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Stereocompilation Equipment Trends in Europe

European plotters and American electronics are being combined in an effort to automate the mapping process.

BY WAY OF INTRODUCTION, it should be mentioned that most European manufacturers are presently maintaining secrecy concerning new developments in instrumentation pending their disclosure at the 11th International Congress of the International Society of Photogrammetry meeting at Lausanne, Switzerland, in July 1968. Also, since it would be presumptuous of me to attempt to evaluate and compare the many fine photogrammetric plotting instruments manufactured in Europe, I will confine my remarks to generalities and not specific equipment.

European organizations and manufacturers have been in the forefront in the development of photogrammetric methods and stereoscopic instruments for many years. Highly skilled technicians were available to produce intricate lens systems and remarkably precise mechanical linkages required in the production of large plotting instruments. These instruments were, and are, marvels of mechanical and optical engineering and perform the necessary photogrammetric solutions by analogue means. Their accuracy is a tribute to the skill of their design; however, as new camera systems were produced and photogrammetric applications became more diversified, greater versatility was required in plotters.

Instrument design trends are dictated by user requirements. Since 1950, photogrammetry in Europe has been applied to large-scale cadastral and engineering surveying. Developing countries of the world enlisted the help of Europeans to provide maps quickly so that their natural resources could be exploited. Electronic computers became available and techniques were developed that analytically solved the photogrammetric orientation and adjustment problems to a high degree of accuracy. Analytic photogrammetry necessitated the development of digitizers for fast access to the computers and automatic plotters to present the results in graphic or photographic form.

THE PHOTOGRAPHIC community, particularly in the United States, began to move toward automation in the 1950's as a means of providing faster and more economical solutions to the basic mapping problem and more accurate engineering and geodetic applications. Fully automated systems are still a dream, and the complex problems involved in this transition are a long way from being solved both from an operational and main-

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* Presented at the Annual Convention of the American Society of Photogrammetry, Washington, D. C., March 1968, as part of the Panel Discussion on "Stereocompilation," and comprising one of the eight panel articles appearing in this issue.

tenance standpoint. The Europeans recognized these problems and, while they are moving slowly in this direction, the classic photogrammetric plotter, with minor modifications, is still basically unchanged, following the principle of walking before running. The trends can be described in three categories: (1) changes in basic plotter configuration; (2) development of periphery equipment to accelerate measuring and plotting; and (3) use of analytic methods to speed up restitution problems.

Stereoscopic plotters for general mapping are becoming more standardized, accommodating near vertical photography with a 9 ×9-inch format, so that the same diapositives or prints can be used interchangeably on bridging and compilation equipment, taking advantage of the full scale of the original compilation procedure by performing many tedious operator functions automatically. First-order plotters are being equipped with servo-mechanisms which remotely control the orientation elements. Electric motors are being provided for driving the lead screws at fast or slow motion in either direction. Some new instruments provide a choice of freehand or motor drive.

Digitization of position and elevation data has been accomplished by electro-mechanical systems driven by encoders connected to the lead screws. These systems usually provided typed, paper tape or card outputs. Maintenance problems became evident to the users of these systems because of the many electrical contacts that are subject to wear. The current trend has been toward the use of electronic circuits.

ABSTRACT: *Classic European stereoscopic plotters are being modified to increase their versatility, and optical and mechanical systems are being simplified. Non-topographic applications of photogrammetry and the design of special purpose equipment is increasing. The increasing use of electronic computers has accelerated the development of attachments to automate partially the photogrammetric orientation and plotting procedures.*

photography. Most of the newly developed plotters are able to accommodate photography taken at a wide range of focal lengths, and diapositives printed on different glass thicknesses.

There has been a trend to simplify topographic plotters by reducing the number of rotations in the optical train. The perspective centers have been placed above the fictitious mechanical photo plane on newer instruments for stability and compactness. Rotation centers for tilt have also been located eccentrically to simplify construction and accelerate the orientation process. Simpler optical systems are also made possible by the use of single cylindrical space rods.

Emphasis has been placed on the comfort of the operator in the development of new plotter configurations. Optical systems which remain fixed during tracking, freehand tracking, and easily accessible setting screws and motion knobs have reduced operator fatigue. Improved mechanical projection systems with rheostat-controlled lighting reduces eyestrain.

PERIPHERY EQUIPMENT has been developed partially to automate instruments both for computer applications and accelerate the

The digitization of graphics and profile data is being accomplished by electronic systems on many new European instruments. Most of these systems involve the use of basic European plotters equipped with American-made encoders and electronic readouts. The volume of data, so derived, has necessitated magnetic tape outputs to alleviate the storage problem. While little progress has been made in the application of this technique in Europe, the trend is moving in this direction and electronic systems are beginning to be produced. System development organizations in Europe are attempting to develop standardized computer programs, recording devices and output media.

Most plotting is accomplished by on-line mechanical means either by gear action or pantograph. However, several manufacturers are producing automatic coordinatographs driven by electric impulses or servo-mechanisms, directed by punched cards or magnetic tape. As the trend toward numerical photogrammetry continues, more of this type coordinatograph will be manufactured.

COMPUTER AVAILABILITY has increased the use of analytic solutions to the problem of orientation of stereoscopic models, and the

adjustment of strips and blocks. Several organizations are using digital means of solving independent models on topographic plotters for subsequent aerotriangulation, thus increasing the versatility of these plotters for small-scale mapping. Most organizations have developed analytic or semi-analytic methods to perform block aerotriangulation.

Computer utilization has also accelerated the quality control studies for photogrammetric systems that have always been emphasized in many European educational institutions. Computerized statistical studies will aid in the development of standards for the performance of cameras, materials, plotters and operators. Compensations for contributory errors so determined will improve the accuracy of precise survey applications.

Orthophotography has received wide acceptance in Europe and is being used extensively for cadastral surveys for land use and urban planning. Orthophoto maps with overdrawn contours are replacing standard topographic map coverage in some areas. Automatic contouring by drop-line method is available on some equipment to be used in combination with orthophotos. Orthoprinting devices have been added to both classic and analytic plotters and it is expected that this equipment will come into wider use in the future.

Terrestrial photogrammetry is increasing in Europe. Equipment is being modified or manufactured and techniques developed to apply photogrammetry to archaeology, architecture, medicine, crime studies, traffic accident reporting and animal husbandry. Photogrammetry is also used to provide camera calibration constants for X-ray instruments and television cameras. These trends are also expected to accelerate.

IN CONCLUSION, photogrammetric plotting instrument trends in Europe are toward simplification of the optical and mechanical systems while, at the same time, their versatility is increased by analytic orientation and adjustment. New instrument design is strongly influenced by ergonomic considerations to increase the efficiency of the operator. European plotters and American electronics are being combined in many instances in an effort to automate the mapping process. The field of photogrammetry in Europe is broadening to encompass many new applications as its accuracy and efficiency can be demonstrated.

I would like to express my appreciation to Mr. Makarovic of the I.T.C. in Delft, Holland; Professor Hallert of the Institute for Photogrammetry in Stockholm, Sweden; Mr. Friedman of the O.M.I. Corporation of America; Mr. Trager of Carl Zeiss, Incorporated; Mr. Wehrli of Kern Instruments, Incorporated; and Mr. Reynolds of Wild Heerbrugg Instrument Company, for their helpful comments on trends in European plotting equipment.

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mation. These functions, however, are distinctly separated from stereocompilation and can, therefore, not be presented here in more detail.

IN SUMMARIZING we make a refreshing observation. Many initially exotic requirements, primarily spawned by desire or necessities above and beyond our economy-bound national operations, are producing advances in science and technology. When these are channeled through the selective process of competitive suppliers and buyers of mapping equipment, they produce a healthy stability on the photogrammetric shareholder's stock exchange.