FACT SHEET **Oct. 14, 2005**

SUBJECT: EXTERNAL TANK TIGER TEAM INTERIM REPORT

The External Tank Tiger Team, chartered after the unexpected loss of external tank insulating foam on the STS-114 space shuttle mission, has completed an interim report following several weeks of fact-finding work on the issue. The Tiger Team has issued a number of near-term and long-term recommendations, as well as two "lessons learned."

The possible causes of the foam loss have been narrowed to a few. NASA will address all the potential causes to ensure a safer flight for our astronauts.

BACKGROUND:

The tank used in the STS-114 mission was known as external tank #121. It lost foam in five areas of concern. The most significant piece of foam lost measured about 3 feet long and 1 pound in weight from the area known as the Protuberance Air Load (PAL) ramp.

The foam used on the LH2 (Liquid Hydrogen) PAL ramp of external tank #121 was a new type developed to meet new environmental regulations banning the use of chlorofluorocarbons (CFCs) in the application process; however, this foam, known as BX-265, has been used in limited applications on previously flown external tanks. The forward 10 feet of the LH2 PAL ramp was removed and replaced with an improved BX-265 spray process as part of the rework required for Return to Flight. However, foam loss occurred in the aft portion of the LH2 PAL ramp that was not removed and replaced prior to launch.

FACTS:

The External Tank Tiger Team's work is key to understanding and addressing the causes of foam loss on the space shuttle Return to Flight mission.

- The Tiger Team looked at the launch environment, pre-flight processing, and the materials used in tank production to see whether they may have contributed to the foam loss from external tank #121. The team narrowed the range of possible root causes and examined whether any of these were unique to the STS-114 mission or tank #121. There were no launch environmental or material concerns found that would be considered unique to that tank.
- Because of post-Columbia redesigns, external tank #121 did experience a significant amount of rework, and the team did find some accidental damage had occurred. The rework of external tank #121 and subsequent tanks, most importantly work done after the LH2 PAL ramp installation, represents a significant change to the normal processing flow at NASA's Michoud Assembly Facility in New Orleans where external tanks are made.

Tiger Team Results

- The Tiger Team issued several recommended actions to reduce the chances that dangerous pieces of foam might fall off future tanks during space shuttle ascents.
    - A separate team, the space shuttle program's "in-flight anomaly resolution team" will continue work to identify the root cause.
- **Recommendations:** The Tiger Team issued four key near-term recommendations to address the loss of foam. Some of the recommendations are designed for key areas.
    - PAL ramp: Removing and replacing the entire length of the PAL ramps using improved processes.
    - Bi-pod: Implement modifications to prevent cryopumping (defined below) through the bi-pod heater wiring. The bi-pod is the device that attaches the space shuttle orbiter to the external tank.
        - Cryopumping: Nitrogen from the atmosphere, in the super-cooled environment of the fueled external tank, can liquefy and move through the bi-pod heater wiring insulation to the area beneath the bi-pod foam. The entrapped liquid nitrogen can heat during ascent, turn back into gas, and cause pressure beneath the surface. The resulting pressure can cause the foam to shed.
        - This condition has been successfully demonstrated in laboratory conditions.
        - Sealing off the flow path in the area around the heater wires will prevent this from happening.
    - Ice/Frost Ramps: Investigate the possibility of venting ice/frost ramps.
        - Foam loss from the ice/frost ramp areas was not expected. It is believed to be caused by an application process that leaves the foam susceptible to internal voids. Venting, or poking holes in the foam, proved successful in reducing foam loss from the intertank area several years ago.
    - Improve hardware protection provisions to minimize the potential for accidental hardware damage during processing, which is described as collateral damage in the Tiger Team's report.
        - The team found that areas of the tank that had more work done also had the highest number of repairs.
        - The team recommended a focused effort to review all devices meant to protect hardware and the use of these devices to reduce the potential for accidental damage.
- **Lessons Learned:** The Tiger Team also noted two lessons learned.
    - The team is recommending that NASA implement additional rigor to its engineering processes to go even further to reduce "schedule pressure" in decision-making.
    - Programs should establish rigorous control over all tools and aids, such as the platforms workers use to access areas of the tank, to ensure minimal risk to flight hardware.

Tiger Team Background

- The External Tank Tiger Team was chaired by Dr. Richard Gilbrech, who also serves as deputy director of the NASA Engineering and Safety Center.
- The Tiger Team operates independently of the space shuttle program in-flight anomaly team, which is continuing its work.
- The interim report represents the conclusions and recommendations of the Tiger Team to date. The team has been released from reviewing continued efforts of the External Tank Project; however, it will be recalled near the end of 2005 to provide a concluding assessment of the progress made by the External Tank Project in reducing further foam loss.