AN ACCIDENT ROOTED IN HISTORY

This public-domain NASA image pinpoints the place where the accident causing the loss of *Challenger* began. NASA describes the image with these words: "Shown here is an interior view of the scorched hole in Space Shuttle *Challenger's* right Solid Rocket Motor. The tapered edges along the hole indicate the inside to outside path of the fire that led to the accident." Click on the image for a full-page view.

Two solid rocket boosters are used during a shuttle's launch - one to the right and the other to the left of the external tank. Because the SRBs are reusable, both Morton Thiokol (their maker) and NASA (their user) could test how they performed during launch.

Although they appeared to perform well (to those not on the inside track), the solid rocket boosters had a fundamental, potentially fatal design flaw.

A solid rocket booster and its solid rocket motor are made separately. The booster and the motor become a single unit when their sections are joined together. Before the *Challenger* disaster, it was the joining of those sections - in the joints themselves - where prior problems during tests and actual shuttle flights had been noted.

The primary culprits were the rubber "O-rings" used to seal joints. Especially in cold weather, the O-rings had a tendency to erode. When they eroded, they could no longer completely seal joints.

Unsealed joints could set up potential failure modes. Morton Thiokol and NASA knew that before the *Challenger* disaster.

Eroded O-rings led to misaligned ("rotated") joints. Misaligned joints led to undesirable things like exhaust gas blowing through, and out of, the solid rocket booster. Exhaust gases must be kept away from the shuttle's external tank (which contains liquid hydrogen and liquid oxygen).

If the rings were not properly sealed, gases would escape. Morton Thiokol and NASA knew that before the *Challenger* disaster.

Erosion of the O-rings had been noted by Morton Thiokol and NASA after other shuttle missions. Because the rings had not failed, however, officials decided the erosion was an "acceptable" flight risk.

As the President's Commission investigating the disaster and its cause later noted in the official report, chapter 6, the *Challenger* disaster was:

> *An accident rooted in history.*

And what a terrible history it was.

See Alignments to State and Common Core standards for this story online at:
http://www.awesomestories.com/asset/AcademicAlignment/AN-ACCIDENT-ROOTED-IN-HISTORY-Challenger-Disaster

See Learning Tasks for this story online at:
http://www.awesomestories.com/asset/AcademicActivities/AN-ACCIDENT-ROOTED-IN-HISTORY-Challenger-Disaster

Media Stream

Challenger - Area Depicting Burn-Through in the Right SRM

NASA image; online via NASA. Public Domain.
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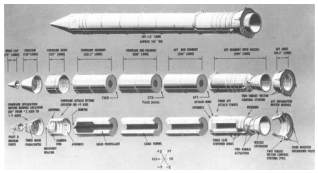

Space Shuttle - Solid Rocket Booster in Segments

Image online, courtesy NASA and "Report of the Presidential Commission on the Space Shuttle Challenger Accident."
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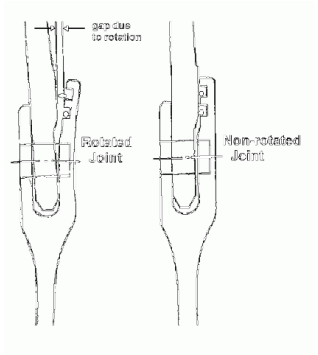

Illustration of Rotated Joint on Solid Rocket Motor: Space Shuttle

Image from "The *Challenger* Accident: Mechanical Causes of the *Challenger* Accident," by the University of Texas. Online, courtesy NASA.
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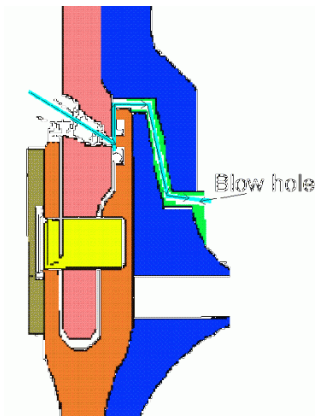

Space Shuttle: Failed O-Ring Causes Blow Hole

Image from "The Challenger Accident: Mechanical Causes of the Challenger Accident," by the University of Texas. Online, courtesy NASA.
The linked illustration - by Kapitel - depicts a simplified cross-section of the field joints which existed between the assembled segments of the Solid Rocket Boosters which NASA used in the *Challenger's* STS 51-L mission. The following legend describes the drawing's details:
A - steel wall thickness 12.7 mm
B - base O-ring gasket
C - backup O-ring gasket
D - Strengthening-Cover band
E - insulation
F - insulation
G - carpeting
H - sealing paste
I - fixed propellant
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