

University of Strathclyde and CALT Launch Joint Laboratory

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China's leading launch vehicle technology provider, the China Academy of Launch Vehicle Technology (中国运载火箭技术研究院, CALT), is attempting to improve its innovation capabilities through a joint laboratory with the Department of Design Manufacture and Engineering Management (DMeM) at the University of Strathclyde in Glasgow, Scotland. A February 2012 agreement created the International Space Mechatronic Systems Technology research laboratory at the university and funded two CALT engineers to conduct research there.¹ The partnership is the first research collaboration outside of China for CALT, and could signal a new emphasis on global outreach by China's space industry.

Background

CALT, also known as the First Academy of the China Aerospace Science and Technology Corporation (中国航天科技集团公司, CASC), is the self-proclaimed "birthplace of China Aerospace." The academy oversees 10 research institutes, and is responsible for research, design, prototyping, testing, and production of launch vehicles and missiles, including Long March launch vehicles and Dong Feng missiles.² China's leadership has inextricably linked national pride with the advancement of the nation's space and defense programs and has designated space as one of China's strategic emerging industries.

CALT's partner, the University of Strathclyde, has a 200-year history as a prominent educator in technology. DMeM aspires to be the world's leading international research center for total engineering, a research approach that "applies engineering process and techniques to all levels of business and manufacture ... in order to improve all aspects of business and manufacturing."³

The purpose of the joint International Space Mechatronic Systems Technology research laboratory, officially opened in August 2012, "is to advance research and development into space mechatronic systems technology, such as mechatronic mechanisms, space robotics for satellite servicing and refuelling, sustainable space exploitation and related manufacturing technologies."⁴ The collaboration could also assist CALT in breaking into civilian

1 "Major Research Initiative for DMeM's Mechatronics Research," March 2012, <http://www.strath.ac.uk/march2012engineering/news/>; "Faculty Collaboration with China Academy of Launch Vehicle Technology Is a World First," *Engineering Insight* 8 (Winter 2012): 4, http://www.strath.ac.uk/media/faculties/engineering/newsletter/insight/EngineeringInsight8_FINAL.pdf.

2 <http://www.calt.com/GuanYuWoMen>; <http://www.nti.org/facilities/59/>.

3 "Design, Manufacture, and Engineering Management: Research," accessed Jan. 25, 2013, <http://www.strath.ac.uk/dmem/research/>.

4 Faculty Collaboration with China Academy of Launch Vehicle Technology Is a World First."

This material is based upon work supported by, or in part by, the U.S. Army Research Laboratory and the U.S. Army Research Office through the Minerva Initiative under grant #W911NF-09-1-0081. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the U.S. Army Research Office.

technologies. According to CALT managing director Li Hong, “The agreement will also open the door for wider collaboration with the company in other technological areas, including renewable energy systems.”⁵ For the duration of the five-year project, two CALT senior engineers will join the lab. Annual seminars will be held to promote academic exchange as well as opportunity for further collaboration. The Chinese government has agreed to fund the lab at a minimum level of £1.5 million (roughly US \$2.3 million).⁶

This is not the first project between CALT and Strathclyde. In 2011, CALT announced that one of its subsidiaries, the Beijing Institute of Aerospace System Engineering (北京宇航系统工程研究所) had signed a cooperative agreement with the school for joint research on the intelligent design and integrated manufacturing technologies of aerospace products. This three-year project was the first time that any CASC entity had received funding from the Ministry of Science and Technology for collaborative international research.⁷ Presumably the success of this shorter project paved the way for the joint lab agreement.

Practical Partnership?

In one sense, a DMeM laboratory stands out as an attractive partner for any CASC academy because the discipline focuses on integrating the design and development process with manufacturing technology and engineering management. As the Chinese defense research and development (R&D) system has undergone significant reforms in the past decade, CASC, the parent company of CALT, has prioritized “a comprehensive approach to innovation” that more closely couples product design and manufacturing with the R&D of individual technologies.⁸ The goal is to move CASC from single technology-oriented innovation to systems-based innovation.⁹

CALT’s partnership with the University of Strathclyde comes as CALT is developing a new series of Long March launch vehicles to replace the current series of Long March launchers developed in the 1970s and 1980s. These new rockets will provide the needed thrust currently lacking in its launch vehicles to put China’s planned large space station or large reconnaissance satellites into orbit or even take humans to the moon. The Long March 5, for example, will more than triple the carrying capacity of China’s current heavy lift launch vehicle, the LM-3, with a “maximum low Earth orbit payload capacity of 25 tons and a geosynchronous orbit payload of 14 tons.”¹⁰

Although the stated nature of the research to be carried out at the lab reflects a focus on satellite technologies that appears outside of the nature of CALT’s R&D efforts, the agreement signals room for future collaboration on a variety of design manufacture and engineering issues that could improve the reliability and efficiency of the new rockets.

5 “Major Research Boost for Space Technologies,” April 29, 2012, http://www.strath.ac.uk/press/newsreleases/headline_615407_en.html.

6 “Major Research Boost for Space Technologies.”

7 Wang Jiang, “北京宇航系统工程研究所首个国际合作项目协议签 [Beijing Institute of Aerospace Systems Engineering Signed First International Partnership Deal],” 航天长征 [Aerospace Long March], Feb. 23, 2011, <http://www.calt.com/ZiXunZhongXin/QiYeXinWen/Detail?ContentId=4579>.

8 Kevin Pollpeter, “The China Aerospace Science and Technology Corporation and the Concept of Integrated Innovation: A Case Study,” paper prepared for the “IGCC Annual Conference on China’s Defense Science, Technology, and Industrial Base,” La Jolla, Calif., July 19–20, 2012, 2.

9 Ma Xingrui, “Continue with Indigenous Innovation and Promote the Development of China’s Space Enterprise [坚持自主创新推动中国航天事业又好又快发展],” *Aerospace China [中国航天]* 8 (2011): 4.

10 Leonard David, “China Eyes New Rockets for Space Station, Moon Missions,” *space.com*, Oct. 25, 2012, <http://www.space.com/18209-china-new-rockets-long-march-5.html>. CALT’s development of the new launchers, however, has encountered problems. The maiden launch for the Long March 5 has been pushed back from 2011 to 2014. See “梁小虹：长征五号和长征七号将在海南首飞 [Liang Xiaohong: Maiden Launch of Long March 5 and Long March 7 Will Be at Hainan],” *People’s Daily Online*, Jan. 26, 2013, <http://scitech.people.com.cn/n/2013/0126/c1057-20334144.html>.

Or Personality Driven?

Upon closer inspection, however, the driving force of the joint lab may not simply be the compatibility of the two institutions, but rather the personality behind the deal: Dr. Xiu Yan, a professor in Strathclyde's DMeM department, who initiated, led, and secured the agreement.¹¹ Yan holds a PhD from the University of Technology in Loughborough, UK, and a BS from the Northwestern Polytechnic University in China, and has managed several projects of the European Commission's Asia-Link, a program to foster cooperation between Europe and Asia in the field of higher education. He previously secured funding from the Chinese government through the 985 and 973 Programs. A 2010 research project of his on intelligent design and integrated manufacturing technologies was funded by the International Science and Technology Cooperation Program of the Ministry of Science and Technology.¹²

Considering the Chinese government's significant investment in indigenous innovation and strategic emerging industries such as aerospace and high-tech manufacturing, funding opportunities are extensive. As an overseas Chinese scientist, Yan is naturally suited to connect international experts looking to collaborate with Chinese partners with Chinese-based funding opportunities. In this vein, Yan advises other European researchers on gaining access to Chinese R&D programs and recommends that European researchers align their research interests with the priorities of funding bodies in China, such as "advanced digital manufacturing, product and system design support for large and complex systems, clean energy, medical engineering, and environmental protection."¹³

A Viable Model Going Forward?

The returns CALT gains from the agreement include trained researchers in design processes and presumably some ownership of the intellectual property created by the lab. By improving the innovation capabilities of CALT and developing Chinese talent through international exchanges, CALT is at the forefront of carrying out government policies on international cooperation in order to make China a "strong" space nation on par with the United States and Russia. Yet with so few international researchers as proactive as Yan in procuring Chinese funding, let alone interested in advancing China's space agenda, it remains to be seen whether this collaboration model will become the norm or the exception for China's space industry.

11 "Editorial Board: Dr. Xiu-Tian Yan," Scientific Research Publishing website, accessed Jan. 25, 2013, <http://www.scirp.org/journal/DetailedInforOfEditorialBoard.aspx?personID=1437>; "Professor Yan Xiu," accessed Jan. 24, 2013, <http://www.strath.ac.uk/dmem/staff/yanprofessorxiu/>.

12 "Supporting the EU Access to Chinese Research and Innovation Programmes: Professor Xiu-Tian Yan," Access4.EU website, accessed Jan. 30, 2013, <http://www.access4.eu/China/780.php>.

13 Ibid.