COMPUTER AIDED PREPARATORY SYSTEM FOR GENERAL PURPOSE BUSINESS FORMS

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Abstract: General purpose business forms require rather precise placement of rules and type as well as constructed items such as flat tints, reverses, diagonal lines, and round corners in various combinations.

Numerous approaches have tried to throw out the ruler, paste-pot, and pen with rather limited success. One more recent approach linked a CAMEX ProFormer to a Monotype Lasercomp.

This paper reviews broad system concept, detailed experience during early engineering evaluation and start up, and production experience in a self contained forms plant. Future directions for development have come from direct experience with this preliminary area composition system.

Early Burroughs Forms Preparatory

One of my history teachers claimed that historical events could best be understood by studying steps leading up to them as well as the events and their consequences. "Before, during, and after" applies to this story of technical adventure.

When the Burroughs Corporation and the Todd Company merged in the mid 1950's, the principal Todd printed products included checks and "board" accounting systems for small businesses. These products had relatively uncomplicated preparatory requirements and very little type. The checks often had a lot of art work both for security backgrounds and for custom illustrations of bank buildings and other business subjects.

The board accounting systems (Write-It-Once

in Burroughs terms) had rather accurate dimensions, but once the basic forms preparatory existed, the customizing work required little time and/or precision. Linotype and Ludlow slugs, repro proofs, paste-up, ruling pens, black and whites, clip art, etc. all played their part as many people labored to prepare originals or intermediates for camera shots to make negatives for litho or letterpress plates.

Burroughs brought in people from rotary forms plants — notably UARCO — and set off in pursuit of continuous forms and snap sets. Preparatory methods changed slightly, but the basic procedures remained familiar.

Cold composition machines such as Varitypers, IBM Composers, Headliners, etc. joined the preparatory equipment list along with ball point pens, drafting machines, and the concept of doing everything at final size.

Preparatory planners broke down the overall requirements into specific tasks and when the individual lines were drawn, words typed, pictures retouched, etc. a model maker assembled the whole collection into one or more flats for camera.

Does all of this bring tears of nostalgia to your eyes? These are the good old ways of hands on prep when what you can see, you can do. We're still doing it this way in most of our preparatory departments in 1984. Oh, some people scribe their lines on film. And others have some early Compugraphic text equipment to set type. But for the most part, we do it with cut, draw, and paste techniques. It's an early form of seeing what you're getting,to warp a current phrase.

Not elegant! But it surely keeps the capital investment down. We also have people who believe what they see in front of them. They touch and move what they see and given patience, practice, and time they make models of complex forms.

In the late 60's a program to upgrade our preparatory technology linked a Photon 713 to a Burroughs computer. Detailed measurement and coded input permitted area composition including lines

and type in place. Well, at least some of the time. This project did not go well.

Part of the trouble came from the electro-mechanical nature of the Photon. Character assembly got a bad name, especially when it came to rules. Detailed measurement, coded input, and working blind also got a bad name. And the corrections!

We also experienced the hazards of developing an experimental system in a production environment although impatience still gets the better of us from time to time.

So much for early history.

Project Definition

By the early 1980's Burroughs had a department store selection of products with a considerable range of preparatory demands. Five web plants each produced some of the product line, but no one plant produced the complete spectrum. However, the variety required preparatory versatility in every plant.

From our perspective, general purpose business forms implies the following products:

1. We don't print money.
2. We don't print securities.
3. We don't print Travelers Cheques.
4. We do print certificates of title, registration forms and the like.
5. We print money orders, lots of them.
6. We print checks of all types for businesses large and small.
7. We do insurance forms, policies, etc.
8. Snap sets of many types cross our presses and collators.
9. Continuous forms include mailer sets,

short run orders, stock tab, and almost any order our direct sales force can sell.

10. We make guest checks for restaurants, and place mats, and forms for hotels.

11. Personalized checks including process color backgrounds, safety backgrounds, and conventional formats make up another product line.

12. Process control documents for internal bank use add yet another product to our mix.

The list could go on, but it seems apparent that versatility and flexibility carry a lot of importance. It should also be apparent that we need the ability to manipulate large amounts of text as well as lines and a few column headings. Since many of our forms go outside the purchasing company (checks, etc.) there is often some aspect of advertising typography included in the forms we produce.

Of course we can't overlook accuracy since many of the forms go over computer printers of various types from the highest speed line printers to the smallest serial printers. Numerous forms also have machine readable requirements which show in line placement accuracy and type fonts.

By the end of the 1970's there were several area composition systems available for some preparatory tasks. Digiform and Berthold systems had some appeal but fell short of a comprehensive solution. CRT based typesetters did the typesetting jobs with blinding speed but fell short with rules, screens, reverses, and illustrations.

In 1979 Burroughs management decided to begin a major effort in the preparatory area. Several engineers visited with various equipment makers but were unable to define requirements and chart a probable progression of technical development.

I had the good fortune to get the assignment to study the developing technology, review the

preparatory requirements in Burroughs, and make recommendations for a pilot program to evaluate the selected technology in detail. We were to identify any weak areas and take corrective steps where appropriate.

The study phase included a trip to Print '80 where I met Dean Layton from the Office of the California State Printer and George White of CAMEX. The ProFormer looked like a promising forms input device, but no appropriate output device had been linked to a ProFormer.

Appropriateness included the ability to place lines & type with suitable accuracy. In addition, we set round corners, reverses, screen tints, and diagonal lines as required enhancements for our first level system. Other factors such as available type fonts and film or paper output in right reading or wrong reading positives or negatives also seemed necessary. We had some hope of getting a plate directly from the unit but initially did not expect to get a complete image — except in the case of personalized checks. Here we believed that a limited list of logotypes could be digitized and called from a library by a fairly simple production control program and merged with the personalizing information on short run plates.

Project Execution

An ad for the Monotype Lasercomp triggered a phone call and before long Paul Kreft from Monotype and I were reviewing hopes and promises. It appeared that if the CAMEX ProFormer were linked to the Lasercomp and appropriate new CAMEX software were developed for the round corners, etc. the Lasercomp could output a usable image.

After some investigation of the Lasercomp by CAMEX, George White stated that they would be willing to create the software link to the Lasercomp, and as a separate effort they would develop the enhancement software. We recognized many uncertainties and quite a few shortcomings, but Burroughs Management thought the risk acceptable and the three parties signed the necessary papers in September of 1980.

The waiting period took longer than anyone predicted, and I spent a lot of time listening to all sorts of people describe the brave new worlds of computer aided preparatory. Many people said that these interactive screens were slower than keystroke input and digitizing tablets didn't work well at all.

Fortunately for my nerves I had seen a tablet system working very successfully in one of our vendors. They input coordinates for very accurate line work through a tablet and plotted the results on a Computer Vision system. They had no doubts about the relative speed of tablets versus keystrokes and their data capture programs made it easy for the operator to be accurate.

The interactive screen speed issue seemed more threatening since people could spend a lot of time looking rather than feeding information into the system. This question still isn't fully resolved, but our experience with a CAD system for Engineering and the ProFormer in Preparatory doing the same forms with the same operator and different operators lead us to favor the interactive screen. And as we all know, computer graphics is a major development area.

In any event, our economic objectives called for a 50 percent reduction in the time required to do forms by the new method versus our old methods. A recent study indicates we're coming very close to this in our first installation.

Back to our story of slow progress.

Bob Christie of Tymshare demonstrated the Camex-Monotype system to me during the 1981 ANPA show at Atlantic City. At the close of the show both pieces of gear came to our lab in Rochester, New York, and we set about to understand this new system.

As we learned and tested we found numerous areas of hardware and software which required various levels of attention. Rather than chronicle the effort in detail, I'll highlight four issues which are not fully resolved but have been driven

to a commercially acceptable level for our use.

1. Operating program
2. Output accuracy of the image setter
3. Digitizing tablet input speed and accuracy
4. Workplace environment including operator comfort and lighting

The basic operating program went through several revisions as we discovered and described "crashes" or unexpected results from various input command sequences. As the CAMEX programmers responded, the system got better and better and by the time the first "enhancement" software came we could cope with these new complications with some confidence.

By mid 1982 we were doing commercial work with part time production workers and engineering technicians with preparatory experience. Difficult jobs soon came our way and it became apparent that the system could do a useful fraction of our work.

Program refinements continued into 1983 after installation in the production plant and by now the program is a solid piece of work. It doesn't do all we need, but the output and display technology will have to change before programming advances will be worthwhile.

The Monotype sat near the CAMEX in the Lab, and one operator handled both machines. We still have the CAM operators tend the Monotype. The roll film feed technology which makes this manning possible also makes absolute accuracy difficult. Squareness and dimensions both across the film and in the direction of film feed can all be held to useful tolerances. However, it requires an aggressive maintenance policy. We achieve film feed accurate enough to produce flat tint screens in positive form in the 10, 20, and 30 percent range. We haven't had much luck with negatives that include tints.

We found that the digitizer input using a

pen-like stylus worked just fine for program commands and coarse position information. However, as we began to work on more complex forms with small increments, the stylus angle variations made significant differences.

Bear in mind that the CAMEX uses a system of electronic gridding which allows the operator to get close to preferred positions and the electronics then selects the nearest gridpoint. It's sort of like graph paper with the only allowed data points at the intersections. With .250 inch increments, everyone wins. It's possible to miss with .125 inch increments. You've got to be careful with .100 inch increments. The stylus angle coupled with movement when depressing the signal switch causes enough misses to kill any speed. The miss is always only one gridpoint, but that's too much.

We've tried the cross wire cursors and think them too slow in the model we could apply. It's a little like trying to hit a bird on the wing with a rifle and telescopic sight.

After some considerable experimentation we developed a lighted stylus mounted on a tripod like structure. The light shines on the pick point through the end of the stylus, and the tripod holds the search coil at the same angle over the tablet at all times. A feather light, highly reliable finger actuated switch lets the operator squeeze off the shot without disturbing the aim. This device lets us handle .050 inch by .0417 inch patterns with dispatch and the flat bottomed holder moves around over the work as fast as the standard stylus.

We also use film overlay grids to guide the operator to the intended intersection. It's easy to force a location to a grid point which isn't the one intended by the form designer. An overlay grid shows the preferred positions quickly. Pin register techniques allow quick changes from one overlay to another.

Workplace environment including operator comfort and terminal lighting quickly proved to be a major factor. Lots of people seem to be able

to sit for hours in front of TV sets in their homes. It's another story with an interactive screen.

In some engineering environments the rooms are so dark that it is difficult to read written materials. This makes it easier to see the screen. We can't tolerate such conditions since the operators must continually examine copy and make judgments based on what they read.

We often get pencil notes that sometimes get lost under normal lighting conditions. Newer tube technology allows brighter lighting, but the vector screen on the ProFormer becomes very hard to see with light levels on the tablet approaching the 200 foot candles recommended for drafting rooms and other similar areas.

After considerable experimentation with all the glare control techniques we could find we decided to build the tablet lighting into a hood attached to the ProFormer tube housing. This allowed us to operate fairly independently of room lighting within broad limits. The operator had fewer distractions from the other activity in the room, and it became possible to put in an 8 hour shift without excessive fatigue.

The eventual design included an interior hood with baffles to keep the screen in shadow, an outer hood to hold the lights and keep the room lighting away from the screen, and a light box containing variable intensity flourescent tubes to allow operators to select their preferred light levels on the digitizing tablet. This approach can stand further refinement in almost all aspects such as materials used, hood geometry, CRT placement, etc., but it does represent a serious try to relieve operator fatigue.

Since operators come in so many different sizes and shapes, we believe it advisable to provide adjustable seating with really rapid ways to change height, tilt, back rest placement, etc. We also like short arms. This is no place to skimp by using some cast off office chair. A five leg base, a seat with good support, solid construction,

and easy adjustment all add a lot to keeping your operators productive.

Operator selection and training make a big difference. The machine is easy to learn to run. We've taken experienced preparatory people who rose through the ranks to become planners. A platemaker runs the system. A camera man learned. Assemblers catch on quickly.

In about two weeks the machine commands and operating procedure allow a variety of people to produce useful work without excessive support. It's more difficult to interpret copy and do the right thing for the customer than it is to run the terminal. The people with most skill reading copy have achieved highest output most quickly.

Project Results

As we said earlier, we've cut our labor hours about in half for the part of the preparatory operation influenced by the Camex-Monotype system. Based on our experience we're out looking to equip all our plants with computer aided equipment.

Future Objectives

No one system offers everything we'd like to see. Our shopping list includes, but isn't limited to the following:

1. Interactive screens for the terminals with digitizing tablets as the primary input.

2. A command structure capable of doing the entire job with lines, type, art, backgrounds, etc. all placed in final position by the terminal operator in labor saving times. We want to generate the complete image at least 95 percent of the time.

3. Ability to drive various output devices appropriate to the task such as proofs, high resolution film, ultra high resolution film, lithographic plates in step and repeat formats, etc.

4. Terminals simple enough to operate to

permit remote copy preparation and local proofing with file transmission to our production plants.

5. Means to scan, store, retouch, and edit transient pre-printed art prior to adding it to the job. Art creation facilities would also be valuable.

6. User access to enough of the operating program to permit software modification for special purposes.

7. Operating system and programming language which allow user incorporation into the overall plant computer system for billing, production control, order entry, etc.

8. Ability to support inter plant job transfer and production.

9. Ability to develop complex security backgrounds and merge them with the basic formats on command.

10. System architecture that allows modular addition of functions without substantial scrapping of previous hardware.

In many ways the above ten items reflect a "wish" list. We're working hard to make them come true and will take any help we can get.