BASTION TECHNOLOGIES

Safety and Mission Assurance in in Human Spaceflight

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This cause of exploration and discovery is not an option we choose; it is a desire written in the human heart . . .

In memory of...

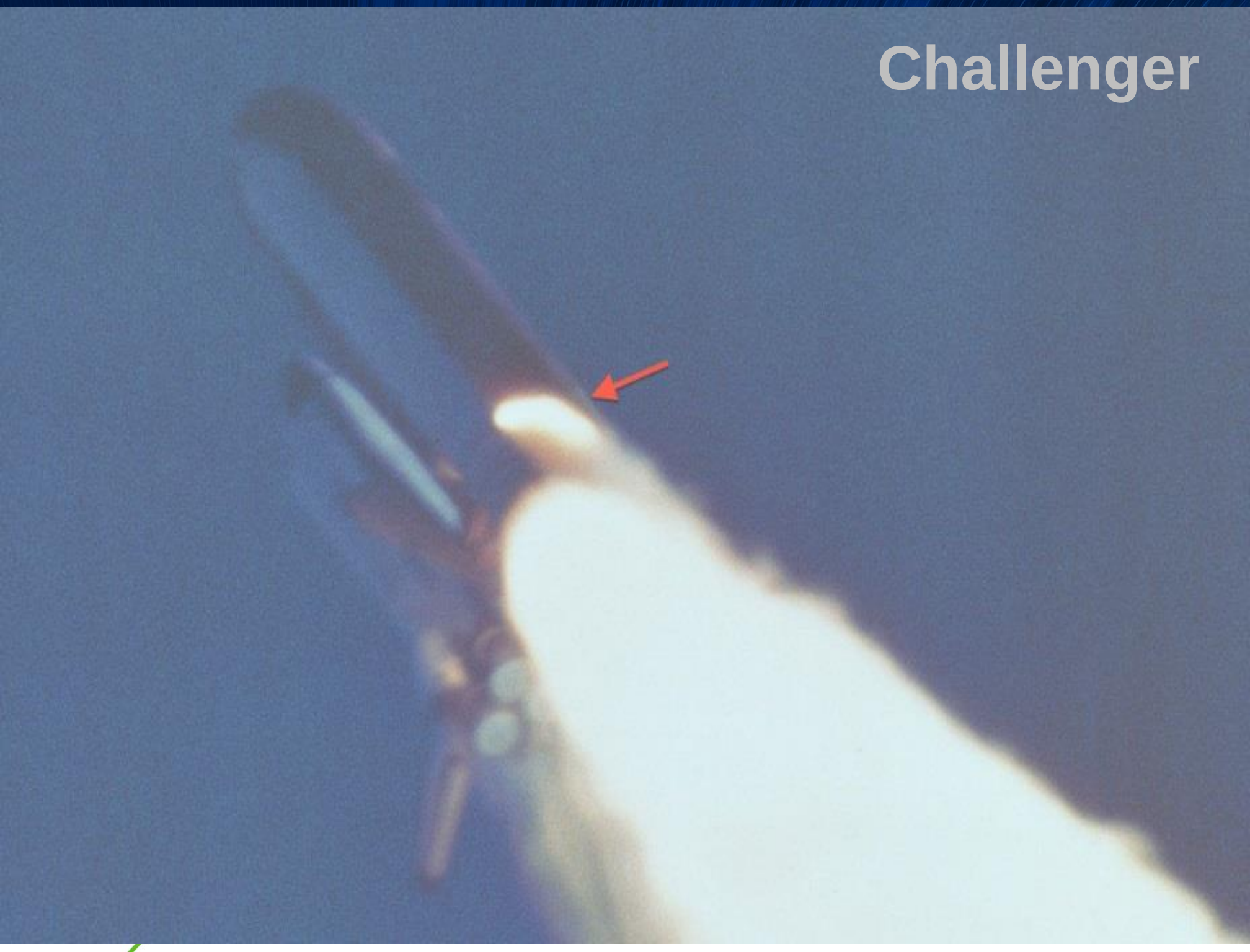
They go in peace for all mankind, and all mankind is in their debt. **– President George W. Bush, February 4, 2003**

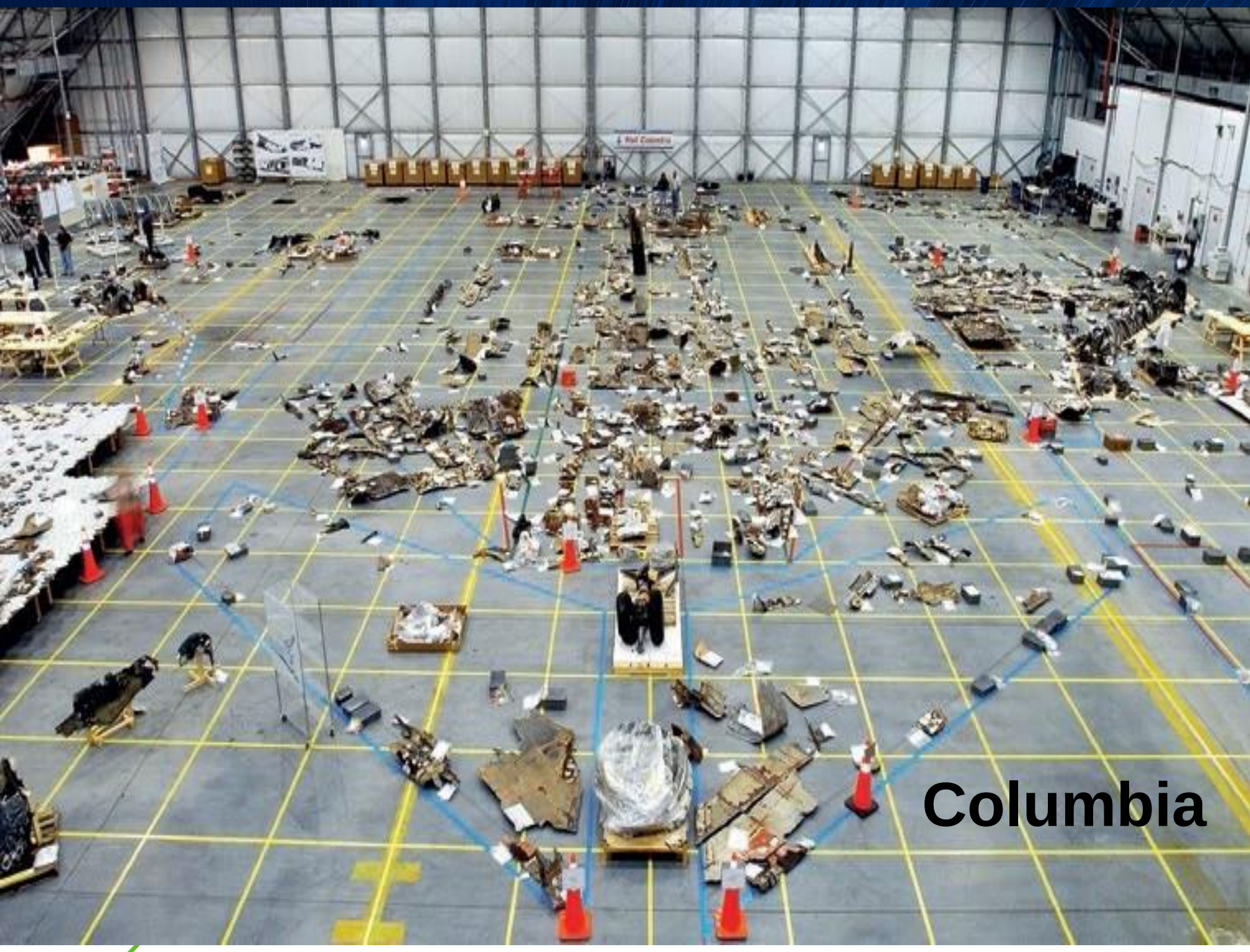
Outline

- **The evolution of SMA in human spaceflight at NASA**
- **What we can learn from Columbia and Challenger**
- **Lessons Learned applied to current programs**
- **SMA in future Human Spaceflight Programs**


Apollo 1
UNITED
STATES

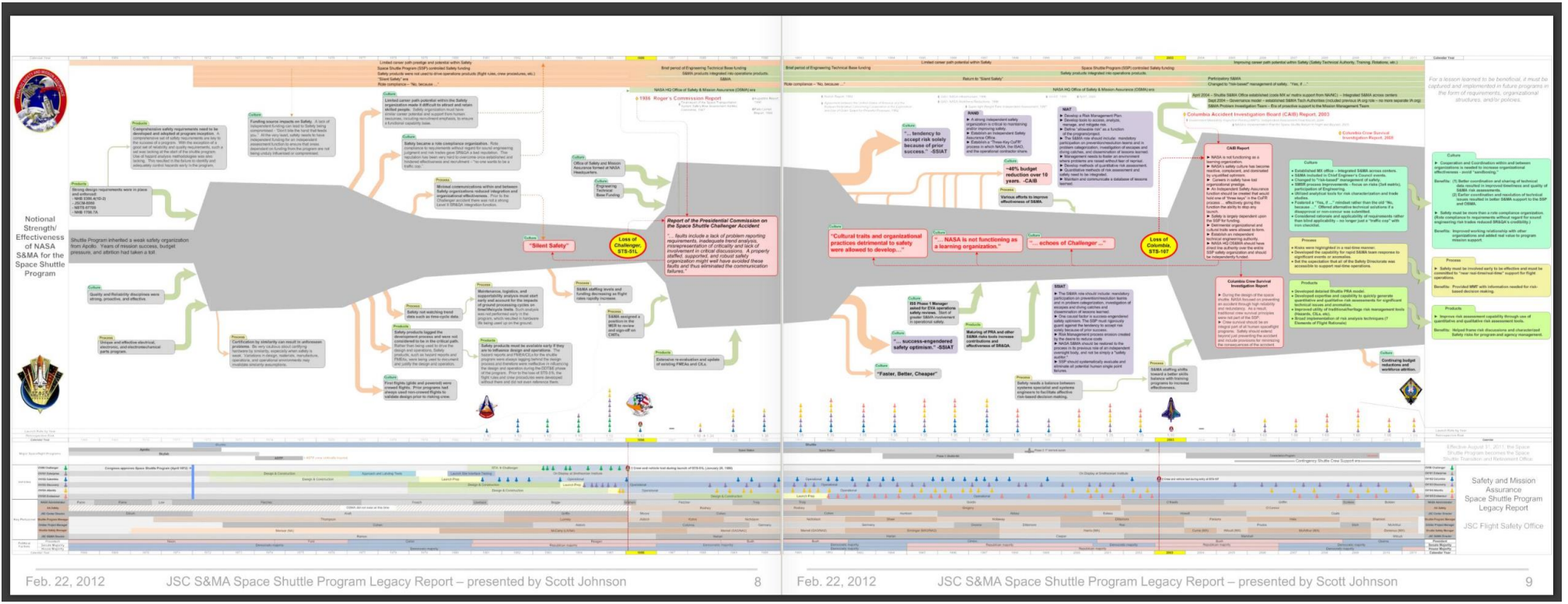
Challenger




Columbia

Evolution of SMA in Space Shuttle Program

From the "JSC S&MA Space Shuttle Program Legacy Report, presentation by Scott Johnson, February 22, 2012



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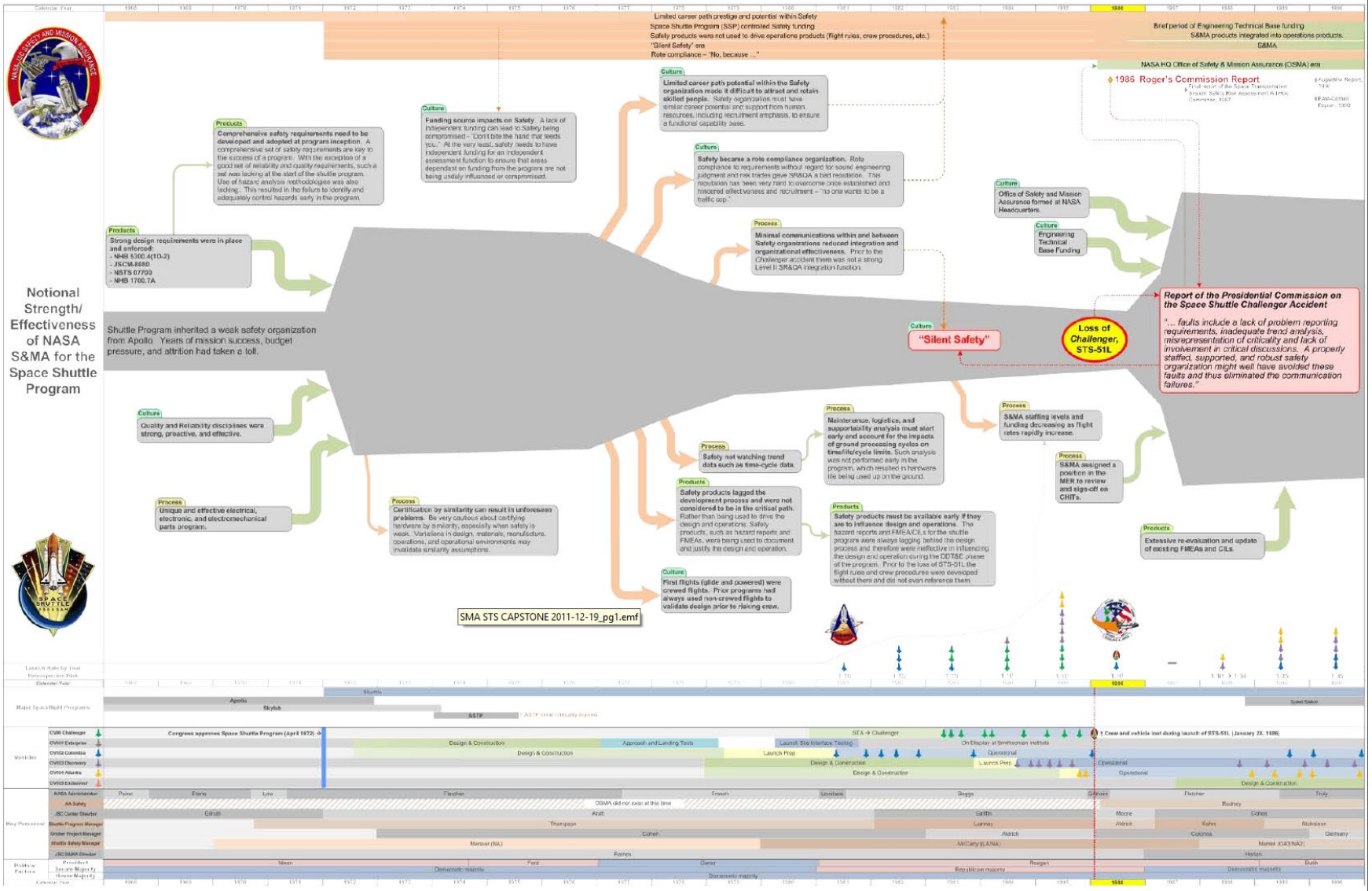
Evolution of SMA in Space Shuttle Program



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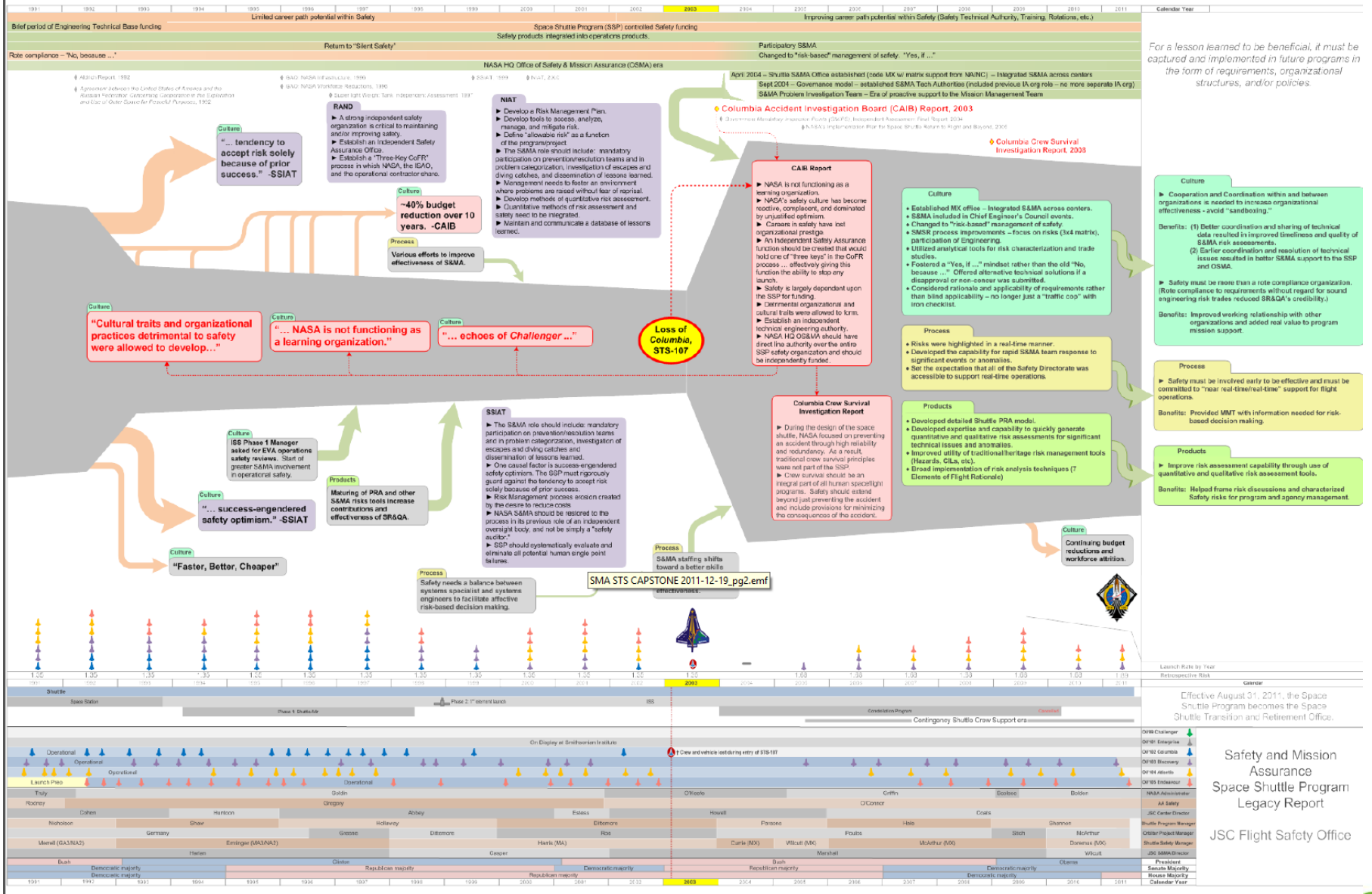
Evolution of SMA in Space Shuttle Program



For a lesson learned to be beneficial, it must be captured and implemented in future programs in the form of requirements, organizational structures, and/or policies.

What can we learn from Challenger and Columbia?

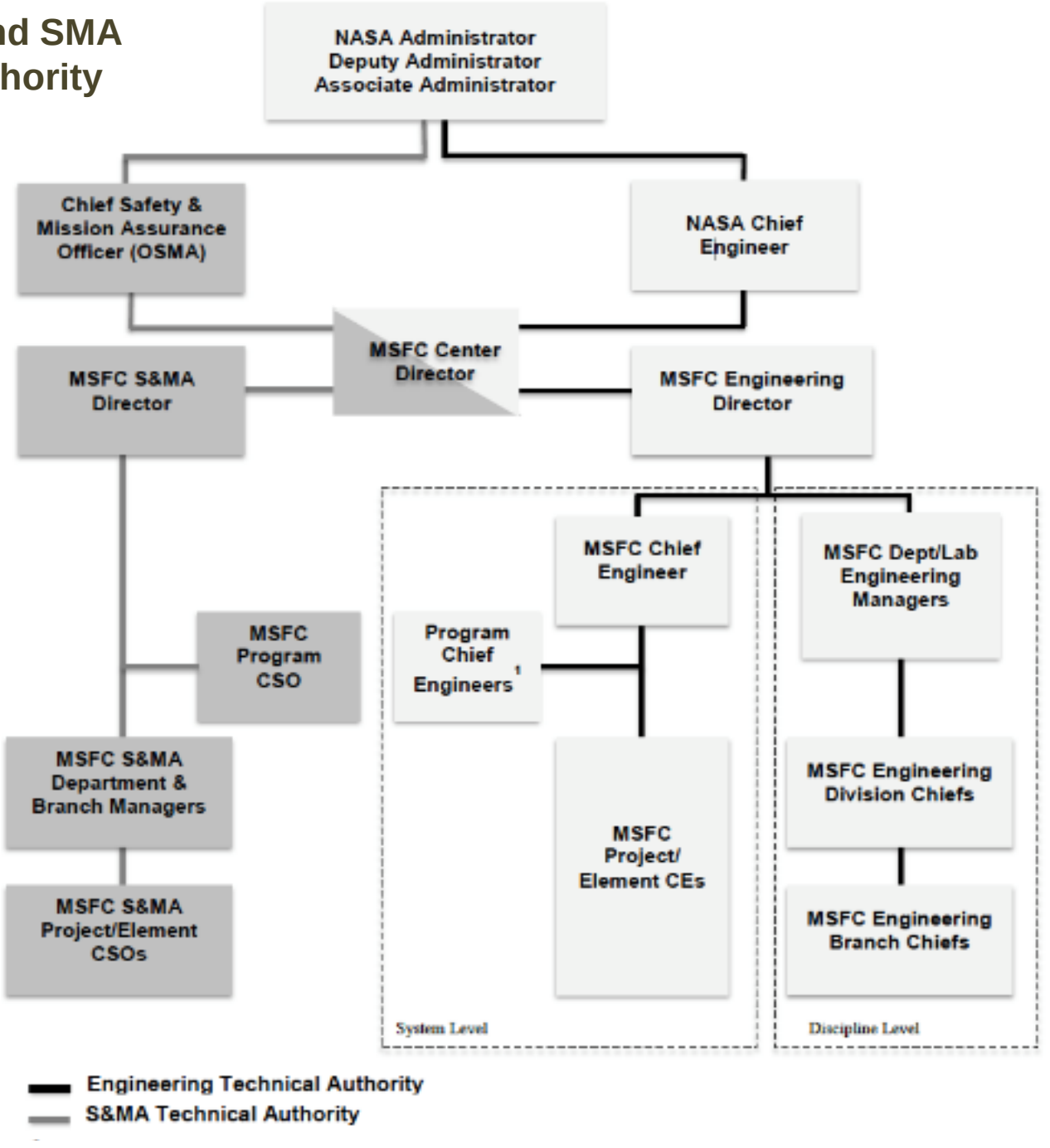
What can we learn from Columbia and Challenger?

- Beware of “normalization of deviance” and group think; don’t use past success to ensure future success
- Provide organization and culture where dissenting opinions can be heard
- Listen to the hardware, and be wary of how data can be misused or misrepresented
- You’re not as smart as you think you are; it can happen to you
- Keep safety programs independent from the programs they evaluate
- Employ a rigorous systems engineering process

- Sources: myself, Terry Wilcutt, Wayne Hale

- The evolution of SMA in human spaceflight at NASA
- What we can learn from Columbia and Challenger
- **Lessons Learned applied to current programs**
- Safety and Mission Assurance in future Human Spaceflight Programs

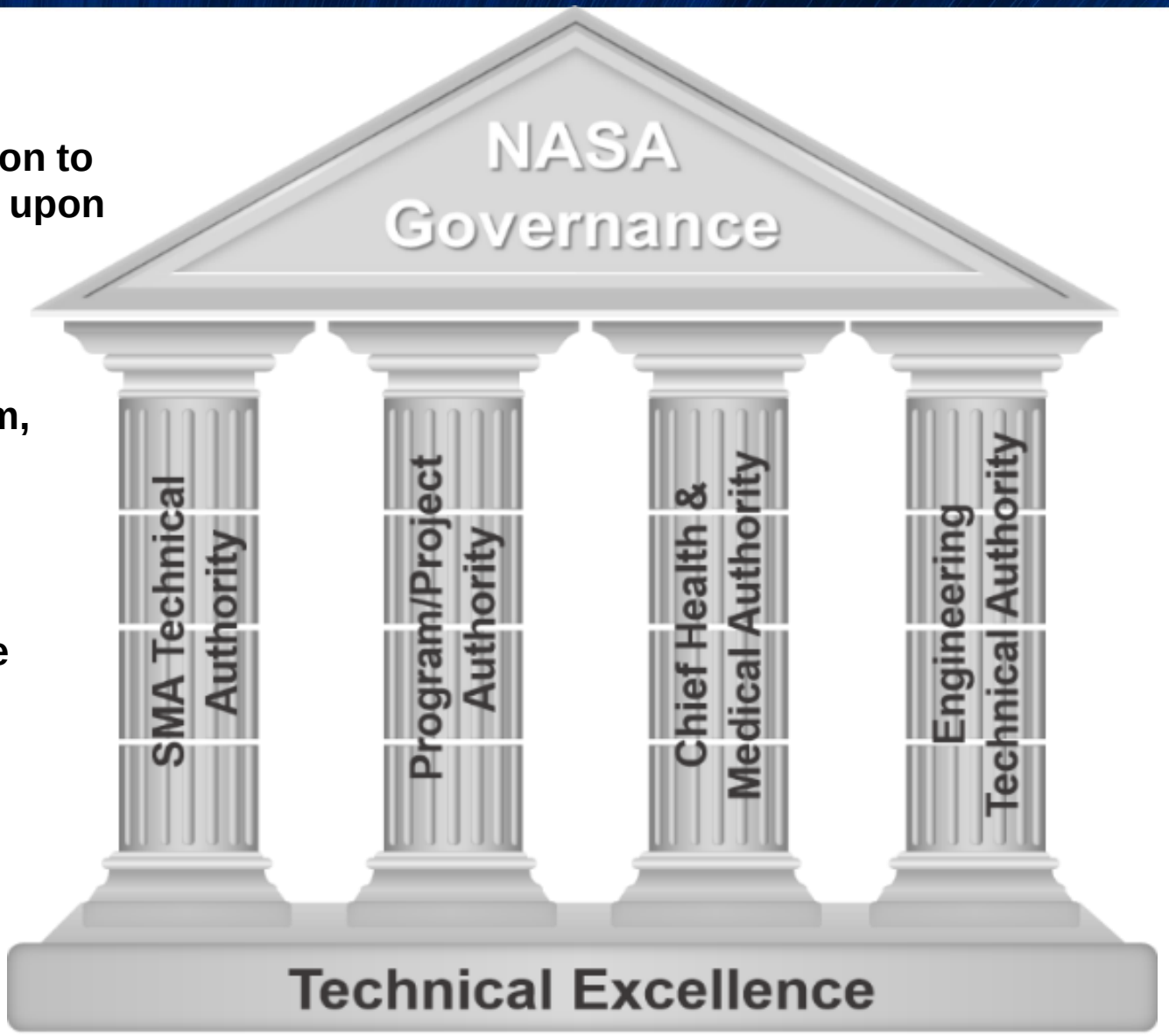
Engineering and SMA Technical Authority



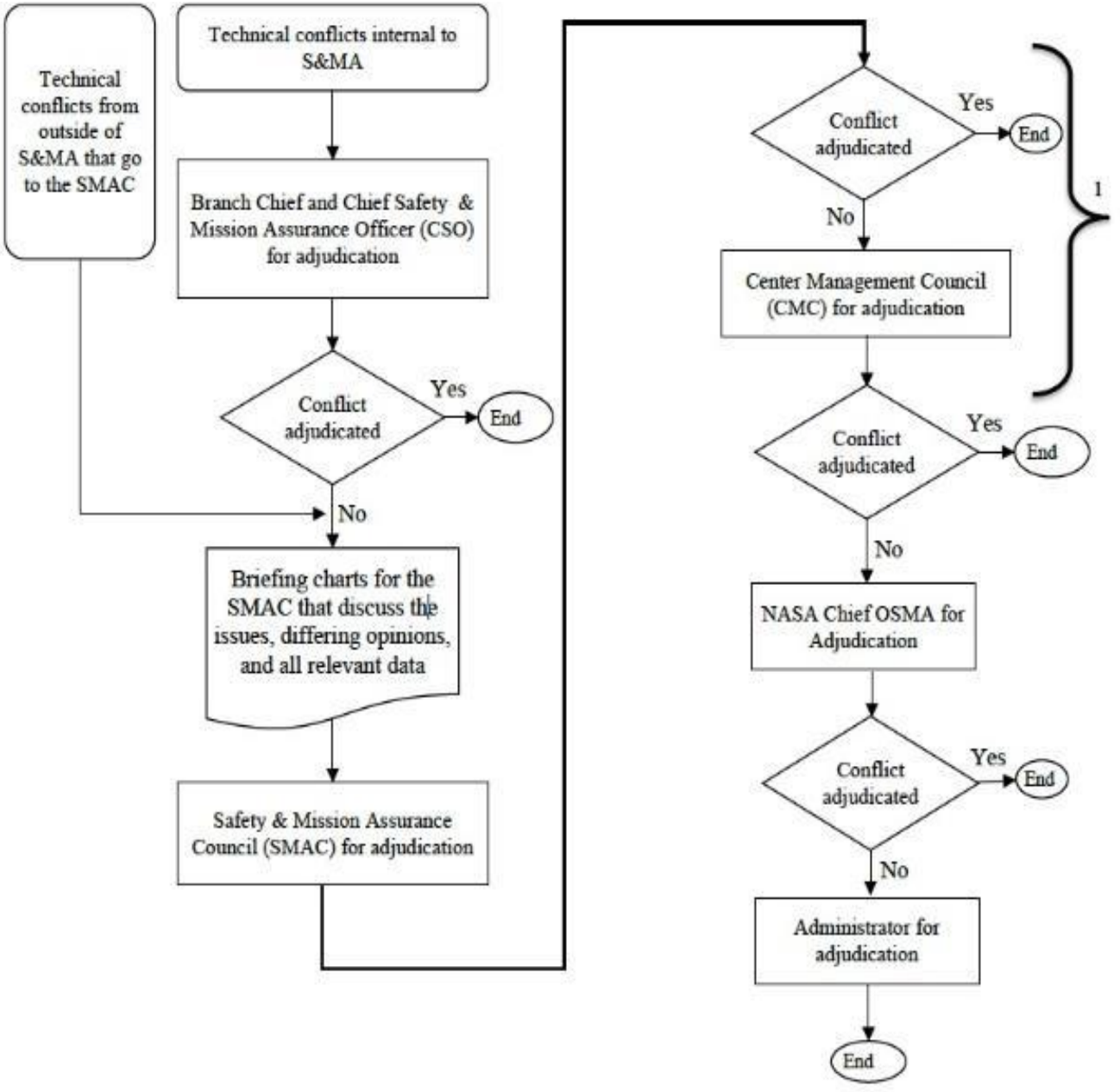
Programmatic Authorities Accept the Risk with Concurrence of the Technical Authorities

"NASA's constant attention to safety is the cornerstone upon which we build mission success.

We are committed, individually and as a team, to protecting the safety and health of the public, our team members, and those assets that the Nation entrusts to the Agency." NPD 1000.0.



Dissenting Opinion at the SMA Council (SMAC)



- The evolution of SMA in human spaceflight at NASA
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Applicability for Future Programs

- **Culture**
  - Cooperation and coordination within and between organizations is needed to increase organizational effectiveness
  - Benefits:
    - Better coordination and sharing of technical data results in improved timeliness and quality of SMA Risk Assessments
    - Earlier coordination and resolution of technical issues results in better SMA support
  - Safety must be more than a role compliance organization (role compliance to requirements with regard to sound engineering risk trades)
  - Benefit: Improved working relationship with other organizations and added real value to program mission support
- **Process**
  - Safety must be involved early to be effective and must be committed to "near real-time" support for flight operations
- **Products**
  - Improve risk assessment capability through use of quantitative and qualitative risk assessment tools
  - Benefit: Help frame risk discussions and characterize safety risks for program and agency management

From the "JSC S&MA Space Shuttle Program Legacy Report, presentation by Scott Johnson, February 22, 2012

Applicability for Future Programs

- **Periodically assess the health of the SMA organizations as they relate to human spaceflight by periodically taking into consideration:**
  - Budget trends
  - Staffing
  - Personnel turnover (loss of critical skills)
  - Anomaly trends/close calls
  - Use of dissenting opinion process
  - Review of SMA products
  - Development of relevant and effective tools for risk qualification and quantification
  - Open and multiple lines of communication
  - Integrity of Independent Technical Authority for engineering and for SMA

Conclusions

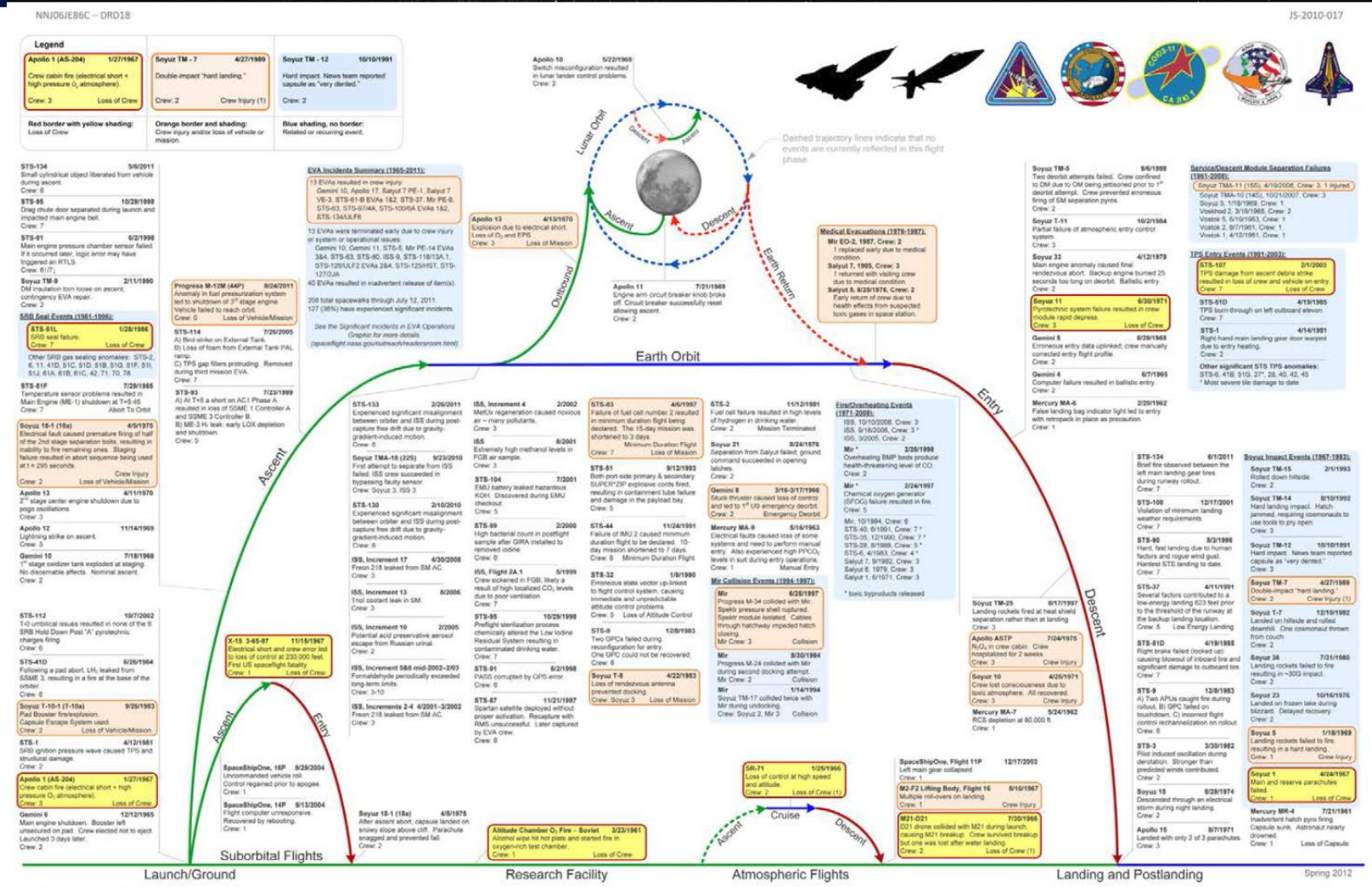
- SMA has evolved over time through accidents, funding shortfalls, and reorganizations to become a mission success organization that is an integral part of programs and projects
- By involving SMA "early and often" in programs and projects, relevant value added inputs can be made to ensure mission success
- A SMA organization can be effective by providing more advanced tools, such as Probabilistic Risk Assessment, and qualitative and quantitative risk assessments that provide a program or project manager with a way to assess, mitigate, and accept risk

Conclusions (cont.)

- The Independent Technical Authority improved the visibility, technical competence, and leadership positions within SMA
- The dissenting opinion process and safety culture addresses ways and environment for people to express their opinions
- NASA Safety Center and other collaborative efforts have provided repositories and information for sharing lessons learned

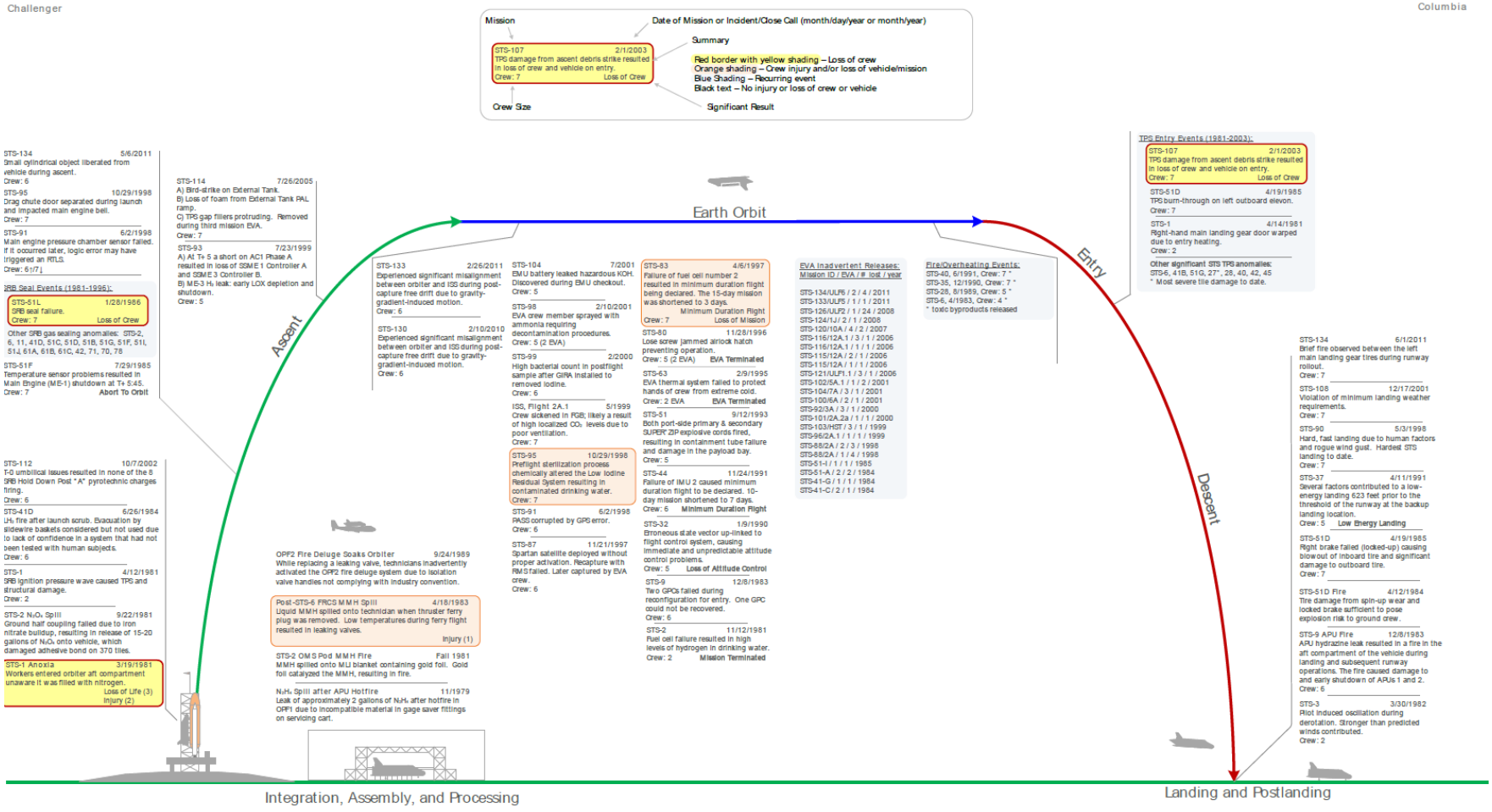
BASTION TECHNOLOGIES

Significant Incidents and Close Calls in Human Spaceflight



Significant Incidents and Close Calls in Human Spaceflight (Space Shuttle Only)

Significant Incidents and Close Calls in Human Spaceflight: Space Shuttle Program



SMA Is An Integral Part Of Mission Success

CONCEPT EVALUATION

Provides a second, independent involvement in design, development, test & evaluation to incorporate checks and balances. Protect lives, high value assets and critical mission success.

REQUIREMENTS DRIVEN

Required by National/ International standards such as AS9100; ISO 9001, etc., NASA Policy/Standards.

TECHNICAL AUTHORITY

A critical complementary second set of eyes and ears to other technical authorities providing healthy checks and balances.

SMA Technical Expertise

Enliven Roles

BENEFITS

Maximize Performance

ACHIEVE RESULTS

SAFETY & QUALITY

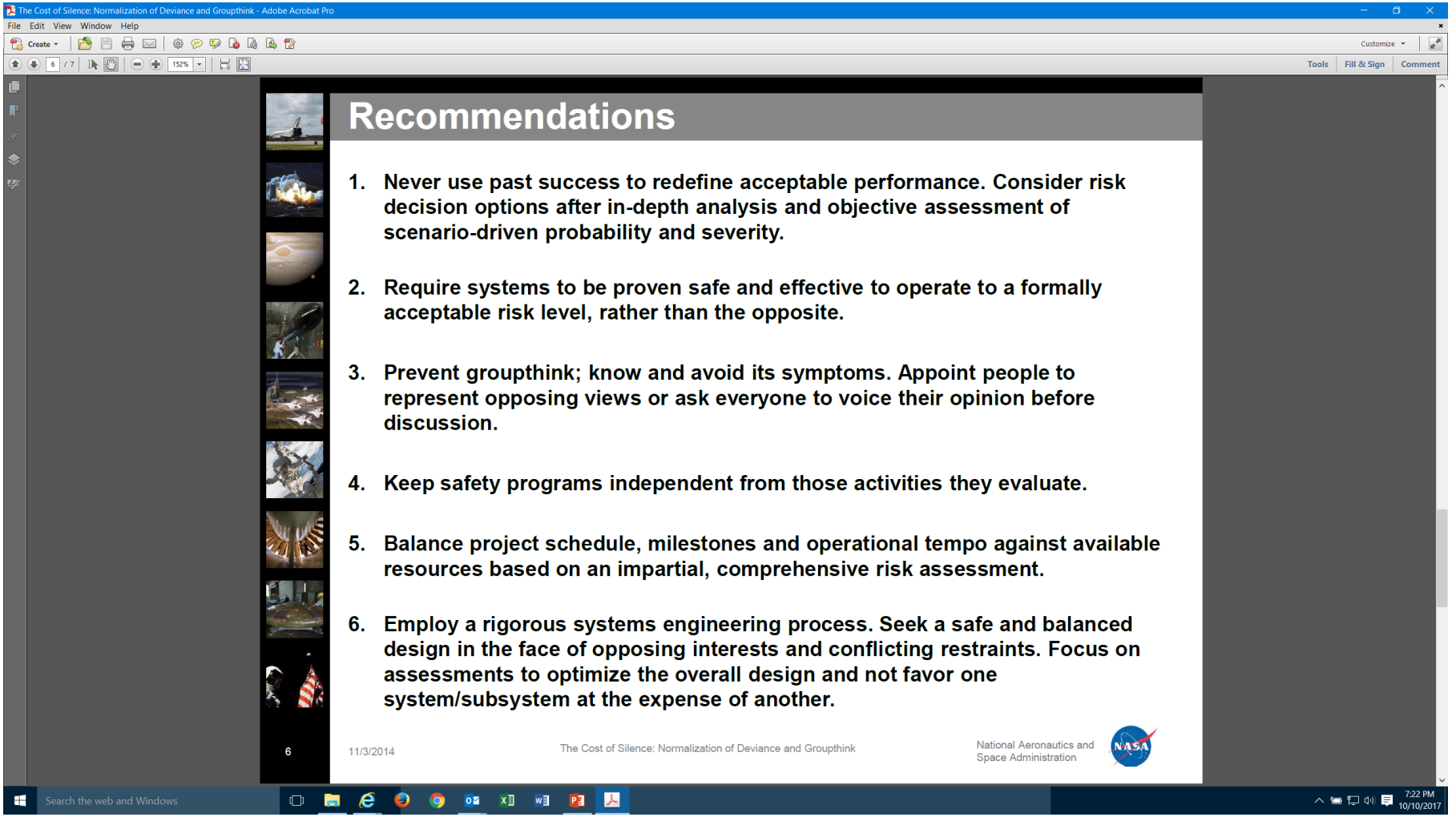
Build in safety and quality; rather than inspect it in.

COMPETENCE

Market competence by producing consistently high quality products without latent defects; requiring low repair, re-work, scrap costs-high value product.

RESULTS DRIVEN

Provide net results, as well as safe, reliable products which save lives, property and money.


The Cost of Silence: Normalization of Deviance and Groupthink - Adobe Acrobat Pro
File Edit View Window Help
Tools Fill & Sign Comment
Recommendations
1. Never use past success to redefine acceptable performance. Consider risk decision options after in-depth analysis and objective assessment of scenario-driven probability and severity.
2. Require systems to be proven safe and effective to operate to a formally acceptable risk level, rather than the opposite.
3. Prevent groupthink; know and avoid its symptoms. Appoint people to represent opposing views or ask everyone to voice their opinion before discussion.
4. Keep safety programs independent from those activities they evaluate.
5. Balance project schedule, milestones and operational tempo against available resources based on an impartial, comprehensive risk assessment.
6. Employ a rigorous systems engineering process. Seek a safe and balanced design in the face of opposing interests and conflicting restraints. Focus on assessments to optimize the overall design and not favor one system/subsystem at the expense of another.
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