Automotive Platforms and Application Systems (APAS) R&D Centre
汽車科技研發中心

Content 目錄

About APAS
研發中心簡介

Automotive Platforms and Application Systems (APAS) R&D Centre was established in 2006 by the Innovation and Technology Commission of HKSAR Government and hosted by the Hong Kong Productivity Council. The Centre undertakes R&D programmes as well as commercialising R&D results in collaboration with industry, universities and technology institutes for the development of the APAS industry. Since its establishment, APAS R&D Centre has carried out over 100 R&D projects and focus on 3 R&D areas, Green Transportation, Smart Mobility and Intelligent Systems. To facilitate greater synergy and further enhance cost effectiveness, APAS is merged with and form part of the Hong Kong Productivity Council with effect from 1 Nov 2012.

香港特區政府創新科技署在2006年成立汽車科技研發中心，並由香港生產力促進局承辦。多年來，一直透過技術研發，並與業界、大學和技術機構合作，把研發成果轉化為商品，從而促進汽車零部件業的發展。本研發中心成立以來，已執行項目超過一百多個。主力研發方向包括綠色運輸、智慧移動和智能系統。研發中心與香港生產力促進局於2012年11月1日合併並成為生產力局的一部份。

Innovation Technology Fund
創新科技基金

APAS R&D Centre coordinates automotive-related project funding application to Innovation Technology Fund. Types of project include:

研發中心負責協調創新科技基金範疇下的汽車科技項目申請。項目種類包括：

Project Type 項目種類	Government Fund 政府基金	IP Owner 知識產權擁有者	Licensing Fee△ 許可費用△	Royalty Sharing△ 提成共享△
Seed 種子	100%	HKPC	✓	✓
Platform 平台	90%	HKPC	✓	✓
Collaborative 合作	49%	Sponsor 客戶		✓
Contract 合約	0%	Sponsor 客戶		

△ Negotiable
△ 可協商

Examples 例如:

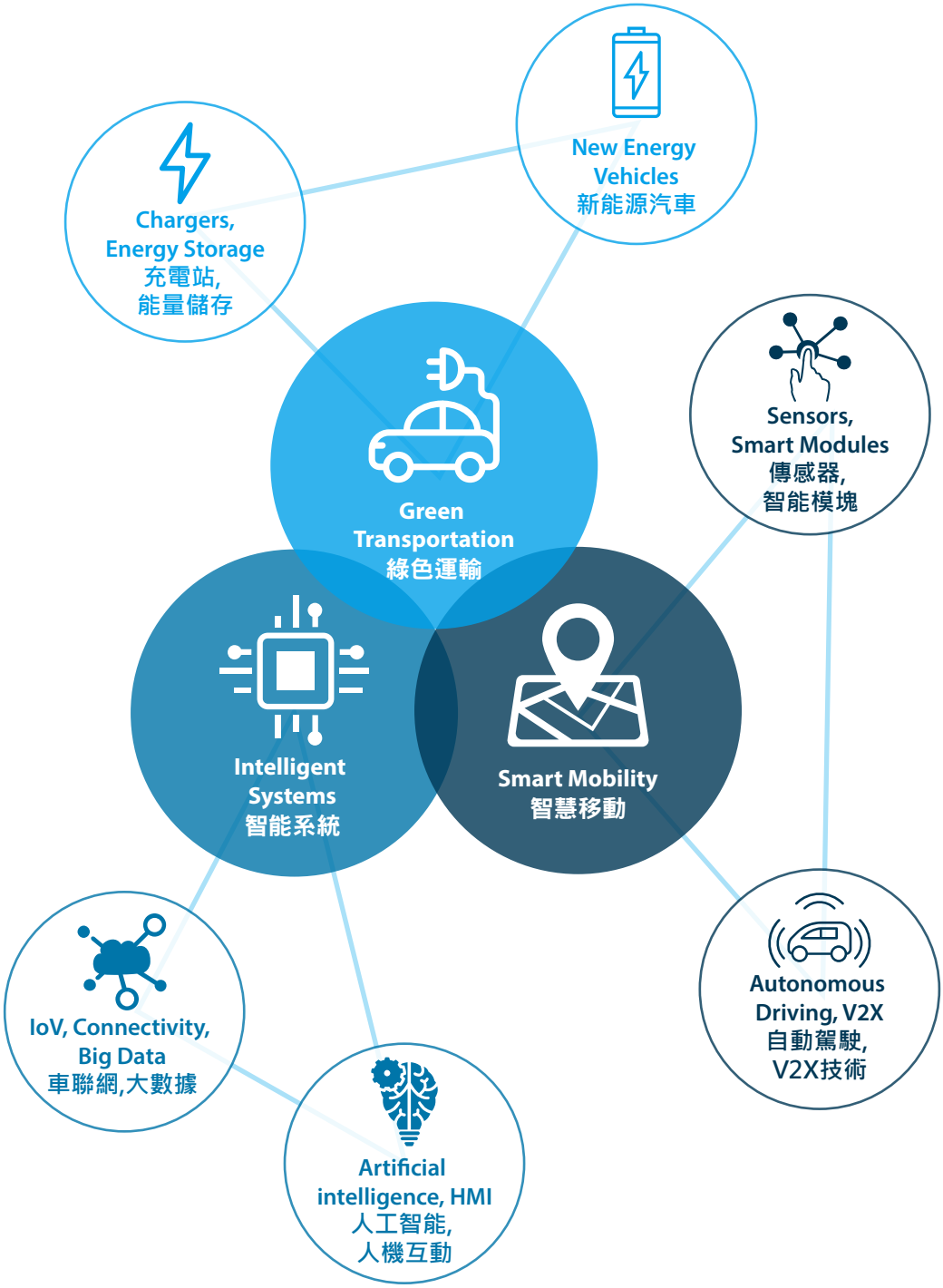
Project Sum 項目總和	Project Fund 項目總類	Gov Fund 政府基金	Industry Sponsorship 業界贊助資金	Cash Rebate* 現金回贈*	Profit Tax Savings# 稅務扣減#	Industry Actual Sponsorship 業界實際贊助
$1000萬	Platform 平台	$900萬	$100萬	$40萬	$29.7萬	$30.3萬
$1000萬	Collaborative 合作	$490萬	$510萬	$204萬	約$134萬	約$172萬

* Under the scheme, the approved industry sponsorship will be able to receive a cash rebate equivalent to 40% of its expenditure from ITF.
* 所有業界投入的贊助資金可獲創新科技基金回贈所投入總額的40%。
\# The deduction will be 300% for the first $2 million of the aggregate amount of qualifying R&D expenditure, and 200% for the remaining amount. There is no cap on the amount of relevant tax deduction.
\# 合資格研發支出總額的首200萬元，可獲300%稅務扣減，餘額亦可獲200%扣減；額外扣稅金額不設上限。

Innovation and Technology Commission has introduced new improvement measures to the Innovation and Technology Fund, for details, please visit http://www.itc.gov.hk

創新科技署推出了多項創新及科技基金優化措施，詳情可瀏覽 http://www.itc.gov.hk

Featured R&D Technologies
重點研發技術領域



Swappable Battery Pure Electric Minibus
可換電池電動小巴

The unique 7-meters 19-seaters Pure Electric Minibus is natively designed to cater for busy commercial vehicles operation in Hong Kong. The drained battery can be swapped quickly and fully automatically with a full-power battery in the swappable battery station. The Electric Minibus is no longer required to wait for long recharging time. This Electric Minibus has the low floor design which provides a safe, stable and comfortable journey to passengers. It also equips a monitoring system to send real-time operation data to fleet center.

這款獨特的7米19座純電動小巴經過精心設計，可滿足香港繁忙的商用車輛運營需求。電動小巴可在換電站中心進行全自動快速換電，不需要用長時間為電動小巴充電。電動小巴以低地台設計，可為乘客提供安全、穩定和舒適的旅程。它還配備了一個監控系統，可以向車隊中心發送實時操作數據。

Major Benefit 主要的好處

1) Zero roadside emission
2) Fast battery swapping in less than 7 minutes
3) The low floor design is safe and easy for passenger boarding and alighting the minibus
4) Real-time passengers counting, seat-belt monitoring and vehicle running data feedback to fleet operation center

1) 可達到路邊零排放
2) 更換電池可於7分鐘內完成
3) 低地台設計，上落小巴較容易和安全
4) 乘客數目、安全帶監控和行車數據實時傳送到車隊運營中心

Application Area 應用領域

1) Public minibus, company shuttle bus, school bus
2) Delivery truck

1) 公共小巴、公司穿梭巴士及校巴
2) 運貨車

12 metre Plug-in Hybrid Electric Coach
12米長插電式混合動力客車

The 12-metre Plug-in Hybrid Electric Coach, the-first-of-its-kind to be designed, developed and assembled in Hong Kong, can recharge its Lithium Titanate batteries on the fly, thereby fulfilling the busy turnaround cycles required by the commercial fleet operator. As compared to traditional diesel coaches, it can achieve at least 40% fuel saving and 50% reduction in emission. There will be further fuel saving when the batteries are recharged at the fast charging stations. It only needs 25 minutes to charge up to 80% battery level.

首部香港設計、開發及組裝的12米長插電式混合動力客車，可以在行駛過程中為車上的鈦酸鋰電池充電，滿足客車服務營運商的繁忙續航要求。插電式混合動力客車比一般柴油客車可節省超過40%柴油消耗，減少廢氣排放超過50%。若使用快速充電站直接為電池充電，可再減低油耗，只需25分鐘便能充滿8成電。

Major Benefit 主要的好處

1) Zero emission under pure electric mode
2) Achieve up to 50% fuel saving as compared to traditional diesel coach
3) The coach can travel continuously without the need to stop for battery recharging, meeting the busy schedule of commercial vehicles

1) 純電動模式下，可達到零排放
2) 相比一般柴油客車節省最多50%柴油
3) 客車可持續行駛而不需停下來充電，滿足營運車繁忙行駛要求

Application Area 應用領域

1) Coach, school bus and circular route bus
2) In pure electric mode, it can operate in zero emissions zone

1) 旅遊巴、校巴及循環線巴士
2) 在純電動模式下，可在零排放地區行駛

16 Tonne Pure Electric Truck
16噸純電動勾斗車

The 16-tonne Pure Electric Truck is equipped with a high efficiency Permanent Magnet Synchronous Motor (PMSM) and high capacity battery pack for long range driving. The integrated motor controller and modular battery pack can be fine-tuned and are suitable for different driving ranges and road gradients commonly seen in Hong Kong and China.

16噸純電動勾斗車配備了高效率永磁同步電機(PMSM)和高容量電池組，適用於長距離行駛。集成的馬達控制器和模組化設計的電池組可以進行微調，適用於香港及中國內地的不同行駛距離和路面坡度。

Major Benefit 主要的好處

1) Long driving range up to 200 km per charge
2) 1-hour battery charging time (using a 180 kW off-board charger)
3) Localization design with the PMSM and Automatic Transmission gearbox for high road gradient up to 20%
4) Universal chassis system design for various applications

1) 續航能力強，充一次電可行駛 200 公里
2) 能於1小時把電池組充滿 (使用180千瓦時的充電樁)
3) 本土化設計的永磁同步電機和自動變速箱，能於坡度為20%的道路行駛
4) 通用式底盤設計，能配合不同車身，應用於不同領域

Application Area 應用領域

1) Solid waste collection trucks
2) Logistics trucks
3) Sweepers

1) 固體廢物回收貨車
2) 物流貨車
3) 機動掃街車

Single-deck Pure Electric Bus
純電動單層巴士

The 12-meter single-decker electric bus is equipped with high efficiency Permanent Magnet Synchronous Motor (PMSM), lightweight body shell that made of T6 grade aluminum alloy, advanced Battery Management System (BMS), Smart Driving System, Vehicle Data Cloud Network Platform and aerosol fire extinguisher, which is fine-tuned and suitable for Hong Kong and Mainland China Market.

12米單層純電動巴士配備了高效能永磁同步馬達、輕量化鋁合金車身、先進的電池管理系統、智能駕駛系統、車聯網雲端大數據平台和氣溶膠電池滅火裝置，適合香港和大陸市場使用。

Major Benefit 主要的好處

1) Lightweight bus body made of T6 grade aluminum
2) Smart driving system enhances driving safety
3) Vehicle Data Cloud Network Platform can facilitate fleet management

1) T6級鋁合金輕量化車身
2) 智能駕駛系統可提升駕駛安全
3) 車聯網雲端大數據平台協助管理車隊

Application Area 應用領域

1) Franchised public bus
2) Non-franchised public bus
3) Sightseeing bus in tourist attraction areas

1) 專營巴士
2) 非專營巴士
3) 旅遊景點內的觀光巴士

Portable Charger Kit
手提式電動車充電系統

The Portable Charger Kit (PCK) is a handheld electric vehicle charger. It replaces the traditional wall-mounted AC charger by using a PCK socket, which is small, low cost, easy to install and maintain. It uses a proprietary AC power socket with wireless authentication for medium to fast charging, reducing the need and cost to install numerous PCK sockets in car parks.

手提式電動車充電系統便於攜帶，毋須安裝傳統的掛牆式充電裝置，體積小巧、成本低，易於安裝和維修保養。系統備有獨立充電器及插座，採用無線認證技術，電動車車主只需將自攜手提式充電器，插於對應的停車場插座，即可為座駕進行中速至快速充電，大幅降低停車場安裝充電樁的成本。

Major Benefit 主要的好處

1) Low installation and maintenance cost
2) Small and easy to install
3) No networking infrastructure is required

1) 低安裝和維修成本
2) 體積小，易於安裝
3) 不需要網絡基礎設施

Application Area 應用領域

1) Provide medium fast charging for electric vehicles
2) Provide charging points in car parks of commercial and residential buildings
3) Car parks where non-designated ("floating") parking spaces in dominant or parking spaces are congested

1) 為電動汽車提供中速充電
2) 在商業和住宅建築的停車場提供充電點
3) 非指定（"浮動"）停車位為主或高密度停車場尤其適合

Wireless Electric Vehicle Charger
無線電動車充電站

The Wireless Electric Vehicle Charger (WEVC) charges the Electric Vehicle (EV) via the air by magnetic resonance. The WEVC transmits electrical energy from transmitter coil on the ground to the receiver coil on the EV chassis with high energy transfer efficiency. APAS has developed a high efficiency and safe WEVC with medium charging power and magnetic flux leakage protection. It is designed to the SAE standard J2954 on wireless power transfer and it is compatible to European, American, Japan and Chinese EVs.

電動車無線充電器(無線充電器)是通過磁力共振原理為電動車隔空充電。利用安裝在地面的發射線圈，高效地把電能發送到安裝在車底的接收線圈。這無線充電器是根據SAE J2954標準設計，兼容歐洲、美國、日本和國內電動車，它還具備電磁洩漏保護設計，令充電更加安全。

Major Benefit 主要的好處

1) Make EV charging more convenient
2) Medium charging power (7kW – can charge up a BMW i3 in 3 hours)
3) Magnetic flux leakage protection
4) Design to SAE standard J2954 for high compatibility

1) 令充電更方便
2) 中速充電(7kW – 以BMW i3 EV為例，只需3小時便可充滿)
3) 具備電磁洩漏保護
4) 根據SAE J2954標准設計，高兼容性

Application Area 應用領域

1) Pure Electric Vehicle (PEV)
2) Plug-in Hybrid Electric Vehicle (PHEV)
3) Other battery powered vehicles

1) 純電動車 (PEV)
2) 插電式混合動力電動車 (PHEV)
3) 其它電池驅動汽車

Smart Mobile EV Charger
智能流動電動車充電系統

Smart Mobile EV Charger is a mobilised charger that offers roadside assistance when the Electric Vehicle (EV) is out of power. It takes 4 minutes to give the battery-drained EV an extra 20 km mileage so that the EV can reach the nearest charging station for proper charging.

這個流動電動車充電系統，能夠提供緊急電動車充電服務，解決電動車於路上「無電拋錨」的問題。只需充電四分鐘，即可為電動車續航20公里，讓電動車可行駛至就近的充電站。

Major Benefit 主要的好處

1) Provide on-spot charging services, effectively resolve driver's range anxiety issue
2) Fast charge for 4 minutes to gain 20km ranging distance, or charge an EV to 80% full in just 40 minutes*
3) All-in-one solution for different EV standards at different charging speeds, including Japan CHAdeMO, Euro IEC CCS (Combo2) and IEC 62196 single-phase
4) Proliferate EV adoption in the community

1) 提供有效到位充電服務，有效解決駕駛者的里程焦慮問題
2) 只需快充4分鐘，便可讓電動車增添20公里里程；或只需40分鐘便可把電動車快充至八成滿電*
3) 完整方案能滿足多個充電標準，包括日本標準CHAdeMO、歐洲標準IEC CCS (Combo2) 及IEC 62196 單相交流中速充電
4) 促進電動車在社會上普及化

Application Area 應用領域

1) Public parking areas (e.g. shopping centers, public car parks)
2) Emergency roadside charging service

1) 公共停車場 (如購物中心、公眾停車場)
2) 路邊緊急充電服務

* Estimation based on Nissan Leaf or BMW i3
* 以日產LEAF或 BMW i3電動車估算

50kW Fast Charging Station
50kW快速充電站

Following its inaugural launch, the 50kW fast charging station with more robust features is introduced to facilitate Electric Vehicle (EV) adoption in Hong Kong. The station takes as fast as 20 minutes to charge an EV up for travelling 150km. It has attained international certification for its excellent performance of maintaining battery life, driving safety and compatibility with electricity networks.

「加強版」50kW快速充電站功能比首個快速充電站更強，幫助推動電動車在香港的發展。以一般電動私家車為例，最快只需20分鐘便能充電八成，可行駛150公里。充電站在保障電池壽命、行駛安全和供電網絡兼容等各方面表現卓越，獲得國際認證。

Major Benefit 主要的好處

1) This quick charging station provides great convenience and efficient EV usage for drivers
2) Offer a complete quick charge solution for both Japanese and European electric vehicles in market

1) 此快速充電站讓司機更方便及有效使用電動車
2) 為市場上的日系及歐系電動車提供了更完備快速充電方案

Application Area 應用領域

1) Public charging stations (e.g. shopping centers, public car parks, highways)
2) Private car parks
3) Public transportation and commercial fleets

1) 公共充電站 (如購物中心、公共停車場、高速公路)
2) 私人車位
3) 公共交通及商用車車隊

Smart EV Charging Station Load Management System
智能電力分配系統

The Smart EV Charging Station Load Management System monitors and analyses power usage of each Electric Vehicle (EV) charger in real-time connecting multiple parking spaces, optimizing the use of limited power. It provides rated power (100%) when there are only a few EVs. When more EVs are connected, the system can reduce power output of some chargers (e.g. 50%) so as to allocate additional power to the just-arrived vehicles.

智能電力分配系統會連接多個充電車位，實時監察和分析充電器的用電情況，善用有限的能源。當只有少量電動車充電時，充電器能以額定值（100%）為電動車充電；當同時有多輛電動車需要充電，系統會因應電池的電量來分配電力，調低部份充電器的電力輸出（例如50%），以騰出電力為剛到達的電動車充電。

Major Benefit 主要的好處

1) Real-time monitor of the power usage of EV chargers
2) Fully utilize carpark electricity capacity for EV charging station
3) More EV chargers can be installed in old building or the existing buildings with limited spare electricity capacity

1) 實時監測充電器的電力使用情況
2) 更有效地分配停車場的電力以供充電站之用
3) 使更多電動車充電器可裝設在一些落成已久或後備供電容量有限的大廈停車場

Application Area 應用領域

1) Carpark with limited spare electricity capacity for EV charging station
2) Carpark need a large scale installation of EV chargers

1) 落成已久及後備供電容量有限作充電站的停車場
2) 需要大規模裝設充電設施的停車場

ISO26262 Compliant BMS
符合ISO26262的電池管理系統

APAS Battery Management System (BMS) was re-developed in compliance with ISO 26262 ASIL C which is on par with the safety integrity level set by leading car makers. Detailed technical design was derived from holistic high level safety analyses including HARA, FTA, FMEA, HAZOP, etc. As a result of complying with state-of-the-art engineering practices, correctness and completeness of requirements, specifications and technical implementation were verified, the outcome is significant improvement in quality, reliability and safety - a hallmark of automotive electronic control system.

APAS遵照汽車功能安全ISO 26262 ASIL C規範提升了現有的電池管理系統(BMS)的品質和安全性，從而使BMS的安全等級與業內領先的汽車生產商一致。技術設計從整體的安全分析開始，涵蓋包括功能安全風險評估(HARA)、故障樹分析(FTA)、失效性分析(FMEA)和危險與可操作性分析(HAZOP)等流程。BMS採用最先進的系統工程規範，確保所有需求、規格及設計的完整性和正確性都得到充分驗證。結果體現在系統的品質、可靠性和安全性都大幅度提升，而這些特性正是汽車電子控制系統的重點。

Major Benefit 主要的好處

1) To provide diagnostic coverage for Single Point Fault Metric (SPFM), Latent Fault Metric (LFM) and quantitative target of Probabilistic Metric for random Hardware Failure (PMHF)
2) Use AUTOSAR OS as Software Element Out Of Context (SEooC) to boost efficiency of software development
3) Maintain holistic work products for development of ISO 26262 systems

1) 提供單點故障(SPM)和潛在故障(LFM)的診斷覆蓋及硬件故障概率(PMHF)的定量目標
2) 採用AUTOSAR作業系統作為SEooC以提升軟體發展效率
3) 全面的維護管理以便其它ISO 26262系統開發

Application Area 應用領域

1) Battery Management System
2) Vehicle Control Unit
3) Safety Critical Automotive Control Systems

1) 電池管理系統
2) 整車控制器
3) 汽車安全控制系統

Advanced and Integrated Motorcycle Electronic Fuel Injection System
先進的集成式電單車電子噴射系統

The advanced and integrated electronic fuel injection system for motorcycle uses the sophisticated control algorithms to realize the optimum air-fuel ratio so as to fulfill the Euro-IV Emission Standard. The system is able to calibrate different types of motorcycle engines through the tailor-made tuning software. The system is also equipped with advanced On-Board Diagnostics (OBD) and Bluetooth module to help the driver to inspect the motorcycle operation status and diagnose the motorcycle faults as well as provide timely maintenance.

電單車電子燃油噴射系統採用了先進的控制算法，以實現最佳的空氣燃料比以達致歐盟四期排放標準，透過定制的標定軟件，系統能夠方便調校不同排量的摩托車發動機。系統還配備了先進的車載診斷系統(OBD)與藍牙模組，方便駕駛員檢查電單車狀態與診斷車輛故障並作出及時維修保養。

Major Benefit 主要的好處

1) Enhance fuel efficiency and reduce emissions
2) Improve the drivability under different engine operation modes
3) Low retrofit cost of electronic fuel injection for conventional carburetors
4) Inspect the motorcycle status and diagnose the motorcycle faults

1) 改善油耗和降低排放
2) 改善不同工況下摩托車的驅動性能
3) 改裝電子噴射系統的成本較傳統化油器的成本更低
4) 檢查電單車的狀態並診斷車輛故障

Application Area 應用領域

1) Motorcycle engines (to fulfil Euro-IV Emission Standard)
2) Industrial machines with small engines (such as lawn mower)

1) 不同排量的摩托車 (需滿足歐盟四期排放標準)
2) 配備小型發動機的工業設備 (如割草機)

Smart Vehicle-to-Home (V2H) System
智能V2H電力供應系統

The Smart Vehicle-to-Home System makes Electric Vehicle (EV) batteries as energy storage devices for households. Installing with V2H system, the electrical power stored in the EV batteries can be transferred to households in peak hours when electricity is at high price. It helps save electricity cost and alleviate the high electricity demand in peak hours.

智能V2H電力供應系統可將電動車電池用作家居儲能裝置。在電費高峰時期，系統可以把儲存在電動車電池中的電力轉移到用戶家中使用，不但節省電費，更有助於緩解高峰時段的電力需求。

Major Benefit 主要的好處

1) Save electricity cost when there is time variant tariff
2) Relieve the high power consumption situation in peak load hours
3) EVs can serve as emergency power sources

1) 可以節省電費的電價
2) 緩解電力高峰時段的供電需求
3) 電動車可以作為應急電源

Application Area 應用領域

1) Energy storage devices for households
2) Emergency power source when there are power outages
3) Temporary power source for premises without power sources

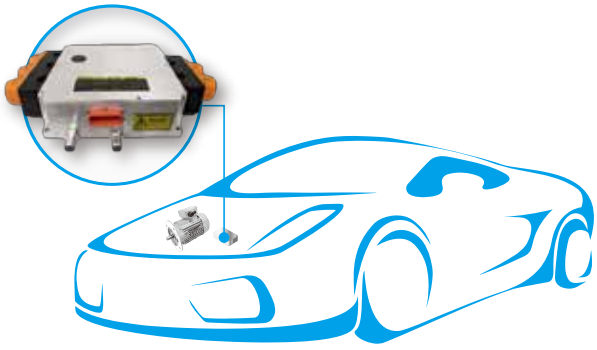
1) 用作家居儲能裝置
2) 停電時提供應急電源
3) 為沒有電源的場所提供臨時電力

High Efficiency Silicon Carbide (SiC) Motor Controller

碳化矽(SiC)高效馬達控制器

Motor controller is used in vehicles with electric powertrains. It supplies battery power to the traction motor during operation and recharges the battery using energy recovered during deceleration. APAS has developed a 150kW high performance motor controller based on the latest Silicon Carbide (SiC) technology, with over 3% boost in efficiency and 30% boost in power density.

在電動交通工具中，馬達控制器負責馬達功率驅動及控制，在車輛駕駛時將電池能量變換為驅動馬達的電能，而在車輛減速時可以回收能量入電池。APAS利用最新的碳化矽(SiC)技術成功開發出一款高性能150kW馬達控制器，相對傳統馬達控制器，最高效率提高3%以上，功率密度提高30%以上。



Major Benefit 主要的好處

1) Higher efficiency with 99% and higher power density with 23kW/L
2) Less current ripple and low noise
3) With robust control algorithm and reliable protection strategy
4) Driving range extends over 5%

1) 效率高達99%和功率密度高達23kW/L
2) 更小的電流紋波和低噪音
3) 採用先進的控制算法和可靠的軟硬體監控保護措施
4) 續航里程可增加5%以上

Application Area 應用領域

1) Pure Electric Vehicle (PEV)
2) Hybrid Electric Vehicle (HEV)
3) Other battery powered vehicles

1) 純電動車 (PEV)
2) 混合電動車 (HEV)
3) 其它使用電池驅動的交通工具

Hybrid Energy Storage System (HESS) For EV
電動汽車混合能量儲存系統

Li-ion batteries are high energy density in nature but not an ideal solution for frequent high power loads of typical cycles. Although ultracapacitors have higher power density, extra-long charge-discharge cycle life, its energy density is relatively low. Such properties make ultracapacitors excellent complementary ESS device to Li-ion battery for EV application. The newly developed HESS was tested with our in-house dynamometer. Since the ultracapacitor module shares most parts of the high current loads, the average current in Li-ion battery pack reduced. As a result, the battery life can be extended.

鋰電池擁有高的能量密度，但並非能滿足實際工況中頻繁的高負載充放電要求的最理想方案。超級電容雖然擁有很高的功率密度及極長的充放迴圈壽命，但其能量密度較低。這些特性使超級電容和鋰電池成為電動車理想的互補儲能裝置。我們成功開發了HESS，並在測功機平臺進行了驗證。由於超級電容分擔了大部份的大電流負載，有效降低了鋰電池平均電流，電池壽命得以延長。

Major Benefit 主要的好處

1) Control software developed by Model Based Development (MBD) has high reusability and robustness
2) Effectively extend battery life
3) Improve available power of ESS, hence achieve better vehicle performance

1) 用建模開發(MBD)的控制軟體，複用性高，安全可靠
2) 有效延長電池壽命
3) 提升儲能系統的可用功率，進而改善車輛的性能表現

Application Area 應用領域

1) Pure Electric Vehicle (PEV)
2) Hybrid Electric Vehicle (HEV)
3) Other energy storage systems

1) 純電動車 (PEV)
2) 混能電動汽車 (HEV)
3) 其它儲能系統

Retired EV Battery Mobile Charger
配備退役電動車電池的流動充電系統

The Retired EV Battery Mobile Charger provides medium charging to Electric Vehicles (EV) or supplies AC electricity. Since a retired EV battery pack still has 60-80% of the original capacity, it can be useful for less demanding energy storage applications so as to extend the life cycle of EV battery. Besides, the real-time status information is uploaded to the backend server via mobile network. Administrators can log into the web portal to monitor and remote control on/off of the Mobile Charger.

配備退役電動車電池的流動充電系統能提供電動車中速充電服務或作為交流電電源。由於退役後的電動車電池仍然有60 - 80% 的容量，因此這些電池可應用於對電力要求較低的儲能系統，從而延長電動車電池的使用壽命。此外，系統經流動網路將實時系統狀態數據傳送到後台管理系統，管理人員可登入網站以監察及遙距開關流動充電系統。

Major Benefit 主要的好處

1) Repurpose retired EV batteries, extend the life cycle of EV battery
2) Real-time online monitoring of charger and battery status (e.g. operating mode, battery voltage, current, state-of-charge, transaction records)
3) Remote control on/off of the mobile charger

1) 重用退役電動車電池，延長電池的使用壽命
2) 實時線上監察系統及電池狀態 (如運作模式、電池電壓、電流、剩餘電量和使用記錄等)
3) 遙距開關流動充電系統

Application Area 應用領域

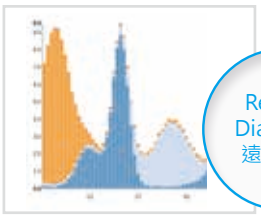
1) Mobile EV charging service
2) Mobile or emergency power source (e.g. at roadworks, during power outage)

1) 流動的電動車充電服務
2) 流動或應急電源 (如在道路工程和停電時等)

Smart Street Lights for V2X
智能街燈系統

The wireless Smart Street Light system uses sensors and data analytics to monitor traffic conditions to enable Vehicle-to-everything (V2X) communication, including infrastructure. Apart from taking remote ON/OFF control, it measures voltage, current and power of each street light, monitoring its real-time status. Information will be uploaded to a central management system via mobile network. In case of malfunction, it will instantly and automatically alert engineers to arrange precautionary maintenance.

無線智能街燈系統配備感應器，透過車輛與周邊基建設施的溝通，分析和監察路面交通情況。此外，該系統亦可遙距控制街燈開關，實時監察每支街燈的狀態，測量街燈的電壓、電流和功率，再經由流動網路將有關實時數據傳送到中央管理系統，即時自動向維修人員發出故障警報，以進行預防式維修保養。



Remote Diagnosis 遠程診斷

Traffic Monitoring 交通監察

Major Benefit 主要的好處

1) Provide real-time traffic conditions to drivers
2) Remote ON/OFF streetlight
3) Voltage, current and power measurements of individual streetlight
4) Automatic detection of malfunction streetlight and preventive maintenance

1) 實時向駕駛者提供路面交通情況
2) 遙距控制街燈開/關
3) 測量街燈的電壓，電流和功率
4) 自動及實時發出故障警報給維修人員及進行預防性的維護

Application Area 應用領域

1) Streetlight system
2) Road Surveillance System

1) 街燈系統
2) 路邊監察系統

The 2nd Generation MOST-150 In-vehicle Infotainment System
第二代MOST-150車內資訊娛樂系統

The 2nd generation in-vehicle infotainment system adopts the MOST-150 "Multiple ring networking technology". The server on board connects to hundreds of high definition display terminals. Through synergy of software and hardware design as well as the provision of big data cloud service, the system will not only integrate more attractive features but also enhance the user experience.

第二代車內資訊娛樂系統採用MOST-150「多環網絡技術」，主機同時連接數百個高清顯示終端機。透過軟硬件協同設計和大數據雲端服務，該系統不但能夠集成更多功能，還能提升用戶體驗。

Major Benefit 主要的好處

1) Provide in-vehicle connectivity technology based on MOST-150 standard
2) Provide rich user experience for long-distance journey
3) Provide business intelligence solution through big data cloud service

1) 提供基於MOST-150標準的車內互聯技術
2) 為長途旅行提供更豐富的用戶體驗
3) 透過大數據雲端服務提供商業智能的解決方案

Application Area 應用領域

1) Mass transportations, include coach, high-speed ship and high-speed train
2) Mobile advertisement and media companies
3) E-commerce companies

1) 集體運輸交通工具 (如旅遊巴士、高速船和高鐵等)
2) 移動廣告傳媒公司
3) 電子商務公司

Full Digital Configurable TFT Instrument Cluster
全數字化配置的TFT儀表盤

The Full Digital Configurable Instrument Cluster Development Platform provides a highly flexible solution for the design of the instrumentation display. It consists of embedded hardware with full TFT display panel and PC based software design tool. The PC software tool facilities the design and simulate of logic and visual effect on the instrument cluster. It can also generate program source code for the embedded hardware. It allows design engineers to shorten the development time, deliver consistent and more reliable program code.

全數字儀表配置開發平台提供了一個高度靈活的解決方案，以開發汽車內儀表的設計。它包括一個完整的TFT顯示面板的嵌入式硬件和於電腦上使用的軟件設計工具。利用電腦軟件工具能夠設計及模擬顯示效果及邏輯，更可產生程序的源代碼，在嵌入式硬件平台上使用，它可使設計工程師能夠縮短開發時間，提供一致和更可靠的程序代碼。

Major Benefit 主要的好處

1) Simplify design process
2) Faster development
3) More reliable program source code

1) 簡化設計流程
2) 加快開發速度
3) 更可靠的程式源代碼

Application Area 應用領域

1) Traditional Vehicles
2) Pure Electric Vehicles (PEV)
3) Hybrid Electric Vehicles (HEV)

1) 傳統汽車
2) 純電動車 (PEV)
3) 混能電動汽車 (HEV)

Autonomous R&D Platform
自動駕駛開放式研發平台

The Autonomous R&D platform is equipped with robust drive-by-wire capability, Artificial Intelligence platform, 8 HD cameras and a 3D Lidar. A 5G receiver is installed on the platform by CMHK, enabling it to be controlled through 5G signal. It is built with multiple levels of operational redundancy, putting functional safety as top priority. At any point, the driver can regain full control.

自動駕駛開發平台具備線控技術、人工智能平台、8個高解像鏡頭和3D光學雷達(LiDAR)。中國移動亦在平台上安裝了5G接收器，因此可透過5G訊號控制平台。此外，平台提供了多重後備運作系統，以提升安全。司機亦可在任何情況下重新控制車輛行駛。

Major Benefit 主要的好處

1) Solve lack of drivers in certain commercial vehicles in Hong Kong
2) Improve safety by avoiding accident caused by drunk driving and distracted drivers
3) Enable V2X applications with 5G technology, including traffic management to improve throughput and safe traffic

1) 解決香港某些商用車輛司機短缺問題
2) 避免醉酒駕駛和司機分心駕駛所造成的事故，提高安全性
3) 使用5G技術啟用V2X應用，包括流量管理，以提高吞吐量和交通安全

Application Area 應用領域

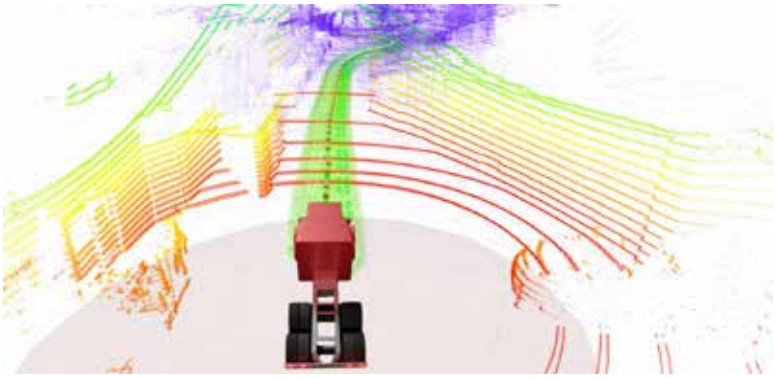
1) Autonomous taxi, bus and tractor
2) Low latency remote controlled driving and traffic management
3) Other autonomous mobile machines used indoor, e.g. mobile vending machine

1) 自動駕駛的士、巴士和拖拉機
2) 低時延遠程操控駕駛和交通管理
3) 其他於室內使用的自動行駛機器，如自動移動售賣機

Autonomous E-tractor
自動駕駛電動拖頭車

The autonomous E-tractor is an innovative initiative in the airport running between the staging area and cargo apron. As a first trial, extensive tests are carried out to ensure quality, safety, and robustness of the tractor to work in the dedicated region. Tests cover a wide range of situations found in daily operations, like running through curve road, merging lane, tunnel, round-about and etc. Finally, professional recommendations and assessment reports about the satisfaction on both functional and safety requirements will be provided by APAS.

自動駕駛電動拖頭車是一項科技創新試行計劃，於機場的貨運區及停機坪間運行。作為第一次試行，我們必須進行廣泛的測試，以確保拖頭車的質量、安全性和穩定性，確保在專用區域能正常運作。測試涵蓋日常操作中會出現的各種情況，如穿越曲線道路、合併車道、隧道和迴旋處等。最後，APAS將提供專業建議和有關功能和安全要求滿意度的評估報告。



Major Benefit 主要的好處

1) Qualify the stability and safety of autonomous vehicles
2) Provide assessment methodology and standard for autonomous vehicles

1) 確保自動駕駛車的穩定性和安全性
2) 為自動駕駛車提供評估方法和標準

Application Area 應用領域

1) Autonomous tractor or truck in confined area of airport and seaport
2) Autonomous vehicles in amusement parks or resorts

1) 在機場及港口的限制區域內的自動駕駛拖頭車及貨車
2) 遊樂園及度假區內的自動駕駛車

Autonomous Delivery Mover (MiniMover)
自動駕駛運載系統

The Autonomous Delivery Mover, named as MiniMover, is equipped with a sensor suite comprising 3D LiDAR, cameras, GPS, Inertial Measurement Unit (IMU) and ultrasonic sensors. Through the technologies of deep learning and sensor fusion, MiniMover is capable of planning suitable path with collision avoidance of stationary or moving obstacles in crowded and dynamic environment, such as buildings, parks or warehouses, in order to delivering goods in short distance autonomously.

自動駕駛運載系統備有一系列的傳感器，包括3D激光雷達、鏡頭、全球定位系统、慣性測量單元和超聲波傳感器。透過運用深度學習及傳感器融合等技術，自動駕駛運載系統能在人多和複雜多變的環境，例如在建築物內外、園區、或倉庫等，規劃出合適的行走路徑來避免碰撞靜止或移動的障礙物，自動進行短程運送任務。

Major Benefit 主要的好處

1) Capable of moving to destination autonomously
2) Plan suitable path with collision avoidance via the technologies of deep learning and sensor fusion
3) Perform last-mile delivery tasks in a more frequent and less labour intensive way

1) 能夠自動地移動到目的地
2) 運用深度學習及傳感器融合技術去規劃行走路徑及避免碰撞到障礙物
3) 以更頻繁和更少勞動力的方式進行短程運送任務

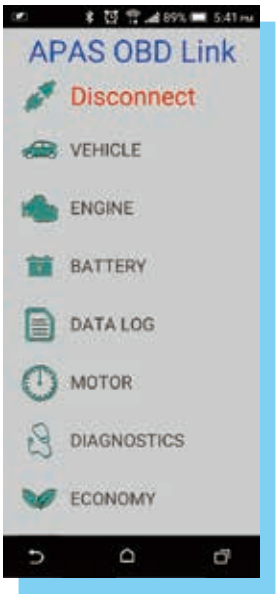
Application Area 應用領域

1) Last-mile delivery in parks or warehouses, or indoor delivery in buildings
2) Perform inspection and patrol tasks

1) 在園區或倉庫內的短程運送，或室內運送
2) 進行視察和巡邏等任務

Advanced OBD with Predictive Maintenance System

智能汽車遠端診斷系統



Unpredicted interrupt of service due to component or system failure is a costly penalty to fleet operators. Periodic maintenance is one of the preventive measures to counter the problem. However, replacing parts ahead of its failure increases maintenance costs. Advanced On-board Diagnostics (OBD) is powered by big data analytics, APAS predictive maintenance algorithm predicts part failure in its infancy. Thus, unpredicted interrupt of service is avoided and maintenance cost is minimized.

對於車隊營運商而言，由個別車輛零件或系統的失效導致的非預期壞車會大大增加營運成本及降低服務質素。定期檢查維護可以降低車輛無故拋錨的機會，但過早更換未損壞零件亦會增加維護成本。智能汽車遠端診斷系統(OBD)利用車聯網大數據分析，監察車輛系統資料，從而在零件即將損壞前發出預警。這樣，既可以降低車隊維護成本又可以避免非預期的拋錨事故。

Major Benefit 主要的好處

1) Predictive maintenance based on actual condition of components
2) Detection and monitoring of driver behavior
3) Lower maintenance costs due to extended parts usage
4) Higher availability of vehicles

1) 基於零件實際狀態的預測性保修
2) 檢測及監管司機駕駛行為
3) 更充分利用車輛零件從而降低維護成本
4) 更高的車輛出勤率

Application Area 應用領域

1) Commercial vehicle fleet
2) Government vehicle fleet
3) Driver behavior based insurance

1) 商業運輸車隊
2) 政府運輸車隊
3) 基於駕駛行為的車輛保險

Advanced Driving Assistance System (ADAS)
先進駕駛輔助系統

Advanced Driver Assistance Systems (ADAS) are developed to enhance on road safety and driving experience. The system helps to avoid collisions and accidents by image detection technology that alerts the driver for potential problems on road.

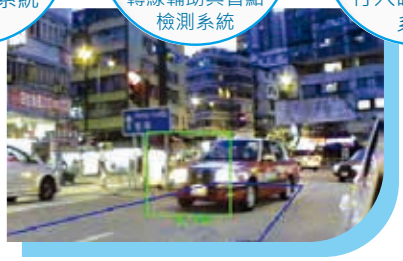
先進駕駛輔助系統是輔助駕駛者進行汽車駕駛的系統, 它可以增加車輛的安全性和道路的安全性。基於視像技術，先進駕駛輔助系統所提供的安全功能旨在避免碰撞和事故發生，警告駕駛者潛在的安全問題。

There are three functions of ADAS, including:
先進駕駛輔助系統主要包括三個功能：

Vehicle Collision Avoidance System
汽車防撞系統

Lane Change Assist & Blind Spot Detection System
轉線輔助與盲點檢測系統

Pedestrian Warning and Protection System
行人識別警報系統



Major Benefit 主要的好處

1) Comfort (Improve driving comfort and reduce driver's work-load)
2) Safety (Prevention of accident and reduction of crashworthiness)
3) Economy (Reduce maintenance fee)

1) 舒適性 (提高駕駛舒適性以及減少駕駛者工作量)
2) 安全性 (預防事故發生以及減少碰撞)
3) 經濟性 (降低汽車意外事故維修費用)

Application Area 應用領域

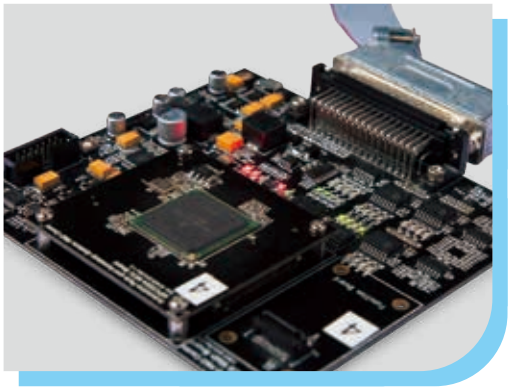
1) Autonomous Vehicle
2) Surveillance system
3) Railway transportation system

1) 自動駕駛車輛
2) 監控系統
3) 軌道交通系統

Vehicle System Controller
電動車整車控制器

Vehicle System Controller (VSC) coordinates driver inputs with powertrain sub-systems including Battery Management System (BMS) and Motor Control Unit (MCU). It plays a crucial role in management of energy flow for enhanced driving experience, efficiency and safety. It also handles brake force distribution between regenerative braking feature and hydraulic brake. APAS's VSC takes automotive functional safety (ASIL C) into design consideration which provides over 97% diagnostic coverage of single point fault.

整車控制器(VSC)負責協調司機操控與整個動力系統的反應，當中子系統包括電池管理系統和電機控制器。VSC透過車輛能量流管理，優化系統效率及安全性。另一個功能是處理再生制動力和液壓制動力的分佈。APAS開發的VSC參照了汽車功能安全(ASIL C)的規範，提供了超過97%的單點故障覆蓋率。



Major Benefit 主要的好處

1) Control software was developed with Model Based Development (MBD) for high reusability and robustness
2) Seamless integration with APAS proprietary BMS
3) Able to control different energy sources on Electric Vehicle (eg. Ultracapacitor and battery)

1) 用建模開發(MBD)的控制軟體，複用性高，安全可靠
2) 與APAS的BMS系統完美配合
3) 可控制電動車上的不同種類電源 (如超級電容及電池)

Application Area 應用領域

1) Pure Electric Vehicle (PEV)
2) Pure Electric Vehicle (PEV) with li-ion battery and ultracapacitor
3) Other battery powered vehicles

1) 純電動車 (PEV)
2) 使用電池 - 電容混合儲能系統的純電動車 (PEV)
3) 其它使用電池驅動的交通工具

APAS R&D Centre Testing Services
研發中心測試服務

APAS R&D Centre test lab is capable to provide support to the research projects related to automotive parts and accessories, as well as to provide testing services to the industry. Services include providing testing facilities and consultation. The Centre can also help to develop test plans, analyze data, design test fixtures, and provide diagnostics and technical supports. Below is a list of tests the Centre provides:

研發中心實驗室可支援汽車零部件的項目研發，以及給業界提供有關的測試服務。服務包括提供測試設備及諮詢服務。同時研發中心也可以幫助制定測試計劃、分析數據、提供診斷和技術支援。以下是研發中心能提供的測試服務：

Testing Equipment 測試設備	Test Standards 基本試驗	Functions 主要功能
Spray Water Test Unit 淋雨試驗箱	IPX3, IPX4, IPX5 and IPX6 according to EN 60529, DIN VDE 0470 	In a water spray chamber, test sample's water leak and evaluate waterproof seal. 在淋雨的環境下，系統地檢測試件的防水和水侵入的情況。
Dust Test Unit 砂塵試驗箱	IP4X, IPX5X according to EN 60529, DIN VDE 0470, SAE J575 	In a dusted environment, validating the testing sample withstands the impacts of dust. 提供砂塵環境，系統地檢測試件的砂塵積存和塵侵入的情況。
Temperature and Climatic Test System for Vibration Test 高低溫/濕度配合振動台綜合試驗箱	ASTM D3580; MIL-STD-883G, Method 2007.3; MIL-STD-883G, Method 2026; MIL-STD-202G Method 201A; MIL-STD-202G Method 204D 	In a controlled temperature and humidity environment, conduct vibration tests and analyze results. 在可控的溫度及濕度環境下，提供振動測試，分析試件的耐振或減振性能。

Testing Equipment **測試設備**	Test Standards **基本試驗**	Functions **主要功能**
Temperature and Climatic Test System 快速溫度變化潮濕試驗箱	IEC 60068-2, 60721-4; DIN 40046, 50014, 72300; ETS 30019; BS 2011; VG 95210, 95332; MIL-STD-202, 810, 833, -E-5272 	Provide temperature with a high change rate and changeable humidity. Test sample's performances in this environment. 提供高速變化的溫度以及濕度環境，測試樣品在高低溫和高濕環境中的性能。
Shock Test System 溫度沖擊試驗箱	IEC 60068-2-14; DIN 40046; MIL-STD-810,8830; JESD22-A101 	Provide instant temperature change by moving parts in the dual chamber to test thermal shock. 在雙箱體之間提供瞬時的溫度變化環境，測試試件承受溫度沖擊的能力。
Battery Testing System 電動車單體電池測試設備	IEC 62660 	Measure single cell battery charge / discharge performance, as well as its temperature move. 測量單體電池充放電性能以及電池溫度曲綫。
EV Battery Testing System 電動車電池能量模擬及測試系統	ISO 12405 	Simulate and evaluate EV battery via high power and adjustable system. 透過大功率可調式系統，模擬及測試電動車電池的性能。
Vacuum Chamber 真空箱	UN38.3 standard (38.3.4.1) 	Provide a vacuum environment to test sample. 提供真空環境，測試樣品的性能。

Testing Equipment 測試設備		Functions 主要功能
Handheld Spectrum Analyzer 手持頻譜分析儀		Used for maintaining or installing transmitter systems, checking cables and antennas, assessing signal quality in broadcasting, radio communications and service, measuring electric field strength or in simple lab applications. 用於維護或安裝發射機系統，檢查電纜和天線在廣播、無線電通信和服務中評估信號品質，測量電場強度或簡單的實驗室應用。
Impedance Analyzer 阻抗分析儀		The equivalent circuit analysis function supports seven different multi-parameter models and simulate equivalent parameter values of components. 等效電路分析功能支持 7 種不同的多參數模型和模擬試件的等效參數值。
Programable Electronic Load 可編程式電子負載		Simulate a variety of load conditions under high crest factor and varying power factors with real time compensation. 通過對電壓波形進行了即時補償來模擬在高峰值因數和變功率因數下的各種負載情況。
EV Charger Analyzer 電動車充電分析儀		Analyze the EV charger performance. 分析電動車充電站的充電性能。

Testing Equipment **測試設備**		Functions **主要功能**
Dynamometer 測功機		Measure the speed, torque, power and efficiency of the motor. 測試電機的速度、扭矩、功率和效率等。
Optical Microscope 立體顯微鏡		Check the PCB quality. 檢查電路板的品質。
Data Acquisition / Switch Unit 數據採集儀		Record the real time current, voltage and temperature data. 即時記錄電流、電壓和溫度資料。
Power Logger 電能質量記錄儀		Conducting energy, load and power quality testing. 進行關於能量、負載和功率品質的測試。

In addition to Environmental Stress Test and Ingress Protection Test, the Centre also provides tests related to the automotive parts and accessory systems of electric vehicle:

除環境應力測試及Ingress Protection防護等級測試外，本中心還提供以下針對電動車零部件的測試：

- Electromagnetic Compatibility (EMC)
電磁兼容測試
- BT2000 Battery Characterization System
電池充放電系統
- Digatron EVT300-500 IGBT Electric Vehicle Tester
電機動力測功系統
- EV Motor Dynamometer Platform
電動車電機動力模擬測功平臺

Management System ISO 9001:2015
TÜVRheinland CERTIFIED
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Test lab is ISO9001:2015 certified
試驗室已取得ISO9001:2015認證

Automotive Platforms and Application Systems (APAS) R&D Centre
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Nov 2019