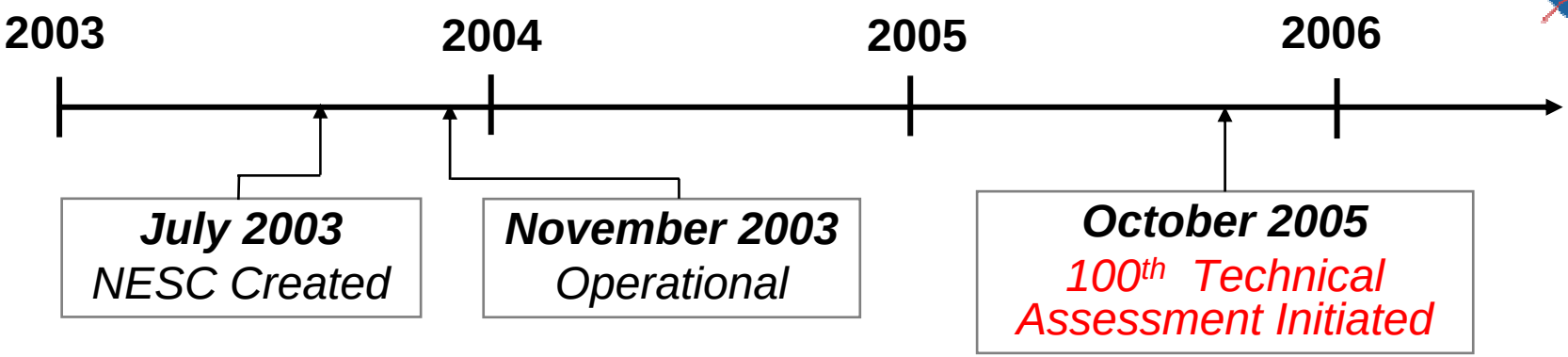
NASA Engineering & Safety Center

Background



Initial NESC Leadership Team, Nov 2003

The NESC provides a strong technical team to coordinate and conduct robust, independent engineering and safety assessments across the Agency.

Background (Continued)

Apollo Saturn 5 Launch Vehicle

- Safety philosophy has 3 tenets:
  - Strong in-line checks and balances
  - Healthy tension
  - "Value added" independent assessment
- NESC provides independent assessment of technical issues for NASA programs and projects

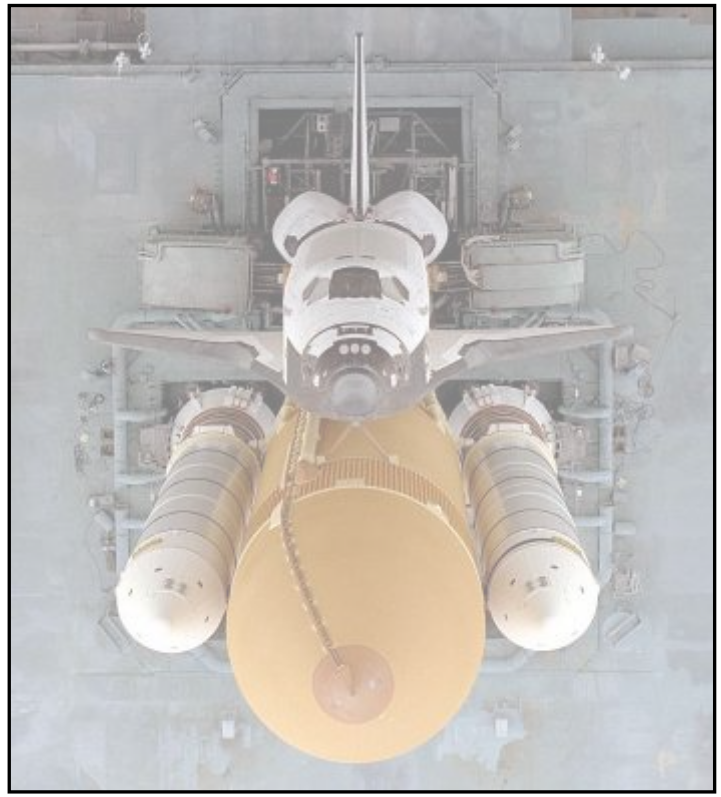
The NESC is cultivating a Safety culture focused on **engineering and technical excellence**, while fostering an **open environment** and attacking challenges with **unequalled tenacity.**

NESC Model

- Simple, straightforward concept – institutionalize the “Tiger Team” approach

  Bring together some of NASA’s best engineers with experts from industry, academia, and other government agencies to address our highest risk, most complex issues.

- Decentralized organizational structure across all Centers reporting to the NESC management office at Langley Research Center
- Engineers need to be where the problems are to stay sharp.
- Synergy gained by using diverse, expert technical teams to develop robust technical solutions



Space Shuttle on Mobile Launch Platform

NESC Model (Continued)

- Small core of engineering experts at Centers for insight into respective programs
- Recognized Agency discipline experts leading Super Problem Resolution Teams (SPRT)
  - Use “ready” experts from across NASA, industry, academia and other government agencies to staff SPRTs.
  - Tap “ready” experts to attack “trouble spots”.

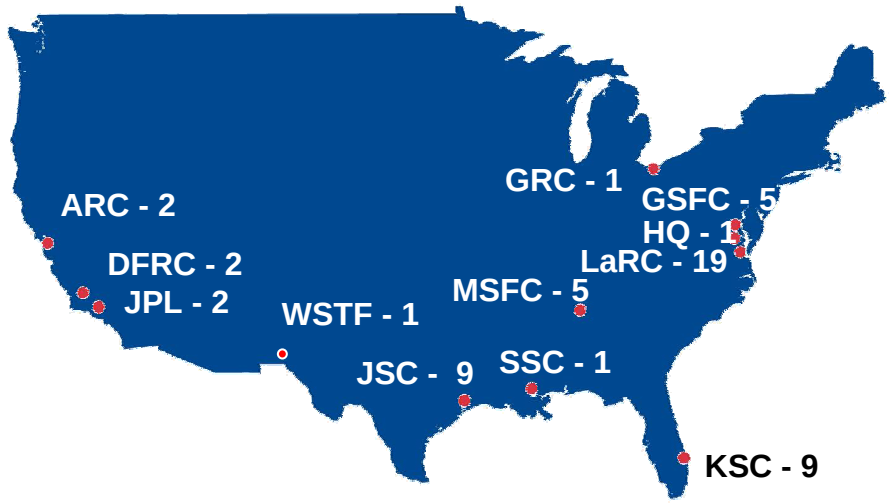
Hubble Space Telescope

- Strong Systems Engineering function for proactive trending and identification of problem areas before failures occur

Focus on technical rigor and engineering excellence

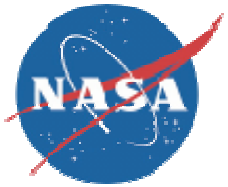
NESC Organization

- 60+ fulltime NESC-badged employees
- Current NESC employees selected from across the Agency, four external to NASA (as of June 2006)
- Super Problem Resolution Teams (SPRT) in 13 engineering disciplines, 2 operations disciplines
  - 15 to 30 matrixed employees per team
- Contracts and partnerships include industry, academia and other Government agencies on our teams



Where Current NESC Employees Came From

NESC Organization (Continued)



Office of the Director (C1)

Ralph R. Roe -- Director
Timmy R. Wilson -- Deputy Director
Kenneth D. Cameron -- Deputy Director for Safety

NASA HQ Chief Engineer Representative

Keith L. Hudkins

NASA HQ Senior S&MA Integration Manager

Wayne R. Frazier

Management and Technical Support Office (C101)

Patricia L. Dunnington -- Manager

Systems Engineering Office (C102)

Dawn M. Schaible -- Manager

Principal Engineers Office (C103)

Three Principal Engineers and Five Back-up Principal Engineers

NESC Discipline Expert Office (C104)

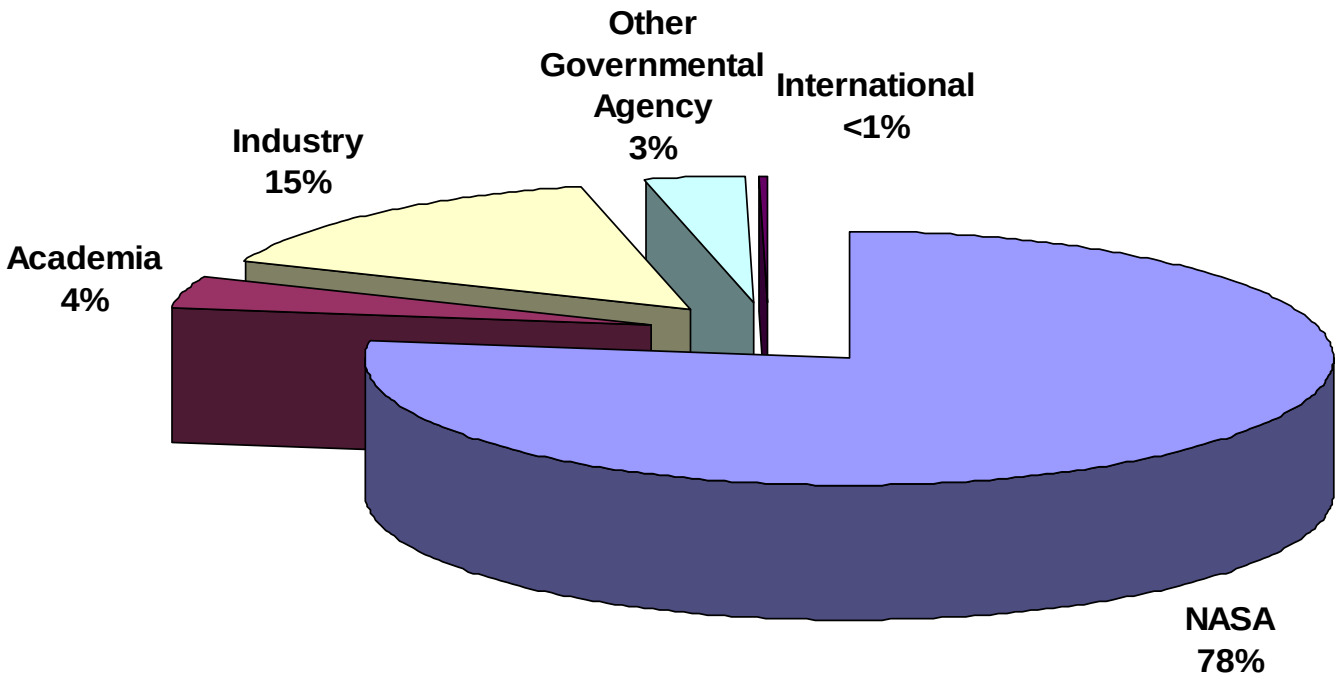
One Discipline Engineer for Each of Twelve Disciplines

NESC Chief Engineers Office (C105)

One NESC Chief Engineer for Each Center and HQ

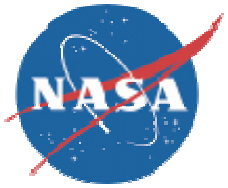
NESC Organization (Continued)

Composition of NESC's Extended Network of Experts



Total SPRT membership = 629 as of April 2006

Partnerships / Collaborations



National Institute
of Aerospace

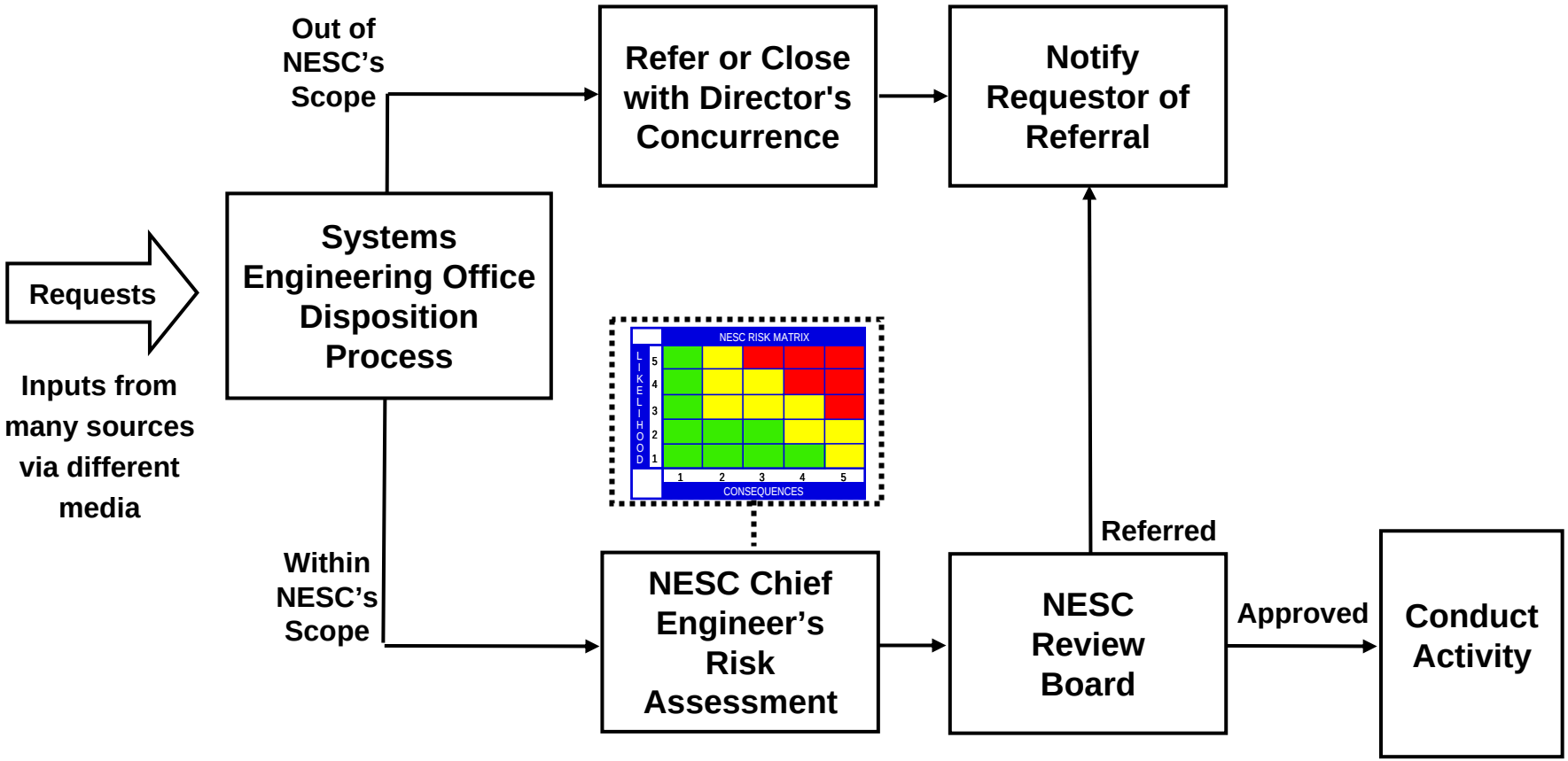
Institute of Nuclear
Power Operations

National Transportation
Safety Board

Lawrence Livermore
National Laboratories

Request Processing

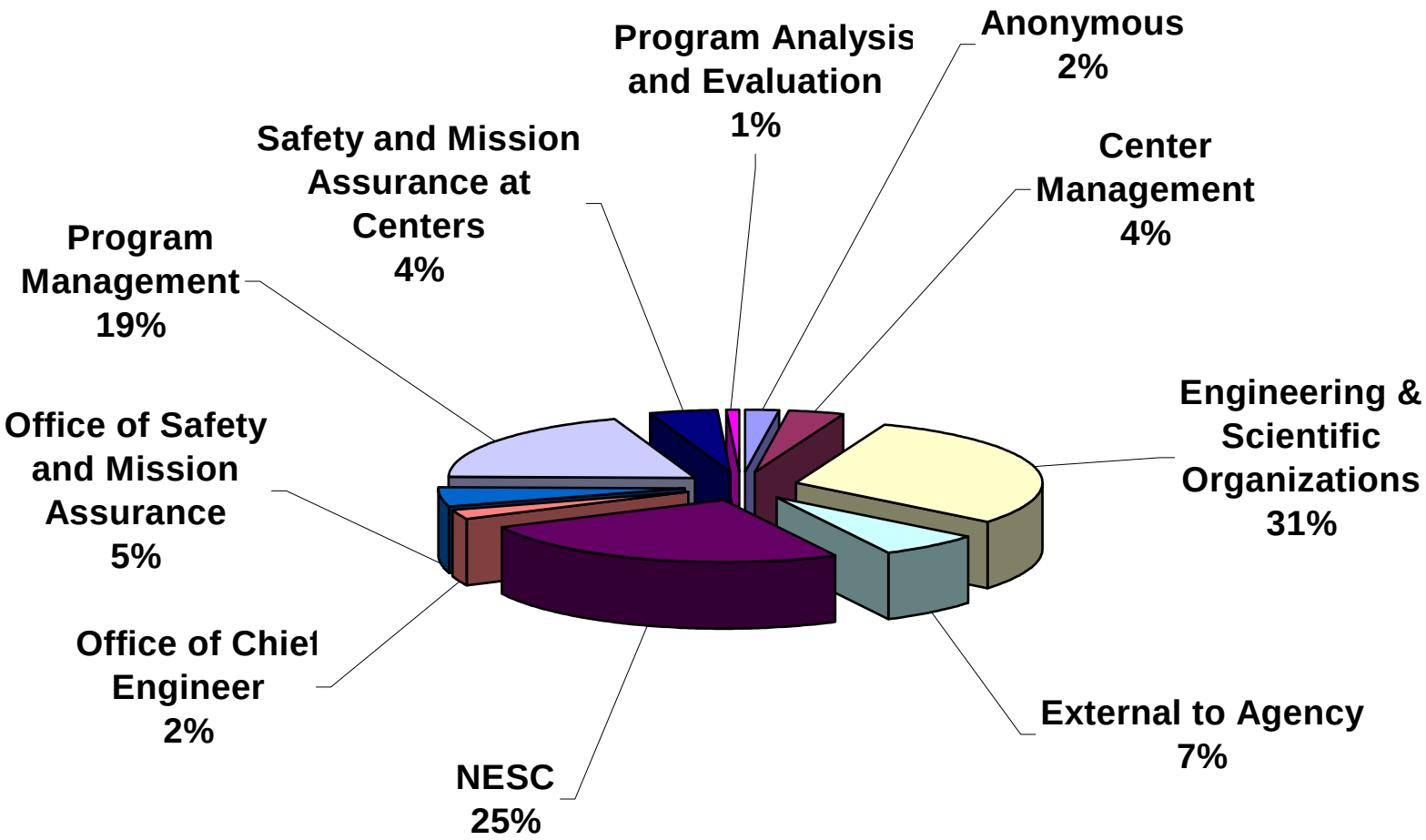
NESC Request Selection/ Prioritization Process



Request Metrics

Sources of Accepted Requests

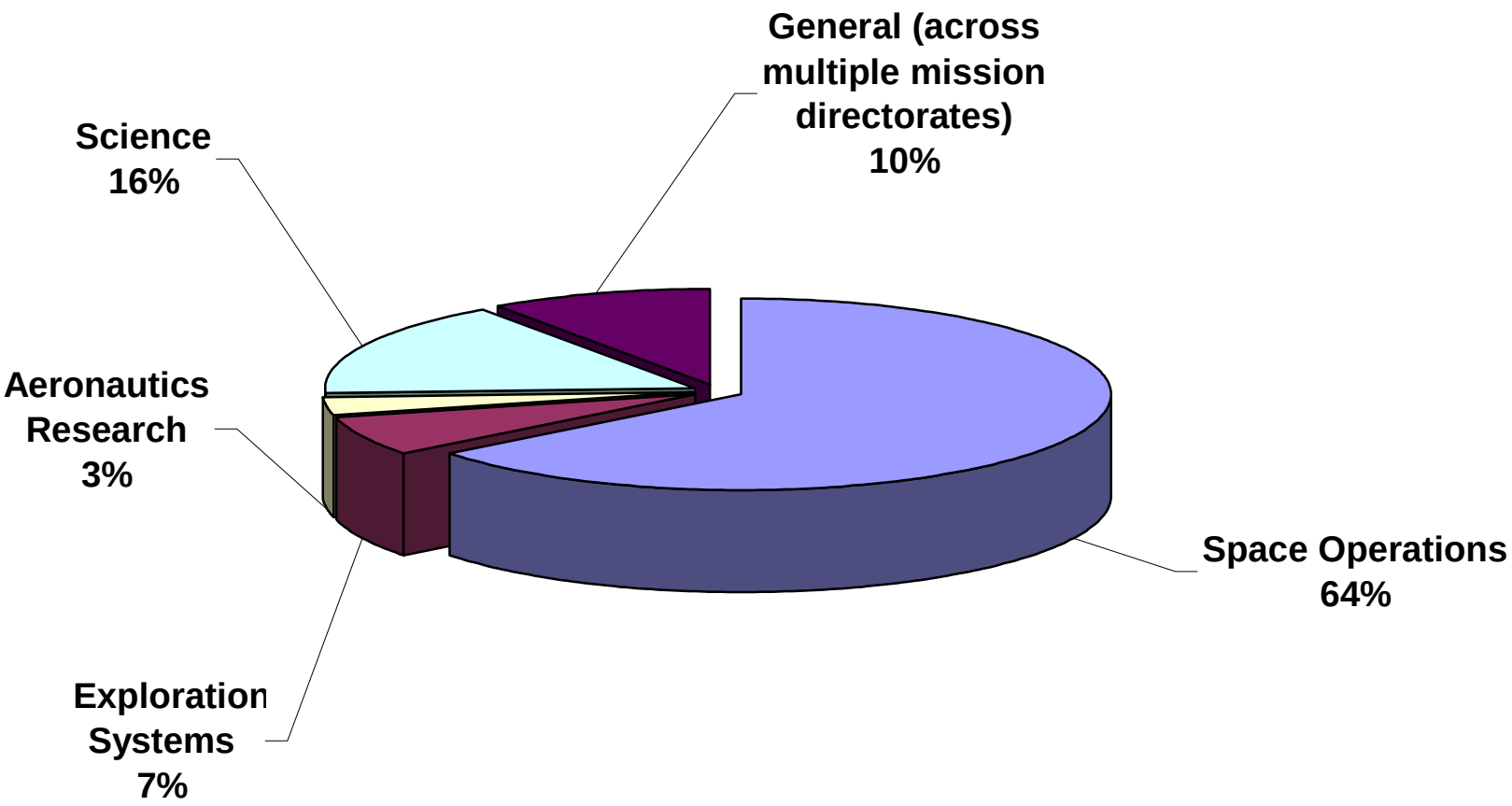
(Total of 137 Requests as of July 6, 2006)



Request Metrics (Continued)

Accepted Requests by Mission Directorate

(Total of 137 Requests as of July 6, 2006)



NESC Contributions

- The NESC has contributed substantially to the mission success of NASA programs — a clear but difficult-to-measure contribution — through many value-added technical assessments.
- The most significant contribution of the NESC is the immeasurable benefit of bringing together NESC experts with Program experts to solve complex problems.
- The results are:
  - Well-informed decision making
  - Stronger checks and balances
  - Better technical solutions

Steve Robinson on 3rd EVA of STS-114 Flight

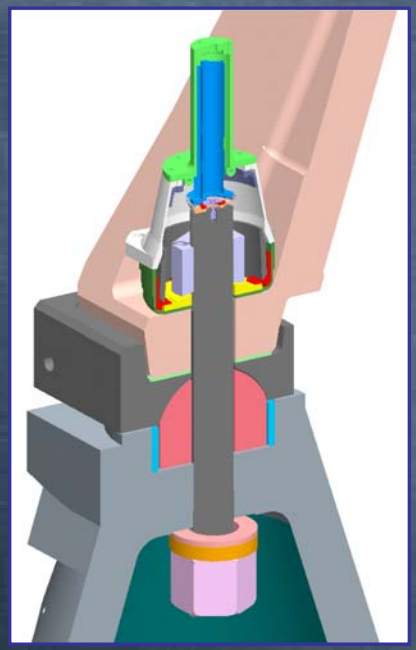
Examples of NESC Value Added

Examples of NESC Value Added

Stardust

Sponsored the airborne observation of the Stardust Return Capsule during reentry

Examples of NESC Value Added
Space Shuttle



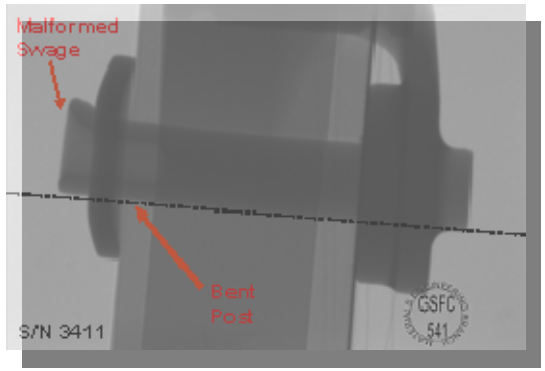
Investigated causes of hang-ups of the Solid Rocket Booster Hold Down Post during launch

Examples of NESC Value Added

Space Shuttle

Provided expertise for investigation of orbiter tile gap filler debonding and separation

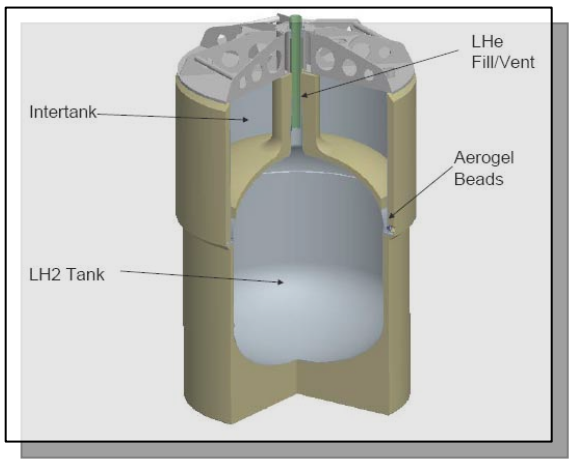
Examples of NESC Value Added
Space Shuttle



Performed testing and physical analysis to determine cause of STS-114 External Tank engine cutoff sensor (ECO) failures

Examples of NESC Value Added
Space Shuttle

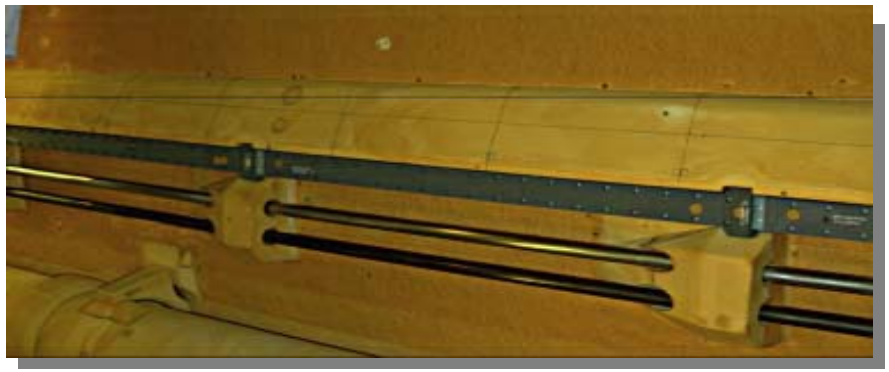
Tested aerogel beads as insulation for the External Tank intertank and the ground umbilical carrier plate



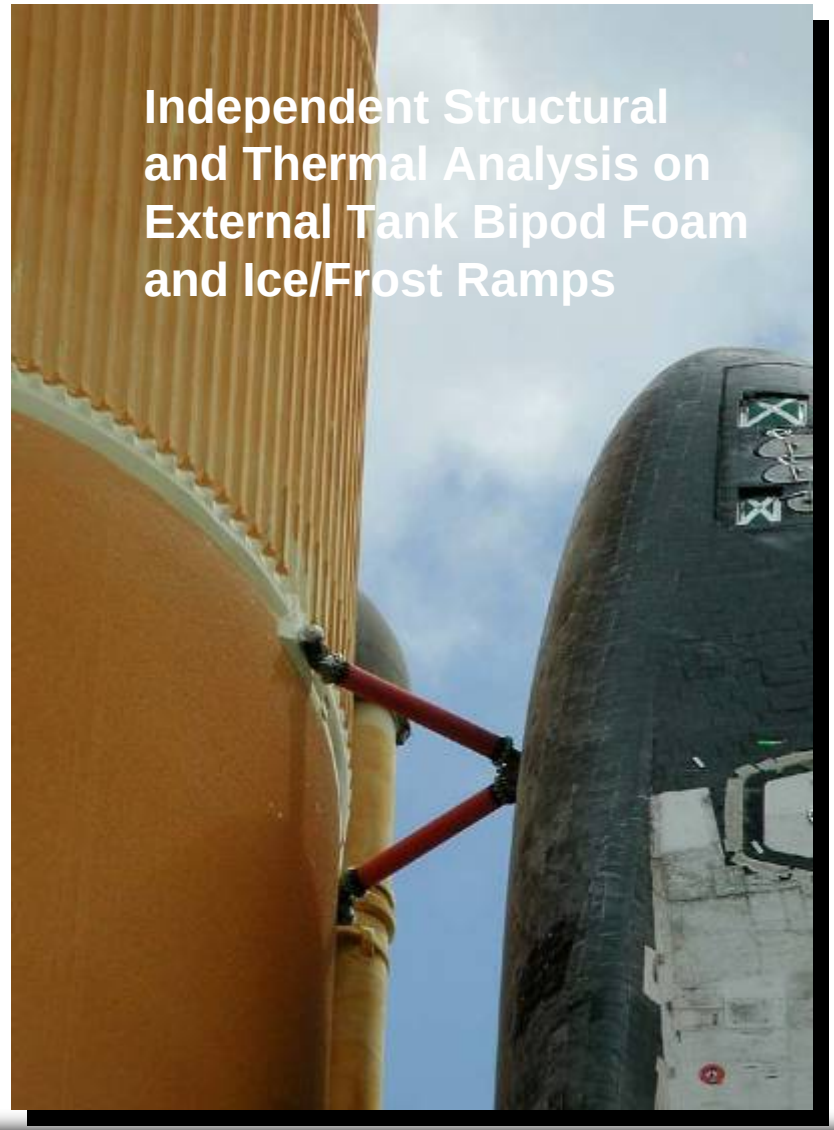
Examples of NESC Value Added
Space Shuttle

Rudder speed brake/body flap power drive unit dry film lubricant investigation/testing and conical seal repair

Examples of NESC Value Added
Space Shuttle



External Tank Protuberance Air Load (PAL) Ramp Removal Feasibility Study

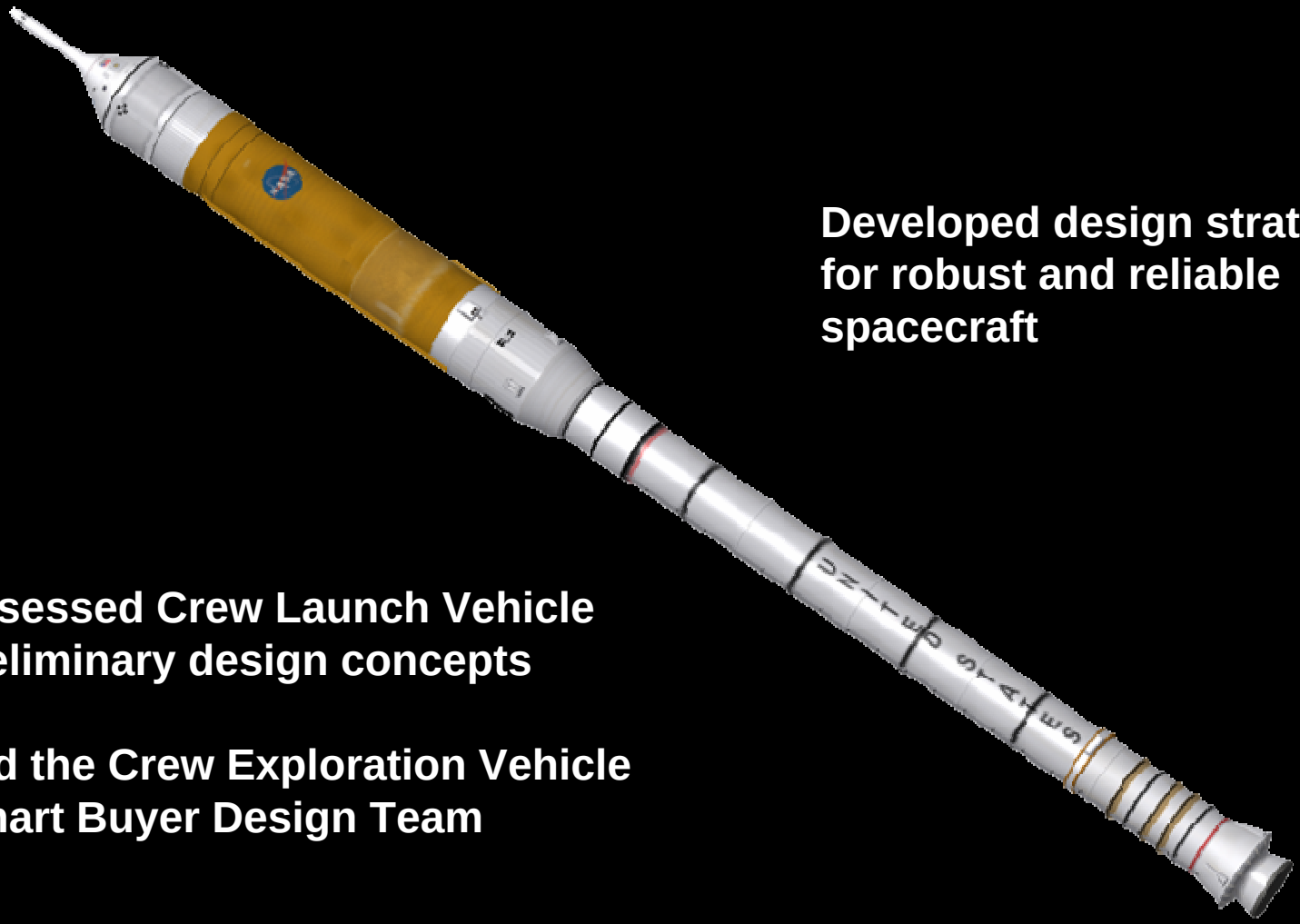


Examples of NESC Value Added

Phoenix

Reviewed descent thruster certification and evaluated structural margins of safety for the Phoenix mission

Examples of NESC Value Added
Constellation



Developed design strategies for robust and reliable spacecraft

Assessed Crew Launch Vehicle preliminary design concepts

Led the Crew Exploration Vehicle Smart Buyer Design Team

Ongoing NESC Work

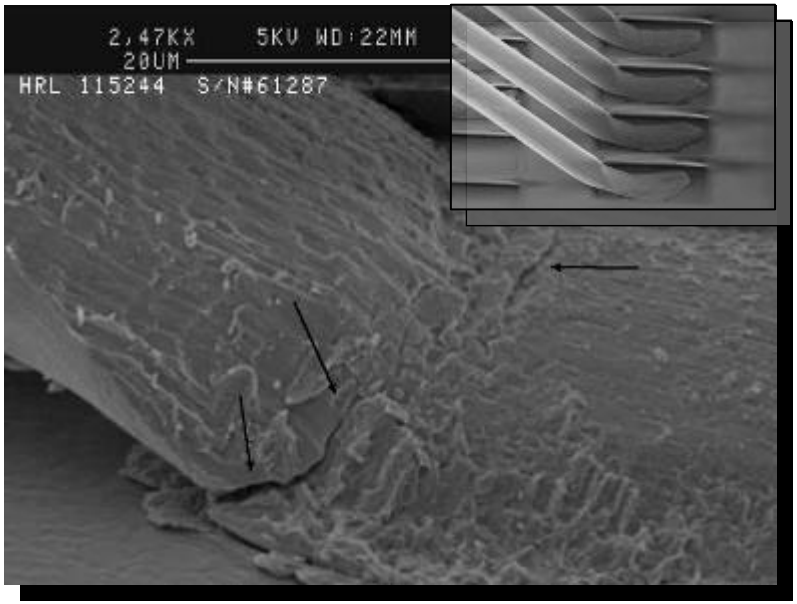
Ongoing NESC Work
International Space Station

Providing expertise to the S-band antenna corona discharge anomaly investigation

Supporting analysis into root cause of failure of the control moment gyro 1

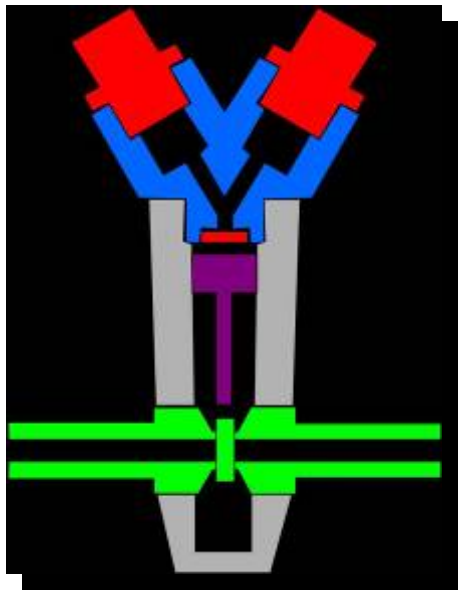
Evaluating Loctite® as a secondary locking feature for ISS fasteners

Ongoing NESC Work
Agency-wide Applications



Independent reliability testing of field programmable gate arrays (FPGA)

Assessment of failures involving CONAX pyrotechnic valves

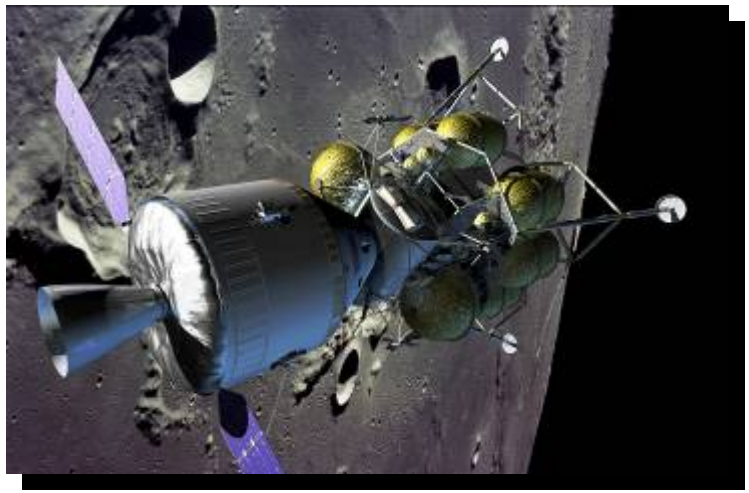


Ongoing NESC Work
Constellation

Apollo 16

Soyuz

Evaluating recovery of the Crew Exploration Vehicle (CEV) on land verses water



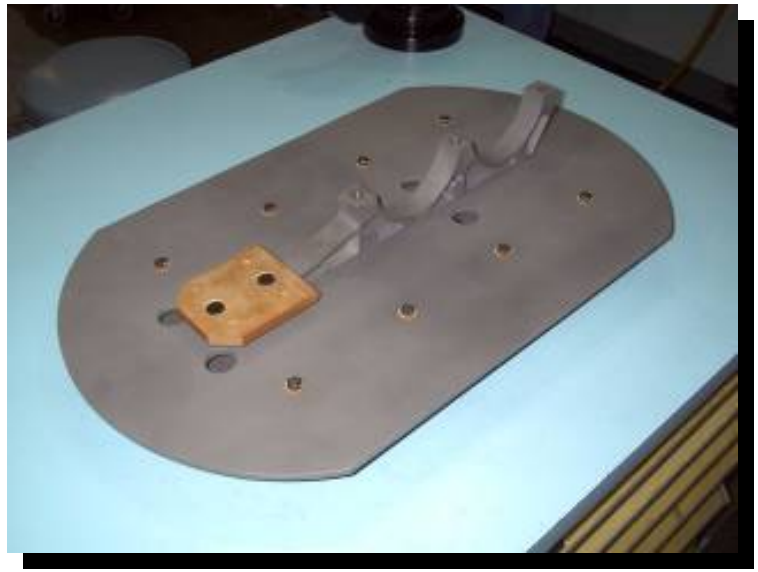
Assessing composite materials for the CEV Crew Module

Analyzing aerodynamic characteristics of different options for the CEV Launch Abort System

Apollo

Ongoing NESC Work
Space Shuttle

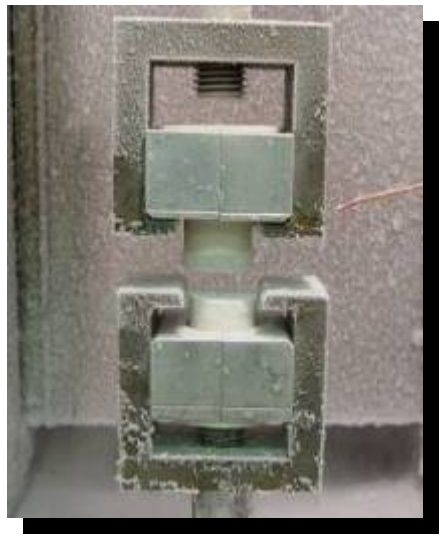
Developing alternative designs to the ET ice/frost ramp to minimize sources of launch debris



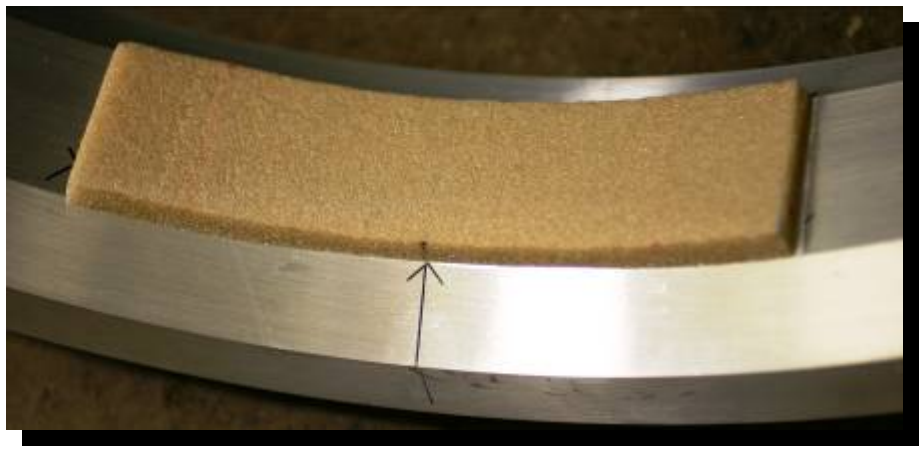
Investigating and developing nondestructive evaluation techniques for the Crawler-Transporter shoes

Ongoing NESC Work
Space Shuttle

Developing a coating to prevent ice adherence on the External Tank (ET) LOX feedline bracket and other areas of the ET and orbiter



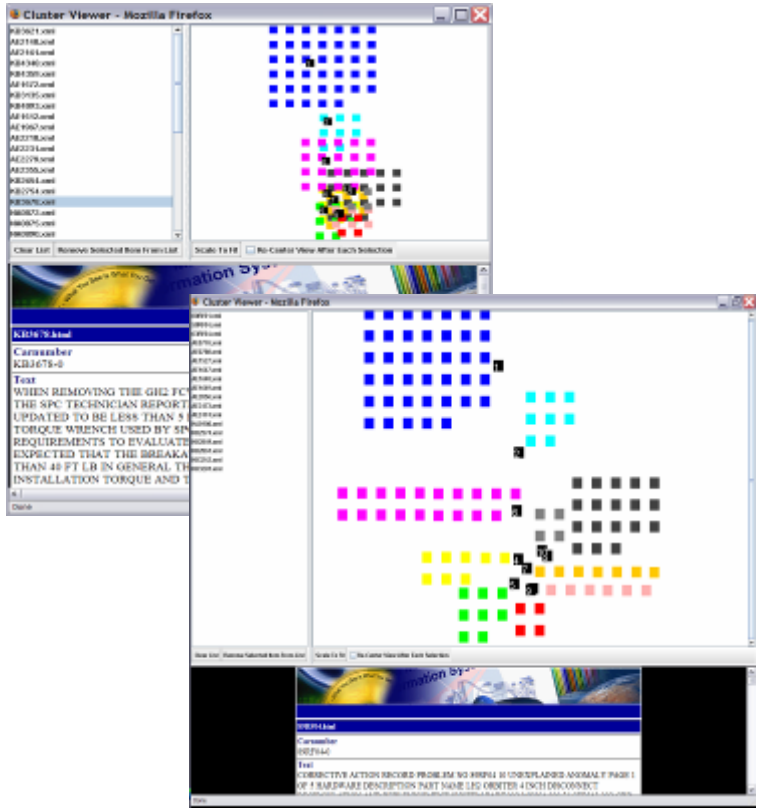
Testing flexible foam for use as insulation in the ET feedline bracket and ice/frost ramp presslines



Ongoing NESC Work

Leading Agency Data Mining & Trending Working Group

- Leading activities to strengthen trending of NASA programs and products
- Implementing data mining tools for use across the working group and beyond
- Working group members serving as experts on best practices for Constellation problem reporting and corrective action Requirements to support future data mining and trending



Leading Taxonomy Working Group

- Developed a common taxonomy proposal for projects to classify nonconformance, anomalies and problems
- Taxonomy formatted and in pre-release for deployment as a NASA Standard

NESC Academy

- The NESC Academy captures the experience of the NESC experts and passes that experience along to NASA's next generation.
- Four courses already completed
  - Space Life Support Systems taught by Hank Rotter at the University of Houston, Clear Lake
  - Space Propulsion Systems taught by George Hopson at Alabama A&M
  - Power and Avionics taught by Robert Kichak at the University of Maryland
  - Satellite Attitude Control Systems taught by Neil Dennehy at the University of Maryland
- Next course will focus on Human Factors and be taught by Cynthia Null in December 2006

Satellite Attitude Control Systems, June 2006

Neil Dennehy (R) and Student

Hank Rotter (R) and Student

NESC Awards

Recognize Technical Excellence of the Centers

June 2005 Williamsburg, VA

August 2005 Cleveland, OH
GRC Group Achievement Award Recipients

June 2005 Hampton, VA
Cassini-Huygens Entry, Descent & Landing Team

January 2006 Orlando, FL

Thank You

Additional information about the NESC and its activities can be found at:

www.nesc.nasa.gov

For general questions and requests for NESC technical reviews:

Email: nesc@nasa.gov

For anonymous requests write:

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