

## Geodetic Journey

From ancient surveying to modern earth observation  
with train from Beijing to Lhasa



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### **Motivation**

Exploring science and technology in China and Tibet Autonomous Region (TAR) with special focus on geodesy<sup>1</sup> and surveying&mapping; linking ancient history and modern development. Demonstrating applications of geodesy in climate change research, geohazards and mass distribution (water cycle).

### **Objectives and goals**

A team of experts will travel through China and the Qinghai-Tibet plateau. Starting in Beijing, the journey will go through the “Mother of China” region and along the ancient Silk Road before reaching Lhasa and Tibet. On the trip the team will unveil China and the Tibetan Plateau's natural beauty and characteristics as well as it's scientific and technical culture, history and recent discoveries. The team aims to develop crosscultural scientific projects that will both contribute to global research and build bridges between countries far apart; Norway and China. The main goals are:

- 1) **A journey** through China and TAR both in time and space
- 2) **Documenting** the journey through different media such as a TV-documentary, popular science articles, diaries, travel reports etc.
- 3) Define the basis for and start project development within **climate change, geohazards and space geodesy** research and **surveying and mapping history**.

### **Background**

The fact that China and TAR has been closed regions for a very long time (centuries) continues to intrigue people on the outside. The world is eager to learn more about this mysterious part of the planet. We do know that the first civilisations developed along the Yellow river in ancient China. Tibet is known for its natural beauty and tough living conditions. We are convinced there are a lot more to discover and learn about China and in particular the Tibetan Plateau now that the barriers are being removed.

The train is important in modern Chinese history and for it's future development. There was a thriving industry in the North-Eastern China around 1850 – 1950 where the train played an important role for the industrial success. In Shanghai we find the worlds fastest train in regular public use. It goes between Shanghai international airport and Pudong – an illustrating example of how fast China is developing today. Another technical achievement is demonstrated in the Qinghai-Tibet railroad. This is the railroad litterally on the roof of the world with its average altitude being more than 4000 meter above sea level.

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<sup>1</sup> [geodesy is the science of the earths shape, size, kinematics and rotation as well as its gravity field](#)

Today the railroad represent an environmental friendly transportation which is really important not only to the local Chinese but for the rest of the world.

Easier access to the environmental and cultural vulnerable regions like Tibet is not only a technological and historical miracle, it inspires and demands a sustainable development of the region. The possibility of producing new and highly valuable knowledge [using earth observation] create an extraordinary opportunity to improve the local management as well as giving important input to regional and global research. However, there is a great danger of damaging irreversibly this until now protected area. The society needs to protect the environment and safeguard the particular knowledge inherit in this exotic region.

### ***The journey(s)***

The journey will go from the Chinese capital Beijing through the ancient centres of the Middle Kingdom to the mysterious Lhasa and the Tibetan Plateau ending finally in modern Shanghai. The route has been chosen based on its historical and geodetic importance. The sites are chosen based on the book *Scenic splendor of China*, Chinese National Geography and their geophysical interest.

This is one of two or more journeys that will all focus on the importance of geodesy and the need for international cooperation to meet the societal requirements today and in the future.

<b><i>Educational travel documentaries</i></b>	
2007	2008?
From ancient surveying to modern earth observation	“From Viking age navigation to todays ice melting”
<p style="text-align: center;">Beijing (2008)  <b>“Mother of China”</b>                      (Kaifeng, Zhengzhou, Luoyang, Xi'an)  <b>The silk road</b>                      (Luoyang, Xi'an, Lanzhou, Xining)  <b>Tibet</b>                      Shanghai</p>	<p style="text-align: center;">Lillehammer (1994)  <b>The fjords</b>                      (Stavanger, Bergen, Lofoten)  <b>Struves Meridian</b>                      (Hammerfest,xx)  <b>Svalbard</b>                      Oslo</p>
Responsible: NMCA in cooperation with SBSM	Responsible: NMCA in cooperation with SBSM

<b><i>Educational travel documentaries</i></b>
2009-2010?
Melting ice in the Arctic and the Antarctic – impacts of the climate changes

To be defined
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NMCA in cooperation with SBSM, SOA, .....
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## **Outreach**

One of the main goals of this journey is to promote science and technology with a special focus on the past and present achievements by China within surveying and mapping, geodesy and its application within climate change research, geohazards and mass distribution (water cycle).

Outreach material within geodesy is scarce and difficult to make. Infotainment like a travel documentary is an effective way of reaching a broad audience from politicians to school children.

A [TV] documentary will only be able to describe geodesy in a simple way. In order to benefit from the public attention that a TV program/documentary can create, a website with more technical and detailed information about both geodesy in general and the selected applications will be made: [www.geodeticjourney.info](http://www.geodeticjourney.info), including links to professional organizations like IAG and GGOS.

Both during the journey it self, wich will take place in August 2007, and when the documentary is ready the parallell use of the website is planned. During the journey a blogg will be made and pressreleases submitted to call for the attention of media. The final documentary will be submitted to the Beijing ISPRS 2008 to be part of the Outreach program and finally during the Olympic Games in Beijing 2008 the documentary will be shown on TV stations – hopefully around the world.

An acknowledged professional TV-photographer/director from the NRK (Norwegian national broadcasting company) with experience from the Himalaya has accepted to join the team and will ensure a lot of footage that can be used for other educational and outreach purposes as well.

*Results: Documentary, articles, website, etc.*

## **International Cooperation**

The basis for this bilateral cooperation is the established contacts between the Chinese and Norwegian mapping authorities. In addition there are other institutions involved in both Norway and China.

### **The State Bureau of Surveying and Mapping of China (SBSM)**

The State Bureau of Surveying and Mapping of China (SBSM) is an administrative agency of the Chinese Government for surveying and mapping, which was established in 1956. SBSM has two main functions: the organization and management of the national basic surveying and mapping work; and the overall administration of the surveying and mapping profession. SBSM is one of the state bureaus under the Ministry of Land and Resources.

## Norwegian Mapping and Cadastre Authority

The Norwegian Mapping and Cadastre Authority is the equivalent to The State Bureau of Surveying and Mapping of China (SBSM) with the addition of its Hydrographic Service. NMCA belong to the Ministry of Environment.

*Organizations assisting in the making of the documentary in China:*

Chinese National Earthquake Administration, Chinese State Council

The Institute for Geographical Science and Natural Resources Research, Chinese Academy of Science

Chinese National Geography, IGSNRR

Local Branches of the Chinese State Bureau for Surveying and Mapping, Ministry of Land and Resources

*International organisations*

Contact with the International Association of Geodesy ( IAG) and its services and commissions as well as with the Global Geodetic Observing System (GGOS) will be made.

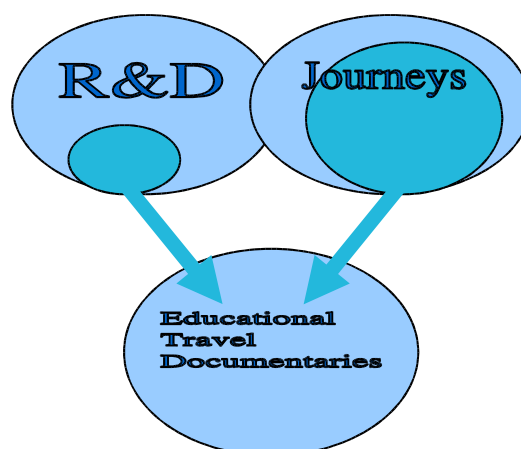
## Research Projects and Outreach

We will use the development of the cooperation between the mapping authorities as the theme and reason for the journey. Thus giving a meaningful background for the geodetic content of the documentary.

We plan to develop concrete cooperation projects within the areas

- Surveying and Mapping History of TAR – from pilgrims and pundits to space geodesy
- Climate change, geohazards and water cycle (mass distribution) research using geodetic tools.

The activities are interlinked as illustrated below:



*Structure of the cooperation projects*

## **About Geodesy**

Four focus topics have been identified within the scientific and technological area of geodesy, surveying and mapping:

- Geodetic reference frames (applications in geohazards etc.)
- Geoid (global geoid, local solutions, unified height reference, use of GOCE, GRACE etc.)
- GNSS – GPS, Galileo and Beidou/COMPASS (applications in geohazards, construction, navigation etc.)
- The history of surveying and mapping
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### *Geodetic reference frames:*

The concept of the geodetic reference frame will be explained. A couple of illustrating examples of its role in society will be made. China and Norway are equally important in defining and contributing to the global terrestrial reference frame. Different cultures – same work - same science – same technology

### *Geoid:*

As Himalaya and Tibet is the starting point for several of the largest rivers in Asia and the source for the fresh water of 40 % of the world population, the societal impact of improving the understanding of the geophysical processes in this area is obvious. Explain what the geoid is and how it contributes to these issues will be one of the major focus areas of the documentary.

The determination of the geoid, the fundamental reference surface for heights both on land and at sea, has been and will continue to be one of the primary objectives of physical geodesy. For land areas a detailed and very accurate geoid model is required, when determining heights by GNSS satellites. For marine areas the geoid is needed for an optimal utilization of satellite altimetry data. The ESA satellite Gravity Field and Steady-State Ocean Circulation Explorer (GOCE), scheduled to be launched in 2007, is expected to significantly improve our knowledge on the geoid. In addition to improving the geoid, the US-German satellite GRACE do allow the determination of large scale changes of the gravity field due to changes in ground water level, melting glaciers etc. Data from GRACE may thus contribute to studies of climate change in the Himalayas, improve our models for mass distribution and aid in local natural resource management.

The team will start the work on a project with the goal of creating a unified height reference for the region around Mt. Everest/Qomolangma. This will be done by attempting to combine the Nepalese and Chinese height systems. The documentary can cover the starting point of this project and visualize the geodetic contribution to the understanding of the water cycle, monitoring of the glaciers etc.

### *Using GNSS – GPS, Galileo and Beidou/COMPASS in understanding geohazard*

Geohazards have great human and economic impacts and understanding the geophysics of these

phenomena is pivotal for mitigation and the prevention of catastrophes. Using geodetic tools like the GNSS techniques and the development of new methodology combining GNSS and seismological tools is in the forefront of geodetic and technological research. Both in China, The Qinghai-Tibetan Plateau and in Norway we have large number of earthquakes, however different magnitudes, and thus a common interest in this field.

### *History of mapping and surveying*

China is one of the oldest civilisations in the world and its culture was amazingly advanced even thousands of years ago. It is therefore particularly interesting to take a closer look at the history of surveying in this part of the world. Only a few years ago the world's oldest benchmark for surveying was discovered in the Xi'an area, on the mausoleum property of the Han Emperor Jing. Surveying was also one of the 200 examples of application of mathematics which can be found in a famous old Chinese book of mathematics dated some 400 BC. Furthermore the Chinese invented both the seismograph and the compass. Visits to selected illustrating sites to learn more about this history where old techniques are being compared with modern geodesy.

The history of surveying and mapping of Tibet is also particularly interesting, now looking back only a couple of hundred years back in time. During the Great Game (1813-1907), the British Empire initiated the special training of surveyors (pundits) to measure distances and heights. The pundits had to disguise themselves as pilgrims or traders travelling in Tibet to avoid being killed by the Tibetans as Tibet was off limits to most foreigners. The surveying data obtained this way improved the accuracy of the position of Lhasa and the maps of Tibet substantially.

## **Sponsors**

*Background - Keywords: Olympic Games Beijing 2008, ISPRS Congress 2008 Beijing, IYPE, IPY, GEO, S&T and economic growth of China, increased focus on climate change, the environment and geohazards.*

The journey is an initiative taken by a team consisting of different specialists. However, we believe there are many more that will be able to enjoy "making this journey" together with us.

The project is open to all who are interested in sponsoring the activity or parts of it both with resources and moral support.

## **The Olympic Games in Beijing 2008**

The Games of the XXIX Olympiad – Beijing 2008 will take place from 8 August 2008 until 24 August 2008. The Games in Beijing will play host to the 28 summer sports currently on the Olympic programme. Approximately 10,500 athletes are expected to participate in the Games with around 20,000 accredited media bringing the Games to the world.

The Olympic Movement consists of three dimensions: sports, culture and environment. The Olympic Movement's IOC approved its own Agenda 21 (see frame below) in 1999.

### The Olympic Movement's Agenda 21 - Objectives

The Olympic Movement's Agenda 21 aims to encourage members of the Movement to play an active part in the sustainable development of our planet. It sets out the basic concepts and general actions needed to ensure that this objective is met. It has been inspired by the UNCED Agenda 21, adapted to the characteristics of the Olympic and sports Movement. It suggests general outlines which should guide the activity of the Olympic Movement in the fields in which it can bring an effective contribution.

It is a theoretical and practical guide for all members of the Olympic Movement and for sportsmen and -women in general: the IOC, the International Federations (IFs), the National Olympic Committees (NOCs), the Olympic Games Organizing Committees (OCOGs), athletes, clubs, coaches and all individuals and enterprises associated with sport.

The Olympic Movement's Agenda 21 suggests to governing bodies areas in which sustainable development could be integrated into their policies. It also points out ways in which individuals can act so as to ensure that their sporting activities and their lives in general play a part in this sustainable development.

The Olympic Movement's Agenda 21 must be implemented in a climate of respect for different social, economic, geographical, climatic, cultural and religious contexts which are characteristic of the diversity of the members of the Olympic Movement.

The IOC Commission and the United Nations Environment Programme (UNEP), with which the IOC signed a Cooperative Agreement in 1994, conduct various activities to raise awareness and educate people on environmental matters. The Beijing Organizing Committee for the Games of the XXIX Olympiad (BOCOG) and United Nations Environmental Program (UNEP) have signed a memorandum of understanding under which the latter will provide BOCOG with data and technical resources on environmental issues.

We will offer the *Geodetic Journey* to be a part of the environmental and cultural program, including education, of the Olympic Games in Beijing 2008.

#### *Why China and Norway?*

The Olympic Games 1994 in Lillehammer, Norway was the first games that integrated an environmental program and the concept of Green Games. UNEP has encouraged China to bring the Green Games a step further by initiating the integration of global perspectives on environment and climate issues in the Green Games of the XXIX Olympiad in Beijing 2008. As geodesy provides important information about the changes in our climate - global as well as local information - China and BOCOG can answer the requests and challenges that UNEP expresses by integrating *Geodetic Journey* in their programs. This way Norway as the first Green Games organizer can cooperate with China in introducing concrete projects addressing global issues and thus assisting in bringing the Green Games from local to global.





STATENS KARTVERK