Swanson, Greg

From: Wells, Doug
Sent: Thursday, January 23, 2003 4:06 PM
To: Swanson, Greg
Cc: Masterson, Sara; McGill, Preston; Gentz, Steven J
Subject: Stoody Balls and Fracture Control

Greg -

Paul Munafo would like the MSFC FCB and others as appropriate (Ecord, Hampton, etc.) to discuss the Stoody ball issue and determine if it is possible to reach the conclusion that the Stoody Ball itself could be classified non-fracture critical based on the work and studies that have taken place to date. There is an agency wide TIM here at MSFC (4612 1008) next week (Wed/Thurs). Paul would like this FC group to participate in this discussion. The decision at hand is whether to spend the time and resources replacing the balls or can we legitimately continue to fly them as is. A multi-center agreement that the balls are not FC would make that easier in Paul's eye. If the FCB needs to get up to speed before the TIM, we may ask Steve Gentz to convey the latest scoop.

-doug

Swanson, Greg

From: Swanson, Greg
Sent: Friday, January 24, 2003 9:09 AM
To: Wells, Doug; McGill, Preston
Cc: Aggarwal, Pravin
Subject: RE: Stoody Balls, SRB ET ring, and Fracture Control

Preston and Doug,

As for declaring Stoody Balls non-fracture critical my assessment is no way. The SSME is sensitive to debri and from the few pictures I have seen there is a real potential to flake off a significant piece. Restate the question to: "Is it possible to implement fracture control for currently installed Stoody Balls short of replacement?" and we may be able to help with a rationale for replacement of cracked balls and periodic inspection. Next week for a TIM, short fuse then, lets talk this afternoon about what to do. Say 12:00, 4666?

Sounds like SRB isn't asking to change the SRB ET ring fracture critical classification, but they do want help with developing alternate rationale. We are not the MRB or FRR, They should use the MRB system first before coming to us, if the issue can not be resolved there with the membership representing our departments then the FCB could be involved. In the end the flight rationale is owned by the project, but in my opinion projects should involve the appropriate technical experts in developing the rationale. Lets talk about this before you respond to David, say after the Stoody discussion today?

Greg

-----Original Message-----
From: Wells, Doug
Sent: Thursday, January 23, 2003 4:06 PM
To: Swanson, Greg
Cc: Masterson, Sara; McGill, Preston; Gentz, Steven J
Subject: Stoody Balls and Fracture Control

Greg -

Paul Munafo would like the MSFC FCB and others as appropriate (Ecord, Hampton, etc.) to discuss the Stoody ball issue and determine if it is possible to reach the conclusion that the Stoody Ball itself could be classified non-fracture critical based on the work and studies that have taken place to date. There is an agency wide TIM here at MSFC (4612 1008) next week (Wed/Thurs). Paul would like this FC group to participate in this discussion. The decision at hand is whether to spend the time and resources replacing the balls or can we legitimately continue to fly them as is. A multi-center agreement that the balls are not FC would make that easier in Paul's eye. If the FCB needs to get up to speed before the TIM, we may ask Steve Gentz to convey the latest scoop.

-doug

Greg,

David Martin, SRB chief engineer, asked me to get your opinion on whether or not the MSFC FCB should review the rationale for flight with respect to fracture control for the next et attach ring. The attach ring is fracture critical and we currently do not meet mission life requirements based on our latest estimate of fracture toughness for the material.

Let me know what you think. I'll be glad to provide more details.

Thanks,

Swanson, Greg

From: Swanson, Greg
Sent: Monday, January 27, 2003 3:15 PM
To: McGill, Preston
Cc: Wells, Doug; Aggarwal, Pravin; Hawkins, Jim
Subject: RE: external tank attach ring and fracture control

Preston,

The answer is yes, the FCB should be involved in review of fracture control of a fracture critical component that has been determined to fall short of fracture control requirements. The ET attach ring would fall into this category. Your question was well stated since the FCB would be involved with the fracture control aspects of the flight rationale, but the other aspects of the flight rationale should be reviewed by other appropriate experts. A flight rationale can consist of many factors, the FCB's function here is to ensure the fracture control issues are properly presented and, if possible, to develop an alternate fracture control rationale.

A fracture critical component that has a reduction in margin against fracture control requirements, but still meets them, would most likely be dispositioned by an MRB. The FCB is available to assist with the fracture aspects of an MR if requested, and the individual members of the FCB will assist the MRB technical representatives within there parent organizations if asked.

Greg
Dr. Gregory R. Swanson
ED22 Strength Analysis Group
NASA/MSFC
(256) 544-7191

-----Original Message-----
From: McGill, Preston
Sent: Thursday, January 23, 2003 5:51 PM
To: Swanson, Greg
Cc: Wells, Doug
Subject: external tank attach ring and fracture control

Greg,

David Martin, SRB chief engineer, asked me to get your opinion on whether or not the MSFC FCB should review the rationale for flight with respect to fracture control for the next et attach ring. The attach ring is fracture critical and we currently do not meet mission life requirements based on our latest estimate of fracture toughness for the material.

Let me know what you think. I'll be glad to provide more details.

Thanks,

Preston
4-2604

Swanson, Greg

From: Gregg, Wayne
Sent: Thursday, February 20, 2003 9:23 AM
To: Swanson, Greg
Subject: RE: Node 2 FYI

Updates..

MSFC CONCLUSION:

The Node 2 primary structure does not meet the requirements of SSP 30558, Section 4.2.4.3, Non-Hazardous Leak Mode of Failure, even though a large portion of the structure can be shown to have a critical flaw of at least 10 times the wall thickness (Note: There are 4 locations in the pressure wall parent material where this does not occur {Ref: N2-TN-AI-0129, Node 2 Leak Before Burst Analysis, page 16}). Inherent to the non-hazardous leak before burst philosophy is the elimination of pressure load in the structure due to leakage, thereby eliminating further flaw growth. The Node 2 is designed to maintain a pressurized environment; therefore, no pressure load loss occurs. The fracture classification for the primary structure pressure walls and welds in N2-LI-AI-0010, Fracture Critical Item List, of safe-life (fracture critical) is correct, and all requirements for fracture critical components must be maintained.

The Fracture Control Requirements for Space Station (SSP 30558, Section 3.3.1) states; "Each Space Station major element or experiment hardware system shall be governed by a Fracture Control Plan ...". The Node 2 Fracture Control Plan (N2-PL-AI-0002, Section 13.2.f) states that performance of nondestructive evaluation inspections includes posttest NDE of all proof tested items. In addition, SSP 30558 Section 3.4.2 states; "As a minimum, changes in design or process specifications, manufacturing discrepancies, repairs, and finished part modification for all fracture critical parts shall be reviewed according to criteria established by the responsible fracture control authority ...". MSFC Memo ED30-01-26 recommends that a post-proof eddy current inspection on both sides of Node 2 welds in non-conformance locations be conducted.

Based on lack of post-proof NDE, which violates fracture control requirements as outlined in the previous paragraph, the PIDS requirement item, 3.3.12.1.4, Fracture Control, is not verified.

-----Original Message-----
From: Swanson, Greg
Sent: Thursday, February 20, 2003 8:50 AM
To: Gregg, Wayne
Subject: RE: Node 2 FYI

See below

-----Original Message-----
From: Gregg, Wayne
Sent: Thursday, February 20, 2003 8:44 AM
To: Swanson, Greg; McGill, Preston; Wells, Doug; Bonine, Lisa
Subject: Node 2 FYI

FYI,

My summary for fracture control verification.

Please provide comments.

Thanks,
Wayne

MSFC CONCLUSION:

The Node 2 primary structure ***[Swanson, Greg]*** does not appear to meet the requirements of SSP 30558, Section 4.2.4.3, Non Hazardous Leak Mode of Failure, by demonstration of a critical through flaw length being at least 10 times the wall thickness and by demonstration of safe-life ***[Swanson, Greg]*** because: There are 4 locations in the pressure wall parent material where this does not occur {Ref: N2-TN-AI-0129, Node 2 Leak Before Burst Analysis, page 16}). ***[Swanson, Greg]*** Moreover, inherent to the ***[Swanson, Greg]*** non-hazardous leak before burst philosophy is the elimination of pressure load in the structure due to leakage, thereby eliminating further flaw growth. The Node 2 is designed to maintain a pressurized environment; therefore, no pressure load loss occurs. The fracture classification for the primary structure pressure walls and welds in N2-LI-AI-0010, Fracture Critical Item List, of safe-life (fracture critical) is correct, and all requirements for fracture critical components must be maintained.

The Fracture Control Requirements for Space Station (SSP 30558, Section 3.3.1) states; "Each Space Station major element or experiment hardware system shall be governed by a Fracture Control Plan ...". The Node 2 Fracture Control Plan (N2-PL-AI-0002, Section 13.2.f) states that performance of nondestructive evaluation inspections includes posttest NDE of all proof tested items. In addition, SSP 30558 Section 3.4.2 states; "As a minimum, changes in design or process specifications, manufacturing discrepancies, repairs, and finished part modification for all fracture critical parts shall be reviewed according to criteria established by the responsible fracture control authority ...". MSFC Memo ED30-01-26 recommends that a minimum post-proof eddy current inspection on both sides of Node 2 welds in non-conformance locations be conducted.

Based on lack of post-proof NDE, which violates fracture control requirements as outlined in the previous paragraph, the PIDS requirement item, 3.3.12.1.4, Fracture Control, is not verified.

Yell, Dena

From: Clark, Linda
Sent: Thursday, March 20, 2003 9:47 AM
To: Yell, Dena
Subject: FW: Lists

FYI

Linda Clark
Safety & Mission
Assurance/QS10
256-544-9323

-----Original Message-----
From: Nehls, Mary
Sent: Wednesday, March 01, 2000 2:38 PM
To: Jones, Chip; Russell, Carolyn; Lawless, Kirby; McGill, Preston; Clark, Linda; Ledbetter, Frank; Sparks, Scotty; Malone, Tina; Gentz, Steven J
Subject: FW: Lists

From: Lusk, Joe
Sent: Wednesday, March 01, 2000 8:23 AM
To: Adrienne Rainwater; Carolyn Russell; CHRISTOPHER REINECKE; Frank Ledbetter; Frank McDaniel; Fred Kienitz; Jody Singer; Joe Lusk; Kirby Lawless; Mark Holderman; Mary Nehls; Mike Butler; Neil Otte; PATRICK ROGERS; PATRICK WHIPPS; Richard Gladwin; Richie Brown; Sherman Avans; STEPHEN BRETTEL; STEVEN HOLMES; Tina Malone
Subject: Lists


ET High Risk List.doc


ET High Risk List Formatted Fe...

For your information.

The first attachment, ET High Risk List, was sent out February 18, 2000. The second list was developed based on the few inputs I received as the top items. I made an attempt to consolidate them.

Jerry Smelser has asked each person in the ET Project people to give him their top 5 concerns, independent of this activity.

Joe Lusk

ET High Risk List

Preliminary

Following is the list of inputs received to date in response to the action to identify the top risks on the External Tank. **It is in a "raw, unedited" format and content.**

1. EPA regulations on ET materials
2. Future material supplier changes causing extensive requal.
3. Loss of corporate knowledge
4. Lack of communication
5. Not following requirements and specifications in testing, manufacturing and material selection
6. Process control of suppliers.
7. Loss of experienced personnel from the program, both contractor and government.
8. Complex repairs (R10 or more) of AL2195 resulting in cryogenic inversion.
9. TPS Debond caused by (a) material deficiency, (b) Improper application, (c) degradation of the TPS during transport, propellent loading, or ascent (d) Heater malfunction which exceeds TPS bondline capability, (e) Purge malfunction (overtemperature), (f) LO2/LH2 Tank Buckling, (g) Propellant leaks, (h) Overheated pressurization gas.
10. Loss of TPS caused by lightning strike.
11. TPS supportability: Availability of foam components, lack of understanding of sensitivity of foam performance to changes in foam processing, material component changes and environments, and limited insight into vendor changes.
12. Lightning strike provides an ignition source resulting in fire and/or explosion or damages the tank directly. This risk is caused by insufficient lightning protection combined with lightning strike.
13. Partially Open GO2/GH2 Vent/Relief Valve Indicated Closed. Design tolerance in the GO/GH vent/relief valve position indicator switch.
14. Hydrogen Venting in Flight. Two false low LH2 tank ullage pressure indications in separate ullage pressure transducers or associated circuitry or one low indication during intact aborts with single engine failure.
15. Limited insight into vendor changes and their process control implementation.
16. Missed flaw following post proof NDE with possible failure in flight.
17. Things overlooked in the manufacturing process, such as planishing of the wrong weld, leaving one in an unplanished condition.
18. Loss of corporate knowledge at MAF and NASA with lots of old timers retiring or taking buyout.
19. Too much work and not enough time to really get up to speed on areas of responsibility The new OMRSD system
20. The new LCC system
21. It was recently discovered that a Level 2 ICD that was wrong and has been wrong since the early 90's when the system was converted. A typo for a dimension was made concerning cork thickness (it is believed) on the SRB side of the ET/SRB RSS fairing cover during the conversion which was the root cause of an interference

problem just discovered. How many other mistakes were made during this conversion that have not been found?

22. Unknown vendor and supplier process changes, including sub-vendors/suppliers.
23. Scrim cloth change
24. Flame retardant in SS-1171
25. Wipe cloth process change
26. Unknown vendor/suppliers' failure to follow requirements.
27. BSTRA heat treat issue (sub-tier vendor)
28. Use of wrong weld rod by vendor (Arrowhead)
29. Wide panel "philosophy" for flight clearance
30. Vendor hardware which is installed on the ET and which Lockheed Martin is not responsible for "touching"
31. Incorporation of upgrades/redesigns and new technology into production. Many things are verified by analysis and/or similarity, there is a risk that some hidden system level effect may be overlooked in the verification process.

Suggest classifying the list by flight safety , supporting flight rate, launch delays, etc.

ET High Risk List

1. Process control of suppliers.
   - Limited insight into vendor changes and their process control implementation.
   - Unknown vendor and supplier process changes, including sub-vendors/suppliers.
   - Flame retardant in SS-1171. Unknown vendor/suppliers' failure to follow requirements.
   - BSTRA heat treat issue (sub-tier vendor).
   - Use of wrong weld rod by vendor (Arrowhead).

2. Not following requirements and specifications in testing, manufacturing and material selection.
   - Things overlooked in the manufacturing process, such as planishing the wrong weld, leaving one in an unplanished condition.

3. Loss of corporate knowledge.
   - Loss of experienced personnel from the program, both contractor and government.
   - Loss of corporate knowledge at MAF and NASA with lots of "old timers" retiring or taking buyout

4. Wide panel "philosophy" used for flight clearance

5. TPS supportability:
   - Lack of understanding of sensitivity of foam performance to changes in foam processing, material component changes and environments
   - Limited insight into vendor changes

6. TPS debond caused by:
   - Material deficiency
   - Improper application
   - Degradation of the TPS during transport, propellant loading, or ascent
   - Heater malfunction which exceeds TPS bondline capability
   - Purge malfunction (over-temperature)
   - LO2/LH2 Tank Buckling
   - Propellant leaks
   - Overheated pressurization gas

7. Vendor hardware which is installed on the ET and which Lockheed Martin is not responsible for "touching."

8. EPA regulations on ET materials

9. Lack of communication

10. Complex repairs (R10 or more) of AL2195 resulting in cryogenic inversion (reduced weld strength at cryo)