PHOTOGRAMMETRY AND REMOTE SENSING IN THE MSC PROGRAMME "ESPACE" AT TECHNISCHE UNIVERSITAET MUENCHEN

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ABSTRACT:

ESPACE is an interdisciplinary Master's study programme of Technische Universitaet Muenchen (TUM) positioned at the interface between space technology and the engineering and natural science-based use of satellite data. It combines the technical aspects of the satellite and observation systems with scientific and commercial applications. A core topic beside space engineering and satellite applications engineering is satellite and remote sensing data analysis. This paper explains the background and goals of the Masters's study programme, addresses the target groups and qualification profile, and gives an overview about the specialization fields. The special role of Photogrammetry and Remote Sensing is further explained in this context. The structure and embedding of international alliances by a double degree program with Wuhan University is shown.

1. INTRODUCTION

Geodesy and especially Photogrammetry has a long history in research and education at Technische Universitaet Muenchen, Germany (Stilla, 2009). Modern geodesy is an extremely diverse discipline. Whilst in the past this term primarily referred to the surveying of land and transport routes, today it covers a whole range of aspects from tunnel surveying, satellite navigation and remote sensing, and even the surveying of other planets. In addition to classic measuring tools, geodesists also use information systems, modern satellite technology, digital remote sensing sensors and develop automatic, computer-assisted procedures to record, process, analyse and visualise spatial information. The various surveying measurement methods range from satellite-supported global Earth measurements, airborne regional site surveys through to terrestrial local engineering surveys of buildings and machines. The geoinformation generated from the geodesists in the official surveying process gives citizens legal security and is a prerequisite for creative, orderly planning measures (land tenure). Geodetic measuring procedures form an indispensable base for disaster management when recording environmental risks and researching the Earth system (global change) and the planets. Today, geodesy is characterised by the intensive use of digital technologies.

The diversity of the observations, disciplines and applications is reflected in the provided study programs related to Geodesy within the Faculty of Civil, Geo and Environmaental Engineering. Currently five study programs are running:
- Geodesy and Geoinformation (BSc) (in German)
- Geodesy and Geoinformation (MSc) (mostly in German)
- ESPACE - Earth Oriented Space Science and Technology (MSc) (in Englisch)
- Cartography (MSc) (in Englisch)
- Land Management and Land Tenure (MSc) (in Englisch)

All programs contain lectures on Photogrammetry and Remote Sensing In this paper the education in the international Master's program ESPACE is focused.

2. ESPACE - EARTH ORIENTED SPACE SCIENCE AND TECHNOLOGY

2.1 Starting point

The Munich region has a unique concentration of expertise in the fields of satellite technology, natural science, remote sensing and navigation distributed among the three universities (Technische Universität München (TUM), Ludwig-Maximilians-Universität München (LMU) and Universität der Bundeswehr München (UniBw)), research institutes (German Aerospace Center (DLR), German Geodetic Research Institute (DGFI)) and industry. The international Master's study programme Earth Oriented Space Science and Technology (ESPACE) makes use of these favourable conditions to train engineers. Numerous reputed scientists at the above-mentioned institutes and external lecturers from industry are involved in the teaching process. We train engineers who manage to bridge the gap between modern satellite technology and its application in terms of earth system research, remote sensing and navigation tasks. Graduates are therefore experts for satellite missions and their use in the above-mentioned fields.

2.2 Masters's study programme

The international English-based Master's study programme "MSc. in Earth Oriented Space Science and Technology" (ESPACE) was established in 2005. ESPACE is an interdisciplinary Master's study programme positioned at the interface between space technology and the engineering and natural science-based use of satellite data. ESPACE combines the technical aspects of the satellite and observation systems with scientific and commercial applications. This requires

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interdisciplinary knowledge beyond the borders of different engineering disciplines such as geodesy, mechanical and electrical engineering, as well as physics, informatics and geosciences.

Typically, tasks of space science and technology are handled in an international framework and at the interface of science and industry with major contributions by national and international space agencies (e.g., ESA, NASA, JAXA), which requires evidently globally inter-linked expert knowledge, and which shall be decidedly linked to high-performance German scientific institutions and industry in this field. Therefore, the ESPACE Master's programme addresses international students with the goal to educate talented professional for both, the German and the international market.

The goal of the ESPACE Master's study programme is to train students to become experts in the use and development of satellites in the three main areas of earth system science, remote sensing and navigation. Students acquire fundamental knowledge and competencies in these three fields as a general basis, as well as the interfaces among them in order to be able link technological with application aspects. They simultaneously learn the necessary basics of signal processing, sensor technology, orbital mechanics and space technology so that they are in a position to help plan and develop future missions for the above-mentioned areas. These fundamental competencies shall enable ESPACE graduates to discuss and interact with experts of all relevant fields of Earth-oriented space science in an interdisciplinary environment. On top, they acquire and deepen their specialist's knowledge in one of the three subjects. Graduates of ESPACE are not only able to interpret, analyse and evaluate satellite data, they also make use of their knowledge to help design all the phases of the development cycle of a satellite mission, be it the satellite design in terms of payload, instruments, orbit, rocket launch, signal processing or the ground segment.

Due to the complexity of the tasks in space and geosciences, which are usually performed in well-organized and functioning interdisciplinary teams consisting of people with different cultural background embedded in an international structure, in frame of the EPACE Master's programme an extensive practising of competencies in teamwork, which are one focus of the education by extensive project-oriented work, as well as intercultural competencies are fostered.

With its declared goals, the study programme meets the growing demand for globally available satellite data (e.g., GPS and the upcoming European equivalent Galileo, TerraSAR-X and TanDEM-X, Sentinels in the frame of GMES, GOCE, GRACE, Cryosat) For instance, this data is especially interesting for security-relevant applications (e.g., the EU programme INSPIRE (INfrastructure for SPatial InfoRmation in Europe) targeting at reaction to crisis situations), for the fast growing international market in the field of satellite-supported positioning, navigation and logistics (from Google Maps to vehicle navigation systems for the purpose of routing and guidance), and for issues connected to the impact of global change on the environment and living conditions (e.g., sea level rise, ice mass melting, natural hazards, early warning systems). Upon completion of their studies, students will be able to make direct and important contributions to current topics that are of paramount importance to society, the economy and science. Accordingly, the need for qualified engineers is high.

By including numerous scientific institutes and the space industry in the teaching concept, ESPACE makes full use of the potential of excellent scientists, offering also the opportunity of dedicated project work and Master's theses in close co-operation with, and in many cases even at the location of these institutions. Thus the students become involved in current projects, state-of-the-art technology and science, and daily practice.

2.3 Target groups

Since the study programme was launched in the winter semester 2005/06, 447 applications have been received (incl. for the winter semester 2012/13). Admission requirements for applicants are an above-average Bachelor's degree, diploma or Master's qualification in a natural or engineering science subject and a very good command of English. No practical experience is required. Generally, the target group is composed of highly motivated candidates with affinity and interest in technical and geoscientific subjects and engineering talent from all over the world, who intend to work in the field of satellite technologies in conjunction with Earth observation.

The qualification of the students for the ESPACE programme is ensured by means of an aptitude assessment process which examines the specific competence and the ability to work in a methodical, principle-based and scientific manner. This is based on the submitted references and certificates. In addition to the content of the degree held (natural or engineering science subject), one particular point of focus is to check whether the competencies gained in the fields of mathematics, physics and informatics are equivalent to those skills gained in a natural or engineering science Bachelor's degree taken at the TUM. Students must submit proof of competence in English (e.g. IELTS, TOEFL) with a minimum score of 6.5 (IELTS) or 80 (TOEFL Internet based testing) before they can be admitted to the programme. A letter of motivation, two letters of recommendation from professors, and an essay on a scientific subject relevant to the general scope of the study programme need to be enclosed with the application documents. The aptitude assessment process is governed by the FPSO of the study programme and is carried out by an aptitude assessment commission. If there is any doubt about the above-mentioned qualification requirements, the applicant is invited to a (telephone) interview. The aptitude assessment process ensures the qualification of the students which is reflected by the very low drop-out figures. Over 80% of those that have taken part in the ESPACE course since it was launched have completed it successfully.

The subjects of the prior Bachelor's degrees, diplomas or Master's qualifications taken by the students vary greatly. Exemplarily, Fig. 1 shows the variety of the Bachelor's degrees, diplomas or Master's qualifications of students who have attended the ESPACE programme so far. On average, 47% of the applicants per cohort were admitted.

2.4 Needs analysis

ESPACE graduates are in great demand at universities, non-university research institutions and industry. The aerospace technology industry and the topics of earth system sciences, remote sensing and navigation are employment fields that will grow in importance in the future. For example, natural catastrophes such as the Sumatra earthquake (2004), the floods in Pakistan (2010) and the Tohoku earthquake (2011) are impressive reminders that there is a great need for earth system sciences research; the primary information sources here are the observations made from space. There is also a great need for globally available data in connection with security-related applications (e.g. for civil defence and humanitarian aid). Likewise, there is a growing international market in the field of satellite-supported positioning, navigation and logistics which is why ESPACE graduates have excellent professional prospects

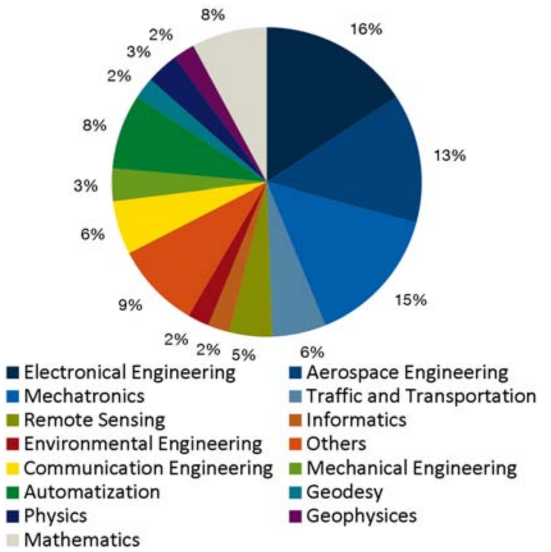

Figure 1. Final degree held by enrolled ESPACE students

2.4.1 Demand for graduates in the labour market: Due to the graduates' excellent competencies and skills the interest in the young scientists enrolled in the ESPACE programme is very high. Based on all graduates (40) whose em-ployment situation is known to the ESPACE programme office, 89 % of the graduates are employed by international aerospace agencies, national and international research institutes or universities in the fields of earth system sciences, remote sensing, navigation and space technology. The TUM and DLR are the largest employers here. 50 % of the graduates go on to complete a PhD.

2.4.2 Demand from potential students: Since the study programme started in the winter semester 2005/06, 546 applications for a place in the course have been received (incl. applications for the winter semester 2013/14). After the aptitude assessment process, 257 students were admitted (incl. applications for the winter semester 2013/14) and 151 students were enrolled (incl. those admitted for the winter semester 2013/14). Figure 2 gives an overview about the development of applications and admissions.

The students who enrol come from a wide range of countries (Fig. 3). The biggest groups come from China (26 %), Germany (16 %) and India (13 %). The percentage of foreign participants is very high totalling 84. The most common reasons why around 45 % of the ad-mitted students do not actually take up their places on the course (94% foreigners) are difficulties relating to finding funding for the course and accommodation, refused visa applications and the decision to take up a different Master's study programme.

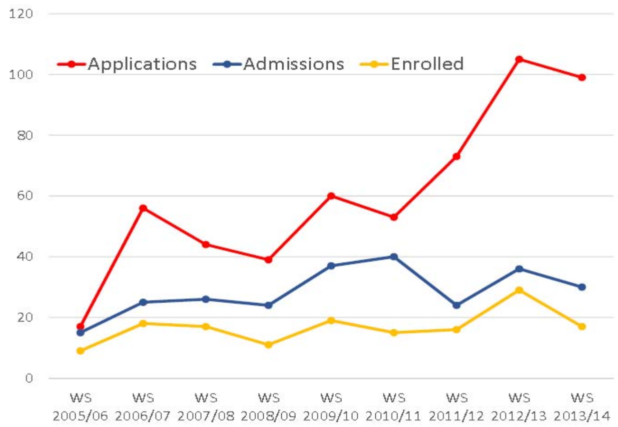

Figure 2. ESPACE applications and admissions WS 20005/06 – WS 2013/14 (WS: winter semester)

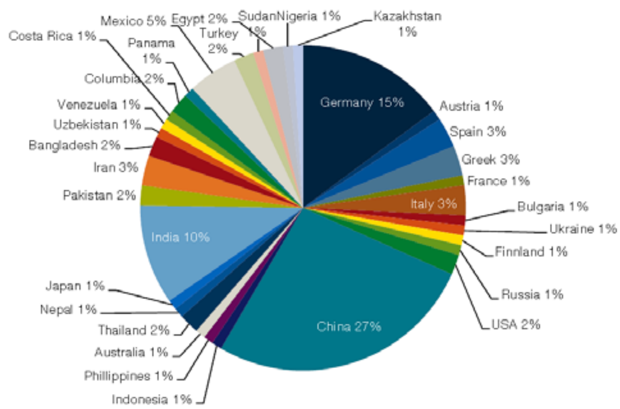

Figure 3. Countries of origin of ESPACE students

By the end of the winter semester 2013/14, about 100 students had successfully passed the ESPACE Master's programme. At 28%, the percentage of women graduates in this natural and engineering science programme high. The average study period is 4.4 semesters.

2.5 Qualification profile

Graduates of the international Master's programme Earth Oriented Space Science and Technology (ESPACE) have solid thematic and methodological competences in the topics of earth-oriented space science and technology, being able to perform a quality conscious, responsible and creative approach and having a solid and comprehensive fundament of expert knowledge. Basic competencies are acquired by all students in three core topics: (i) satellite and remote sensing data analysis, (ii) space engineering, and (iii) satellite application engineering, in order to establish fundamental knowledge of all relevant subjects enabling the graduates to work in a wide range of space sciences. Table 1 gives an overview about the modules in the first two semesters.

2.5.1 Satellite and remote sensing data analysis: The focus of the first core topic lies on the development and application of processing methods to satellite-derived data and models. With this core topic, students acquire the methodological competence to apply different processing methods and approaches to practical problems of satellite and space engineering, to select the optimum method for certain practical problems in the field of satellite and remote sensing data analysis, to work with data and process models, to assess the results quantitatively and to interpret the results before the background of space science and technology aspects.

2.5.2 Space engineering: In the second core topic, students acquire thematic and methodological competences in the field of spacecraft technology (spacecraft design, spacecraft subsystems, launcher systems, rocket design), orbit mechanics and dynamics, ground segment design, and robotics. Graduates have the basic know-how and competencies required to review state-of-the-art knowledge of space engineering, to systematically expand existing specialized know-how by developing, upgrading and implementing new methods and technologies in the field of space engineering, and they are able to realize and to analyse the inter-linkage among the subdomains of space engineering. They are able to understand and to apply the control principles for orbital, spacecraft attitude and robotic operations, and to reproduce the behaviour of these systems on ground for verification purposes.

2.5.3 Satellite applications engineering: The focus of third core topic lies on the analysis, modelling and interpretation of satellite and remote sensing data related to the key satellite applications. Graduates have the competence to deeply understand the basic components of sys-tem Earth and its main geodynamic processes in the Earth interior, at the surface, and the global energy budget, and they are able to newly develop, upgrade and implement mathematical and physical concepts and to apply them for the solution of practical problems in the field of satellite applications engineering, to interpret geophysical, geodetic and geodynamical results, and to put them into the scope of geoscientific concepts. They are able to understand the basic principles and concepts of photogrammetry, remote sensing, geoinformation systems, and satellite navigation, and they are able to apply related methods, to assess and to interpret the results. Graduates have the competence to view processes in their entirety, to connect the expertise acquired in a certain detail discipline with a more general scope and to derive consequences and action rules from it.

These core competences in the three fields enable the ESPACE graduates to have an overview of the most important fundamentals in the field of earth-oriented space science and technology, to build interfaces and to develop overarching concepts and technologies among them. This interdisciplinary expertise qualifies ESPACE graduates for a wide range of professional profiles both in science and in industry.

ESPACE is an international study programme, and accordingly students come from very different cultural groups. Against this background, participants do not only develop thematic, methodological and technical skills, but also social competencies and intercultural skills. In the course of the programme, students develop and practice their ability for intercultural communication, which is addressed in a dedicated seminar and encouraged in group work during projects. Intercultural competence is highly important, because typically tasks of satellite technology and research are performed in an international framework at the interface between science and industry, which requires the ability to work effectively with people from different cultural and interdisciplinary groups. By taking part in various projects and seminars, the graduates gain the ability to work in teams, to positively solve group-dynamical conflicts, and to jointly develop solutions and present these accordingly.

1. Semester	2. Semester
Introduction to Earth System Science 6 Credits	Projects in Earth Oriented Space Science and Technology *8 Credits*
Numerical Modelling 6 Credits	Applied Earth Observation and Mission Engineering 6 Credits
Introduction to Photogram-metry, Remote Sensing and Image Processing 6 Credits	Satellite Navigation and Advanced Orbit Mechanics 6 Credits
Signal Processing and Mi-crowave Remote Sensing 5 Credits	Estimation Theory 3 Credits
	On-Orbit Dynamics and Robots 3 Credits
Orbit Mechanics 4 Credits	Spacecraft Technology 2. + 3. Semester 8 Credits
Applied Computer Science 3 Credits	
30 Credits	**30 Credits**

Table 1. Overview of the current ESPACE study plan of the first two semesters showing the modules and the credits..

Due to the requirement to write scientific project reports and a Master's thesis, graduates of the ESPACE programme are able to define milestones and to meet the related deadlines, they are able to work in a problem-focussed way, and they have learned to critically evaluate by self-reflection their own work.

2.6 Specialization fields

On top of the competencies in the three above mentioned core topics, the main criteria of the qualification are further focussed by three selected specialization fields: Earth System Science from Space, Remote Sensing, and Navigation (Tab. 2). Here the students acquire specialized expert knowledge in one thematic field, and they are trained to acquire in-depth knowledge, to apply related methods, to assess and to evaluate results and to create new methods and technologies dedicatedly in this field.

Specialisation		
Earth System Science	*Remote Sensing*	*Navigation*
Atmosphere and Ocean 6 Credits	Photogrammetry 6 Credits	Precise GNSS 6 Credits
Earth System Dynamics 6 Credits	Remote Sensing 6 Credits	Advanced Aspects of Navigation Technology 6 Credits
Earth Observation Satellites 6 Credits	Geo Information 6 Credits	Navigation Labs 6 Credits

Table 2. Specialisation options in the third semester: An overview of the three specialist fields with their respective modules. The modules are compulsory modules within the respective specialist field

2.6.1 Earth System Science: Graduates selecting the specialization field Earth System Science from Space acquire a profound scientific knowledge of the Earth's system and its sub-components (ocean, atmosphere, hydrosphere, solid Earth).

They are able to link data from Earth observing satellites and geophysical models describing Earth system dynamics, to apply them to record, present and evaluate processes and mass transport in the system Earth, and to evaluate their impact for global change.

2.6.2 Remote Sensing: Graduates of this specialization field are able to apply in-depth methods to record, analyse and visualise sensor data of various wavelengths and scales. They are able to evaluate the suitability of ground-based, airborne and space-assisted optical, infrared and microwave sensors for task-specific problems in the field of remote sensing. They have the competence to combine data analysis methods for creating digital city and terrain models, change analysis and monitoring/forecasting natural hazards.

2.6.3 Navigation: Graduates of this specialization field are able to apply and evaluate methods for precise navigation and global surveying using geodetic space procedures and calculating precise orbits using data from GNSS and terrestrial navigation systems. They are able to analyse and solve problems of sensor fusion and integrated navigation systems and related practical applications such as car navigation, aeronautical and space applications.

3. PHOTOGRAMMETRY, REMOTE SENSING, AND GEOINFORMATION

The education in the field of Photogrammetry, Remote Sensing, Geoinformation and the required fundamental lectures is distributed step by step over the three semesters and embedded in modules. Table 3 gives an overview about the lectures in the corresponding semester (Sem) and the hours per week (SWS).

Lectures	Sem	SWS
Introduduction to Photgrammetry and Remote Sensing	1	2
Image Processing	1	2
Signal Processing	1	2
Microwave Remote Sensing	1	2
Applied Computer Science	1	2
Estimation Theory	2	3
Applied Earth Observation and Mission Engineering	2	2
Photogrammetry- Selected Chapters	3	4
Remote Sensing - Advanced Methods	3	2
Remotes Sensing - Seminar	3	1
Nonlinear Optimization Methods	3	1
Geoinformation	3	4

Table 3. Lectures related to photogrametry and remote sensing during the 3 semesters

Because of the limited space in this paper only a small selection of lectures shown in Table 3 are further addressed in the following paragraphs. The listings should give an overview about the placed topics.

3.1 Introduction to Photogrammetry and Remote Sensing

This lecture is designed to introduce the students into the field of Photogrammetry and Remote Sensing. Table 4 gives an idea about topics explained during lectures. The competences reached in this lectures are proved by a written exam.

Introduction to Photogrammetry and Remote Sensing:
Introduction: Definition, Principle, Characterization, Application areas, History
Photogrammetry: Central projection, Pinhole camera, Image recording und image formats, Metric camera, Interior orientation, Analogue aerial camera, aerial, Flight planning, Photo scale, Digital aerial camera, Line scanner, Close-range acquisition, Natural and artificial stereoscopic vision, Techniques, Stereoscopic measurement, Collinearity equations, Rectification, Orthoprojection, Position errors, Linescanner correction, Stereo pair, Orientation steps, Image block and aerial triangulation, Accuracy of measured points
Remote Sensing: Electromagnetic radiation, Basics, Spectrum, Radiometric quantities, Lambertian radiator, Photometric quantities, Absorptance, Transmission, Reflection, Albedo, Bidirectional reflectance distribution function, Spectral signatures, NDVI, RVI, Feature space, Multispectral classification, -supervised, -unsupervised, Sequential-, Box-, Minimum-Distance-, Maximum-Likelihood classification, Bayesian Theorem, Cluster analysis, Quality of classification, Confusion matrix, Quality measures, Multi- and hyperspectral sensors, Applications
Image quality: Models of image formation, Distortion, Image quality of geometrical mapping, Diffraction, Aberration, Depth of sharpness, Critical aperture, Motion blur, Image quality of geometrical mapping, Resolution, Resolving power, Modulation Transfer Function (MTF), Examples for active sensors, Airborne Laserscanning (ALS), Synthetic Aperture Radar (SAR)

Table 4. Topics addressed in the lecture '*Introduction to Photogrammetry and Remote Sensing*' (1. semester)

3.2 Image processing

The lectures on image processing lead to cross-cutting knowledge and support in this role understanding and competences not only to *Photogrammetry and Remote Sensing* but also to the specialisation '*Earth system science*' and '*Navigation*'.

Image processing
Introduction: Motivation, Application areas, Definition, Image analysis
Image characterization: Sampling, Quantisation, Storage, Coding, Formats, Statistic, Histogram, Entropy, Co-occurence matrix, Covariance, Correlation
Image transformation: Geometric transformation, Resampling, Point transformations, Scaling, Convolution, Gradient operators, Laplace operators, LOG, DOG, Calculation effort, Rank operators, Algebraic operators, Image pyramids
Segmentation: pixel oriented, region oriented, low level model oriented, Hough transform
Binary image processing: Neighbourhood, Morphological operators, Dilatation, Erosion, Opening, Closing, Centre axis, Distance transformation
Vectorization and geometric primitives: Linear structures, Linking, Chain code, Areal structures, Polygon approximation, Approximation of line segments and circular structures
Feature extraction: Extraction of points, Moravec operator, Extraction of lines, Busch operator, Extraction of regions

Table 4. Topics in the lecture '*Image Processing*' (1. Semester)

3.3 Applied Earth Observation and Mission Engineering

3.3.1 Contents: The module Applied Earth Observation and Mission Engineering consists of two lectures, (i) Ground and User Segment and (ii) Applied Remote Sensing, as well as a project (iii) Satellite Mission Design Project

Ground and User Segment:
Data handling, processing and management of remote sensing sensors. Refining of raw data to information products.
Transfer of remote sensing data to ground and its technical and operational impact on the ground segment.
Ground segment concepts and engineering, standards and legal aspects

Applied Remote Sensing:
Earth observation systems and sensors
Remote sensing applications for environmental monitoring
Land use mapping and Geo Information Systems
Applications of remote sensing in natural disaster management and emergency response
Global Monitoring for Environment and Security
Infrastructure for Spatial Information in Europe

Satellite Mission Design Project:
In groups of about 5-7 students a proposal for a satellite mission (the topic is provided by the teacher) has to be worked out. The proposal should contain scientific objectives and mission design such as orbit, payload, spacecraft, and launcher. In a final presentation the proposals of each group have to be defended.

Table 5. Topics addressed in the module '*Applied Earth Observation and Mission Engineering*' (2. semester)

3.3.2 Objectives: At the end of the module, the students are able to understand the elements of an Earth observation ground segment and its interaction with the satellite and its sensors. They are able to analyze existing ground segments and to develop concepts for new and user specific ground segments based on engineering methods and standards. The students know about the most relevant Earth observation missions and are able to analyze their appropriate fields of applications according to the sensor specifications. They are able to understand the application of remote sensing and GIS techniques for environmental mapping and monitoring. They can evaluate the possibilities and limitations of using earth observation for disaster management and emergency mapping, and they know the relevant international mechanisms, which are put in place by space agencies world-wide. They are able to provide an overview on the main objectives of the European programs INSPIRE (Infrastructure for Spatial Information in Europe) and GMES (Global Monitoring for Environment and Security). The students have acquired knowledge about the design and the various components of a satellite mission. They are able to apply the mission planning software STK and evaluate the results of the simulations.

The competences reached in this lectures are proved by a written exam.

4. DOUBLE MASTER'S PROGRAMME TUM -WHU

The TUM specifically concentrates on forging international alliances with leading teaching and research institutes and networking in the fields of science and commerce. The international ESPACE Master's study programme, one of the first international study programmes installed at the TUM, follows this TUM's mission goal and enjoys an excellent reputation both at home and abroad thanks to the involvement of teaching staff from a large number of scientific institutes, international organisations and the global space industry as well as guest lecturers from Germany and overseas. In TUM, the cooperation afforded via the teaching concept stimulates lots of new, highly innovative research cooperation projects between the participating organisations from which the students also profit.

The mission goal of internationality is fostered, further extended and has been solidly established by the integration of a double Master's programme for especially talented students in cooperation with a university in China - the first of its kind at the TUM. The Double-Masters Agreement with the Wuhan University (WHU), one of the TUM's partner universities, was launched for the winter semester 2010/11. The positive acceptance by Chinese students, which have to pass a co-operative German-Chinese entrance selection process to ensure top quality of the candidates, demonstrates the demand for such an international agreement.

The WHU is the most important university in China in the fields of geodesy and geoinformation. Students who want to take part in the Double-Master's programme need to study for an extra year (three instead of two years), during which at least one whole year needs to be spent at the WHU and one whole year at the TUM. The specialisation option in the third year of the programme is available at both the TUM and the WHU allowing the students free choice of where to study their specialised subjects. The Master's thesis (six months) is supervised jointly by professors of both universities. This also strengthens the research cooperation between both universities. Graduates of the Double-Master's programme receive two Master's certificates, one from the TUM and one from the WHU. The Double-Master's agreement between both universities that was signed in 2010 governs the process and the curriculum of the Double-Master's programme. The first ten students from WHU with a double MSc degree are expected in the summer semester 2014.

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