Interdisciplinary Knowledge Transfer within Surveying Higher Education

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i3mainz
Institute for spatial information and surveying technology

scientific organisation of department of geo-information and surveying,
university of applied sciences Mainz

- centre of research in German Land Rhineland-Palatinate
- centre of competence for spatial information technology in the field of heritage and arts

i3mainz
founded in 1998
activities
applied research and development and transfer of technology in the field of spatial information and surveying technology
- precise collection, processing and visualisation of spatial information of all kinds of spatial objects
financial base
project financing (2007: 1.3 MEUR)
personal
actual 20 scientific staff members, (3 phd students)
supported / guided by 5 professors

Institute for Spatial Information and Surveying Technology

Competence Center
Spatial information and surveying technology for the Humanities

Geographic Information Systems
Design and development for applications in economy, administration and traffic management

Information technology
Process development for Internet, multimedia, visualization and eLearning

3D Metrology
Precise spatial object survey for documentation and quality inspection
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3D industrial metrology @ i3mainz

- Equipment -

3D scanners

FaroArm

Laser interference comparator

Laser tracker

Theodolite measurement system

Precision cameras

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Presentation Overview

- long-term experience at i3mainz available in co-operation projects with partners from the humanities
- archaeological and cultural heritage documentation
- discussion of about 40 diploma thesis executed outside Germany
- close co-operation with students and professionals of other disciplines
- surveying students gain valuable knowledge from other fields

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3D-Scanning

Terrestrial laser scanner

Leica HDS 6000

Leica HDS 3000

Faro LS 880

GOM Atos II

- accuracy: 5 mm

• accuracy: up zu 0,02 mm

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- Countries Co-operation since:
  - i) China since 1993
  - ii) Turkey since 1998
  - iii) Yemen since 1998
  - iv) Israel since 2004
  - v) Ukraine since 2006

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**China since 1993**

- Shaanxi province, People’s Republic of China, location of 18 Mausoleums of Tang Emperors (> 100 km²)
- Internal part of one single mausoleum > 10 km²
- International research project at Roman Germanic Central-Museum in Mainz, Germany, tasks of geometric documentation of sites and findings
- 10 diploma works, field work and home work
- Measurement field work in close cooperation with archaeologists and additional local staff

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**Official reference frame not accessible → local reference frames, orientation by astronomical azimuths**

**Topographic maps generation in various scales for whole mausoleums and for selected parts**

- 40 maps in scales from 1/5 up to 1/10000
- Small-scale maps, aerial images not available → satellite images LANDSAT 30m, SPOT 10m
- Large-scale maps → tacheometric measurements, GPS
- More than life-sized sculptures of humans, animals, mythical creatures at precession ways → terrestrial photogrammetry
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Turkey since 1998

- Ancient Galatian city of Tavium located at present-day village of Büyüknefes, 150 km east of Ankara, 20 km from the Hittite capital of Hattusha
- In 3rd century BC occupied by Celtic tribe Trocmii, flourishing phase in Hittite period
- 150 hectares city area surveyed by a team led by Karl Strobel, University of Klagenfurt, Austria concentrating on extensive Roman and Byzantine remains
- 11 diploma works, field work and home work
- Official reference frame not accessible, no aerial images available, no satellite images available due to very restricted budget
- 1/500 large scale documentation of core area by tacheometric and GPS surveys
- 1/5000 small scale documentation of surroundings by digitizing existing maps

3D digital height model generated from existing maps
- Base for perspective views, virtual flights, cross sections, visibility analysis, slope aspect/ratio analysis

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Yemen since 1998

- In 1998, Heidelberg University initiated a programme of excavation, mapping and training.
- Documentation of the terrain surface and archaeological findings.
- Local reference frame, weak GPS reference frame.
- Generation of digital orthophotos, digital height models, virtual three-dimensional reconstructions from satellite images.
- Development of a prototype geoinformation system.

The ruined city of Zafar, location some 130 km south-south-west of the Yemenite capital, Sanaa in the mountains at 2800 m altitude.

In the 6th century AD, Zafar, it is one of the most important cities in the Near East.
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4 diploma works
- Spatial reference system connected with the official Israel reference system
- Re-survey of the 10,000 m² site of Tel Kinrot
- Development of an optimised workflow, precise and fast differential GPS survey of antemeridian work → noontime processing → updated database for the afternoon work
- Aerial photos from a small hot-air ship, DISTA (digital stereoscopic evaluation architecture) - system developed at i3mainz → build up stereo models and registration of 3D objects (points, lines, poly-lines, polygons)
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Israel since 2004
Interdisciplinary Staff 2008

Dr. Guy Bar-Oz (palaeoecology), Gus Besuijen (survey registrar), Rick Bonnie (area-supervisor), Irina Gutman (restorer), Stefan Höhn (field assistant; landscape archaeology), Virpi Holmberg (researcher), Dr. Marlies Klee (palaeobotanist), Ronja Kratz (graphic artist), Dipl. ing. Daniel Lechner (surveyor), Christa Lennert (graphic artist), Katri Mäen (conservation specialist), Dipl. ing. Barbel Schneider-Mehring (architect), Dipl. ing. Christian Meyer (GIS-specialist), Inga Müller (excavation registrar), Stefan Münger (co-director), Prof. Martti Nissinen (area-supervisor), Dos. Dr. Juha Pakkala (co-director), Dr. Lucas Petit (field director, Horvat Kurn贼rea-supervisor), Maike Range (graphic artist), Kari Steinerl (area-supervisor), Dr. Johanna Saikkonen (researcher), Kerstin Schier (restorer), Dipl. ing. Natalie Schmidt (surveyor, 3D-modeling), David Steinmann (cartographer), Iris Thomsen (field assistant), Tuula Tykkö (ceramist), Kari Valkama (co-field director Tel Kinneret/area-supervisor), Martin van den Enden (survey-co-director), Daniela Wes (field-assistant), Patrick Wissmann (photographer/numismatics), Prof. Dr. Jürgen Zangenberg (co-director), Prof. Dr. Wolfgang Zwickel (project coordinator).

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Field work opportunity

Are you interested in participating in the archaeological field work of the Kinneret Regional Project? Browse through these webpages to learn more.

Registration for 2009 soon to be opened. Check back soon or contact us if you have any questions regarding the project.

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Kinneret Regional Project

Researching the Stratigraphy and Architecture in 'Field'

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Kinneret Regional Project

confirmed by geologist

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- Ukraine Peninsula Crimea since 2006
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Ukraine since 2006

- Settlement history starting from 6th century AD of two hill settlements, Eski-Kermen and Mangup-Kale
- 3D-documentation of landscape and of more than 600 artificial caves
- Cooperation of Mainz University of Applied Sciences and Roman-Germanic Central Museum, Mainz
- 3 diploma thesis, 1 master thesis
- Establishment of a common reference system for all findings
  - long-range >50 km GPS application
- Efficient use of methods for geometric documentation in archaeology
  - use of GPS, total station, close range photogrammetry, 3D-laserscanning
- Integration of old maps with modern data by using old landscape marks
- GIS for storage, administration and analysis of all project data, collection of attribute data in close cooperation of German and Ukrainian archaeologists
- Generating maps in various scales, visualization and reconstruction tasks

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Eski-Kermen, Southern main gate view from south

Main measures of the interior of a cave

measurement of carved objects in a cave considering the position under (green) or above (red) the section line

Eski-Kermen Exterior area with a great rectangular cutting and negative traces of buildings recorded data from total station measurements view from south

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Conclusions

- Integrated approach of research co-operation and higher education
- Substantial benefit for students from close research co-operation of spatial information and surveying specialists with partners from the humanities, arts, etc.
- Valuable personal and professional experience for students gained from remote field work within an interdisciplinary team
- Development of new interdisciplinary professional fields
- Development of integrated interdisciplinary study courses with partners of different scientific background from different higher education institutions

Future work

- Development of an integrated curriculum for archaeologists and spatial information technology engineers
- Entrance qualification
  - BA in Archaeology or similar (Mainz University or others)
  - BA in Geoinf & Surveying or similar (Mainz Univ of Appl Sciences or others)
- One semester
  - knowledge adaptation
  - separate education
- Three semesters
  - Interdisciplinary applications of Spatial Information and Surveying Technology
  - collective education
- Award of joint MA master degree
  - MA in ???