



Engineering Excellence

NASA Engineering and Safety Center Overview

October 2011

The NESC Goal



Engineering Excellence



Ensure safety and mission success through value-added independent testing, analysis, and assessments of high-risk projects



The NESC Background

Why the NESC was Formed



Engineering Excellence



**NESC Core
Team (2010)**

- ✓ In response to the observations of the Columbia Accident Investigation Board (CAIB) that specified a need for *independent* technical reviews of NASA's programs

The NESC Benefits

What the NESC Team Contributes to the Agency



Engineering Excellence

- ✓ A unique resource that benefits the entire Agency with a focus on technical rigor and engineering excellence
- ✓ Established processes and infrastructure to **quickly form** diverse multi-disciplinary teams
- ✓ Participation on NESC teams provides value to home organizations
 - *Valuable problem-solving experience*
 - *Broad Agency-wide perspective*
- ✓ A place to turn for world-class engineering expertise

Solar Alpha Rotary Joint Team



Dr. Dan Polis *GSFC*
Ian Fernandez *ARC*

The NESC Framework

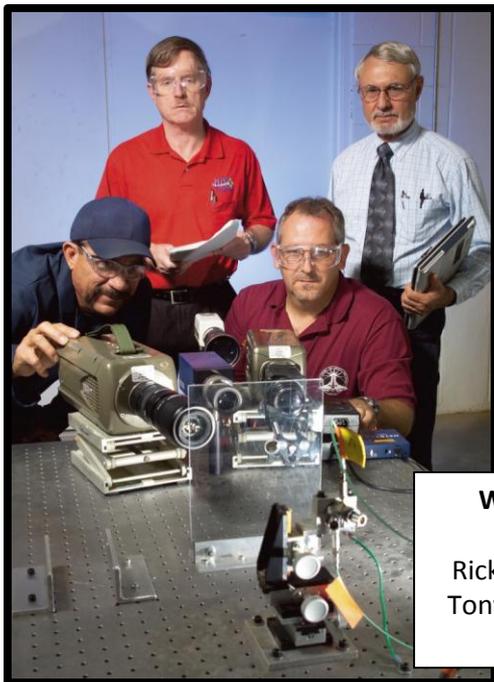
How the NESC Operates to Benefit the Agency



Engineering Excellence



Dr. Phillip Tang *KSC*
Omar Torres *LaRC*



White Sands Test Facility
Pyrovalve Team
Rick Madrid, Steve McDougle,
Tony Carden, Regor Saulsberry

- ✓ Independent from mission directorates, their programs and Center leadership
- ✓ The independent engineering chain of command ensures consideration of all points of view regarding complex technical issues
- ✓ NESC performs test and analysis to **provide data** to help solve technical issues

The NESC Team

Who Contributes to the NESC



Engineering Excellence

- ✓ Less than 60 full-time members organized into 6 offices in the NESC core team
- ✓ Matrix team of NASA engineers at the division and directorate levels of the Centers are the strength of the NESC
 - *Actively engage in Technical Discipline Teams*
 - *Participate in NESC-led assessments*
 - *Perform testing, modeling, analysis, and data collection as required*
- ✓ **Vast majority of the NESC work is done by engineers across the NASA Centers**



**Mechanical
Systems
Technical
Discipline
Team**

**Max Launch Abort
System Team**



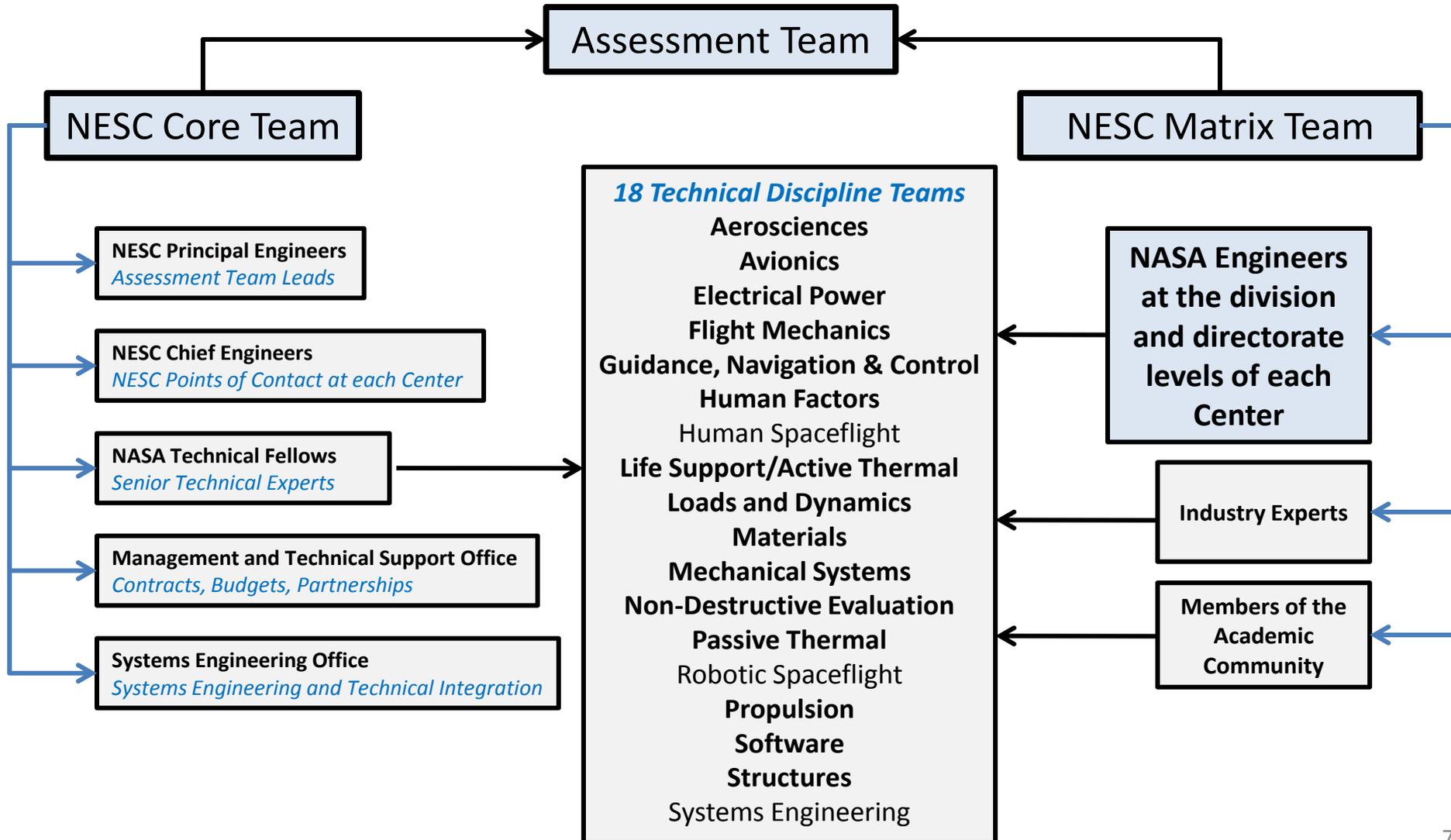
The NESC Assessment Team Composition

A Diverse Group of Technical Experts



Engineering Excellence

Experts are pulled from any of the groups below based on the needs of each individual assessment

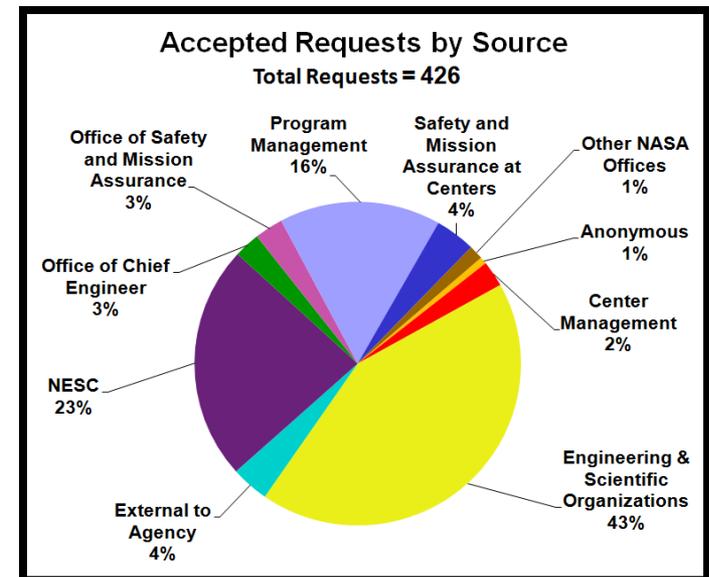
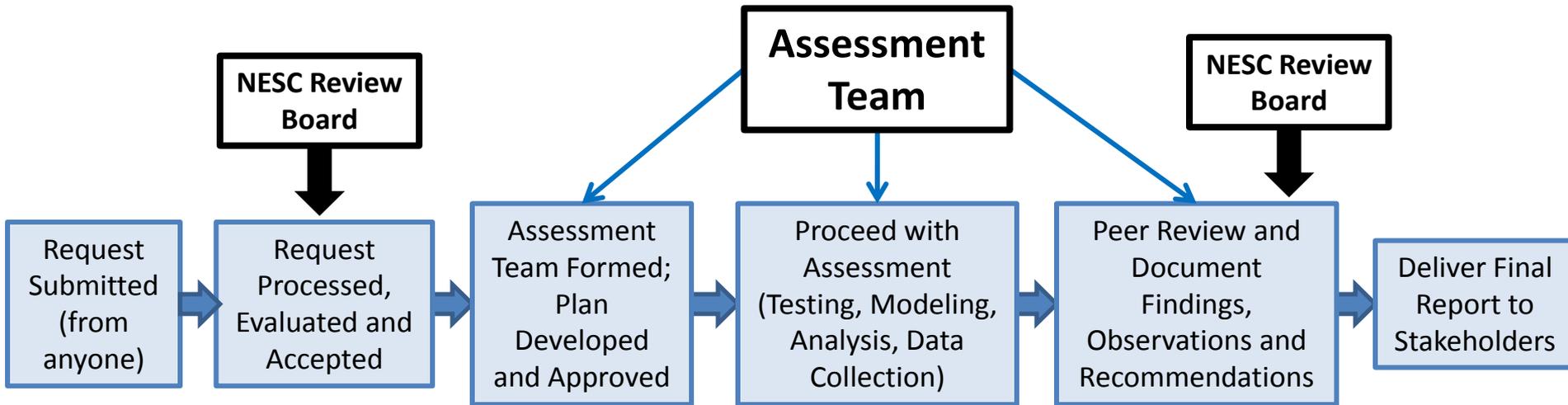


Performing NESC Assessments

An Overview Flowchart



Engineering Excellence



The Many Roles of the NESC

A Safety Culture Focused on Engineering and Technical Excellence



Engineering Excellence

*Perform Independent
Engineering and Safety
Assessments in Support
of Projects*

Provide Support to
Program and Project
Teams, Boards, and Panels

**Provide Younger
Engineers with
Agency-wide
Perspective**



*Capture and
Share Collective
Expertise and
Lessons Learned*

Conduct Test and
Analysis to Avoid
Potential Future
Problems

*Expand the
NESC Model
Beyond
NASA*

*Work on Known
Problems Currently
Not Being Addressed by
Any Project*

Primary Roles of the NESC:

Engineering and Safety Assessments/Support for Projects in the Operations Phase



Engineering Excellence

✓ Provide real-time problem solving for programs and projects in operations or flight phase

- *ET-137 Intertank Stringer Cracking Issue*
- *ISS Control Moment Gyroscope (CMG) Performance Investigation*
- *Hubble Space Telescope Attitude Observer Anomaly*

Greg Shanks *LaRC*



CMG Flywheel Modal Testing

Primary Roles of the NESC:

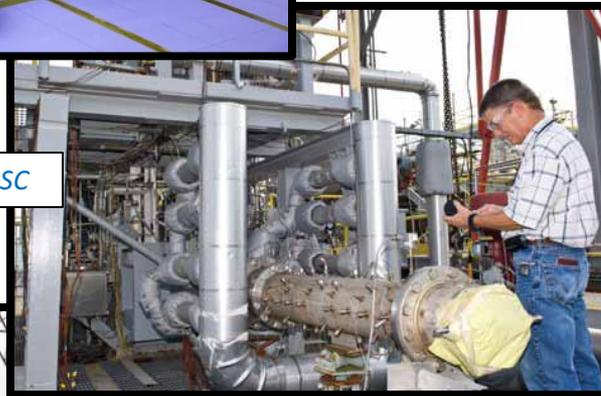
Engineering and Safety Assessments/Support for Projects in the Design and Development Phase



Engineering Excellence



Mars Science Laboratory at KSC



Lester Langford SSC



Crew Module Drop Test

- ✓ Support the development of critical robotic spacecraft missions
 - Mars Science Laboratory: Aero/Reaction Control System Interaction Model Validation, Ground Test and Checkout Review
 - James Webb Space Telescope: NIRSpec Micro Shutter Subsystem

- ✓ Conduct independent testing and analysis for the next generation of launch vehicles and spacecraft
 - Crew Module Water Landing Modeling
 - Structural Dynamics Analysis Review of SSC's A-3 Test Stand
 - Technology Roadmap Teams

Primary Roles of the NESC:

Safety and Technical Assessments/Support for Projects in the Design and Development Phase



Engineering Excellence

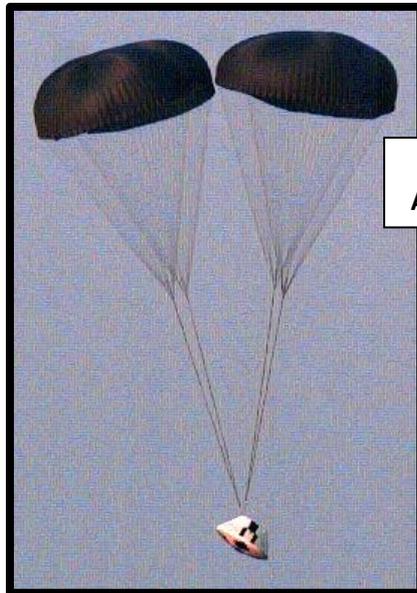


Composite Crew Module



- ✓ Conduct Technical Interchange Meetings with new commercial partners to share lessons learned and best practices

- *Launch Abort Systems*
- *Landing Systems & Water Landing*
- *Aerodynamics*
- *Composite Spacecraft Design*



Max Launch Abort System



Crew Module Water Landing Modeling Assessment

Primary Roles of the NESCC:

Work on Known Problems Currently not being Addressed by any Project



Engineering Excellence

- ✓ Conduct independent testing and analysis to identify system deficiencies, improve system performance, and increase system safety

- *Shell Buckling Knockdown Factor*



Shell Buckling
Knockdown
Factor Test



Mark Hilburger *LaRC*
Michael Roberts *MSFC*



David Brewer *LaRC*

Primary Roles of the NESCC:

Work to Avoid Potential Future Problems



Engineering Excellence



**Composite Pressure
Vessel Working Group:**

Dr. John Thesken *GRC*

Eric Baker *GRC*

James Sutter *GRC*

- ✓ Perform independent testing and analysis of problems that have been identified but have not been resolved
 - *COPV Life Prediction Model Development*
 - *Shock-Proof and Corrosion Immune Bearings*
- ✓ Develop engineering guidelines and recommended best practices
 - *NASA Fault Management Practitioners Handbook*
 - *Determining Readiness for Crewed Flight on New Spacecraft Systems*
 - *NASA Models and Simulations Guidebook*

Additional Roles of the NESCS:

Expand the NESCS Model Beyond NASA



Engineering Excellence



Mike Kirsch, *NESCS Principal Engineer, and NHTSA representatives*

✓ Support Investigations Outside of the Agency

- *National Highway Traffic Safety Administration (NHTSA) Unintended Acceleration Investigation*



NHTSA Investigation Team Members:
Oscar Gonzales *NESCS*
Mike Aguilar *NESCS*
Peter Berg *ARC*

✓ Support International Efforts

- *Rescue of Trapped Chilean Miners*



Clint Cragg, *NESCS Principal Engineer, and other members of the Chilean Miner Rescue Team meeting President Obama*

Additional Roles of the NESC:

Offer a Unique Learning Opportunity for NASA Engineers



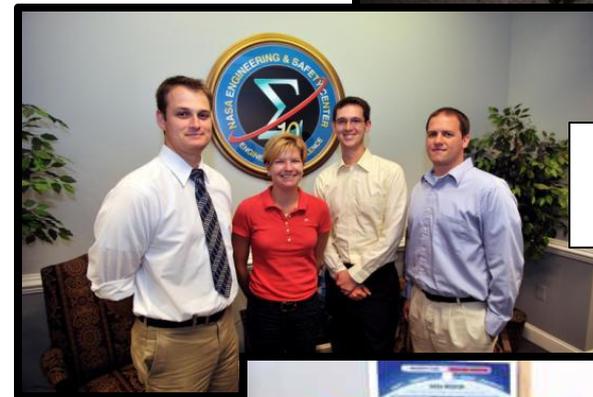
Engineering Excellence

- ✓ Opportunity for early career participants to gain hands on experience working with NESC technical experts and leaders
- ✓ Connects senior engineers to a younger generation that offers a fresh perspective to technical activities
- ✓ Provides a technically diverse learning experience outside the boundaries of the participant's home organization

MLAS Resident
Engineers and
Mentors
2008-2009



NESC Resident
Engineers
2009-2010



NESC Resident
Engineers
2010-2011

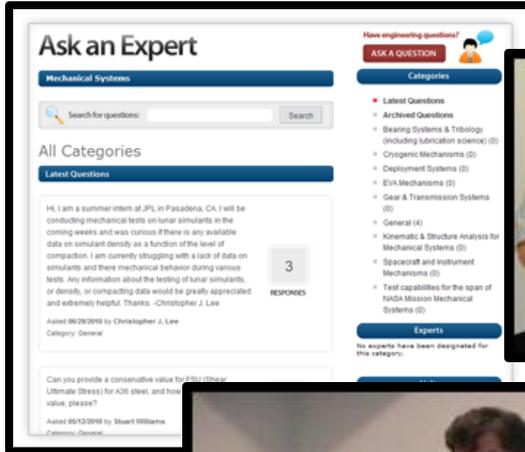


Additional Roles of the NESCS:

Share Collective Expertise and Lessons Learned



Engineering Excellence



Gene Ungar *JSC*
Hank Rotter *Life Support/Active Thermal Technical Fellow*



Neil Dennehy
GNC Technical Fellow



- ✓ Supply information on NESCS activities and provide a forum for knowledge sharing
 - *NASA Engineering Network*
 - *NESCS Technical Reports*
 - *NESCS Technical Bulletins*
 - *NESCS Technical Update*

- ✓ Educate the NASA workforce on critical competencies
 - *NESCS Virtual Academy*

Additional Roles of the NESCC:

Returning Lessons Learned to Home Centers



Engineering Excellence

- ✓ NESCC Alumni return to leadership positions at home centers with lessons learned through NESCC experiences
 - *Chief Engineers*
 - *Program Managers*
 - *Center and Engineering Management*



NESCC Alumni Panel Discussion

Summary



Engineering Excellence

- ✓ The NESC model demonstrates the benefits of bringing together diverse technical experts to solve the Agency's most difficult problems
 - *Creative, robust technical solutions*
 - *Stronger checks and balances*
 - *Well informed decision making*
- ✓ The NESC provides opportunities for the NASA workforce to gain valuable hands-on experience on broad Agency-wide issues



Composite
Crew Module
Full-Scale
Testing

Engineers from the Centers are the strength of the NESC