"Suresh Kulkarni gave this invited speech to the Engineering School of Osmania University in January 2019 as possibly it's most influential senior graduate, who was given the final responsibility to launch all manned US spacecraft, representing hundreds of B$ and many lives."
His proud teacher Carl H. Gibson

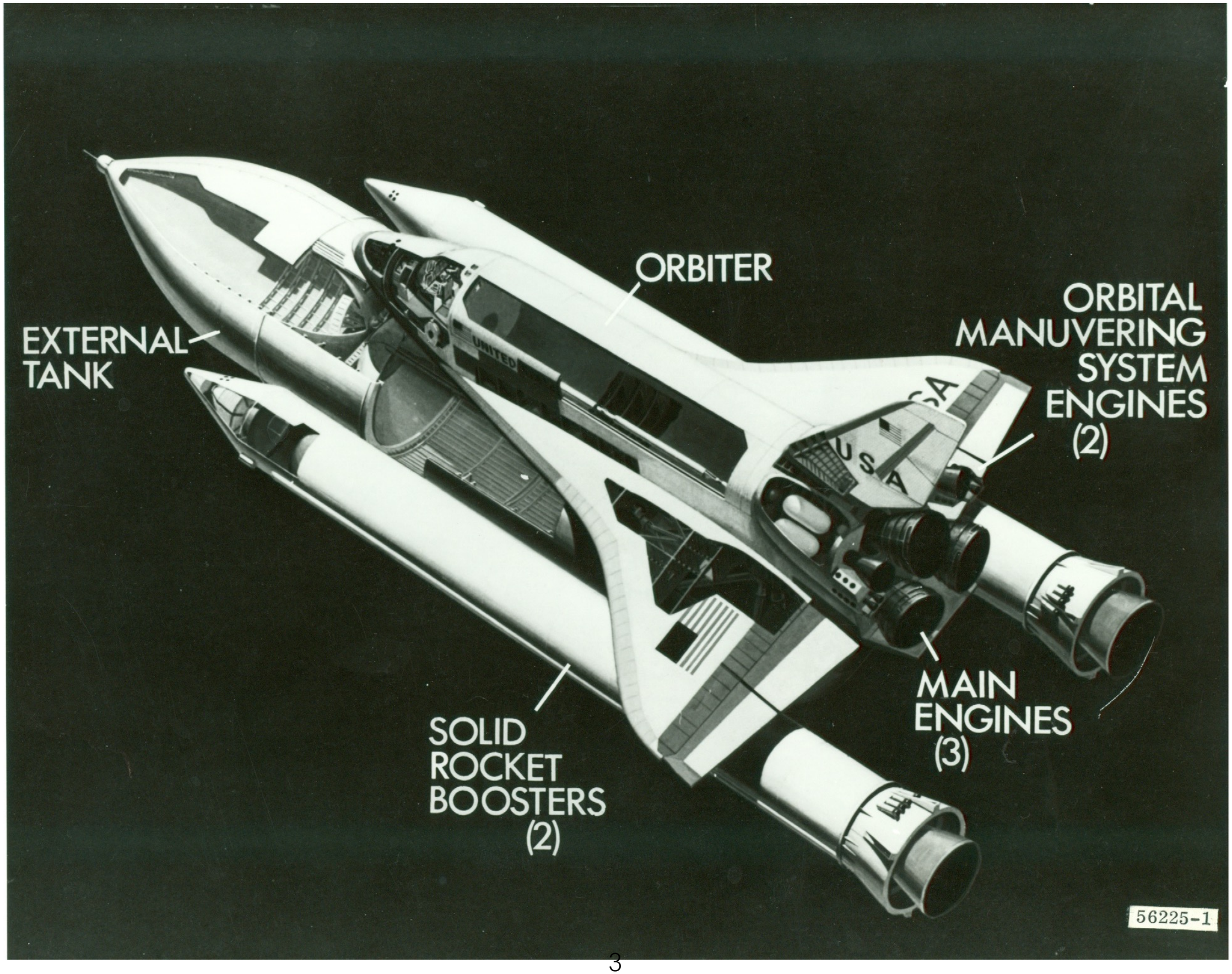
1962-1964

See journalofcosmology.com volume 26 for details.

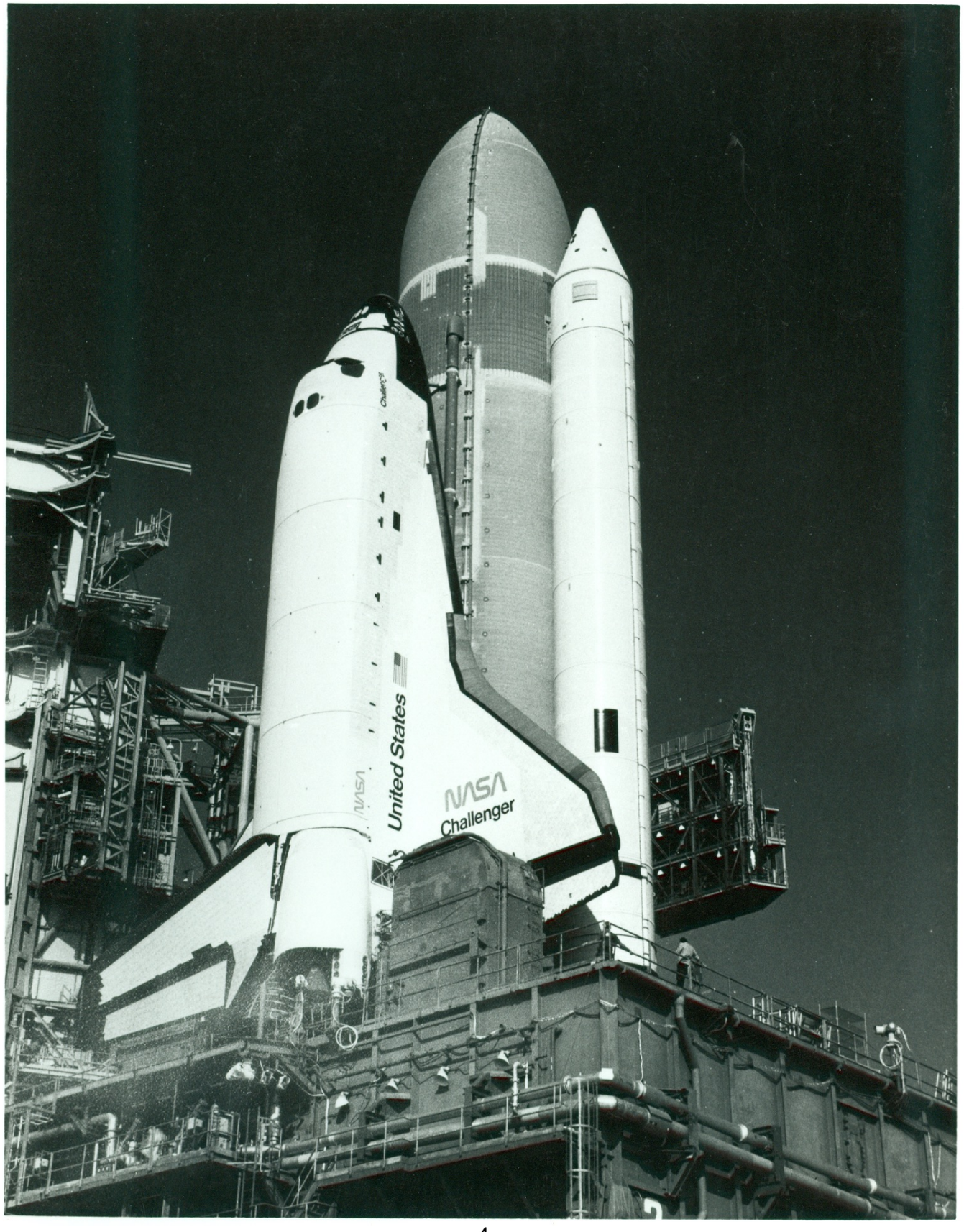
Engineering Role
Pre and Post Challenger

Dr. Suresh Kulkarni
Retired Vice President of Space Engineering
Thiokol Corporation, Brigham City, Utah

Introduction



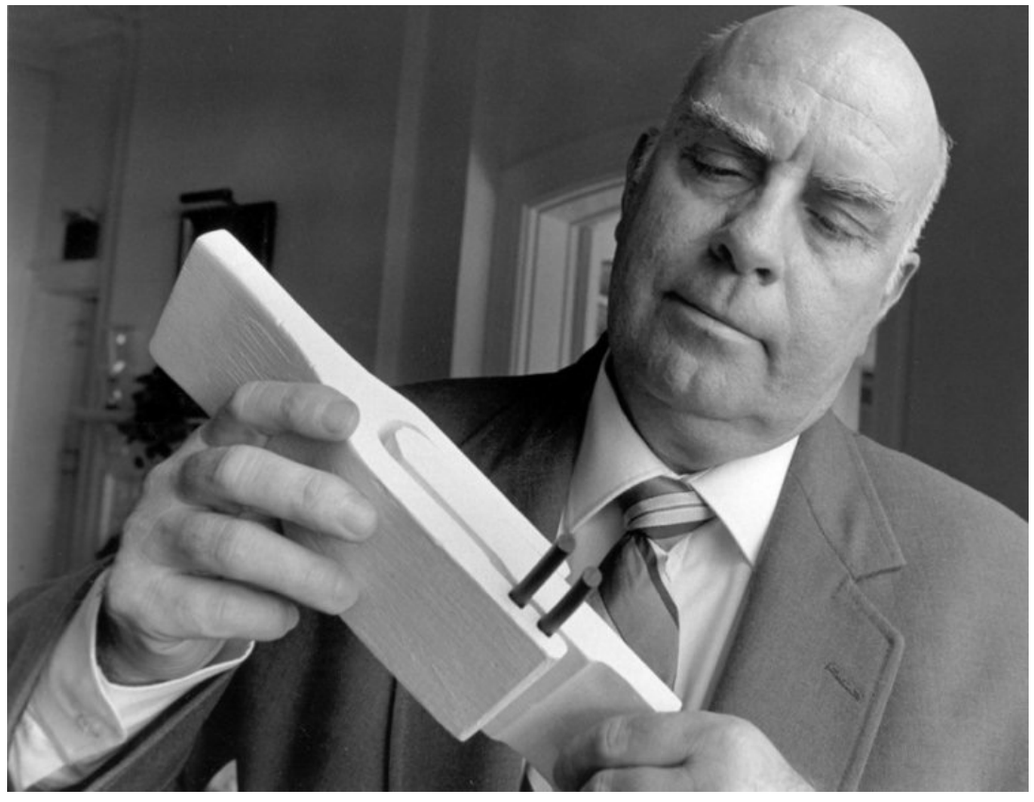
Introduction (continued)



Challenger Disaster Background – 26 January 1986

- Robert Ebeling: “God, you picked a loser.”
- Roger Boisjoly

Robert Ebeling



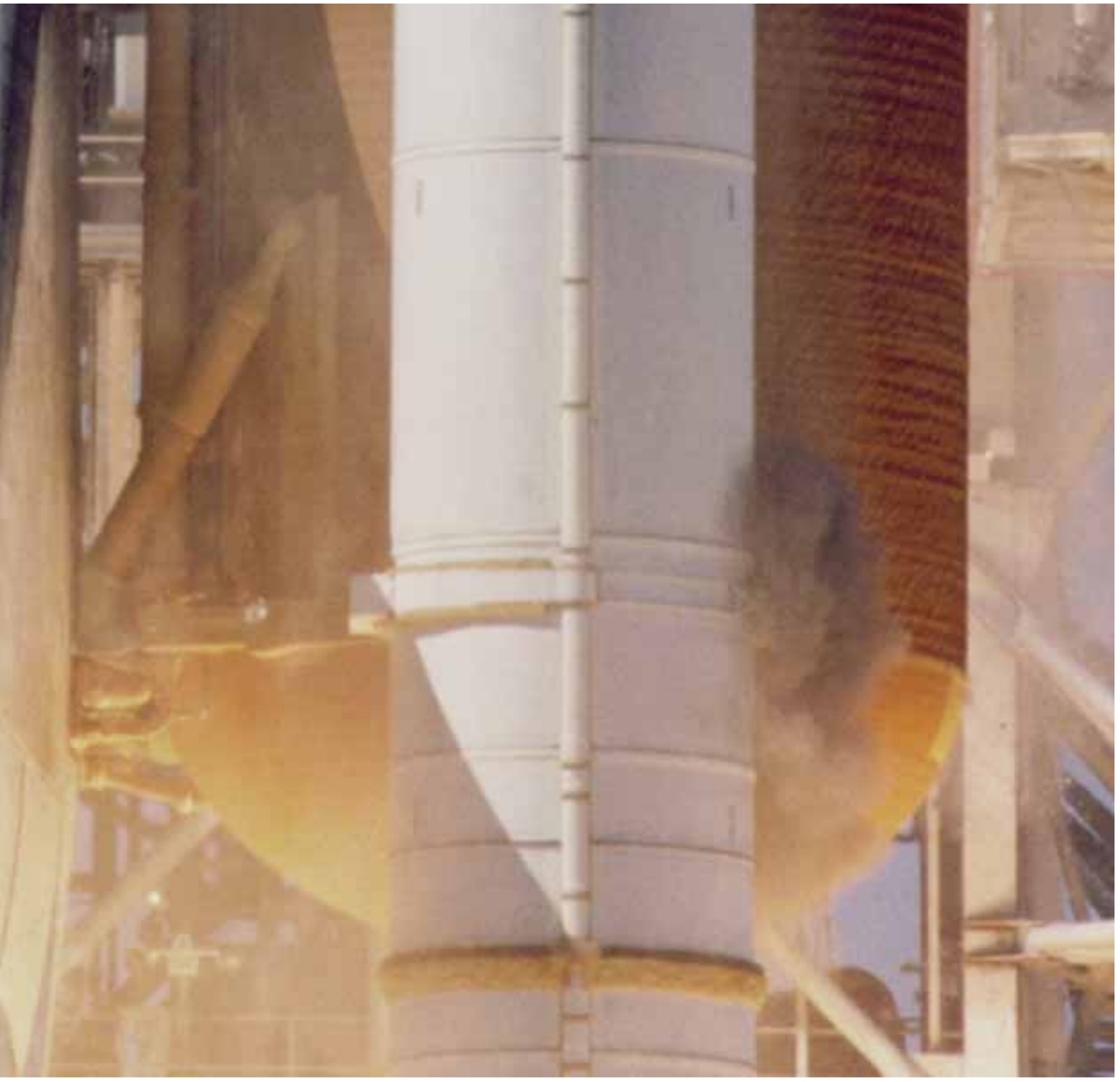
Roger Boisjoly

NASA and Thiokol Role Reversal on check and balance

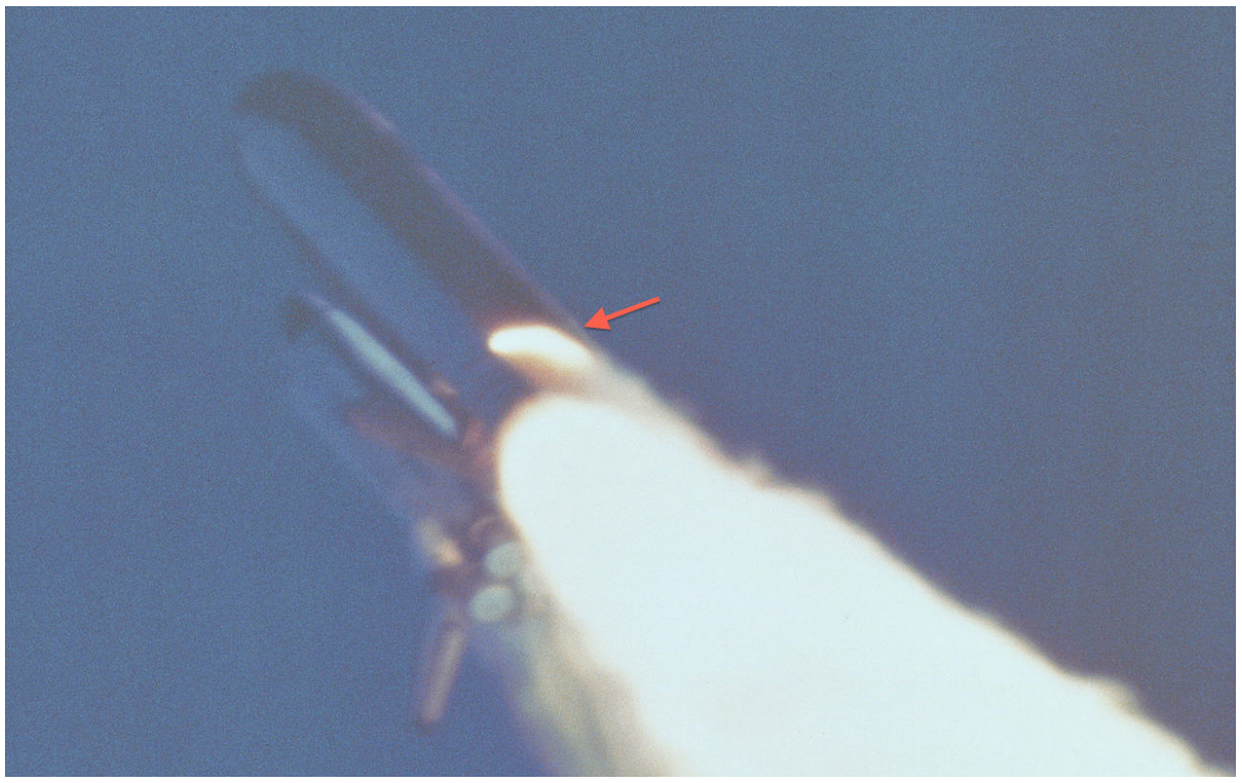
Presidential Commission Finding

"The space shuttle's solid rocket booster problem began with the faulty design of its joint as both NASA and contractor management first failed to recognize it as a problem, then failed to fix it, and finally accepted it as an acceptable flight risk."

Challenger Launch



Gray smoke on booster



Booster rocket breach

Failed joint was recovered from ocean floor

Engineer’s Role – Pre Challenger

- Thiokol General Manager (GM) final authority on recommending "OK" for launch to NASA
- Engineering Vice President (VP) provided organization recommendation to GM
- NASA program manager forwarded Thiokol recommendation to KSC launch director
- Process was conducted by telecom
- Quality inspectors performed post flight inspection of hardware

Launch Control Center at Kennedy Space Center

Engineer's Role – Post Challenger

- Engineering VP had to present to NASA Level 1 Board at KSC flight acceptability of hardware
- Engineering VP had to certify in writing hardware was safe to fly
- Engineering VP presence required at KSC launch console – "Go ahead" for ignition 5 minutes before solid rocket motor ignition
- Engineering process strengthened at Thiokol
  - Pre-ship review for each rocket motor segment
  - Flight Readiness review at Thiokol
  - "Out of family" discrepancy review and approval by Engineering VP
  - Post flight inspection of hardware performed by design engineers
  - Training on accountability

Initiatives to Improve Communications and Transparency

- Establishment of a dedicated Engineering Organization to support space shuttle rocket motors
- Establishment of Engineering Review Board chaired by Engineering VP to listen to engineers' concerns

- Establishment of a toll-free line at Thiokol and NASA, maintaining anonymity
- Colocation of engineers in manufacturing areas as well as at KSC in Florida and MSFC in Huntsville, Alabama

- Employee feedback survey every three years
- Frequent astronaut visits
- Weekly management walk-arounds
- Extensive use of statistical process control – over 10,000 inspection points
- Establishment of "Motor Mothers"

Best Advice by Thiokol General Manager

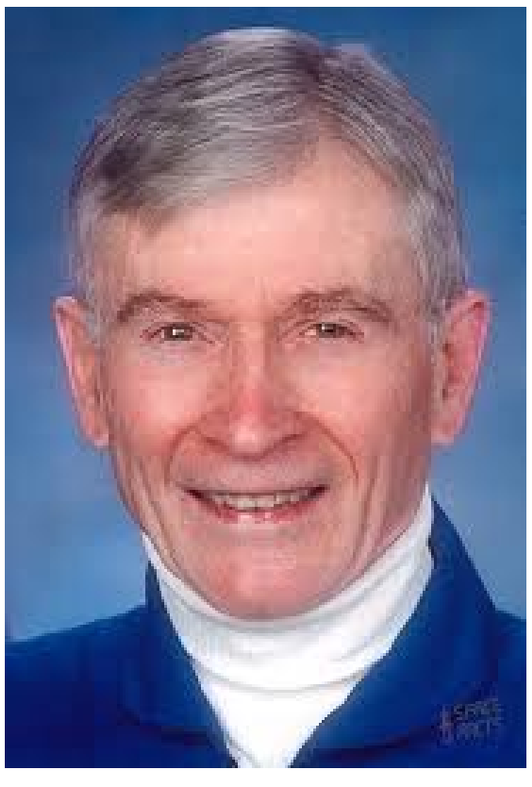
"The shuttle is not getting off the ground until you say Yes."

–Robert Lindstrom

Some Interesting Facts

- John Young's role as Director of Flight Safety
- My launch scrubs

John Young and Bob Crippen- 12 April 1981



John Young

And then Columbia disaster happened on 1 Feb. 2003

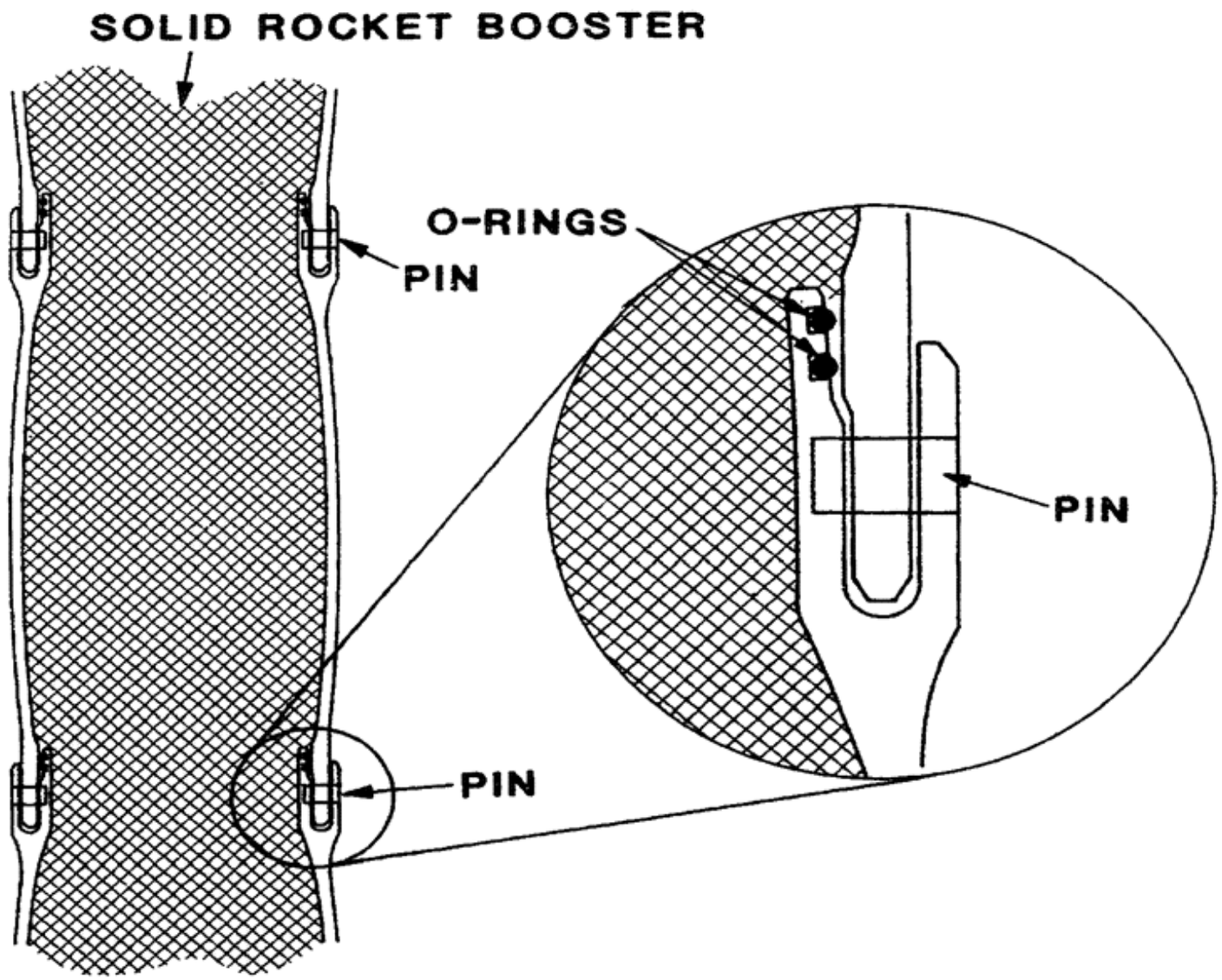
113th launch of 135 missions

Space Shuttle Future

Summary

When you see something, say something!

Appendix1- Challenger Field Joint



Appendix 2- Redesigned Field Joint