Jun 4th, 10:00 AM

STS-114 Bill Parsons

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STS-114

Return to Flight Lessons Learned

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Associate Program Manager
June 4, 2019

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Columbia Accident Investigation Board Report Executive Summary *(excerpt)*

"The organizational causes of this accident are rooted in the Space Shuttle Program's history and culture, including the original compromises that were required to gain approval for the Shuttle, subsequent years of resource constraints, fluctuating priorities, schedule pressures, mischaracterization of the Shuttle as operational rather than developmental, and lack of an agreed national vision for human space flight. Cultural traits and organizational practices detrimental to safety were allowed to develop, including: reliance on past success as a substitute for sound engineering practices (such as testing to understand why systems were not performing in accordance with requirements); organizational barriers that prevented effective communication of critical safety information and stifled professional differences of opinion; lack of integrated management across program elements; and the evolution of an informal chain of command and decision making processes that operated outside the organization's rules."

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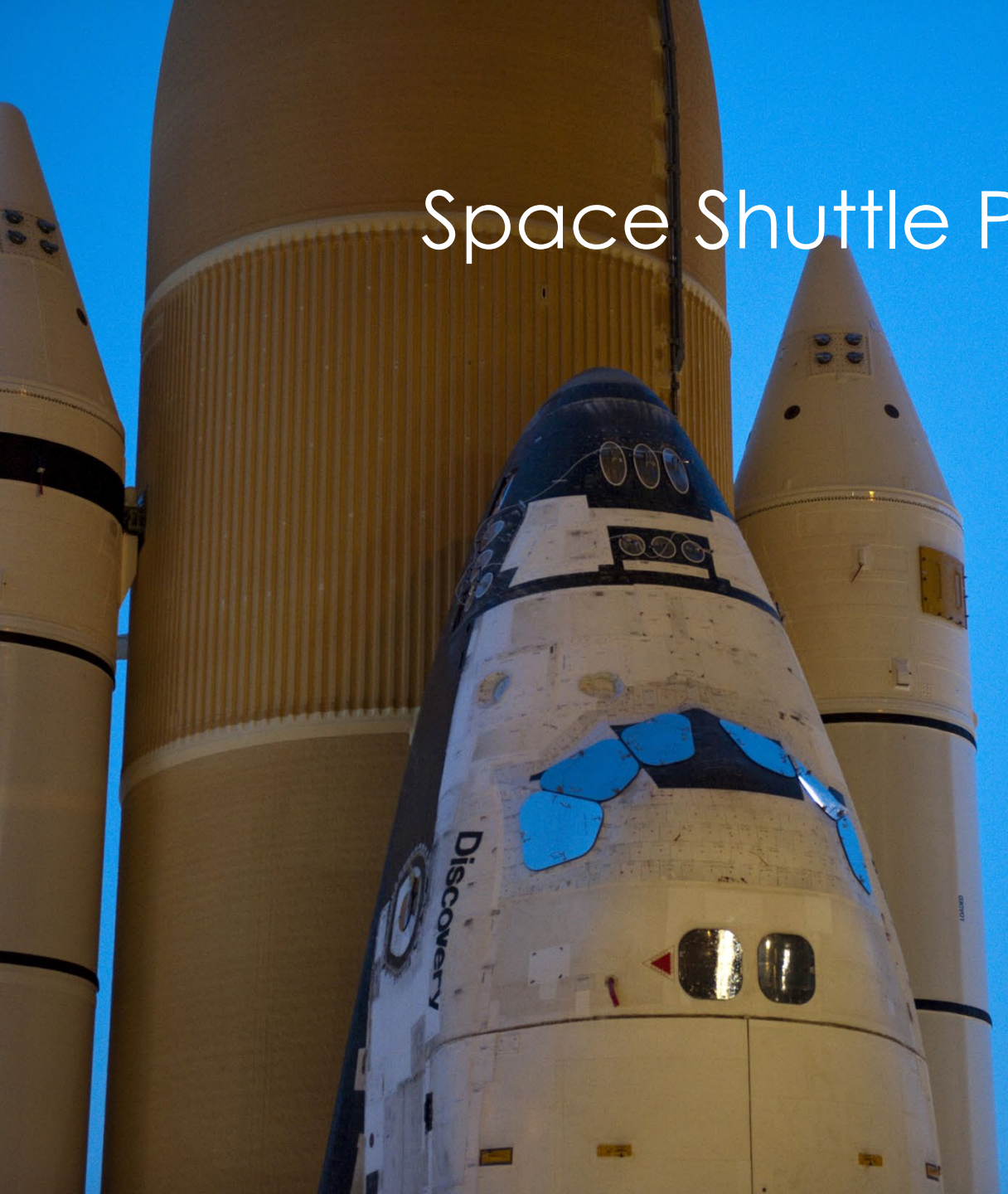

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Space Shuttle Program History and Culture

- Original compromises
- Resource constraints
- Fluctuating priorities
- Schedule pressure
- Calling Shuttle Operational versus Developmental
- Lack of a National Vision for Human Space Flight

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Cultural Traits and Organizational Practices

- Reliance on past success
- Lack of testing to understand system performance
- Stifled professional differences of opinion that prevented communication
- Lack of integrated management across Program Elements
- Evolution of an Informal Chain of Command allowing for decision-making outside of the formal process

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SETTING THE STAGE

- **Challenger Accident Backdrop**
  - Temperature at launch: 36 degrees Fahrenheit
  - Launch postponed three times and scrubbed once from original planned date of January 22, 1986
  - First teacher in space
  - State of the Union address scheduled evening of launch
- **Columbia Accident Backdrop**
  - 16-day mission included 80+ science experiments
  - Successful launch
    - "Typical" foam insulation shedding from external tank showed up on launch footage
  - Mission going well on-orbit; Mission Management Team elects not to meet daily
  - Heading into a 3-day Holiday weekend

Challenger Fast Facts

Launch Date: January 28, 1986, 11:38 a.m. EST

Accident: 73 seconds after launch

Orbiter: Challenger (OV-099) - 10th mission

STS-51L: 25th Space Shuttle Flight

Columbia Fast Facts

Launch Date: January 16, 2003, 10:39 a.m. EST

Accident: February 1, 2003, 9 a.m. EST - Columbia and crew lost during reentry over East Texas 16 minutes prior to planned landing at KSC

Orbiter: Columbia (OV-102) - 27th mission

Oldest Orbiter in the fleet (STS-1 in April 1981)

STS-107: 113th Space Shuttle Flight

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LEADERSHIP LESSONS

Leadership issues that contributed to each accident were very similar

"Based on NASA's history of ignoring external recommendations, or making improvements that atrophy with time, the Board has no confidence that the Space Shuttle can be safely operated for more than a few years based solely on renewed post-accident vigilance." (Source: CAIB Report, Vol. I, Aug. 2003, page. 13.)

Schedule vs Safety as a Priority

- Challenger
  NASA published a projection in 1985 calling for an annual rate of 24 flights per year by 1990, which drove pressure to hold launch date in spite of weather conditions outside of Launch Limit Criteria
- Columbia
  Didn't want to impact planned on-orbit mission objectives/science experiments by adding requirements for tile inspection Extravehicular Activity (EVA) or external imagery support

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LEADERSHIP LESSONS

Normalization of Deviance

- Challenger
  – O-Ring Unexplained Anomalies (UA) from previous flights
- Columbia
  – Foam shedding on other missions deemed “typical”

Suppressing vs Encouraging Dissent

- Challenger
  Solid Rocket Booster manufacturer’s Senior Vice President at home plant overruled Launch Site Chief Engineer and signed Certificate of Flight Readiness (CoFR)
- Columbia
  Numerous experienced Contractor and NASA personnel expressed concerns with foam shedding

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LEADERSHIP LESSONS

Technical Competence vs Bureaucratic Process

Bureaucratic Decision Processes

- Challenger
  - Decision to launch was flawed. Decision-makers did not take into full account:
    - Recent history of problems with O-rings
    - Contractor advising against launch with propellant bulk temperatures below 53 degrees Fahrenheit
    - Continuing opposition of engineers after management reversed its position
- Columbia
  - A culture of bureaucratic accountability emphasized chain of command, procedure, following the rules, and going by the book.
  - While rules and procedures were essential for coordination, they had an unintended but negative effect
  - Allegiance to hierarchy and procedure had replaced deference to engineers' technical expertise

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LEADERSHIP LESSONS

Enduring Lessons

- Speak up
- Dissention has tremendous value
- Question conventional wisdom
- Engineering is done with numbers

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