NASA Engineering & Safety Center
The NESC provides a strong technical team to coordinate and conduct robust, independent engineering and safety assessments across the Agency.
Background (Continued)

- 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”.
- 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

- HQ - 1
- ARC - 2
- DFRC - 2
- JPL - 2
- WSTF - 1
- GRC - 1
- GSFC - 5
- MSFC - 5
- KSC - 9
- JSC - 9
- SSC - 1
- LaRC - 19
- MSFC - 5
NESC Organization (Continued)

Composition of NESC’s Extended Network of Experts

- NASA: 78%
- Industry: 15%
- Academia: 4%
- Other Governmental Agency: 3%
- International: <1%

Total SPRT membership = 629 as of April 2006
Partnerships / Collaborations

National Institute of Aerospace

Lawrence Livermore National Laboratories

Southwest Research Institute

Weeden Associates, Inc.

Boeing

Swales Aerospace

Engineering Excellence
Request Processing

NESC Request Selection/ Prioritization Process

- **Requests**
  - Inputs from many sources via different media

- **Within NESC’s Scope**
  - Systems Engineering Office Disposition Process
    - NESC Chief Engineer’s Risk Assessment

- **Out of NESC’s Scope**
  - Refer or Close with Director’s Concurrence
    - Notify Requestor of Referral
      - Referred
        - NESC Review Board
          - Approved
            - Conduct Activity

- NESC’s Scope
  - NESC Risk Matrix

12 3 4 5
L  I  K  E  L
I  H  O  D
5 4 3 2 1
Request Metrics

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

- NESC: 25%
- External to Agency: 7%
- Engineering & Scientific Organizations: 31%
- Center Management: 4%
- Safety and Mission Assurance at Centers: 4%
- Program Analysis and Evaluation: 1%
- Anonymous: 2%
- Office of Chieft Engineer: 2%
- Office of Safety and Mission Assurance: 5%
- Program Management: 19%
Request Metrics (Continued)

Accepted Requests by Mission Directorate
(Total of 137 Requests as of July 6, 2006)

- Space Operations: 64%
- Exploration Systems: 7%
- Aeronautics Research: 3%
- Science: 16%
- General (across multiple mission directorates): 10%
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

Independent Structural and Thermal Analysis on External Tank Bipod Foam and Ice/Frost Ramps

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

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

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

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

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

Assessing composite materials for the CEV Crew Module
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
NESC Awards
Recognize Technical Excellence of the Centers

June 2005 Williamsburg, VA
GRC Group Achievement Award Recipients

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

August 2005 Cleveland, OH

January 2006 Orlando, FL
Thank You

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

www.nesc.nasa.gov

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