A DFLSS team set-out to optimize the design of a complex fighter jet environmental control system (ECS). The ECS was analyzed for critical to quality characteristics (CTQs); of all the CTQs identified, the ability of the control system to transition to emergency mode was deemed the most critical to quality.

Emergency mode transition is required if this single engine fighter jet experiences an engine failure at altitude. Without the engine operating, the bleed air from the engine would no longer be available for pilot life support. The transition mode enables the auxiliary power unit turbo-machine to take over and provide life-sustaining air to the cockpit.

The Design for Lean Six Sigma team therefore analyzed system variability to ensure smooth, safe transition. This involved functional mapping of the system and identifying design parameters most likely to affect this transition mode. Scripts were then developed to exercise a Matlab/Simulink mathematical model with an analytical design-of-experiments. Due to the size of the model, the scripts took several hours to run (it was left running overnight).

A simplified model (transfer function) of the transition mode was developed and analyzed to understand the factors affecting this transition mode. The analysis revealed response times for two specific valves in the system were drivers of the performance of the system during emergency mode. Specification limits were clarified and the valves were proactively designed to ensure flawless system performance. The ECS system was later tested revealing a successfully achieved emergency mode transition.

Proactively modeling and analyzing design performance helped the team avoid several thousand dollars in troubleshooting, redesign and test costs.