HOW TO CAPITALIZE ON CONCURRENT ENGINEERING

Experts look at CE strategies that can move your career ahead

Concurrent engineering (CE) can dramatically reduce the time between product conception and the first production run. In today's marketplace, many companies consider time-to-market the key to industrial competitiveness.

Concurrent engineering also can improve the design engineer's position within a company. Many times the designer serves as the team leader in the development of a new product. At the least, CE broadens the engineer's horizon. He or she must now become increasingly familiar with all the ingredients that go into the design of a successful product—planning, testing, marketing, production, sales, and customer service.

Approached correctly, CE can result in 30% to 50% faster product launches, experts say. Equally important, the end-product is usually of better quality, costs less to produce, and meets with market success. Approached incorrectly, however, CE can become a stumbling block for members of the team. Failures have sent engineers' careers tumbling.

The following articles, written by leading experts, not only put CE in perspective, but they provide guidenes for a successful CE venture. Not only will they help you avoid pitfalls in getting CE started, but they will show you how to sell management on CE, and how you can improve your CE training.

In spite of its proven advantages, and its growing use as indicated by *Design News* readers, studies show that many U.S. firms still don't practice CE. The reasons are not hard to decipher.

Traditional "consecutive" or "linear" engineering, especially from a management standpoint, fits nicely within typical bureaucratic organizations. It helps middle managers establish and maintain their fiefdoms.

Moreover, the sequential approach to design has succeeded in emphasizing innovation within each function area—without the need for any coordination or integration among them. Therefore, disadvantages are not viewed as significant, because the importance of time-based competition and built-in quality has not been fully recognized by key managers.

A third major reason for consecu-

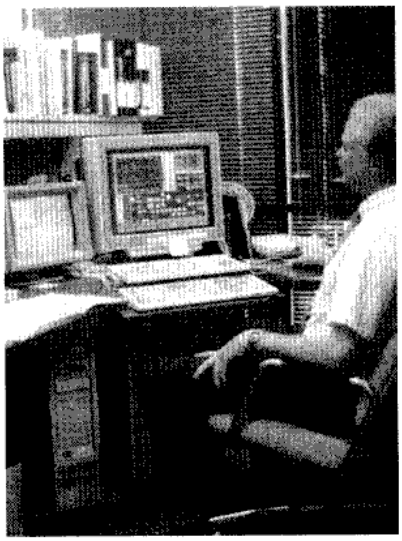
Test version of 777 nose section confirms that team-oriented, computer-design processes work. The section is being built as final verification that parts designed and 'preassembled' electronically fit the way they do on the computer screen.

tive engineering's continued use relates to a company's computer and communication tools. Many firms still lack the electronic wizardry to make real-time design or management decisions among the various design functions possible.

Keys to CE success. Establishing a successful CE program requires an integrated management perspective that blends the functional areas into an "inception-to-launch" process. It takes six ingredients to make it work:

- A dedicated core team of "equals" with the authority to deliver a product concept to market. The team must take advantage of each other's capabilities in parallel.
- Close physical proximity among project team members to reduce communication problems in the transfer of information. Computer networking tools can overcome some geographical drawbacks.
- A "contract" between top management and the project team that spells out the schedule, budget, resources, product performance, and time-to-market, plus the team authority to carry it out.
- Formation of a phase and milestone-driven process. Phases provide the structure for overall management of CE efforts, while a common and consistent milestone framework supports achieving the phase requirements.
- A robust product definition. One cannot predict a design realization date with confidence until such a definition is in place and its feasibility proven.
- Measurement criteria and incentives. People need rewards for breaking down cross-functional barriers and working in unison, as well as a way to measure when such awards are merited.

Implementing CE. Small projects, large projects, incremental improvement projects, and projects for developing radically new products—all come within the scope of CE. The development and production of Boeing's new 777 widebody jetliner illustrates the successful execution of CE for a large project.



Abbott Laboratories conquered the 'too big syndrome' that can doom the concurrent engineering initiative.

Prior to the 777, the Boeing Commercial Airplane Group followed the traditional lengthy, inefficient, and costly product development route. Now, it applies CE initiatives to the entire 777 design process. The objective: "delivery of a service-ready product that will set the highest standards for quality and reliability."

The effort began with the formation of design/build teams in 1990. Earlier meetings had defined the basic customer-driven configuration of the aircraft. Each team has the responsibility for a section of airframe or major systems. It is staffed by experts from diverse disciplines—engineering, production, procurement, customer support, and other specialties. More than 230 design/build teams, some of which include members from suppliers and customers, work on the new design.

Team members based in the same facility share their knowledge with one another, rather than applying their skills separately in a sequence of steps. Structures and systems evaluation from this multidisciplinary perspective help assure producibility, cost-effectiveness, and maintainability.

Two key measures made the concept work—communications and computers. Powerful digital computer-aided design (CAD) technology enabled the teams to create the 777's parts and systems as 3-D solid images, not traditional two-dimensional drawings. Team members shared their design through a common database accessed through digital design workstations.

The team views parts and systems as electronically pre-assembled solid images on computer screens. Interference or misalignment between parts becomes readily apparent and is corrected before releasing the final design. This greatly reduces the need for costly full-scale mockups of the aircraft.

"Instead of the planned 19 weeks to assemble a 777 floor beam, it took only three weeks," says Alan Mulally, 777 Division vice president and general manager. "It's a real tribute to the collaborative effort behind the design."

In the past, analysts and engineers, working with two-dimensional drawings, took turns adding elements to the design. Completed designs were released to production specialists, who developed tools and manufacturing plans.

Boeing plans to turn over the first 777 to United Airlines in May 1995. United placed a launch order for the twinjets in October 1990. If the CE teams continue to exceed expectations, Boeing should have no problem meeting that schedule.

Small-project impact. At the other end of the spectrum is TN Technologies' development of ERIC, an explosion-proof, corrosion-proof sonic transducer. TN, a small subsidiary of the giant Baker Hughes conglomerate in Houston, designs and produces advanced high-tech analytical instruments.

TN has had Concurrent Product

Development in force for two years on all new product efforts. The engineering-manufacturing-marketing teams operate in co-located offices that include a conference room and prototyping areas.

Program reviews take place every two weeks at a fixed time. If a member of the executive group is missing, the meeting is rescheduled within a one-week timeframe. Management clears any obstacles and makes certain that financial and human resources promised the team are available. The management team also assists in feature trade-offs that arise during the definition and early design phases.

With CE in place, the TN design team brought ERIC to market 40% quicker than previous projects. The development cost was only 2% off target. No engineering change orders were needed after the product's release to manuacturing. And the final product cost came within 4% of the goal. Most important, this was the TN team's first venture with CE.

"We will never go back to the old sequential way of developing products," says Fred Ohler, senior manufacturing engineer for TN. "We have experienced a tenfold increase in communications between team members as well as management and the teams."

Developing diagnostics. Product development in the medical field can face even greater complexities than those found in the design of a future aircraft, advanced semiconductors, or the next-generation computer. The Diagnostics Div. of Abbott Laboratories, Abbott Park, IL, proves it.

The division relies on CE for the design of all new instrument programs. Abbott "trained the trainers" during the initial stages of installing CE.

More than 150 people were involved in assessing, planning, and implementing the program. The in-person communications management approach keyed on focused meetings. In a few instances, video conferencing tied in personnel at remote sites.

The interpersonal format resulted from the formation of several operating groups, then dividing the various tasks and activities among them. Initially, a decision-making council was established composed of the project managers. The council, in turn, selected technical and functional leaders of product development efforts within the division. This upper management steering committee navigated the CE program across the numerous rapids associated with major reengineering initiatives.

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In addition, the steering committee directed two sets of volunteer working groups. The first group consisted of eight Focused Topic Teams that involved 60 people. These teams assessed needs and priority areas.

The second group, composed of four Implementation Teams and 40 people, designed and detailed actual programs under the direction of the steering committee. In addition, some 30 to 40 managers remained continually briefed on the CE effort at their weekly staff and department meetings.

The small steering committee proved effective in facilitating the tougher decisions, as well as gaining consensus through effective planning. By involving more than 150 people in a team-based approach to implement the initial program, Abbott conquered the "too big syndrome" that often dooms such company-wide initiatives.

Although several years into CE, the initial CE-developed products won't be on the market until later this year. Development cycles for diagnostic instruments are often long—roughly the equivalent to designing a next-generation airplane. Still, Abbott can track numerous enterprise-wide improvements due to its CE program.

Project plans are focused and documented prior to beginning development. This includes critical pre-development activities, such as nailing down and documenting product specifications. Engineers now "design to spec" on a much larger scale, which speeds the whole design process.

In addition, projects are designed and managed by well-defined phases that result in more autonomy and better use of time by team leaders and members. Much of the "top management-interface overhead" was removed, freeing team members to focus on actual product development. As a result, Abbott has experienced reduced cycle times on these multi-year projects.

"Concurrent Product Development has changed the way we approach all aspects of product definition, design, and development," adds Robert Dodge, director of instrument engineering for the Diagnostics Div. "Development professionals from engineering, marketing, chemistry, manufacturing, and field service embrace the CE process and the changes that it brings in their day-to-day activities."

Microfilm magic. When it came to the design of a low-cost desktop microfilmer, Kodak had to offer significant advantages at a competitive price to beat the competition. Time also proved a major hurdle. So Kodak, too, turned to CE. The

result: a "from-the-ground-up" product in only 21 months.

For the project, Kodak established a core team that included design, marketing, manufacturing, quality assurance, assembly, and customer-equipment service. The team had the responsibility for taking the product through the entire product development cycle and into production. To enhance communications and avoid distractions, the team worked in a separate area.

Each team member had an equal say in the design. This eliminated problems that could have surfaced. No expensive design changes were needed down the road.

Not only did Kodak get a timely product that responded to market demand, but the desktop unit offered special features requested by customers. Among them: interchangeable film cassettes, an automatic feeder, and duplex filming. Kodak reports that the unit "is selling well above projections."

What can we learn from these success stories? Several of the key elements can be found within each company's CE efforts: a dedicated core product team, geographical closeness—a least in the virtual sense, agreement that the teams would not be micromanaged, use of a phased-milestone process, early product definition, and, most important of all, a willingness to abandon traditional sequential approaches to product development. The message: CE success breeds organizational change. Expect to see more companies following suit during the 1990s and beyond. □

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Mr. Goldense has consulted to over 50 of the Fortune 1000 and has worked on productivity improvement and automation projects in over 150 manufacturing locations. He has worked in North America, Europe, and the Middle East. Abbott Laboratories, Sikorsky Aircraft, Sematech, Mercury Computer, Keithley Instruments, Carrier Corporation, Molex, Monsanto, Loral-Vought Systems, and Bose Corporation are representative among GGI's clients.

Prior to founding GGI in 1985 Mr. Goldense worked for CSC/Index, the company which invented and initially developed the "reengineering" body of knowledge, and for Price Waterhouse's Manufacturing Consulting Practice. In the 1970s, he worked for Texas Instruments as a Design Engineer and then Program Manager where he was responsible for managing complex engineering projects. Brad had turn-key responsibility for designing and starting-up two TI manufacturing plants.

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Brad has authored numerous articles on competitive product development and manufacturing with known industry publication such as Design News, Machine Design, Manufacturing Breakthrough, World Class Design To Manufacture, and Industry. He is a nationally recognized expert on product development.