Summary report of High Level Training Course on World Heritage under the framework of Digital Belt and Road

1. Background

The Silk Road Economic Belt and the 21st Century Maritime Silk Road, known as the Belt and Road Initiative or One Belt One Road, focuses on connectivity and cooperation among more than 60 countries. It offers many exciting prospects for design, development and implementation of projects, especially in the management and conservation of the environment, natural and cultural heritage.

The Digital Belt and Road or DBAR Initiative, launched by the Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, aims at advocating and demonstrating the smart use of Big Earth Data across a range of applications, including the management and conservation of UNESCO Designated Sites (including World Heritage sites, world biosphere reserves and UNESCO global geoparks).

Recognizing the needs of the UNESCO member states for improving their capacities in understanding and interpreting satellite images for better monitoring and conservation of their UNESCO designated sites and the opportunities that DBAR provides, the International Centre on Space Technologies for Natural and Cultural Heritage (HIST) under the auspices of UNESCO, organized the “High-Level Training Course on World Heritage under the Framework of Digital Belt and Road (DBAR)” in collaboration with the International Society for Digital Earth from 02 - 17 September, 2017 in Beijing and Zhengzhou, Henan Province. The course was financially sponsored by the Chinese Academy of Sciences (CAS) and was attended by 19 high-level policy makers and managers of UNESCO designated sites from 10 Belt and Road nations across Asia, Africa and Europe and by 6 candidates from within China. Spanning over 15 days, the course started in Beijing on the premises of the Chinese Academy of Sciences and moved to the HIST Zhengzhou Base in Henan province for the subsequent week. The training comprised of lectures, hands-on
training sessions, field visits and interactive exchanges on experiences and techniques in the monitoring, conservation and management of World Heritage sites.

2. Objective

The training course aims to provide high level policy-makers and managers of UNESCO designated sites an insight into the use of space technologies for the enhancement of their capacity to monitor and conserve their respective sites and promote international cooperation with and between the participating countries and sites.

3. Basic Information

3.1 Opening ceremony

The opening ceremony of the training course was held on September 4, 2017 and was presided over by HIST Executive Deputy Director and Secretary-General Mr. Hong Tianhua. The welcome speech was made by Prof. Liu Jianbo, Deputy Director of RADI. The representative from the Ministry of Housing and Urban-Rural Development Mr. Sun Tie and from the State Administration of Cultural Heritage, Mr. Huang Xiaofan made their opening remarks. Prof. Wang Changlin, Executive Director of the International Society for Digital Earth (ISDE) then introduced ISDE’s mandate and activities, following which Prof. Chen Fulong from HIST/RADI made a speech on behalf of the lecturers for the course and Mr. Momchil Petrov from Bulgaria spoke on behalf of the participants.
The participants were then taken for a tour of RADI’s facilities, wherein they viewed the demonstration video titled ‘Space Technologies for World Heritage’, visited the Satellite Operation and Management Department and the Airborne Remote Sensing Centre.

The opening ceremony for the second phase of the course was held at the HIST Zhengzhou base premises on September 11 and was attended by the head of the base Prof. Feng Dexian, Prof. Hong Tianhua and other attendees. The significance of Henan province’s rich heritage was highlighted by the dignitaries and they wished that the trainees would get to experience the real China from this visit.

3.2 Teaching Arrangement

3.2.1 Lecturers

There were more than 14 lecturers who made presentations on a wide variety of topics, including Guo Zhan from ICOMOS-China, Shi Yichuan from the UNEP-World Conservation and Monitoring Centre, Philippe Delanghe, head of the culture unit at UNESCO Phnom Penh, Francesca Cigna from the Italian Space Agency ASI, Natarajan Ishwaran, visiting professor at HIST, Ma Xiaolin, deputy director of the Henan museum and several lecturers from RADI/HIST.
3.2.2 Teaching contents

The training course focused on the themes under the Digital Belt and Road initiative and centered on their application in World Heritage sites and other protected sites, most importantly the use of space technologies in monitoring and conservation of these sites. It included lecture sessions on basic areas and applications of space based technologies in heritage, hands-on training sessions, field visits and exchange of experiences on their management and conservation. Covering a broad spectrum of relevant topics, there was something of interest for all of the trainees and the combination of theory and practice was welcomed by the trainees.

The first week in Beijing focused on lectures, hands on sessions and brainstorming. During the hands on sessions trainees learnt about acquiring remote sensing data, working with different software, performing basic image processing and making observations from the results obtained. Brainstorming sessions saw them coming up with challenges facing their sites, the learning they received from the course or from their experiences and identifying particular remote sensing challenges. They were also divided into three groups, each selecting their own group leader, to enhance participation and interaction.

The group then travelled to Zhengzhou for the second week of the course, which also saw a medley of lectures and hands on training. But most importantly, the trainees made their first field tour to the archaeological site of Shuanghuaishu in Henan province, located on a mound in Heluo town of Gongyi city, located 2km to the south bank of Yellow River and 4km to the east bank of Yiluo River.
According to the result of prospection, the area has reached 1.17 million square meters, and it has been found to be dating back to the middle - advanced stage of the Yanshao period (5300BP). The important discovery has been of the trebling large circle trenches, a big rammed earth relic, two tombs of Yangshao period, a distribution area of large house, and 13 sacrificial pits with plentiful or special antiques. This was witnessed by the trainees and the team on the ground, with a demonstration of 3D modeling and UAV technologies.
The second field visit was made to the World Heritage site-Historical Monuments of Dengfeng in the “Centre of Heaven and Earth” on September 14. Located at the base of the Songshan Mountains, this heritage site is a cluster of eight monuments spread over a 40km² circle. The group visited the architectural complex of the Shaolin temple and the Observatory. The architectural works, stele inscriptions, and murals in the Shaolin Temple fully demonstrated the history and significance of Shaolin Martial Art, while the complex was found to be notable for its architectural splendour. The Observatory is a building for scientific observation and was constructed from the 13th to the 16th year of the Zhiyuan Period in the Yuan Dynasty (1276–1279) making it China’s oldest surviving astronomical observatory.

The group at the astronomical observatory heritage site

The course material covered the following spectrum of topics:

1. Program of DBAR (Digital Belt and Road)
   Lecturer: Ms. Liu Jie, RADI

Ms. Liu Jie introduced the Digital Belt and Road program with information regarding its background, beginnings, evolution and current status. She provided a comprehensive overview of the projects coming under the purview of DBAR and presented possibilities of mutual collaboration among the participating countries, especially the avenues for doing so.
2. DBAR Program for Heritage
Lecturer: Prof. Wang Xinyuan, RADI

Prof. Wang Xinyuan gave an introduction to the DBAR Natural and Cultural Heritage International Working Group (DBAR-Heritage) as being dedicated to transferring the benefits of rapidly advancing Earth Observation Science and Technology (EOST) to protect the CNH sites and support global efforts to attain the sustainable development goals. He added that there were thousands of cultural and natural heritage (CNH) properties distributed on the BAR region, including more than 700 world heritage properties, distributed along the BAR and highlighted that most of the properties lacked effective protection due to an imbalance in scientific-technological development along the BAR. He then mentioned the objectives, composition of the team and project progress of the working group.

3. ISDE and Digital Silk Road Alliance
Lecturer: Prof. Wang Changlin, RADI

Prof. Wang Changlin gave an overview of the Digital Earth initiative as being a common platform to support national and international cooperation for global
sustainable development, and a newly-developing point of economic growth and social well-being. He said that the International Society for Digital Earth (ISDE) promotes international cooperation of the Digital Earth vision, and enable Digital Earth technologies to play key roles in, inter alia, economic and socially-sustainable development, to promote information technology and to reduce digital divide.

Prof. Wang Changlin speaking about ISDE

4. Optical remote sensing technology and its application
Lecturer: Prof. Gao Lianru, RADI

Prof. Gao Lianru gave an introduction to the principles of optical remote sensing. He then went into detail regarding the spectral properties of earth materials, sensor technologies, image data processing and models. The presentation included applications of optical remote sensing, including precision agriculture, mineral Exploration, urban and artificial objects detection, water quality detection, and so on. Average feedback score: 8.2 (10 point)

Session with Prof Gao Lianru

5. Microwave remote sensing technology and its application
Lecturers: Dr. Chen Fu/Dr. Ma Yong, RADI

The course introduced an active-passive joint method for detecting the surface change
with the active and passive remote sensing data. This method used the multi-source remote sensing data to make up for the disadvantages of single source data, and used the advantages of each data source in space, radiation, texture and backscatter to increase the recognition ability of the detection target. By using the comprehensive analysis of multi-temporal multi-source data, the continuity and validity of the target monitoring was shown as being improved, and the reliable and accurate objective information was efficiently extracted so as to be better applied to the practical management work.

Average feedback score: 7.9 (10 point)

Lecture of Dr. Chen Fu/ Dr. Ma Yong

6. Geographic Information System (GIS) and its application
Lecturer: Dr. Jiang Hao, RADI

This presentation discussed the fundamentals of GIS and its benefits to a new concept Digital Earth. Some principles of GIS were introduced, including purpose of GIS, spatial data types, data storage and processing, spatial analysis and data visualization. Web GIS technology was demonstrated as a portal for earth observation data sharing and data observation.

Average feedback score: 8.25

Prof. Jiang Hao’s session
7. Virtual Satellite ground receiving station
Lecturer: Prof. Liu Jianbo, RADI

Prof. Liu Jianbo’s presentation focused on a new way to access remote sensing satellite image, by making use of the strong available capacity to transfer, calculate, and compress the remote sensing data immediately after data reception from a satellite, and provide the image in near real-time to users. He spoke about the major functions of the satellite ground receiving station, including full resolution, overlaid with vector data such as longitude/latitude and administrative name, image zooming/panning, satellite/sensor information, data reception schedule, etc. He also mentioned the advantages of the using such a system and its applications in monitoring of heritage sites.
Average feedback score: 8.26

8. World Heritage in China
Lecturer: Prof. Guo Zhan, ICOMOS-China

Prof. Guo Zhan introduced the heritage sites in China, by providing an overview and explaining the concept of outstanding universal value. He then proceeded to talk about mixed sites in China, serial nomination sites and about the Silk Road project. Delving deeper into the Silk road, and cultural routes in general, he enumerated the various projects and mentions attributed to cultural routes in international texts and explained how the Silk Roads fulfil the criterion related to cultural routes perfectly. He then expounded further on the management and processes involved in the serial nomination process for transnational world heritage silk road.
Average feedback score: 8.4
9. Radar remote sensing for cultural heritage applications
Lecturer: Prof. Chen Fulong, HIST/RADI

Synthetic aperture radar (SAR) was mentioned to be increasingly recognized as an irreplaceable tool in applications of archaeological prospection as well as cultural heritage conservation taking advantage of the all-day and all-weather observation capabilities. Prof. Chen Fulong explained the unique performance of SAR compared with optical approaches, including subsurface imaging and interferometry, and how it was objectively exploited and assessed using simulations and case studies. He specifically highlighted how Multi-Temporal SAR interferometry (MT-InSAR) was useful in risk monitoring and preventive diagnosis of cultural properties as well as their hosting landscape using millimetre-level motion indicators.
Average feedback score: 8.19

10. Remote sensing technologies for monitoring and conservation of heritage
Lecturer: Dr. Shi Yichuan, UNEP-WCMC

Dr. Shi Yichuan’s course provided an insight into the prototype work of IUCN and UNEP-World Conservation Monitoring Centre (UNEP-WCMC) into scaling up of monitoring efforts using GIS and remote sensing. He first introduced IUCN the
advisory body on natural World Heritage sites and UNEP-WCMC in relation to the Convention, on nomination, monitoring and capacity building. He then focused on the progress of using GIS and remote sensing under IUCN’s Brighter Outlook project. The session also saw brainstorming by the candidates on challenges and opportunities for remote sensing to be used in conservation and monitoring.
Average feedback score: 9.4

Prof. Shi Yichuan’s session

11. Application of LiDAR for archaeological sites
Lecturer: Prof. Philippe Delanghe, UNESCO-Phnom Penh

Prof. Philippe Delanghe presented the project application of LiDAR on the Angkor World Heritage Site conducted by a consortium of national and international teams from Cambodia, France, Australia, Japan, Italy and the USA. In 2015, a LiDAR mission was launched as a follow up to a previous mission in 2012. This time the areas around Phnom Penh, Phnom Kulen, Sambor Prei kuk, Preah Khan Kampong Svay and Preah Vihear were also included in the mission. Prof Delanghe then went on to explain parts of these new discoveries, with some special features on pre-Angkor discoveries.
Average feedback score: 8.5
12. Resources and Management of Cultural Heritage in Henan, China
Lecturer: Dr. Ma Xiaolin, Henan Provincial Administration of Cultural Heritage

The lecture introduced the cultural heritage resources in Henan province, the laws and rules concerning cultural heritage in China, and the organization of cultural resource management in Henan. Dr. Ma Xiaolin went into deeper details in the lecture, including providing the details of immovable cultural relics, historical and cultural monuments, museums etc. He also explained the different aspects of the Law on the Preservation of Cultural Relics of People’s Republic of China.
Average feedback score: 8.0

Prof. Ma Xiaolin’s lecture

13. Multisource Spatial Data Acquisition and 3D Modeling of Cultural Sites
Lecturer: Dr. Ruixia Yang, RADI

Dr. Yang Ruixia spoke about the 3D documentation of an archaeological site, excavated close to Zhengzhou city, by UAV and 3D-Lidar, and archaeological record and surveying and mapping. She explained that first, the archaeologist would elucidate the base information, such as its time, feature, relics, Object-oriented 3D technical requirement, and then the collection of the 3D data, including tombs, pit, profile, foundations and so on will be conducted. Use of Lidar scanner and multi-view photography was explained, following which details of data processing and modeling using special software was given.
Average feedback score: 7.9
14. Mapping geohazards affecting UNESCO designated sites using Earth Observation data
Lecturer: Dr. Francesca Cigna, Italian Space Agency (ASI)

Dr. Francesca Cigna provided and overview of the potential of Earth Observation (EO) data to map and characterize geological processes and hazards in UNESCO World Heritage sites. She explained that EO data from optical and radar sensors and image analysis techniques provide robust geo-information and observations for the monitoring of ground instability over wide areas, enhancing our understanding of geological processes. Further, Dr. Cigna presented case studies from Europe and beyond and participants were given chance to familiarize themselves with satellite EO data and perform geological interpretation and analysis using a GIS platform.
Average feedback score: 9.4

15. Space Technologies and Heritage Management: towards a problem focused approach for collaboration
Lecturer: Dr. Natarajan Ishwaran, HIST

Dr. Ishwaran spoke about how collaboration between managers, scientists and
technologists for heritage management is often constrained by different educational backgrounds, varying emphasis on practical as opposed to theoretical problems and social, economic and political contexts. He then mentioned that a problem focused approach to bringing together heritage managers, scientists and technologists will bring greater benefits and satisfaction to all parties concerned and has better chances of convincing managers of the importance of effective use of space technologies for conservation and sustainable development of heritage, using specific examples and case studies.

Average feedback score: 8.9

Lecture by Dr. Natarajan Ishwaran

All through the first week in Beijing, the trainees presented their experiences in the management of heritage sites. With a good mix of trainees from natural and cultural sites, they were able to appreciate the challenges faced by either type of sites and find synergies and points of contact amongst the ones similar to theirs. They actively communicated with each other and formed connections for future collaboration. Further coordination was enhanced by special group building and creative quality exercises which were conducted for the trainees. They enjoyed the session and were able to talk freely amongst themselves whilst working in groups and individually.
Exchange of experiences by the trainees

Participants during the creative quality exercises

3.2.3 Closing ceremony
The closing ceremony was held on September 15 at the HIST Zhengzhou base. The ceremony was preceded by a feedback session, chaired by Prof. Hong Tianhua, with Dr. Natarajan Ishwaran and Dr. Francesca Cigna. During this session, the trainees were able to express their thoughts on the workshop. They all thanked the organisers, HIST, RADI and CAS for conducting the workshop and extending the invitation to them.

The ceremony began with a warm note, with a special video played for the trainees comprising of the moments captured during the workshop. Prof. Hong Tianhua then made his closing remarks, wherein he presented a brief summary of the course, thanked the trainees for having attended the course and for having extended their cooperation. He also expressed his gratitude to the organisers and the team at HIST Zhengzhou base for making the course happen. Prof. Wang Changlin then presented his closing remarks to the audience. The distinguished guests on the podium then presented the trainees with their certificates for participation. With this, the training course was wrapped up successfully.

4. Conclusion

The first of its kind training course for high level practitioners and managers from UNESCO sites was successfully conducted. The following factors were the highlight of the course

1. **Common connections between the nations** - the course saw attendees from nations along the Belt and Road and were able to find linkages between their work and their sites among each other, highlighting the shared common heritage amongst these nations.

2. **High level practitioners and decision makers** - this year’s training saw trainees coming from various functional levels in heritage management. Training of candidates from diverse functional levels serves a critical purpose in spreading the
knowledge and awareness regarding new technologies available for meeting their needs and it also helps to bring out issues and methods which may not surface with a homogenous crowd working on similar themes and levels.

3. **High calibre of the faculty**- the faculty consisted of experts and scholars who had a solid background and understanding of their course material. They were receptive to the trainees’ requirements from the course and were able to share their knowledge in that context, making the courses relevant and interesting.

4. **Innovative field training sessions**- the experience of visiting the two sites was an eye opener for many trainees. The trainees got to experience effective prospection, identification and monitoring from the first site, while they could observe effective conservation and management of sites from the second site, apart from enjoying the beauty and splendour of the sites.

5. **Co-learning between teachers and trainees**- the approach to the training course was based on the needs of the trainees and hence the delivery was targeted and problem oriented. The teachers also learnt many valuable inputs on their course material, delivery and general information about management issues/technical advancements which were discussed through interactions.

6. **Experience training in different cities**- the training course was a result of synergistic organisation, spanning over Beijing and Zhengzhou. The trainees were hence able to experience and appreciate the culture, cuisine, hospitality and infrastructural features of the cities and learn in-situ about heritage and the technologies used.

**5. Experience**

**5.1 Teaching**

During the training, HIST explained the operation method and applications of the UAV and 3D Laser scanning on the field at Shuanghuaishu archaeological site. The training workshop set a precedent for on the field teaching of such technological innovations and in the teaching model is expected to be replicated and enhanced in the future trainings.

**5.2 Organisation**

The organisational capabilities of the Organising Committee of the training course has been recognised and appreciated. As mentioned above, the conduct of the training
course between two cities, not to mention the arrangements for logistics for transfer, boarding and lodging, field visits and travel to airports and railway stations made the arrangements challenging. Despite this, the team was able to successfully manage the logistics and conduct of the course. All the trainees thanked the organising team and praised their work in organising the course, keeping in mind dietary habits, religious beliefs and cultural differences among the trainees.

5.3 Promotion

External promotion is essential as it may help showcase the training course to the whole world. This year the announcement for the training course was displayed on the UNESCO World Heritage Centre website, along with the HIST official website. Therefore, based on the successful experience, we shall attach greater importance to media cooperation and promotion in the future.

6. Feedback

After the successful completion of the High Level Training Course on World Heritage under the framework of Digital Belt and Road, 24 participants filled out the feedback questionnaire to evaluate the effectiveness and overall arrangement of the training workshop. Compilation and analysis was done for the responses to identify the strengths and weaknesses for the reference of the organisers to improve the conduct of future events.

6.1 Analysis of feedback

The questionnaires were divided along the lines of feedback for the lecturers, sessions and organisation.

6.1.1 Sessions, understanding and organisation

The hands on training and the field visit sessions were well received by the trainees. Certain feedback indicated that they required more time for conducting the exercises. 61% of the trainees felt that the hands on sessions were very good, while more than 50% felt that the site visits were excellent.
The majority of trainees felt that they received a very good overall understanding of the concepts and principles introduced. 63% of them also felt that the interaction between the trainees during the workshop was very good.

The organisational success of the training course was reflected in the feedback received regarding the facilities, the coordinating team and the overall organisation. 48% of the respondents felt that the facilities, including the boarding and lodging etc. were excellent, while 80% felt that the overall organisation was very good. The coordinating team received good reviews, with 90% feeling that they were excellent.
### 6.1.2 Additional Comments

All the respondents felt that the course was very useful in enhancing their understanding about the topic. Some of them mentioned specific sessions that were of interest to them, particularly Radar remote sensing and introduction to remote sensing software.

Certain suggestions were made regarding provision of guides or prior information with respect to field visits and boarding/lodging arrangements which have been taken into consideration for future courses. Overall the organisation was highly lauded by the trainees.