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Highlights of Current Stereocompilation Practices

Applications range from 1 : 120 scale mapping with helicopter photos from 300 feet to 1 : 100,000 scale Lunar mapping from 28 miles up.

The need for maps has existed since man began to move from place to place; however, it has only been a scant 30 years that we have realized a means to meet the increasing demand for adequate topographic maps. Our farsighted colleagues have provided this means by recognizing the potentialities of the stereoplotter. With the advent of World War II, the overnight requirement for up-to-date topo maps was unbelievable. This undoubtedly hastened the move of that courageous and legendary figure—the "topographer"—from his happy home in the field to a semi-darkened stereoplotter room.

The Multiplex, referred to as the *workhorse of the Army*, was also the early workhorse for the U. S. mapping community. We have seen the early normal angle Zeiss equipment replaced by the Bausch and Lomb normal angle projectors and, in turn, in the early 1940's, by the Wide-Angle Projectors which utilized the 6-inch focal-length photography.

The 1950's brought changes in U. S. made stereoplotters. The U. S. Geological Survey (USGS) developed the ER-55; Mr. Harry Kelsh, the Kelsh Plotter; Bausch and Lomb, the Balplex; the Army Map Service (AMS) designed the AMS-M2 stereoplotter, which is manufactured by Belfort Instrument Company.

In the past few years, modifications and improvements have been made on some of the later models, and a few other similar type instruments have been placed on the market.

During the same period, the European made instruments have had their impact on the U. S. mapping community. These instruments primarily employ a dual optical train for viewing the spatial model with a design that is more sophisticated and complex than the U. S. type, and consequently has a much higher price tag. Nevertheless, we photogrammetrists have needed the more expensive 1st order universal type stereoplotting instruments as manufactured by Nistri, Wild and Zeiss, for use in producing photogrammetric control.

More recently, the larger mapping organizations have turned to stereocomparators to acquire precise measuring data for analytical reconstruction of spatial models; thus, attaining a high degree of accuracy. These instruments have not only reduced the overall aerial triangulation time but also the high cost of establishing additional field control which is required for the less sophisticated plotters.

At this point, some of you may be thinking

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that a brief review of some of the equipment used has nothing to do with "highlights of current stereocompilation practices." In a sense, I might agree; however, for your consideration and participation in this program, let me pose these questions. What does *Stereocompilation Practices* imply to you? Does it include the many operations involved, such as procurement of aerial photography and control, preparation of diapositives, layout, stereoplotting and the other cartographic steps to produce a final map product? Or, are you thinking strictly in the sense of what is produced from the stereo model? If you consider the compilation of a stereo model by analog methods, what have we to highlight? Basically, we still push tracing tables or drive floating marks throughout the model to plot and measure the detail. Yes, we have gone from paper to more stable plastics, pencil to pen and inks easier to use, and in some instances attempted direct scribing of the lines. Many believe we have reached a plateau in this phase of our operations, and it may be so if, at this time, we eliminate automated compilation which will be covered by the final speaker of this panel.

ABSTRACT: *This is the first of several panel presentations on Stereocompilation. A review of stereoplotting instruments most commonly used in the United States, examples of compilations produced, and, improvements and developments of materials and equipment is presented. The primary intent of this paper is to stimulate panel and audience discussion.*

If the plotting of stereo models does not deserve highlighting should we consider some of the products that have been produced? A recent article in PHOTOGRAMMETRIC ENGINEERING describes mapping at a compilation scale one inch on the map equalling 10 feet on the ground and still maintaining a high degree of vertical accuracy. In this instance, photography was obtained from a camera mounted in a helicopter and flown at an altitude of 300 feet. Extremely large scale compilations have been produced for some time by mounting cameras on booms, dollys, and the like, but this type of mounting lacks the flexibility of aircraft platforms for topographic mapping. On the opposite end of the scale, 1:250,000 scale maps have been produced covering the United States using photography obtained at an average altitude of 30,000 feet. It is needless to point out that in between these extremes, varying scales of compilations must be produced to meet the many diversified requirements. A unique type of map providing the horizontal and vertical accuracy inherent in an original stereocompilation is being produced using a contoured orthophoto base and the principles of the pictomap.

STEREOCOMPILATION HAS also kept pace with the Space Program. A 1:5,000,000 scale topo map of the visible lunar surface was made in 1961 using earth based telescopic photography. At the present time, 1:25,000 and 1:100,000 scale Lunar Landing Sites are being compiled from the Lunar Orbiter photography taken approximately 28 miles above the surface of the moon.

Stereo models today are a vast improvement over those of 10 to 20 years ago. The lens systems in both the cameras and plotters have a much higher resolving power, and in most cases are designed to produce a distortion-free model. The development of the Log-Etronics Printer provided the means for a controlled quality production of diapositives—as well as quantity with an automatic batch processor.

Black-and-white photography is usually considered for stereocompilation; however, color and infrared photography are used by the Coast and Geodetic Survey for compiling hydrographic data. This has proven to be much more accurate and less time consuming than compiling with the black-and-white film.

It is expected that more consideration will be given to mapping from color photography since the recent development of the Stereo Image Alternator (SIA) by the USGS. To "trade-off" the colored filters of our anaglyphic stereoplotters for the SIA system is considered an outstanding contribution to the mapping community. This not only permits the use of color photography, but alleviates the age-old problem of model clarity due to light loss through filters, proper lighting controls, and adequate color spectacles for the compiler.

IN THIS BRIEF examination of the "high-

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ciently with black-and-white imagery in a relatively high level of ambient light. Second, even before development of the SIA, photogrammetrists had come to realize that the isolated booth in near darkness was not necessary for efficient operation of the anaglyphic plotters. Today, these plotters are often installed in groups of 10 or more in large rooms where the general illumination is only subdued. Compilers freed from the confined environment of the dark booths have the feeling of being part of a team, with a beneficial effect on morale.

Solutions to the fading challenge in stereocompilation as proficiency increases are not easily found. One avenue is through emphasis on the creative aspects of the task of reducing the raw data imaged on the photograph to useful information in the form of a map. Without the creative efforts of the human, the images on the photograph are part of a picture—nothing more. Through his efforts the picture becomes related to a coordinate system on the earth's surface and the photographic images become map symbols, providing useful information for many important activities.

APART FROM TECHNOLOGICAL developments, what can be done to reduce the human problems in stereocompilation? These could be reduced to a considerable degree by careful screening of prospective employees. Restriction of employment to only those candidates with good visual ability, introversive self-discipline, dedication to individual performance, an appreciation for the creative challenge of reducing raw data to a useful form, and a willingness to exchange this rather rare combination of abilities for the relatively inadequate salaries paid to compilers would minimize the human problems we now encounter. In today's limited labor market, such screening is virtually impossible.

Since careful selection of candidates with all the desirable attributes is nearly impossible, management is faced with its own creative challenge—that of developing the personnel it is able to recruit into effective, efficient, and motivated employees. To this end the manager must employ the optimum mix of technological developments, aids to vision, and alleviation of undesirable environmental conditions, and then develop in his compilers an appreciation of the creative challenge in stereocompilation in order to reduce the human problems in his work force.

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lights of current stereocompilation practices," items concerning the automated procedures have purposely been omitted, rather than impose on other presentations in this panel. I have also omitted any reference to the related uses of the stereoplotter, such as the determination of profiles or volume studies.

Stereocompilation Practices have chalked-up some definite highlights throughout the years. Those currently being achieved undoubtedly *out-shine* those of 10 to 20 years ago. The primary objective of this paper is to stimulate your interest and participation in the panel discussion to follow. We'll be awaiting your contributions.

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efficiency of the succeeding phase. In photogrammetric procedure, it is imperative that the quality of the aerial photography be high to permit good stereomodels, that the field personnel fulfill their objective in a thorough and accurate manner and that the computations and the plotting of control data likewise be done accurately. If these operations are not done completely and accurately, it will have a detrimental effect on the efficiency of the stereocompilation which often cannot be overcome by the organization of procedures and proper attitudes. Finally, stereocompilers must accomplish their objectives also with the anticipation of what problems they might create for the draftsmen who must be able to interpret the compilation in order to maximize the efficiency of the drafting operation.