Fuel/Burning Test

Issue

The rejection of an acceptable batch of rocket motor propellant, due to an inaccurate test, results in $40,000 loss of propellant. The acceptance of non-conforming batches of propellant and subsequent casting of rocket motors eventually results in a $700,000 recovery effort when the motors are rejected during lot acceptance testing.

Breakthrough Strategy

Measure	Process mapping identified the process input and output variables. The process inputs were further characterized as critical parameters, process parameters, standard operating procedures, tribal knowledge, and noise. A Cause and Effect Matrix and an FMEA were used to define the relationship between KPIV's and KPOV's.
Analyze	Hypothesis testing was done in an effort to further characterize the effect of KPIV's on the KPOV's. Gage studies were also performed to quantify the uncertainty of the process output (burn rate test data).
Improve	The primary tool used was the Design of Experiments (DOE) to determine a mathematical expression describing the burn rate test as a function of pressure and temperature. Another DOE was designed to determine if delay time between propellant mixing and strand casting is a significant factor affecting burn rate results.
Control	The short-term control approach involves procedural modifications establishing tolerances for controlling KPIV's and the addition of pressure and propellant temperature measurement and recording. The long-term action plan is to provide a PC-based data and control system that has the capability to sequence the process, initiating testing only when the specified test conditions are met.
Results	Traditional testing method was an inadequate tool for accurate test results for higher burning propellants. Increased burn rate test sizes are now utilized.
Savings	$740,000 in lost propellant and engine recovery