

# RAPIDS: How a Manufacturer achieved Speed to Market with their Online Product Configuration System

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**Abstract - Fluid flow pumps are a highly complex product. For a purchaser, the selection process can be a daunting task. Understanding this, Toronto-based S.A. Armstrong Limited, a global manufacturer for nearly 70 years, turned to Toronto-based information technology specialists to design a system to take the complexity out of purchasing their pumps. The resulting application – RAPIDS – helped S.A. Armstrong Limited to become one of the lowest transaction cost companies in a highly complex configured world. RAPIDS simply wrapped the know-how of the organization around its customers 24 hours a day, seven days a week. <http://www.rapidstechnology.com>**

The primary objective of mass customization is to deliver goods and services that meet individual customers' needs with near mass production efficiency (Pine, 1993; Tseng and Jiao, 2001; Piller, 2005). The secondary objective is to have custom configured products provided without the high cost (and price premiums) usually connected with (craft) customization.

Fluid flow pumps are a highly complex product. Selecting such products can be daunting because end consumers do not always have the necessary knowledge to specify an individualized solution that corresponds to their requirements.

Since its founding in 1934, S.A. Armstrong Ltd. has pioneered a range of fluid flow pumps and heat exchangers for global residential, commercial and industrial markets. Today, it holds #1 market position in Canada, #1 market position in the UK and #3 market position in the USA. It has manufacturing plants in all three countries.

As part of Armstrong's extended range of professional services, it offers its customers ready access to expert, personalized engineering support. While the company operates largely through a Representative network of over 200 engineering firms in North America, the company's staff addresses all customer questions and provides individualized technical assistance, from product selection to providing installation and operating instructions. For Armstrong, there were three factors involved in the motivation to meet "the mass customization challenge."

1. Meeting the needs of customers who bring unique requirements and want to collaborate in designing high quality, custom product solutions;
2. The desire to provide rapid delivery of high quality products configured from standard components at a standard price;
3. The desire to have an Advanced Product Catalogue and Configuration System that guides selection of the exact product that fits the customer's requirements and captures all pertinent order information, without the assistance of an engineer.

The backbone of the mass customization project (RAPIDS) was the company's own proprietary software: ACE (Armstrong Catalogue Expert). In 1994 ACE was developed first as a DOS product, later migrating to the Windows platform. ACE allowed customers to define and even design their specific project needs, and then checked this information against the company's product line, matching technical specifications against technical test data.

Initially, the ACE product selection software was made available to Armstrong's customer base as standalone software on disk, but in recent years, addressing multiple Windows platforms and operating environments became impractical. With the most recent version of ACE, over 5,000 CDs were being shipped to users. It was time to migrate the application to an online XML platform.

The new system had to address stringent requirements. First and foremost, the system needed to reduce the time and costs associated with processing orders. This meant order workflow needed to be streamlined and integrated with the enterprise resource planning (ERP) system, in this case BAAN. Most quotes and orders also included engineering drawings, so further integration with the CAD system SolidWorks was required. Lastly, because customers are located globally, product and pricing information needed to be available in the units of measure and currency specific to their home country.

All customer and client issues were considered before embarking on the migration project.

TABLE I

Feature Comparison of Windows-based ACE vs. Web-based RAPIDS

On the technical side, the new application had to address:

- Difficulty maintaining non-internet based in-house software (ACE Classic)
- Inconsistent pricing
- Multiple currency issues
- Incompatible order options
- Order entry mistakes which were always costly
- Not all capabilities presented to the client

From the business process side, the new application would have to improve upon:

- Long quotation lead times
- Sales staff spending time on non-value-added activities
- Product-driven sales as opposed to customer need driven sales
- Missed opportunities because of a high cost to quote

In short, RAPIDS had to tackle very complex product rules and fill the needs of companies with Engineer-to-Order, Configure-to-Order, Assemble-to-Order, Make-to-Order, and Design-to-Order requirements. From the software developer’s perspective, the software had to be scalable and had to be cost-justifiable by any configured manufacturing companies, independent of their size or industry.

One advantage of the RAPIDS software development effort was that the new application could borrow features from the existing standalone software (ACE) while implementing an updated architecture. This allowed existing features to be enhanced in a significant way, and afforded the opportunity to add important new features that had been lacking. (See Table 1)

One of the most interesting aspects of Armstrong’s mass customization project was the emergence of a new role: the Product Data Expert (PDE). The PDE was responsible for articulating all the rules and constraints for each product. Almost all of the engineers who held the role of PDE had had customer / sales rep interactions and performed customer support. This gave them the opportunity to acquire and assimilate the customer needs and manufacturing limits (existing or otherwise). Later, it became advantageous to move PDEs from position to position to gain even greater understanding of the value chains and supply chains.

Feature	ACE	RAPIDS
Product Selection	Yes	Yes
Solution Selection	No	Yes
Product knowledge maintained by ...	IT	Engineering / Technical Sales
Price knowledge maintained by ...	IT	Marketing
Embodies a value chain	Linear	Circular
Integrates with legacy and 3 <sup>rd</sup> party tools / applications	No	Yes
Server based – sharable database	Partial	Yes – ACE Online
Version available with stand alone database	Yes	Yes – ACE Remote
Data synchronization between shared and stand-alone versions	Partial – manual	Yes - automatic
Project tracking	Yes	Yes
Underlying technology	Windows app, MS Access	Internet, MS SQL Server, Plug & play

All customer input, particularly demand information, can have significant impact on the supply chain. This input has to be interpreted, converted and shared as quickly as possible with all relevant units. Understanding the impact of customer information on all functional units (sales, marketing, engineering, manufacturing, accounting, R&D) will be critical if PDEs are to advance efficacy in the organization.

From a knowledge management perspective, the activity of the PDE was the definitive example of “tacit to explicit” knowledge conversion. *Note: A moderately complex product might take up to three weeks to be entered into the system. (Armstrong currently has 25 product modules set up on its system.)*

From a customer-centric perspective, here, finally, was the know-how of the organization “wrapping itself around the customer.”

From a brand building perspective, the company’s single largest investment in structural capital was now poised to become the litmus test for “an unparalleled customer experience.”

From a new capability perspective, PDEs will continue to evolve into important information hubs, for both incoming and outgoing information. They will need to have deep knowledge of the firm’s routines and internal processes, particularly the manufacturing process. They will need to have the skills and knowledge to design and re-design the routines that facilitate combining existing knowledge and newly acquired product knowledge. And lastly, they must be self-initiating in their role as primary sources of information about the rapidly evolving marketplace.

After two years of software development, Armstrong could boast the following Solution Features in Spring 2005:

- RAPIDS™ Advanced Product Configurator and Catalog
- Integration to Baan IV
- RuleStream™ connector to Solid Works™
- Installations and successful deployment in both North America and UK locations

Armstrong’s sales channel and clients are located around the world. With the Web-based system allowing for self-service, Armstrong’s customers can now get product configuration, pricing and order status information without having to deal with a sales person.

RAPIDS reduced the cost of processing an order for Armstrong by integrating with their Baan enterprise resource planning (ERP) system. Information entered into RAPIDS is automatically fed into the ERP system, thus removing the requirement to re-enter information after an order is received.

The additional integration of RAPIDS with RuleStream™ and Solid Works™ enabled the automated generation of computer-aided design (CAD) drawings and bills of material (BOM), thus improving the internal process for engineered to order (ETO) solutions. As an example, this enabled the presentation of “the mechanical room on a skid” concept, and the embedding of a variety of 3rd party components. (See Figure 1.) Further integration of RAPIDS with Armstrong’s engineering and manufacturing systems has reduced errors in drawings and instructions, and has resulted in less product scrap or rework.

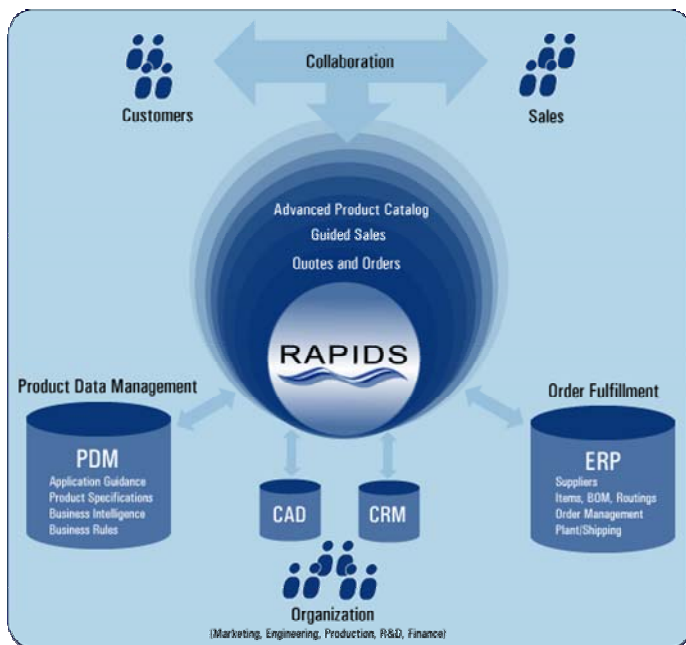


Fig. 1. Bridging Product Data and Order Management

But what of the cultural impacts of a system like RAPIDS? Internal change management is part of the integration phase of a successful mass customization implementation.

Why is change management important? This is important because mass customization empowers customers to become co-creators and collaborators in the process of designing products that meet their specific requirements. Empowered customers, however, have to work with motivated and competent employees. Every member of the manufacturing organization must understand mass customization and their role in this co-creation process. Managing mass customization must therefore include a program that addresses the cultural issues of moving the organization from a closed production system towards a system of mass customization. This will require the organization-wide shifting of the locus of value creation towards customers.

The following are three customer-focused programs implemented at Armstrong intended to support its mass customization implementation.

### 1. Customer Learning

Members of the manufacturer organization have to be motivated to acquire information from the customer (e.g. need and/or solution information) that can be used in the production process, and share this information with all relevant functional units. Sales personnel, customer service, technical support, senior managers - in fact, anyone who comes in contact with a customer needs to embrace this customer learning role in the fullest sense. In addition to training, this will require appropriate information support systems and easy to use technology that makes customer information management simple and straightforward.

Armstrong developed its own conversational process, FIELD, which is a methodology focused on learning about customer requirements through diagnostic questioning. Five stages (Fact-Finding, Investigation, Exploration, Linking and Differentiation) advance the customer dialogue toward delivering the ‘unanticipated solution.’

### 2. New Capability Generation

Special learning systems will be required to support PDEs in their information management roles in the new mass customization environment. This will include regular input from each functional unit (marketing, IT, etc.) on how customer information is currently being handled, and in what form it is being shared with other functional units.

### 3. Brand Building

All customer-facing activities, including guided sales systems and product configurators, present unique and unprecedented opportunities for co-creating and innovating with the customer. This kind of innovating contributes directly to brand building

at the highest level, because brand building and innovation are two processes that dovetail one another.

What follows are a few examples of how a mass customization implementation such as RAPIDS impacts on brand-building (Saint-Onge and Armstrong, 2004) [4].

**Increased Innovation:** Time-consuming processes like quotes are accelerated, allowing product engineers to invest more time in product innovation.

**Increased Customer Capital:** Order entry is virtually error-free and vastly accelerated with a mass customization system, leaving more time for innovating with the customer to arrive at the “unanticipated solution” with the customer.

**Increased Structural Capital:** The know-how of subject matter experts is converted from tacit to explicit knowledge, and documented in the form of the rules and constraints that comprise each product module.

With the launch of RAPIDS in late fall of 2004 (North America) and in spring 2005 (UK), S.A. Armstrong Limited became one of the lowest transaction cost companies in a highly complex configured world. The RAPIDS Product Configuration System significantly reduced the long cycle time involved in converting a quotation into an order, making orders simple and error-free and facilitated changing customer problems into solutions with quotation drawings and product specifications.

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