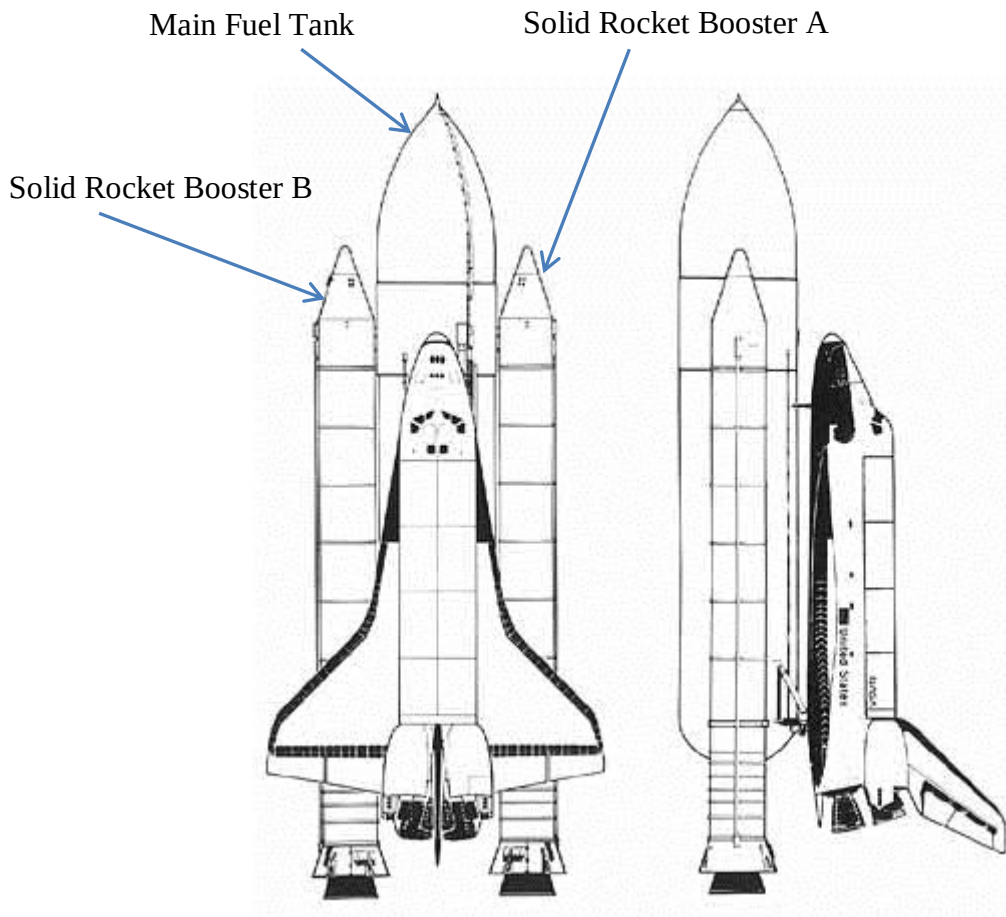


Case Study Problem

The Challenger Explosion

On the morning of January 28th 1986 the decision was made to launch the space shuttle Challenger (STS 51-L). The engineers at Morton Thiokol were unhappy about the decision but could not persuade managers that there was any possible danger in launching the shuttle. On launch, two rubber O-rings leaked and the shuttle exploded. The air temperature that day was approximately 30F.

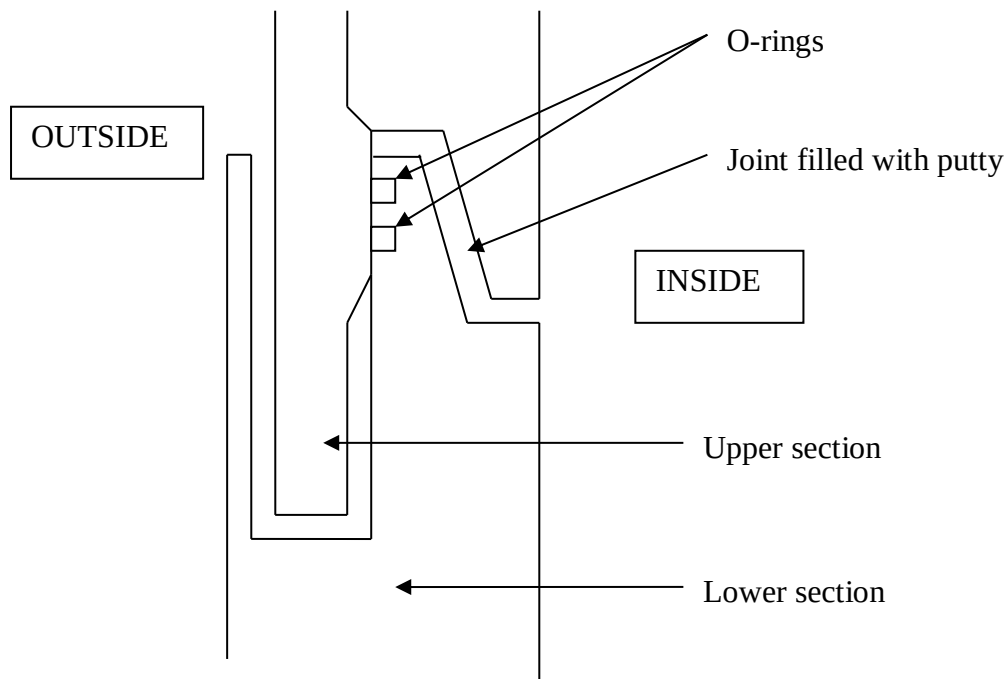


Space shuttle in launch configuration¹

Background

When it launches, the space shuttle has two solid rocket boosters (usually referred to as SRBs, although in some Morton Thiokol documentation the term Solid Rocket Motor, or SRM is used), A and B, on the right and the left of the main fuel tank. These are built in several different segments and then joined together. At each joint the top section slides into the bottom section and the joint is filled with putty to ensure a good seal. Two O-rings are also used as backup safety devices; if hot gas from the inside of the booster escapes through the putty then it will be stopped by the O-rings, which fit tightly all the way around the circumference of the joint (see diagram below).

¹ <http://www.hq.nasa.gov/office/pao/History/rogersrep/v1p3.jpg>



Simplified diagram of SRB joints

It is very important that the O-rings fit tightly, as any escape of hot gas from the booster would be catastrophic. They are made of rubber, which shrinks at low temperatures. If the temperature is low enough then they shrink so much that they no longer provide an effective seal. This is what happened to the Challenger – the O-rings failed and the booster exploded, destroying the shuttle with it. (It's slightly more complicated than that, and involves soot particles and unexpectedly high winds but that's the gist of it.)

Your tasks

- Watch the television documentary on the loss of the Challenger (links available through Moodle) to get the background to the problem.
- Look at the data provided in the 'Original Documents' file and identify **three** different ways in which the data presented makes it difficult to understand the threat to the shuttle.
- Using data selection and rearrangement, redesign the presentation of the data in order to make the correct decision (not to launch) more obvious.
- Create one or more diagrams that make clear the dangers of launching the shuttle at low temperatures.
- Identify **three** ways in which your data presentation is easier to understand than the original