NASA Engineering and Safety Center Overview

Tim Trenkle

12/6/2011

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

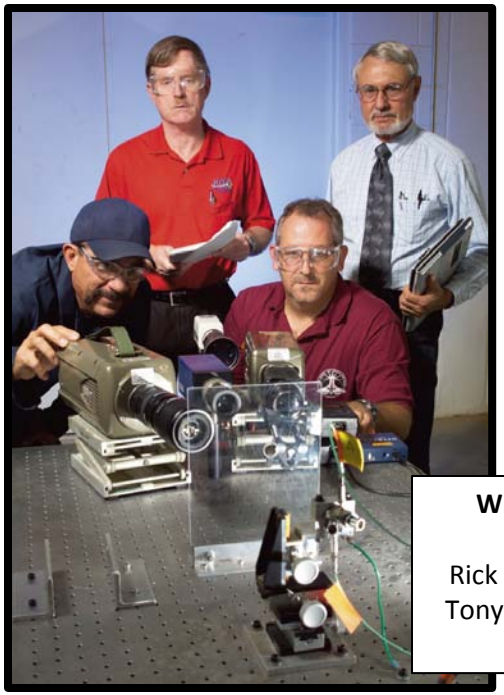
Dr. Dan Polis *GSFC*
Ian Fernandez *ARC*

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; **independently funded**
- ✓ 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

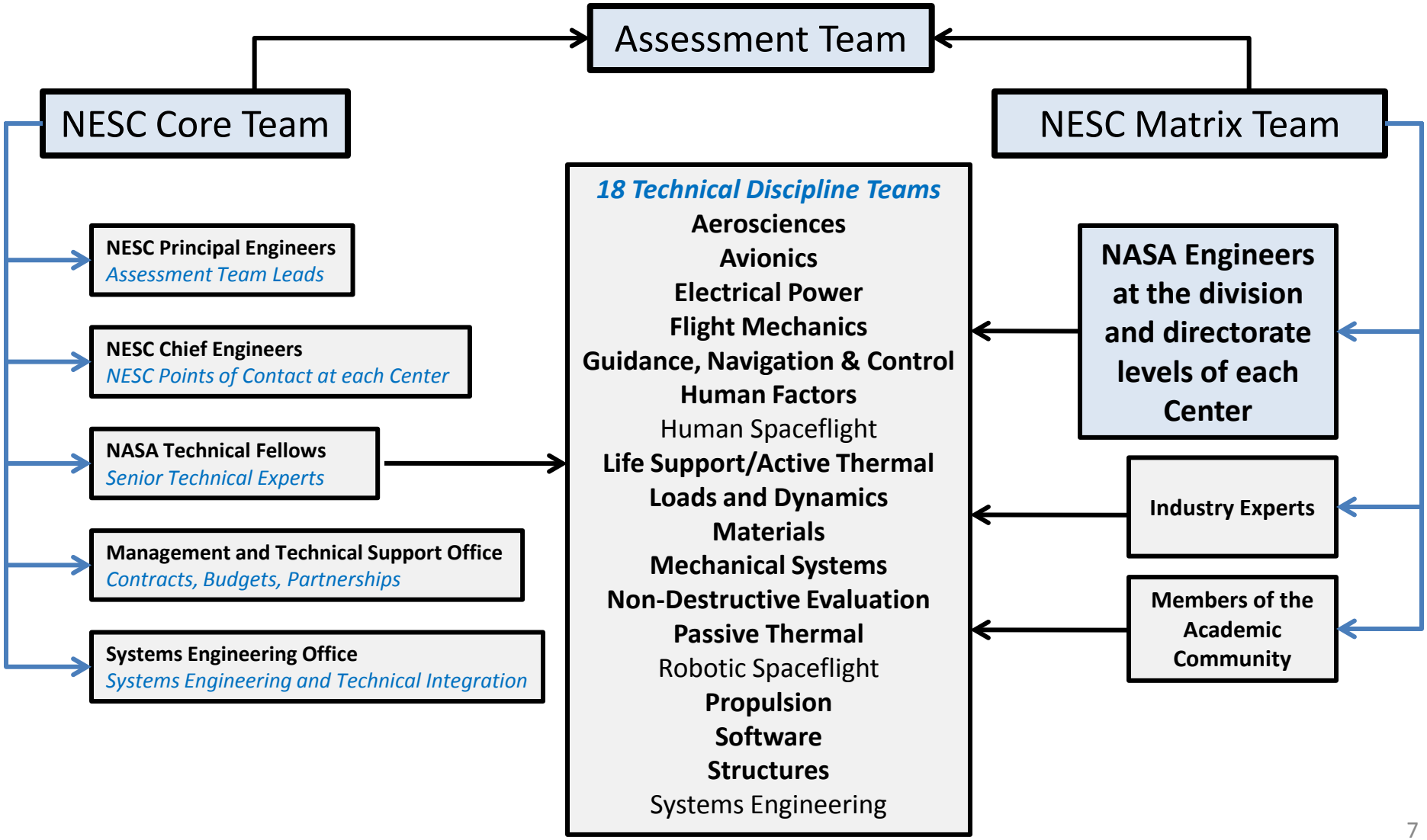
Max Launch Abort System Team

The NESC Assessment Team Composition

A Diverse Group of Technical Experts

Engineering Excellence

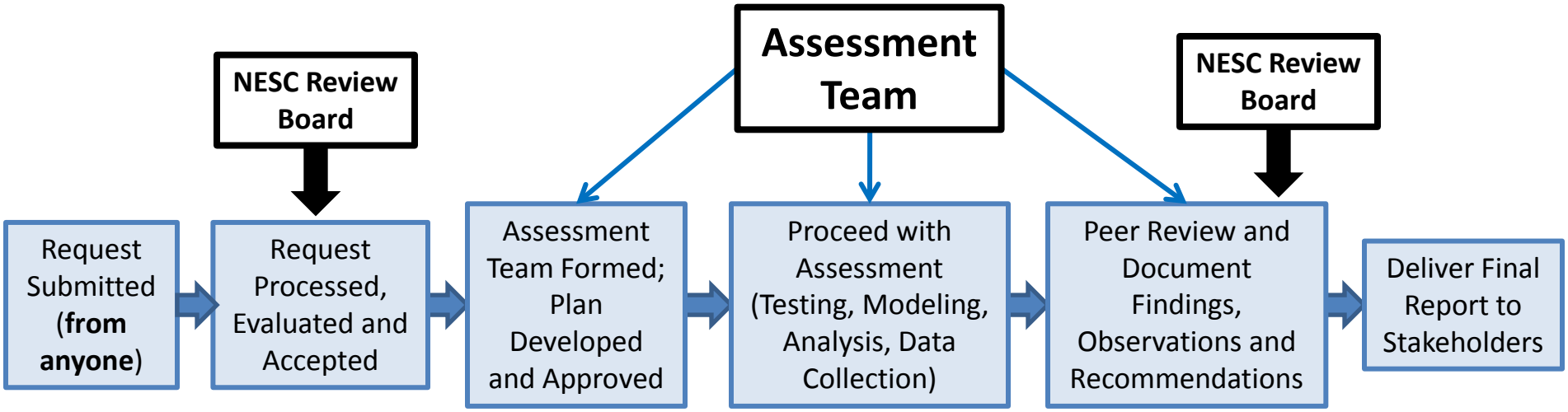
Experts are pulled from any of the groups below based on the needs of each individual assessment

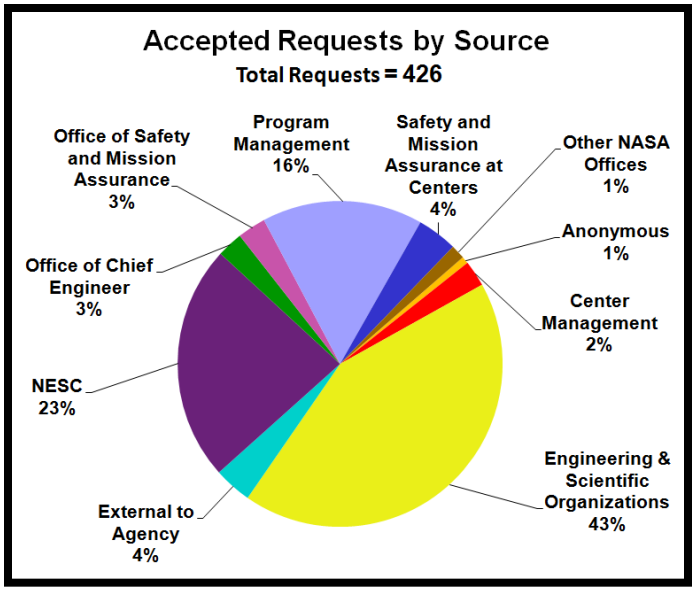


Performing NESC Assessments

An Overview Flowchart

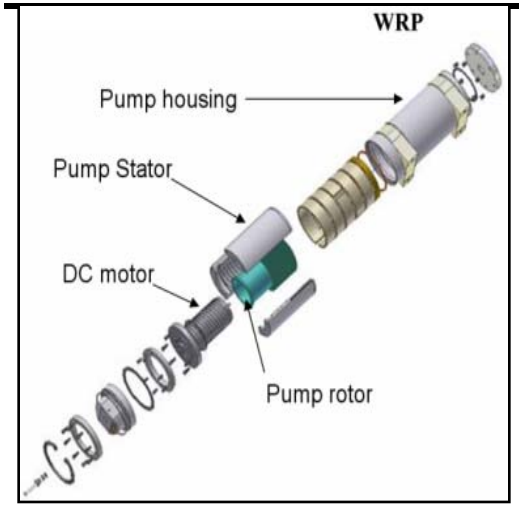
Engineering Excellence



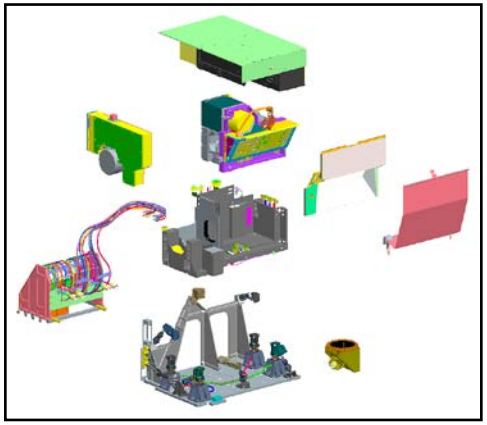


Selected NESC Assessments/Reviews of Issues Impacting GSFC Missions

Engineering Excellence

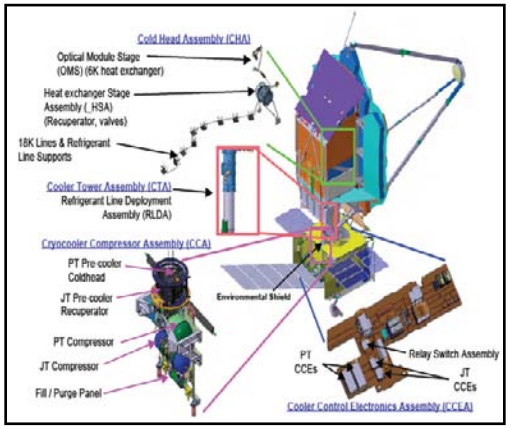


MSL/SAM Wide Range Pump
Independent Review

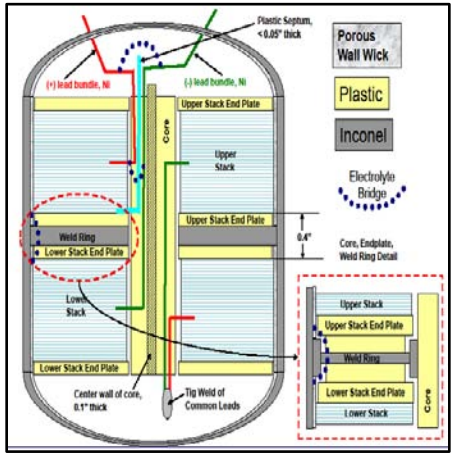


JPSS/CrIS Instrument Frame
Independent Assessment

TDRS Reaction Wheel Assembly Lubricant Contamination
Independent Technical Review



JWST/MIRI Cryo-cooler
Disturbance Models Review



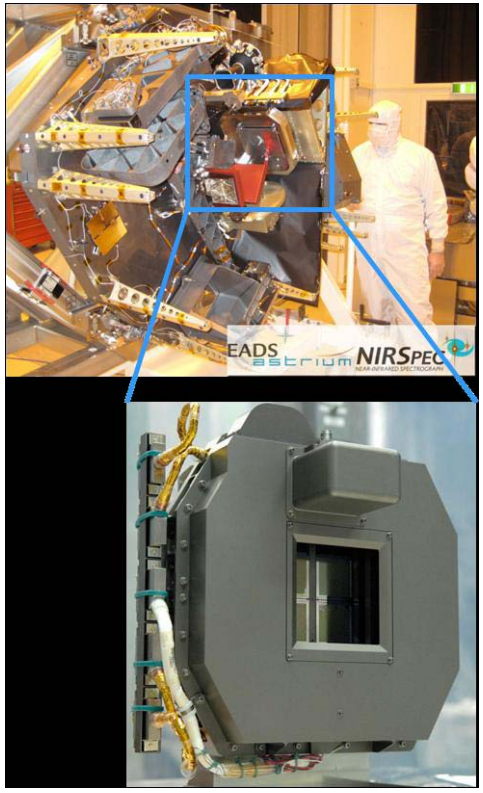
WMAP On-Orbit Single Pressure Vessel
NiH2 Battery Anomaly Assessment

Selected NESC Assessments/Reviews

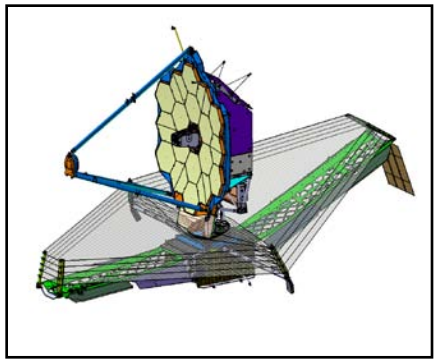
Engineering Excellence

Crew Module Simulator Center of Gravity Measurements at Wallops Dock

Taurus XL Fairing Frangible Separation Ring Qualification Assessment



JWST/NIRSpec Micro Shutter Subsystem Assessment



JWST Sunshield Venting Analysis

United States Department of Transportation

NHTSA National Highway Traffic Safety Administration
Our Mission: Save lives, prevent injuries, reduce vehicle-related crashes
www.nhtsa.gov

NHTSA Toyota Sudden Acceleration Investigation

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
  - *NPP Solar Array Deployment Torque Margin*
  - *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

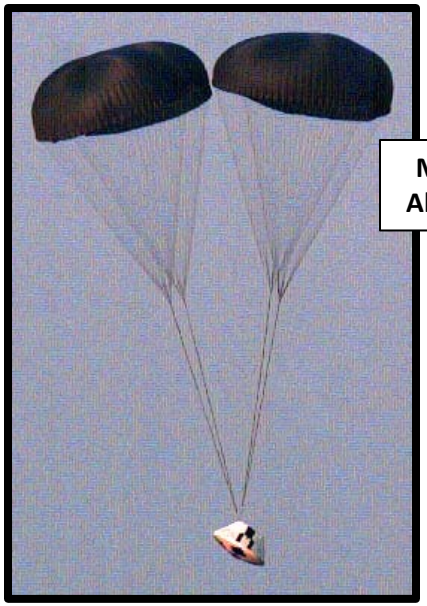
- ✓ Support the development of critical unmanned spacecraft missions
  - *Mars Science Laboratory: Aero/Reaction Control System Interaction Model Validation, Ground Test and Checkout Review*
  - *James Webb Space Telescope: NIRSpec Micro Shutter Subsystem*
- ✓ Conduct independent testing and analysis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



Max Launch Abort System

Crew Module Water Landing Modeling Assessment

- ✓ 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*

Primary Roles of the NESC:

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*
  - *NASA Standard For Fasteners*

Additional Roles of the NESC:

Expand the NESC Model Beyond NASA

Engineering Excellence

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

NHTSA Investigation Team Members:
Oscar Gonzalez *NESC*
Mike Aguilar *NESC*
Peter Berg *ARC*

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

- ✓ Support Investigations Outside of the Agency
  - *National Highway Traffic Safety Administration (NHTSA) Unintended Acceleration Investigation*
- ✓ Support International Efforts
  - *Rescue of Trapped Chilean Miners*

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
- ✓ Center NCE works with Engineering Divisions to identify candidates to help with assessments

MLAS Resident Engineers and Mentors 2008-2009

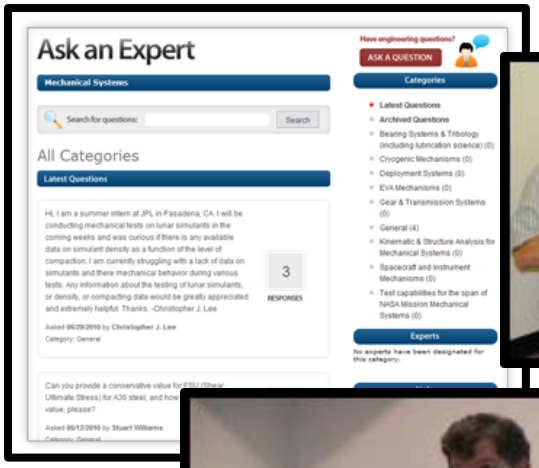
NESC Resident Engineers 2009–2010

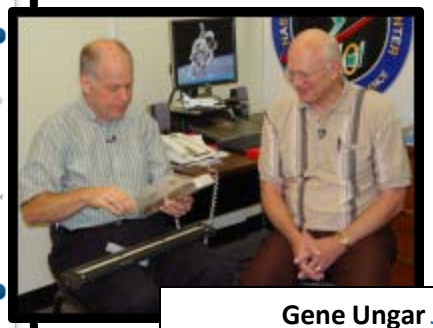
NESC Resident Engineers 2010-2011

Additional Roles of the NESC:

Share Collective Expertise and Lessons Learned

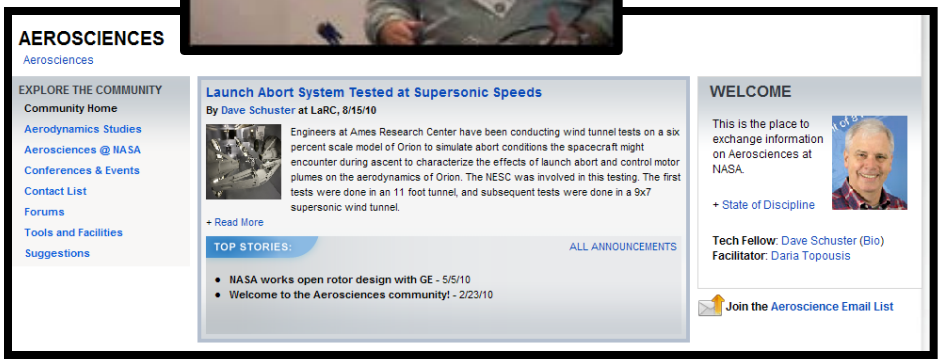
Engineering Excellence





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

Neil Dennehy *GSFC GNC Technical Fellow*



- ✓ Supply information on NESC activities and provide a forum for knowledge sharing
  - *NASA Engineering Network*
  - *NESC Technical Reports*
  - *NESC Technical Bulletins*
  - *NESC Technical Update*
- ✓ Educate the NASA workforce on critical competencies
  - *NESC Virtual Academy*

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

MLAS Launch From Wallops

Engineers from the Centers are the strength of the NESC

Contacting NESC

Engineering Excellence

NESC Contacts at GSFC

Tim Trenkle / NESC Chief Engineer at GSFC
Timothy.G.Trenkle@nasa.gov 301-286-5802

Neil Dennehy / NASA Tech Fellow for Guidance, Navigation & Control
Cornelius.J.Dennehy@nasa.gov , 301-286-5696

Joe Pellicciotti / NASA Technical Fellow for Mechanical Systems
Joseph.W.Pellicciotti@nasa.gov , 301-286-0744

Mike Aguilar/NASA Technical Fellow for Software
Michael.L.Aguilar@nasa.gov , 301-286-0156

Oscar Gonzalez/NASA Technical Fellow for Avionics
Oscar.Gonzalez@nasa.gov , 301-286-7165

Denney Keys/NASA Technical Fellow for Electrical Power
Denney.J.Keys@nasa.gov , 301-286-6202

NESC Website: http://www.nasa.gov/offices/nesc/home/index.html