Accelerating Product Development in a Global Enterprise

With the goal of compressing cycle times by up to 50 percent, the Velocity Product Development (VPD) initiative at Honeywell Aerospace uses engineering simulation to eliminate delays while lowering cost and maintaining high quality standards for innovative designs.

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Honeywell Aerospace is a leading global provider of integrated avionics, engines, systems and service solutions for aircraft manufacturers, airlines, business and general aviation, military, space and airport operations. A strategic business unit of parent firm Honeywell International, the company employs 40,000 people in 97 manufacturing plants, design centers and service sites around the world.

Despite initiatives such as Design for Six Sigma (DFSS), typical problems experienced by a global organization of this type in developing complex products include lengthy design cycles, the inability to predict product performance early in design, missing product release schedules, cost overruns, slowness to adapt to market change and inefficiencies in utilizing design centers around the world.

Competitive pressures demand that end-to-end cycle times be compressed while lowering costs and maintaining high quality standards for innovative product designs.

In July 2005, Honeywell Aerospace reorganized to address these challenges. At the foundation of this change was Velocity Product Development (VPD™), a process for making dramatic improvements in cycle times and success rates for new products. With a lean focus on engineering and development, VPD is based on DFSS and works synergistically with the company’s advanced manufacturing and marketing groups to ensure a streamlined and quality-focused product development process.

Engineering simulation plays a critical role in enabling Honeywell Aerospace to reach the ambitious goal of VPD to reduce cycle times up to 50 percent. Through the use of analysis tools from ANSYS, engineers address several areas that often cause delays and other problems in the product introduction cycle. Simulation allows product performance and risk to be assessed and mitigated early in development so that troubleshooting and correcting problems with hardware prototypes can be avoided. Problems are fixed up front rather than later in the design cycle, so re-work is reduced. Simulation-driven development guides the design and enables engineers to create and assess innovative ideas.
that might not otherwise have emerged by studying various alternatives and optimizing the best ones.

At the inception of VPD, the Toyota Product Development System was studied to help formulate the processes to be used in Honeywell’s approach. While the Toyota system is not a drop-in solution for aerospace product design, there are applicable methods and disciplines. In particular, their Set-Based Concurrent Engineering (SBCE) method and culture of disciplined Knowledge Management (KM) were identified for adoption by Honeywell.

For example, a chief engineer or systems design lead submits a target specification to subsystem design teams. The specification is highly aligned to the “Critical to Quality” customer requirements of the design offering. Initially, each subsystem team defines a design space of alternative approaches to achieve a robust system design offering. The subsystem teams then meet to present their design alternatives and collectively perform successive system-level experiments designed to find the optimal solution. The subsystem teams then meet to present their design alternatives and collectively perform successive system-level experiments designed to find the optimal solution. Analysis at the system level is necessary to determine loads on subsystems and assemblies and component parts — with all designs studied carefully with computer models.

Within Honeywell’s VPD initiative, ANSYS technology is particularly valuable for stress, vibration and heat-transfer analyses of rotating hardware such as fans and compressors, as well as static equipment such as engine frames and cases. Linear and non-linear analysis is done, often taking into account creep, plasticity and contact forces. Optimization and design of experiment (DOE) studies are done to evaluate and refine designs. The models carry a fair amount of detail and make use of fine meshes to accurately represent the complex contours of aerospace components.

In one study to predict vibration in mistuned jet-engine turbines, a parametric finite element model of an impeller blade was created with a specified range of variables defining its shape. ANSYS Probabilistic Design System (PDS) then automatically went through numerous iterations in which modal deformation and stress were determined for various blade geometries. A transfer function based on the PDS database of the results helped define the regions of the airfoil in which geometric variations have the greatest impact on vibration. This information then was used to optimize the design of the blade for minimal stress and vibration within a range of operating frequencies. In this way, the best design of the blade for a particular application could be determined. The use of simulation to achieve this goal saved months of time and tens of thousands of dollars in hardware testing.

As Honeywell Aerospace moves forward with VPD, the focus will be on the following:

- Establishing one set of development processes to deploy globally
- Using common design and simulation tools
- Assuring technology readiness before starting detailed design
- Improving the development estimating processes and disciplines
- Becoming obsessive about “Design to Unit Cost”
- Significantly increasing “Design Re-use”

At Honeywell, VPD is a key part of the “Lean Enterprise” in which value from the customer’s perspective drives the process, waste is eliminated, and the workforce is involved in an atmosphere of continuous improvement. Engineering simulation is a key element enabling the company to meet these objectives and strengthen its competitive position in the aerospace market.