



Case study on

The Space Shuttle Columbia disaster

DR. M.ELANGO VAN

PROFESSOR, DEPARTMENT OF AEROSPACE ENGINEERING

SNS COLLEGE OF TECHNOLOGY





The Case.. investigates the causes of the disaster



The 28th flight STS-107 flight of Space Shuttle Columbia disintegrated upon **re-entry** into Earth's atmosphere.

Occurred on February 1, 2003

Resulted in the loss of all seven crew members aboard the shuttle





Objectives of the Mission

The primary mission objectives of STS-107 were to conduct various scientific experiments in the fields of space and life sciences, material sciences, and Earth and space observations.

The crew conducted experiments related to combustion, plant growth, fluid physics, and more.

Mission Name: STS-107

Space Shuttle: Columbia (OV-102)

Launch Date: January 16, 2003

Landing Date: February 1, 2003

Mission Duration: 15 days, 22 hours, 20 minutes





Crew of Columbia Space shuttle

- 1. Rick D. Husband (Commander):** Colonel in the U.S. Air Force.
- 2. William C. McCool (Pilot):** Commander in the U.S. Navy.
- 3. Michael P. Anderson (Payload Commander):** Lieutenant Colonel in the U.S. Air Force.
- 4. Ilan Ramon (Payload Specialist):** The first Israeli astronaut and a colonel in the Israeli Air Force.
- 5. Kalpana Chawla (Mission Specialist):** An Indian-born American astronaut and the first woman of Indian origin in space.
- 6. David M. Brown (Mission Specialist):** Captain in the U.S. Navy.
- 7. Laurel B. Clark (Mission Specialist):** Commander and flight surgeon in the U.S. Navy.



Kalpana Chawla



Rick D. Husband



Laurel B. Clark



Ilan Ramon



Michael P. Anderson



D





Foam Strike:

The immediate cause of the disaster was a piece of insulating foam that broke off from the shuttle's external fuel tank during liftoff. This foam struck the left wing, damaging the thermal protection tiles. The foam strike was captured on video but was not initially recognized as a serious problem.





Damage to Thermal Protection System:

The foam strike created a breach in the shuttle's thermal protection system.

During re-entry, superheated air entered this breach and damaged the wing's internal structure.

This damage ultimately led to the breakup of the shuttle.

1. Launch: 16 Jan 2003
Foam from external tank strikes wing





Lack of In-Orbit Inspection:

Despite the fact that the foam strike was observed, NASA management did not consider it a critical issue.

They failed to conduct an in-depth inspection of the shuttle's thermal protection system using available imagery and sensors.

This was a crucial oversight that could have revealed the extent of the damage





Organizational and Cultural Factors:

The Columbia Accident Investigation Board (CAIB) identified several organizational and cultural factors within NASA that contributed to the disaster.

These factors included a normalization of deviance, where recurring issues with foam strikes were not treated with the seriousness they deserved.

Also, there was a lack of effective communication between





Inadequate Risk Assessment:

NASA's culture often prioritized schedule and mission completion over safety concerns.

Risk assessments were sometimes downplayed, and dissenting voices within the organization were not always heard.

The culture led to a lack of vigilance regarding safety issues.





Lack of Contingency Planning

NASA had no effective plan for addressing catastrophic damage to the shuttle's thermal protection system, even though the possibility of such damage had been acknowledged.





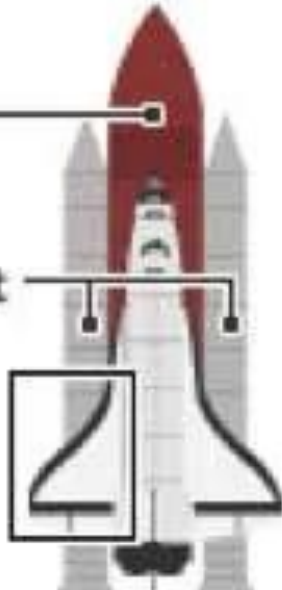
1. Launch: 16 Jan 2003

Foam from external tank strikes wing



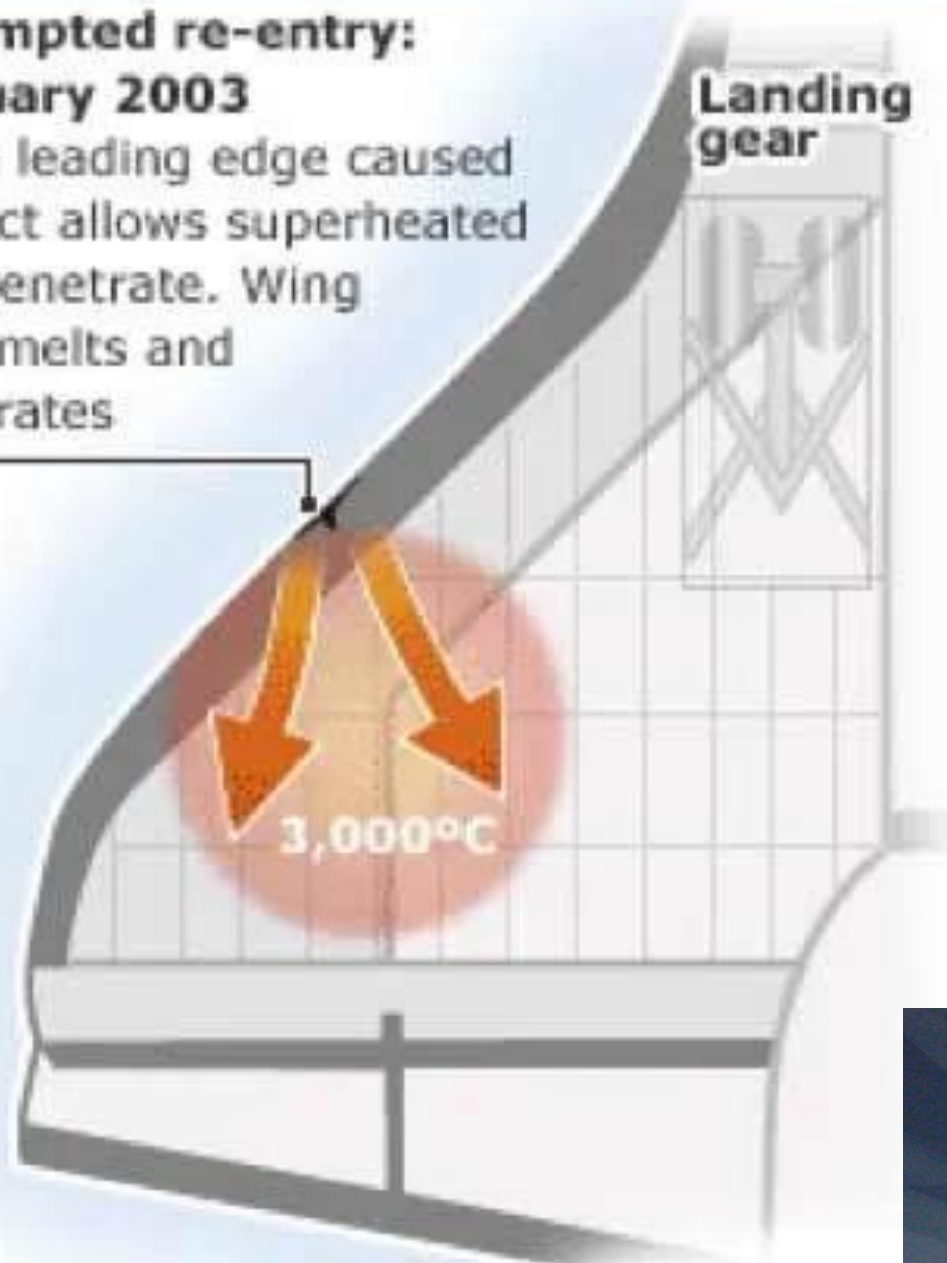
External fuel tank

Solid rocket boosters



2. Attempted re-entry: 1 February 2003

Crack in leading edge caused by impact allows superheated gas to penetrate. Wing interior melts and disintegrates





The final report

The Columbia Accident Investigation Board's final report, released in August 2003, highlighted these causes and made numerous recommendations to improve the safety and culture within NASA.

The disaster ultimately led to changes in NASA's organization, procedures, and safety protocols to prevent similar incidents in the future.

It also grounded the Space Shuttle program for more than two years until enhancements were implemented.





THANK YOU

