M. Cramer: EuroSDR network on Digital Camera Calibration
EuroSDR newsletter 2004, no 1, pp. 19-20

The need of camera calibration is a fundamental requirement in the field of photogrammetric data processing. For airborne sensors this calibration is typically realized under well controlled laboratory conditions where especially designed calibration setups are used to determine the internal camera characteristics with sufficient accuracy. Such calibration facilities like multi-collimator or goniometer devices are used to determine the camera distortion parameters from the obtained discrepancies between measured coordinates or angles versus their a priori known values. Besides this, the focal length and principle point coordinates are estimated to minimize the absolute amount of lens distortions and to realize a symmetric distortion pattern.

However, situation changes with the availability of new digital airborne imaging systems mainly due to the following two aspects: First, comparing such digital sensor systems from their system design concepts, there are large variations within the specific system realizations and in comparison with standard analogue cameras, i.e. frame sensor concepts versus line scanning approaches, multi-head systems versus single head sensors, large image format data acquisition versus medium or even small format cameras, pan-chromatic and/or multi-spectral image data recording. Due to the new multi-spectral imaging capability calibration should not only be restricted on the geometric aspects but has to be extended on the radiometric part also. The second fact is mainly due to the integration of the imaging sensors with additional sensors for direct sensor trajectory determination like GPS or integrated GPS/inertial modules. The combination of digital imaging sensors with direct orientation components is straightforward since they provide very accurate information on the sensors movement which can be used for fast generation of photogrammetric products like ortho images. In case of line scanning systems a tight coupling with GPS/inertial sensors is even mandatory to allow for an efficient image data processing. Hence, calibration has to cover the whole sensor system consisting of imaging part and additional components like GPS/inertial sensors. From this background the need of more complex, extended and more general calibration procedures is evident, where the aspect of in situ calibration will gain in importance also.

This today's situation gives the framework of the EuroSDR initiative on "Digital Camera Calibration". Within this project a network is established formed by experts from camera manufacturers, software developers, private companies and universities. Up to now, more then 30 experts already joined this group. First contacts to the north-american calibration activities are already established. Nonetheless, additional people being interested in this field of work are still invited to become active members of this group. Currently the project is running in its first phase. This starting phase is used to compile an extended report providing fundamental knowledge on realized digital camera calibration methodologies. Right now, the report compilation is mainly based on publications already published in conference proceedings or scientific periodicals. Besides this, some of the system manufacturers provided additional non-published but public material (i.e. calibration protocols) and first personal experiences are included. Nonetheless, in order to guarantee a complete description of the applied calibration methods, additional active input of all participants is desired. Since this report is open to manufacturers, users and customers it will be used to gain experience and knowledge in digital airborne camera calibration. Additionally, such basic compilation will be helpful for definition of future strategies and potential experimental work in the subsequent second project phase.

The second phase should focus on the development of accepted procedure(s) for camera calibration and testing. It seems to be necessary to concentrate on some of the technical aspects in a sequential order, possibly starting with geometrical aspects and verification in a limited number of test flights by different camera producers and discussion on radiometric and image quality aspects. This second project part requires a fine definition of goals which

should not lead to direct comparisons of cameras, but to individual recommendations for each major camera type. The results of the currently running first project phase will be used for definition of goals and design of empirical tests.

Dr. Michael Cramer
Institute for Photogrammetry (ifp)
University of Stuttgart
Geschwister-Scholl-Straße 24 D
70174 Stuttgart / Germany
Phone: +49-711-121-4118
Fax: +49-711-121-3297
Email : michael.cramer@ifp.uni-stuttgart.de
WWW: http://www.ifp.uni-stuttgart.de