Our Ethical Findings in the Challenger Disaster

Presenter: Francisco Lara

The NASA Situation

- Cost efficient space transport system.
- Compete with Russian Space Program.
- US Government pressure to see results.
- Gain public interest.
- NASA came up with the Space Shuttle Transport System.

Space Shuttle Transport System

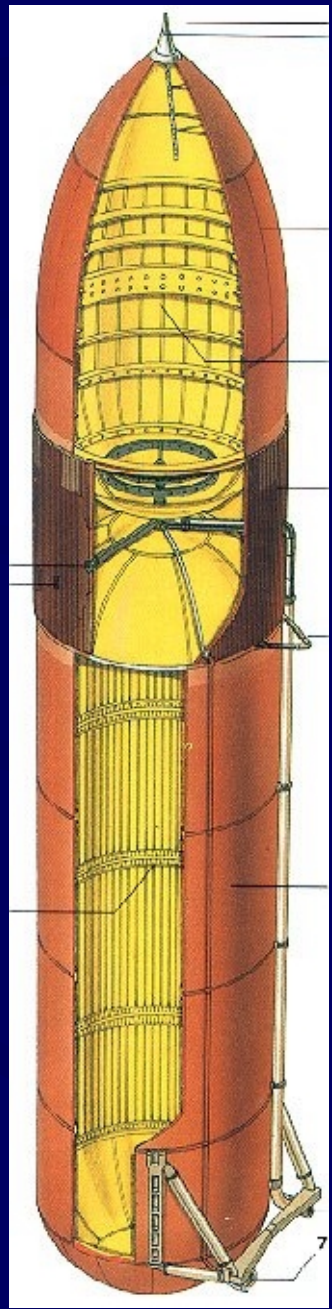
- Reusable manned vehicle.
- Transport payloads into orbit and back.
- Consists of three main Parts:
  - The Orbiter
  - The External Tank (ET)
  - Solid-Rocket Boosters (SRBs)

The Orbiter

- Resembles an Aircraft.
- Three different operational modes:
  - Launched as a Rocket.
  - Operates as a Spacecraft.
  - Lands as an Aircraft.

External Tank (ET)

- Only part that is not recycled.
- Carries fuel for space shuttle's 3 main engines.
- Feeds orbiter with fuel.



Solid-Rocket Boosters (SRBs)

- Responsible for takeoff.
- 11 individual segments.
- Recovered, maintained and reused.
- Segments reinforced with:
  - Fiber glass tape.
  - Rubber seal bands known as O-Rings.
- Major part of Challenger Disaster Investigation

A Formula For Disaster

- Reasons for catastrophe:
  - Faulty design of O-rings.
  - Low temperatures at launch time.
  - “No Launch” recommendation overruled.
  - Negligence of technical problems.
  - Re-usage of SRBs.

The O-Ring Situation at Morton Thiokol

- Morton Thiokol (MT): Builder of the SRB.
- Knew about O-ring problems for over a year.
- Roger Boisjoly: MT Employee, discovers O-ring malfunction.
- Concluded that hot gases were seeping through during rocket's burn.
- Deformation of O-rings in low temperatures.

Roger Boisjoly's Course of Action

Jan 1985, discovers problems & reports to superior

Feb 1985, presented problem to NASA.

Consulted colleague, suggested to test his findings

Mar 1985, Resiliency test performed

Jun 1985, post flight inspection, found primary seals eroded

July 1985, presented test results to NASA

Aug 1985, formation of Seal Task Team

Oct 1985, presented seal problem to 130 technical experts

Jan 27, 1986, gave final presentation to NASA & MT mgt. With recommendation, not to launch under 12°C

Jan 28,1986, Roger Boisjoly witnessed Challenger blow up

The Actions Taken by the Actors

Roger Boisjoly

- Detected problem and reported to superior.
- Presented problem to higher authorities.
- Consulted colleague.
- Ran some test.
- Formed Seal Task Team.
- Gave final presentation and recommendation not to launch.

NASA and MT Mgt.

- NASA authorized flight after being warned of defects.
- MT decides resiliency test on seals are too sensitive to release.
- MT forms Seal Task Team under pressure by Roger Boisjoly.
- MT under manages the efforts of Seal Task Team.
- MT Mgt. overrule Roger's recommendation not to launch.
- NASA accepts.

The Consequences

- Seven human lives
  - 6 Astronauts
  - 1 High School Teacher
- Challenger Orbiter.
- Trust in Manned Space Program.
- Billions of dollars.

Steps To Alleviate

- 13 member Presidential Commission assigned to investigate disaster.
- Technical details, decision making and management infrastructure were scrutinized.
- Report showed that O-Ring malfunction at low temps. was the reason for failure.
- Endeavor was made to replace Challenger.
- O-Ring design was altered and improved.
- SRB design also altered.

Who Is To Blame? (The big picture)

- The Commission blamed NASA.
- Commission made recommendations:
  - Overhaul of Shuttle management.
  - Shuttle Safety Program
  - Greater involvement of astronauts in safety operations.
- Commission concluded flawed decision making in behalf of NASA.

Who Is To Blame? (The small picture)

- MT blamed Roger Boisjoly
- Argued, he seeped confidential information.
- As a result, Boisjoly and other engineers who testified to Commission were demoted.

What About Software Engineering

- Taught designing is important part of project. "Get things done right the 1st time."
- Field's short life experience has taught that a sound design from the start saves both time and money.
- However we need to devote time to testing.
- Main objective is to satisfy Specifications.

To Conclude

- Engineers build big things that affect society in big ways.
- Undertake this responsibility
- Every part of system is of importance
- Our duty is to satisfy the specifications.

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