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The Analytical Plotter—Its Future

Special-purpose plotters, a digital systems approach, and a concern for standard formats are stressed.

Introduction

Wide acceptance of the analytical plotter principle became abundantly clear at the Helsinki Congress in July of 1976. The many papers published in this issue of *Photogrammetric Engineering and Remote Sensing* attest to that, and indicate the current state of the art. This paper sketches out some relatively near-term development possibilities of commercial analytical plotters and then proceeds to express a couple of concerns. Timely expression of these concerns will we hope lead to constructive thought that can help us alleviate the problems involved.

Technical Development-What's Next?

All commercial analytical plotters on the market today may be classified as "universal", or "top-of-the-line" instruments. They incorporate fairly powerful minicomputers with large memories, and various special features. Instruments (or better: systems) of this class will probably be popular for some years to come. However, they will certainly be complemented by other instruments and systems, designed to meet special requirements. Such requirements will arise from the desire to optimize the performance of analytical plotters for large-scale mapping, small-scale mapping, engineering measurements, non-cartographic applications, etc., and from the eventual necessity to develop digitally integrated "map factories" involving extensive automation and large groups of instruments of various "orders" and types. This kind of a trend is common in technology; in the case of the analytical plotter the trend is likely to be accelerated for several reasons. *One,* very shortly (if not already), the major cost item in the analytical plotter will be its optical-mechanical part, rather than its computer-control system. Consequently, significant cost benefits can be expected from optimizing the optical-mechanical design for a specific purpose. *Two,* very low-cost microcomputers with minimal peripherals will be sufficiently powerful for some special-purpose analytical plotters. *Three,* special-purpose instruments need less software, which in addition may be standardized. This reduces the (possibly very large) software development cost component. *Four,* photogrammetry can profitably do some technological catch-up. The possibilities offered by digital electronics are not yet fully exploited by photogrammetry.

Even though there will be specialization in instruments, they will still retain numerous common features—in much greater detail than what could be expected from their generic similarity alone. For example, it is virtually certain that all of them will have capabilities to accept given orientation elements. After all, this feature is very useful and costs almost nothing to implement. Similarly, all of them will probably have powerful analytical orientation programs, even in cases where the instrument is not meant primarily for stand-alone use. With time, the cost of this feature becomes insignificant. The same applies to means for digital recording. Furthermore, instruments built by the same company (at least!) will have identical or highly similar operating procedures. "Intelligent" plotting tables will be similar and common to various instrument types whenever graphical plotting is required.

Discussion of technical development prospects in detail calls for a longer paper, and is not pursued further here. The total effect of the trends outlined above needs to be emphasized, however. In short, the effect is that in a few years the analytical plotter will be price-competitive across the entire spectrum of photogrammetric instruments, even without accounting for its superior performance.

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Concern for System Approach

It would seem that everything is fine and rosy for a promoter of analytical plotters. And so it is, from the point of view of instrument makers. However, if one takes a broader view, it becomes immediately and eminently clear that for the users there is much more at stake. The benefits from adaptation of the analytical plotter principle can be redoubled by adopting a digital system principle. The concern of the author is: How can the users, large and small, new and old, convert to digital systems in practice?

As a starting point for progress toward realizing digital system benefits, one should first describe what is meant by a photogrammetric digital system. The trouble is that there is no unique description. Much depends on what the user already has, what his tasks and plans are, and what his resources are. One could attempt to give a guideline, though (each user could try to fit it to his own circumstances). In photogrammetry, we start with geodetic control and aerial photographs, and at the end supply earth-related information to end users. In between, there are numerous steps that use or will use digital techniques for processing and communication. A photogrammetric digital system is one in which these steps and the communications between them are coordinated to bring the job through with minimum delay and cost.

Without doubt, the digital system approach will bring major benefits to the users, and eventually will be commonplace. However, the road to that goal may be long and arduous. The most important thing is to start, and the first step should be to do some thinking about it. We may hope that many users will be prompted to do that. Then, in due time, most manufacturers of instruments will be able to help—willingly, or out of necessity.

Concern for Standard Formats

The concern for standard formats is a corollary of the previous one. However, it has a wider scope because it is involved in inter-user, inter-manufacturer, and user/manufacturer relations. The problem is that each manufacturer and each user can specify internal communication formats in myriads of different ways. Even if there is an agreement to stick to some generally accepted standards (e.g., ASCII code, etc.), it would still be virtually certain that communication outside a given system would be very difficult, or impossible. The only cure is an agreement that deals with the problem systematically and in detail.

The author does not have much hope that the required level of standardization will be reached. The problem must become acute first—and then it is too late to do anything. In the computer field considerable *de facto* standardization has been achieved because of the overwhelming dominance of IBM. However, there does not seem to be anything equivalent in photogrammetry.

Concluding Comments

The era of commercial analytical plotters has just started. Rapid development can now be expected, all to the benefit of the users of photogrammetric instruments. These benefits, which are significant, could be redoubled by expanding conceptual thinking and subsequent implementations on the basis of digital system principles. Transition in this direction is inevitable for economical reasons and promises exciting future capabilities.

Errata

In the list of Officers of the Technical Commissions of the International Society for Photogrammetry, in the July 1977 Yearbook issue (page 816), the U. S. Correspondent to Commission III was not listed. He is *Prof. James M. Anderson,* Dept. of Civil Engineering, University of California, Berkeley, California 94720.

The Report of the Professional Activities Committee in the July 1977 Yearbook issue (page 930) failed to list *Mr. Joseph Danko,* instrument manufacture area, and *Mr. Eldon Sewell,* federal government area.

The correct dates for the ISP Commission VI Symposium, Planning, Economy, and Education in Photogrammetry, listed on page 1026 of the August 1977 issue, are August 8-10, 1978.