



Doctoral Thesis

## Mapping and photointerpretation system based on stereo-orthophotos

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**Publication Date:**

1971

**Permanent Link:**

<https://doi.org/10.3929/ethz-a-000093908> →

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**Diss. No. 4792**

# **Mapping and Photointerpretation System Based on Stereo-Orthophotos**

DISSERTATION

submitted to the  
SWISS FEDERAL INSTITUTE OF TECHNOLOGY  
ZURICH

for the degree of Doctor of Technical Sciences

Presented by

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Juris Druck+Verlag Zurich  
1971

## ZUSAMMENFASSUNG

Das Kartierungs- und Photointerpretationssystem, aufgebaut auf dem Konzept der Stereo-Orthophotos, stellt eine neuartige Entwicklung in der Photogrammetrie und Kartographie dar. Stereo-Orthophotos sind Orthophotopaare, in welchen man einem Orthophotobild künstliche Parallaxen derart gibt, dass eine stereoskopische Betrachtung und exakte Höhenbestimmung des Geländes möglich ist. Das Ziel, das der Autor verfolgte, bestand darin, ein System zu entwickeln, das nebst einer Beschleunigung und Automatisierung der Kartierungsarbeiten auch eine funktionelle Trennung der Auswertarbeiten zwischen prinzipiellen, rein photogrammetrischen und anderen Operationen bieten würde; dies namentlich in Anbetracht der Tatsache, dass die Luftaufnahmen heutzutage ausser von Vermessungsingenieuren und Kartographen in vermehrtem Ausmass auch von Nichtspezialisten auf dem Gebiet der Vermessung und Kartographie verwendet werden.

Der Autor stellt die grundlegende Theorie dar und beschreibt die Instrumente, die er entwickelt hat: den "Orthocartograph" zur Herstellung von Stereoorthophotos, und den "Stereocompiler", ein ganz besonderes, sehr einfaches und leistungsfähiges Auswertegerät. Die Resultate einiger Experimentalarbeiten in Klein- und Grossmassstäben geben einen Ueberblick über die Leistungsfähigkeit des Systems bei den Inventarisationsarbeiten einschliesslich eines ökonomischen Katasters. Dadurch, dass sich die eigentlichen Kartierungsarbeiten und die Photointerpretationsarbeiten auf die gleichen und metrisch genauen Unterlagen stützen, ist ein besonderer Vorteil erreicht, der vor allem den entwicklungsbedürftigen Ländern zu Gute kommen dürfte.

of the technique, essentially uniform results are assured in spite of decentralization of the work.

- Realisation of the concept required development of new, suitable pieces of equipment. This has been accomplished for the most crucial components, such as the Stereocompiler. The peripheral equipment, the contouring table and the relief shading device have been developed and initial experimenting has been carried out. Other equipment, such as the Orthocartograph, has been designed and its construction will soon be completed.
- The system is the first complete answer to the requirements encountered in various fields outside the surveying disciplines, in which aerial photographs must be used. Moreover, the system brings the above operations to a common basis with the standard mapping operations. Important technical and economic advantages result from this conformity of techniques and results.
- The system may provide an efficient answer to one of the most cumbersome problems in mapping: updating of existing maps.
- The basis was provided for a geometrically correct, three dimensional map presentation. This may eventually change the map concept in various applications and allow highly automated map-production processes.

2. Full scale experiments involving small scale, intermediate and large-scale mapping, proved the soundness of the system. In particular, the experimental results support fully the results of the theoretical work carried out in this field by Collins, van Wijk and the author.

Present results and their detailed analysis leave no doubt that quite a surprising accuracy in elevation can be expected once the production of the stereo-orthophotos will rigorously follow the basic, theoretical requirements.

3. Extreme simplicity and other characteristics of the system make it very suitable for establishment of a country-wide land inventory including modern cadastre. This should be of particular interest to the developing countries.

4. There is no doubt that the system will permit a rapid and economic mapping of huge territories that so far have remained unmapped because of the complexity, expense and slowness of the conventional approach. The system should also find extensive use in special applications for which it is particularly well suited.

There are however also limitations which must be clearly recognized. Since the system is based on stereo-orthophotos, which are derived from original photographs, the accuracy of the technique described cannot match the accuracy of classical photogrammetric methods. Therefore, where the highest possi-

ble numerical accuracy is of primary importance, the classical photogrammetric or field surveying methods should be used. Because of perspective displacement of details that are over ground surface, very large scale mapping of cities with high-rise buildings may not be well suited for the proposed system. This does not exclude, however, the use of the system in various other applications in city areas.

5. The system opens up a new, huge area for further research, development, improvement and change. Change is the essence and the expression of progress, bound only by imagination. Πάντα ρεῖ!

Ottawa, June 1971.