THE MAGAZINE OF CHOICE FOR THE Pro/ENGINEER® USER

A CONNECTPRESS® LTD., PUBLICATION

www.proe.com

PRO E THE MAGAZINE™

VOLUME 8, NUMBER 3
MAY 2000

Maintaining parametrics

Hardware happenings

Delivering an innovation

CASE STUDY

Delivering an innovation

DuPont and ENSER collaborate on breakthrough "FLEXO" film machine for the print industry

Marco Arnone

What is "FLEXO" film? It is not the hottest super hero but the latest innovative technology that will lead the packaging printing industry into the 21st century. This industry has remained status quo on existing technology that mandates a "wet" process for removing negative material from a polymer-based, flexographic printing plate. The methods were ready for modernization. The industrial giant DuPont of Wilmington, Del., was already supplying the majority of the printing market with the raw materials for this procedure when the company seized the opportunity to revolutionize the process. Its mission was to design and build a new "FLEXO" film machine that does not use the conventional chemical solvent or aqueous washout for removing the relief layer. The new dry process reduces plate-making time from up to three hours to less than an hour. A combination of proprietary flexo plate formulation and newly developed thermal mass-transfer techniques have led to a breakthrough piece of equipment that has sparked a keen interest from packaging producers. The nature of this redesign was to include a new form for the new function. The goal was to create a unit that would be acceptable in an office environment as well as in the traditional manufacturing setting. A significant effort was focused on the aesthetics, ergonomics and safety of the final design.

Brought to fruition

The Cyrel Packaging Graphics Business, a division of DuPont, sought assistance in bringing this project to fruition. Without the resources to tackle such a daunting task, it turned to DuPont's Beech Street Engineering Center (BEC) to make this vision a reality. A BEC project manager, lead mechanical designer and lead electrical engineer were handed the reins for the entire project. The lead mechanical designer knew that BEC did not have the resources available to assign him to this project; therefore, he formed a team of subcontractors to assist him in completing this 18-month project in eight months. ENSER Corp., an engineering company in Cinnaminson, N. J., was assigned the tasks of engineering, designing and detailing under the direction of the lead mechanical designer. ENSER formed an internal team that included six machine designers, an industrial designer and two detailers. A pioneering Philadelphia thermoforming company created all of the molded plastic parts and a highly respected New Jersey machine shop, under the direction of a BEC lead mechanical technologist, manufactured all of the machined parts for the prototype.

One of the most difficult tasks facing the BEC lead mechanical designer was coordinating the efforts of everyone involved. He emphasized, "A close team effort and coordination process was critical for the on-time completion of the project. We had no room for error, thus we had to be one step ahead at all times."

By aggressively driving the project, as can be seen in *Figure 1*, a working prototype was completed in less than eight months—less than half the time originally estimated by most industry insiders for implementing an alpha machine. ENSER's project manager, Mike Wahner, managed ENSER's designers and distributed the prototype parts to be manufactured on the tight time schedule.

"The aggressive scheduling made it critical for the detailed drawings that were sent to the machine shop to be accurate," maintained Wahner. "Any little mistake would become very significant to the vital delivery schedule."

The team used the full array of Pro/ENGINEER and PDM modules, while strictly adhering to rigorous standards for engineering, design, drafting and file management set by Dupont's CAD department. The use of a T-1 connection between ENSER's New Jersey location and DuPont's Delaware location made it possible for the ENSER team to submit and retrieve files directly from DuPont's PDM system. This made it easy for the iterative design process to coincide with the parametric capabilities and bi-directional associativity inherent in the Pro/ENGINEER object files. With such a tight delivery schedule, there was no time for duplication of efforts. As design changes became necessary, the shop was able to receive updated prints with the confidence that all of the surrounding elements had been thoroughly reviewed. By working in the assembly, all the parts could be changed in full sight of each other to preserve design integrity. Because the detail drawings were created in concert with the parts and assemblies, updated prints were ready as soon as the designer documented the revision history.

Evaluation

Design decisions were made based on common engineering and design experiences; only key elements were analyzed using FEA (in Pro/MECHANICA). However, a significant issue remained: using the main components for a larger unit in the future. The solution was to evaluate one core structure at its worst condition (the next generation larger-capacity unit) and redesign it accordingly to suit both the smaller and larger machines. Results of the initial analysis led the team to consider increasing the machine's main shaft diameter to prevent a potential bending condition. The cost associated with evaluating a suspect design point was minimal compared to a random solution or failure of one of the core

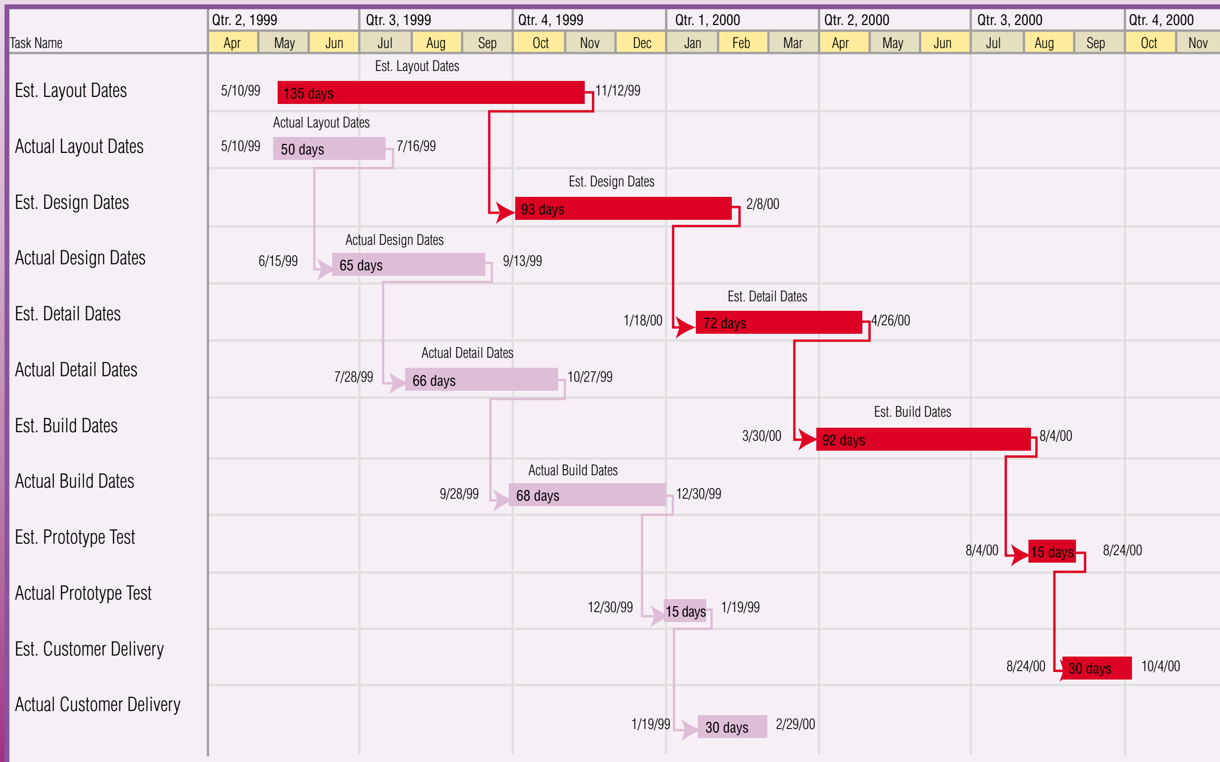

Figure 1.

machine elements. The analysis was an iterative process, so the designers could arrive at the minimal essential design in the shortest time possible. Stress, strain and displacement plots were added to the engineering documentation to validate the effort spent revising the design.

Design integrity was an important concern for future units. As a result, the ENSER team was given the responsibility of using Pro/ENGINEER to its fullest capacity. The team's goal was to arrive at an accurate design using appropriate modeling techniques, which resulted in a stable and robust 250-sheet drawing package. DuPont demands that zero created dimensions be used on any drawings, forcing the CAD operators to use all of the techniques learned throughout years of Pro/ENGINEER operation. Weldments were sophisticatedly created so those part features with assembly references could be shown in their proper dimensioning schemes on the drawings. All self-reporting fasteners used in the assemblies were either created during the course of the project or started from PTC's fastener libraries, making for quick work of the assembly documentation task. Models were created using Pro/ENGINEER's integral tolerancing and GD&T functionality to ensure that proper design intent remained with the models. Intelligent symbols and a bill of materials that reported model parameters for automatic ballooning of the assembly drawings were used throughout the drawing package for consistency. A customized assembly report was created for exportation to a spreadsheet for inclusion in the package of engineering documentation. The installation, service and parts catalog images were generated using Pro/ENGINEER for local isometric views, exploded assembly views (similar to *Figure 2*), manual cover perspective illustrations, and replacement parts lists.

(Continued on back)

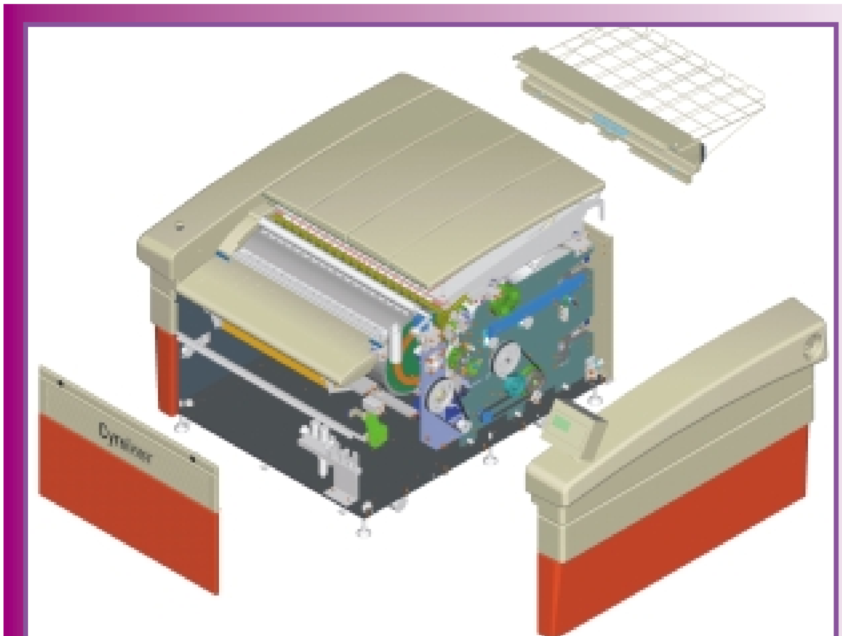

Figure 2.

CASE STUDY

Delivering an innovation

Prototypes

The prototype had to be completed at a rapid pace. Using the tried and true method of hand-delivering clear and concise drawings to the machine shop allowed more than 200 parts to be fabricated as fast as the machinists could change out their machines and prepare for the next work piece. As the assembly stage progressed, it became apparent that some design points should be improved upon before the commercial version was committed to manufacturing. By taking advantage of Pro/ENGINEER's parametric capabilities to quickly change the design, the utmost consideration was taken so that the existing parts would be altered rather than scrapped. During the course of the project, the assemblers created many "gingerbread" parts, i.e., brackets for sensors and switches. These, of course, needed to be documented for inclusion in the final design package because only shops that have access to the PDM database will fabricate the Beta and commercial units. Because all of the data was contained intelligently in the electronic files, there was no need to deliver the entire paper package (250 drawings and two 50-page spreadsheets).

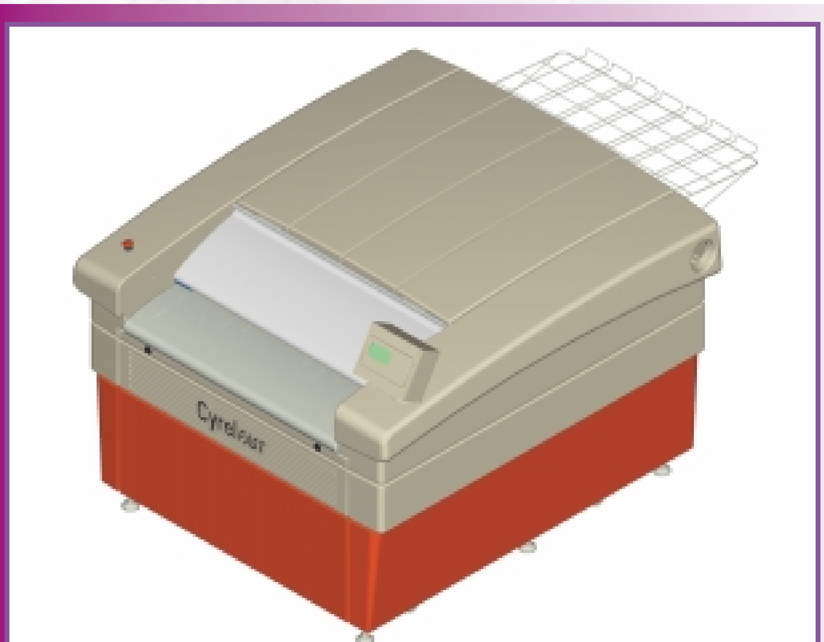

Figure 3.

Once the appearance of the unit became more than just an afterthought, stylish, flowing lines were created by sewing surfaces together as quilts for solidification. The sweeping arcs were tweaked until DuPont's Cyrel marketing team decided on the shape that would maximize customer appeal (see *Figure 3*). The databases that were developed for the thermoformed ABS dress panels were exported via IGES to the thermoforming company for prototype tool generation. All drafts and rounds necessary for forming were included in the models in order for the mold software to perform a draft check on the surfaces before the commitment to tooling was made. Detailed drawings were generated for each of the 22 plus molded parts so that various post-processing tasks could be performed. These steps included routing holes and slots, gluing in support blocks and installing threaded inserts. The thermoforming company, whose particular experiences in both design and fabrication were essential in incorporating changes on-the-fly, created the plastic panels. This guaranteed that the form, fit and function of the outer body was sleek, tight and efficient. The company also developed the prototype tooling and generated any miscellaneous parts, which were documented for inclusion in the total design package.

Parts that were created using the prototype tools were inherently less accurate than the future production parts. Therefore, greater tolerances were built into the solid models used for the first 20 sets of the body panels. Tighter-fitting parts to be used for the production tooling were started by copying the original parts (along with the assemblies and drawings) outside of Pro/ENGINEER into a parallel working directory. Since separate assemblies and drawings would be generated for the production panels, the task of reinstalling the panels into a new assembly was eliminated simply by properly renaming the panels with the appropriate assemblies and drawings in session. Once this was accomplished, the top-level assembly and drawing were renamed. The entire process allowed the new panels and their referenced objects to be submitted to Pro/PDM as "new" objects. This technique, along with a logical use of local searchpaths, was used extensively during the course of this project by the ENSER design team. The result was little or no reassembling of redesigned components that required the assignment of new engineering numbers (i.e., file names).

Fast film

"Cyrel Fast is a major leap in improving the productivity and environmental friendliness of the flexo platemaking process," said Joe Glenn, Global Manager for the DuPont Cyrel Fast development. Early in the program, the market was surveyed to determine operating parameters and capacities so that those requests could be included in the final product. DuPont is reaping the rewards of the thought given to the needs of its customers when the parameters of this machine were developed. Incorporating quick-change capabilities for a larger platemaking process into the smaller machine proved another wise investment of time and money. By spending extra effort up front, another generation of flexographic plate processing equipment is nearly complete.

Marco Arnone is general manager of Enser Corp. in Cinnaminson, N.J. He can be reached at **arnonema@enser.com**.