國豪先生 | 21 October 2014<br>二零一四年十月二十一日 |
| Mr. Luther Wong Lok-tak<br>王樂得先生 | 21 October 2014<br>二零一四年十月二十一日 |

## Meeting and Attendance

The Board and the Functional Committees convene meetings on a regular basis. Special meetings will be held as and when necessary.

The following are attendance records of ASTRI Board and Functional Committee meetings held during the year:

## 會議及出席率

董事局及功能委會員定期舉行會議，並於有需要時召開特別會議。

以下是董事局會議及各功能委員會會議的出席紀錄：

| Board Meetings 董事局會議 | 09/07/2014 | 08/10/2014 | 18/12/2014 |
|---|---|---|---|
| Total No. of Directors during the Period 期內董事局成員人數 | 18 | 18 | 19 |
| Total No. of Directors Present at Meeting 董事出席人數 | 17 | 15 | 17 |
| Total No. of Apologies 缺席人數 | 1 | 3 | 2 |
| Group Attendance in Percentage 出席率 | 94% | 83% | 89% |

| FAC Meetings 財務與行政委會員會議 | 06/06/2014 | 21/08/2014 | 13/11/2014 | 18/12/2014 | 06/03/2015 |
|---|---|---|---|---|---|
| Total No. of Directors during the Period 期內董事局成員人數 | 7 | 7 | 7 | 7 | 7 |
| Total No. of Directors Present at Meeting 董事出席人數 | 6 | 5 | 5 | 7 | 7 |
| Total No. of Apologies 缺席人數 | 1 | 2 | 2 | 0 | 0 |
| Group Attendance in Percentage 出席率 | 86% | 71% | 71% | 100% | 100% |

| TC Meetings<br>科技委會員會議 | 19/06/2014 | 22/09/2014 | 26/11/2014 | 24/03/2015 |
|---|---|---|---|---|
| Total No. of Directors during the Period<br>期內董事局成員人數 | 14 | 14 | 15 | 15 |
| Total No. of Directors Present at Meeting<br>董事出席人數 | 10 | 11 | 11 | 12 |
| Total No. of Apologies<br>缺席人數 | 4 | 3 | 4 | 3 |
| Group Attendance in Percentage<br>出席率 | 71% | 78% | 73% | 80% |

| AC Meetings<br>審計委會員會議 | 25/06/2014 | 08/09/2014 | 03/12/2014 | 17/03/2015 |
|---|---|---|---|---|
| Total No. of Directors during the Period<br>期內董事局成員人數 | 5 | 5 | 5 | 5 |
| Total No. of Directors Present at Meeting<br>董事出席人數 | 3 | 4 | 5 | 5 |
| Total No. of Apologies<br>缺席人數 | 2 | 1 | 0 | 0 |
| Group Attendance in Percentage<br>出席率 | 60% | 80% | 100% | 100% |

# Corporate Governance

# 企業管治

## Corporate Governance Manual

ASTRI has adopted a Corporate Governance Manual to clearly state its policies and principles in achieving good governance. The Manual has facilitated the Board and Management to operate and oversee ASTRI's business in a transparent and accountable manner.

In past years, sections of the Manual were updated and modified, taking into account changes and developments required for improving ASTRI's operation, as well as responding flexibly to, and reflecting on, the changing terms and conditions of the business environment in which ASTRI operates.

## 企業管治手冊

應科院已制定企業管治手冊，清楚列明達致優良管治的政策和原則，以協助董事局和管理層以高透明度和負責任地經營及監督應科院的業務。

過去數年間，企業管治手冊中多個段落已有所更新，把對改善應科院運作所必要的轉變和發展涵蓋在內，及對應科院所處的營運環境的轉變作靈活的應對和考量。

## Internal Audit

To efficiently exercise good corporate governance, an Internal Audit Department (IAD) under the Audit Committee was set up in 2003 to assist the Board by providing it with information and assurance on internal management controls.

In April 2007, the Board appointed the Head of Internal Audit as Compliance Officer to assist its governance by providing timely information to the Audit Committee on the compliance status of ASTRI regarding policy and procedures of project management, finance, human resources and administrative management.

To ensure continuous compliance with the Guide to Information and Technology Support Programme, ASTRI's corporate governance policy, operational procedures and other relevant guidelines, the Compliance Officer is required to submit quarterly reports to the Audit Committee.

Since July 2013, an Internal Audit Charter was introduced into the Corporate Governance Manual, enhancing and consolidating existing provisions. Among other things, the Charter sets out more clearly the responsibilities, independence, authority, planning and reporting processes of the IAD. For example, the department would report half-yearly to the Audit Committee on progress of its different assigned tasks.

## 內部審計

為有效進行良好的企業管治，應科院於二零零三年成立內部審計部門，隸屬於審計委員會，協助董事局，向其提供有關內部管理控制的資訊及保證。

二零零七年四月，董事局委任內部審計主管擔任合規主任，協助進行企業管治，適時向審計委員會提供有關應科院遵守項目管理、財務、人力資源及行政管理政策和程序的情況。

為確保應科院持續遵守《資訊及科技支援計劃指引》、企業管治手冊、運作程序及其他相關指引，合規主任必須每季度向審計委員會提交報告。

自二零一三年七月起，為加強現有規範，企業管治手冊加入內部審計章程，對內部審計部門的職責、獨立性、職權範圍、規劃及滙報等事項作出更明確的列明。例如，內部審計部門會每半年就其計劃的進度向審計委員會提交報告。

## Safeguard Against Conflicts of Interest

As a public organisation, it is important to have an effective mechanism to safeguard against conflicts of interest. In September 2014, ASTRI updated the Code of Conduct for Employees and the Declaration of Interest Process with an aim to provide necessary guidelines for establishing a system to detect potential conflicts, manage declared conflicts, including actions taken to mitigate conflicts.

In February 2015, ICAC was invited to deliver a seminar on People Leadership Accountability to our senior staff on corruption prevention and managing conflicts of interest concerning commercialisation of our technologies to industry.

## 防範利益衝突

作為一所公營機構，應科院須要一個有效的機制來防範利益衝突。在二零一四年九月，應科院更新了員工行為守則和利益申報程式，旨在為員工提供指引，並建立一個完善的制度來檢查潛在的利益衝突和處理已申報的衝突，包括減低衝突所須要採取的行動。

廉政公署於二零一五年二月應邀為應科院管理人員舉行有關領導者責任的講座，闡述如何在將技術市場化過程中，預防貪污和處理利益衝突。

## Workplace Policy

ASTRI is committed to providing a workplace free of discrimination and harassment. In September 2014, a workplace policy was established to guide employees at all levels to treat their colleagues, job applicants, and customers with respect and dignity. Equal Opportunities Commission was invited to deliver customised workshops to equip senior staff with the key concepts in anti-discrimination laws and the best practices in addressing equal opportunities issues.

## 工作環境守則

應科院致力提供一個沒有歧視和騷擾的良好工作環境。在二零一四年九月，我們訂立了工作環境守則，為全體員工提供指引，使員工對各同事、求職者及客戶互相尊重，彼此享有尊嚴。平等機會委員應邀為應科院舉行工作坊，為高層職員提供有關反歧視法例和平等機會課題最佳實踐守則的關鍵概念。

## Risk Management and Control

Under the direction and guidance of the Board via the Audit Committee, management and the Internal Audit Department conducted a company-wide Risk Profiling and Assessment exercise in 2010. As a result, several high risk areas were identified prompting management to take action ensuring preventive controls were in place to manage them. A Risk Register has been formulated and would be updated when necessary to further enhance effective governance of ASTRI.

## 風險管理和控制

管理層和內部審計部門在董事局通過審計委員會指導下，於二零一零年進行了一項全公司的風險描述與評估的工作，辨別出幾個高風險範疇，管理層也採取了行動確保防範性的控制措施已準備就緒，以應付該些風險。「風險登記冊」已經制定，並會按需要作出更新，以進一步加強應科院的有效管治。

## ISO-based Quality Management System

ASTRI passed the annual ISO 9001 surveillance audit held by the certification body on May 2014. There was no nonconformity found in the surveillance audit, indicating that that ASTRI's business operation fully complied with the international norm.

## 以ISO為基礎的品質管理系統

應科院於二零一四年五月通過ISO 9001年度監督審核，並沒有發現不符合規定的項目，這顯示應科院的商業運作完全符合國際準則。

## Senior Management

As at 31 March 2015, the composition of the senior management is as below:

### Chief Executive Officer (CEO)

**Dr. Frank Tong Fuk-kay**

### Headquarters Executives

**Dr. Jack Lau**, Chief Marketing Officer
**Ms. Ivy Leung**, Acting Chief Administrative Officer
**Ms. Betty Law**, Chief Financial Officer (resigned on 1 March 2015)
**Mr. David Poon**, Vice President, Corporate Communications and Company Secretary
**Mr. David Kwong**, Senior Advisor to CEO

### Technology Division Heads

**Dr. Justin Chuang,** Vice President and Group Director, Communications Technologies
**Dr. Daniel Shi,** Director, Electronics Components
**Mr. Yiu-kei Li,** Director, IC Design Digital
**Dr. Keh-chung Wang,** Vice President and Group Director, IC Design Analog
**Dr. Enboa Wu,** Vice President and Group Director, Opto-electronics
**Dr. Duncan Wong,** Director, Security and Data Sciences
**Dr. Jay Liou,** Director, Software and Systems

## 高級行政人員

截至二零一五年三月三十一日，高級行政人員包括：

### 行政總裁

**湯復基博士**

### 總部行政人員

**廖家俊博士**，首席市場總監
**梁穎莊女士**，署理首席行政總監
**羅翠萍女士**，首席財務總監
(於二零一五年三月一日退任)
**潘占達先生**，副總裁(傳訊)及公司秘書
**鄺國權先生**，行政總裁高級顧問

### 技術部門領導

**莊哲義博士**，通訊技術部 副總裁及技術部 總監
**史訓清博士**，電子元件技術部 總監
**李耀基先生**，集成電路設計 數碼技術部 總監
**王克中博士**，集成電路設計群組 副總裁及研發群組 總監
**吳恩柏博士**，光電子技術部副總裁及技術部 總監
**王石博士**，信息安全與數據科學技術部 總監
**劉遠昭博士**，軟件與系統技術部 總監

### Annual Remuneration of Senior Executives

Number of Senior Executives by Grade Level

**各級別高級行政人員數目**


### 高級行政人員薪酬

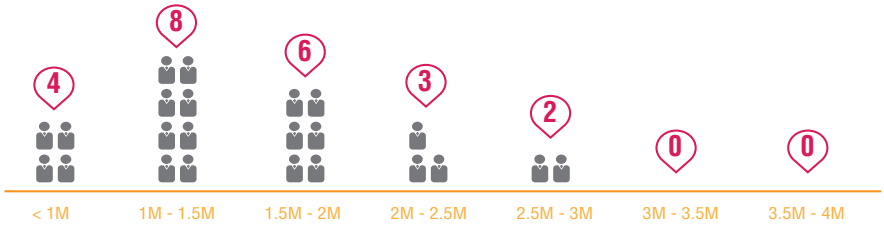
Annual Remuneration # 1 April 2014 – 31 March 2015 (HK$M)

**全年薪酬** # 由二零一四年四月一日至二零一五年三月三十一日(百萬港元)

# For senior executives who joined in the course of the financial year, their annual remunerations were calculated on a prorated basis.
在財政年度中加入應科院的高級行政人員，其全年薪酬按比例計算。

Annual Remuneration (HK$) 1 April 2014 – 31 March 2015

**全年薪酬(港元) 由二零一四年四月一日至二零一五年三月三十一日**



# Management Structure

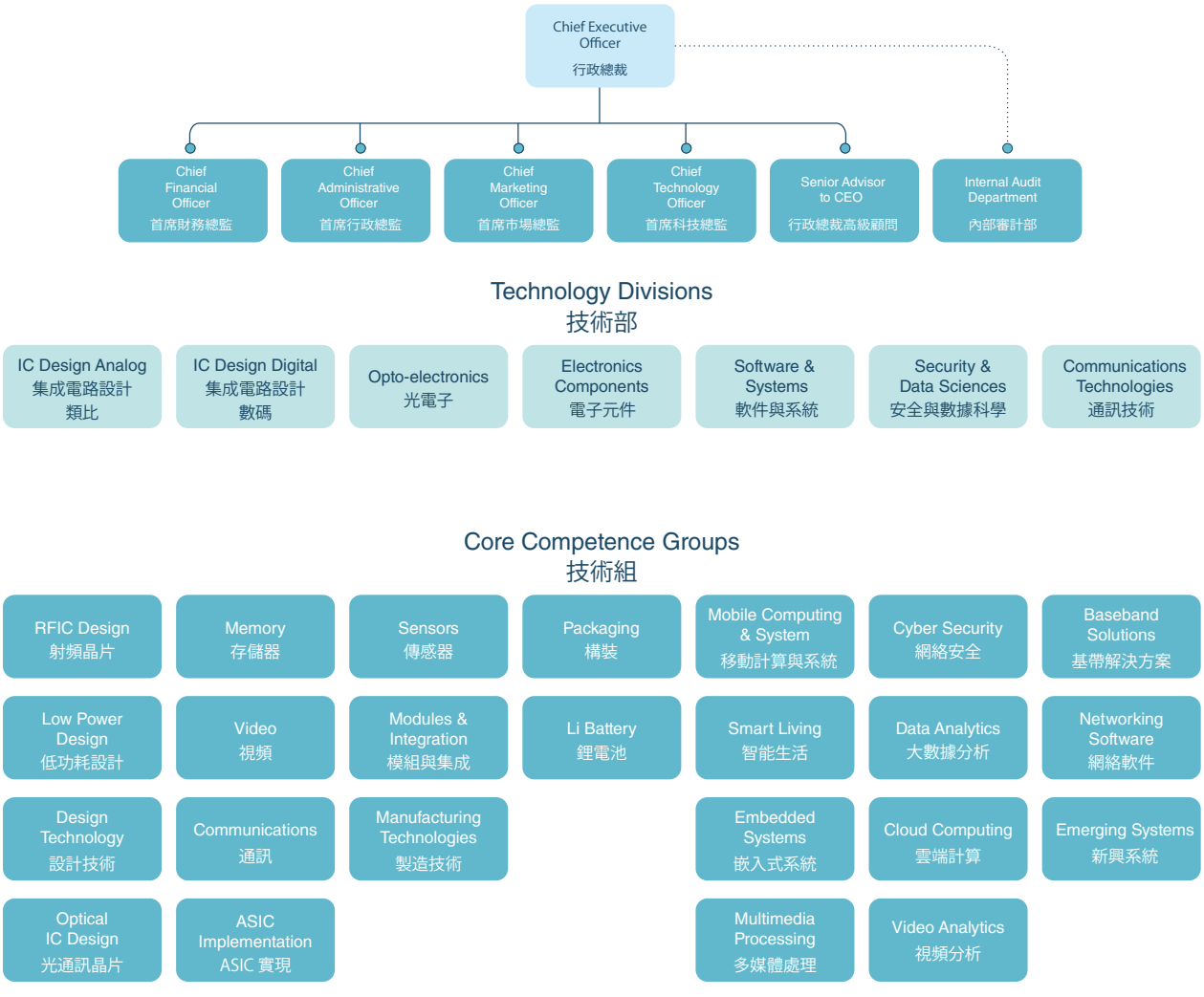
ASTRI is headed by a Chief Executive Officer who is responsible to the Board of Directors for the overall management of the company. He is assisted by the Technology Division Heads as well as senior executives responsible for administrative, financial, commercial and other supporting functions respectively.

To scale up our research capabilities and activities, ASTRI has strengthened its management structure to provide more room for growth and promote technology development. Below is the management structure as at 31 March 2015:

# 管理架構

應科院由行政總裁領導，並向董事局負責公司的整體管理。行政總裁旗下有技術部主管及高級管理人員，負責行政管理、財務、商務及其他支援性職責。

為了提升研發能力及擴闊研究的規模，應科院優化其管理架構以提供更多發展空間及開拓更新科技。下圖為截止二零一五年三月三十一日應科院的管理架構：



## A Professional Team

ASTRI builds its strengths on people and talent. Over 80% of ASTRI's staff are in R&D, with expertise and experience covering a broad range of technological areas.

### Headcount Status

The following is a breakdown of the staff members under respective groups and teams as at 31 March 2015:

## 專業團隊

人才是應科院的重要發展支柱。研發人員佔整體員工百份之八十以上，他們的科技知識領域十分廣泛，肩負研發創新科技的工作。

### 員工人數

以下是截至二零一五年三月三十一日有關員工所屬團隊的統計資料：

**Headquarters 總部**

HQ

83

**Technology Divisions 技術部**

| Communications Technologies 通訊技術 | Electronics Components 電子元件 | IC Design Analog 集成電路設計 類比 | IC Design Digital 集成電路設計 數碼 |
|---|---|---|---|
| 74 | 39 | 68 | 43 |

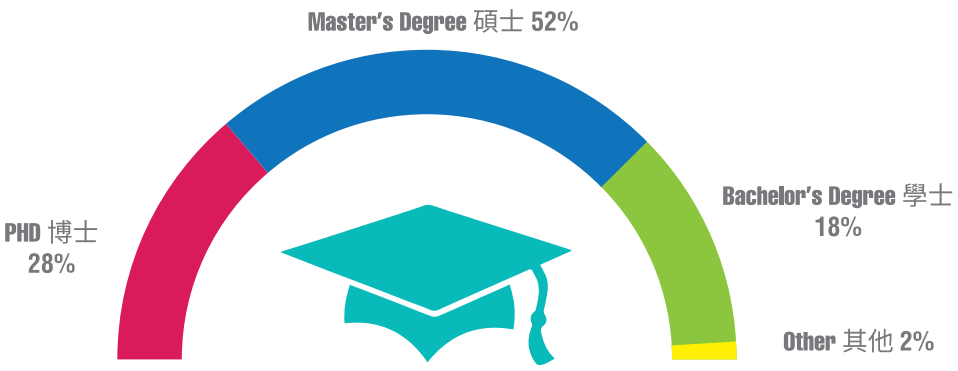
| Opto-electronics 光電子 | Security and Data Sciences 信息安全與數據科學 | Software and Systems 軟件與系統 | Others 其他 | Interns 實習研究員 |
|---|---|---|---|---|
| 49 | 58 | 55 | 16 | 27 |

Sub-total 小計: 429

Total 總數: 512

### R&D Personnel Academic Qualifications

### 研發人員學歷

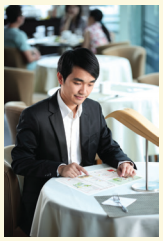



As at 31 March 2015
Including personnel under Technology Divisions, excluding headquarters staff and interns.

截至二零一五年三月三十一日
包括技術部轄下員工，不包括總部員工及實習研究員。

# Awards and Achievements 應科院屢奪殊榮

## 2014 China Electronic Information Expo (CITE) Innovation Award
## 二零一四年中國電子資訊博覽會創新獎



The Portable Interactive Surface developed by ASTRI won the Innovation Award at the 2014 China Electronic Information Expo (CITE). The project also won the Gold Award, Best Lifestyle (Learning & Living) in 2014 Hong Kong ICT Awards.

應科院研發的「便攜式互動桌面」於二零一四年度中國電子資訊博覽會中榮獲「創新獎」，同年於「二零一四年香港資訊及通訊科技獎」中榮獲「最佳生活時尚獎(學習・生活)金獎」。

## The World Summit Awards (Mobile) China-Hong Kong 2014 Championship in m-Learning 二零一四年世界信息峰會移動大獎中國香港 (移動學習及教育) 冠軍

The ALS Classroom Management System, an e-learning solution jointly developed by ASTRI and its partner Active Learning Solutions Ltd, won the Championship in m-Learning and Education in the World Summit Awards (Mobile) China-Hong Kong in 2014.

由應科院及其合作夥伴Active Learning Solutions公司共同研發的ALS課堂教學管理系統在二零一四年榮獲「世界信息峰會移動大獎中國香港(移動學習及教育)冠軍」。


## The Hong Kong Internet-of-Things (IoT) Awards Gold Award (Winning Internet-of-Things Technology Category) & Guangdong-Hong Kong IoT Awards Best IoT Product Award
## 香港物聯網大獎最佳物聯網技術金獎及粵港物聯網大獎最佳物聯網產品獎

ASTRI's self-developed Mobile Heart Health Monitoring System won the Gold Award (Winning Internet-of-Things Technology Category) in the Hong Kong Internet-of-Things (IoT) Awards and the Best IoT Product Award in the Guangdong-Hong Kong IoT Awards.

應科院自行研發的移動心臟健康監測系統於「香港物聯網大獎」中榮獲「最佳物聯網技術金獎」，以及在「粵港物聯網大獎」中獲頒發「最佳物聯網產品獎」。

## Performance

As a publicly-funded applied research institute, ASTRI is committed to doing its utmost to maximise "public good", which is measured by the economic impact and other benefits it brings to the industry and the community. To generate economic impact, ASTRI vigorously focuses on customer needs and commercialisation of its technologies.

A vitally-important part of ASTRI's customer-focused R&D practices is the rigorous setting and monitoring of quantitative performance targets.

## 業績

作為一家政府資助的應用研發機構，應科院堅守一個信念，就是以產生最大的「公眾利益」為目標，而此公眾利益是以應科院帶給業界和整體社會的經濟效益和其他得益來衡量。為了創造更大的經濟效益，應科院過去一直全力以赴，以迎合客戶需求和將技術市場化作為工作重點。

應科院為其業績設立嚴謹的可量化目標，成為其以客戶為導向的研發工作中重要的一環。

## Quantitative Performance Targets

ASTRI has set for itself three major quantitative performance targets:

## 可量化工作目標

應科院設立了三個可量化工作目標：

**Number of technologies transferred to industry per year**
**每年轉移至業界的技術數目**

This is the most crucial target as the transferals are the "paths" towards commercialising IPs developed by R&D projects.

由於這是研發項目所開發的知識產權轉至市場化發展的「門徑」，所以至為重要。

**Number of patent applications filed and granted**
**每年申請和取得的專利數目**

This is important because patent is an essential indicator of the worthiness of innovations and is being used to increase the value of technology transfers.

專利是評估所研發的技術是否有價值的主要指標，並可增加技術轉移活動的價值，因此十分重要。

**Annual income from industry**
**每年從業界所得的收入**

As ASTRI continues to engage customers and build a valuable brand name for its customer base, the eventual income from this base through services such as licensing and technology sales, design and product development will increase.

隨著應科院繼續爭取客戶並在客戶心目中建立有價值的品牌，透過各種服務、如授權協議、技術轉售、定制設計及產品開發等，自客戶取得的最終收入將會增加。

ASTRI has achieved the above targets with satisfactory results, thus making steady and good progress during the year.

年度內，應科院在各個工作目標都表現理想，維持顯著和平穩的發展。

## Planning and Monitoring

ASTRI strives to maximise the impact of its R&D work on customers by translating research into actual results. We systematically build customer focus into every aspect and every step of ASTRI's R&D programmes, from initiating ideas to transferring generated intellectual properties to our customers. We also put emphasis on assuring the quality of both our research and management processes.

Annual Planning Cycle, comprised of three steps, is in place to assure the quality of our R&D programmes. The three steps are:

1. Annual update of the technology roadmap in December for review by the Board's Technology Committee;
   每年十二月更新應科院的技術路線圖，並由應科院董事局的科技委員會審閱
2. Review of ASTRI's overall strategies and implementation by our Technology Advisory Committee, which is comprised of renowned international technology, experts every two years;
   應科院的科技顧問委員會由世界知名的國際科技專家組成，每兩年檢討應科院的整體策略及其執行情況
3. ASTRI Board's Review and Approval by ASTRI's Board of Directors
   由應科院董事局審閱及批核

In addition to the three-step process, our Technology Committee also selects and reviews ongoing R&D projects to evaluate the effectiveness of customer engagement within six and nine months after a project is commenced.

Meanwhile, ASTRI submits a report to the Innovation and Technology Commission for them to monitor progress against stated milestones every six months. Each ongoing project is monitored monthly for progress by our senior management.

To improve patent quality and increase financial returns, we adopt a balanced measure that includes the number of patent applications filed and granted, and income from patent licensing to gauge success of our R&D work.

## 策劃與監察

應科院努力確保研發活動產生最大客戶效益，將研究轉化為實際成果，並有系統地把客戶導向納入各研發項目的每一環節每一步驟，由研究計劃開始直至將所研發的知識產權轉移至客戶。應科院對確保研究和管理過程的質素也非常重視。

為了確保研發項目的質素，我們以年度週期作出規劃，當中包括下列三個步驟。

除了採取這些步驟外，應科院董事局科技委員會於這些項目開始後的六至九個月內進行抽核，以評估其獲取客戶支持的成效。

同時，每半年向創新科技署提交的進度報告也便於查考進展以及達標程度。而高級管理層會監察各項目每月的進度。

為了提升專利質素以增加收入，應科院採用多個合理指標以評估研發成果的成績，其中包括申請專利數目，成功獲批專利數目及專利授權收入等。

## Four Main Types of Research Projects

Our research projects fall under four categories:

1. ITF-funded Platform Projects
2. ITF-funded [1] Seed Projects
3. Industry Collaborative Projects in which both ASTRI and partners contribute fund and other resources
4. Contract Research Projects which are R&D projects customised according to industry partners' requests. Partner is responsible for 100 per cent of R&D project costs

## 研發項目主要分四大類

我們的研究項目分為四大類型：

1. 創新及科技基金資助平台項目
2. 創新及科技基金資助種子項目
3. 由業界夥伴及應科院共同投入資金及其他資源的業界合作項目
4. 按業界夥伴個別需要而定制的合約研究項目，業界夥伴須負責全部研發成本

1 Innovation and Technology Fund

## Technology Transfers

During the year, 80 transfers of technology to industry were recorded.

### Number of Technology Transfers by Technology Divisions/R&D Groups

## 技術轉移

應科院年度內向業界作出共八十項技術轉移。

### 各技術部/研發群組向業界轉移技術的數量

| Technology Divisions/R&D Groups 技術部/研發群組 | 2014/15 | 2013/14 | 2012/13 |
|---|---|---|---|
| Communications Technologies 通訊技術 | 7 | 16 | 19 |
| Software & Systems (formerly Enterprise & Consumer Electronics) 軟件與系統 (前為企業與消費電子) | 14 | 13 | 23 |
| IC Design 集成電路設計 | 21 | 28 | 24 |
| Sensing & Integration (formerly Material & Packaging Technologies) 感測與集成 (前為材料與構裝技術) | 31 | 28 | 45 |
| Bio-Medical Electronics (Team) 生物醫學電子 (組) | N/A 不適用 | 2 | 1 |
| Exploratory Research Laboratory (Team) 信息研究室 (組) | N/A 不適用 | 1 | 1 |
| Thrust Projects + 主推項目+ | 7 | N/A 不適用 | N/A 不適用 |
| Total 總數 | 80 | 88 | 113 |

+ Thrust projects are corporate level initiatives leveraging ASTRI's broad technical competencies and resources across various R&D groups to target new technology areas in emerging markets.
主推項目主要是結合各研發群組的資源和技術專長，以跨領域合作形式，開發針對新興市場需要的新科技。

The following table illustrates the number of technology transfers to industry by various channels during the past three years:

下表列出過去三年應科院通過各種途徑向業界轉移技術的數量:

## Number of Technology Transfers to Industry by Various Channels 向業界轉移技術的途徑及數量

| Contracts Signed 簽訂項目 | 2014/15 | 2013/14 | 2012/13 |
|---|---|---|---|
| Industry Collaborative Projects 業界合作項目 | 2 | 3 | 1 |
| Contract Research Projects 合約研究項目 | 46 | 60 | 75 |
| Licensing Agreements 授權合約 | 32 ^ | 24 ^ | 37 ^ |
| Patent Assignments 專利轉讓 | N/A 不適用 | 1 | N/A 不適用 |
| Total 總數 | 80 | 88 | 113 |

^ Note: Certain licensing agreement consists of contract service provided by ASTRI
^ 備註: 部分授權合約包含應科院提供的合約服務

The following table shows the three major types of projects undertaken by ASTRI in the past three years. The number of new projects was 39 in 2014/15:

下表展示過去三年應科院進行的三類主要研發項目的數量,二零一四 / 一五年展開的新項目共三十九項:

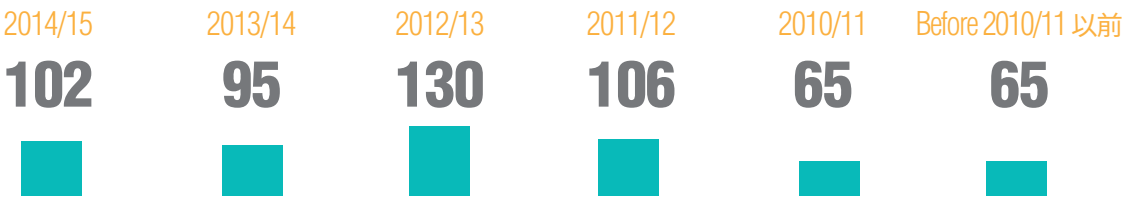
## Number of Projects Undertaken 應科院開展的研發項目數量

| Project Types 項目種類 | 2014/15 | 2013/14 | 2012/13 |
|---|---|---|---|
| ITF-funded Platform Projects 創新及科技基金資助平台項目 | 53 | 53 | 49 |
| ITF-funded Seed Projects 創新及科技基金資助種子項目 | 21 | 22 | 25 |
| Industry Collaborative Projects 業界合作項目 | 7 | 7 | 6 |
| Total 總數 | 81 | 82 | 80 |

## Patents

A total of 102 new patents were granted to ASTRI during the year, taking the total number of ASTRI-owned patents to 563 as at 31 March 2015. The following graph shows the pattern of growth in previous years, including patents granted in the U.S., the Mainland and other countries:

### Number of Patents Granted




A total of 50 patent applications were filed on the Mainland, the U.S. and other countries during the year. The number of applications filed by R&D groups in the past three years is tabulated below:

### Number of Patent Applications Filed by Technology Divisions/R&D Group

| Technology Divisions/R&D Groups 技術部/研發群組 | 2014/15 | 2013/14 | 2012/13 |
|---|---|---|---|
| Communications Technologies 通訊技術 | 11 | 5 | 17 |
| Software & Systems (formerly Enterprise & Consumer Electronics) 軟件與系統 (前為企業與消費電子) | 4 | 6 | 17 |
| IC Design 集成電路設計 | 12 | 7 | 22 |
| Sensing & Integration (formerly Material & Packaging Technologies) 感測與集成 (前為材料與構裝技術) | 21 | 44 | 37 |
| Bio-Medical Electronics (Team) 生物醫學電子 (組) | 0 | 10 | 0 |
| Exploratory Research Laboratory (Team) 信息研究室 (組) | 2 | 0 | 0 |
| Non-R&D Department 非研發部門 | 0 | 0 | 0 |
| Total 總數 | 50 | 72 | 93 |

## 專利

應科院本年度共獲發一百零二項專利，截至二零一五年三月三十一日止，應科院累積專利共五百六十三項。下圖展示應科院過去數年從美國、中國內地及其他國家取得專利的數目：

### 獲得專利數目

本年度應科院在中國內地、美國及其他國家共提交五十項專利申請。下表列出過去三年各研發群組申請的專利數目：

### 各技術部/研發群組申請的專利數目

## Income from Industry

Income received ^ from industry for all projects amounted to HK$76.97 million, with the contribution level * at 33.8 per cent. The table below shows income from industry received in the past three years:

### Income Received ^ from Industry (HK$M)


^ Including cash and in-kind contribution
* Percentage of industry income received over total R&D project spending

Income received ^ from industry by various R&D groups in the past three years is tabulated below:

### Income Received ^ from Industry

| Technology Divisions/R&D Groups 技術部/研發群組 | 2014/15 (HK$M) (百萬港元) | 2013/14 (HK$M) (百萬港元) | 2012/13 (HK$M) (百萬港元) |
|---|---|---|---|
| Communications Technologies 通訊技術 | 12.52 | 32.75 | 21.56 |
| Software & Systems (formerly Enterprise & Consumer Electronics) 軟件與系統 (前為企業與消費電子) | 11.34 | 10.04 | 11.68 |
| IC Design 集成電路設計 | 16.79 | 20.06 | 14.6 |
| Sensing & Integration (formerly Material & Packaging Technologies) 感測與集成 (前為材料與構裝技術) | 25.04 | 20.05 | 18.92 |
| Bio-Medical Electronics (Team) 生物醫學電子(組) | 0 | 0.41 | 1.21 |
| Exploratory Research Laboratory (Team) 信息研究室(組) | 2.56 | 3.5 | 0.06 |
| Thrust Projects 主推項目 | 8.67 | 0.7 | N/A 不適用 |
| General Support Programme 一般支援計劃 | 0.05 | 0.29 | 0.04 |
| Total 總數 | 76.97 | 87.8 | 68.07 |

^ Including cash and in-kind contribution
包括現金及物資資助

## 業界收入

本年度應科院從所有項目取得的業界收入^總額為七千六百九十七萬港元，業界投入資金水平*亦達至百分之三十三點八。下表顯示過去三年從業界所得收入總額：

### 已收取的業界收入 ^ (百萬港元)

^ 包括現金及物資資助
* 從業界所得收入佔總研發項目支出的百份比

下表列出過去三個財政年度各研發群組所獲得的業界收入 ^：

### 已收取的業界收入^

# Impactful Collaborations and Commercialisation

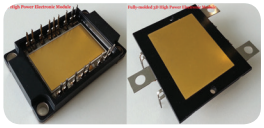
ASTRI signed 80 agreements for technology transfers to industry through licensing, contract research and other means, resulting in many fruitful collaborations and commercialisation.

## Communications Technologies

During the year, ASTRI's Baseband Solutions Group further developed and commercialised the LTE-Release-9 small cell baseband reference design with network monitoring mode for multiple 3G/4G standards.

## Electronics Components

### 3D Power Modules



The technologies and products of 3D High Power Electronics Module and Integrated Power Module, including package and module design, process recipes, simulation and testing, were developed and provided to five companies in Hong Kong and the Mainland. The technologies and products were also introduced to many other companies for business collaboration.

### Materials and Process for 3D-Interconnect

The technologies and products for 3D-Interconnect, including additive materials and process recipes, were developed and provided to four companies in Hong Kong and the Mainland.

## IC Design Analog (ICDA)

ASTRI has successfully transferred a number of low power analog-to-digital converter, integrated analog front-end (AFE) technologies for sensor interface and consumer grade low noise Readout IC (ROIC) for IR thermal imaging technologies to the regions' manufacturers. These high performance analog integrated circuit IP made it possible for them to achieve realistic returns in a relative short period of time.

Analog front-end IPs were licensed to a startup company for Sensor SoC in Hong Kong. The project went into production last year. More than three million units of the product were shipped to customers in the first 12 months of production.

# 具影響力的合作和技術市場化

應科院簽訂了八十項協議，通過授權、合約研究等方式，將技術轉移至企業，造就許多具超卓成果的合作和市場化進程。

## 通訊技術

過去一年，應科院的基帶解決方案小組進一步開發並商品化了LTE Release-9小基站參考設計，包括在3G/4G頻譜下具備網絡偵測模式。

## 電子元件

### 三維功率模塊

我們經已開發三維高功率電子模塊和集成電源模塊的技術和產品，包括封裝和模塊的設計、工藝配方、模擬和測試等，並供給香港和內地五家公司。此外，我們向其他公司推介此技術與產品，爭取業務合作。

### 三維互連的材料和工藝

我們開發了三維互連的技術和產品，包括添加劑材料和工藝配方，並供給香港和內地四家公司。

## 集成電路設計 類比

應科院成功轉移若干低功率類比-數字轉換器、傳感器接口的集成類比前端技術和消費級低噪音讀出紅外熱成像，為區內廠商提供紅外線熱成像技術。這些高性能類比集成電路的知識產權，能夠在短時間內產生實際回報。

我們將類比前端的知識產權授權予香港一家傳感器SoC初創企業。該項目在過去一年開始投產。在生產的首十二個月內，已經有超過三百萬件產品運送予客戶。

Uncooled infrared micro-bolometer arrays have become the technology of choice for lower-cost infrared imaging systems (vs cool IR thermal imaging). This technology is widely used in applications such as thermograph, firefighting, driver night vision, security and surveillance. ICDA developed a Readout IC (ROIC) platform and delivered the technology to industrial partner to manufacture micro-bolometer for high resolution uncooled infrared camera and imaging equipment.

非製冷紅外微測輻射熱計陣列已經替代冷卻式紅外熱成像成為低成本紅外成像系統的首選技術，這項技術被廣泛用於如熱成像、消防、駕駛員夜視、安防和監控等領域。團隊開發了讀出集成電路平台，並授權該技術予合作夥伴生產微測輻射熱計，用於高分辨率非製冷紅外攝像機和成像設備。

## IC Design Digital (ICDD)

### 3D Conversion and Resolution & Image Enhancement Technologies

ASTRI has been developing the 3D conversion and resolution and image enhance technologies for several years, with several platform projects related to these areas being underway. These projects mainly strive to design a hardware or hardware-software hybrid platform with the implementation of ASTRI's self-developed image processing algorithms for 3D conversion and resolution and image enhancing technologies.

In 2014/15, these technologies have been successfully licensed and commercialised in Hong Kong and the Mainland.

## Opto-electronics

### Compact Camera Module – Compact optical zoom and DSC-like technologies

The Compact Optical Zoom and DSC-like Technologies were licensed to Wintronic Technology Limited.

### Concentrating Photovoltaic Module

The High Concentrating Photovoltaic (CPV) Technologies were licensed to Hong Kong CPV Green Energy Limited in September 2014.

## 集成電路設計 數碼

### 三維轉換和解像度及圖像增強技術

近年，應科院一直致力開發三維轉換和解像度及圖像增強技術，現時有若干平台項目涉及這些領域。這些項目主要集中於設計硬件或軟硬件混合平台，配合採用應科院研發的三維轉換和解像度及圖像增強技術的圖像處理系統。

在二零一四/一五年度，這些技術已成功授權，並在香港及中國大陸進入商品化進程。

## 光電子

### 微型相機模組 - 微型光學變焦和DSC類像技術

我們將小型光學變焦和DSC類像技術授權震威電子有限公司。

### 聚光光伏模組

我們將高聚光光伏技術授權予香港聚光新能源能源有限公司。

# Performance

# 業績

## Compact Camera Module – Batch-processed Chip Scale Autofocus Camera Technologies

The Batch-processed Chip Scale Autofocus Camera Technologies were licensed to Sunming Technologies (HK) Limited.

## Manufacturing Technologies

A contract service agreement with a tier-one manufacturing company was signed in August 2014 for the development of LCD panel dead pixel inspection system and mechanical part appearance defects inspection system.

The see-through automotive heads-up display (HUD) and see-through near eye head mount display (HUD) were licensed to the industry in Hong Kong.

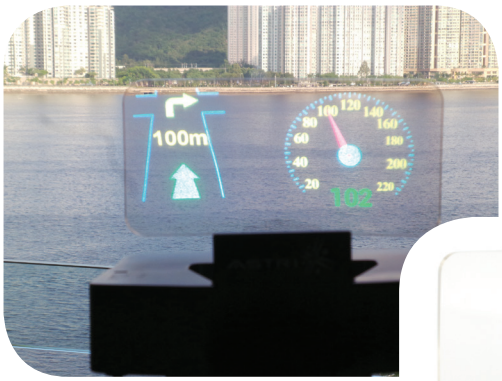
## 小型相機模組 - 批次處理晶片尺寸的自動對焦相機技術

三鳴科技(香港)有限公司獲授權處理自動對焦攝影機技術。

## 製造技術

我們於二零一四年八月,與一家一線生產商簽訂合約服務協議,開發液晶面板壞點檢測系統和機械部件外觀缺陷檢測系統。

我們將可透視型車載平視顯示器技術授權一家香港公司。





See-through Automotive Heads-Up Display (HUD)
透視型車載平視顯示器

## Modules and Integration

The cardiovascular monitoring technology was licensed to several tier-one healthcare manufacturers in Hong Kong and the Mainland for products commercialisation. Also, the non-invasive blood glucose measurement technology was licensed to a number of healthcare manufacturers in Hong Kong and the Mainland.

## 模組和集成

我們將心血管監測技術授權予數家在香港和內地的一線醫療生產商,將產品市場化。此外,我們將無創血糖測量技術授權予若干香港和內地醫療生產商。

## Security and Data Sciences

ASTRI has forged close collaborations with Hong Kong Monetary Authority (HKMA), financial institutes, and Financial Technology (FinTech) companies including many startups on developing advanced FinTech technologies. The newly established ASTRI Security Lab (ASL) has been working with HKMA, Hong Kong Police Force (HKPF) and major banks such as HSBC and Bank of China (Hong Kong) on various cyber security research, training, and intelligence sharing systems. ASL has also been working with different financial services institutes on research-based cyber security vulnerability studies, and cloud security system development. Furthermore, ASTRI engineering teams have been working with FinTech startups on developing various cyber security and big data analytics products and systems.

ASTRI has been working with industry and universities to nurture more talents for the financial services technology industry. These initiatives include establishing research and teaching collaboration platforms with local universities such as the University of Hong Kong to facilitate professors and students to work with ASTRI researchers on financial services technology projects, devising an incubation programme to train young entrepreneurs and, conducting Financial Technology talk series.

## 信息安全與數據科學

應科院一直與香港金融管理局、多間金融機構和金融科技公司包括多間初創企業緊密合作，開發先進金融科技。新成立的應科院網絡保安研究所與香港金融管理局、香港警務處及主要銀行如香港匯豐銀行和中銀香港共同進行不同網絡保安的研究、培訓和智能分享系統。應科院網絡保安研究所亦與不同金融服務機構進行網絡保安漏洞的研究和研發雲端保安系統。此外，應科院的工程團隊與金融科技初創企業共同研發多項網絡保安和大數據分析產品及系統。

應科院一直與業界和大學共同努力，培育金融科技的優秀人才。我們與本地大學如香港大學建立科研與教學合作平台，讓教授、學生及應科院的研究人員，在金融科技項目上共同合作。此外，我們亦制定培育年輕企業家的方案及舉辦一系列的金融科技講座。


## Software and Systems

ASTRI has provided its video/image post processing technology component to a surveillance system company for it to develop customers' surveillance video analysis system. The system is targeted at the China market.

Work on a Smart Classroom project that faciliates in-class interactive and collaborative learning is underway.

ASTRI has provided its mobile client-based health data collection software to a prominent partner in Hong Kong for enterprise applications.

## 軟件和系統

應科院為一家監控系統公司提供其視頻/圖像後處理技術組件，以開發中國市場的監控錄像分析系統。

應科院亦正開發智能教室項目，使學習有更多互動和合作。

以移動客戶端為基礎，應科院提供健康數據採集軟件予香港一家著名的合作夥伴，以支援持其企業應用程式。

## Technology Application in Public Sector

ASTRI is an active participant in the "Promotion of Innovation and Technology in Public Sector" programme initiated by the Innovation and Technology Commission.

Working in conjunction with various government agencies, academia and NGOs, we strive to introduce our technologies to the public at large.

### Communications Technologies

#### X86 based LTE Core Network with LTE Small Cell

During the LTE private network trial conducted in the relevant field, we deployed the x86 based LTE core network along with the LTE small cell developed by Sunnada Communication. The result showed that the private LTE network achieved better throughput, latency, and packet drop performance than public LTE network connections for surveillance video streaming applications.

### Electronics Components

#### Anti-counterfeit Identification Microsystem (AIM) by SiP Technology

In conjunction with the Hong Kong R&D Centre for Logistics and Supply Chain Management Enabling Technologies (LSCM R&D Centre), ASTRI developed an Anti-counterfeit Identification Microsystem in SIM card format by using the System-in-Package (SiP) technologies. The microsystem can be implemented into the phones to successfully access the database stored in the server for real-time and in situ anti-counterfeit identification and logistics tracing of the wine products.

### Opto-electronics

#### Interactive Technologies for the Elderly

With the help of two technologies developed by ASTRI, the Hong Kong Housing Society has succeeded in joining the Age-Friendly City network of the World Health Organization.

The "Interactive Projector" and "Interactive Touch Frame" allow elderly people to play games together on a touch screen by using a finger or a stylus, enhancing their mental alertness through interacting with the display. It is easy for the elderly people with limited moving capability to manage the touch. Incorporating the hardware with suitable games, this technology enables the elderly to enjoy social life and achieve better mental agility.

## 公共部門的技術應用

應科院積極參與由創新科技署推出的「在公共部門推廣創新科技應用」計劃。

透過與各政府機構、學術界和非政府機構合作，我們致力向社會大眾引進技術。

### 通訊技術

#### 基於X86架構的LTE核心網與LTE小基站

在室外現場進行的LTE專網測試中，我們採用了基於x86架構的LTE核心網及由三元達通訊開發的LTE小基站。結果顯示，LTE專網在監控視頻串流應用方面，較公共LTE網絡能提供更佳的吞吐量、延遲和數據包丟棄等性能指標。

### 電子元件

#### 系統級封裝技術的防偽識別微系統

應科院與香港物流及供應鏈管理應用技術研發中心合作，通過使用系統級封裝（SiP）技術開發SIM卡格式的防偽識別微系統。微系統安裝於電話，以查閱存儲在伺服器中的數據，實時和原位防偽識別和物流追踪葡萄酒產品。

### 光電子

#### 長者互動技術

由應科院開發的兩項技術，成功支持香港房屋協會加入世界衛生組織的全球長者友善城市網絡。

「互動投影機」和「互動式觸控框架」讓長者能用手指或手寫筆，在觸控屏上一起玩遊戲，透過與顯示屏的互動，加強他們的心理警覺性。即使老人活動能力有限，也可容易掌握這種觸控技術。這類技術結合硬件與適合的遊戲，讓長者可以享受社交生活，使思維更敏捷。

Interactive Technologies for the Elderly in action
長者正在學習使用互動技術

## Security and Data Sciences

### Augmented Reality (AR) and Video Analytics Technologies at Hong Kong Science Museum

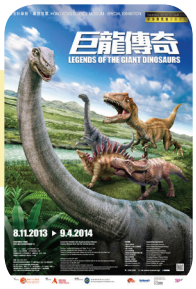
ASTRI's AR tracking technology was used by Sengital Ltd to develop an AR mobile app and exhibits for the "Legends of the Giant Dinosaurs" at the Hong Kong Science Museum. Our zone intrusion detection technology was used to protect dinosaur bones. The AR elements of this exhibition received very positive reviews by the Hong Kong Science Museum. The AR mobile app developed for this exhibition also won the Hong Kong ICT Awards 2014 Gold Award, Best Mobile Apps (Mobile Information).

## 信息安全與數據科學

### 香港科學館的擴增實境和視頻分析技術

港科研有限公司使用應科院的擴增實境跟踪技術，為香港科學館「巨龍傳奇」科學電影開發擴增實境移動應用程式及展示品。我們的區域入侵檢測技術應用於保護恐龍化石。是次展覽會的擴增實境元素獲得香港科學館非常正面的評價，其開發的擴增實境移動應用程式，還獲得二零一四年香港資訊及通訊科技獎最佳流動應用程式獎（流動資訊）金獎。

"Legends of the Giant Dinosaurs" at the Hong Kong Science Museum
香港科學館「巨龍傳奇」




## Software and Systems

### e-Learning Trial for Police College

ASTRI's e-Learning solutions have been customised for training purposes at the Hong Kong Police Force, meeting the rigorous requirements on confidentiality of the training materials and the security of the training devices. The solutions are being put on trial in three Police units including the Foundation Training Centre, Management Learning Division, and the Disaster Victim Identification Unit.

## 軟件與系統

### 警察學院的電子學習試驗

應科院為香港警務處定制電子學習方案，作為培訓用途所設計的方案需要符合教材保密性，以及訓練設備安全性的嚴謹要求。學習方案在三個警務單位，包括基礎訓練中心、管理學習科及災難遇害者辦認組進行試驗。

e-Learning Trial for Police College
警察學院的電子學習試驗

# Performance

# 業績

## e-Education for Age-friendly City

Under a pilot scheme, e-Learning technologies have been customised for e-Education for the elderly people, as part of Hong Kong's endeavour to gain admission into the World Health Organization's Age-Friendly City (AFC) Network. Contributing to the area of Communication and Information, one of the eight areas of AFC, the trial scheme is conducted in a senior citizen community, using tablets, wireless network and a document management system.

As part of the AFC certification process, the AFC features were demonstrated to World Health Organization delegates during their visit to an elderly community in Tsuen Wan in October 2014. In February 2015, Tsuen Wan was accepted into the AFC Network, becoming the first district in Hong Kong (and the eighth in Asia) to receive this honour.

## 長者友善城市的電子教育

香港努力爭取加入世界衛生組織的長者友善城市網絡。我們為長者而設的電子學習技術，正是此試驗計劃的一項舉措。這項計劃為通訊與信息科技作出貢獻，亦為長者友善城市八大領域之一。試驗計劃於長者社區推行，使用平板電腦、無線網絡和文件管理系統。

二零一四年十月世界衛生組織的代表到訪荃灣長者社區，我們向代表展示長者友善城市的特質，這是作為長者友善城市的認證程序之一。二零一五年二月，荃灣獲接納加入長者友善城市網絡，成為香港第一個地區（亞洲第八個地方）獲得這項殊榮。

e-Education for Age-friendly City
長者友善城市的電子教育

## Community Elderly Healthcare System

Contributing to the area of Community Support and Health Services, one of the eight areas of AFC, ASTRI has customised its telehealth technology platform for trial in a senior citizen community. The key health-related features supported by the system include health data collection, instant feedback on the collected vital sign measurement data, and health data report generation.

This system was showcased to the World Health Organization delegates in October 2014 to support Tsuen Wan's certification as an Age-Friendly City.


## 社區長者醫療保健系統

社區支援和醫療服務是長者友善城市八大領域之一，應科院定制其遠程醫療技術平台，於長者社區進行試驗。系統的主要醫療功能包括：健康數據收集、即時回應收集的生物信號量度數據，以及健康數據報告。

我們於二零一四年十月向世界衛生組織的代表展示此系統，以支持荃灣獲認證為長者友善城市。

## Outreaching to Industry and Society

Committed to taking up corporate social responsibility, ASTRI organises visits, seminars and various outreaching events to promote its latest technologies, contributions and achievements to the community.

During the year in review, ASTRI organised a number of visits and received visitors from the government officials, industry and community such as students from local universities and secondary schools; delegation from Beijing Science and Technology Cooperation Center, to name but a few. We also organised technology seminars and supported other events.

## 聯繫業界和社會

應科院致力履行企業公民責任，並組織探訪、研討會和不同類型的外展活動以宣傳其最新的技術、貢獻和成就。

回顧過去一年，應科院組織了多個參觀探訪，接待政府、業界和社區的訪客。當中包括本地大學和中學生及來自北京科技協作中心的代表團等。我們亦定期舉辦科技研討會或支持各項活動。

## Social Media

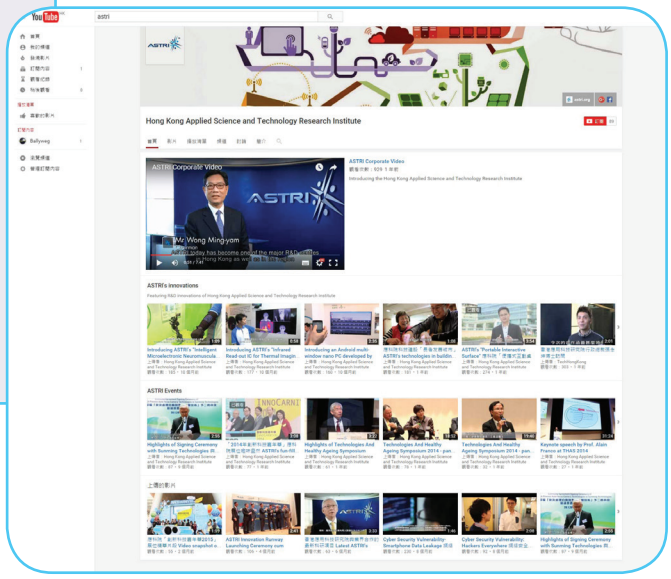
ASTRI has maintained its momentum in communicating with the online community through its YouTube channel set up in 2011 and its Facebook fan page in 2012.

During the year, we launched 30 videos on YouTube to showcase our major events and achievements. On the other hand, an additional 2,000 fans have subscribed to ASTRI's Facebook fan page to keep track of ASTRI's posts and to take part in discussions.

## 社交媒體

應科院與網上保持社區溝通，主要透過其二零一一年成立的YouTube頻道，以及二零一二年推出的Facebook專頁，維持應科院的曝光率。

過去一年，我們在YouTube推出了三十條影片，展示主要活動和取得的成就。另一方面，再有二千多名用戶對應科院的Facebook專頁讚好，以緊隨應科院的最新消息及參與討論。

# Communications Technologies (CT)

## Overview

The Communications Technologies (CT) Division was established in 2005 to conduct research, develop and commercialise leading-edge communications technologies and solutions for industry and the community, through building value-added information and communications technologies (ICT) applications and services.

CT researchers and engineers come from a diversity of countries with different academic and career backgrounds. Most of them have worked in overseas multinational corporations and research institutes.

Consolidating CT's core technical competences in the following areas, we provide end-to-end system solutions:

- Networking Software (NSOFT): large-scale and real-time software in telecom networks, network management, and network virtualisation;
- Baseband Solutions (BSOL): communications systems, baseband algorithms and L1-L3 embedded software/digital signal processor reference design on system-on-chip (SoC) platforms;
- Emerging Systems (ESYS): 5G technologies, software-defined radio, high-efficiency RF, dynamic spectrum utilisation, and Broadband Wireless Innovation Platform.

CT works closely with government, industry, universities, and research institutes worldwide to deliver market-driven, commercial-quality solutions.

# 通訊技術

## 概要

通訊技術部成立於二零零五年，致力於研究、開發和商用化先進的通訊技術和解決方案，為業界和社區提供增值資訊及通訊科技應用和服務。

通訊技術研發究人員來自不同的地區，大多具有在跨國公司、研究機構的工作經驗，為團隊和合作夥伴帶來廣泛而寶貴的專業知識和經驗。

目前，通訊技術的核心技術能力涵蓋以下方面，可提供端到端系統解決方案:

- 網絡軟件(NSOFT)：電訊網絡中的大規模實時軟件、網絡管理和網絡功能虛擬化;
- 基帶解決方案(BSOL)：通訊系統、基帶算法、L1-L3嵌入式軟件/DSP和參考設計;
- 新興系統(ESYS)：5G技術、軟件定義無線電、高效率的射頻、動態頻譜技術、以及寬帶無線創新平台。

通訊技術部密切與政府、產業界、大學和研究機構合作，開發市場導向，具有商業品質的解決方案。

## Technology Focuses and Services

### Networking Software

The Networking Software Group has developed a series of standard-based LTE networking software for mobile network infrastructures. These include:

- LTE Evolved Packet Core (EPC)
- LTE Small Cell Gateway
- IPSec Security Gateway
- WiFi + 4G Small Cell Convergence Gateway

Currently the research and development focus of the group is network virtualisation. The Group leverages their expertise in network protocols to develop virtual network functions (VNFs), including integration with cloud platforms for the next generation networks. The Group has demonstrated IPSec Security Gateway and small cell gateway VNFs with high availability. We collaborate with operators and cloud platform providers and leverage industry forums (e.g. OPNFV) to develop and integrate the technologies being developed with industry platforms.

The Group has also built a standard based cross-technology IoT management platform, extending their platform to address different applications and services, including smart city, smart home and smart energy.

## 技術重點與服務

### 網絡軟件

網絡軟件小組已經開發了一系列基於標準的LTE移動網絡軟件產品，包括：

- LTE的核心網（EPC）
- LTE小基站網關
- IPSec安全網關
- WiFi+4G融合小基站網關

目前，我們的研發重點是網絡虛擬化。通過利用我們在網絡協議方面的專長，開發新一代網絡的虛擬網絡功能（VNFs）以及與雲平台的整合。我們已經實現了虛擬化安全網關和小基站網關的虛擬網絡功能，具有高可用性。我們將與運營商和雲計算平台提供商合作，並利用行業論壇（如OPNFV）在開發技術的同時，與業界平台完成集成。

同時，我們已經開發了基於標準的物聯網管理平台，我們將在此基礎上繼續開發，支持不同的應用和服務，包括智能城市、智能家居和智能能源管理。

# Reports of Technology Divisions and R&D Directions

# 技術部報告及研發方向

## Baseband Solutions

The Baseband Solutions Group is one of the worldwide pioneers in LTE and beyond standard compliant communications technologies, including baseband and upper layer protocol stacks.

In collaboration with industry partners, the Group delivered the world's first commercial grade FDD/TDD dual mode LTE small cell and TD-LTE terminal baseband core reference designs. These technologies address the demand for high speed mobile data and higher quality services in both public telecom and private mobile networks.

The Group's reference designs are industry proven and have passed interoperability tests with infrastructure vendors and operators. In particular, the Group enables partners to pass a leading operator's stringent tender tests on small cells and terminals.

BSOL is developing LTE self-organising network (SON) technologies to facilitate the dense deployment of LTE small cells. Other ongoing R&D efforts include next generation small cell technologies, physical layer algorithms for ultra high speed mobile communications in 5G, and low cost LTE machine-type communications (MTC) terminal reference design for the Internet of Things (IoT).

## Emerging Systems

The Emerging Systems Group focuses on the research and development of forward looking communications technologies. The Group is undertaking projects to develop a software defined radio (SDR) platform and core technologies for C-RAN architectures for increasing spectrum efficiency, and reducing both hardware cost and energy consumption. The Group is also developing LTE device-to-device communications (D2D) technologies for public safety networking and smart city applications.

The Group works with government bodies and cellular operators to conduct trials on state-of-the-art wireless technologies to enable new application solutions (e.g. millimetre wave and TV white space technologies), and to develop an open Wireless Innovations Platform (WIP) by integrating ASTRI and other third party's technologies to provide a configurable network environment for system development, integration and verification.

The Group also collaborates with leading industry partners and academia to create IPs and to contribute to 4/5G standardisation communities.

## 基帶解決方案

基帶解決方案小組是全球LTE及後續演進標準的通訊基帶技術的開拓者之一。與業界夥伴合作，我們推出了全球第一款商用級FDD/TDD雙模LTE小基站和TD-LTE終端基帶參考設計。這些技術用於解決包括公共和專用移動網絡在內的高速數據和高品質服務的需求。我們的參考設計經過了業界的驗證，並通過了多間通訊設備供應商和運營商的互通性測試。其中，我們協助合作夥伴通過了領先的運營商的非常嚴格的小基站與終端集採測試。

小組現正開發LTE自組網（SON）技術，用於小基站的密集部署。其他的開發項目包括新一代的小基站，用於5G超高速移動通訊算法，和應用於物聯網（IoT）的低成本LTE機器類通訊（MTC）終端。

## 新興系統

新興系統小組專注於前瞻性通訊技術的研發。正在開展的項目包括開發軟件定義無線電（SDR）平台，和雲架構無線接入網（C-RAN）核心技術，以提高頻譜效率，並降低硬件成本和功耗。我們也在開發LTE終端直連通訊（D2D）技術，以支持公共安全網絡和智能城市應用。

我們與政府機構和移動運營商合作，通過試驗網絡，驗證先進的無線技術（例如，毫米波和電視白頻段技術），為新的應用提供解決方案。同時，我們建立了一個開放的無線創新平台（WIP），採用應科院及第三方的技術，為系統的開發，集成和驗證提供可配置的網絡環境。

我們也積極與行業合作夥伴和學術機構合作，開發專利技術，並參與4/5G標準的製定。

## Applications

- CT's licensable, commercial-grade and standard based LTE core network software, including (1) LTE Evolved Packet Core (EPC), (2) LTE Small Cell Gateway, (3) IPSec Security Gateway, and (4) WiFi + 4G Small Cell Convergence Gateway, can be used for both private/enterprise (e.g. oil fields, subways) and public LTE networks.
- CT's LTE small cell baseband reference design has been licensed to multiple customers (e.g. Sunnada, Sunwave, Innofidei, and HBFEC), and adopted in their small cell products and multiservice distributed antenna system (MDAS) products to improve system capacity and coverage in public mobile networks. Some of the products target at private enterprise wireless broadband communications, e.g. communication services for railroads, oil fields and coal mines.
- CT's LTE MTC user terminal (UE) reference design provides the communication link for IoT, which can be used in many vertical markets for value generation, such as smart grid, medical, retailing, and fleet management.
- CT has set up an Open Broadband Wireless Innovation Platform (WIP), which is an end-to-end LTE network demo system to provide a configurable network environment for system development, integration and verification.
- CT has conducted an LTE network field trial for public safety and critical communications application.

## 技術應用

- 通訊技術部的可授權、商用級及符合規範的LTE核心網絡軟件，包括(1)LTE核心網軟件(EPC)，(2)LTE小基站網關，(3)IPSec安全網關，以及(4) WiFi + 4G小基站融合網關，可作私人/私營(例如：油田、地鐵)和公共LTE網絡之用。
- 通訊技術部的LTE小基站基帶參考設計已授權給多個客戶(例如：三元達、三維通信、創毅視訊和河北遠東通信)使用，並應用到他們的小基站產品和多業務分佈式天線系統(MDAS)產品上，以改善系統容量及公共移動網絡的覆蓋率。其中一些產品以私營企業的無線寬頻通訊為目標，例如：鐵路、油田和煤礦的通訊服務。
- 通訊技術部的LTE機器型通訊使用者終端(UE)參考設計，提供有效的物聯網的通訊連接，適用於多類垂直市場的應用，例如：智能電網、醫療、零售和車隊管理。
- 通訊技術部已成立了一個開放式寬頻無線網絡(WIP)。它是一個端到端的LTE網絡演示系統，為系統開發、整合及驗證提供一個可配置的網絡環境。
- 通訊技術部完成了LTE網絡現場試驗，測試其公共安全應用及關鍵技術。

# Reports of Technology Divisions and R&D Directions

# 技術部報告及研發方向

## Innovations

- Network Function Virtualisation (NFV) for Security Gateway and LTE Small Cell Gateway:
  - NFV is getting much attention by mobile operators and is becoming an industry trend for increasing flexibility of network deployment and reducing cost. However, there are technical challenges in delivering the performance and ensuring service availability. CT's LTE IPSec security gateway and LTE Small Cell gateway technologies are now capable to demonstrate on NFV platform with high performance and high availability (HA).
  - In the 2015 Mobile World Congress, ASTRI has demonstrated ASTRI's innovative FastGate protocol stacks and HA systems framework in virtualised gateways. When there is a critical failure, the system can ensure the sessions in different layers (e.g. service, IPSec, SCTP and GTP-U) are taken over seamlessly by the standby virtual instance without affecting the service.
- Commercial grade LTE small cell reference design, including baseband and protocol stack algorithms.
  - Industry-proven LTE/LTE-Advanced baseband technologies.
  - Industry's best commercially available multi-mode Sniffer solution, which enables Self-Organising Network (SON), VOLTE and radio interface based synchronisation.
  - SON algorithms such as mobility load balancing (MLB) and inter cell interference coordination (ICIC).
  - VOLTE: support simultaneous calls up to 32/64 UEs with good mean opinion score (MOS) and short call setup time. Support VOLTE enabling protocol stack features, including robust header compression (RoHC), Discontinuous reception (DRX), semi-persistent scheduling (SPS) and Transmission Time Interval (TTI) bundling.
- LTE MTC UE reference design (baseband and protocol stack):
  - Release 12 Cat 0
  - Release 13 Cat 0 UE in the roadmap
  - Low cost and power efficient
  - Extended coverage

## 創新

- 安全網關和LTE小基站的網關網絡功能虛擬化(NFV)：
  - 網絡功能虛擬化技術(NFV) 是當前網絡和通訊行業發展的大趨勢，NFV能節省建網和營運成本，提高網絡部署的彈性，因此受到移動營運商的高度關注。在虛擬化環境下提供移動營運商要求的高性能和高可用性，在技術上具有很大挑戰。應科院開發的IPSec安全網關和LTE小基站網關，支援在NFV平台上提供業務，不僅性能良好，同時也支持高可用性(HA)。
  - 我們在二零一五年世界移動通訊大會上展示的虛擬化網關，包括了應科院創新的FastGate協議棧和HA系統架構，當系統出現嚴重故障時，可以自動和無縫地將服務切換到備用的虛擬化網關，確保不同網絡層的會話和業務(包括服務、IPSec、SCTP和GTP-U)的連續性和業務不受影響。
- 商用級LTE小基站參考設計，包括基帶和協議棧算法：
  - 業界認可的LTE/LTE-Advanced基帶技術。
  - 業界最佳的商用多模網絡偵聽解決方案，支持自組織網絡(SON)技術、VOLTE 和無線空口同步技術。
  - 自組織網絡算法，例如移動性負載均衡(MLB)和基站間干擾協調(ICIC)。
  - VOLTE：支援高達32/64個用户終端(UE)的同時通話，並有良好的平均意見得分(MOS)和較短的通訊建立時間。支援VOLTE實現協議棧，包括穩健的字頭壓縮(RoHC)、不連續訊號的接收(DRX)、半永久性調度(SPS)和傳輸時間間隔(TTI)捆綁。
- LTE機器型通訊使用者終端參考設計(基帶和協議棧)：
  - Release 12 Cat 0
  - Release 13 Cat 0 UE規劃的版本
  - 低成本和低功耗
  - 擴展的覆蓋範圍

## Project Highlights 研發項目

| Projects 項目 | Duration 時期 |
|---|---|
| Highly Integrated LTE Small Cell Baseband Core Based on Mainstream SoC Device<br>高整合度LTE 小型基站基帶核心 | Mar 2013 – Sep 2014<br>二零一三年三月至二零一四年九月 |
| Self-organizing and Coordinated LTE Small Cells<br>自優化和協調 LTE 小型基站 | Apr 2014 – Oct 2015<br>二零一四年四月至二零一五年十月 |
| LTE Machine Type Communications (MTC) Baseband Technologies<br>LTE 機器類型通訊基帶技術 | Mar 2015 – Sep 2016<br>二零一五年三月至二零一六年九月 |
| Internet of Things Management and Application Platform with Broadband Wireless (IMAP)<br>物聯網設備管理和應用平台 | Feb 2014 – May 2015<br>二零一四年二月至二零一五年五月 |
| WiFi + 4G Convergence Gateway Software Platform<br>WiFi + 4G 融合網關平台 | Dec 2013 – Nov 2015<br>二零一三年十二月至二零一五年十一月 |
| LTE Access Network Management and Legacy 3GPP interworking (LM3G)<br>LTE接入網絡的管理和傳統3GPP互通 | Apr 2013 – Sep 2014<br>二零一三年四月至二零一四年九月 |
| High Efficiency RF System<br>高效射頻系統 | Mar 2015 – Sep 2016<br>二零一五年三月至二零一六年九月 |
| Active Antenna System Development Platform<br>有源天線系統開發平台 | Oct 2013 – Apr 2015<br>二零一三年十月至二零一五年四月 |
| Broadband Cable Technology Platform<br>寬帶有線技術平台 | Apr 2013 – Apr 2015<br>二零一三年四月至二零一五年四月 |
| Machine to Machine (M2M) Communication Technologies for Internet of Things (IoT)<br>物聯網 (IoT) 機器對機器 (M2M) 通訊技術 | Jun 2014 – Mar 2015<br>二零一四年六月至二零一五年三月 |
| 5G Radio Access Technologies<br>5G 無線接入技術 | Jul 2014 – Apr 2015<br>二零一四年七月至二零一五年四月 |
| 5G RF Front-end Systems<br>5G射頻前端系統 | May 2014 – Feb 2015<br>二零一四年五月至二零一五年二月 |

# Electronics Components (EC)

## Overview

The Electronics Components (EC) Technology Division specialises in market-driven solutions that focus on advanced packaging technologies, materials development and module integration for applications in consumer electronics, Internet of Things, automotive electronics, and power electronics.

ASTRI has provided solutions to tier-one electronic component manufacturers as well as small- and medium-sized technology enterprises. Through these contract research, our industry partners can realise their commercial products more rapidly.

Packaging (PACK) and Lithium-ion Battery (LIB), our core competence groups, will continue to expand relevant research and development activities for the industry.

## Technology Focuses and Services

EC has established its core competences and infrastructure in the four major aspects:

- Multi-physics designs, including electrical design, substrate design, thermo-mechanical design and chip-package-substrate co-designs.
- Manufacturing process recipes, including High-Density-Interconnect (HDI), Si interposer, 3D-Integrated Passive Devices (IPD), 3D-SiP and Trough-Silicon-Via (TSV).
- Materials formulation and synthesis, including polymer additives, Sn-based anode and lithium-rich cathode materials.
- Comprehensive R&D labs and pilot line, including wet labs, 3D-SiP, reliability and failure analysis.

## Applications

With the establishment of the core competences and infrastructure, the division focuses on high frequency and high power related applications, including consumer electronics, automotive electronics and power electronics.

# 電子元件

## 概要

電子元件技術部擅長設計市場導向的解決方案，主力研發可應用於消費電子、物聯網、汽車電子和電力電子的先進構裝技術、物料開發和模組集成。

電子元件技術部為一線電子元件製造商和中小型科技企業提供先決技術，迅速實現商業產品。

我們的兩個主要技術小組：封裝(PACK)和鋰電池(LIB)，將繼續在各自的技術趨勢範疇內，擴展相關研究和開發活動，以保持其核心技術的領導地位。

## 技術重點與服務

電子元件技術部於四個方面建立了其核心研發能力及相關基礎設施：

- 多重物理設計，包括電路設計、基板設計、熱機械設計和芯片封裝基板共同設計。
- 生產工藝配方，包括高密度互連(HDI)、矽載板、三維集成無源器件(3D-IPD)、三維系統級封裝(3D-SiP)，以及硅通孔(TSV)。
- 材料配方與合成，包括聚合物添加劑、錫基陽極和富鋰的陰極材料。
- 功能齊備的研發實驗室和試驗線，包括濕實驗室、三維系統級封裝、可靠性和失效分析。

## 技術應用

配合已有的核心技術和基礎設施，電子元件技術部專注於高頻和高功率相關的應用，包括消費電子、汽車電子及電力電子等。

## Innovations

### (1) 3D High Power Electronics Modules

Based on the 3D packaging technology, ASTRI has developed the first wirebondless high power (0.5~1.0MW) IGBT module in the world. Compared to conventional wirebond-based module packaging, ASTRI's 3D power module solution offers three advantages: (1) reduces approximately 70% voltage overshoot and 30% current density inside the interconnects; (2) enhances the overall thermal dissipation performance by approximately 35% using special cooling methods and structures; (3) achieves 80% thickness reduction and 70% weight reduction by using a new fully-molded packaging approach.

ASTRI's high power electronics modules can be widely utilised in industrial electronics, electric vehicles as well as wind and solar power generators.

### (2) New Electrodeposition Additives for 3D-Interconnect

3D copper interconnects are widely used in advanced IC substrate and IC chip integration, such as product multi-function and miniaturisation. Electrodeposition additives are essential for copper electrodeposition fabrication of 3D interconnects, and these additives can be provided by only a handful of electronic material companies from Japan, Germany and the U.S. and can command very high profit margin. Based on in-depth research on the mechanism of electrochemical and molecular structure, ASTRI developed new sets of electrodeposition additives for next generation 3D-interconnect for China, including accelerator, suppressor and leveller, which offer a number of advantages: (1) achieves smaller microbump (10-20um) and microvia (15-50um) electrodeposition fabrication; (2) achieves higher technical requirements, including thinner surface deposition (down to 10um) and smaller dimple (down to 3um); (3) proposes a methodology for fast screening of electrodeposition additive candidates in order to shorten the material development cycle time and reduce the development cost.

ASTRI's electrodeposition additives can be widely used for wafer microbump and IC substrate microvia 3D copper interconnects fabrication.


## 創新

### (1) 三維高功率電子模組

應科院根據現有三維封裝技術，成功開發全球創新的無引線高功率(0.5~1.0兆瓦)IGBT模組。與傳統的線焊封裝模組相比，應科院的三維功率電子模組方案有三大優勢：(1)減少約百分之七十電壓過衝和百分之三十的互連電流密度；(2)使用特別散熱方法和結構，提升整體電熱性能約百分之三十五；(3)使用全新的全塑封技術，達至減少百分之八十厚度及百分之七十重量。

應科院的三維高功率電子模組可以廣泛應用在工業電子、電動汽車，以及風能和太陽能發電機上。

### (2) 全新三維互連的電鍍添加劑

在進階集成電路基板和集成電路芯片集成，例如產品多功能化和微型化，廣泛使用在三維銅互連技術上。在銅電沉積製造三維互連時，電鍍添加劑的使用不可或缺，但這些電鍍添加劑現時只有少數在日本、德國和美國的電子材料公司有供應，且其獲利率極高。深入研究電化學和分子結構的機制後，應科院開發出一套全新的電鍍添加劑，作中國新一代三維互連之用，包括促進劑、抑製劑和整平劑。這套添加劑有多種好處：(1)在電沉積製造上，達至較小的微凸塊(十至二十微米)和微孔(十五至五十微米)；(2)可以符合更高技術要求，包括更薄的表面沉積層(小至十微米)和更小的凹坑(小至三微米)；(3)提出一套快速篩選電鍍添加劑的方法，以縮短材料開發時間和減少開發成本。

應科院的電鍍添加劑可廣泛應用在製造晶圓微凸和在集成電路基板製造三維銅互連微孔。

# Reports of Technology Divisions and R&D Directions

# 技術部報告及研發方向

## Consortium

ASTRI has established an Advanced Packaging Technologies Consortium (APTC) in 2006 to promote the advancement of electronics packaging technologies to the local industry.

- APTC provides updated market analyses, product intelligence and applications of advanced packaging technologies such as reverse engineering on the latest products for its members.
- It introduces leading-edge electronics packaging technologies to its members.
- It also provides a networking platform for the whole supply chain of electronics packaging industry.

As at March 2015, APTC has 56 members, including foundries, packaging subcontractors, materials and components manufacturers, design houses, testing services, and universities.

## 聯盟

應科院於二零零六年成立了先進封裝技術聯盟(APTC)，向本地業界推廣先進微電子封裝技術。

- 為會員提供有關最新的先進封裝技術(例如最新產品之工程分析)的市場分析、產品情報及技術應用之資料。
- 為會員介紹最新的封裝技術。
- 提供平台讓業界整個供應鏈的上下游之間互相交流。

截至二零一五年三月，先進封裝技術聯盟共有五十六家公司會員，成員包括晶圓廠、封裝代工廠、材料及元件製造商、設計公司、測試服務和大學等。


Advanced Packaging Technologies Consortium (APTC) website
先進封裝技術聯盟(APTC)網頁

## Project Highlights 研發項目

| Projects 項目 | Duration 時期 |
|---|---|
| 3D High Power Electronics Modules<br>三維大功率電力電子模塊 | Mar 2014 – Sep 2015<br>二零一四年三月至二零一五年九月 |
| New Electrodeposition Additives for Next-Generation 3D-Interconnect (NEA-3D)<br>應用於下一代三維互連技術的新型電沉積添加劑 | Mar 2014 – Aug 2015<br>二零一四年三月至二零一五年八月 |
| Miniaturized Dual-frequency RFID Reader (MDR) w/ NFC Functions for Smartphone<br>具有NFC功能的用於智能手機的微型化雙頻RFID讀寫器 | Aug 2014 - May 2016<br>二零一四年八月至二零一六年五月 |
| New Materials & Process Next-generation High Density Interconnect Applications (NMP-HDI)<br>應用於下一代高密度互連的新材料和工藝 | Mar 2015 – Nov 2015<br>二零一五年三月至二零一五年十一月 |
| Integrated Power Module for Networking and Telecommunication Equipment (IPM-NTE)<br>應用於網絡和通訊設備的集成功率模塊 | Mar 2015 – Mar 2017<br>二零一五年三月至二零一七年三月 |
| Lithium Rich Cathode Material for High Energy Density Advanced LIB (LRCM-F)<br>先進高能量密度鋰離子電池富鋰正極材料 | Dec 2014 – Aug 2016<br>二零一四年十二月至二零一六年八月 |

# IC Design Analog (ICDA)

## Overview

ICDA is dedicated to realising leading-edge ICs and solutions. Several technology initiatives are underway to fulfill the goal of developing innovative technologies for the industry. The targeted IC applications of ICDA covers Internet of Things (IoT), wireless communications, sensor signal processing and etc. The Division offers competitive Intellectual Properties (IPs) and IC solutions in the following key technology areas:

- Wireless IoT System on Chip (SoC) Design
- Ultra Low Power IC Design
- Electrostatic Discharge (ESD) and Input/Output (I/O) Design Technology

## Technology Focuses and Services

In the financial year, ICDA division has successfully completed four different projects and secured funding for another five. The funding opportunity allows us to further strengthen our competency in radio frequency and ultra low power mixed signal IC design and applications. Many innovative product IPs have been delivered to industry.

Narrowband Cellular Internet of Thing (CIoT) is a new global standard based on public and spectrum-licensed 4G/LTE networks. It is a wide area wireless technology which enables ubiquitous connections. Anything can be connected to LTE 4G network from anywhere, regardless of its distance to the base station. A set of narrowband CIoT IPs including RF transceiver, baseband and protocol will be developed and delivered by 2017.

In SOI device modelling project, ICCAP of Agilent is used to extract DC and RF model for the devices fabricated in 0.13um SOI process. Both active devices including MOSFET, diode and bipolar, and passive devices such as resistor, capacitor and inductor models are extracted. As for MOSFET, floating body (FB) device, single body contact (T Type) and double body contact (H Type) device are covered in model extraction. Model library includes temperature, noise and RF. Corner model is also included to cover process variations. Automatic layout tools developed in ICDA is applied to generate nearly 1,000 device patterns. The models are qualified by commercially available QA tools (MQA).

# 集成電路設計 類比

## 概要

集成電路設計　類比技術部致力實現領先的集成電路和解決方案。我們現正研發數個項目，以達至為業界開發新技術的小組目標。集成電路設計類比技術部的目標集成電路應用涵蓋物聯網、無線通訊、傳感器信號處理等。技術部在以下的重點技術研究範疇，提供具競爭力的知識產權及集成電路解決方案：

- 無線物聯網系統晶片(SoC)設計
- 超低功耗集成電路設計
- 靜電防護(ESD)和輸入/輸出(I/O)端口設計技術

## 技術重點與服務

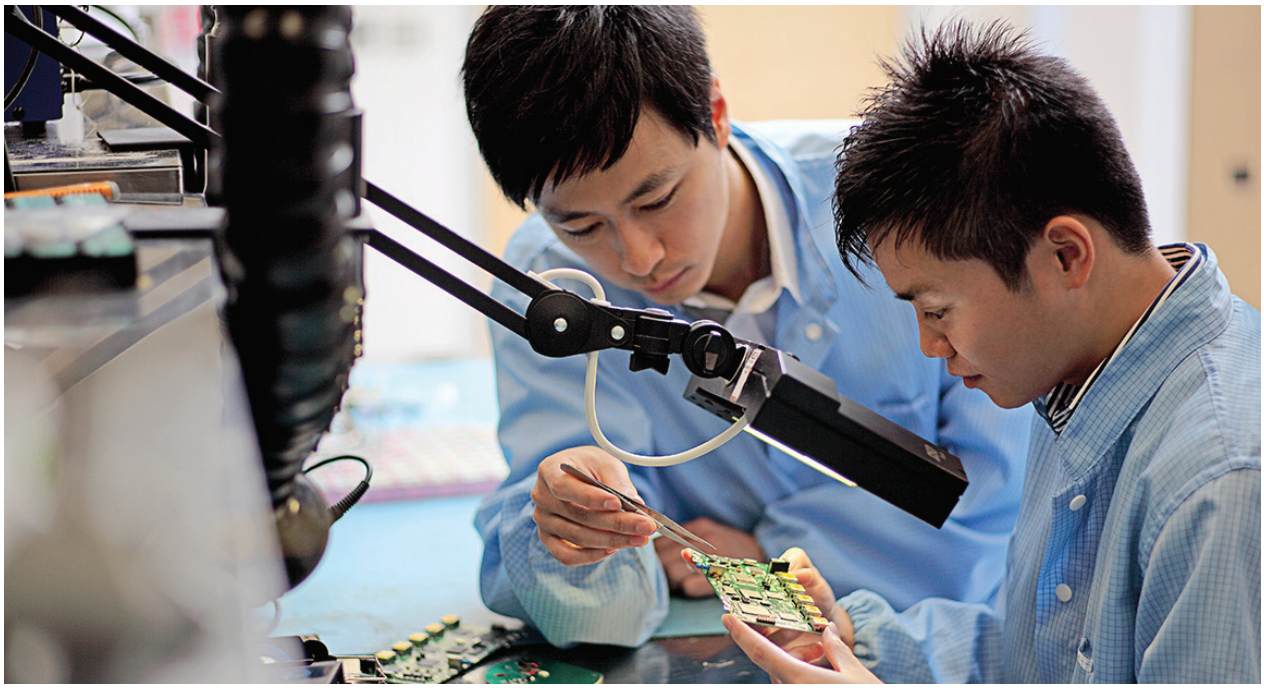
在本財政年度，集成電路設計 類比技術部成功完成四個不同項目，並籌集到足夠開展五個項目的資金。這一筆資金可以進一步強化我們的無線電射頻技術，以及超低功耗混合信號集成電路設計及應用。我們已為業界帶來眾多創新知識產權產品。

窄帶物聯網(CIoT)是基於公開和授權頻譜的4G/LTE網絡的新全球標準。它使物聯網的覆蓋拓展到任何4G/LTE網絡能夠覆蓋的地區。無論與基站距離多遠，任何裝置或人員均可連接到LTE 4G網絡。我們將會開發一系列CIoT的IP，包括RF收發器、基帶和協議棧，並在二零一七年發佈。

在SOI器件建模項目中，使用了安捷倫公司的ICCAP軟件，對零點一三微米SOI工藝所生產的器件進行直流與射頻建模。器件提取了MOS管、二極管、三極管等有源器件和電阻、電容、電感等無源器件。對於MOS管的模型提取，涵蓋了襯底懸空(FB)器件，襯底單一接觸(T型)和襯底雙接觸(H型)器件。模型包括溫度、噪音及射頻模型。對於工藝波動還包括了corner模型。採用了集成電路設計　類比技術部開發的自動化版圖設計工具，產生近千個測試圖形。模型通過了專用QA工具軟件(MQA)的質量檢查。

# Reports of Technology Divisions and R&D Directions

# 技術部報告及研發方向



## Applications

Brain Computer Interface (BCI) applications are growing exponentially in healthcare wellness monitoring through accurate detection and analysis of one's electroencephalography (EEG). It requires precision analog front-end (AFE) design, mixed signal integration of digital signal processing (DSP) and low noise measurement. ICDA has conducted research on microvolt signal detection and advanced signal processing SoC platform. It will provide a portable and low cost solution for brain signal pattern detection and recognition applications.

Near-field communication (NFC) is not new. However, their impacts on logistics operation, mobile payments and consumer electronics have yet to see its full effect. There are lots of opportunities in high performance NFC IPs. NFC IPs and application modules development are completed and ready to serve this market.

With ASTRI On-chip semiconductor sensor design and optimisation technology, Hall sensors have been simulated in virtual fab platform. Several design parameters such as dimension, doping concentration, contact size have been simulated and optimised using TCAD. Hall voltage and sensitivity curve have been obtained to predict the performance of the sensor. Other process options such as p+ implant on top, replacing n-well with p-sub have also been simulated to compare the performance.

## 技術應用

在健康監測方面，透過準確的檢測與個人腦電圖的分析，腦機接口(BCI)的應用迅速發展。這項技術需要精密類比前端設計、數碼信號處理(DSP)的混合信號集成，以及低噪測量。集成電路設計　類比技術部對微伏信號檢測和先進的信號處理系統晶片(SoC)平台進行研究，提供低成本和可攜帶的大腦信號模式檢測和識別應用的方案。

近場通信(NFC)技術都不是新技術。不過，它們對物流營運、移動支付和消費電子方面，仍有大量發展的空間。在高效近場通信知識產權方面，尚有很多發展機會。我們的近場通信知識產權及應用模組開發已經完成，並可以投入市場。

在片上集成半導體傳感器設計與優化項目中，在虛擬製造平臺上進行霍爾傳感器的仿真，利用TCAD軟件，對若干設計參數進行仿真和優化，例如器件尺寸、摻雜濃度、接觸尺寸等。提取霍爾電壓和靈敏度曲線可以對器件的整體性能進行預測與分析。還對其它可選的工藝步驟進行了仿真與性能比較，例如在表面進行P+摻雜，利用P襯底代替N阱進行器件設計等。

## Innovations

We are developing an Ultra Low Power RF IPs and SOC Platform for BLE WBAN. Bluetooth Low Energy (BLE) consumes only a fraction of the power of classic Bluetooth radio. It extends the use of Bluetooth wireless technology to devices that are powered by small, coin-cell batteries such as watches and toys. Other devices such as sports, fitness and healthcare devices, keyboards and mice, beacons, wearables and entertainment devices are also enhanced by this technology. In many cases, these devices could operate for more than a year without recharging.

The year's innovative achievement can further be demonstrated in the patent application performance: 13 granted (including 5 U.S. patents and 8 China patents) and 10 additional patent (8 U.S. patents and 2 China patents) applications filed.

## 創新

我們正在開發藍牙低功耗(BLE)WBAN的超低功耗射頻知識產權和SOC平台。BLE的功耗非常低。它使藍牙無線技術的應用，可擴展至由小型鈕扣電池供電的設備，例如手錶和玩具。其他如運動、健身、醫療健康設備、鍵盤和滑鼠、信標(beacons)、可穿戴裝置和娛樂設備等的應用，也因該技術而得以加強。在許多情況下，這些設備可以運作超過一年而無需充電。

本年度的創新成果更可由專利申請結果證明：獲得十三項授證專利(包括五項美國專利和八項中國專利)和正在申請十項附加專利(八項美國專利和兩項中國專利)。

## Project Highlights 研發項目

| Projects 項目 | Duration 時期 |
|---|---|
| High Speed & Agile Direct Digital Synthesizer<br>高速捷變的直接數字綜合器 | Oct 2012 – Oct 2014<br>二零一二年十月至二零一四年十月 |
| Power Factor Correction for Dimmable and Green LED lighting<br>功率因數校正適用於可調光LED綠色照明系統 | Apr 2013 – Jun 2014<br>二零一三年四月至二零一四年六月 |
| AFE and Mixed Signal IPs for Integrated RFID NFC controllers Design<br>RFID和NFC控制器中模擬前端和混合信號IP設計 | Jul 2013 – Dec 2014<br>二零一三年七月至二零一四年十二月 |
| µV Signal Detection and Advanced Signal Processing SoC Platform for Brain-Computer Interface (BCI)<br>應用於腦機界面的微伏信號檢測和先進訊號處理系統晶片平台 | Jan 2014 – Nov 2015<br>二零一四年一月至二零一五年十一月 |
| LTE-Advanced RF Transceiver Chip<br>LTE-Advanced射頻收發器芯片 | Sep 2014 – Mar 2016<br>二零一四年九月至二零一六年三月 |
| Advanced Device IP Platform<br>先進器件IP平臺 | Mar 2015 – Mar 2017<br>二零一五年三月至二零一七年三月 |
| Ultra Low Power RF IPs & SOC Platform for BLE WBAN<br>用於低功耗藍牙(BLE)無線體域網(WBAN)的超低功耗射頻IPs與系統芯片平台 | May 2014 – Mar 2016<br>二零一四年五月至 二零一六年三月 |
| Feasibility of Intelligent Power IC and Module for Green Energy<br>智能功率集成電路及模塊在綠色能源上應用的可行性研究 | Feb 2014 – Oct 2014<br>二零一四年二月至二零一四年十月 |
| AMS IP Platform for mobile health monitoring devices<br>移動健康監測設備的模擬和混合信號知識產權平台 | Aug 2014 – Aug 2015<br>二零一四年八月至二零一五年八月 |
| Semi-Autonomous Wireless Sensing IC Platform for IoT<br>半自主無線傳感物聯網集成電路平台 | May 2014 – May 2015<br>二零一四年五月至二零一五年五月 |

# IC Design Digital (ICDD)

# 集成電路設計 數碼

## Overview

The IC Design Digital (ICDD) Division boasts core competences in state-of-the-art SoC design services - from advanced algorithm research to IC specification and implementation to production IC testing. ICDD makes contributions to the Chinese National Engineering Research Centre (CNERC) for Application Specific Integrated Circuit System (Hong Kong Branch). It strives to create valuable silicon IPs through market driven in-house research for emerging IC applications in IoT communication, 3D and video super-resolution and hardware oriented secure data storage platform. ICDD is committed to value creation by actively engaging partners in relevant industries and by channelling advanced research results from local universities to commercialisation through IC realisation and customisation. To enhance the competitive edge of industry partners, the group offers commercially competitive IPs and total turn-key IC solutions.

ICDD's researches focus on the following key technology initiatives:

- IoT Communication IC
- Hardware Oriented Secure Data Storage Platform
- 3D and Video Super-resolution
- SoC Design Services

## 概要

集成電路設計 數碼技術部擁有最先進、全面的系統晶片設計服務 – 從創新的算法研究至晶片規範、實現及測試。本部門是國家專用集成電路系統工程技術研究中心香港分中心的一部分。其使命是透過市場導向的內部研究，如新興物聯網通信集成電路應用、三維顯示和視頻超分辨率，以及硬件導向安全數據儲存平台，創造具價值的晶片知識產權。集成電路設計 數碼技術部積極聯繫合作夥伴，並通過本地大學的先進研究成果，透過實現和定制集成電路，落實到商業化的電路設計，以創造更高價值。為提升業界夥伴的競爭力，小組提供商業上具競爭力的知識產權，以及全面的集成電路解決方案。

集成電路設計研究集中在以下主要技術：

- 物聯網通信集成電路
- 硬件導向安全數據儲存平台
- 三維顯示和視頻超分辨率
- 系統晶片(SoC)設計服務

## Technology Focuses and Services

The Communication IC Group continues the development effort on the smart appliance transceivers. The team would implement silicon IPs to improve the communication robustness over power line network based on the HomePlug Green PHY standard. On the other hand, the Group would also develop hardware security IPs to improve overall security in IoT devices.

The Video Group focuses on development of novel techniques to improve people's visual experience in display applications. The Group applies human visual sensitivity models to develop a super-resolution platform for HD-4K conversion. The super-resolution platform is used in HD video library upgrade and 4K display devices. The Group integrates motion tracking sensors, 3D display and projection system to create an immersive, natural human-computer interface (HCI) platform. This HCI platform can be used in education, gaming, exhibition and product promotion applications. 3D conversion is one of the technology focuses in the video group. The team has developed a hardware platform to perform real-time 3D conversion for various 3D displays including state-of-the-art ultra-high definition glasses-free 3D display. Moreover, the team has developed the world's first software-hardware hybrid platform for 3D conversion. This platform can greatly expedite 3D content production by making use of the FPGA-based hardware accelerator and custom-made software plug-in.

SoC Design Service Team realises IC's and product ideas for our innovative designs. Turning IC and system product ideas into real products involves various design processes covering architecture, digital logic, analog circuitry, physical, component simulation, system testing and software. The team works closely with other groups and customers to implement their architecture designs and logic forms into a production ready silicon and system platform. The support model is flexible enough to balance among the various trade-offs based on diversified design scenarios and maximal design value.

Hardware Oriented Secure Data Storage Group focuses hardware secured solution on Solid State Disk (SSD) storage technology. ASTRI-developed SSD storage technology can apply to USB 3.0, SATA and PCIe interface, offering users a convenient connection to host PC. The completed solution is offered to the customer including firmware and FPGA solution.

## 技術重點與服務

通訊集成電路小組繼續進行智能家電收發器的開發工作。小組將會實施晶片知識產權，為電力線通訊基礎如HomePlug Green PHY標準改善通信穩健性。另一方面，小組亦會開發硬件保安知識產權，以提高物聯網設備的整體安全。

視頻小組主力開發提升使用者整體視覺體驗的技術平台。技術組應用人體視覺敏感度模型，開發一個超分辨率平台用作高清-4K的轉換。超分辨率平台應用於高清視頻庫升級和4K顯示設備等。技術組整合運動追蹤傳感器、三維顯示與投影系統創造一個有如身臨其境、自然的人機介面（HCI）的平台。這個人機介面平台，可應用於教育、遊戲、展覽和產品推廣等應用。三維轉換技術是視頻小組內其中一個重點技術。小組已開發一個硬件平台進行實時三維轉換，此平台可應用於各種三維顯示器之上，包括先進的超高清裸眼三維顯示器。此外，小組亦已經開發世界首個軟硬件混合三維轉換平台。該平台通過FPGA硬件加速器和定制的軟件插件，大大減少三維內容的製作時間。

系統晶片(SoC)設計服務小組將創新的設計及集成電路實現為具體的產品。將集成電路和系統產品意念實現成具體產品的流程包括：產品架構生成、數碼邏輯設計、模擬電路設計、物理層面設計、電路仿真、系統測試以及軟件編寫等。技術組與其他部門以及客戶密切合作，確保他們的設計能變成可隨時投產的晶片和系統平台。我們也為客戶提供靈活多樣的合作模式，平衡各種設計需求的代價，以達至最大的設計價值。

硬件導向安全數據儲存小組重點研發固態硬盤(SSD)技術的硬件安全解決方案。應科院開發的SSD技術可應用於USB3.0、SATA和PCIe介面上，為用戶提供便利的電腦對接。我們為客戶提供全面的解決方案，包括韌件和FPGA解決方案。

# Reports of Technology Divisions and R&D Directions

# 技術部報告及研發方向

## Applications

The Communication Group (COMM) focuses on developing applications for secured IoT devices such as smart home, building and lighting and will further extend the application to financial technology (e.g. crypto-currency) in the future.

The 3D technologies developed in video group can be widely applied in 3D conversion service, digital signage, movie and gaming. The applications can also be extended to education and medical imaging.

The SoC Design Team has been developing Analog IP's for various IC applications. Both Analog IP blocks for SoC application and pure Analog base IC's are supported. Some of the examples are multi-channel ADC for video application, network controller, motor driver, and ultra-low power timing control IC.

Data Storage Group has implemented several SSD storage products for customers to serve both the client and server side in the cloud applications.

## Innovations

The Group has developed a mobile crypto-currency hardware wallet for storing private keys and signing transactions within the device. Special algorithms are developed to allow keys recovery in case the wallet is lost, and prevent malicious attacks.

The algorithms being developed in the 3D conversion aims to generate professional 3D output (for both stereo and auto-stereo) in real-time up to ultra-high definition, which are far more superior to any solutions available in the market. The hardware accelerated software-hardware hybrid conversion platform is also the world's first technology for 3D conversion.

Multiple patents have been filed and granted along the years for several analog circuit designs in the area of low power and area saving. These innovations contribute to the success of our own and customers' ICs.

## 技術應用

集成電路通訊技術組專注於發展物聯網安全設備的應用，包括用於智能家居、大廈和電燈，未來亦將擴大應用範疇至金融科技(如虛擬貨幣)上。

視頻小組開發的三維技術可廣泛應用於三維轉換服務、電子廣告板、電影及遊戲。該三維技術的應用亦可擴展至教育及醫學影像之上。

系統晶片(SoC)設計服務小組一直為各種集成電路應用發展模擬IP，支援應用於SoC的模擬IP模塊以及純模擬基礎集成電路。小組已開發視頻應用的多通道ADC、網絡控制器、電機驅動器及超低功耗的時間控制集成電路。數據儲存小組已製成數個SSD儲存產品，為客戶在雲端應用上服務客戶端和服務器端應用。

## 創新

技術組亦有發展移動硬件加密貨幣錢包，該設備可用作儲存私人電子鑰匙及達成電子交易。我們已發展特殊算法，使錢包能防止惡意攻擊。當遺失錢包時，用戶能恢復電子鑰匙。

小組所開發的三維轉換算法，可達至實時及超高清的高品質三維輸出(包括傳統三維左右圖和多視三維裸眼)，該算法遠勝於市場上已有方案。此外，小組開發的硬件加速三維轉換平台，更是世界上第一個軟硬件混合三維轉換技術。

小組多年來已申請及獲得多項授證專利，專利的技術範疇包括低功耗和面積節省等方面的模擬電路設計。這些技術突破協助我們和客戶在集成電路方面取得成功。

## Project Highlights 研發項目

| Projects 項目 | Duration 時期 |
|---|---|
| Hardware Accelerated Super-Resolution Technology (HAST)<br>硬件加速超分辨率技術 | Jul 2012 – Aug 2014<br>二零一二年七月至二零一四年八月 |
| Versatile Display Processor (VDP)<br>多功能顯示處理器 | Apr 2013 – Jul 2014<br>二零一三年四月至二零一四年七月 |
| Stereoscopic Image Signal Processor (SISP)<br>立體圖像信號處理器 | Mar 2012 – May 2014<br>二零一二年三月至二零一四年五月 |
| Hardware Accelerator for Professional 3D Conversion (HA3D)<br>應用於專業3D轉換之硬件加速器 | Apr 2014 – Jul 2015<br>二零一四年四月至二零一五年七月 |
| Visually Enhanced Ultra HD (VEUHD)<br>超高清顯示視頻提升技術 | May 2014 – Feb 2016<br>二零一四年五月至二零一六年二月 |
| Next-generation Interactive Display Platform (NIDP)<br>新一代互動顯示平台 | May 2014 – May 2015<br>二零一四年五月至二零一五年五月 |
| Secure Mobile Storage Processor<br>行動存儲安全處理器 | Mar 2013 – Dec 2014<br>二零一三年三月至二零一四年十二月 |
| PCIe SSD Application Platform<br>PCIe固態存儲應用平臺 | Jul 2013 – Apr 2015<br>二零一三年七月至二零一五年四月 |
| Next-Gen Nonvolatile Memory Controller Technology and Application<br>下一代非揮發存儲控制技術及應用 | Jul 2014 – Apr 2015<br>二零一四年七月至二零一五年四月 |
| PCIe Solid-State Disk Controller SoC<br>PCIe 固態硬盤控制器芯片 | Mar 2015 – Jun 2016<br>二零一五年三月至二零一六年六月 |
| Smart Appliances Transceiver<br>智能家電收發器 | Jul 2013 – Aug 2015<br>二零一三年七月至二零一五年八月 |
| Hardware Acceleration in Financial Computing<br>金融運算的硬件加速技術 | Jun 2014 – May 2015<br>二零一四年六月至二零一五年五月 |
| Wireless Power Technology for Multi-standard Platform<br>無線電源技術的多標準平台 | Jul 2013 – Jul 2014<br>二零一三年七月至二零一四年七月 |

# Opto-electronics (OE)

## Overview

Opto-electronics (OE) Technology Division has two Core Competence Groups (CCG) specialising in developing and commercialising market-driven solutions. The Manufacturing Technologies (MTECH) CCG focuses on machine vision, intelligent display, and robot perception. The Modules and Integration (MI) CCG specialises in healthcare electronics. The Division has accumulated over 200 granted invention patents and 160 technology transfers to the industry. It has also stepped into new sensor areas aiming for tactile sensing and food safety.

## Technology Focuses and Services

### (A) Manufacturing Technologies (MTECH)

#### Technology

MTECH CCG focuses on vision and perception technology development. It has miniaturised optical engines, as well as image understanding and metrology algorithms as the core competence. There are two technology platforms in MTECH CCG. The first one is the "Machine Vision" technology platform focusing on developing core technologies for visual defect inspection. The technologies involved include both 3D and 2D optical inspection system, automation, and machine learning-based inspection algorithm development for next generation "intelligent manufacturing" (industrial 4.0). The team has been working with tier-one manufacturers to develop automated visual inspection systems for their production lines to replace operators on both functional and cosmetic defect inspections.

The second technology platform is the "Intelligent Projection" technology platform, focusing on miniaturised projection together with sensing technologies for next generation display applications, including head up display (HUD), head mounted display (HMD) and portable interactive surface (PIS). The team has developed the first single-camera-based touch sensing projection system for PIS and extended the developed technologies to HMD and HUD. Both of the latter two systems involve natural user interface (NUI), including hand, finger, face and eye detection and tracking features. The developed technologies and solutions will be applied to automotive, wearable and advanced manufacturing fields.

# 光電子

## 概要

光電子技術部包含兩個核心研發能力技術組，致力研發以市場為導向的解決方案。製造技術組專注機器視覺、智能顯示和機器人感知；模組與集成組則投入在醫療健康電子的開發。技術部已累積超過二百項獲得授證的發明專利，並簽署一百六十項技術轉移至業界。部門同時也朝向觸覺感測與食物安全等新範疇發展。

## 技術重點與服務

### (甲) 製造技術

#### 技術

製造技術技術組專注於視覺與感知技術，核心技術為微型化光引擎和影像識別與認知算法。目前在製造技術組有兩個主要技術平台：第一是機器視覺技術平台，主要致力於研發缺陷自動化視覺檢測核心技術，包括三維和二維光學檢測系統、自動化和機器學習檢測軟件算法的開發，並應用於新一世代先進製造(或工業4.0)技術。技術組已經與一線製造商合作，開發自動化缺陷視覺檢測系統，以替代該製造商生產線上的工人檢測產品功能性缺陷和外觀性缺陷。

第二技術平台是以微型化投影加上感測的智能投影技術平台為核心的新型顯示應用，包括車載平視顯示裝置(HUD)，頭載式顯示器(HMD)以及可攜式互動桌面(PIS)。該小組已成功開發出用於PIS的單攝像頭的觸控投影技術，並把相關技術研發延伸到平視顯示以及頭載式顯示領域。這兩個系統結合了自然人機互動(NUI)技術，針對手、手指、臉、眼進行檢測追蹤。開發出來的成果將會應用到車載、可穿戴裝置以及先進製造等領域。

## Applications

### 3D/2D Machine Vision

- Defect inspection in Surface Mount Technology (SMT) process
- Consumer electronics manufacturing in-line inspection
- Automotive manufacturing
- Food and pharmaceutical in-line inspection
- Fabric and paper printing inspection

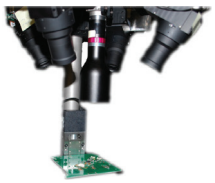
### Intelligent Projection (HUD/HMD/PIS)

- Education
- Entertainment
- Automotive
- Wearable display
- Manufacturing

## Innovations

### (1) 3D Machine Vision

ASTRI's 3D machine vision (3D Solder Paste Inspection, SPI/3D Automated Optical Inspection, AOI) adopts the digital fringe projection technology to develop a fast and highly accurate 3D micro meter grade vision system. It can significantly improve the failure detection rate especially for false soldering in Surface Mounted Technology (SMT) process. The major innovations of the project are (1) shadow-free multiple projection system configuration, (2) multi-frequency fringe modulation, and (3) super fast multi-way phase integration.



### (2) 3D/2D Defect Inspection

ASTRI's 3D/2D defect inspection involves three essential enabling technologies: (1) All-in-focus image capture technology can detect the defects in different thin stacked layers (50um) with transparent surface. (2) Human eye bionic illumination technology enables the light to be adjusted automatically with angle, size and topology structure according to the inspected object. It solves the long period machine adjustment problem caused by model switch during the manufacturing process. (3) Anti-glare image illumination/capture technology can solve the glare problem for image capturing which is very suitable for shinny surface and curved surface defects inspection.

## 技術應用

### 三維和二維機器視覺

- 表面貼裝工藝(SMT)的缺陷檢測
- 消費類電子生產的在綫檢測
- 汽車生產
- 食品和藥品的在線檢測
- 紡織品和印刷品的檢測

### 智能投影（平視顯示裝置/頭載式顯示器/可攜式互動桌面）

- 教育
- 娛樂
- 車載
- 穿戴顯示
- 生產製造

## 創新

### (1) 三維機器視覺

應科院的三維機器視覺系統（三維錫膏檢測3DSPI/三維自動光學檢測3DAOI）是採用數位投影技術開發的一種快速高精度三維微米級視覺系統。該系統可以在表面貼裝工藝(SMT)生產過程中高效地檢測缺陷，提升品質，降低誤判率，特別是假焊檢測。該系統的主要特點包括：(1)百分之百無陰影的多投影系統；(2)多頻調製相位；(3)快速多相位整合算法。

### (2) 三維和二維缺陷檢測

應科院的三維和二維缺陷檢測包括三種必需的先決技術：(1)全焦點影像捕捉技術可以檢測出各透明薄疊層(五十微米)之中的缺陷。(2)人眼仿生照明技術可以根據檢測物件的角度、大小和拓撲結構，自動調較光線。這項技術可以解決製造過程中，因模式切換而需長時間調機的問題。(3)防眩影像照明/捕捉技術可以解決捕捉影像時的眩光問題，適合用作光亮表面和曲面的缺陷檢測。

### (3) Single-camera Based Touch Sensing Projection System for Portable Interactive Surface (PIS)

ASTRI's Portable Interactive Surface uses innovative depth detection technology and optical sensors to allow users to perform interactive touch operation directly on the projection surface. It can instantly turn an ordinary flat surface into an interactive surface with multi-touch function, and can be used to project contents from PC, smartphone, tablet or its own in-built Android system. With ASTRI's short-throw pico-projection engine, the image can be projected to an area as large as 20" at 30 cm projection distance without compromising the system's portability and high image quality.

### (3)可攜式互動桌面(PIS)的單攝像頭的觸控投影系統

應科院的可攜式互動桌面使用創新的深度檢測技術和光學感應器，讓使用者能以觸控方式直接在投影表面上進行互動操作。這項技術可以即時將一個普通的平面，變成擁有多點觸控功能的互動平面，更可以用作投影個人電腦、智能電話、平板電腦或其內置Android系統中的內容。在不影響系統可攜性和影像質素的前提下，利用應科院的短焦距微型投影機可以在三十釐米的投影距離將影像投影至二十吋的範圍。

### (4) Ultra Compact Miniature Projection System for Head-Up Display (HUD)

ASTRI's Intelligent Heads-Up Display can provide drivers with a see-through virtual display with a friendly gesture control and anti-fatigue warning function, while keeping theirs on the road. It uses ASTRI's compact optical projection design together with patent-protected sensing technology to achieve an ambient adaptive high quality virtual display, and accurate driver assistance sensing with low system power and production cost. This Intelligent Heads-Up Display has built in an Android operating system. With its compact palm size, this device is available for new and aftermarket automotive applications.

### (4)車載平視顯示裝置(HUD)的超微型投影系統

應科院的智能平視顯示裝置能為駕駛者提供透視虛擬顯示，配合方便使用的手勢控制和疲勞警報功能，讓駕駛者的眼睛可以保持看著路面。這項技術應用了應科院的微型光學投影設計和專利感應技術，達至可適應周遭環境的高質虛擬顯示，並在低系統耗能和低生產成本下，提供精確的輔助駕駛傳感。這項智能抬頭顯示器內置安卓操作系統。顯示器只有手掌般的大小，可以應用在全新及其後的汽車市場。

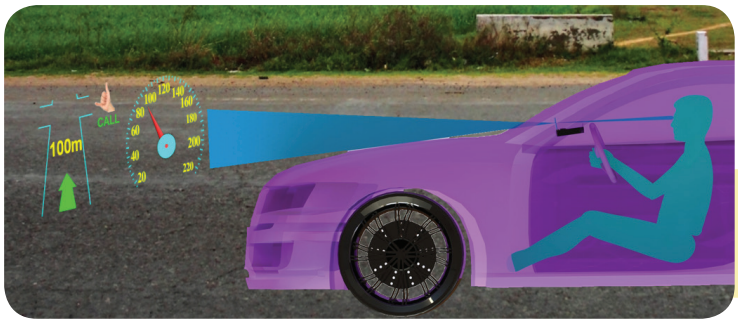



Illustration of Heads-Up Display (HUD)
車載平視顯示裝置圖示

### (5) Sensing Integrated Compact Module Design for Eye Tracking/ Gesture Detection for Head Mount Display (HMD)

ASTRI's Head Mount Display uses an optical system with coaxial optical path for micro-display and bi-directional sensing. The design concept of sharing the optical path among inward sensing, outward sensing and display is novel, and is a technology breakthrough compared with the existing see-through optical design. This integration leads to a more compact system than that with separate optical design. It also helps greatly simplify algorithms for eye pupil tracking, finger tracking and touch detection.

### (5)針對眼動及手勢進行追踪檢測的頭載型顯示器傳感一體式微型模組設計

應科院的頭載式顯示器使用同軸光路的光學系統，進行微型顯示和雙向傳感。設計使用了共用內外傳感及顯示光路這一新穎概念，突破現有的透視光學設計技術。這種一體式設計令系統較分拆式的光學設計更微型，而且有助大幅簡化瞳孔追蹤、手指追蹤及觸控檢測的算法。

## (B) Modules and Integration (MI)

### Technology

Ageing population is a global phenomenon; people are now increasingly more health conscious. In view of the growing demands for healthcare products and services, MI CCG is focusing on developing different preventive healthcare technologies in the emerging market.

MI CCG's current technologies include arterial stiffness measurement, continual cuffless blood pressure monitoring, physiological and psychological condition monitoring and non-invasive blood glucose monitoring.

### Applications

- Cardiovascular Monitoring
- Cognitive Health Monitoring
- Blood Glucose Monitoring

### Innovations

#### (1) Cardiovascular Monitoring Device

A revolutionary cardiovascular monitoring device using smart sensor to measure blood pressure, arterial stiffness and heart rate at wrist has been developed. Unlike traditional cuff-based blood pressure metres, this new device does not block blood vessels during measurement and hence allows continual measurement. The measurement results can be conveniently uploaded to a central database through tele-care systems available in Hong Kong or mobile devices to facilitate health monitoring by medical professionals.

#### (2) Cognitive Health Monitoring Device

A device to facilitate early detection and screening of elderly with cognitive health problems is developed. It can also be used to assess the stress level of the general public. This device can be used for early detection and continual monitoring of cognitive impairment, as well as improving the experience and ease of cognitive assessment for the elderly people in Hong Kong.

#### (3) Non-invasive Blood Glucose Monitoring Device

A portable embedded optical device for non-invasive blood glucose measurement which can be easily used to measure blood glucose instantly and non-invasively is being developed. This device can be used for screening of pre-diabetics and frequent blood glucose measurement of diabetes patients.

## (乙) 模組與集成

### 技術

現今人類的健康意識日漸提高，人口老化已是全球現象。有鑑於對保健產品和服務的需求日益上升，模組與集成的技術組在新興市場中，主力研發各種預防類保健技術。

模組與集成的技術組的現有技術包括動脈硬度測量、持續無袖帶血壓監測、生理和心理狀態監測和無創式血糖監測。

### 技術應用

- 心血管監測
- 認知健康監測
- 血糖監測

### 創新

#### (1) 心血管監測儀

革命性的心血管監測儀使用新研發的智能感應器，可以在手腕位置監測血壓、動脈硬度和心跳率。與傳統的袖帶型血壓計不同，這個新儀器在測量時並不會阻塞血管，因此可以進行持續監測。測量結果可以透過適用於香港的遠程保健系統或移動裝置上載至中央數據庫，以便醫護人員進行健康監測。

#### (2) 認知健康監測儀

我們研發了一個能用作早期檢測和篩查長者認知問題的儀器。該儀器亦能讓一般市民用作測試壓力水平。這個儀器可以用作早期發現和持續監測認知障礙，以及改善長者在香港接受認知評估的體驗和困難。

#### (3) 無創式血糖監測儀

我們現正研發出用作無創式血糖測量的可攜式嵌入光學儀，它可以即時測量血糖水平，而且是無創式的。這個儀器可以用作早期糖尿病篩查，以及為糖尿病患者進行頻繁血糖測量。

## Project Highlights 研發項目

| Projects 項目 | Duration 時期 |
|---|---|
| Cognitive Health Detection Device<br>認知健康狀態檢測裝置 | Jun 2014 – Nov 2014<br>二零一四年六月至二零一四年十一月 |
| Cardio-Vascular Monitoring Devices for Tele-Care System<br>用於遠程照顧的心血管監察儀 | Dec 2012 – Jun 2014<br>二零一二年十二月至二零一四年六月 |
| Optical System for Health Assessment (Full)<br>用作健康評估的光學系統 | Jan 2014 – Jan 2016<br>二零一四年一月至二零一六年一月 |
| Interactive Displays for E-Classroom<br>e教室之互動顯示 | Oct 2012 – Jul 2014<br>二零一二年十月至二零一四年七月 |
| Smart Compact 3D Machine Vision System<br>智能微型三維機器視覺系統 | Dec 2013 – Jun 2015<br>二零一三年十二月至二零一五年六月 |
| Smart Digital Signage: Audience Expression Analysis<br>智能數字標牌 : 觀眾表情分析 | Dec 2013 – Jun 2015<br>二零一三年十二月至二零一五年六月 |
| Intelligent Wearable Information Display (IWID)<br>智能穿戴式顯示器 | Mar 2015 – Aug 2016<br>二零一五年三月至二零一六年八月 |
| 3D Pico Projector and Mobile Interactive I/O Devices (Public Sector Trial Project)<br>三維微投影系統與便攜式互動I/O終端 (公營機構試用計劃項目) | Aug 2014 – Mar 2016<br>二零一四年八月至二零一六年三月 |

# Security and Data Sciences (SNDS)

## Overview

Security and Data Sciences Division is consisted of four core competence groups, one research centre and one laboratory. The four competence groups are cyber-security, data analytics, cloud computing and video analytics, together with the ASTRI-HP Information Technology Research Centre (AHITRC) and ASTRI Security Lab (ASL). Its vision is to build up a strong software development team for Hong Kong's endeavour to become a Financial Technology (FinTech) Hub in Asia-Pacific.

Comprising cyber-security experts, cloud computing, big data, and video analytics engineers and scientists, SNDS strives to establish a world-class cloud-based information security and data/video analytics R&D team, which develops advanced information systems, provides consultancy and assessment to the industry, and nurtures local information security and big data analytics experts and practitioners.

## Technology Focuses and Services

### Cyber-security

Information security is the enabling technology of secure and reliable communication networks and systems, and storage. Data encryption, network and system security, software security, authentication and identification, digital signature, cloud security, and secure data analytics are all the key components for protecting our data and the privacy of our personal information on the Internet. Information security is also the crucial ingredient towards a sustainable and vibrant IT infrastructure and ICT development. ASTRI's Cyber-Security Core Competence Group (CCG) strives to develop innovative and advanced security technologies, and provides industry-standard security solutions and nurture cyber-security talents to enhance privacy protection for the society.

Cyber-Security CCG develops open source software systems that drive towards technology deployment. Some examples include cloud security applications, secure virtual machines in infrastructure-as-a-service model, attribute-based encryption applications, and searchable encryption technology.

# 信息安全與數據科學

## 概要

信息安全與數據科學技術部由四個技術組、一所研究中心和一個實驗室組成。四個核心研發能力技術組包括網絡安全、大數據分析、雲端計算及視頻分析。隨著應科院 - HPE資訊科技研究中心和應科院網絡保安研究所的成立，技術部旨在建立頂尖的軟件開發小組，支持香港成為亞太區的金融科技樞紐。

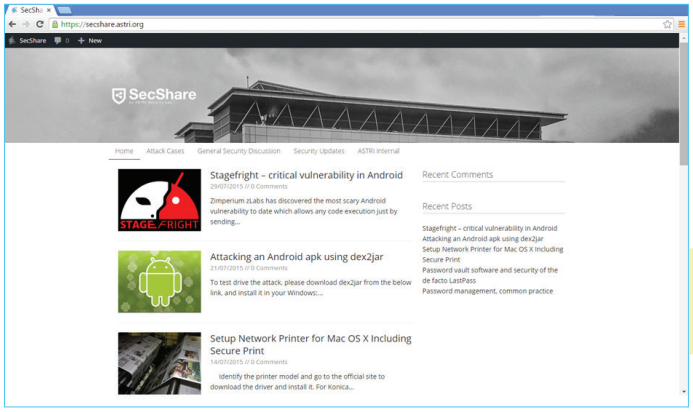
坐擁網絡安全專家、雲端、大數據分析工程師及科學家，信息安全與數據科學技術部致力組織世界級信息安全和數據分析的研發小組，開發先進的信息系統，並為業界提供咨詢和評估，培養本地信息安全及大數據分析專家和從業員。

## 技術重點與服務

### 網絡安全

信息安全是安全可靠的通訊網絡和系統的先決技術。數據加密、網絡和系統安全、軟件安全、認證和識別、數碼簽署、雲端保安、安全數據分析等，全都是在網絡上保護數據和個人資料私隱的關鍵部份。信息安全亦對可持續發展及充滿活力的信息技術基礎設施，以及信息通信技術的發展十分重要。應科院網絡安全技術組致力開發創新及世界頂尖的安全技術，並提供符合業界標準的安全解決方案，更致力培育網絡安全人才，令他們可以在保障安全和私隱方面作出貢獻。

應科院的網路安全技術組研發一套開源程式系統，推動技術應用。其中一些例子包括雲端保安應用程式、在作為服務模式的基礎設施中確保虛擬機安全、基於屬性的加密應用、以及可檢索加密技術。




Cyber-Security Information Sharing Platform (SecShare)
網絡保安信息共享平台 (SecShare)

The group is also working on building a Cyber-Security Information Sharing Platform (SecShare), which is a highly secure interactive portal for cyber-threat information management, dissemination and sharing. SecShare possesses a secure data collection, consolidation, and management system for collecting and managing cyber-attack cases, updates, and related information with encryption-based mechanisms for protecting against data leakage.

The SecShare platform can provide instant, secure, consolidated, highly specific, and technically in-depth cyber-security and threat intelligence to the banking industry, law enforcement agencies, regulatory authorities, and the critical infrastructure providers. The platform also facilitates cyber-security intelligence exchange among various parties in our critical infrastructure with the ultimate goal of supporting a responsive and synergetic cyber-attack defense frontier, especially in the financial services industry.

## Data Analytics

ASTRI's effort in Big Data Analytics can be classified mainly into three areas: Platform, Algorithms, and Domain Applications. Platforms are built through deep integration and orchestration of existing open source big data Hadoop ecosystem and extended with additional modules, such as data source connectors, workflow manager, data visualisation, for making them easy to use for non-technical business users. Analytics software libraries are built from open source machine learning and analytics libraries. The Group collaborates with university professors in transferring the latest research results in analytics algorithms to our libraries, for example, NLP, sentiment dictionary, and concept space for sentiment analysis. On domain applications, the Group collaborates with industrial partners in utilising and customising our platform for use in their domain applications, such as sentiment indicators of stock based on sentiment analysis of newsfeed, tweets, forums, correlation analysis of sentiment indicator with stock price and stock price trend prediction from such correlation.

技術組亦提倡建立網絡保安信息共享平台(SecShare),以開發高度安全的互動門戶,應對網絡威脅情況下的信息管理、傳播、交流和共享。網絡保安信息共享平台擁有安全的數據收集、整理和管理系統作收集、管理和更新網絡攻擊的情況,以及加密機制的相關資料,以避免數據泄漏。

網絡保安信息共享平台可以為銀行業、執法機構、情報監管部門和關鍵的基礎設施供應商等非對外群組,提供即時、安全、統一、高度特化及技術上較深入的安全網絡及威脅情報。該平台亦促進各方在我們的關鍵基礎進行網絡安全情報的交流,以建立應對網絡攻擊的靈敏協同防禦線,尤其在金融服務業。

## 大數據分析

應科院在大數據分析方面的努力主要可分為三個範疇:平台、算法和領域應用。大數據平台是透過對現有開源大數據的Hadoop生態系統,進行深入整合和編排而建成,並利用附加模組,例如,數據源的連接器、工作流程管理員、數據可視化等擴展平台,方便非技術商業使用者使用。從開源的機器學習和分析庫建立了分析軟件庫。小組與大學教授合作,將最新分析算法的研究轉移至我們的分析庫中,例如,自然語言處理(NLP)、情緒詞典和作情緒分析的概念空間。在領域應用方面,小組與業界夥伴一同將平台放至夥伴的領域內進行應用,例如按照新聞流、推特、論壇等的情緒分析得出股票景氣指數、股價景氣指數的關聯分析,以及從該等關聯中推算股價趨勢。

## Cloud Computing

Built on top of multi-disciplinary research and development in network, media, and security, the Cloud Computing CCG provides high performance large-scale distributed computational platform with efficiency, reliability, performance and flexibility for a range of cloud computing applications from media broadcast, digital rights management, cloud storage, network virtualisation, P2P webRTC (realtime communication), to intelligent demographics, internet finance and financial trading applications. Our core computing engine is built upon innovative distributed load balancing processor elements (PE) with dynamic expansion/shrink, load shedding, and complex event processing. It has built-in scalable and distributed statistics computation algorithms aiming at multi-modal data processing, pattern recognition, and machine learning for large stream data sets. The CCG team provides system, platform, solution, and consulting services so that customers can focus on their core businesses.

## Video Analytics

The Video Analytics team focuses on computer vision technologies, which include, but are not limited to, video surveillance and security, video analytics, object detection, manufacturing and robotics, as well as augmented reality. ASTRI offers technology IP licensing and provides contract services for customers. Applications include staff monitoring and protected zone intrusion alert for building management and security, applying our zone intrusion detection and activity detection technologies; identification of suspects and recognition or authentication of VIPs using face recognition or verification technology; video surveillance and instant traffic flow analytics using our 4G LTE mobile video streaming devices; object and personnel detection; and gaming and educational applications using augmented reality.

## 雲端計算

基於網絡、媒體和保安的多學科研究和發展，雲端計算技術組提供高效、可靠、高性能的大型分佈式計算平台，同時可支援一系列雲端計算應用，由媒體播放、數碼版權管理、雲端儲存、網絡虛擬化、P2P實現WebRTC(實時通訊)，至智能人口統計、互聯網金融和金融交易應用。雲端計算技術組的核心計算引擎，建立在創新動態擴展/收縮的分佈式負載均衡處理器單元(PE)、減載和複雜事件處理之上。其內置的可擴展和分佈式數據計算算法，旨在為大規模數據集流進行多模式數據處理、模式識別和機器學習。技術組為客戶提供系統、平台、解決方案，以及顧問服務，令他們可以專注在其核心業務。

## 視頻分析

視頻分析小組主要研究機器視覺技術，包括但不限於視頻監控和保安、視頻分析、物件檢測、製造和機械人，以及擴增實境。小組提供技術的知識產權授權，並為客戶提供合約服務。應用包括工作人員監控，以及建築管理和保安的保護區防盜警報，這應用了我們的保護區防盜檢測和活動檢測技術；嫌疑人識別和貴賓識別或驗證使用了面部識別或驗證技術；視頻監控和即時交通流量分析，使用了我們的4G LTE移動視頻流媒體設備；物件和人員檢測；以及使用擴增實境的遊戲和教育應用。

AR tracking with animation
動畫化的擴增實境追蹤

# Reports of Technology Divisions and R&D Directions

# 技術部報告及研發方向

## Project Highlights 研發項目

| Projects 項目 | Duration 時期 |
|---|---|
| Secured Personal Health Record for Chronic Disease Management - Patient-centric, Privacy-preserving, Cloud-based PHR<br>為慢性疾病管理而設的個人健康記錄 (PHR) 系統 - 以病人為中心、有隱私保護、並雲端技術的PHR系統 | May 2014 – Apr 2015<br>2014年5月至2015年4月 |
| SecaaS: Cloud-based Security as a Service<br>SecaaS: 雲端資訊安全服務技術 | May 2014 – Apr 2015<br>2014年5月至2015年4月 |
| Fine-Grained Access Control for Secure Cloud Storage via Attribute-Based Encryption<br>通過基於屬性加密的安全雲端儲存細粒度訪問控制 | Mar 2015 – Feb 2016<br>2015年3月至2016年2月 |
| eLearning Analytics<br>電子學習數據分析 | Jan 2015 – Jul 2016<br>2015年1月至2016年7月 |
| Bamboo: A Big Data Analytics Platform<br>Bamboo：大數據解決平台 | Nov 2013 – Nov 2015<br>2013年11月至2015年11月 |
| Cloud-Facilitated eLearning<br>雲端輔助之電子學習平台 | Nov 2012 – Nov 2014<br>2012年11月至2014年11月 |
| Cryptographic Biometrics as Personal Security and Access Technology<br>針對個人安全和接入的生物識別加密技術 | Mar 2015 – Mar 2016<br>2015年3月至2016年3月 |
| Intelligent Cloud Security Computation for Big Data Application<br>大數據的智能雲安全計算平臺 | Jul 2013 – Jan 2015<br>2013年7月至2015年1月 |
| Open P2P Mobile Web<br>開放P2P移動網路 | Jul 2013 – Jan 2015<br>2013年7月至2015年1月 |
| LTE Wireless Broadband Applications for Smart Transportation and Public Safety – Thrust 1<br>LTE無線寬帶智能交通和公共安全應用-主推項目一 | Feb 2015 – Jan 2017<br>2015年2月至2017年1月 |
| Advanced Augmented Reality Technologies<br>先進增強現實技術 | Aug 2013 – Jan 2015<br>2013年8月至2015年1月 |
| Intelligent Surveillance Video Scene Analysis Technology Platform<br>智能監控視頻分析技術平台 | Mar 2013 – Oct 2014<br>2013年3月至2014年10月 |

# Software and Systems (SNS)

## Overview

Software and Systems Division strives to create and expand Hong Kong's core intellectual property focusing on four technology areas to develop software-based system solutions. The four are Embedded Systems, Mobile Computing and System, Multimedia Processing, and Smart Living.

Within those areas, SNS has acquired the relevant domain knowledge and developed systems and relevant applications, covering infotainment, health and medical, retailing, and smart city, to establish its core competences. SNS continues its expansion on the relevant research and development activities within the scope of industry technology trends such as user experience focus, smart devices and wearables to maintain its technology leading position in the years ahead.

## Technology Focuses and Services

With respect to the technology areas, there are corresponding Core Competence Groups (CCGs) established under SNS. Each group focuses on a particular technology area and relevant software-based system solutions.

### Embedded Systems

The next generation of embedded systems will be more intelligent and deeply connected with the information and physical worlds. These embedded systems, also known as Cyber-Physical Systems (CPS), will be deployed in the domains of automotive, aerospace, health and energy as well as smart city. As the Fourth Industrial Revolution, Industry 4.0, is underway, CPS is fundamentally changing the landscape of manufacturing industries. The process of turning the vision into reality will involve evolutionary and even drastic changes in the design and building of the architecture of the systems.

The Embedded Systems Group focuses particularly on Virtual Prototyping of CPS, which deploys Model-Based Design (MBD) principle for supporting the emulation of the complex system dynamics and the evaluation of the overall system performance prior to constructing any physical prototypes in order to reduce design iterations and optimise for higher levels of performance and reliability.

# 軟件與系統

## 概要

軟件與系統技術部致力創造和擴展香港的核心知識產權，並專注於四個範疇：嵌入式系統、移動計算和系統、多媒體處理，以及智能生活，以開發軟件系統解決方案。

在這些技術範疇內，軟件與系統技術部已獲得相關的領域知識，並開發出系統和相關應用程式，涵蓋資訊娛樂、醫療健康、零售和智能城市，以建立其核心技術。軟件與系統技術部未來將繼續在業界科技趨勢範圍例如著重用戶體驗、智能設備、可穿戴式設備等內，擴展相關研究和開發活動，以維持其技術領導地位。

## 技術重點與服務

軟件與系統技術部轄下每個技術範疇都設有對應的技術組。每一個小組均專注在其特定技術範疇，以及相關軟件系統解決方案。

### 嵌入式系統

新一代嵌入式系統將會更加智能化，並與資訊和實體世界有更深入的聯繫。這些嵌入式系統亦稱信息物理系統(CPS)，將會應用於汽車、航空、醫療、能源以及智慧城市等領域上。特別是在第四次工業革命「工業4.0」，信息物理系統正從根本開始改變製造工業的景況。然而，要實現這些應用，將涉及系統構築和建造過程的演進甚至顛覆性的改變。

嵌入式系統小組特別專注於採用基於模型的(MBD, Model-Based Design)原則構建的虛擬樣機(Virtual Prototyping)，以支援複雜動力系統級仿真及整體系統的表現評估，用以在製造實體樣機之前，減少設計上的修改，並優化出更高的性能及可靠級別。

# Reports of Technology Divisions and R&D Directions

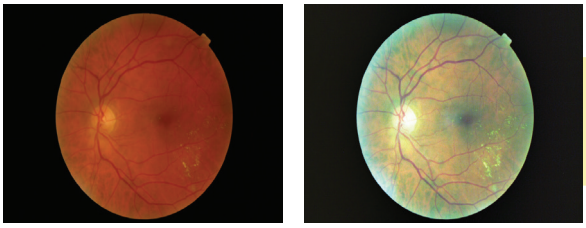
# 技術部報告及研發方向

## Mobile Computing and System

The Mobile Computing and System Group focuses on embedded OS optimisation, CPU/GPU computing optimisation, and wearable computing to push intelligence and computing power to close to mobile/wearable end devices as much as possible. Assembling these technologies and corresponding backend data analytics capability, the group has developed relevant devices, applications and system solutions in a few main market segments such as infotainment, retailing and medical devices.

## 移動計算和系統

移動計算和系統小組專注於優化嵌入式操作系統、優化CPU/GPU計算，以及可穿戴式計算設備，以盡量把智能及計算能力推至移動/可穿戴式終端裝置。集合這些技術和相應的後台數據分析能力，小組已在數個主要市場領域，如信息娛樂、零售和醫療儀器方面，開發出相關裝置、應用程式和系統解決方案。



Colour enhancement for medical application
醫療應用的彩色強化處理

De-blurring for surveillance application
監控應用的去模糊化處理

## Multimedia Processing

The Multimedia Processing Group has specific R&D competence in the processing of video, image, audio and voice, and has contributed multimedia components in the product development of medical device, set-top box, multimedia streaming engine, VoIP system, HDTV, and multimedia SoC. The group also possesses rich experience in the optimised implementation of multimedia codecs in various kinds of platforms.

The group currently undertakes R&D in multimedia signal enhancement processing as well as intelligent video and image processing, covering colour image enhancement, image de-blur, bio-medical image enhancement, 2D to 3D video engine, acoustic noise and echo cancellation, audio post-processing enhancement, multiple image registration, panorama image generation, depth-map generation from single view or multiple views, object tracking, and feature detection and categorisation.

## 多媒體處理

多媒體處理小組在視頻、影像、音頻和聲音處理方面，擁有專門的研究和開發技術，並在開發醫療設備、機頂盒、多媒體串流引擎、VoIP系統、高清電視和多媒體SoC等產品方面提供多媒體組件。小組亦擁有在各種平台實行優化多媒體編解碼器的豐富經驗。

小組現在正進行多媒體信號強化處理和智慧視頻及影像處理的研究和開發，包括彩色影像增強、影像去模糊、生物醫學影像增強、二維至三維視頻引擎、噪音和回音消除、音頻後期處理增強、多重影像配準、全景影像生成、從單一的視圖或多個視圖生成深度圖、物件追踪，以及特徵檢測和分類。

### Smart Living

The Smart Living Group focuses on three main solutions/platforms, namely e-Learning, Smart City and Healthcare. For e-Learning, the group has developed a rich portfolio of e-Learning technologies, including e-Reader, classroom management system, smart classroom solution, and elderly e-Information system. The e-Learning technologies have been applied to schools, corporate training, government and NGOs in Hong Kong.

For smart city, the group also provides various kinds of smart city applications through cloud and popular mobile clients. The applications can be used for indoor or outdoor object tracking, navigation tour, museum guide, retail promotion, inventory checking, and on-site digital sign-up.

For healthcare, the group has developed a healthcare system which collects health data to support on-going health monitoring. The key technologies provide user-friendly interface, healthcare device management, health data analytics, and sharing and alerting mechanism.

## Applications

### Infotainment

The Mobile Computing and System CCG assembles its technologies and corresponding backend data analytics capability to address the infotainment market segment. Its virtual reality head-mounted device using optimised CPU/GPU and combining with sensor fusion technology has been developed as a platform for game, e-touring and e-shopping related applications.

### Retailing

The Mobile Computing and System CCG has developed a smart mirror system that can collect fashion shoppers' information such as sex, skin colour and age for analysing and recommending suitable clothes to shoppers at retailer stores.

### Medical Devices

The Mobile Computing and System CCG has developed a low cost handheld medical grade device with video scope with streaming capability to transmit real-time images to support local or remote diagnosis. The device also supports device management such as device's location for inventory control.

### 智能生活

智能生活小組專注在三個主要解決方案/平台，分別為電子學習、智能城市和醫療健康。電子學習方面，小組已開發出豐富的電子學習產品組合，包括電子閱讀器、課室管理系統、智能課室解決方案，以及長者電子信息系統。電子學習技術已應用至香港各學校、企業培訓、政府和非政府機構中。

至於智能城市，小組亦透過雲端和流行的移動客戶端，提供各種智能城市應用程式。這些應用程式可以用於室內或室外物件追蹤、導航旅程、博物館導覽、零售促銷、庫存檢查和現場數碼註冊。

而在醫療健康方面，小組已開發出一個醫療健康系統，收集健康數據，支援持續健康監測。主要技術提供了方便使用的介面、醫療健康儀器管理、健康數據分析，以及分享和警報機制。

## 技術應用

### 資訊娛樂

移動計算和系統技術組組合其技術和相關後端數據分析能力，以解決信息娛樂市場領域的問題。我們已開發出使用優化CPU/GPU，配合傳感器融合技術的頭載式虛擬實境裝置，作為遊戲、電子遊覽和電子購物相關應用的平台。

### 零售

移動計算和系統技術組已開發出智能鏡像系統，可以收集服裝店顧客的資料，例如性別、膚色和年齡等作分析，在零售店內向顧客作服裝建議。

### 醫療儀器

移動計算和系統技術組已開發出低成本的手提醫療級設備，附有視頻鏡，可以串流傳送實時影像，支援現場或遙距診症。該儀器亦支援作庫存控制的裝置位置功能，以便管理裝置。

# Reports of Technology Divisions and R&D Directions

# 技術部報告及研發方向

## e-Learning

ASTRI's e-Learning technologies have been applied in a variety of domains. Besides being deployed in K-12 education, the technologies have been adopted for corporate training and meetings and elderly e-Education. Requirements of corporate training obviously resemble those of K-12 education, thus the e-Learning technologies constitute a natural fit for this domain. Interactions and collaborations are key elements in corporate meetings, thus relevant solutions developed in classroom interactions and collaborations are also adopted for this application domain. Last but not the least, the technologies are also applied in the elderly sector, primarily for dissemination of information related to elderly living.

Two public-sector trial projects related to these new application domains, i.e. in corporate training and elderly living, are already underway. ASTRI is also in discussion with other government bureaus in adopting the e-Learning technologies to meet their operation and training needs.

## Smart City

ASTRI also provided various kinds of applications through cloud and popular mobile clients. The applications can be used for indoor or outdoor object tracking, navigation tour, museum guide, retail promotion, inventory checking, and on-site digital sign-up.

## Elderly Care

ASTRI has been undertaking some elderly related projects, including an elderly healthcare solution platform project for general practitioners to better serve the elderly suffering from chronic diseases (hypertension and diabetes). They also include three Public Sector Trial Scheme (PSTS) projects on the building of a healthy and comfortable living environment at Clague Garden Estate and a PSTS project to help elderly daycare centres to track Alzheimer's elders when conducting outdoor activities.

ASTRI's technologies have been applied on elderly-friendly applications support private clinics, elderly communities and elderly daycare centres. These projects help create increased value in Hong Kong with their social impact. Four out of these five projects were developed by the Healthcare Team under Smart Living Group.

## 電子學習

應科院開發的電子學習技術已應用至多個不同領域上。除了已應用在K-12教育之內，該技術亦可應用在企業培訓、企業會議，以及長者電子教育之上。企業培訓的要求明顯與K-12教育的要求相若，因此，電子學習技術十分適合此領域。互動和合作是企業會議重要的一環，因此，在課室互動和合作中開發出的相關解決方案，亦可應用在此領域上。最後，這些技術亦可應用在長者界別，主要用作傳播與老年人生活相關的信息。

現在，我們正進行兩個新應用領域的試驗，即企業培訓和長者生活的公共部門的試驗。應科院亦正與其他政府部門討論在其運作和培訓上，採用電子學習技術以應付需要。

## 智能城市

應科院透過雲端和流行的移動客戶端，提供各種智能城市應用程式。這些應用程式可以用於室內或室外物件追蹤、導航旅程、博物館導覽、零售促銷、庫存檢查和現場數碼登記。

## 長者護理

應科院現正進行一些與長者相關的項目，包括長者保健解決方案平台，讓普通科醫生可以更周詳地照料患有慢性病(高血壓和糖尿病)的長者；三個公營機構試用計劃(PSTS)，以在祈德尊新村共同建立一個健康舒適的生活環境；以及一個公營機構試用計劃，以協助長者日間護理中心在進行戶外活動時，追踪患有阿爾茨海默氏症的長者。

應科院的技術應用在長者使用的應用程式中，並能支援私人診所、老年社群及長者日間護理中心。這些項目有助在香港創造更高的社會影響力。智能生活小組轄下的醫療健康小組，已經完成五個項目中，其中四個項目的開發。


e-Education and Information Platform for the elderly
長者電子學習及資訊平台

## Innovations

The Mobile Computing and System Group has prototyped and evaluated a re-architected and optimised version of Linux/Android OS for multitasks, multi-sensors devices with multi-sensing technologies and low latency wearable systems/applications. The effort was on the embedded software algorithm to manage the input devices/sensors, the interconnection with other personal/home devices (such as smart phone and PC), the accessing of cloud services and the information fusion for activity recognition. The output of work will be used to support ASTRI's sensor technologies and other third parties' off-the-shelf hardware components.

The Multimedia Processing Group has continued to develop various image enhancement algorithms for different applications. These algorithms include (1) An image de-blur preprocessing algorithm to enhance the quality of the images with different kinds of blur, mainly for motion de-blur and out-of-focus de-blur, resulting in improved accuracy of license plate identification in surveillance systems. (2) An auto-regressive image de-blocking and de-noising algorithm to eliminate the image distortion caused by low signal to noise ratio and compression. (3) An automatic colour enhancement algorithm based on the characteristic of human eyes to remove the haze and improve the image quality under dim light condition. (4) A RGB colour based gray-scale image enhancement algorithm to enhance the quality of gray-scale image, which is helpful for defect/detail detection in surveillance systems and defect detection systems.

## 創新

移動計算和系統小組已經試製和評估了一個重新設計和優化版Linux/安卓操作系統，可用作多重任務、利用多傳感技術的多傳感器裝置，以及低延遲可穿戴式系統/應用。重點在於處理嵌入式軟件算法，以便管理輸入設備/傳感器、與其他個人/家用設備(例如智能電話和個人電腦)之間的互連、存取雲端服務，以及活動識別的資訊融合。成果將會用作支援應科院的傳感器技術，以及其他第三方的現成硬件組件。

多媒體處理小組繼續為不同應用程式開發各種影像增強算法。這些算法包括(1)影像去模糊預處理算法，以提升不同模糊影像的質素，主要用作處理動態模糊和失焦模糊，以提高監控系統內的車牌識別精確度；(2)自回歸影像消除馬賽克和去噪算法，以去除因低信噪比和壓縮而造成的影像失真；(3)自動色彩增強算法，根據人類肉眼的特徵移除陰霾，改善昏暗的光線下的影像質素；(4)基於RGB色彩的灰階影像增強算法，以改善灰階影像的質素，有助在監控系統和缺陷檢測系統中進行缺陷/細節檢測。

## Consortium

### Digital Living Consortium

Digital Living Consortium (DLC) was established in 2007 with a mission to promote and sustain a digital living ecosystem in the region. The goal is to provide a platform to help facilitate the industry to develop next generation Consumer Electronic products and solutions that are at lower cost, more technologically advanced and timely, and meet the needs of the emerging market. The platform enables the industry to share valuable standards, technologies, markets and industry knowledge, develop networking and promoting technology transfers.

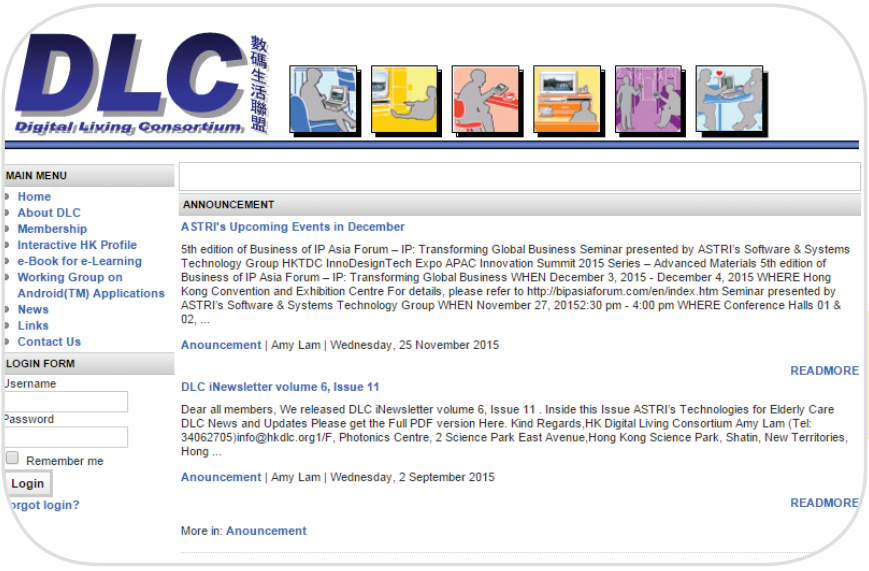
In order to share market intelligence, technology advancements, and standards developments, the DLC has established three Special Interest Groups (SIGs), namely Interactive TV HK Profile, e-Book for e-Learning and Working Group on Android Applications. The DLC currently has 216 members.

## 聯盟

### 數碼生活聯盟

數碼生活聯盟(DLC)於二零零七年成立,其使命是要促進業界發展新一代消費類電子產品及解決方案,在本區推廣和實踐數碼化生活。數碼生活聯盟為業界提供了一個可以互相交流和合作的平台,讓彼此可以分享具有價值的標準、技術、市場和產業知識,建立行業關係網絡和促成技術轉移,令業界有能力開發更多配合新興市場需求、更低成本、技術先進和開發周期短的產品。

為達至分享市場信息、最新的技術和技術標準的發展,數碼生活聯盟成立了三個專門小組,分別為「香港互動電視規格小組」、「適用於電子學習的電子書小組」和「安卓應用程式工作小組」。聯盟現時共有二百一十六名會員。




Digital Living Consortium (DLC) website
數碼生活聯盟(DLC)網頁

## Project Highlights 研發項目

| Projects 項目 | Duration 時期 |
|---|---|
| Smart Consumer Electronics Operating System Framework -- Android Plus<br>智能消費電子產品操作系統框架– 安卓+ | Oct 2012 – Apr 2014<br>二零一二年十月至二零一四年四月 |
| Android GPU Technology<br>安卓GPU處理器技術 | Dec 2013 – Jun 2015<br>二零一三年十二月至二零一五年六月 |
| Android Software for Wearable Applications<br>安卓穿戴式軟體 | May 2014 – Nov 2014<br>二零一四年五月至二零一四年十一月 |
| Elderly Healthcare Solution Platform<br>長者醫療保健解決方案平台 | Jun 2014 – Jul 2015<br>二零一四年六月至二零一五年七月 |
| Community Elderly Healthcare for Aged Friendly City<br>長者友善城市社區老年醫療保健 | Jun 2014 – Sep 2015<br>二零一四年六月至二零一五年九月 |
| e-Education for Aged Friendly City<br>為長者友善城市而設的電子教育 | Jun 2014 – Dec 2015<br>二零一四年六月至二零一五年十二月 |
| Smart Classroom<br>智慧教室 | Jun 2014 – Dec 2015<br>二零一四年六月至二零一五年十二月 |
| IoT via BLE Application and Systems<br>物聯網: 低功耗藍牙應用和系統 | Jan 2015 – Dec 2015<br>二零一五年一月至二零一五年十二月 |
| e-Learning Trial for Police College<br>警察學院電子學習試驗計劃 | Apr 2014 – Jan 2016<br>二零一四年四月至二零一六年一月 |
| Hybrid Tracking System for Enhancing Elderly Caring Service<br>混合跟踪系統提升長者關愛服務 | Nov 2014 – Apr 2016<br>二零一四年十一月至二零一六年四月 |
| Intelligent Distributed Mobile Computing-OS Technology<br>智能分佈式移動計算-操作系統技術 | Mar 2015 – Sep 2016<br>二零一五年三月至二零一六年九月 |

# Highlights of the Year

# 年度焦點

1 September 2014

## ASTRI's New Chief Executive Officer, Dr. Frank Tong Fuk-kay, Assumes Office

二零一四年九月一日

## 湯復基博士出任應科院行政總裁

3 & 17 September 2014

## 2014 Industry and University Consultation Forum

The Forum was held at the Charles K. Kao Auditorium, Hong Kong Science Park. Over 250 representatives from the Government, academia, industry and research centres gathered to seek synergy in advancing innovation and technology in Hong Kong. The same Forum was held in Shenzhen on 17 September 2014 whereby over 120 latest R&D projects of ASTRI were presented.

二零一四年九月三及十七日

## 二零一四科技項目推介會

是次推介會於香港科學園高錕會議中心舉行，並邀得政府、業界、學術界及研發中心等逾二百五十名代表出席，共同探討本港官產學研各界如何加強合作，進一步推動創新及科技的發展。另一場推介會於二零一四年九月十七日在深圳舉行，推介逾一百二十項應科院最新研發項目。

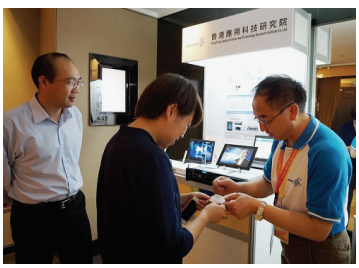

Officiating at the opening ceremony are (from left) ASTRI Chairman Mr. Wong Ming-yam, BBS, JP; Acting Deputy Commissioner for Innovation and Technology Mr. Vincent Tang; Hong Kong University of Science and Technology Prof. Tony F Chan, and ASTRI CEO Dr. Frank Tong.

主持開幕儀式的人士包括 (左起) 應科院主席王明鑫先生, BBS, JP、創新科技署署理副署長鄧智良先生、香港科技大學陳繁昌教授及應科院行政總裁湯復基博士。

16 - 18 September 2014

## ASTRI Successfully Demonstrates End-to-End LTE Small Cell Network Solution in Taiwan

ASTRI performed a live demonstration of an End-to-End LTE Small Cell Network Solution at the Mobile Broadband Development Summit Forum and LTE TDD/FDD Product Exhibition held in Hsinchu, Taiwan.



二零一四年九月十六至十八日

## 應科院於台灣成功演示端到端 LTE 小基站網絡解決方案

應科院於台灣新竹舉辦的「行動寬頻發展高峰論壇暨 LTE TDD / FDD產品展示會」成功演示了應科院及其與合作夥伴共同開發的端到端LTE小基站網路解決方案。

30 September 2014

## Technologies and Healthy Ageing Symposium

ASTRI joined hands with Cadenza: A Jockey Club Initiative for Seniors and The CUHK Jockey Club Institute of Ageing to organise the symposium. An overview of government's elderly policy, the existing ecosystem and the latest technologies developed to facilitate healthy ageing was presented.


二零一四年九月三十日

## 康頤科技研討會

應科院與「流金頌：賽馬會長者計劃新里程」及香港中文大學賽馬會老年學研究所聯合舉辦是次研討會。研討會闡述了目前政府的安老政策、分析社會現況和介紹一系列最新的康健樂頤科技。

29 October 2014

## ASTRI and HKCPV Join Hands in Concentrating Photovoltaic Research

ASTRI and Hong Kong CPV Green Energy Co Ltd announced the signing of an agreement to engage in long-term strategic collaboration on research and development in concentrating photovoltaic (CPV) technology.


二零一四年十月二十九日

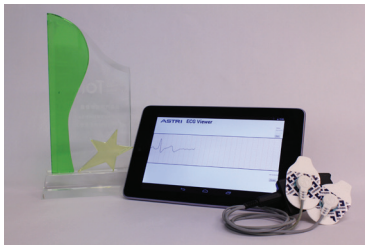
## 應科院與香港聚光新能源集團協議合作研發聚光光伏技術

應科院與香港聚光新能源集團宣佈，就聚光光伏技術的研發和應用達成長期戰略性合作協議。

October 2014

## ASTRI's Healthcare Technology Wins Double Honours in Hong Kong and Guangdong

ASTRI won the Gold Award (Winning Internet-of-Things Technology Category) in the Hong Kong Internet-of-Things (IoT) Awards and the Best IoT Product Award in the Guangdong-Hong Kong IoT Awards with its self-developed Mobile Heart Health Monitoring System.



二零一四年十月

## 應科院電子醫療技術於粵港兩地獲雙重殊榮

應科院憑藉其自行研發的移動心臟健康監測系統，於「香港物聯網大獎」中榮獲最佳物聯網技術金獎，以及在「粵港物聯網大獎」中獲頒發最佳物聯網產品獎。

# Highlights of the Year

# 年度焦點

January 2015

## ASTRI and INRIA Form Partnership on ICT Research

ASTRI has formed an international partnership with the French National Institute for Research in Computer Science and Automation (INRIA) in the area of information and communications technologies for active international collaboration on "Virtual Prototyping of Embedded Software Architectures".

二零一五年一月

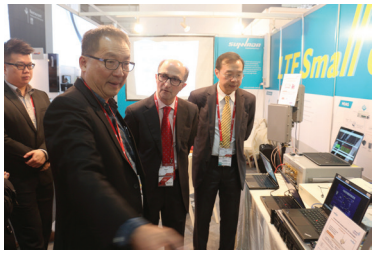
## 應科院與法國國家信息與自動化研究院合研通訊及資訊科技

應科院與法國國家信息與自動化研究院（簡稱INRIA）最近成為國際合作夥伴，在資訊及通訊科技領域中積極開展國際合作，共同研發「嵌入式軟件架構的虛擬樣機」。

2 - 5 March 2015

## ASTRI Showcases Latest LTE Technologies with Industry Leaders at Mobile World Congress

ASTRI collaborated with Fujian Sunnada Communication Co Ltd, Rohde & Schwarz, Keysight Technologies Inc, and Wind River, to showcase its latest series of LTE technologies at the Mobile World Congress 2015 held in Barcelona, Spain.



二零一五年三月二至五日

## 應科院與業界龍頭企業在世界移動通訊大會上進行演示

應科院與福建三元達通訊股份有限公司、羅德與施瓦茨、是德科技有限公司，以及風河公司，在西班牙巴塞隆納舉行的二零一五年世界移動通訊大會上演示其最新系列LTE科技。

6 March 2015

## ASTRI Signs Memorandum to Set Up Largest IP Pool on Technology Patents in Hong Kong

ASTRI announced the signing of a Memorandum of Understanding with PolyU Technology and Consultancy Company Limited, HKBU R&D Licensing Limited and Hong Kong Productivity Council to form the largest pool of intellectual properties related to information and communications technologies developed locally in Hong Kong. Putting together their respective ICT patents, totalling over 560, the four institutions intend to establish a one-stop shop readily accessible by potential industry buyers.

二零一五年三月六日

## 應科院簽署備忘錄成立香港最大知識產權庫

應科院宣佈與理大科技及顧問有限公司、浸大科研發展有限公司和香港生產力促進局分別簽署了諒解備忘錄，合作建立大型知識產權庫，網羅最多本港研發的資訊及通訊科技知識產權。四所機構把它們共逾五百六十項資訊及通訊科技研發專利集中在一起，以期建立一站式服務，方便工業界潛在買家購取。

# Financial Report

## Overview

For the 2014/15 financial year, the income and expenditure of ASTRI amounted to HK$415,983,719 and HK$408,368,120 respectively, resulting in a surplus of HK$7,615,599.

The funds from the Government is comprised of HK$124,263,924 from recurrent subvention, HK$193,752,810 from ITF project funds, HK$376,015 from ITF General Support Programme, HK$7,568,328 from Public Sector Trial Scheme, HK$3,843,724 from ITF Internship and HK$4,560,398 from ITF for Chinese National Engineering Research Centre for Application Specific Integrated Circuit System (Hong Kong Branch). In the financial year, the income from the industry amounted to HK$81,618,520, which was roughly at the same level as the previous year.

The total expenditure of recurrent subvention amounted to HK$125,222,863, which represented a decrease of HK$5,076,782 (3.9% decrease) compared with the previous year. The decrease was mainly due to net savings in general operating expenditure. ASTRI's operation remained steady with prudent financial management throughout the year.

The total expenditure of the R&D projects amounted to HK$237,327,665, of which 73% of the expenditure was spent on manpower and 27% of the expenditure was spent on equipment and other direct costs. The total expenditure mainly represented the actual cash outflow incurred during the year for 68 full projects, 38 seed projects, 1 General Support Programme (GSP) project and 7 public sector trial scheme projects. Meanwhile, the internship expenditure amounted to HK$3,843,724, which represented the actual cash outflow of salary payment for interns engaged in 28 full projects.

The consolidated financial statements for the year ended 31 March 2015 of ASTRI have been audited by independent auditors with unqualified audit opinion, an extract of the Consolidated Statement of Profit or Loss and Other Comprehensive Income and Consolidated Statement of Financial Position are set out on the pages 72 - 75.

# 財務報告

## 概況

應科院在二零一四/一五年度的收入和支出分別為港幣415,983,719元及港幣408,368,120元，所得盈餘為港幣7,615,599元。

來自政府款項包括經常性撥款港幣124,263,924元；創新及科技基金的研發經費港幣193,752,810元；創新及科技基金的一般支援計劃資助港幣376,015元；公營機構試用計劃資助港幣7,568,328元；創新及科技基金的實習研究員計劃資助港幣3,843,724元及創新及科技基金向國家專用集成電路系統工程技術研究中心香港分中心提供的資助港幣4,560,398元。在年度內從業界所得的總收入為港幣81,618,520元，與去年水平大致相若。

經常性撥款的總支出為港幣125,222,863元，比去年同期減少港幣5,076,782元(3.9%)，主要是由於一般營運開支的淨節省。應科院全年保持穩定經營及繼續以審慎原則執行財務管理。

研發項目的總開支達港幣237,327,665元，當中73%用於人力資源，27%用於儀器及其他直接開支，總開支主要為六十八個正式項目，三十八個種子項目，一個一般支援計劃項目和七個公營機構試用計劃項目的實際現金支出。同時，實習研究員計劃支出為港幣3,843,724元，為實習研究員參與二十八個正式項目的實際薪酬支出。

應科院全年截至二零一五年三月三十一日止的綜合報表經由獨立核數師審計，並獲發無保留審計意見書。綜合損益及其他全面收益表及綜合財務狀況表詳載於第七十二至七十五頁。

## Consolidated Statement of Profit or Loss and Other Comprehensive Income
## 綜合損益及其他全面收益表

For the year ended 31 March 2015 截至二零一五年三月三十一日止年度

| | | 2015<br>HK$ 港幣 | 2014<br>HK$ 港幣 |
|---|---|---|---|
| **Subvention** | **資助** | | |
| Income from Government subvention | 政府資助收入 | 124,263,924 | 129,008,612 |
| Administrative expenses | 行政支出 | (125,222,863) | (130,299,645) |
| Deficit on subvention | 資助虧損 | (958,939) | (1,291,033) |
| **Project Funding from Innovation and Technology Fund and Industry Contributions** | **創新及科技基金及業界投入資金** | | |
| Project fund income | 項目收入 | | |
| - Innovation and Technology Fund | - 創新及科技基金 | 193,752,810 | 204,706,863 |
| - Industry contributions | - 業界投入資金 | 35,575,897 | 24,650,677 |
| Project expenditure | 項目支出 | (229,328,707) | (229,357,540) |
| Balance on project funding | 項目資金餘額 | - | - |
| **Project Fund Income - General Support Programme** | **項目資金收入 - 一般支援計劃** | | |
| - Innovation and Technology Fund | - 創新及科技基金 | 376,015 | 341,209 |
| - Industry contributions | - 業界投入資金 | 54,615 | 292,800 |
| Project expenditure | 項目支出 | (430,630) | (634,009) |
| Balance on project funding | 項目資金餘額 | - | - |
| **Project Fund Income - Public Sector Trial Scheme** | **項目資金收入 - 公營機構試用計劃** | | |
| - Innovation and Technology Fund | - 創新及科技基金 | 7,568,328 | 1,162,279 |
| Project expenditure | 項目支出 | (7,568,328) | (1,162,279) |
| Balance on project funding | 項目資金餘額 | - | - |
| **Internship Funding from Innovation and Technology Fund** | **創新及科技基金的實習研究員計劃基金** | | |
| Internship fund income | 實習研究員計劃資助收入 | 3,843,724 | 3,890,103 |
| Internship expenditure | 實習研究員計劃支出 | (3,843,724) | (3,890,103) |
| Balance on internship funding | 實習研究員計劃資助餘額 | - | - |

| | | 2015<br>HK$ 港幣 | 2014<br>HK$ 港幣 |
|---|---|---|---|
| **Funding Support from Innovation and Technology Fund for Chinese National Engineering Research Centre for Application Specific Integrated Circuit System (Hong Kong Branch)** | **創新及科技基金給國家專用集成電路系統工程技術研究中心(香港分中心)的資助** | | |
| Expenditure incurred in relation to Funding Support from Innovation and Technology Fund | 由創新及科技基金資助的有關支出 | (4,560,398) | (4,892,303) |
| Amount for reimbursement | 發還款項 | 4,560,398 | 4,892,303 |
| | | - | - |
| **Other Net Income** | **其他淨收入** | | |
| Other income | 其他收入 | 45,988,008 | 58,270,480 |
| Other expenses | 其他支出 | (24,601,445) | (29,651,497) |
| Other net income | 其他淨收入 | 21,386,563 | 28,618,983 |
| **Amount Refund to the Government of the Hong Kong Special Administrative Region** | **退還香港特別行政區政府款項** | (12,329,240) | (22,192,895) |
| **Surplus Before Taxation** | **稅前盈利** | 8,098,384 | 5,135,055 |
| **Income Tax Expense** | **稅收支出** | (482,785) | (791,620) |
| **Surplus for the Year** | **本年度盈利** | 7,615,599 | 4,343,435 |
| **Other Comprehensive Loss to be re-classified to Profit or Loss in subsequent periods** | **在以後會計期重新分類作收入或虧損的其他全面虧損** | | |
| Exchange differences arising on translation of foreign operations | 外幣報表換算差額 | (148) | (10,063) |
| **Total Comprehensive Income for the Year** | **本年度全面總收入** | 7,615,451 | 4,333,372 |

## Consolidated Statement of Financial Position
## 綜合財務狀況表

As at 31 March 2015 and 2014 於二零一五年及二零一四年三月三十一日

| | | 2015<br>HK$ 港幣 | 2014<br>HK$ 港幣 |
|---|---|---|---|
| **Non-current Assets** | **非流動資產** | | |
| Property, plant and equipment | 物業、機器及設備 | 4,713,131 | 5,791,065 |
| **Current Assets** | **流動資產** | | |
| Prepayments, accounts and other receivables | 預付賬款、賬戶及其他應收款項 | 23,403,511 | 24,993,949 |
| Amount due from the Government of the Hong Kong Special Administrative Region | 應從香港特別行政區政府收回款項 | 4,560,398 | 4,892,303 |
| Tax receivable | 可退回稅項 | - | 188,333 |
| Bank balances and cash | 銀行結餘及現金 | 260,249,921 | 218,008,965 |
| | | 288,213,830 | 248,083,550 |
| **Current Liabilities** | **流動負債** | | |
| Accounts and other payables | 賬戶及其他應付款項 | 59,070,424 | 58,106,612 |
| Receipts in advance | 預收款項 | 143,523,013 | 102,763,139 |
| Amount due to the Government of the Hong Kong Special Administrative Region | 應付予香港特別行政區款項 | 12,430,686 | 22,202,916 |
| Tax payable | 應付稅項 | 440,965 | - |
| | | 215,465,088 | 183,072,667 |
| **Net Current Assets** | **流動資產淨值** | 72,748,742 | 65,010,883 |
| **Total Assets Less Current Liabilities** | **總資產減流動負債** | 77,461,873 | 70,801,948 |
| **Non-current Liabilities** | **非流動負債** | | |
| Deferred tax liabilities | 遞延稅項 | - | 955,526 |
| **Net Assets** | **資產淨值** | 77,461,873 | 69,846,422 |
| **Equity** | **股權** | | |
| Share capital | 股本 | 2 | 2 |
| Accumulated surplus | 累計盈餘 | 77,412,788 | 69,797,189 |
| Translation reserve | 折算儲備 | 49,083 | 49,231 |
| **Total Equity** | **股權總值** | 77,461,873 | 69,846,422 |

Note:

The above financial information relating to the years ended 31 March 2015 and 31 March 2014 set out on pages 72 - 74 does not constitute the Company's statutory annual consolidated financial statements for those years but is derived from them. Further information relating to those statutory consolidated 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 auditors have reported on the financial statements of the Company for both years. The auditors' reports were unqualified; and did not include a reference to any matters to which the auditors drew attention by way of emphasis without qualifying their reports; and did not contain a statement under section 406(2), 407(2) or (3) of the Hong Kong Companies Ordinance.

備註：

以上第七十二至七十四頁截至二零一五年三月三十一日及二零一四年三月三十一日的財政資料並不構成本公司有關財政年度的法定財務報表，但這些財務資料均取自有關財務報表。有關這些法定財政表需要根據香港公司條例第四百三十六條作進一步披露的資料如下：

由於本公司是私人公司，無須向公司註冊處遞交財務報表，同時從未遞交過。本公司的核數師已報告了兩年間的財務報表。核數師呈交的無保留報告，並不包括該核數師在其報告不作保留意見之情況下，以強調的方式促請有關人士注意的任何事宜之提述，亦未載有按香港公司條例第四百零六(二)、四百零七(二)或(三)所指的陳述。

## Contact Us

### Head Office

**Hong Kong Applied Science and Technology Research Institute Company Limited**

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

**Tel:** (852) 3406 2993
**Fax:** (852) 3406 2801
**Email:** corporate@astri.org

### Shenzhen Office

**ASTRI Science and Technology Research (Shenzhen) Company Limited**

Room 220, 2/F, Chinese Overseas Scholars Venture Building, South District, Shenzhen Hi-tech Industrial Park, Nanshan, Shenzhen, Guangdong, PRC 5180587

**Tel:** (86 755) 8632 9394
**Fax:** (86 755) 8632 9394
**Email:** corporate@astri.org

## 聯絡我們

### 香港辦事處

**香港應用科技研究院有限公司**

香港沙田香港科學園科技大道東2號光電子中心5樓

**電話:** (852) 3406 2993
**傳真:** (852) 3406 2801
**電郵:** corporate@astri.org

### 深圳辦事處

**應科院科技研究(深圳)有限公司**

中國廣東省深圳市南山區高新區南區南環路29號留學生創業大樓2樓220室(郵編:518057)

**電話:** (86 755) 8632 9394
**傳真:** (86 755) 8632 9394
**電郵:** corporate@astri.org

This annual report is published by the authority of the Board of Directors of ASTRI

此年報由應科院董事局授權印製

The project team would like to thank the various ASTRI departments and valued partners for their contributions and support.

謹此特別鳴謝應科院各部門及合作夥伴為製作這份年報所提供的協助和支持。