

## **Australia-China Cooperation to Enhance the Knowledge and Impacts of Historical Culture through 3S Technologies in the Hanzhong Area of Western China.**

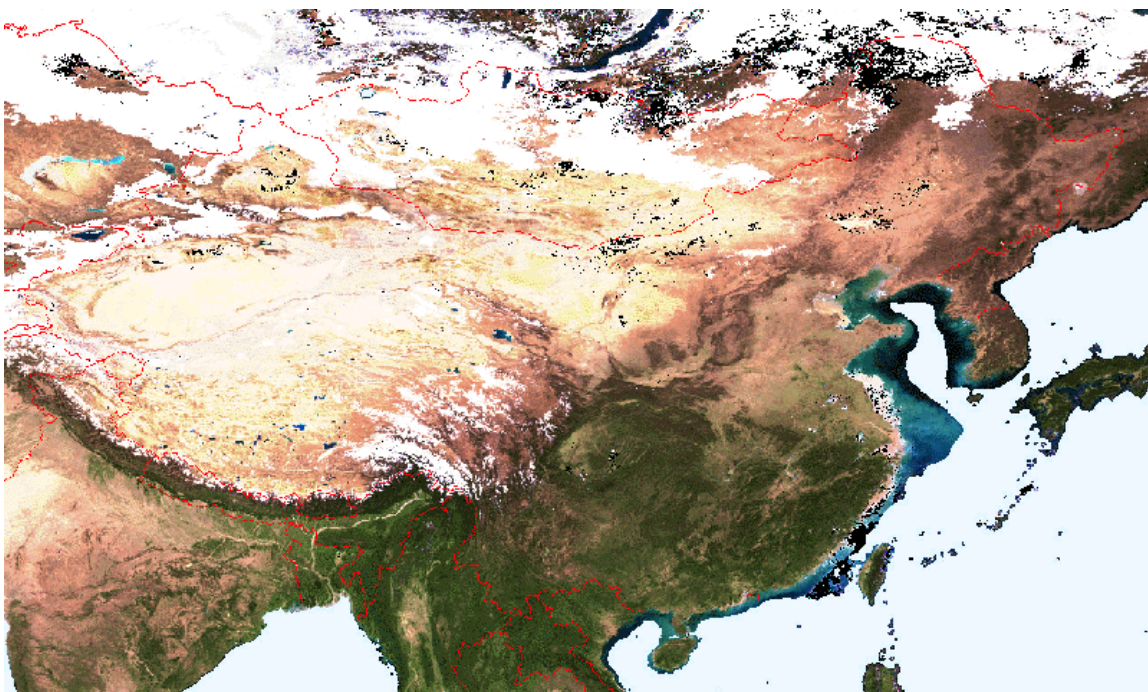
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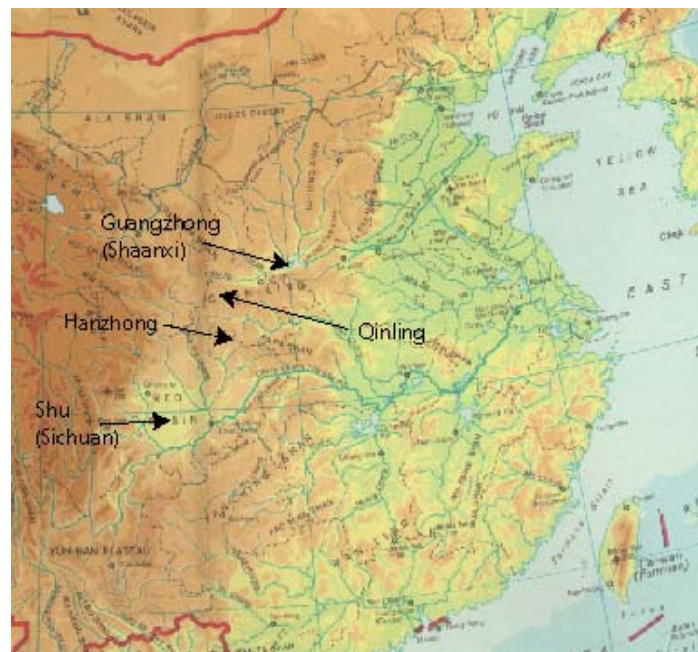


**Project supported by the Australia-China Council, UNSW at ADFA, CAS Institute of Soil and water Conservation in Shaanxi, Yangling and the Hanzhong Museum.**

# 1 INTRODUCTION

## 1.1 The Qinling Barrier

The Qinling (秦岭) is a mountain range in Shaanxi (陕西) that divides the climate, environment and geography as well as the history and archaeology of the northwest from the southwest of China. The temperatures and rainfall to the south of the Qinling are governed by the annual monsoon which brings warm moist air from the south in summer and to the north of the Qinling the cold dry air from the Siberian plains dominates in the winter. The mountains modulate the climate and the Qinling marks the boundary between the more moist and warm predominantly rice growing south and the dryer (in summer) and colder (in winter) predominantly wheat growing north.



## 1.2 The roads to Shu

The Qinling created challenges for interchange and communication between cultures that developed in present day Shaanxi and Sichuan (四川). The project outlined here is about the communications, interchange, trade and traffic that developed across the Qinling in ancient times. It involves links between three relatively protected valleys that have played significant roles in China's history and the pathways taken by the linking roads through the mountains that surround them. To the north, the Wei River valley, or "Guanzhong" (关中) that stretches between Xi'an (西安) in the east and Baoji (宝鸡) in the west is especially rich in agriculture and history. South of the Guanzhong past the Taibai mountain range (太白山) is the Han River (汉水) valley with the historical city of Hanzhong (汉中) at its centre. South across the Bashan (巴山) mountain barrier lie the plains of present day Sichuan or the ancient region of Shu (蜀). The roads through the Qinling and Bashan mountains have therefore often been called the Roads to Shu.

The mountains of this region are steep and dangerous and the few natural pathways through them are still challenging for modern engineering technology. Nevertheless, the journey had its rewards. Much of the silk that travelled the Silk Road (丝绸之路) first crossed the Qinling to reach the northern roads to the west. However, the first recorded roads across the Qinling were the military roads built by the state of Qin (秦, during the Warring States 战国 period) to support their conquest of Shu for its vital resources and as a strategic move against its rival Chu (楚). This happened in about 316 BCE and led to the establishment of the Dujiang irrigation area (都江堰灌溉系统) that made Shu a “rice bowl” for Qin and fed its armies. The irrigation area and much of its original engineering is still in operation.

### 1.3 Plank Road History

Through the Qin and Han dynasties (秦汉代) and through to the Tang (唐代) the roads to Shu were built, destroyed, rebuilt and repaired but the traffic generally continued one way or another and still does today. But if traffic through high mountains and steep valleys were not enough, the roads to Shu involved something extra special. To make roads through the narrow and dangerous valleys where floods, landslides and even wild animals made it hard to travel the ancient road builders created a style of road that was unique and effective. These roads were “plank” or trestle roads in which were built on the sides of the valleys and linked the more open areas through narrow and dangerous passages. The Plank Roads were described by Sir Joseph Needham (1971) as “The greatest engineering work of Qin/Han roadbuilders” and Lecomte in the 17<sup>th</sup> century wrote: “The Road from Si-ngan-fou (Sian) to Hamtchoum (Hanchung) is one of the strangest pieces of work in the world. They say, ..., upon the side of some Mountains which are perpendicular ... they have made a sort of Balcony without rails, which reaches through several Mountains in that fashion”.



The Plank Roads are strongly embedded in the history and culture of China. In history, as described in Sima Qian’s “Records of the Grand Historian” (司马迁, “史记”), after the fall of Qin and at the instigation of Zhang Liang (张良), Liu Bang (刘邦) “burnt the Baoye plank road” (烧绝褒斜栈道) to convince (deceive) the hegemon of Chu, Xiang

Yu (项羽) into believing that he had no intention of returning from his kingdom in exile of Shu, Ba and Han to conquer China. Liu Bang defeated Xiang Yu and went on to found the first major and long lasting Chinese dynasty. During the Later Han the Shu roads were major pathways for armies (de Crespigny, 1984) and as the Han broke up, the Shu Roads were the routes by which Zhuge Liang (诸葛亮) and the Shu armies travelled to attack the kingdom of Wei as they tried to restore the Shu Han king Liu Bei (刘备) and his heirs as the inheritors of the Han. Then, in the “Romance of the Three Kingdoms” (三国演义) and other stories these histories moved deeply into the literature, traditions and culture of China. In following centuries, people, trade, communications, animals, information, ideas, armies and emperors continued to use them and even lychees were brought along the Shu roads to satisfy the needs of Yang Guifei.

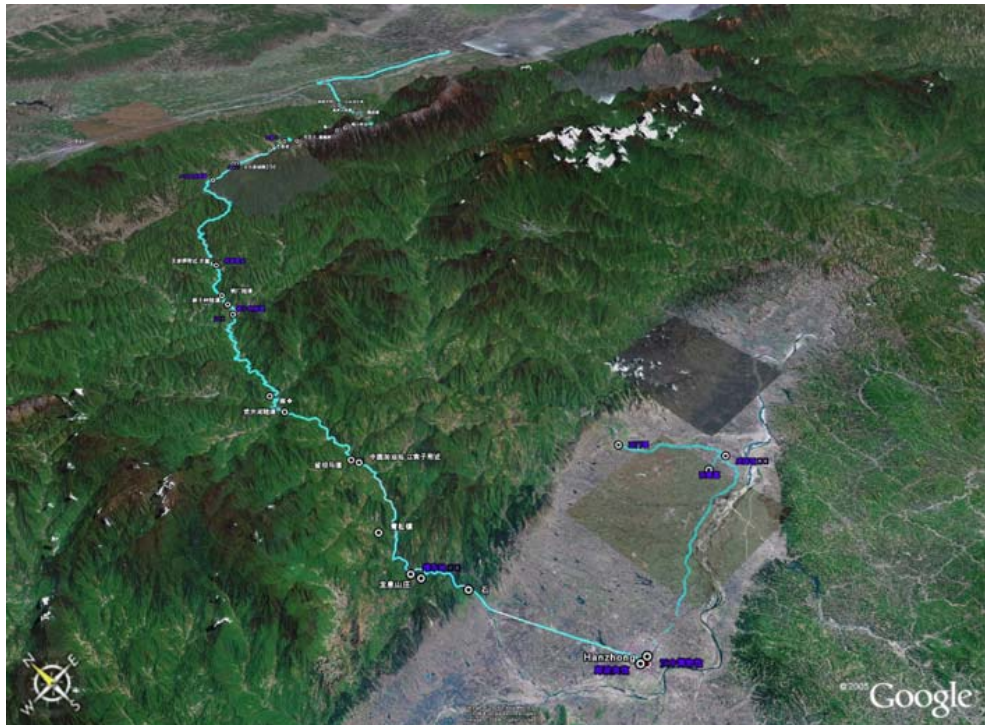
At the centre of the Qinling traffic stood the rich and fertile plain surrounding the Han River and its major city Hanzhong. The upper Han River valley was home to Chinese civilisation since Neolithic times and maintained a central position down to the present day as a privileged and well protected area between north and south. Its temperate climate and civilisation have led to it being called “The little Yangse River of the Northwest” (西北小江南) and in more ancient times “Yu Pen” (玉盆) or the precious basin. This was where the first Han emperor Gaozu (Liu Bang) had his palace – at the Hantai (古汉台) where today this history and culture is recorded by the Hanzhong Museum (汉中博物馆).



## 1.4 3S and the Plank Roads

The paths for the roads to Shu as well as from Shu to Guanzhong were strongly determined by the terrain and its opportunities and constraints as well as by the ingenuity of human engineers and determination of armies, conquerors, rebels and Emperors. They have a strong geographical aspect, determination and relationship and can therefore be profitably represented in the framework called “3S” in China. “3S” stands for Remote Sensing (usually from satellites), Geographic Information Systems (GIS) and the Global Positioning System (GPS).

The following image shows the “3S” in one picture. It is a Google Earth view of the Qinling mountains with the Guanzhong in the north (top) and Hanzhong in the south (bottom). The track plotted on the image is the path taken by driving along a modern road close to one of the ancient Shu roads and where some of the remaining relics were mapped by GPS and marked as way points. The terrain is provided by the SRTM layer of Google Earth and the information attached to the way points and tracks can be interrogated from the software. There is also in this image the record of a visit to two of the many ancient sites near Hanzhong – the tomb of Han period diplomat Zhang Qian (张骞墓) and the ancient irrigation engineering site at Wumenyan (五门堰).



There are many cases where an established geographic framework for ancient relics and roads can help the task of conservation and preservation. The framework needs to be at the appropriate scale and the value can grow as geographic and non-geographic information is collated onto the same base. In addition, in these regions where the terrain and associated climates play such a dominant role in the record of history, the value of an accurate geographic framework to answer questions and resolve remaining mysteries

concerning possible pathways and associations adds another dimension to the pursuit of research into the Shu Roads. Bringing the geographic information of ancient texts and maps into a consistent modern mapping framework identifies errors and ambiguities and also generates new associations and ideas.

The objectives of this Australia-China Council (ACC) supported project are to demonstrate how history, terrain and 3S may be integrated and used as a tool so that people at the centre of the history, its conservation and preservation – the Hanzhong museum – can access and use it for their work and to generate new ideas. The aims include bringing along associated technologies such as document and photograph scanning to support the integration of a wide variety of information onto a base that is geographic, electronic, historical and cultural. It has already started and is planned to finish by mid-2008.

## **2 PROJECT OBJECTIVES**

1. To provide an introduction to 3S technology appropriate to historical and archaeological studies at a Symposium on Shu Roads and Plank Roads in Hanzhong;
2. To promote the interactions in applications of 3S technology to preservation and conservation for historical relics and records and the resolution of historical questions between Hanzhong Museum and similar Australian academic groups and Museums;
3. To promote the application of Australian experience in 3S technology, historical research, conservation and preservation of history, historical records and environment as well as tourism at the practical level needed in China;
4. To organise specific meetings in China and Australia to help bring groups together and build a sustainable support mechanism in China and also to advertise and report on the progress of the project;
5. To promote the development of interactions between the Hanzhong city governments with Australian groups to promote development of ecological, historical and adventure tourism.

## **3 SUMMARY OF THE PROJECT PLAN**

The Project will proceed in two Phases. Phase 1 will organise a Symposium on Shu Roads (with special emphasis on the Plank Roads) at which the opportunities and technologies provided by 3S technologies will have a specific focus. The Symposium will also help define a specific pilot project. Phase two will carry out the pilot project identified in Phase 1 to demonstrate the application of 3S technology to Plank Road research.

The first Phase of the Project Plan also involves visits to China with meetings in Yangling and Hanzhong in October and November 2006 to establish the detailed activities of the Project and to plan and promote the Symposium. Visits by Chinese representatives to Australia in 2007 will develop links, visit Museums and academic groups and promote the Symposium on Shu Roads (with special emphasis on the Plank Roads) and advance the implementation of the second phase.

The Pilot Project of Phase 2 may be refined and have additional detail following the Symposium in 2007 but will involve the accurate mapping of one or more Shu roads, the GPS location of sites and records of condition of relics and the integration of information from a number of sources. This information will include satellite data, terrain models, ancient and modern maps, photography and ancient texts. When combined they will be used to support conservation, preservation and historical research.

## **4 CONTACTS FOR PRINCIPAL INVESTIGATORS**

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## 5 REFERENCES

### 5.1 Supporting documents for the text

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de Crespigny, R. (1984). *Northern Frontier – The politics and Strategy of the Later Han Empire.* Faculty of Asian studies, Australian National University, 1984.

Luo, G. (1360). *Three Kingdoms.* Translated by Moss Roberts. Foreign Languages Press, Beijing, 1994. (罗贯中, 三国演义)

Sima Qian (120 BCE). *Records of the Grand Historian.* Translated by Burton Watson, Columbia University Press, 1961, (司马迁, 史记)

### 5.2 Other Supporting Documents for the Project

David Jupp (2006). Satellite mapping of the Roads to Shu – Update 蜀道卫星影像 –更新换代 (Powerpoint file as PDF)

David Jupp (2005). The Baoye Road to Shu – from Guanzhong to Yu Pen (Visit to the Baoye Road (褒斜道) in 2005) as PDF File.

### 5.3 The Australia-China Council (ACC)

The Australia-China Council (ACC) was established by the Australian Government in 1978 to promote mutual understanding and foster people-to-people relations between Australia and China. More information can be found at:

<http://www.dfat.gov.au/acc/>





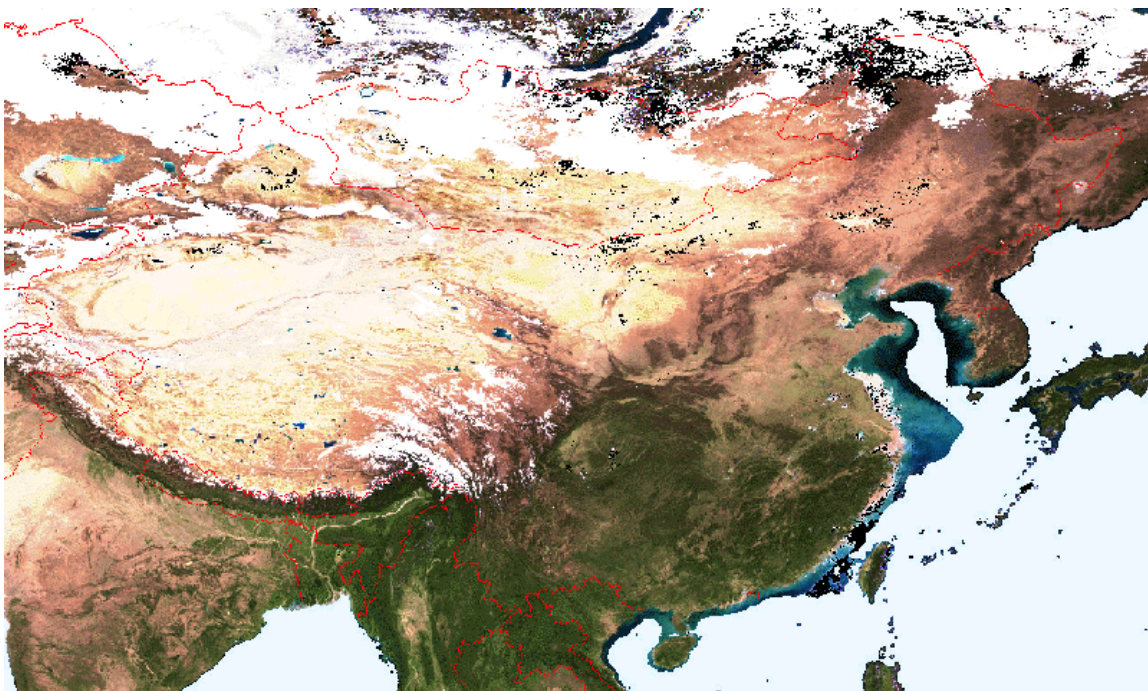
## 中澳合作

### 在中国西部汉中地区应用 3S 技术

### 促进历史古迹研究，提高历史文化影响

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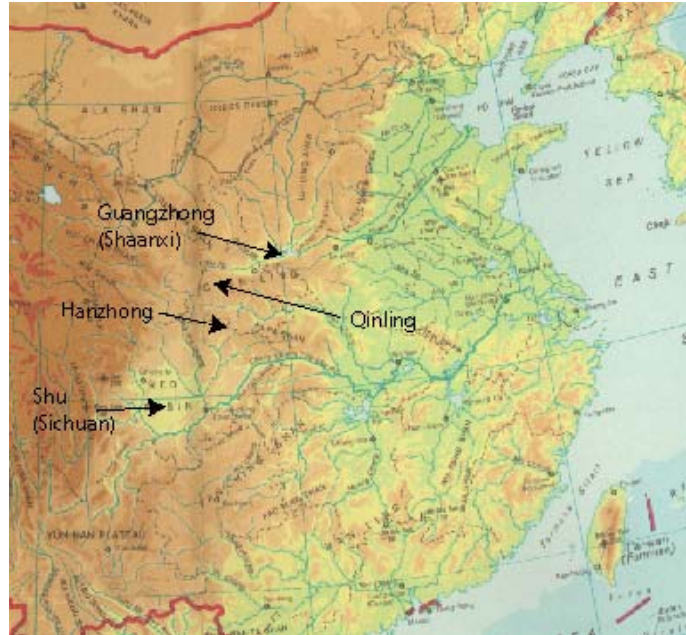


此项目由澳中理事会资助，澳大利亚新南威尔士大学国防学院分校、中科院水土保持研究所（陕西省杨凌）和汉中博物馆联合承担。

# 1 简介

## 1.1 秦岭屏障

秦岭山脉位于陕西境内，将中国西北和西南的气候、景观、地理以及历史古迹截然分开。秦岭还是中国南方（夏季较温暖潮湿，主要生产大米）和北方（冬季干燥寒冷，主要生产小麦）的分界线。



## 1.2 蜀道

秦岭曾经给历史上的陕西和四川两地之间的文化交流带来很大困难。本项目研究古代的通讯、交流、贸易和交通如何穿越秦岭而发展。研究的对象是将三个相对封闭的谷地连接起来的交通路线，包括这些路线上穿越周围山地的小道。这三个谷地在中国历史上扮演了十分重要角色。最北面是渭河盆地（关中），西起宝鸡，东到潼关，农业发达，开发历史悠久。关中往南跨过秦岭的主峰太白山脉为汉水谷地，历史名城汉中位于其中心。再向南穿过巴山山脉就是四川平原，这是古代的蜀国所在地，因此穿越秦岭和巴山的道路也常常被称为“蜀道”。该地区山脉陡峭而危险，仅有的几条天然道路，即使对现代的工程技术来说也是个挑战。然而这些通道在历史上发挥了重要作用，通过丝绸之路运往西域的上许多丝绸，就是通过这里运到秦岭北面的道路上再西去的。不过第一条有历史记录的穿越秦岭的道路是条军用道路，系战国时期秦国为了攻占蜀国，获得其富饶的资源而修建的，修路同时也是针对敌国--楚国的一个战略行动，这发生在公元前 316 年左右；接着，秦又建立了都江堰灌溉系统，使蜀成了秦的“粮仓”，供养了它的军队。都江堰灌溉区和大部分原有的工程设施现在仍然发挥着作用。

### 1.3 栈道的历史

从秦汉代到唐代，蜀道被不断地修建、摧毁、重建、修补，然而无论怎样，交通都始终持续着，直到今天。如果跨越高山、穿过陡谷还不足以说明什么的话，蜀道确实还包含了一些更特别的东西。在狭窄危险的山谷，洪水、滑坡还有野兽使得旅行很艰难，古代的工匠们就发明了一种独特而有效的修路方式，这就是“栈道”，或者叫“栈桥”，建在山谷侧面，连接较开阔的区域以跨越狭窄危险的小路。李约瑟爵士（1971）认为栈道是“秦汉造路史上最伟大的工程”；17世纪的李明（法国传教士）写道“从西安到汉中的道路是世界上最奇特的工程之一。”“他们还说，‘...，在一些垂直的山壁...他们建了一个没有围栏的阳台，穿越了一座座山脉’。”



栈道作为一种含义深刻的古迹深嵌在中国的历史和文化之中。司马迁的史记中描述到，秦朝灭亡之后，刘邦听从张良的建议，烧绝褒斜栈道，使楚霸王项羽相信他要守在他的领地（蜀、巴、汉），不会再回到关中争夺天下。但他后来打败了项羽，建立了中国第一个历时悠久的大汉王朝。东汉时期，蜀道成为重要的行军通道（据 de Crespigny 1984 年文献，见参考书目）。汉朝瓦解后，诸葛亮数次领兵经蜀道攻打魏国，试图扶助蜀汉王刘备及他的后嗣恢复汉室。在《三国演义》和其它的故事中这部分历史深深地融入了中国的文学、习俗和文化。此后的许多世纪里，人类、动物、军队、帝王、贸易、通讯、信息、理念等方方面面都继续沿用着蜀道，甚至满足杨贵妃需要的荔枝也是通过蜀道运送的。

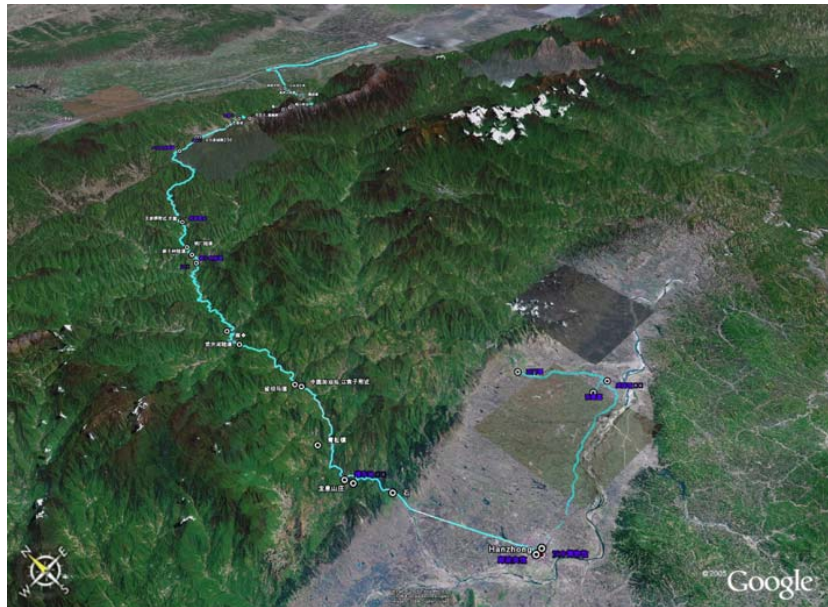
秦岭交通的中心是沿汉水发育的富饶平原和位于其中的重要城市汉中。汉水流域上游，自新石器时代以来就是中国文化的摇篮，它介于南、北方之间，得天独厚，未曾受过大的破坏，直到现在还维持着中心地位。气候温和，文化发达，被称作“西北小江南”，在更早的时候则被称为“玉盆”。这里也有汉朝第一个皇帝高祖（刘邦）建造的行宫——古汉台。这些历史和文化如今都在汉中博物馆里有记录。



#### 1.4 3S和栈道

蜀道位置的选择，无论是进四川还是去关中，主要受地形条件的制约，同时也受工匠的能力，以及军队、征服者、造反者和帝王的行为等人为因素的影响。它们有很强的地理特征、属性和关联，因此可以很好地用中国所说的“3S”技术进行研究。“3S”代表遥感（Remote Sensing，通常通过卫星）、地理信息系统（GIS），以及全球定位系统（GPS）。

下面的一幅图展示了“3S”的应用。这是 Google Earth 显示的秦岭地区图，关中在北面（图片上方），汉中南面（图片下方）。图片上描出的道路是我们 2006 年开车走过的现代公路，距离一条古代蜀道很近。一些遗留的古迹用 GPS 定位，标识为航迹点。地形特征由 Google Earth 的 SRTM(航天飞机雷达地形测量任务)图层显示，航迹和航迹点所附信息可以从软件中调出来。汉中附近的古迹很多，我们参观了其中的两个——汉代外交家张骞的墓地和五门堰的古灌溉工程，在该图也有显示。



有许多研究实例表明，建立古遗迹和道路方面的地理信息系统有助于遗迹的保护和保存。这个系统应有适当的尺度，当地理的和非地理的信息都汇集在同一个数据库时，原有信息的价值就会增加。尤其在那些地区，地形和相关的因素对历史起了决定性的作用，用一个精度较好的地理系统来解答关于古道的可能位置和相关事宜的疑问，给蜀道的研究提供了新的途径。把古代文字材料和地图里的地理信息汇入可靠的现代制图系统中，既可以找到以往错误或模棱两可的地方，也有利于研究人员发现新的关联，产生新的思路。

本项目由澳中理事会资助，其目的在于展示如何将历史纪录、地形分析和 3S 技术统一起来，形成一个工具，让处于有关历史事件中心位置并担当其保护保存任务的汉中博物馆的工作人员使用，促进新观念的形成。目标是在各种相关技术（例如文件和图片的扫描技术）的支持下，把多种信息综合到一个兼具地理、电子化、历史和文化属性的数据库里。这个项目已经启动，并计划于 2008 年中期完成。

## 2 项目的目标

1. 2007 年在汉中举行蜀道研讨会，系统介绍古代栈道研究成果，研讨 3S 技术在历史和考古研究中的应用。
2. 促进汉中博物馆和类似的澳洲学术团体及博物馆在应用 3S 技术保护保存历史遗迹和文献、解决历史难题方面的合作与交流。
3. 根据中国的实际需要，引进澳大利亚在 3S 技术应用、历史研究、历史记录和环境的保存与保护，以及旅游方面的成熟经验和研究成果。

4. 在中国和澳洲举办会议，使参与项目的各方进一步交流，并在中国建立一个可持续的支持机制，宣传项目进展，扩大影响。
5. 增进汉中市和澳洲团体组织间的交流与合作，进而促进生态、历史和探险性旅游的发展。

### 3 项目计划概要

项目将分两阶段进行。第一阶段在预研究和野外考察基础上举办蜀道（着重于栈道）及“3S”技术应用研讨会。确定的试点研究项目的具体内容和方案。

在项目的第一阶段，澳大利亚方面的科学家分别于2006年10月和11月到中国进行考察，在杨凌和汉中举行双边会议，讨论拟定具体的分阶段计划。2007年初中国方面的合作者到澳大利亚访问，参观博物馆和学术团体，并进一步讨论落实蜀道（着重于栈道）及“3S”技术应用研讨会的准备，和第二阶段的合作计划。

2007年研讨会之后，项目进入第二阶段，重点是完成试点项目内容包括一条或多条蜀道的精确定位、遗址的GPS位置记录、遗迹状况报告和各种来源信息的整合。这些信息包括卫星数据、地表模型、古代和现代的地图、照片和古代文字材料。将它们结合在一起，有助于古迹的保存保护和历史研究。

### 4 主要研究人员的联系方式

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## 5 参考书目

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贾大卫(2005), *通往蜀国的褒斜道? — 从关中到玉盆(2005 年褒斜道考察)*, PDF 文件格式。

### 5.3 澳中理事会(ACC)

澳中理事会由澳大利亚政府于 1978 建立, 以促进澳大利亚和中国之间的互相理解, 增强两国人民的关系。更多信息请见: <http://www.dfat.gov.au/acc/>