DECISION DAY FOR AUTOMATING

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INTRODUCTION

Decisions are not made in a vacuum. To give direction, management must have both the facts and expert predictions on the outcome of each alternative. Automation is a particularly thorny decision for management. There are a few route markers. The equipment is frighteningly expensive. Personnel must be retrained or recruited. Finally, the production flow must be altered. So it is not hard to see why those who decide are often hesitant.

When first asked to serve on this panel, I reflected on the decision points in various governmental cartographic units. When these were listed, the exact chronology of events seemed unimportant. In each case, the "why" seemed more critical than the "when". Therefore, this discussion will focus on the rationale for automation rather than on the timing.

In developing this topic, I will first give eight reasons for automating and then relate four case histories. Despite the reference to Federal Government in the session title, one British and one Canadian and two U.S. agencies have been chosen as examples. This diversion was made because of the significance (and success) of their efforts and because this is an international meeting.

WHY AUTOMATE IN THE FIRST PLACE?

There are many arguments for automation and they can undoubtedly be divided in many different ways. I have observed eight good reasons and offer them as the basis of the rationale in each example. The eight are as follows:

1. Economy

   In such a labor-intensive field as cartography, management must be constantly alert to new methods to offset rising wages as well as increasing materials costs.

2. Speed

   In applications where data are highly perishable, such as weather and intelligence, automation significantly reduces reporting time. Even where the production cycle is less hurried, the elapsed production time can be markedly reduced.

3. Original Data in Machine Form

   Substantial bodies of scientific, engineering, and business data are

initially captured in machine-readable form. Continued automation in the process of data reduction to map or chart form is desirable and the only possible way cartographers can keep pace with increasing data collection and graphic demands.

4. Volume

Spatially organized data in some information systems is so voluminous that only the most sophisticated automated techniques can handle the load. Census, telemetry, and hydrologic data are examples of products from large information systems that employ computers, automatic plotters, and other display devices to reduce raw input to meaningful lists, graphs, charts, and maps.

5. Accuracy

Map data can be handled by the computer with a fraction of the errors generated by manual systems, thereby eliminating most of the current editing procedures. Format, balance, and procedure checks placed in the computer programs can, in themselves, virtually eliminate processing errors.

6. Graphic Precision

Improvements in positional accuracy and graphic quality are among the benefits of the new technology over manual methods. The computer and high-precision automatic plotters now give operational results equal or superior to manual techniques in most areas. Even typography and hill-shading are now being tackled successfully.

7. Computation

When highly complex and repetitive computations are required, the computer or programmable calculator becomes a necessity. These are currently employed for map projection and control work by many mapping units.

8. Data Manipulability

If the same data are presented in differing ways, automated techniques are indicated. Varying scale, format, and center are common graphic payoffs. In the nongraphic area there is a growing list of applications. Examples include area and volume calculation, network analysis, correlation of overlaying features, and line-of-sight computations.

FOUR DECISIONS

The four agencies chosen as representative examples are the Ordnance Survey at Southampton, England; the Ontario Ministry of Transportation and Communication in Toronto, Canada; the Central Intelligence Agency and the U.S. Geological Survey, both in the Washington, D. C. metropolitan area.

THE ORDNANCE SURVEY

This organization has almost one-quarter of a million large-scale maps to maintain with an annual revision rate of 11,000. Further, these maps represent the legal description of the land for ownership purposes. They have to be correct! The decision to automate was made in 1970 but only after exhaustive studies. The route chosen was point digitizing and menu coding on a Ferranti Digitizer, main-frame processing and verification plotting on a Xynetics, digitizer corrections and final photo scribing on a Ferranti Master Plotter.

The result was a series of high-quality maps that cost slightly more to produce, at least the first time. The payoff, though, is the beginning of a cartographic data base that can satisfy not only future revisions and smaller-scale needs but also the increasing demands of planners and managers for digital spatial data. Returning to the eight reasons, the Ordnance Survey made its decision primarily on the basis of data manipulation and to a lesser extent on requirements for accuracy and graphic precision.

ONTARIO MINISTRY OF TRANSPORTATION AND COMMUNICATION

The photogrammetric unit of this organization is responsible for preparation of large-scale engineering drawings for highway rights-of-way. A means was sought to replace the lengthy conventional procedure that began with a stereomodel and then went to a pencil manuscript and next to an inked or scribed fair drawing. A proposal was made in 1969 to record the output from the Zeiss Planimat directly onto digital tape via a Wang or Instronics digitizer. This would then be processed on the Hewlett-Packard 2116B computer, which also served as the controller for the Gerber 1232 plotter, which in turn was used to photoscribe the final drawings. Since installation in 1970, the cost per drawing has been reduced 50%. The primary impetus in this case was economy, but speed and data manipulability from the resulting data base were also considered.

CENTRAL INTELLIGENCE AGENCY

The CIA began planning for cartographic automation in 1965 and initiated a pilot system two years later. A producer of small-scale thematic maps, it needed the capability of quickly varying all map parameters. The resulting system, called AUTOMAP, used a Bendix digitizer, IBM 2250 CRT for correction, and IBM 360 computers for manipulation to input data into a cartographic data bank of the world. The same main frame is used to generate plots on CRT and a wide variety of vector or raster plotting devices. The main reason for AUTOMAP was data manipulability with speed and computation following closely behind.

U.S. GEOLOGICAL SURVEY

The USGS was in some respects a latecomer to automation. While there was substantial employment of automated photogrammetric devices, cartographic advancement was limited to photomechanical slope mapping, projection computation, and the plotting of grids and grid values. What was lacking was commitment to an overall goal. This gap has been filled since we last met in December. The Topographic Division management designed a new National Mapping Program with a pledge to produce maps in both analog and digital form. You will hear more of this effort elsewhere on the conference program. This discussion, however, will only deal with the reasons behind the decision. The prime motive behind a Digital Cartographic Data Bank, a major feature of the National Mapping Program, is data manipulability.

Secondary reasons are speed and the fact that significant bodies of the original data are already in machine form.

DECISIONS FOR AUTOMATION IN FOUR ORGANIZATIONS

REASONS	ORDNANCE SURVEY	ONTARIO MTC	CIA	USGS
1. Economy	-	1	-	-
2. Speed	-	2	2	2
3. Machine form	-	-	-	3
4. Volume	-	-	-	-
5. Accuracy	2	-	-	-
6. Graphic precision	3	-	-	-
7. Computation	-	-	3	-
8. Manipulation	1	3	1	1

CONCLUSION

Here in four examples from three countries, we have spanned ten years between times of decision. What is noteworthy among the reasons offered for automation is the emphasis on data manipulability and speed. While cost consciousness is a mandatory goal for those employing public funds, the need to present the same data in different ways (such as smaller scales and format variations) and to reduce the elapsed time for production is paramount. Manipulability and speed can be combined into one and called responsiveness. And responsiveness to the map user is what cartography is all about in 1975.