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DESIGN FOR MANUFACTURING

The Newsletter of Concurrent Product Design

METRICS THAT SPEED PRODUCT DEVELOPMENT

Problem areas emerge from measurements of project size, staffing, and involvement levels.

■ One area of concurrent engineering that seems still to be in its infancy is that of measuring the product development process. The only widely used metric today is performance to schedule, which gives no insight as to the source of problem areas.

There is a move afoot to more precisely measure macro factors that can determine, early on, whether specific projects may be in trouble or even doomed to failure. On this score, a few key metrics for measuring product development have been described by Brad Goldense, president of Goldense Group Inc., a consulting firm specializing in business and technology management practices. World-class companies, he points out, have begun gauging all the steps between the time a product concept is first identified and when the finished article finally reaches the market. Beginning the measurement process at the inspiration stage tends not only to raise warning flags early, but also to reduce the time needed for ideas to bubble up and hit production, says Goldense.

Among the techniques that can expose difficulties are measuring target project size, constructing a concurrency matrix, and boosting project staffing speed.

Target project size — Most organizations are good at handling projects defined by a specific duration and employing a finite amount of company resources. Projects that are too small may not be worth the effort. Projects that are too big risk delays and gross misjudgment of required assets. So it makes sense to quantify the scale of projects your firm can reasonably undertake. Though many companies have an inherent feel for such limitations, real insights can come from a more structured analysis.

Take a set of representative projects (Goldense suggests 10 or 15) and for each one plot "total project person-years" against time-to-market. Now categorize each project first as either successful or unsuccessful, and second in terms of whether it was an incremental or a next-generation development effort.

For most companies, successful projects tend to congregate in what could be called sweet spots on the graph. Problem children are more likely to be

continued on page 2

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Sources: We receive thousands of news releases each month, from which we select two or three for analysis. We also talk with many vendors and user firms in the field. We welcome your tips, rumors, case histories, and, yes, even your press releases.

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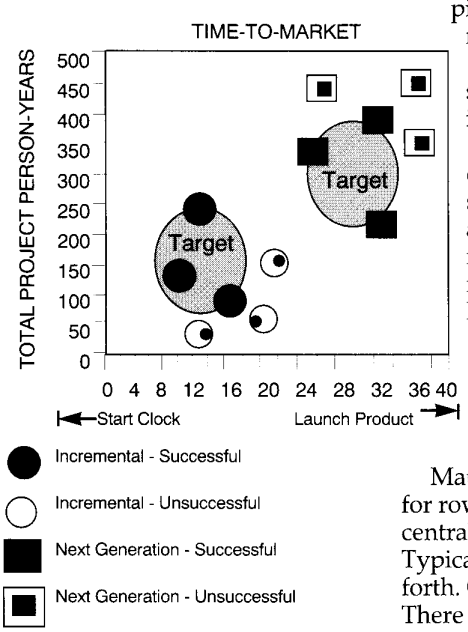
TABLE OF CONTENTS

continued from page 1



Successful projects are likely to cluster together in sweet spots when plotted on a time-to-market versus person-years diagram.

splattered all over the map. The best way to make use of this information is to pick out the common attributes of the successes, and of the failures, then make some assessments.

It is neither possible nor prudent to have all your projects in the sweet spots, says Goldense, but be forewarned if a new effort looks as though it will fall outside their boundaries.

Concurrency matrix — Many organizations construct a two-dimensional matrix to describe when and how different disciplines should begin work during development. But the approach can be taken a step further to highlight where skills are being applied too late. This is important because though numerous manufacturers now preach early involvement by cross-functional teams, the reality often remains too-little/too-late resource deployment.

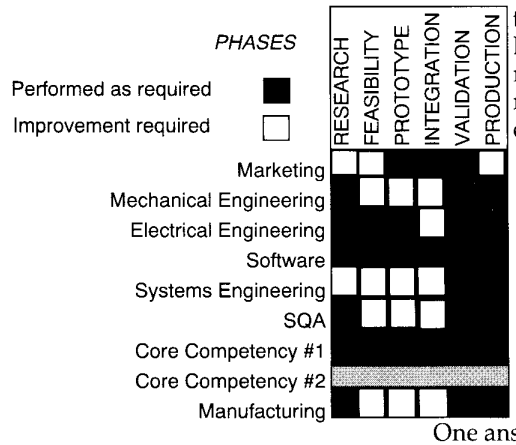
A concurrency matrix can show graphically where organizational commitment is lacking. It is of most benefit when first embarking on CE. Ideally, you would construct before-and-after concurrency matrices, one using pre-CE development procedures, the second later on to verify changes brought about by concurrent methods.

Matrix definition requires that program managers agree on common terms for row and column headers. First to be decided is the list of functions that are central to the development of new products. Each function becomes a row. Typical functions would be software development, structural analysis, and so forth. Columns become the major phases in the product development process. There are typically between four and seven phases. What's tricky about this is that different phases may mean different things to different managers. Though most manufacturers have a formal new product-development process, there are typically a wide range of approaches in applying it, says Goldense. So getting managers to agree on terms may take a long time.

It is useful to define three to five specific activities that occur in each matrix box. Now fill in every box with a graphic representing whether or not (or to what degree) needed functions participated in each phase.

The benefits of the approach include an ability to see late commitments at a glance. If the same pattern tends to happen frequently, you probably have a glitch in your system. You can take the method further and calculate a "% concurrent" figure for each project. Assign a certain number of points per completed box. If all activities took place on time, the box is worth two points, say. Award one point for every box where only a portion of the tasks happened or happened on time, no points for a complete bust. Dividing the total score by the maximum possible score gives a percentage.

CONCURRENCY MATRIX



One concurrency matrix revealed that the system engineering and marketing functions were systematically under involved in the early phases of development.

An advantage of this exercise is it can highlight deficiencies that should become the first priority of any reengineering effort. Examining a concurrency matrix this way, says Goldense, led one manufacturer to redefine its marketing department. Marketers had merely been glorified salespeople in the old regime. The function changed to include product planners dedicated to assisting technical personnel starting in the early phases of product definition. Similarly, nobody in the systems engineering department was taking ownership of specific projects, discouraging early involvement. A more formal process solved the problem and helped management understand that systems engineering was really one of the firm's core competencies.

Staffing speed — A common malady of product development efforts is full staff ramp-up happening too late, typically in the "middle" of the project when the design is almost complete and it's time for a prototype.

One answer: Focus attention on the rate at which projects ramp up by graphing the number of involved people versus time. The idea is that if you start earlier, you will finish sooner. Goldense says fast project ramp-up will work if three things occur during the feasibility phase.

First, analysis and experimentation must cut development risk so the

schedule can be predicted to an accuracy of ±20% or better. Second, customer requirements must be fairly complete and documented — in other words, they are not going to change much as the project proceeds. Third, the architecture of the product must be complete, though the specifications need not be. Use this information to confidently estimate project resources early on.

Most companies perform these activities, but don't carry them far enough to reduce development risk, says Goldense. This leaves too much work for the development phase. Conversely, they may estimate funding and resources early, but before the product has been sufficiently defined. The obvious result can be efforts that are drastically overdue and over-budget.

Earlier staff ramping can be beneficial even if planning isn't entirely complete. The act of assigning most professionals at the feasibility phase is likely to force expedited definition and planning.

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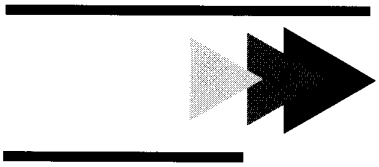
HOT TOPICS



Smart, Simple Design — That's the title of a new book by two-term Baldrige examiner Gwendolyn Galsworth that deals with Variety Effectiveness. The idea: Unwarranted variety in a product line is actually a form of waste. To eliminate it, you need a method for measuring and identifying the trade-offs associated with variety, and to understand the root causes of variety. This book is billed as a blueprint for cutting back the mass of parts and processes resulting from years of product proliferation. Most variety in part design, product structure, and process selection results not from customer need, but from a series of internal policies and behaviors that needlessly complicate the production process. The key benefit of the technique is that it supports broad selection for the customer while reducing variety in the product line in a manner transparent to the customer. The 311-page hardback costs $37.50 and is published by Oliver Wight Publications Inc., Essex Junction, Vt.., phone 800-343-0625 or 802-878-8161.

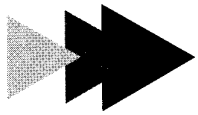
Stratasys buys IBM RP — Rapid prototyping vendor Stratasys Inc. last month announced that it had purchased the RP technology developed at IBM's T.J. Watson Research Center. Under the terms of the purchase agreement, IBM becomes a significant shareholder in Stratasys. The IBM and Stratasys technologies are similar. (See 4/4/94 MACHINE DESIGN, pg. 26, for a review of IBM's work.) Both lay down thin layers of extruded material, maintaining liquid modeling material just above the solidification point until it solidifies as it is directed into place from an extruding head nozzle. Stratasys gets from IBM patents, patent discolsures, prototype machines, and documentation.

Quick cores and cavities — When confronted with the need to quickly produce injection molds characterized by complex contouring, Durden Enterprises Inc. took a CAD solids model of the required part, extracted the respective core and cavity surfaces, and merged them into blocks to create solid models of the mold inserts. RP vendor 3D Systems used these to build tooling masters out of liquid epoxy resin. These, in turn, went to Solidiform in Texas which created aluminum investment castings from them. Durden added texturing to the castings and completed the mold. The entire process took 16 weeks. The mold has produced about 2,000 production parts to date. Durden expects to cut such efforts down to six weeks or less through further process refinements. The contact at the Auburn, Ga. firm is Bill Durden, 404-963-0637, fax 404-995-7067.

Machining for Windows — Version 2.0 of MFW recently became available from Boothroyd Dewhurst Inc. It is an upgrade of the firm's DFM software series that lets users develop process plans, get cost estimates early in the

continued on page 4

HOT TOPICS



continued from page 3

concept stage of design, figure quotations and help in production planning. Visual aids guide users through a DFM analysis. The package lets users select parts to be machined from stock material or near-net shaped workpieces, such as castings or forgings. User-editable material and operations libraries move the user through manufacturing analysis, allowing selection of tool material, type of cut, dimensions of cut, and surface finish. The program then selects cutting speeds and feeds for the selected tools and operations, corrects the values as needed for the hardness of the work material and size of the cut, and calculates the machining time. Machining limitiations are automatically imposed as are corrections for tool approach and other fixed parameters. BDI is in Wakefield, R.I. at 401-783-5840, fax 401-783-6872.

Engineering on the Internet — *Science & Engineering Network News* is a monthly newsletter soon to be followed by an online service that focuses on news, reviews, and tutorials of science and engineering resources available on the Internet and related bulletin boards. Among the topics to be covered are reviews of sites, mail lists, and electronic journals, tutorials on Internet protocols for accessing information online and using front-ends such as Mosaic, reviews of Internet books and CD-ROMs, and news about resources for technical disciplines that include space sciences, materials science, software engineering, biology, control engineering, and others. The newsletter is available at a charter subscription rate of $97 which will climb to $195 after the offer is over. Publisher is Soliloquess Communications in Worcester, Mass., 508-755-5242, fax 508-795-1636.

Advanced manufacturing — The Advanced Manufacturing Research conference in Cleveland March 29 aims to provide a technology overview for managers dealing with technology investments. Among the topics covered by speakers from the National Center for Manufacturing Sciences, Allied Signal, AT&T Network Systems, AEG Schneider Automation, Allen Bradley, IBM, and Action Instruments will be object technology, complex systems management, adaptive control, and software management. Registration costs $995. The sponsor Advanced Manufacturing Research Inc. is in Boston at 617-542-6600, fax 617-542-5670.

Document management — A bevey of document management conferences and expositions are coming up this spring. **The AIIM Show & Conference** commences Apr. 10 through 13 in San Francisco. Some 350 exhibitors will display products in imaging and data management, and conference sessions will treat subjects such as multimedia and compound document architectures, management tools for workflow, object-oriented database management, workflow automation, and more. Exhibits are free, the conference is priced by the day starting at $650 for one day. Association for Information & Image Management is in Silver Spring, Md. at 800-477-2446, 301-587-8202, fax 301-588-4838. Management Roundtable's **12th International Conference on PDM** runs May 15 through 17 in Waltham, Mass. and is designed to explore strategies for developing a PDM program addressing short-term goals while providing a foundation for longer-term growth. Case histories and users will cover pitfalls in implementation, barriers, price vs. functionality, quantifying benefits, effects on internal company structure, and more. Information is available from Gregg Tong at 800-338-2223, 617-232-8080, fax 617-232-0879.

EDM'95 runs June 4 through 8 in Atlanta. Conference sessions are of particular interest to design firms and architects. Topics will cover the automation of document and drawing handling within design and construction projects, manufacturing, safety and facilities management. The exhibition features some 50 displays of imaging application products devoted to engineering document management, plus another 400 exhibitors in the areas of CAD, scanners, plotters, and more. Information is available from Document Management magazine, in Arizona at 602-585-5580, fax 602-585-7417.