Dreams come true in space research

太空科研夢成真

For years, PolyU scientists have carried out research unmatched by other universities in Asia in support of China's ambitious space missions.

多年來，為支持中國雄心壯志的航天使命，理大的科學家進行了多項太空科研計劃，這方面的成就遠超亞洲其他大學。

President of CAST Mr Yang Baohua and Acting PolyU President Prof. Philip Chan announce the establishment of a Joint Laboratory.
中國空間技術研究院院長楊保華先生(右)與理大署理校長陳正豪教授宣布成立一所聯合實驗室。

PolyU enjoys close partnership with national space authorities

PolyU enjoys close working relationship with national space authorities, namely the China Academy of Space Technology (CAST), the Astronauts Training Centre in China, and the Centre for Space Science and Applied Research, Chinese Academy of Sciences.

Recently, PolyU and CAST announced the establishment of a Joint Laboratory in precision engineering research for space applications. Under the agreement, CAST will donate sophisticated equipment to the value of RMB5 million to PolyU for the new Laboratory. Both parties will jointly invest RMB10 million of research funding for the Laboratory in the next five years, and the research work will be carried out under the supervision of an Experts Committee.

Advanced camera pointing system under development

Currently, Prof. Yung Kai-leung, Associate Head of Department of Industrial and Systems Engineering, and his eight-member team are developing a state-of-the-art camera pointing system custom made for a future lunar lander, following a research collaboration agreement signed between the University and CAST in June 2010 relating to China's lunar exploration programme.

In October this year, Prof. Yung witnessed in Xichang, Sichuan, the launch of China's lunar orbiter Chang'e-2, which recently completed its mission of taking pictures of the surface of the Bay of Rainbows from a close distance of just 15 kilometers above the moon. The pictures assist the identification of a suitable landing ground for future Chinese landers. "Chang'e-2 is so close to the moon that it can see the undulations on its surface," said Prof. Yung.

Regarding his latest endeavour, an initial design for the camera system has already been completed and an engineering model has been produced by the Industrial Centre of PolyU for testing purposes. But Prof. Yung said that continual revisions would need to be made to fit the other changing designs of the lander and, meet the stringent safety and security standards. "The system will operate under very extreme temperature. During the day,

理大與國家航天機構合作緊密

理大與多個國家航天機構合作緊密，其中包括中國空間技術研究院、中國航天員科研訓練中心及中國科學院轄下的空間科學與應用研究中心。

最近，理大與中國空間技術研究院宣布共同成立一所「空間精密機械技術聯合實驗室」。根據協議，中國空間技術研究院將會為新成立的聯合實驗室提供總值達五百萬元人民幣的基礎設施。雙方將於未來五年合共為聯合實驗室投入研究經費一千萬元人民幣，在專家委員會指導下開展科研活動。

研發先進的相機指向機構系統

Prof. Yung Kai-leung
容啟亮教授

繼理大於二零一零年六月與中國空間技術研究院簽訂了聯合研發協議，在國家探月工程相關領域展開合作後，工業及系統工程學系副系主任容啟亮教授與他的八人團隊現時正積極研發一具精密的「相機指向機構系統」，專供未來特製的月球探測器使用。

今年十月，容教授在四川西昌見證了中國探月衛星嫦娥二號發射升空。該衛星近日更完成任務，成功在月球上方僅十五公里的近距離，拍攝到月面虹灣的相片，這些圖片有助確定日後適合中國探測器登陸的地點。容教授表示，嫦娥二號的位置非常接近月球，因而可看見月球表面的起伏小波。

容教授最新發明的相機系統的初步設計經已完成，並由理大工業中心製成

the sun will shine on the equipment heating it up to 180 degree Celsius. At night, the temperature may drop to minus 180 degrees. To ensure that the system will not be damaged by extreme environmental conditions, we have applied a thermo control scheme so that the delicate parts will be protected from the extreme temperature."

"We also have to put in intelligence to help the system adapt to unpredictable situations during the launch and when the camera is in use. It is an advanced system as it has to adapt to many, many different environments," added Prof. Yung.

Years of dedication in innovating space tools

It is uncertain whether the camera system will be put on board Chang'e-3, due to be launched around early 2013, or Chang'e-4, whose launch is scheduled for the year after. But having worked at the Department of Industrial and Systems Engineering for more than 20 years, Prof. Yung undoubtedly derives much satisfaction from his research endeavours. "No other university in Asia has got the experience that we have in relation to space research projects."

"The work gives me a chance to exercise what I know and have learned from the past. Not many people are able to see their theories being applied in the real world, and yet much of the research and experience I have had in the past can be well-utilized."

His team's another invention, the soil preparation system (SOPSYS) designed and manufactured for a joint China-Russia mission to Mars, is set to be launched next year to process in-situ soil samples from its innermost moon called Phobos, and to grind and sift Phobos rock for in-situ analysis. Also, the Mars Rock Corer developed by the team in 1997 was officially commissioned by the European Space Agency for its Mars Express Mission.

"The knowledge we have accumulated from the previous projects is useful for developing the camera pointing system," said Prof. Yung, adding that simulation technology was used to test for heat transfer and dissipation, and perform stress and vibration analysis.

But getting access to the hi-tech materials and components required for the making of the system presented a challenge. Unable to buy them from overseas manufacturers, Prof. Yung had to produce them on campus instead with alternative materials. "Countries do not want to transfer hi-tech to another country. The US, for example, will not export hi-tech components. Apart from the design and manufacturing which was within our control, every part of our research was difficult. Though we knew what was suitable and where to buy them, we could not get them because of many advanced countries' embargo on hi-tech components and materials."

Prof. Yung Kai-leung witnesses the launch of Chang'e-2 in the China Xichang Satellite Launch Centre.
容啟亮教授於西昌衛星發射中心見證嫦娥二號發射升空。

一個工程模型作測試用途。他表示，系統必須持續進行改善，以符合探測器在設計上的其他改變、以及安全和防護的嚴謹標準。「該系統會在極端的氣溫下運作，太陽在白天會把儀器加熱至攝氏一百八十度，夜間氣溫卻可能降至零下一百八十度。為避免系統被極端的環境情況破壞，我們採用了一個溫度控制裝置，令精密的零件在極端的氣溫中受到保護。」

容教授稱：「我們亦需要在系統內加入智能裝置，幫助系統適應發射升空和操作時意料不及的各種情況。這是個先進的系統，它要有能力適應很多不同的環境。」

多年致力研發太空儀器

嫦娥三號及嫦娥四號，預期分別於二零一三年初及二零一四年發射升空，這具相機系統會否跟隨升空仍屬未知之數。然而，在工業及系統工程學系工作逾二十年的容教授，無疑在經年累月的研發過程中獲得很大的滿足感。他說：「在亞洲，沒有其他大學擁有我們於太空科研範疇的經驗。」

「我的工作為我提供了運用以往所知和所學的機會。能夠把自己的論說應用於現實世界中的人並不多，但我很多的研究和以往的經驗都被成功地應用了。」

容教授團隊的另一項發明是為中國和俄羅斯的聯合勘探火星計劃設計和製造的「行星表土準備系統」，系統將於明年升空，用作實地處理火星的衛星火衛一(Phobos)的泥土樣本，並將土壤磨碎及篩濾以作實地分析。此外，研究團隊於一九九七年研製的「岩芯取樣器」亦被歐洲太空總署正式採用於「火星快車」計劃中。

容教授表示：「我們從先前進行的計劃累積的知識，對研發『相機指向機構系統』很有幫助。」他更運用模擬技術來測試熱傳輸和功率消耗、以及進行壓力和震動分析。

在研製該系統的過程中，尋找高科技物料和零件確是一個挑戰。由於容教授未能從海外製造商中購入零件，只好轉為在校園以代替物料製造零件。「各國都不想將高科技轉移到另一個國家，例如美國就不會輸出高科技零件。除了設計和製造範疇可以由我們控制之外，研究過程中的每一部份都很艱難。即使我們知道那裏可以買到合適的零件，我們卻因為先進國家禁止售賣高科技零件和物料而買不到零件。」

Micro-gravity hurts astronauts but solutions are up and coming

At the same time, various teams at the Department of Rehabilitation Sciences are focusing on research targeting at the effects of a micro-gravity environment on astronauts' physical and emotional health. Under the Chinese Astronaut Medical and Rehabilitation Research Programme, seven professors from the department are investigating interventions for problems likely to occur from a prolonged period in space, such as bone loss, muscle wasting and deterioration of the cardio-vascular system. They are working in collaboration with the China Astronaut Research and Training Centre.

Team leader Prof. Chetwyn Chan, Chair Professor of Rehabilitation Sciences, said, "It is our national plan to build a space station within the next decade. The preparation of astronauts for undertaking long spaceflight mission, such as working six months in the space station, has become one of the research foci of the joint research team."

微重力影響太空人健康　理大積極研究應對方案

與此同時，康復治療科學系的幾個團隊正集中研究微重力對太空人身心健康的影響。在中國航太員醫療及康復研究計劃下，學系的七位教授正探討長期逗留在太空所可能引致的問題和改善方法，例如骨質流失、肌肉萎縮、以及心血管系統的退化。該計劃是與中國航太員中心醫學監督與醫學保障研究室共同合作。

領導該計劃的康復治療科學系講座教授陳智軒教授表示：「國家準備在十年內建設一個太空站。因此，怎樣預備太空人在太空站內執行可能長達六個月的長期航天任務，就成為了聯合研究團隊的其中一項研究重點。」

Prof. Chetwyn Chan
陳智軒教授

Chinese herbal medicine to keep astronauts emotionally healthy

Prof. Chan is the principal investigator of a study on the effectiveness of a Chinese herbal medicine[1], with 40 traditional ingredients including Ginseng, Huang Qi and Dang Gui as the main ingredients for enhancing astronauts' cognitive and emotional functions when working under extreme micro-gravity conditions. This herbal medicine was originally invented by the Astronaut Centre. Parallel to this study is the design of a computer-based evaluation system which captures fluctuations of these cognitive and emotional functions. The evaluation system is characterized by its simple operation and suitable for repeated measurements. The evaluation system has been used for monitoring astronauts' performance in the recent spaceflight mission.

「太空養心方」— 提升太空人精神健康

由太空人中心研發的一種中藥—「太空養心方」[1]，包含了四十種成份，並以人蔘、黃芪及當歸等為主要成份，用以提升太空人在極端微重力環境下的認知和情感功能，而陳教授正是研究該中藥成效項目的主要研究員。此外，研究團隊亦設計了一個電腦量度系統，用以測量認知和情感功能的起伏波動。這量度系統易於使用，亦可作重複測量。在最近的太空任務中，系統亦用於監測太空人的表現。

中國航天員科研訓練中心對該中藥的成效進行了測試，一組實驗對象服用該中藥，而另一控制組則在沒有服食該藥的情況下進行測試。為了模擬微重狀態，兩組的對象都必須在整整六十天內臥床，並保持頭部向下六度及腳向上。陳教授表示：「這六十天的實驗是世界罕見的，因為通常只進行三十天或六星期。在這六十天內，我們比較實驗對象的變化，以重複進行的測試量度他們的自我控制能力、冒險的行為、以及能否在實驗期間保持情緒冷靜。」

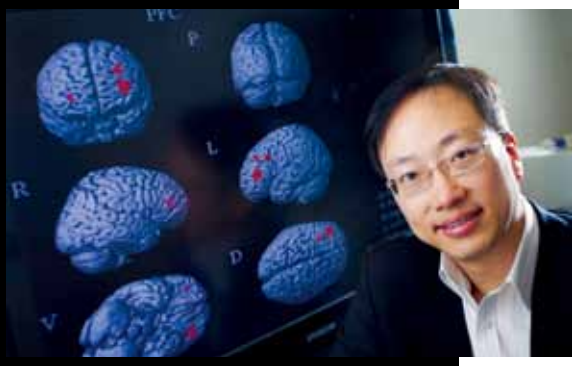
[1]Chan CCH, Li Y-Z, Guo L-G, Zhou X-N, Luo Y-J, & Lee TMC. (2010). Chinese herbal medicine and cognitive and emotion functions during 60-day head-down bed rest. *Aviation, Space, and Environmental Medicine*, 81, 754-760.

The testing on the effectiveness of the Chinese herbal medicine was conducted at the Chinese Astronaut Research and Training Centre. The herbal medicine was administered to one group of subjects, while the control group went through the experiment without it. Both groups had to lie down for 60 days, their head tilted six degrees downward and their legs upward to simulate the effects of micro-gravity. "It is rare around the world for such an experiment to be implemented over 60 days,' said Prof. Chan. "Usually it is 30 days or six weeks. We compared the changes in the subjects across the 60 days with repeated tests measuring their self-regulatory functions, advantageous risk-taking behaviour, and whether they stayed emotionally calm during the period."

It turned out that those on herbal medicine appeared stable on various fronts at the beginning, in the middle of and near the end of the experiment, while the performance in the control group fluctuated – some missed making necessary decisions or took risks that they should not have taken.

To obtain further evidence, the subjects were also tested by a brain scanner both in the beginning and at the end of the project. "We looked at which part of the brain got activated, whether the activation changed across time and whether the activation could explain our behavioural data," said Prof. Chan. It was found that the brain area responsible for risk-taking - the area affecting a person's decision-making capability - was activated among subjects who were administered the herbal medicine[2].

Prof. Chan's team is set to refine their measurement package further so it can be incorporated into future space missions. He also hopes to put it and the medicine to wider use to treat people with emotional, self-control or risk-taking problems. "We still need to do further research on who will benefit from this medicine, but we are pretty sure that the drug may be useful to people with self-regulatory function problems, such as emotional regulations problems. Imagine how someone will feel having to put his head down for 60 days? It's a test of someone's emotional stability because he or she may get upset, angry and feel bored," said Prof. Chan. His laboratory on applied cognitive neuroscience has for long researched on self-regulatory functions and developed ways to enhance post-stroke patients' learning capability.



The brain scan of those subjects who have taken the Chinese herbal medicine shows that some parts of their brains have been activated.
服食中藥的人的腦部掃描顯示，腦的某些部位曾受到該中藥的刺激。

實驗證明服用中藥的一組人無論在實驗的最初、中段或後段的時間都表現比較穩定，控制組則表現波動，有些人忘記作出有必要的決定或做出不當的冒險行為。

為進一步求證，實驗對象再被安排於計劃開始及結束時進行腦部掃描。陳教授解釋說：「我們研究他們腦內甚麼部位受到刺激、這些刺激有否隨時間改變、以及這些刺激可否解釋得出的行為數據。我們發現有服食中藥的人當中，腦內主管冒險行為的部份，即影響一個人判斷力的部份有受到刺激[2]。」

陳教授的團隊將繼續改良這測量裝置，以期應用於未來的太空任務中。同時，他希望上述裝置和中藥得以廣泛使用於治療有情感、自我控制或冒險行為問題的人士身上。「我們仍需繼續研究這中藥會對那些人有效，但我們大概可肯定它對有自我控制問題的人確實有幫助，例如那些有自我控制情感問題的人。試想一個人的頭部維持向下狀態連續六十天，他會有甚麼感覺？他可能會感到不高興、憤怒和沉悶，所以這其實是測試一個人在精神上的穩定性。」由陳教授帶領的應用認知神經科學實驗室，一直以來都致力研究自我控制能力的問題及如何幫助中風後的病人提升學習能力。

Counter bone loss with laser acupuncture

The prototype can administer laser and magnetic stimulus to human subjects.
可以將雷射和磁性刺激傳到人體內的儀器。

In another study, held in collaboration with the astronauts' training centre, Associate Professor Dr Guo Xia is studying how to counter bone loss - a problem common to astronauts in a micro-gravity environment - through acupuncture. "Astronauts have had many treatments like medication, receiving stimulation from vibration, etc., but there is no effective treatment method yet," she said.

In collaboration with Prof. H.C. Man, Head of the Department of Industrial and Systems Engineering, Dr Guo designed a prototype that can administer laser and magnetic stimulus to human subjects, at a favourable level of stimulation

雷射針灸治療預防骨質流失

另一項計劃由副教授郭霞博士與中國宇航員健康及訓練中心聯合進行，研究以經絡刺激方式解決太空人在微重力環境下經常遇到的一個問題 — 骨質流失。

[2]Lee TMY, Guo L-G, Shi H-Z, Li Y-Z, Luo Y-J, Sung CYY, Chan CCH, Lee TMC (2009). Neural correlates of Traditional Chinese Medicine induced advantageous risk-taking decision making. *Brain and Cognition*, 71, 354–361.

and frequency. Animal experiments were staged to test responses to laser stimulations to specific acupuncture points on specific meridians. “Attaching the device to a rat for three minutes a day could provide enough stimulus to overcome disuse-induced bone loss,” said Dr Guo. Since 1996, she has been carrying out animal and human experiments for her study.

She expects human testing in a simulated micro-gravity environment to be conducted early next year in Beijing. Meanwhile, she will continue to improve on the equipment’s overall design. “The equipment’s current weight, size and operation are not ideal for space missions,” she explained.

Electrical stimulation to tackle muscle atrophy

Drs Ella Yeung (left) and Simon Yeung
楊慧博士(左)及楊世模博士

Associate Professors Dr Ella Yeung and Dr Simon Yeung, on the other hand, are tackling another problem – muscle atrophy. Depending on their length of stay in a micro-gravity environment, astronauts are prone to developing the problem. Over the past three years, the pair has carried out studies using an animal model where the hind legs of the animal were lifted up and then unloaded for a period of time. They attempted to examine the activity of the satellite cells, and explore the reserve cell populations that will be activated and proliferate when subject to changes. The experiments showed that electrical stimulation is a useful means for improving muscle mass. “Low-frequency electric stimulation may be good for the maintenance of muscles that are prone to muscle atrophy,” said Dr Ella Yeung. “Other researchers have studied the satellite cells, but not why stimulations counteract the problem of muscle atrophy. We are trying to bridge the knowledge gap.”

The two researchers had compared six protocols involving three different frequencies and two kinds of durations, before coming to the conclusion that a “low frequency, long duration” stimulation approach worked best. With support from the Innovation and Technology Fund, they are now in the process of optimizing the protocol through conducting more animal studies, and later on, human studies.

Some practical issues will need to be sorted out before their findings can be applied to astronauts confined in space. For example, there may be a need to create innovative clothing, be it a jacket or a pair of stockings, that allows for the conductivity of electricity into human muscles. “Electric stimulation has to apply to the vulnerable muscles and the machine has to be small enough to be carried by astronauts,” said Dr Ella Yeung.

Dr Simon Yeung added that their discovery can be applied not just to astronauts but also to, for example, bedridden patients, old people with muscle

郭博士表示：「太空人已嘗試過很多治療方法，例如服用藥物和震動刺激法，但效果都不理想。」

郭博士與工業及系統工程學系系主任文效忠教授合作設計了一個儀器，它可以根據一個合適的刺激水平和頻率，將雷射和磁性刺激傳到人體內。在動物測試中，研究人員以雷射刺激動物的一些特定經絡上的特定穴位。郭博士表示：「每天用這儀器刺激大鼠三分鐘，就已經有足夠刺激去防止廢用性骨質流失。」自一九九六年起，她開始進行該研究的動物和人體測試。

郭博士預期，在模擬重力環境下進行的人體試驗將於明年年初在北京展開。她現時正繼續改良這儀器的整體設計，她解釋說：「這儀器現時的重量、大小和操作仍未適用於太空任務中。」

電刺激療法對抗肌肉萎縮

此外，楊慧博士和楊世模博士兩位副教授正在研究解決另外一個問題—肌肉萎縮。太空人處於微重力環境一段時間，就會出現肌肉萎縮問題。過去三年，兩位楊博士進行了對抗肌肉萎縮的動物實驗，以動物後肢被吊起導致後肢肌肉失負荷一段時間來模擬微重力性肌肉萎縮。他們試圖研究肌肉的幹細胞(也稱衛星細胞)的活性及應對刺激信號可激活和增值的衛星細胞儲備。實驗顯示，電刺激可改善肌肉重量。楊慧博士表示：「低頻電刺激有利於維持微重力環境下易損肌肉的重量和體積，其他研究人員也研究過微重力對衛星細胞的影響，但電刺激為甚麼可以對抗肌肉萎縮仍屬未知。我們正試圖填補這個知識的空白。」

兩位研究人員比較了包括三種刺激頻率和兩段刺激週期的六個不同方案，結果顯示「低頻、長週期」刺激為最佳療法。這項研究得到創新科技基金的資助，現正透過進行更多動物測試和未來的人體試驗，以完善此項研究。

太空人的活動空間局限於太空，所以該研究必須解決一些實際的問題，才可應用到太空人的身上。研究人員可能需要設計創新的衣物，例如外套或襪褲，讓電流可傳到人體的肌肉。「電刺激必須用於易損肌肉，而刺激儀必須小巧，使太空人易於攜帶。」楊慧博士說。

楊世模博士補充說，該療法除可應用到太空人身上外，亦有助長期臥床的病人、患廢用性肌肉萎縮症或有肌肉萎縮問題的長者，以及患旅行血栓症的旅客(因長途飛行而導致小腿血管內形成血凝塊)。

disuse or immobilization, and victims of traveller's thrombosis (the formation of blood clots within vessels in the lower legs of passengers of long-haul flights).

Certainly more time and efforts are required before the dedicated researchers can come up with optimal solutions for their research, but it will be relatively easy when it comes to the making of the final equipment. "We design innovative equipment for all kinds of patients almost every day; that is our bread and butter. Designing for the need of astronauts will not be a problem," said Prof. Chetwyn Chan.

In the pipeline, PolyU will establish one or two special research institutes to support the further advancement of space research, and explore the possibility of turning its space technology for civilian use in the future.

無可否認，這羣充滿熱誠的研究人員還需投放大量時間和心力，才會找到有關研究的最理想方案，而製造最終的儀器反而相對較容易。陳智軒教授表示：「我們每天都為各類病人設計創新儀器，這是我們基本的工作，所以為太空人的需要而設計亦不成問題。」

展望將來，理大計劃成立一至兩個研究所，以進一步推動太空科技研究，並探討日後將太空科技轉為民用的可能性。

PolyU's milestones in space research 理大太空研究里程

1989-1994

Dr Ng Tze-chuen conceptualized the first HK-made space forceps. With the support of Prof. Yung Kai-leung from the Department of Industrial and Systems Engineering, together with the researchers from the Industrial Centre at PolyU, the "Space Holinser Forceps System" was developed.

伍士銓牙科醫生從一把牙醫抓鉗工具取得靈感，構思首個香港製造的太空鉗。在理大工業及系統工程學系容啟亮教授及工業中心研究員的協助下，太空鉗的理念得以發展成「太空持崁鉗」。

1995

Four sets of "Space Holinser Forceps" were ordered by the Russian Space Agency for use by astronauts in precision soldering at the former MIR Space Station.

俄羅斯太空總署訂製四套「太空持崁鉗」，送到前「和平號」太空站供太空人作精密焊接之用。

1997

The "Space Holinser Forceps" were conferred "The Certificate of Merit in Consumer Product Design" in the "1997 Hong Kong Awards for Industry", organized by the Federation of Hong Kong Industries.

「太空持崁鉗」在香港工業總會舉辦的「一九九七年香港工業獎」選舉中榮獲「消費產品設計」組別中的優異獎。

1997

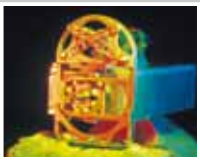
The "Mars Rock Corer" was developed. The European Space Agency officially commissioned the PolyU team to take part in the "Mars Express Mission".

「岩芯取樣器」研製成功。歐洲太空總署正式委任理大研究小組參與「火星快車」計劃。

2000

The "Mars Rock Corer" was honoured "The Most Innovative Award" in the "Election of 10 Engineering Wonders in Hong Kong", jointly organized by the Hong Kong Institution of Engineers and the Leisure and Cultural Services Department.

「岩芯取樣器」在香港工程學會及康樂及文化事務署舉辦的「香港十大傑出工程項目」選舉中榮獲「最具創意獎」。



2000

The project team of the "Mars Rock Corer" received the "1010 Award for Innovation" in the "Leader of the Year Award 2000", organized by the Sing Tao Group.

「岩芯取樣器」研究小組在星島集團主辦的「二零零零年傑出領袖」選舉中贏得「1010創意大獎」。

2001

The project team of the "Mars Rock Corer" captured a gold medal in the "Brussels Eureka", which was also known as the "50th World Exhibition of Innovation, Research and New Technologies".

「岩芯取樣器」研究小組在比利時布魯塞爾舉行的「第五十屆世界創新科技博覽會」中獲得金獎。

2003

Installed with the "Mars Rock Corer", the Beagle 2 Lander was launched from Kazakhstan as part of the European Space Agency's "Mars Express Mission".

「岩芯取樣器」隨著「獵犬二號」登陸船，在歐洲太空總署的哈薩克基地升空往火星進行探索工作。

2004

The Institute of Textiles and Clothing (ITC) was invited to design the anti-static clothes for China National Space Administration (CNSA) staff at its Control Centre. ITC researchers were also responsible for choosing, developing and testing the fabrics used so that stringent requirements of CNSA were met in full.

理大紡織及製衣學系獲國家航天局邀請，為其地面控制中心工作人員設計防靜電航天工作服，並挑選及測試有關物料，以符合國家航天局嚴謹的要求。

2006

PolyU entered into an agreement with the Lunar Exploration Centre of the Commission of Science, Technology and Industry for National Defense to initiate exchange and cooperation in training and scientific research.

理大與中國國家月球探測工程中心簽訂協議，在人才培養，科學研究及學術交流三大範疇，展開交流與合作。

2007

A collaboration agreement was signed between China and Russia to join hands in a mission to Mars and its innermost moon Phobos. PolyU was commissioned to develop the "Soil Preparation System" to collect samples of Phobos soil and to grind and sift Phobos rock for in-situ analysis.

中國和俄羅斯簽訂合作協議，共同勘探火星及其衛星火衛一 (Phobos)，理大負責研發「行星表土準備系統」，用作磨碎及篩濾火衛一的表層土壤以作實地分析。

2007

Prof. Luan Enjie, Commander-in-Chief of China's Lunar Exploration Programme visited PolyU. Prof. Chen Yong-qi, the then Head of the Department of Land Surveying and Geo-informatics, was appointed a member of the Experts Committee for China's Lunar Exploration Programme. Since 2006, Prof. Chen Yong-qi has been contributing to the determination of the Moon's shape and size and lunar mapping based on the data obtained from the Chinese orbiter Chang'E I.

國家航天局月球探測工程中心欒恩傑總指揮訪問理大。土地測量及地理資訊學系前系主任陳永奇教授獲委任加入「國家繞月探測工程科學應用專家委員會」。自二零零六年起，陳永奇教授已開始利用中國探月衛星嫦娥一號所獲得的數據，為確定月球形狀與大小，以及繪製月圖作出貢獻。