AUTOMATING MAP SPECIFICATIONS FOR A BILINGUAL WORK FORCE: AN EGYPTIAN/AMERICAN CASE STUDY

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ABSTRACT:

In an effort to update and modernize map specifications for an ongoing project in the Arab Republic of Egypt, an Egyptian/American team investigated and implemented some innovations which minimize the use of language, and maximize the use of symbols and icons. The team produced bilingual documents using word-processing, graphics, and database applications commonly found on the Apple Macintosh computer. These documents comprise a complete cartographic specification including feature descriptions, standard operating procedures and quality assurance guidelines currently in use for the production of a completely new 1:50,000 topographic map series. Specifications of similar format are in development for several other cartographic products.

The team developed map specifications using flow diagrams patterned after those described by J.S.Keates (*Cartographic Design and Production*, John Wiley & Sons, 1989) and an original database design for feature descriptions which illustrate the complete history of each feature (from photogrammetry to field completion to cartography) in a graphics-oriented database manager for the Apple Macintosh called Hypercard. These documents serve as procedure outlines which help coordinate the various map-making production groups. Lessons learned in putting the standard operating procedures into action--the technician-level acceptance, production tracking, and procedure enforcement--have helped pave the way for the development of additional specifications for more challenging digital products.

KEY WORDS: Cartography, Specifications, Language

1. INTRODUCTION

The Surveying and Mapping component of the Irrigation Management System (IMS) project began in 1990 and is responsible for the production of manual and digital maps of agricultural Egypt at scales ranging from 1:1000 to 1:100,000. In the process of generating these map products, the project is also to conduct extensive training and reorientation to bring the Egyptian Survey Authority (ESA)--the principle map-making agency within the A.R.E. Ministry of Public Works--in line with the latest cartographic production techniques.

An international team of ESA engineers and contract advisors from the Geonex Corporation was charged with the task of developing cartographic specifications and procedures for several map products for the S&M Component of the IMS Project. Beginning with the 1:50,000 series of manual Topographic Maps, the team made an assessment of the most recent similar mapping activity and proceeded to design a strategy for developing a dynamic system of cartographic specifications which could continue to be serviceable to the ESA long after the IMS project is complete.

It was quickly decided that the traditional method of color-separating and printing cartographic symbol sheets was not conducive to the editing and periodic update anticipated for the various map series. Although commendable effort had been done with this approach in recent foreign-assisted mapping projects, the specifications which resulted were ultimately not in the control of the ESA, but delivered, as it were, a final product in itself. What was wanted was a more dynamic approach to cartographic specifications which would allow the ESA to make decisions and change symbology without the usual penalties associated in the traditional symbol-sheet approach.

Furthermore, the specifications development strategy had to deal with the language capabilities of the international team. While English was acceptable during the planning stages, it was not generally understood by the technical work force. All English text would have to be translated into Arabic and subject to possible misinterpretation. It became the objective of the specifications team, therefore, to produce specifications and procedure documents with an absolute minimum dependance on language. As much as possible, the strategy would be to use symbols and flowcharts in place of narrative exposition.

2. THE SPECIFICATIONS

2.1 The Feature Card

The team started by entering cartographic specification data in personal computer databases. This allowed maximum flexibility in altering symbology or generalization standards and validating afterwards that no two features were mistakenly given the same symbology. What it did not do was provide cartographers with a good sense of the effectiveness of selected symbology. Cartographers needed to see pictures.

Consequently, the effort to create a dynamic cartographic specification evolved into a mixture of graphics and database attributes. The specifications team used the Apple Macintosh computer with *Hypercard* software to add raster sketches of features to their feature description "cards".

The *Hypercard* approach proved useful in laying out a complete feature history in one location. Specifications relating to photogrammetric compilation, field edit, color separation and photo reduction were organized in a roughly clockwise pattern starting in the upper left. The specifications team recognized that this was a departure from conventional specifications which generally separate discussions of compilation from discussions of color separation (scribing). By using a database approach to the specifications (as opposed to just drawing pictures), we found that the complete feature card was useful during planning stages and could be easily divided afterwards for specific work groups.

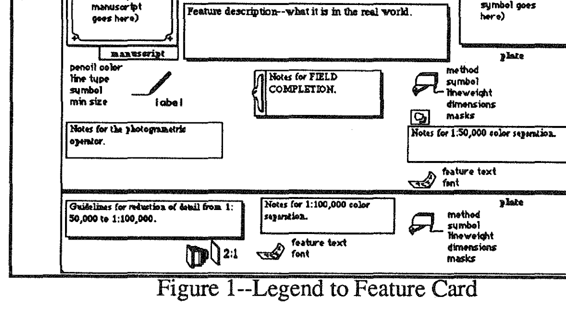

Figure 1--Legend to Feature Card

To reduce clutter, field names were listed in a "Legend" card and small icons were kept in the background of each feature card to remind the user of the locations of specific information. For example, a sketch of the photogrammetric compilation image was placed in a frame meant to look like a 9x9 stage. Notes for field edit were placed in a frame looking like a clipboard. Scribing point sizes were listed next to a scriber icon, typesetting specifications were placed next to a PMT icon, and so forth.

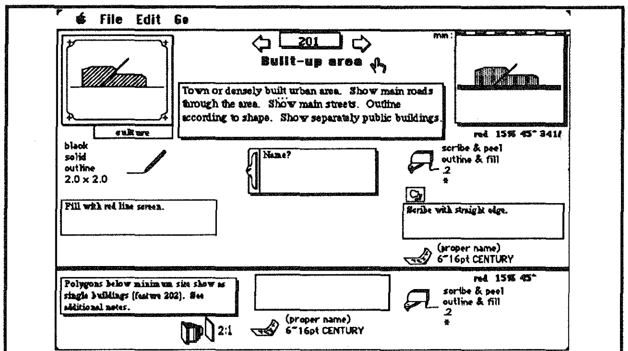

Figure 2--Sample Feature Card

Although the cartographic feature card used some icons to reduce unnecessary text, there was still a good deal of English which required translation to Arabic. During the planning stages, the English was not a problem for the middle-to-high level Egyptian management, but first-line supervisors and the technicians themselves, could not use the feature cards effectively. To provide a ready reference for first-line supervisors and technicians, the information on the feature cards was separated into more specialized documents for Compilation, Field Edit and Color Separation. The resulting Color Separation Reference had so little text, it was practical to provide Arabic translations for each word except for numbers and some type font names.

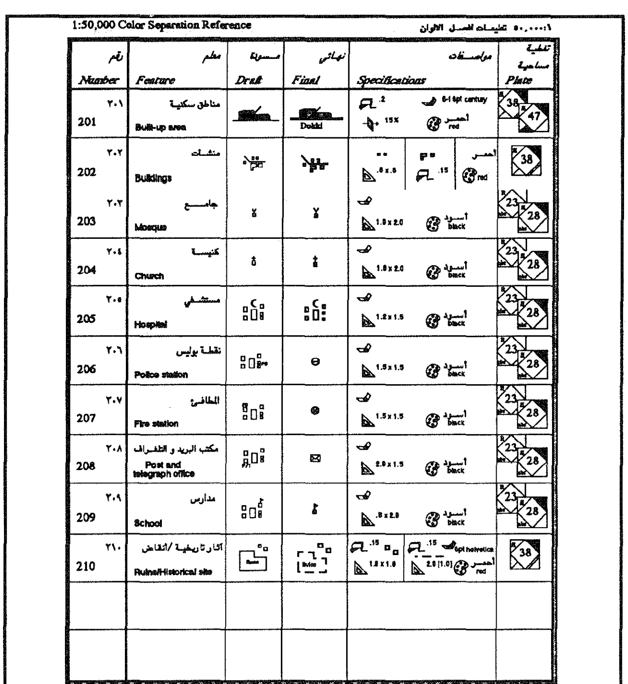

Figure 3--Color Separation Reference

2.2 The Color Separation Reference

The Color Separation reference was laid out in a fashion similar to the conventional symbol sheet, but with a few notable exceptions. First, the images and selected text were raked off the feature cards digitally to minimize redundant data entry and allow for quick updating. The fact that the feature sketches were reproduced exactly from the feature cards made it easy for middle management to correlate the two documents. Secondly, specifications regarding dimensions, color and lineweight were presented in a procedure-oriented fashion. For example, the scriber icon appears with the lineweight dimension only for those features which would be scribed. Lineweights of stick-up features are not listed; a PMT icon indicates the prescribed procedure.

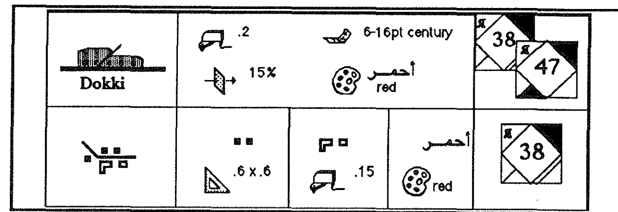

Figure 4--Color Separation Reference Detail

A significant departure from the conventional symbol sheet was the decision to add a column which shows which photo-reproducible plate or plates are involved in the color-separation process. This column contains specific plate icons which are keyed to the Color Separation Flowcharts.

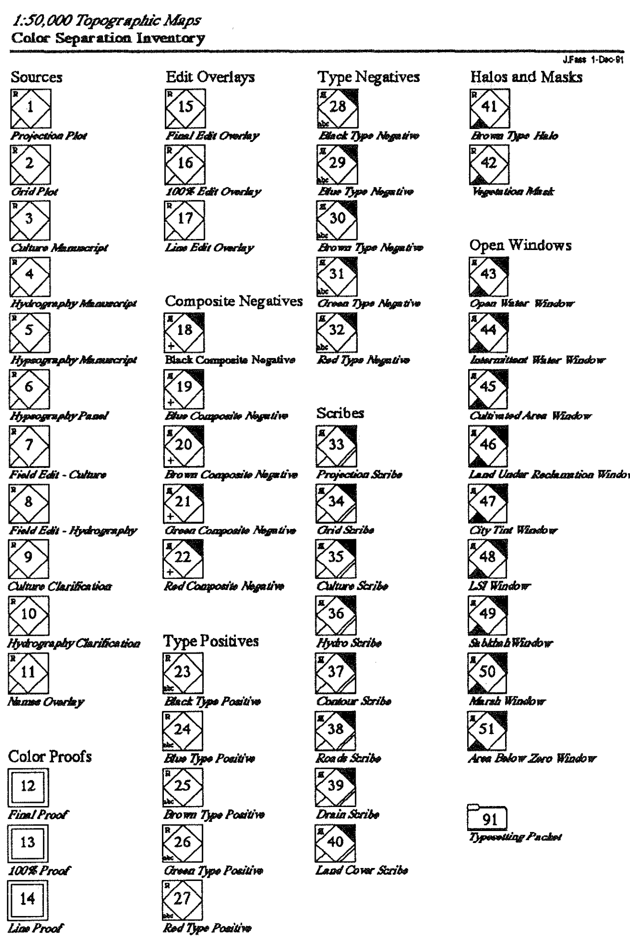

Figure 5--Color Separation Inventory

2.3 The Plate Inventory

The first step in preparing a production flowchart for color separation was to assign standard icons for each plate which may exist in the color separation packet for a particular map series. The specifications team started with the 1:50,000 scale topographic map series and listed each plate according to category: Sources, Proofs, Composite Negatives, Type Positives, etc. Then the plates were numbered sequentially and given a characteristic plate symbol based on the conventions described by J.S.Keates (*Cartographic Design and Production*, John Wiley & Sons, 1989).

By these conventions, the upper left corner of the icon indicates whether the plate is "right reading" (emulsion up) or "wrong reading" (emulsion down). The upper right corner indicates whether the plate is a positive (white) or negative (black) image. The lower left corner indicates the type of image on the plate: line, text, open window or composite. The lower right corner is occasionally used to indicate the type of material used or the process required to create the image.

The combination of plate symbol and number made a unique icon for each plate that could possibly exist within the color separation packet. The use of these plate icons eliminated a lot of text which would otherwise be necessary in forming the production flowcharts.

2.4 The Production Flowcharts

Next, production flowcharts were constructed to demonstrate the relationship between plates and the photo-reproduction processes. Arrow placement was complicated by the fact that many plates, once created, were needed for displacement reference during the creation of other plates. The complete procedure for the color separation of the five-color 1:50,000 series had to be divided into multiple flowcharts as shown.

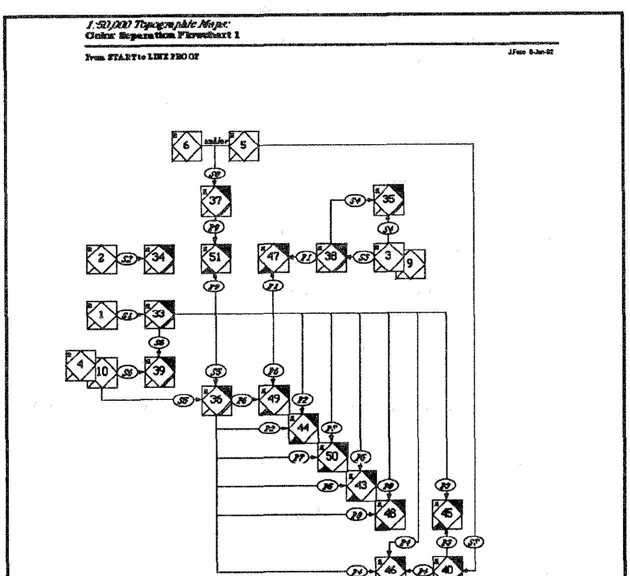

Figure 6--Color Separation Flowchart (part 1)

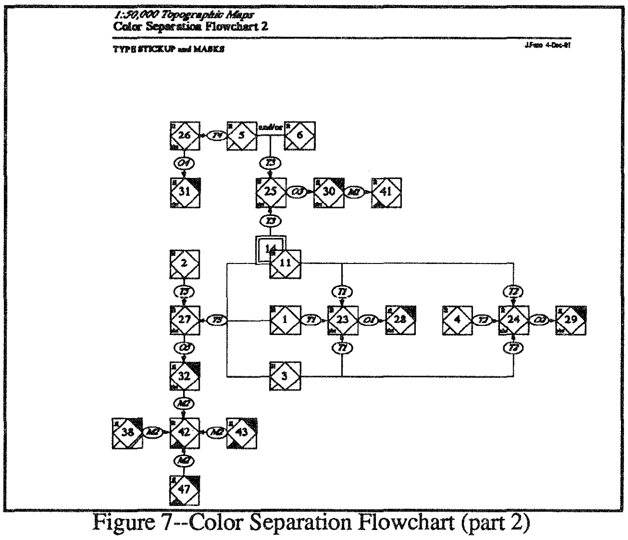

Figure 7--Color Separation Flowchart (part 2)

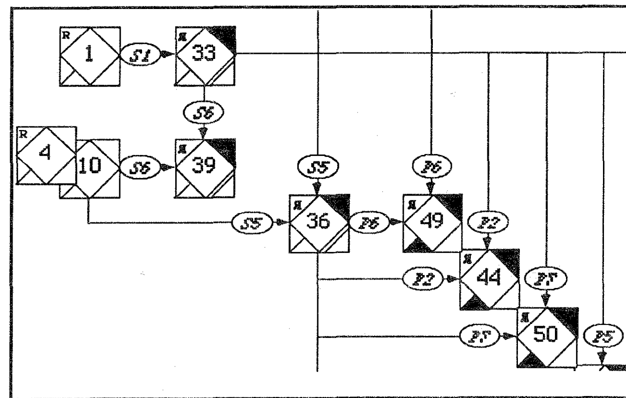

Figure 8--Color Separation Flowchart Detail

Computer-generated labels with a complete set of plate icons for each map were then created so the technician could positively identify which plate corresponded to his or her procedure in the flowchart.

Specific procedures in the flowchart are given numbers for convenience in work order processing and production tracking. For example, the several scribing related tasks are numbered S1, S2, S3 and so on. Although Keats describes variations on arrows to indicate different processes, we chose to keep the arrows simple and let the procedure numbers represent the procedure type.

2.5 The Standard Operating Procedure

The conceptual design of the Standard Operating Procedure (SOP) was to take a blow-up of each link in the Color Separation Flowchart and list the steps required to complete production. In this example, procedure S1 (Scribing Projection) is shown in enlargement against the background of the larger flowchart to show its context. Then a list of steps is described in English. Eventually, each SOP sheet required translation to Arabic to be useful on the production floor.

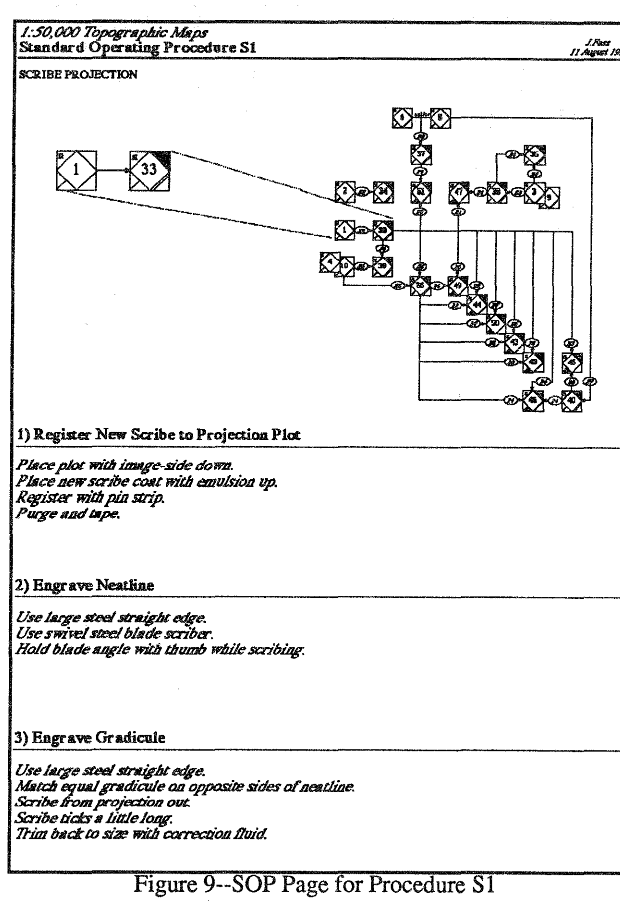

Figure 9--SOP Page for Procedure S1

2.6 The Cartoon Procedure

After preparing a few SOP sheets, it became obvious that some procedures did not require documentation as much as others. In fact, the procedures which did require documentation seemed to require extensive graphic demonstration while several procedures were so well understood that no documentation was required at all. So the specifications team abandoned the plan of making an SOP sheet for each branch of the flowcharts (although the flowcharts remained a valuable tracking and work-order processing tool) in favor of selected "cartoon procedures".

In this example, a cartoon procedure is used to describe how cartographic offset distances are calculated when the compilation for parallel features is distributed on separate manuscripts. Note how the cartoon procedure uses the standard plate icons to communicate that the manuscripts involved are the Culture Clarification Overlay (9) and the Hydrography Clarification Overlay (10).

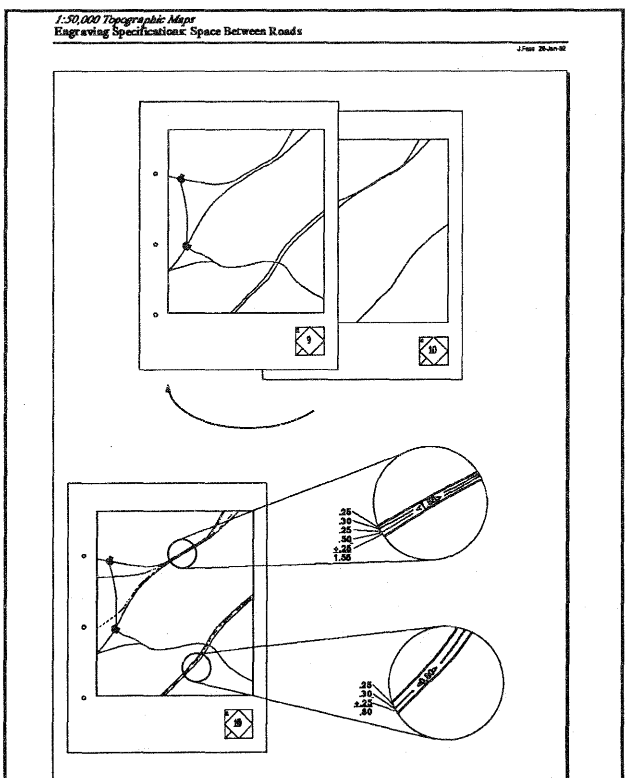

Figure 10--Cartoon Procedure: Scribing Displacements

2.7 The Bilingual Procedure

Try as we might, some procedures were too complex to describe without supporting text, so the specifications team adopted a format for the bilingual procedure. In this example, guidelines for deciding how many pylon symbols to place along an electric powerline are demonstrated.

3. THE RESULTS

3.1 What We Did Wrong

The most common source of misunderstanding in the procedures and specifications had to do with the conventions used in the Color Separation Reference to describe feature dimensions. Numbers placed after a measurement triangle icon proved to be no substitute for the large-scale blowup with dimension lines found in conventional symbol sheets.

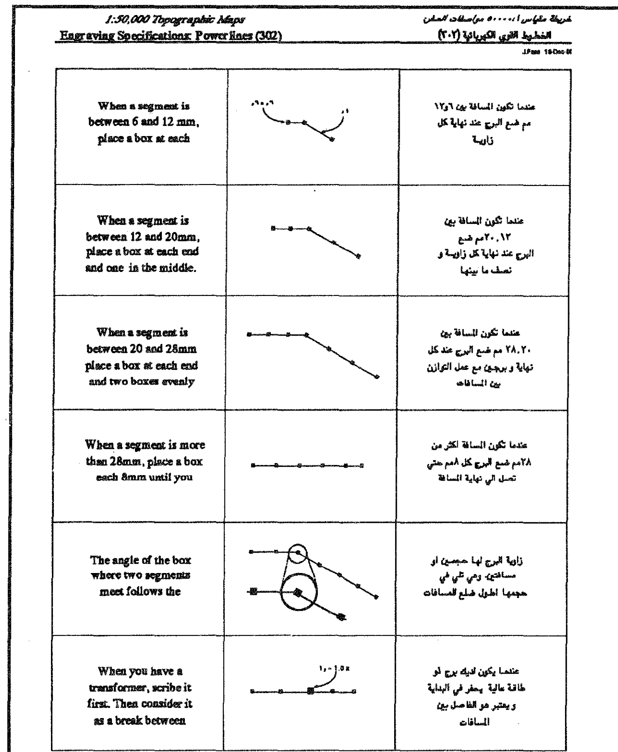

Figure 11--Bilingual Procedure: Powerline Pylons

Some confusion resulted from the necessarily grainy sketches of the symbols. The specifications team chose to use *Hypercard* for its ease of operation and seemingly universal installation. Unfortunately, *Hypercard* allowed only raster images comparable to screen resolution (72 dpi) which were too coarse to describe geometry of some features. As an alternative, a database such as Acius' *4th Dimension* may have been more suitable because of its capacity to incorporate scalable vector graphics.

3.2 What We Did Right

What proved to be a significant benefit in the specifications development strategy we chose was the improved coordination between departments which resulted from standardizing plate names and procedure labels. Photo lab work order processing, for example, was greatly simplified. Rather than having to describe to the photo lab which plates needed to be exposed in which manner, the color separation technician could now initiate a work order by simply asking for process CN4 for example. The photo lab technician would then find process CN4 on his flowchart and see which plates were to be used for which exposures.

Some of our most positive responses from the technician level were received as a result of the "cartoon procedures." We found technicians eager to write their own captions to the pictures which then became their most frequently used references.

Perhaps to hardest to quantify, but potentially the most significant benefit was the reusable quality of the work which had been done. Since the original release of the 1:50,000 map specifications, several changes to the Feature Cards and Color Separation references were made and the documents were printed and distributed rapidly. Because the data was organized in a database, there was no time wasted in reformatting sheets for the insertion or deletion of features. Furthermore, the cut-and-paste approach to reusing feature sketches and specifications greatly accelerated the development of specifications for additional map series.