

PHOTOGRAMMETRIC EXPERIENCE EXCHANGE

BETWEEN BRAZIL AND GERMANY

Heckmann, Heide¹
Oliveira, Francisco Henrique²
Loch, Carlos²

¹Institute of Photogrammetry and Remote Sensing (IPF)
Englerstr. 7
76128 Karlsruhe - Germany
heckmann@hotmail.com

²Federal University of Santa Catarina (UFSC)
Department of Civil Engineering
Caixa Postal 476, Campus Universitário
Florianópolis - SC - Brazil - 88040001
ecv3fho@ecv.ufsc.br

KEYWORDS: Cooperation between Universities, Campus-Information-System.

ABSTRACT

For about two years an intense exchange of "early career scientists" has taken place between the IPF Karlsruhe and the UFSC. The main task of this cooperation is to develop a Campus-Information-System for the two Universities. Not only the scientific development of the system is of interest but also the initialization of an educational flow of knowledge. By Close Range Photogrammetry a virtual 3D-model of both campi is made. These models are described by the Virtual Reality Modeling Language (VRML) and are used as an interface to a database. This technology will help the decision makers to optimize the management of the campi. Schedules, rooms, courses, and all kind of information about the activities on campus will be found in the database and are accessible by internet. For the documentation and access of historical heritage data the system has just to be filled with the corresponding data. The exchange is supported by the program PROBRAL (Program Brasil Allemania), which is established by CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) and DAAD (German Academic Exchange Service) who intend to intensify the scientific cooperation between Brazil and Germany.

RESUMO

Um intenso intercâmbio entre "jovens cientistas" da Universidade de Karlsruhe – IPF a da Universidade Federal de Santa Catarina – UFSC, têm acontecido celebrando dois anos de efetiva parceria. O principal objetivo da cooperação entre as duas universidades está no desenvolvimento do "Sistema de Informação do Campus", assim como iniciar e sedimentar um fluxo de conhecimento educacional. Através da aplicação da fotogrametria a curta distância e do modelamento 3D em ambiente computacional para ambos os campi, estima-se criar um ambiente universitário virtual. Os modelos são gerados utilizando-se a linguagem VRML associado a um banco de dados. Assim, esta tecnologia ajudará na tomada de decisão, otimizando o gerenciamento dos campi, como: horários, salas, cursos e as atividades geral de planejamento. Estas informações serão encontradas em um banco de dados e disponibilizada na internet. O projeto é fomentado pelo programa PROBRAL (PROgrama BRasil ALemania), firmado entre a CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) e o DAAD (German Academic Exchange Service), o qual pretende intensificar a cooperação entre o Brasil e Alemanha.

A relationship between Germany and Brazil

In May 1998 an exchange of Ph.D. students sponsored by the program PROBRAL (Program Brasil Allemania) began

between the IPF (Institute of Photogrammetry and Remote Sensing of the University of Karlsruhe) and the LFSG (Laboratório de Fotogrametria, Sensoriamento Remoto e Geoprocessamento at the UFSC). The exchange will last up to three years and support a group of "young career scientists", who work abroad in their fields of studies. During the interchange it is planned to expand the concept of the Campus-Information-System (CIS) developed at the University of Karlsruhe to the UFSC. In this paper the focus is put on the interchange of individuals involved in Photogrammetry, their experiences abroad and how these experiences can be used to preserve cultural heritage by using the CIS.

Developing a CIS

In Germany the administration of the University of Karlsruhe had the idea to create a CIS with the intention to develop an open Information System using modern tools based on the geodata of buildings, rooms, general installations, staff, and furniture. The scientific part of the project on the German side was the creation of large scaled geodatabases in 3D for the optimization of the management of complex institutions, e.g. factories, hospitals, and offices. In addition modern sensors and data techniques for an optimal organization and benefit of the University are to be used. The CIS can be distributed and accessed via internet and is open to integrate historic buildings or ensembles.

For the world wide distribution of the 3D-model it was described by the 'Virtual Reality Modeling Language' (VRML). Within the described 3D-world an easy-to-handle interface to go step by step from one hyperlink to another one is realized. The model is accessible on the World Wide Web via a standard Web browser which is able to interpret the code and to create a walk-through virtual world in near real-time. This interface connects to a database management system. The advantages of this system are the use of low-cost no proprietary software and common hardware. Finally not much training is necessary to handle the system (Landes 1999).

In spring 1996 the project started at the University of Karlsruhe. A couple of graduates and students were involved in the development, acquisition, and manipulation of the data for the CIS. One of the former graduates had the opportunity to participate in the exchange described. The project was supervised by Dipl.-Ing. S. Landes who developed his Ph.D. in this field at the Institute of Photogrammetry and Remote Sensing in Karlsruhe, Germany.

The CIS as a joined project

During the interchange it is planned to transfer, adapt, and extend the concept of the Campus- Information-System (CIS) developed at the University of Karlsruhe to

the campus of the UFSC. Setting up this joined project was only possible because of the a-priori activities of the Professors Bähr and Loch. In their administrative position at the Universities they assembled previous knowledge of the methods of managing a campus as well as of the arising problems. In addition the structure of the campus of the UFSC is similar to the campus of the University of Karlsruhe, and the technical equipment of both departments, e.g. computer hard- and software and an appropriate camera, is nearly identical. This CIS is going to be used to guide visitors of both Universities to their point of destination and to pass on information about the facilities of the University. In Brazil the internet is playing an important role in every day life. So the CIS will be an other way to distribute the needed information in the vast country and the students from far away can picture their future place of being.

In addition the development of the project is a prototype for the planning of the campus, using tools of Close Range Photogrammetry, Virtual Reality Modeling Language, a database, and conceptions of taking decisions to give support for planners. In future this system will be found in a lot of places where it is necessary to manage spatial environment. To have a look at the state of the art feel free to surf to the homepage of the University of Karlsruhe to access CISKA (Campus-Information-System of the University of Karlsruhe) at the site <http://www.rz.uni-karlsruhe.de/~Campus3D/>. At the UFSC the homepage is not yet accessible.

The program PROBRAL

Before the project started, H.-P. Bähr and S. Landes came to Brazil with the purpose to give a course of Digital Photogrammetry to the Brazilian group of LPSG. After this course in Brazil, the Brazilian group began to work with the goal to collect data of the campus of Florianópolis, but this was difficult because no good cartographic base was available. This was a first obstacle to overcome. Meanwhile the German group continued to develop a good and low-cost way for the acquisition of data.

At the beginning of the project a large amount of data had already been collected by the German group in contrast to the Brazilian group. In addition the two groups use different ways of planning. After this exchange of knowledge the participation in the PROBRAL program is a further step to keep the connection and the flow of knowledge running between the IPF and Brazil.

PROBRAL is a project-based exchange of people the DAAD (Deutscher Akademischer Austauschdienst, German Academic Exchange Service) and the Brazilian "Coordenação de Aperfeiçoamento de Pessoal de Nível Superior" (CAPES) realized since 1994. The aim of the program PROBRAL is the intensification of the Brazilian and German scientific cooperation. To stimulate new

projects with emphasis on "early career scientists" is another goal of the program, where the participation of Ph.D. students is recommended. The program is open to all courses and is sponsored by CAPES on the Brazilian side and by the ministry of education, science, research, and technology on the German side.

Objectives of the development of the project:

- Create a model for the Campus-Information-System for a better planning in the Universities;
- Intensify discussions about peculiar characteristics of both Universities considering the different rules of planning;
- Compare different methodologies which ought to be applied in managing and planning of the physical-spatial domain of restricted areas, e.g. Universities;
- Facilitate the interchange between German and Brazilian researchers in a way that the possibility to visit "in loco" exists, verifying the differences and difficulties in the planning of university campi;
- Learn about the culture abroad and take the opportunity of "living" as a person of the country.

In the course of the program, seven individuals from both countries were participating in the exchange. To get a closer idea about the possibilities in a foreign country two of the exchange people (Heckmann, Heide, Germany and Oliveira, Francisco H., Brazil) have reported their work, experiences, impressions, and results in this paper.

The project at the LFSG/Florianópolis (Brazil) from May 1998 until August 1998 (Heide Heckmann)

After arriving in Brazil one of the first tasks was to view the already existing material, mainly the maps of the campus and the data already collected for the database. Time was used to become acquainted with the software package MicroStation 95 used to create 3D wire frames and to rectify the images. In a next step a concept was set up for the photogrammetric acquisition of the façades of the buildings. Having all this material the visualization of the buildings in the 3D virtual world could be set up.

Viewing the model it can be seen that no plane unicolored texture is used to visualize the buildings. Here a texture of each façade was created, derived of images taken of the object with a middleformat camera (Pentax PAMS 645). A digital camera (Olympus C-820L) was also used in a later state of the acquisition. The result also turned out to be

useful, especially considering the gain of time skipping the development of the film.

Apart from the images for the texture a second data source is needed: 2D ground plans. This type of information was obtained from the existing digital map of the campus. Unfortunately the map turned out to be a patchwork of many different maps. Reliability playing a minor role at this stage of the development of the Campus-Information-System made it possible to use it for demonstration purposes anyway. A new survey was necessary because there was no basic surveying net and the old existing map material was accurate to about 7 m due to the differences in planning and realization of the buildings. For the CIS it was not of much importance at this time if a building is built some meters on a different location as planned. The survey for the new map of the campus has been started before the exchange began but was not finished yet. Therefore it is useful as a reliable planning tool only in future. Because of this, after the new map is established, the 3D-model has to be adapted by transforming the buildings to their true location.

A wire frame has been created out of the 2D ground plan and the information of the height of the buildings. Textures of the façades were mapped onto the wire frame. Here digital photogrammetric methods were used to derive a realistic-looking texture. In the case of the Brazilian Campus it was not necessary to model the buildings in a very detailed way because most of the buildings have a rather simple geometry. Reasons for the low detailed model are also matters of time, imagesize, and the purpose the model is created for. So just a projective rectification was used after the acquisition and scanning of the slides. It is good to check the aim of the system because more detail means more work. When using this system for more detailed objects it is necessary to change the way of creating the model. To see how more complex buildings might look when modeled in the simpler way access the CISK (Campus-Information-System of the University of Karlsruhe). One example of a more detailed low-cost acquisition and modeling is the project of Laguna, Santa Catarina, Brazil. With the help of the software PhotoModeler of EOS-Systems the historic part of the town was documented and modeled. This way of modeling was much more time-consuming than the simple rectification used for the CIS.

The result after three months of work has led to a partly photo-realistic visualization and the connection to homepages with

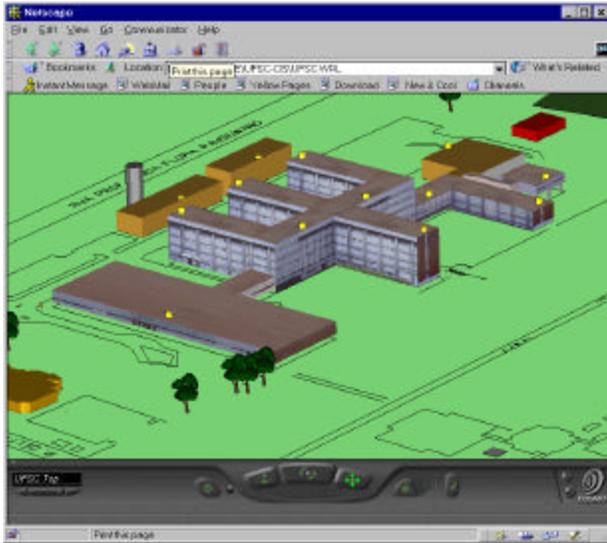


Fig. 1: Screenshot of the hospital complex

information of the buildings or about the staff. Most of the hospital complex (Fig.1) has been modeled and connected to already existing homepages. In the next step the model has to be completed and the connection to the database realized. For the CISKA the connection to the database was set up by using a Java Applet. Further information about the connection to the database can be found in (Landes 1999). During the upcoming exchanges the user-interface has to be adapted to the database.

A special part of this interchange was the close work with students of Architecture who are interested in historic buildings. So it was possible to get a slight idea how this matter is handled in Brazil and how Photogrammetry could be used to maintain, document, or reconstruct cultural heritage. During my stay I was asked to participate in a project in which the reconstruction of a building out of old existing images was discussed. Also the cooperation with the IPHAN (Instituto do Patrimônio Histórico e Artístico Nacional) shows their interest of using Photogrammetry in order to maintain and document the historic buildings as well as the culture found in the melting pot Brazil. Here the old part of the town Laguna, Santa Catarina is modeled in a way similar to the CIS. The IPHAN is interested in the documentation of the cultural heritage and it is also aiming to involve the inhabitants of the buildings and make them aware of the treasure they own and should pass on to future generations. A trip to the town of Laguna and the short overview of the work done there by Mrs. Lilian Simon pushed my interest to the topic using Close Range Photogrammetry for documentation and reconstruction of buildings. Because of this I have decided to study a year of building reconstruction at the University of Karlsruhe to understand the needs.

**Project at the IPF (Germany) from November 1998 until February 1999
(Francisco H. Oliveira)**

After landing in Germany, it has been decided to prepare a presentation of the CISKA for the people of the administration of the University of Karlsruhe. At this time not all buildings have been modeled in VRML and did not appear with texture so far. Therefore it was necessary to create the wire frames of the missing buildings and link them to the database. The wire frames were made by using the software package MicroStation 95. Each building was export in VRML, DXF and DGN format, to be able to include it in the 3D model of the CISK. Instead of a realistic looking texture the wire frames have been filled with one color (Fig 2).

A course in Oberkochen at Carl Zeiss Company was the second part of this exchange The course was about Digital Photogrammetry, in special PHODIS – Photogrammetric Digital System. These system is a compound of modular design: PHODIS SC/SCAI – photogrammetric scanning system with autowinder option, PHODIS AT – full automatic aerotriangulation, PHODIS ST – modelorientation and stereoplotting using MicroStation, PHODIS TS – automatic correlation of digital terrain models, PHODIS OP – orthophotos and mosaics and PHODIS BASE – common base for all modules with all important photogrammetric tools. In the first week a theoretical course took place and in the second week a practical one. Here all steps were reproduced with the aim to learn how to use the entire system.

It is quite difficult to write about the impressions if you consider this as being my first time abroad. Most things and the way things are done are different. In this affirmation must be also considered not only in the scientific way of developing work, but also the way of life, the way of thinking, and the behavior in situations.

The experience of exchanging people in one project between two countries is fantastic for the people who are involved in the work. The opportunity to spend a time abroad makes you improve yourself and pay attention much more on little details. As well as to improve the capacity of self critic with the things that are been done, this is just possible because you have the opportunity to exchange experiences and get some advise from other professionals.

After this experience of exchange, the people who were involved in this project could get parameters of comparison about different methodologies adopted in Brazil and Germany for developing the same project applied in a different environment.

Finally, the best conclusion of the exchange is that German people develop projects with a lot of care,

thinking of all sorts of detail before putting them into practice. This means that at the end of a project the results are always good and they really know how to organize and store the surveyed data in order to use it again. So, this is the second great difference, because they have historic data of all sorts of surveys, what is completely different in Brazil, once that we are not used to organize or store it. Because of this, the German scientists have more time in their project to spend with the analyzing of the results, and Brazilian scientific people spend a lot of time during the projects just for acquiring the data and organizing it. On the other hand, both sides reach good scientific results. The only problem is the previous organization of data and the ower of analyzing it. This the Brazilian people still have to learn.

References:

- Bähr, H-P., 1996. Das Geodäsieprojekt an den brasilianischen Universitäten in Curitiba und Recife 1981-1995 -Verlauf und Ergebnisse- . In: zvf 1996, pp. 341-350.
- Renuncio, L. E.; Loch, C.; Bähr, H.-P. Parceria Universidade de Karlsruhe - UFSC em Fotogrametria e Geoprocessamento. In: INTERTECH 98 -V Conferência Interamericana de Educação em Eng^a e Tecnologia. Maio/98.
- Landes, S., 1999. Access to Virtual Worlds via Internet, GIM International, January 1999, pp 76-79.

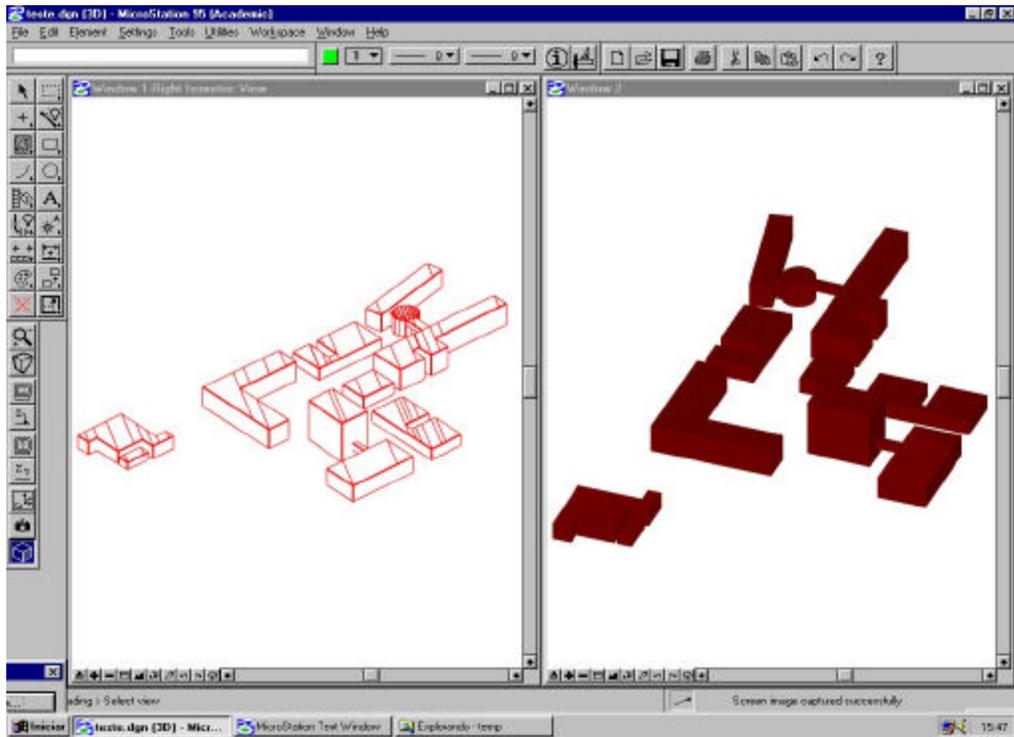


Fig. 2: Screenshot of some buildings from the Karlsruhe University modeled in 3D