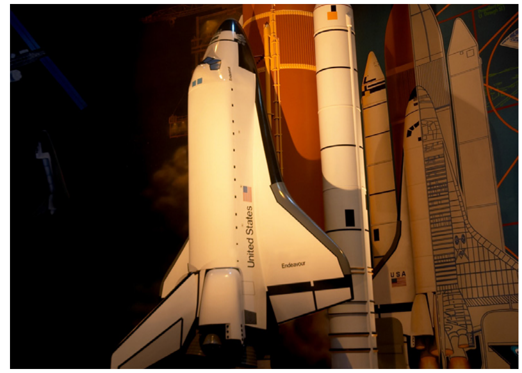
Rocket Booster Transport Schedule & Supply Chain Analysis

Aerospace and Aircraft Mfg

Thiokol Propulsion

Success Story

ProModel Optimization Suite



SITUATION

At T minus six seconds, the space shuttle's three main engines ignite and pilots prepare for launch. At T minus three seconds, the main engines reach 90 percent of thrust. At T minus zero, flight computers ignite two of the world's largest segmented boosters. Boasting a combined thrust of nearly six million pounds, these leviathan motors heave the shuttle from the earth and hurl it into orbit.

As you might guess, these 149 foot tall, 12 foot diameter, 1.3 million pound (when loaded) boosters are quite expensive to build and maintain. To combat the high costs associated with the boosters, our engineers designed the rocket motor segments to be recovered, refurbished, and reused as many as 20 times each. This complex task requires special facilities and equipment.

To transport the booster segments to Utah for servicing, we use special rail cars. These cars are lined with uniquely developed insulation and carry instruments necessary to monitor temperature and climate for each segment. Since we own a limited number of these cars, we must carefully plan every transport to ensure that the cars are available and accessible. To do this, we adopted the use of simulation modeling.

OBJECTIVES

Master schedulers assemble a schedule of how often we need to ship loaded motors to Cape Kennedy and how often we have to bring burned out flight hardware back to Ogden. If we can maintain that schedule, we can maintain the flight rate NASA needs. Our question was how could we make certain we had enough rail cars to support the flight schedule? If we took these rail cars in and out of the shipping fleet for maintenance actions, how could we make sure we always had enough cars available to transport rocket segments?

If schedulers increase the number of flights per year, it poses a potential problem. Since the cost of purchasing additional rail cars is enormous, we must look at other options. Rather than purchase new cars, we could pay huge premiums to one of several different railroads to put the car on a fast train instead of making the boosters wait at several different sites. Alternatives included finding a way to expedite the maintenance activities performed on rail cars or constructing additional service facilities. The problem was that we could not assess the impact of any of these options on the entire system—the supply chain is complex and contains much variation.

RESULTS

With this model, we can take new launch schedules from NASA and immediately determine the most cost-effective way to meet that schedule. Now we have an alternative to purchasing $600,000 rail cars.

The bottom line is that we are able to save time and money, NASA can meet their flight schedules, and management can feel confident with proposed changes.

This model will be used on an ongoing basis to test possible ways to improve or completely revamp the supply chain when NASA requires a major flight schedule change. In our next project we will look at synchronized scheduling scenarios to reduce inventory and overall span time.

SOLUTION

Using ProModel, we created a simulation model that exactly mimics our entire rocket supply chain system to see how variations to the current system would delay or speed up the process. Input parameters were set up so that the Logistics department, and not the programmers of the model, could run "What-If" scenarios and test possible solutions without worrying about affecting the integrity of the model.

It allowed schedulers to model travel time, the number and availability of rail and Pullman cars, shift schedules, and maintenance activity time. Additionally, Logistics analyzed potential solutions such as including dedicated facilities to service the rail cars, additional workers or shifts, and other changes that may speed up the process. When they changed model parameters, the simulation provided them with the actual dollar cost of the proposed change. Using ProModel's run-time capability, we were able to allow the Logistics department to use the model on an ongoing basis while we continue to build other applications.