

## Monitoring World Heritage Sites

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### Abstract

The [First Periodic Reporting Cycle \(2000-2005\)](#) of the [Convention Concerning the Protection of the World Cultural and Natural Heritage](#) adopted by the GC of UNESCO in 1972 is a strategic challenge for the whole remote sensing and GIS community. From 630 sites already inscribed on the World Heritage List 487 will be scrutinized on a regional basis during the six years. At the end of each year the World Heritage Committee will adopt recommendations for each region that just reported about the implementation of the Convention. Hopefully a strategic guideline will emerge at the end of each cycle that ought to include recommendations on monitoring and change detection for preservation and development of world heritage sites. Remote sensing & GIS could not yet play the role it should to provide the desperately needed tool for governments, municipalities, local communities, investors and developers who are all involved at the world heritage sites. Their education, training and sensitivity are key to the sustainable resource management at the most precious cultural and natural sites of the world. Research communities and universities should work in close cooperation with the key stakeholders for the benefit of all. Synergy of RS & GIS in a global Internet based environment should serve as a model for new site nominations as well as improve disaster-monitoring capacity for site managers and national authorities. Europe together with North America, parts of the same regional group shall report on their sites in 2004 and 2005. Their report is ought to set a standard for the next cycle, among others, regarding education and use of integrated RS & GIS techniques at world heritage sites. Promising results are achieved in Hungary and many other individual countries of Europe and North America during the last decade regarding all aspects discussed above, however, without a major step forward in establishment of international programs to support implementation of the Convention for a long term regional and global data exchange and quality evaluation of satellite derived parameters evolving into standards would not be possible.

## 1. Periodic Reporting<sup>1</sup>

To ensure the efficient implementation of the World Heritage Convention it is essential that all the actors involved have access to up-to-date knowledge on the application of the Convention and on the state of conservation of World Heritage properties.

Discussions on the most appropriate means to establish this up-to-date information were initiated in 1982 and continued since then at the sessions of the World Heritage Committee, the General Assembly of States Parties to the Convention and the General Conference of UNESCO. A consensus was reached in 1997 that States Parties would provide, in accordance with [Article 29](#) of the Convention, periodic reports on the application of the Convention and the state of conservation of World Heritage properties.

The World Heritage Committee, at its twenty-second session held in December 1998, adopted a number of decisions with regard to the submission of periodic reports. The Committee agreed on the periodicity of the reporting, the contents of the reports and the manner in which it will handle the States Parties reports. The Committee adopted at the same time the [format](#) for the periodic reporting as well as substantive [explanatory notes](#).

### 1.1 Why periodic reporting?

The periodic reporting on the application of the World Heritage Convention is intended to serve four main purposes:

- to provide an assessment of the application of the World Heritage Convention by the State Party;
- to provide an assessment as to whether the World Heritage values of the properties inscribed on the World Heritage List are being maintained over time;
- to provide up-dated information about the World Heritage properties to record the changing circumstances and state of conservation of the properties;
- To provide a mechanism for regional co-operation and exchange of information and experiences between States Parties concerning the implementation of the Convention and World Heritage conservation.

### 1.2 How will it work?

The World Heritage Committee has chosen a regional approach to periodic reporting as a means to promote regional collaboration and to be able to respond to the specific characteristics of each region. For each of them, regional periodic reporting strategies will be developed to ensure full participation of States Parties, competent institutions and regional expertise. The final result of each regional strategy will be a Regional State of the World Heritage Report. The Committee will examine these regional reports according to a pre-established schedule. This schedule is based on a six-year cycle.

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<sup>1</sup> The presentation based on the related documents prepared by the World Heritage Center. Further details may be found at [www.unesco.org/whc/](http://www.unesco.org/whc/).

SIX-YEAR PERIODIC REPORTING CYCLE

Year of examination by Committee of Regional State of the World Heritage Report	Region	Number of States Parties (as per December 1998)	Reporting on World Heritage properties inscribed up to and including	
			Year	No.
2000	Arab States	16	1992	46
2001	Africa	31	1993	40
2002	Asia and Pacific	31	1994	96
2003	Latin America and the Caribbean	29	1995	62
2004	Europe and North America	48	1996	243
2005				

*1.3 What is a periodic report?*

A periodic report provides an assessment of the application of the World Heritage Convention by the State Party and of the state of conservation of World Heritage properties on its territory. The Committee approved at its twenty-second session held in December 1998 a [format](#) for the periodic reports, which is accompanied by substantive [explanatory notes](#). This format consists of two sections:

- Section I constitutes the State Party's report on the application of relevant articles of the World Heritage Convention, including those referring to: the identification of properties of cultural and/or natural value; protection, conservation and presentation of the cultural and natural heritage; international co-operation and fund raising; and education, information and awareness building.
- Section II refers to the state of conservation of specific World Heritage properties located on the State Party's territory. The main objective of this section is to obtain an assessment of whether the World Heritage value(s) for which a property was inscribed on the World Heritage List is maintained over time. In addition, States Parties are requested to provide up-dated information on the management, factors affecting the property and monitoring arrangements.

*1.4 Who is responsible for what?*

While the General Assembly of States Parties to the World Heritage Convention and the World Heritage Committee has a standard-setting role, the management and monitoring of World Heritage properties remain the responsibility of the States Parties. The States Parties themselves are also responsible for the preparation of the periodic reports.

The World Heritage Committee and its Secretariat (the UNESCO World Heritage Center) support the States Parties in these tasks and facilitate the implementation of the regional periodic reporting strategies. States Parties may request expert advice from the Secretariat and/or the Advisory Bodies (ICOMOS, ICCROM and IUCN). The Secretariat may also commission expert advice with the agreement of the States Parties.

The World Heritage Committee examines and responds to the States Parties' periodic reports. It will include its findings in its report to the General Conference of UNESCO.

### 1.5 Periodic Reporting Process

World Heritage Committee establishes a 6 year periodic reporting cycle
Implementation of regional strategies to provide for: <ul style="list-style-type: none"><li>• Participatory process</li><li>• Involvement of States Parties, competent institutions and regional expertise</li><li>• Assistance to States Parties in preparing reports</li><li>• Exchange of experiences among States Parties</li><li>• Analysis of reports in regional context</li><li>• Preparation of Regional State of the World Heritage Report</li></ul>
Regional State of the World Heritage Report
Regional State of the World Heritage Report examined by the World Heritage Committee
<ul style="list-style-type: none"><li>• World Heritage Committee responds to the Regional State of the World Heritage Report (formulates recommendations to States Parties, draws conclusions for its own policy and decision making)</li><li>• World Heritage Committee response included in its report to the General Conference of UNESCO</li></ul>

## 2. Expert Meeting on digital and cartographic guidelines for World Heritage sites<sup>2</sup>

### 2.1 Background

At its twenty-second session in Kyoto, Japan (December 1998), the World Heritage Committee requested that the format of geographic information to be presented in Periodic Reports by States Parties should be further examined by the Bureau. To this end, an Expert Group was convened in London on 15 October 1999, to examine a proposal that would improve the quality of mapping and presentation of geographic information for World Heritage properties.

The Expert Group concluded that the accuracy and detail in maps and boundary information submitted with many of the early nominations was inadequate for modern mapping purposes and that new maps should be provided by the States Parties for most sites. The group also agreed that the cycle of periodic reporting established by the Committee was the best means of compiling this information. It is proposed that a detailed assessment of geographic information in each site file will be prepared in consultation with the Advisory Bodies (IUCN for natural, ICOMOS for cultural sites and ICCROM for training) and submitted to the relevant States Parties.

### 2.2 Objectives

The meeting sought to identify a way forward on five related objectives:

1. To ensure that a recommendation goes forward from the next World Heritage Committee meeting (it was held in Marrakech, Morocco, December 1999), asking States Parties to make adequate maps available as part of their nominations and state of conservation reports. The objective was fulfilled administratively and an appropriate letter was sent to the State Parties. However, since the related technical expertise and institutions have not yet been pooled the outcome of those recommendations is still unclear.

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<sup>2</sup> The following part is based on, but substantially altered the report of the expert meeting, thus expresses the views of the author alone and not in any way that of the group. The full text of the report is in document WHC-99/CONF.209/INF.19 of the World Heritage Committee.

2. To draft guidelines for maps and geographic descriptions that should form part of such a recommendation, and be subsequently incorporated into the Operational Guidelines and explanatory notes for nominations and state of conservation reports. With the exception of the modification of the Guidelines that is part of a broader reform process of the whole implementation mechanism of the World Heritage Convention that objective was also achieved. However, the explanatory note ought to be discussed and implemented by the expert community and not rest in files of government officials in charge.
3. To make recommendations on the review of currently available information and possible mechanisms for collecting maps where adequate information is not currently available. The first regional group that will report in Cairns, Australia is the Arab region with 46 world heritage sites in 16 countries. The basic findings of a preliminary assessment of the existing files showed that only 2 out of 51 nomination dossiers contain adequate geographic information. The findings underline the necessity of the annual Periodic Reporting in accordance with the current standards on requested information. However, again, without the organized and properly agreed involvement of the international GIS community it is a task that will not harmonize but rather further destabilize the on-going GIS activities in the highly different site, national and regional environment.
4. To make recommendations on appropriate mechanisms for making map-based information more widely available to those who may need it. These recommendations should come from the most prominent international GIS organizations as the International Society for Photogrammetry and Remote Sensing (ISPRS), in general, or its technical Commission VII, in charge of resources and environment monitoring on local, regional and global level, in particular. First steps into that direction have been made at the last XIXth Congress of ISPRS in Amsterdam (16-23 July, 2000) where for the first time a panel discussion took place under the title of "Monitoring and Change Detection for the Preservation and Development of Cultural and Natural World Heritage Landscapes".
5. To identify ways to facilitate increased use of geographic information systems (GIS) in World Heritage site planning and management.

### *2.3 Overview of the current situation*

World Heritage Center (WHC) and the World Conservation Monitoring Center (WCMC) in Cambridge, UK (recently reassigned as the official institution of UNEP) has been reviewing the available mapped information on inscribed World Heritage sites. In doing so it has become very apparent that the available information varies considerably.

The WHC has been undertaking a program to scan nomination dossiers so that they can be stored and accessed electronically. In doing so it has become apparent that many dossiers are incomplete, that in some cases there is no map, in others the map is a photocopy or sketch map and of little value in the accurate location of a site and its boundaries.

The adequacy of the information is of concern because the location of boundaries of the World Heritage site and any zones within and around it is essentially legal information. It is vital that the WHC and the Advisory Bodies know what constitutes an inscribed World Heritage site. This information is equally important within the nomination so that a proper evaluation can be carried out.

As a result of the increase in size and variability of nominations in general, were prepared and distributed for States Parties on recommended formats for both nominations and state of conservation reports.

### *2.4 Experiences of the world heritage Expert Meeting*

The experience of participants ranged widely from those working at the international level in information management, to those working at national and site levels. This sharing of experience

resulted in the identification of a number of generic points of relevance to the present discussions, including the following:

- a) **Time-dependent data:** Maps display a single point in time, but the information used in compiling them is dynamic in nature. This has important messages for both periodicity of monitoring and handling of metadata.
- b) **Degree of resolution:** The resolution required in mapping vary significantly depending on the purpose for which the map is required. Maps for management will require significant detail, while those required for nomination and state of conservation reporting only need to be detailed enough to ensure clear identification of the site.
- c) **Access to base maps:** Appropriate base maps at a relevant scale may not exist in many countries, or access to them may be strictly controlled. This may be solved in part by developing partnerships with the military, or other agencies with strong mapping interests.
- d) **Adequacy and accuracy of maps:** Issues of adequacy and accuracy of maps are true at all levels, and there may be significant cost implications involved in improving the existing information. This is also true when information has to be re-registered against different base maps.
- e) **Technical support and capacity building:** In many parts of the world the development of appropriate maps for development of nominations, let alone for management purposes, is a capacity building exercise. Inclusion of stronger requirements in the nomination and state of conservation reporting requirements may lead to opportunities for increased technical support in this area.
- f) **Negotiated access to global datasets:** There are opportunities for the WHC to help States Party by negotiating with organizations that can supply global or regional datasets. This applies, for example, to access to remote sensing imagery.
- g) **Negotiated partnership with GIS producers:** There are opportunities for the WHC to negotiate with GIS developers, research institutions and universities and other educational institutions for their support in increasing access to GIS technology for implementation of the World Heritage Convention.
- h) **Sovereignty issues:** Because of the nature of the Convention, it is necessary to use officially sanctioned data wherever possible. Also, availability and provision of maps may be a sovereignty issue in some countries - the Convention must be sensitive to this. Hence a new standard should emerge as a result of the First Periodic Reporting Cycle.
- i) **Timing:** It is important to link the compilation of improved map-based information on inscribed World Heritage sites to the timetable for on-going State of Conservation reporting, thus to processes that are parallel with the Periodic Reporting Cycle. The first reports are expected from the Arab countries, and there is a need to get the guidance to them rapidly if they are to take advantage of the new guidance.
- j) **Purpose of maps:** The information required for mapping will differ significantly depending on the purpose for which the map is required. For example, there is a significant difference between maps and associated information required for presentation purposes and those required for legal purposes.

### 3. Existing Hungarian experience - a case study

The Royal Angkor Foundation in Hungary<sup>3</sup> in close cooperation with SOAS<sup>4</sup> (London University, School of Oriental and African Studies) and NASA Jet Propulsion Laboratory<sup>5</sup> has been working on world heritage sites, in general, and on Angkor (Cambodia), in particular, for a decade.

The Angkor GIS (AGIS) is an information system which helps professionals to get information about the Angkor Eco-site. It contains information from a wide area of interest to help see the facts about Angkor globally. Angkor GIS has been developed first by György & Annamária Csáki (1992-1993)<sup>6</sup> for the 'Zoning and Environmental Management Plan' (ZEMP) for UNESCO to apply GIS technology on the archaeological sites in Angkor, Cambodia. AGIS-1 incorporated research achievements of numerous professional fields. It was also a well-applicable methodology of data acquisition, and provided analysis and proposed solutions for preparing a new nomination dossier at that time for Angkor. The new approach required new tools to be involved. The handling and analyzing of the huge quantities of data was not possible with traditional manner already 8 years ago. And, this was the point where the help of a computer had to be taken together with the dynamically developing new branch of informatics, the GIS.

During the next phase of development (1993-1997) in the Angkor GIS Center at [Department of Geoinformatics College of Surveying and Land Management](#), University of Sopron at that time, Róbert Kuszinger, András Diószegi and Szilvia Ódor improved dramatically the performance of AGIS-2.<sup>7</sup> Aerial photography, satellite and radar images were incorporated together with a great amount of raster and vector data, all integrated and geo-referenced into a single and fully open to any known GIS system.

Let me give a very short dataset review of AGIS-2 to make clear the comprehensive character of the data:

- Digital Terrain Model
  - TIN structure is the base (10 m between the closest points), Lattice or Grid can be generated
  - up to 10m/pixel resolution for the whole area (80 by 100 km)
  - derived from topographical maps
  - contour lines by 10 m (5m supplementary)
  - height information is given for contour lines in database
- Land cover
  - 26 categories, most of them for vegetation
  - polygons cover the whole area
  - data for botanical value, wildlife value can be related
- Infrastructure
  - line data
  - 10 categories of roads and other
- Hydrology
  - 11 categories for hydrological features
  - database linked for certain points
  - photographs, cross-sections, profiles, textual descriptions
- Zoning (plan) for Angkor Park

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<sup>3</sup> See <http://www.angkor.iif.hu/kuszi/angkor.html>

<sup>4</sup> See [www.soas.ac.uk/artarch/TLTP/](http://www.soas.ac.uk/artarch/TLTP/)

<sup>5</sup> NASA/JPL NASA is the National Aeronautics and Space Administration of the United States of America, with its headquarters in Washington, D.C. JPL is the Jet Propulsion Laboratory, a research arm of NASA. Located in Pasadena, California, its homepage is <http://southport.jpl.nasa.gov/>

<sup>6</sup> See [www.erda.hu](http://www.erda.hu)

<sup>7</sup> See: <http://www.angkor.iif.hu/kuszi/agis/agis.html>

- zone boundaries
- Soil types
  - Polygons for 5 main categories
- Administration
  - database for villages
    - number of buildings
    - population data
    - information for transport, fuel, etc.
  - commune and district boundaries
- Geology
  - 4 base categories
- Monuments and archaeology
  - database linked to point locations
  - data for monuments (century, status, etc.)
  - tabular, textual and image data
- Remote sensing
  - RADAR
  - SPOT.

The greatest achievement of AGIS-2 was the incorporation of the latest NASA technology into the database. The SIR-C/X-SAR<sup>8</sup> was operated two times in 1994, mounted on the space shuttle Endeavour as part of NASA's Mission to Planet Earth and made extensive datatakes on Angkor for RAF and World Monuments Fund (USA).

The next step will be the synergy of all the above information with data obtained from NASA AIRSAR technology.<sup>9</sup> In December 1996, the NASA/JPL imaged three flight lines over Angkor. Each flight line is about 10x60 km. The three runs were made into a mosaic at JPL which displays the brightness of the return (the 'backscatter') from the P, L, and C Bands. It also displays the height (the interferometric data).<sup>10</sup>

#### 4. Conclusions

Hopefully a strategic guideline will emerge at the end of each regional cycle that ought to include recommendations on monitoring and change detection for preservation and development of world heritage sites. Remote sensing & GIS could not yet play the role it should to provide the desperately needed tool for governments, municipalities, local communities, investors and developers who are all involved at the world heritage sites. Their education, training and sensitivity are key to the sustainable resource management at the most precious cultural and natural sites of the world.

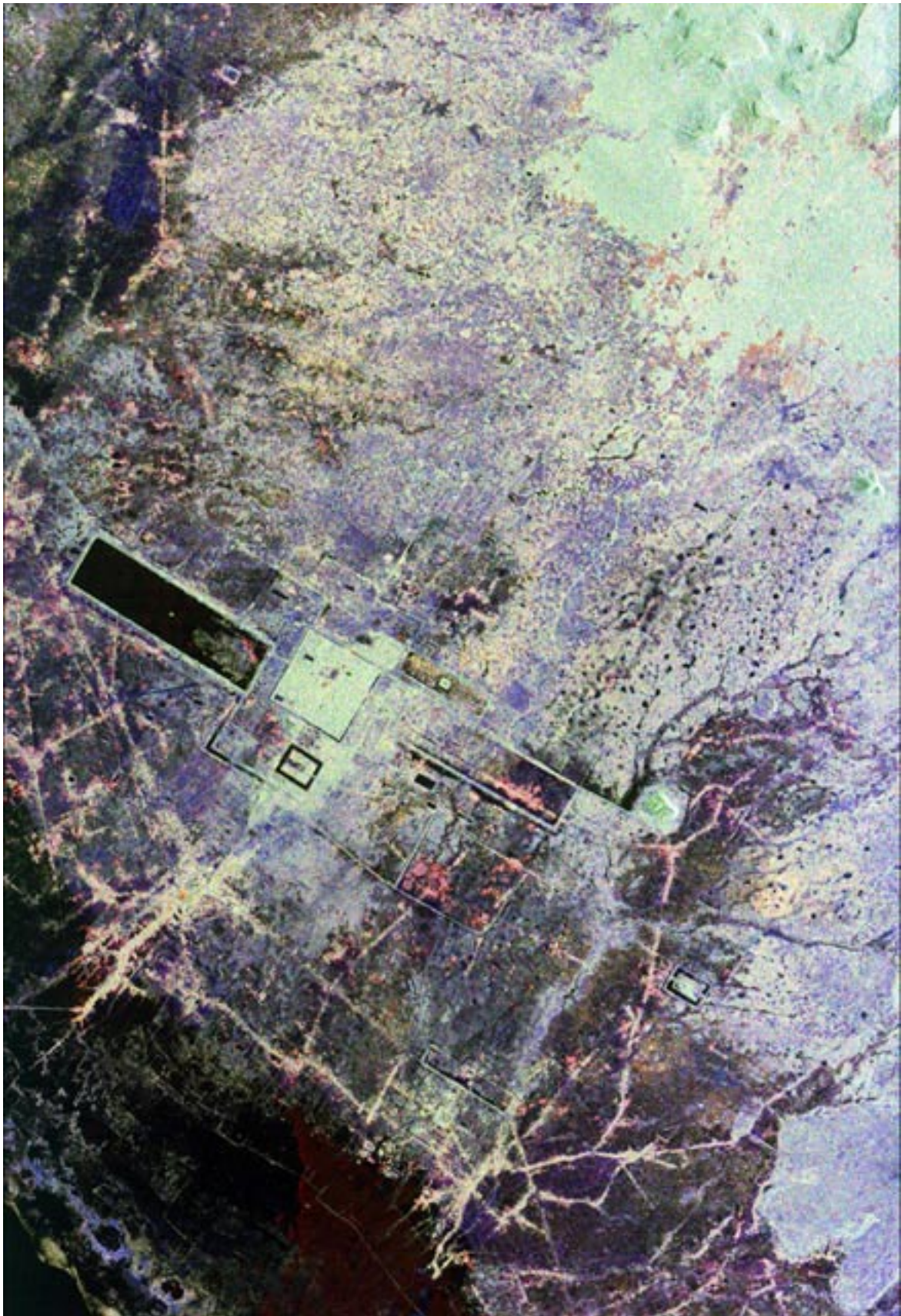
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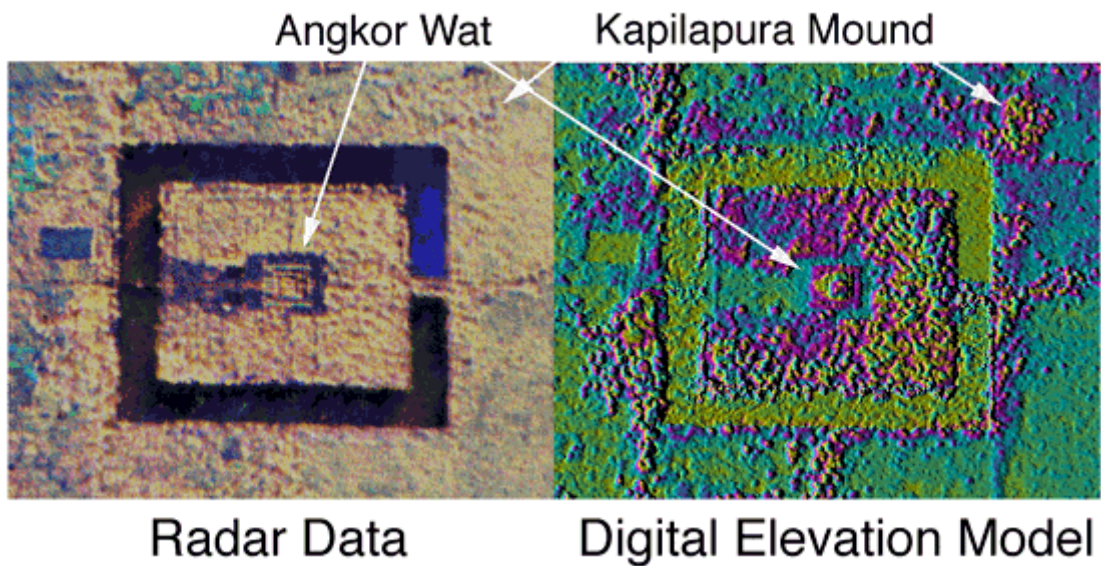
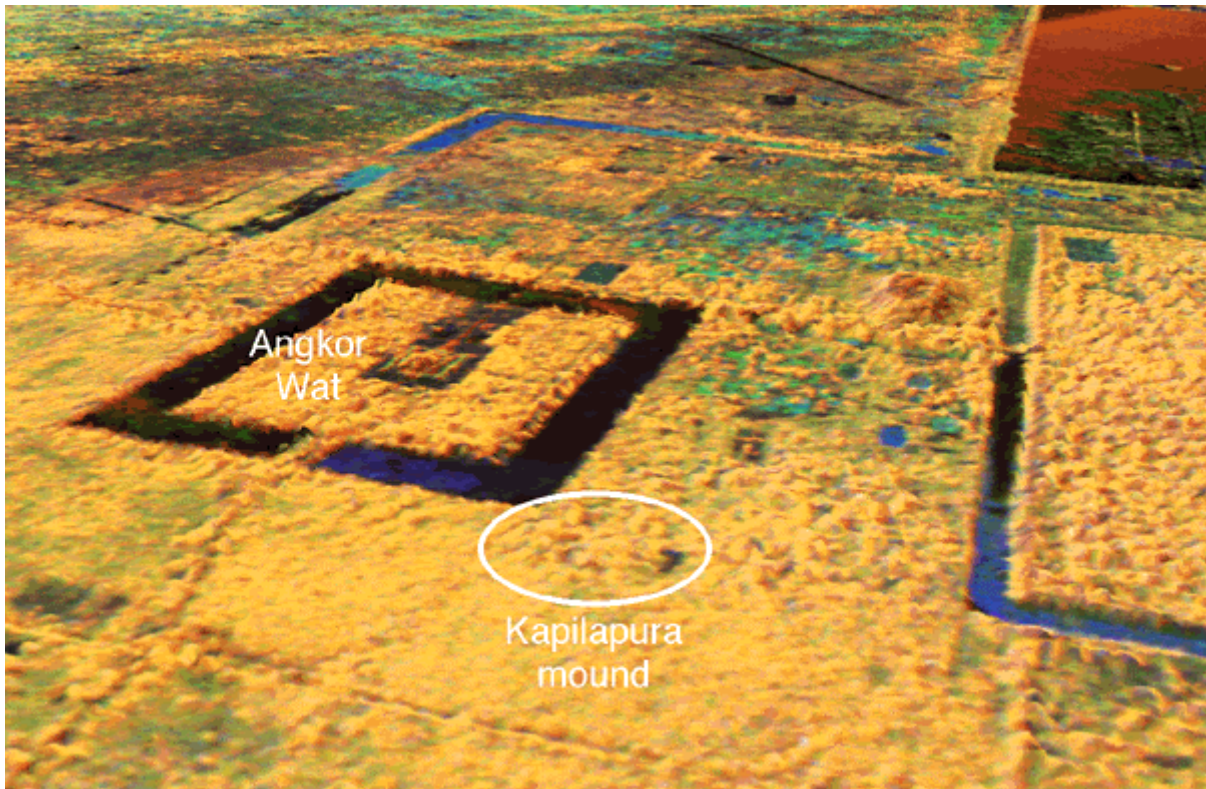
<sup>8</sup> The instrument was the result of a joint US-German-Italian co-operation. The data collected is being used to study how our planet is changing. Projects included studies on hydrology, oceanography, calibration, ecology and geology. All these international studies help scientists understand the interactive process needed to generate the Earth's environment. During the first mission alone, 47 terabits of data were acquired, equal to some 30,000 volumes of an encyclopaedia.

<sup>9</sup> The NASA/JPL Airborne Synthetic aperture (AIRSAR) is operated onboard a DC-8 aircraft. It generally flies at 8000 metres above the earth, collecting data in a swath some 10 km wide. AIRSAR is fully polarimetric and acquires data at three frequencies, C-Band (6-cm), L-Band (23-cm) and P-Band (68-cm). It can also make interferometric radar measurements, used to generate height measurements of the imaged area. AIRSAR interferometry is made possible by two sets of sensors mounted on the exterior of the aircraft, so the height data is acquired on a single flight. SIR-C collected interferometric data but with only one antenna. The data were obtained on repeat passes over the same site, separated by twenty-four hours.

<sup>10</sup> For the description we express sincere thanks to Dr. Elizabeth Moore at the SOAS. Please refer for further information to her homepage at [www.soas.ac.uk/artarch/TLTP/](http://www.soas.ac.uk/artarch/TLTP/).

Research communities and universities should work in close cooperation with the key stakeholders for the benefit of all. Synergy of RS & GIS in a global Internet based environment should serve as a model for new site nominations as well as improve disaster-monitoring capacity for site managers and national authorities. Europe together with North America, parts of the same regional group shall report on their sites in 2004 and 2005. Their report is ought to set a standard for the next cycle, among others, regarding education and use of integrated RS & GIS techniques at world heritage sites.





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