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"Mass Customization Reduces Costs and Shortens Delivery Time"

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Naser Chowdhury is Manager of Design Engineering for the Electronics Division of Air Products and Chemicals, Inc. His presentation outlined a six step process for implementing "mass customization". He used the gas cabinet product line for illustration. A gas cabinet is composed of four components: (1) process panel, (2) purge panel, (3) controller, and (4) enclosure. Gas cabinet customization is needed because customer differences and industry turbulence prevent standardization. Implementing mass customization is a team process requiring change in the business approach from focus on individual projects to focus on product-lines. The concept of mass customization separates nicely to have features from a bare bones product. According to Chowdhury, the six steps of mass customization are:

1. Scope of Work (SOW)
2. Building Blocks
3. Modular Analysis
4. Product Configuration
5. Detailed Designs
6. Training and Management of Change

The personnel vital to implementation comprise what is called the "core team." Members of this team include employees from design, process, and manufacturing engineering divisions, as well as employees from commercial electronics, electronics operations, and safety. An effective mass customization system requires efficient communication and accurate documentation by team members.

Step 1 requires development of a high level SOW document. The SOW includes commercial objectives, technical objectives, and a list of deliverables. Additional elements in the SOW include a schedule/budget and definitions of roles and responsibilities within the respective organizations. At this time, functional requirements of the customer are also considered.

Building blocks are developed during Step 2. Building blocks are subdivisions of complex systems and are defined by the core team. Typical challenges encountered during this step are product line design, product operation, safety, and commercial issues. Customer requirements are defined and documented during the building blocks stage. Position papers developed during the building blocks step summarize core team decisions by analyzing design issues and customer requirements. Examples of customer functional requirements are the following:

- Process- flow, purity, temperature, uptime
- Safety- health, physical
- Operations- required hardware
- Maintenance- diagnostic hardware, facilitate component repair
- Miscellaneous- aesthetics, ergonomics

In Step 3, modular analysis, task force teams from each division, with the support of the core team,

perform the majority of the work. During Step 3, the product line is structured into a menu of required features and optional features. Required features are components needed to meet the customer's functions. Optional features include enhancements above and beyond those required to meet the customer's basic functions. In the gas cabinet example, modular analysis assists the vendor (Air Products) in selecting the quantity of cylinder panels or how many different configurations of controllers to offer.

Step 4 is product configuration. A knowledge-based computer application called a configurator is developed to represent the mass customized product line. The configurator can be used as a design tool for product engineering and manufacturing documents. Air Products views the product configurator not only as an order entry tool, but as a design tool with the ability to provide real time design of the product line, and managing all the variables and available options. The configurator also generates system schematics on a laptop to share immediately with customers. An additional feature is the ability to interface with CAD systems to produce manufacturing drawings and work instructions in hours rather than weeks or months.

In Step 5 detailed designs are verified. The mass customization system is tested by examining "end-to-end" dimensions of all parameters of the product line. A complete mass customization system accommodates all the possible designs in a product line.

The sixth and final step is training and management of change. Various levels of training are required for each configurator depending on the complexity of the product line. Also, because industry turbulence and customer differences prevent standardization, product line changes occur incrementally. Therefore, the work force must take a proactive stance in managing the configurator since such changes can be realized immediately through modular enhancements.

A firm seeking to adopt mass customization must be flexible, innovative, risk-taking and entrepreneurial. The organization must also shift from a hierarchical to a network-based structure. The ability to move quickly cannot be understated. This drives the need for empowerment and elimination of boundaries between different parts of the organization so work can flow in a rapid and seamless manner.

Editor's Note: Ingersoll-Rand invited Naser Chowdhury to be a guest speaker for an all day session on "Implementing Mass Customization" to a cross-functional team at Ingersoll-Rand's Athens, PA location on January 3, 1997. This is an example of the type of networking between companies that the Advanced Manufacturing Forum was designed to promote.

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