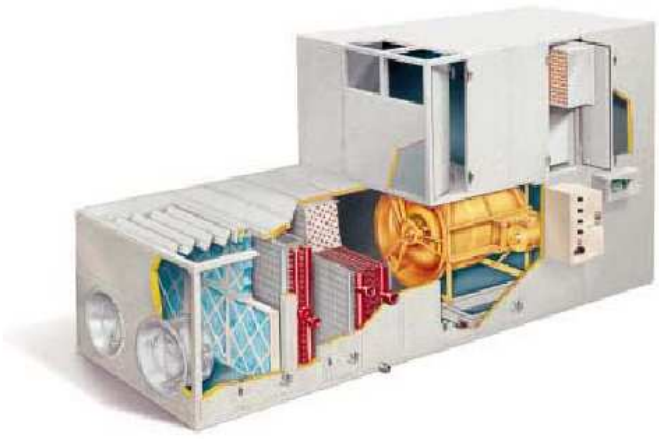
Trane Next Generation Air Handling Units project (2007)

What is an air handling unit?
Air handling units are used in large buildings to handle the ventilation and condition the air to maintain building comfort. The air handler is a device that takes outside air, mixes it with return indoor air, cleans it, passes it through a coil (for heating or cooling, as appropriate) and then sends it into the building occupied space. The illustration below shows a typical air handler configuration and some of the equipment inside the unit.



Introduction
Trane's central station air handling units expand a wide range of unit sizes and offer a multitude of features and options to meet the different needs of many building types in many climates. This product flexibility over time led to the proliferation of tens of thousands of parts and high product and systems complexity and associated costs.

Modular Management led Trane through a process to better understand the cost of this complexity and the opportunities to reduce this cost. Modular Management helped develop a new approach to modular design focused on part count and complexity reduction while adding to the product flexibility for the customer. This new approach, together with innovative engineering systems design, is providing Trane with opportunities for significant direct and indirect labor efficiencies and much faster product change through the product life cycle.

Company
Trane is a leading global provider of residential heating, air conditioning and commercial HVAC (**H**eating **V**entilation **A**ir **C**onditioning) solutions that reliably improve indoor environmental quality.

Trane provides energy efficient commercial air conditioners, chiller systems, HVAC controls, HVAC parts and supplies and building automation systems that contribute to sustainable building design.

Challenge
Trane Commercial Systems has successfully maintained a market leading position for a long time with the indoor M-Series platform, but as the product is aging the need for replacement has become evident. With a flexible offering including many different options, the cost of complexity has become a significant part of the operational cost.

The challenge for the new product is to strengthen Trane's position as a market leader by offering state-of-the-art performance and an increase in the product offering while at the same time reducing material and labor costs. One key to reach the cost savings is to create a Modular Platform with greatly reduced unique part numbers.

Although Trane has enjoyed a strong market share in the North American region for nearly 100 years, there was concern an aging product platform could retain the strong share.

Among customers, there was a feeling that Trane Air Handling Units are rugged and perform well, but may not contain all of the standard options expected in a configure to order AHU product.

Trane situation 2007

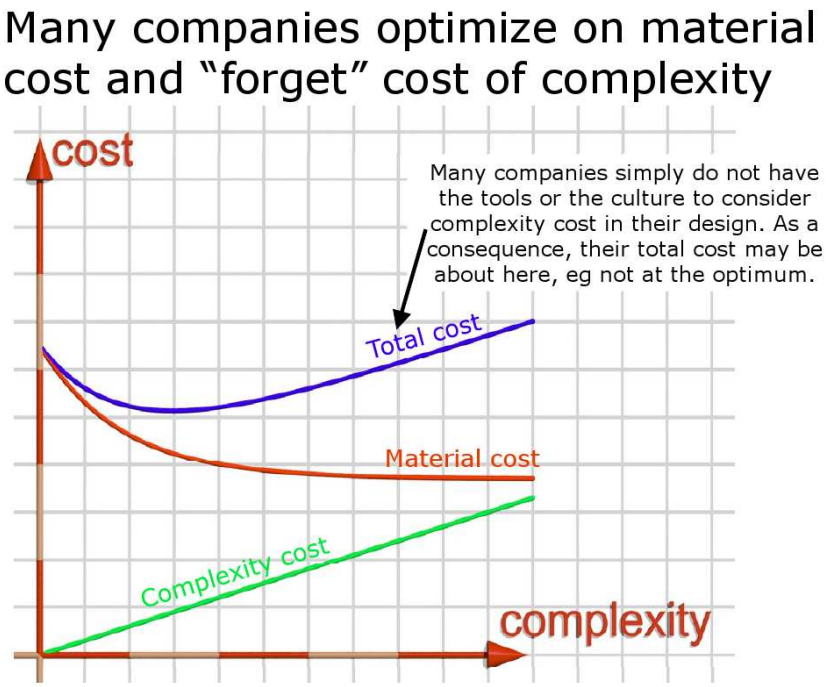
- Trane's Air Handling Units are still commercially successful but market indicators and voice of customer work suggested a new product platform would soon be necessary.

- Parallel production systems and a flexible product offering makes the cost of complexity a significant part of the overall cost.

- The Macro trend of "commoditization" of AHU products and the growing buying influence of the Contractors requires a delicate balance between cost reduction and product performance.

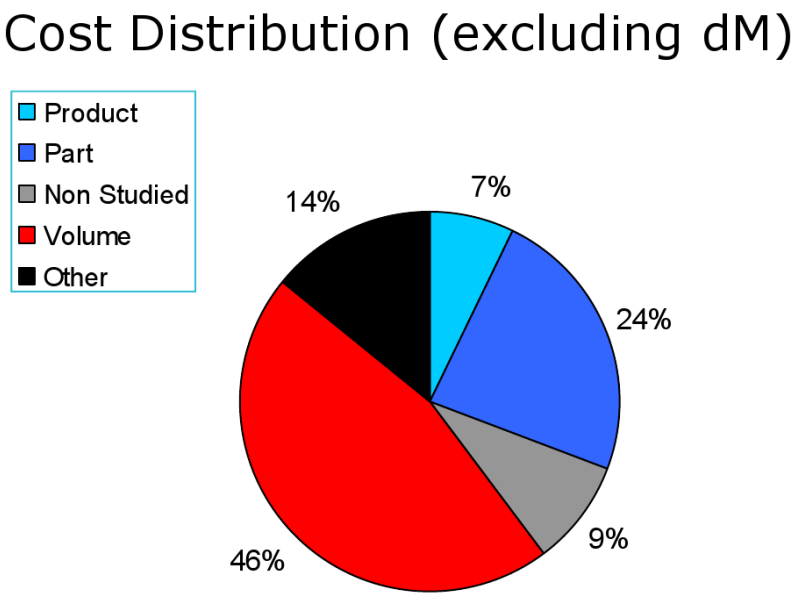
Balancing direct material and complexity
As many other companies, Trane has solid tools for calculating the direct material cost effects of different design decisions. For many types of components, the cost goes up as the capacity or performance level increases. This would be true for motors, blowers, coils and other key components of an air handler. Since air handlers are offered in a range of sizes, engineers select the components with just the right performance level for the particular size they are designing. This approach minimizes the direct material cost in each particular size, and the total material cost for the range of sizes. It does not, however, consider the indirect cost of the unique parts that are created. Each component, whether purchased or made in-house, has drawings, quality documentation, assembly instructions etc – all of which must be kept up-to-date and changed when required. This incurs activities that are not dependent on the production volume. These activities must be carried out independently of the production volume, and are driven only by the product complexity itself. Very often, the unique part number count is used as a measure

of the complexity of the product. To minimize the total cost for the company, the direct material cost considerations described above must be balanced with the complexity cost. If each new size is allowed a unique set of motors, blowers, and coils, for example, the unique part number count is higher and the indirect cost may offset some of the direct material cost savings. The illustration below shows this conceptually.



The figure shows how direct material cost, in red, typically reaches a minimum if motors etc are selected with the exact performance level required by the application. The green line shows complexity cost increasing at the same time, so the total cost, in blue, gets a minimum somewhere. Finding it is possible only when the *indirect cost structure is understood*.

How Modular Management helped
As a first step, Modular Management carried out a Modular Strategy and Potential Analysis (MSAP). One of the outputs was a detailed understanding of the complexity cost in Trane. The figure below shows the cost distribution for the value-adding activities in Trane, excluding the cost of direct material itself. The two blue segments correspond to complexity cost incurred by product configurations and unique part numbers and account for 31% together.



Based on these numbers, and other key financial data, Modular Management helped Trane compile the overall business case of replacing the M–Series with a new platform.

Using its unique methods and tools, Modular Management supported the cross-functional team within Trane to develop the Modular Architecture. The complexity-related indirect costs described above provided tools that enabled the team to evaluate both indirect and direct cost in concept and design decisions. Modular Management supported the engineers with quality assurance to meet the part number reduction goals throughout the design work. As a result, the reduction in hard billed part numbers was 58 percent while the product offering in Air Handling Units increased.

Modular Management also engaged in the design of a new production system for the modular platform and conducted a study where the efficiency loss was evaluated for different line concepts. The production team used these results to choose a concept that provided a 15 percent efficiency improvement in final assembly.

Path to a Modular Architecture Driven Enterprise

First Step:

- Define Strategic Goals using a Modular Architecture
- Quantify the potential of a Modular Architecture

Second step

- Define scope and plan the first Modularization Program
- Secure Resources

Third step

- Create a conceptual Modular Product Architecture
- Quantify the cost driven by Product Structure (ABC analysis)
- Implementation

Results

- Part Number Reduction: 58 percent
- Time to Market: The Next Generation Air Handling Unit was developed in 18 months compared to 24 months for similar projects before.
- Efficiency improvement in Final Assembly: 15 percent
- Operation Cost Reduction: 10 percent
- Material Cost reduction: 7 percent
- Increased offering in number of options

Final words by Jim Wendschlag

"Trane's central station air handling units expand a wide range of unit sizes and offer a multitude of features and options to meet the different needs of many building types in many climates. This product flexibility over time led to the proliferation of thousands and thousands of parts and high product and systems complexity and associated costs.

Modular Management led us through a process to better understand the cost of this complexity and the opportunities to reduce this cost. They helped us develop a new approach to modular design focused on part count and complexity reduction while adding to the product flexibility for the customer. This new approach, together with innovative engineering systems design, is providing us with opportunities for significant direct an indirect labor efficiencies and much faster product change through the product life cycle."

Jim Wendschlag

Director, Air Systems Product Engineering

Acknowledgements

Thanks to Trane Air Handlers division for letting us use this case story.

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