From: "JOHNSON, NICHOLAS L. (NICK) (JSC-SX) (NASA)"
<nicholas.l.johnson@nasa.gov>
To: "'Wayne R. Frazier'" <wfrazier@hq.nasa.gov>
Subject: RE: 107 debris risk
Date: Sun, 2 Feb 2003 14:39:19 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

Wayne,

I do not have the STS-107 FRR numbers with me (I am at home at the moment). However, I received a message today from JSC/DM that I was designated to lead the OD assessment team on the accident. We will be looking at all possible debris sources, both orbital debris and meteoroids.

Will keep you posted.

Nick

> -----------
> From: Wayne R. Frazier[SMTP:wfrazier@hq.nasa.gov]
> Sent: Sunday, February 02, 2003 2:29 PM
> To: JOHNSON, NICHOLAS L. (NICK) (JSC-SX) (NASA)
> Cc: jlemke@hq.nasa.gov; jlloyd@hq.nasa.gov; mkowales@mail.hq.nasa.gov;
> wbihner@hq.nasa.gov; whill@hq.nasa.gov
> Subject: 107 debris risk
>
> Nick,
>
> I am sure you have already been thinking this, but what were the risk
> numbers for this profile. I know that some science missions and their
> orientations drive us to higher chance of on orbit hits. Also, do you
> know
> if anything was predicted to be reentering thru the area at the time?
>
> We should definitely investigate to cross off the list!
>
> W
> ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
> Wayne R. Frazier
> NASA Headquarters - Code QS
> Office of Safety and Mission Assurance
> Washington,DC 20546-0001
> Ph: 202 358-0588 Fax: 202 358-3104
> ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
>
> "Mission success starts with safety"
>

X-Sender: jmullin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 18 Feb 2003 16:14:20 -0500
To: jlloyd@hq.nasa.gov
From: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>
Subject: Fwd: Fw: Columbia follow-up
Cc: jlemke@hq.nasa.gov, wfrazier@hq.nasa.gov

Jim, thought you might pass this note on. It comes from Mike McCombs at Vandenberg. I am sure that the board is considering all of the possibilities. This note is a bit stale as it was sent to my home computer, and Barb is using it most of the time. Regards, Jon

Sent: Sunday, February 02, 2003 9:36 AM
Subject: Columbia follow-up

Jon,

I've heard word of debris striking wing on ascent. If they are not already lending some focus to that, consider the "build-paper trail" for that particular ET and go for the foam mixing ratios, mix times and cure times, etc. If you recall the Delta failure in 98 at the Cape, the investigation got to the build-paper for the GEM cases at their manufacturing point; records showed the resins had been cured within spec, but at the upper/lower end of the spec, and coupled with other specs in the mixing, temperature, set-time, etc., the result was a cured product that was more brittle than expected. When the GEM ignited, and "perhaps - not proven, I recall - due to a small flaw in the fibers, the GEM ruptured lengthwise.

It could be a similar situation in that at that point where a shift-change occurred and mix working time was shakey, but someone thought the foam was still workable and application continued, resulting in a less-than-adequate bond and hence a large piece could have been easily dislodged. This would require investigation to see if somehow, somewhere, sometime, an individual made a decision to cut-a-corner to save time or $, instead of meeting the requirement.

Note I am not saying this is the smoking gun, but this concept is what the Fault Tree Analysis would prove or de-bunk.

Michelle Laufer (working in SES since the late 80s and with Rockwell before that) called me yesterday morning "offering" to support any investigation that might be initiated. I think that goes for all of us.

Bye for now, and good sailing. Try to keep those folks on-track.

Mike

Jonathan B. Mullin
Manager Operational Safety
Emergency Preparedness Coordinator
Headquarters National Aeronautics and Space Administration

Phone (202) 358-0589
FAX (202) 358-3104
"Mission Success Starts with Safety"

To:
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: MOre shuttle info
Cc:
Bcc:
Attached:

http://spaceflight.nasa.gov/shuttle/

See A/F images of the orbiter going overhead. Unfortunately, the part of the left wing of interest appears to be in the shadow.

From: "Cooke, Douglas K., Col, SAF/AQPC" <Douglas.Cooke@pentagon.af.mil>
To: "'Wayne R. Frazier'" <wfrazier@hq.nasa.gov>
Subject: RE: Photo from STS107
Date: Thu, 13 Feb 2003 08:24:15 -0500
X-Mailer: Internet Mail Service (5.5.2653.19)

everything looks to be where it is supposed to be...there does appear to be a small shadow toward the end of the left-hand leading edge -- appears to be a slight depression; doubt it's anything of concern, however.

I guess for the future, you'll have to increase surveillance on the vehicle as it orbits -- high speed photography; high res radar tracking; thermal imaging... could/should all future missions conduct EVAs once on-orbit and just prior to return to get a visual inspection of the spacecraft? Having said that, there probably isn't much repair capability if external damage is noted???

-----Original Message-----
From: Wayne R. Frazier [mailto:wfrazier@hq.nasa.gov]
Sent: Thursday, February 13, 2003 8:10 AM
To: Keith.Eden@pentagon.af.mil; Douglas.Cooke@pentagon.af.mil
Subject: Fwd: Photo from STS107

Here is a shot of the wings taken on orbit from one of my contacts in JSC. Not much can be determined from this limited shot, but just shows what we're up against getting to the bottom of this.
More to come.
Wayne

>This looks like a large portion of the wing, but it really is not. The
>photo, of course, was taken from one of the two windows at the front of the
>cargo bay.
>
>
>Nick
>

From: "Frost, John C SAFETY" <john.frost@us.army.mil>
To: "'wfrazier@HQ.NASA.GOV'" <wfrazier@HQ.NASA.GOV>
Subject: High Speed Foam Damage Potential
Date: Thu, 6 Feb 2003 18:17:20 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

Wayne,

As we discussed by phone, the Army has recently done some testing that might be
of some use to the Columbia investigation.

In short, after years of missile firings without incident, we recently began experiencing significant damage to the tail structures of helicopters firing a
specific version of the Hellfire missile. After much investigation, the only change we could find was that the new rocket motor manufacturer had started adding a foam insert inside the rocket motor. However this foam was very soft and light, much like a few ounce "Nerf Ball" and didn't seem capable of damage
to the robust aircraft structures.

To resolve the issue we test fired motors and measured speed, damage, dispersion
etc. Bottom line was that even this extremely light weight, low density foam was
capable of surprising damage at high speeds. Test results from the redesigned replacement motor are attached. They briefly describe the problem and our test
setup. The PDFs entitled 1-Summary and 2-Program have a little background.

I understand that the density and speed of our "foam" is very different than your insulation, but do want to make sure you know what we know. If this phenomenon turns out to be of interest to you, I can put you in touch with our
experts that tested the damage potential of the foam.

Good luck on your investigation. Call if we can help on any.

Best Regards,

John C. Frost, P.E.
Chief, AMCOM Safety Office

-----Original Message-----
From: Mulkey, Bob A SAFETY
Sent: Wednesday, February 05, 2003 2:29 PM
To: Frost, John C SAFETY
Subject: FW: Rocket Motor Report

To: "Cooke, Douglas K., Col, SAF/AQPC" <Douglas.Cooke@pentagon.af.mil>
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: RE: Photo from STS107
Cc:
Bcc:
Attached:

Yea, not much you can do for the thousands of unique tiles. For this mission they could not even do an EVA. The EVA hatch was blocked with a tunnel to the SpacHab module. I am sure we'll take some hits for our lack of on orbit surveillance and repair capability from the board, especially since tile damage has been a problem. At 08:24 AM 2/13/2003 -0500, you wrote:
> everything looks to be where it is supposed to be...there does appear to be a small shadow toward the end of the left-hand leading edge -- appears to be a slight depression; doubt it's anything of concern, however.
>
> I guess for the future, you'll have to increase surveillance on the vehicle as it orbits -- high speed photography; high res radar tracking; thermal imaging... could/should all future missions conduct EVAs once on-orbit and just prior to return to get a visual inspection of the spacecraft? Having said that, there probably isn't much repair capability if external damage is noted???
>
> -----Original Message-----
> From: Wayne R. Frazier [mailto:wfrazier@hq.nasa.gov]
> Sent: Thursday, February 13, 2003 8:10 AM
> To: Keith.Eden@pentagon.af.mil; Douglas.Cooke@pentagon.af.mil
> Subject: Fwd: Photo from STS107
>
> Here is a shot of the wings taken on orbit from one of my contacts in JSC. Not much can be determined from this limited shot, but just shows what we're up against getting to the bottom of this.
> More to come.
> Wayne
>
> >This looks like a large portion of the wing, but it really is not. The
> >photo, of course, was taken from one of the two windows at the front of the
> >cargo bay.
> >
> >
> >Nick
> >

From:
To: <wfrazier@hq.nasa.gov>
Reply-to: snewman@hq.nasa.gov
X-your-intranet-is:
X-for-help-with-Intranets:
Date: Sat, 01 Feb 2003 22:27:36 GMT
X-mailer: AspMail 4.0 4.03 (SMT412E7EF)
Subject: An Invitation from
X-OriginalArrivalTime: 01 Feb 2003 22:27:37.0296 (UTC)
FILETIME=[1FADBD00:01C2CA41]

Dear Wayne,

We've set up an intranet for 107 Team and want you to check it out.

Here's a personal message from

Our intranet is our group's private website. We can use it to share group documents, schedule events, hold online discussions, and more. Only people who are invited to join can become members. I've created a temporary login name and password to make it easy for you to access our site.

GETTING STARTED: To become a permanent member, all you have to do is complete your registration when you log in.

To begin, click here:

If you are not interested in participating, you can decline your membership by clicking here:

I hope to see you soon in our intranet!

Regards,

X-Sender: mstamate@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 11:11:16 -0500
To: James Lloyd <jlloyd@hq.nasa.gov>,
"Wayne R. Frazier" <wfrazier@hq.nasa.gov>
From: Michael Stamatelatos <mstamate@hq.nasa.gov>
Subject: Re: Old shuttle risk study by Pate-Cornell
Cc: prutledg@hq.nasa.gov, jlemke@hq.nasa.gov, jlyver@hq.nasa.gov

Jim:
I already gave Wayne copies of two papers published by Elizabeth based on that work. I am also getting a copy of the report today and I will forward a copy to you and Wayne.
Michael

At 10:26 AM 2/4/2003 -0500, James Lloyd wrote:
I recall seeing the study and recall it being on workmanship and its relationship to goodness of tile application. The study also treats the risk in a probabilistic sense. Maybe Bill Loewy could do a search on the web if it might be available externally or on the servers if internally. I think it predates Bob Weinstock but I may be wrong unless it was worked through Vitro. I would bet it is somewhere where we might have all the supporting documents for risk assessment.

At 09:58 AM 2/4/2003 -0500, Wayne R. Frazier wrote:
Jack Mannix from legal just called me. They are looking for a 1990 study by Elizabeth Pate-Cornell at Stanford on Shuttle Risk Analysis. I think I remember Bob Weinstock working that from here out of Code Q funds. Does anyone have a copy. Apparently its getting some press.

Wayne
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Wayne R. Frazier
NASA Headquarters - Code QS
Office of Safety and Mission Assurance
Washington,DC 20546-0001
Ph: 202 358-0588 Fax: 202 358-3104
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

"Mission success starts with safety"

Jim

****
Dr. Michael Stamatelatos
Manager, Agency Risk Assessment Program
NASA Headquarters - Mail Code QE
Office of Safety and Mission Assurance
300 E Street, SW

Washington, DC 20024
Phone: 202/358-1668 Fax: 202/358-2778
E-mail: Michael.G.Stamatelatos@nasa.gov
(Please note change in e-mail address)
****
"Mission success starts with safety"

Content-Type: application/x-msexcel; name="STS-107 Comm.xls"
Content-Description: STS-107 Comm.xls
Content-Disposition: attachment; filename="STS-107 Comm.xls"

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****
Jack Lekan John.F.Lekan@nasa.gov
NASA John H. Glenn Research Center (216) 433-3459 Office
at Lewis Field (216) 433-3790 Fax
Mail Stop 77-7
21000 Brookpark Road
Cleveland, Ohio 44135
****

Ann P. Over/Microgravity Science (216) 433-6535 (Fax 3-8050)
NASA Glenn Research Center, M.S. 77-5 (Rm. 228)

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* * * * * * *

Martha S. Wetherholt
NASA HQ Code QS

mwetherh@hq.nasa.gov
(202) 358 - 0470
(202) 358 - 3104 FAX

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* * * * *
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From:
To: "Wayne Frazier (E-mail)" <wfrazier@hq.nasa.gov>
Subject: Columbia
Date: Wed, 5 Feb 2003 08:23:22 -0500
X-Mailer: Internet Mail Service (5.5.2653.19)

Did you ever find out if the wheel well was pressurized? I agree with you that it does not need to be. If the compartment is heated, I would think that some level of presurization is required. Do you have any information on the tire? What is the tire pressure and what loads can it take?

Appreciate anything you can provide.

BAE Systems Team
Stafford Virginia 22554

To: Martha Wetherholt <mwetherh@hq.nasa.gov>
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Re: Fwd: STS-107 Commemorative Shirts
Cc:
Bcc:
Attached:

I am interested in several.At 02:28 PM 2/7/2003 -0500, you wrote:
FYI:
Just in case you're interested, I just received the (final version) of the order form from the On-Deck company in Florida for STS-107 commemorative shirts. **As indicated on the order form, proceeds from this will go to the Astronauts Memorial Fund.**

Martha

Anyone here at Code Q interested? I might be willing to coordinate it - next week -- if there is an interest.
We should pool together if anyone wants one.

Martha

X-Sender: lvover@popserve.grc.nasa.gov
Date: Thu, 6 Feb 2003 10:09:34 -0500
To: "Recipient.List.Suppressed": ;;, @nasa.gov
From: "Ann P. Over" <Ann.P.Over@nasa.gov>
Subject: STS-107 Commemorative Shirts

Date: Tue, 4 Feb 2003 06:11:38 -0800 (PST)
From:
Subject: STS-107 Commemorative
To:

Many people have asked for a commemorative shirt for the STS-107 mission. Here
is an order form, and artist sketch of the design. (It may get some more
tweaking)

There will only be two printing deadlines.
Please share this with you coworkers, and see if there is any interest.

We look forward to processing your orders.

ON DECK

To: "JOHNSON, NICHOLAS L. (NICK) (JSC-SX) (NASA)"
<nicholas.l.johnson@nasa.gov>
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Re: Photo from STS107
Cc:
Bcc:
Attached:

Thanks,

W

At 07:48 AM 2/12/2003 -0600, you wrote:
<<sts-107-wingcompare-extra.jpg>>

This looks like a large portion of the wing, but it really is not. The photo, of course, was taken from one of the two windows at the front of the cargo bay.

Nick

To:
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Orbiter tires
Cc:
Bcc:
Attached:

Talked to our shuttle folks and aviation folks here in our office. Orbiter mains are 315 psi and nose is 300 psi with GN2. Neither thinks that any gear bays are pressurized in military, or civil. Gotta go!
W

To: "Frost, John C SAFETY" <john.frost@us.army.mil>
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Re: High Speed Foam Damage Potential
Cc:
Bcc:
Attached:

thanks JOhn. I will let you know. Space Debris is the current hot topic and I may get all the help I need and more.

W

At 06:17 PM 2/6/2003 -0600, you wrote:

LANDING SUMMARY
STS-107 (OV-102) PAR

• Orbital Debris / Meteoroid Risk Assessment

source: Space Science Branch, SN3

- **Probability of a maneuver warning is ~1 in 5.7 (1 in 6 is typical)**
  - If there is an alarm and no avoidance maneuver is performed, the probability of collision with a cataloged object is estimated to be at least 1 in 100,000.

	Mission Specific	Program Acceptance
Odds of critical penetration	1 in 370	1 in 200
Probability of no critical penetration	0.9973	0.995
Odds of radiator leak	1 in 315	1 in 61
Probability of no radiator leak	0.9968	0.9837
Expected number of window replacements	2.1	
Window replacement risk	88%	

X-Sender: jlloyd@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 13 Feb 2003 08:27:12 -0500
To: salexand@hq.nasa.gov, elvia h thompson <ethompso@mail.hq.nasa.gov>,
cac <cac@hq.nasa.gov>, hcat@hq.nasa.gov, jmannix@hq.nasa.gov
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: ASAP minutes in regard to concerns of MMOD Damage and
Mitigating Responses to Threat
Cc: wfrazier@mail.hq.nasa.gov, jlemke <jlemke@hq.nasa.gov>,
prutledg@hq.nasa.gov, mark Kowaleski <mkowales@hq.nasa.gov>,
prichard@hq.nasa.gov

Not sure who is now leading the collection of reports that may instigate questions but here is one that is in the public domain and has information on MMOD risks.

http://www.nap.edu/books/0309059887/html/index.html

X-Sender: wfrazier@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Wed, 12 Feb 2003 07:08:52 -0500
To: James Lloyd <jlloyd@hq.nasa.gov>
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Re: ASAP minutes
Cc: jlemke@hq.nasa.gov, mkowales@mail.hq.nasa.gov, wbihner@hq.nasa.gov,
lsirota@hq.nasa.gov

Yesterday, I received from Nick Johnson a fax of Tommy Holloway's response to the 1997 NRC Report concerning the risk of OD damage to the orbiter. The report chaired by Rick Hauck, former astronaut and now a DC area space insurance executive, is very prophetic when is comes to some of the risk scenarios I have read about in the paper.

http://www.nap.edu/books/0309059887/html/index.html

W

At 06:22 PM 2/11/2003 -0500, you wrote:
Len,

I have excerpted a section from the November 7, 2002 minutes of the open ASAP meeting at Houston. These minutes are on the web site and freely open to public. Buried very carefully in the Aviation Safety section (:>)) you can find a reference to the need to do more fact finding on on-orbit repair capability in the face of the enhanced risk of MMOD damage on extended duration stays. This is what the AP reporter wants to interview someone about. Elvia Thompson, PAO, says the reporter is also looking for the NASA response to this. Since it isn't even a recommendation, let alone a report to NASA, I suspect people have not had a chance to even know that this observation/need to fact find even exists. The entire report is 7 pages in

length and is a PDF located at:

http://www.hq.nasa.gov/office/codeq/asapmeet/11_7_2003.pdf

Messrs. Goranson and Guiterrez are the ASAP members with the stated interest.

Aviation Safety
Mr. Gutierrez discussed the continuing Panel concern about who the Center Aviation Safety Officers report to. The ASAP has consistently taken the position that the ASO should report directly to the Center Directors. NASA does not have a consistent organization across all Centers and does not believe this structure is necessary to have a safe operation. It was agreed that the issue would be closed in the Annual Report with an agreement to disagree.

Mr. Gutierrez also mentioned the SATS program and the no-fly zone concerns as possible issues which would be addressed in the visit to LaRC the following week.

Mr. Goetz noted that Orbital Debris was still an open issue that needed to be addressed.
Ms. McCarty wanted the funding status of the JSC capability to be included in the next JSC briefing. Messrs. Goranson and Gutierrez desire more fact-finding about on-orbit vehicle repair techniques and characteristics for extended on-orbit durations.

Mr. Schaufele discussed the common issues of Second Generation launch vehicles, SLI, CRV, CTV and upgrades. The requirements have not been adequately defined, have not considered full lifecycle costs, have not been focused on a long-range NASA vision and have not had adequate focus on safety. The inter-relationship between SLI and CRV/CTV need to be considered as well as the compatibility of the CRV/CTV with EELV's. It was noted that the Integrated Space Transportation Plan, currently under NASA review, would address the requirements of these programs.

Jim

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Wayne R. Frazier
NASA Headquarters - Code QS
Office of Safety and Mission Assurance
Washington,DC 20546-0001
Ph: 202 358-0588 Fax: 202 358-3104
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

"Mission success starts with safety"

</x-html>

Jim

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-qs using -f
X-Sender: mkowales@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 06 Feb 2003 11:31:24 -0500
To: code-qe@lists.hq.nasa.gov, code-qs@lists.hq.nasa.gov
From: Mark Kowaleski <mkowales@hq.nasa.gov>
Subject: Fwd: crew escape system studies list.ppt
Cc: Charles.M.Chesser@msfc.nasa.gov, Thomas.W.Hartline@msfc.nasa.gov
Sender: owner-code-qs@lists.hq.nasa.gov

Hi Folks,

This is a question from HCAT:

Does anyone have any of the following:

- Crew Escape Module Study, Rockwell, 1989
- Shuttle Evolution Crew Escape Study, Rockwell, 1991
- Access to Space Study, NASA, 1994
- Space Transportation Architecture Study, NASA, 1999

X-Sender: whill@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 06 Feb 2003 11:00:02 -0500
To: Mark Kowaleski <mkowales@hq.nasa.gov>
From: William Hill <whill@hq.nasa.gov>
Subject: crew escape system studies list.ppt

Think Safe, Be Safe
NASA's New Vision: To improve life here,
to extend life to there,to find life beyond.
NASA's new Mission Statement:

To understand and protect our home planet
To explore the universe and search for life
To inspire the next generation of explorers
.....as only NASA can.

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: gtemplet@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 21 Jan 2003 08:24:21 -0500
To: code-q@lists.hq.nasa.gov
From: Geoffrey Templeton <gtemplet@hq.nasa.gov>
Subject: STS-107
Sender: owner-code-q@lists.hq.nasa.gov

STS-107 is scheduled for March 1. If you send me names earlier, they will received invitations. If you wish to have anyone else witness the launch, please let me know by January 29, 2003. Remember, I need full names, titles, and occupation of the principal, and the full names of all those in the party. Thanks. Geoff

Geoffrey B. Templeton
Director, George M. Low Program/CI
NASA Headquarters, Code Q
Washington, DC 20546-0001

Phone: 202.358.2157
Facsimile: 202.358.2779
E-Mail: gtemplet@hq.nasa.gov

X-Sender: mstamate@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 11:13:52 -0500
To: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
From: Michael Stamatelatos <mstamate@hq.nasa.gov>
Subject: Re: Old shuttle risk study by Pate-Cornell
Cc: jlloyd@hq.nasa.gov, prutledg@hq.nasa.gov, jlemke@hq.nasa.gov, jlyver@hq.nasa.gov

We talked about this and I gave you copies of two papers Cornell wrote based on it. I should also get later today a copy of the report and I will make you a copy.

At 09:58 AM 2/4/2003 -0500, Wayne R. Frazier wrote:
Jack Mannix from legal just called me. They are looking for a 1990 study by Elizabeth Pate-Cornell at Stanford on Shuttle Risk Analysis. I think I remember Bob Weinstock working that from here out of Code Q funds. Does anyone have a copy. Apparently its getting some press.

Wayne
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Wayne R. Frazier
NASA Headquarters - Code QS
Office of Safety and Mission Assurance
Washington,DC 20546-0001
Ph: 202 358-0588 Fax: 202 358-3104
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

"Mission success starts with safety"

****
Dr. Michael Stamatelatos
Manager, Agency Risk Assessment Program
NASA Headquarters - Mail Code QE
Office of Safety and Mission Assurance
300 E Street, SW
Washington, DC 20024
Phone: 202/358-1668 Fax: 202/358-2778
E-mail: Michael.G.Stamatelatos@nasa.gov
(Please note change in e-mail address)
****
"Mission success starts with safety"

From: "CURRY, JOHN M. (JSC-DA8) (NASA)" <john.m.curry@nasa.gov>
To: DL ESAT <DL-ESAT@ems.jsc.nasa.gov>
Subject: Fairfield, CA video/website
Date: Sun, 9 Feb 2003 00:43:31 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

Here is a very interesting piece of video from Fairfield, CA (a town located just south of the Columbia ground-track between San Francisco and Sacremento). The newsclip says it was taken by a gentleman named . I can't find a tracking number for this guy or this video, so unless somebody knows about it already, I will contact the TV station (KRON Channel 4).

If this video turns out to be time synced properly, this could be the earliest evidence of shuttle tile shedding (possibly verification of the Bissinger tile shedding event at around 135336 GMT. The time stamp on the tape says 1351, but I assume that is off since 1351 is still well out over the water.....we'll need to time sync that to UTC). Anyway, we need to get Spencer and Co. to look at it.

John M. Curry
Flight Director, JSC-DA8
Work: 281-244-1029;
john.m.curry1@jsc.nasa.gov

From: "FENNELLY, JASON L. (JSC-GA) (IDI)" <jason.l.fennelly1@jsc.nasa.gov>
To: ANTHONY CECCACCI <anthony.j.ceccacci@nasa.gov>,
CHARLES BOEHL
<charles.boehl1@jsc.nasa.gov>,
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SUSAN ZARELLA <susan.c.zarella1@jsc.nasa.gov>
Subject: STS-107 MIT EOC ONBOARD and Digital Video
Date: Mon, 10 Feb 2003 16:41:19 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

Updated lists. A CD of AMOS and Starfire imagery was delivered to analysis. EOC 2-4-0064 is "5:51am Columbia Shuttle, Fairfield California, Lionel Machado". Sorry for the confusion.
<<STS107GlobalTracking.doc>>

<<STS107DIGITALLIST.doc>> <<STS107DVONBDLIST.doc>>
<<STS107EOCHANDLIST.doc>> <<STS107MITLIST.doc>>

Jason Fennelly
Mission Video
Voice: 281-483-0925


STS107GlobalTracking1.doc


STS107DIGITALLIST2.doc


STS107DVONBDLIST.doc


STS107EOCHANDLIST2.doc


STS107MITLIST2.doc

STS-107 Investigation: Global Tracking List

Tape Format: **Various** | Civil Service Recipient: | Date Received: | IMPASS Recipient: | Date Received:

Serial Numbers, Other Information:

ISD Contacts: Ed Wilson 483-7736, Patrick Chimes 483-2397, Rick Slater 483-7723

Description of * (asterisk) in Data Stamp column: F- Full Data Stamp, P - Partial Data Stamp, N - No Data Stamp, S - Data Stamp starts and stops

Logging Team: | Opr.Team Members: BT - Trainor, C -, CD - Dupla, DD - Duling, JC - Clemons, JF - Fennelly, JW – Wheeler, LS - Salazar, RG-Geeseman, SK - Knarr, SZ - Zarella, TH - Henson, TS - Starks, O-KirkOlson, Y-MitchYouts

Logging/timing start date/time: | Processing start date/time: | Processing completion date/time:

Ref ID	Date Rcvd	Media Identification and attached materials	Received From:	Media Type	Process	Media Destination Location	EOC / MIT # Number	Release Authority	Op
1	02/01/03	Biljanes2.zip, full.avi,		Digital AVI Movie	Digital Video Processing	Columbia Images Repository STS107CLIP0001		ISD TM	JF
2	02/01/03	Fredbruenjes_020103_1005pm.rm Fredbruenjes_020103_1005pm.txt		Digital Real Media	Digital Video Processing	Columbia Images Repository STS107CLIP0002		ISD TM	JF
3	02/01/03	STS107.mpg		Digital MPEG	Corrupt	Bldg.8 Misison Video Corrupt folder		ISD TM	JF
4	02/01/03	MOV00439-2.MPG		Digital MPEG	Digital Video Processing	Columbia Images Repository STS107CLIP0003		ISD TM	JF
5	02/01/03	thomastrissell_020103am.mpg thomastrissell_020103am.txt		Digital MPEG	Digital Video Processing	Columbia Images Repository STS107CLIP0004		ISD TM	JF
6	02/02/03	Im000110.avi, emailtext.txt		Digital AVI	Digital Video Processing	Columbia Images Repository		ISD TM	JF
7	02/03/03	Hfxben_clips.wav, emailtext.txt		Digital WAV		Columbia Images Repository Audio Folder		ISD TM	JF
8	02/03/03	Gates_witness030201.ram, emailtext.txt		Digital Real Media	Digital Video Processing	Bldg.8 Misison Video Corrupt folder		ISD TM	JF
9	02/03/03	Columbia.rm, emailtext.txt		Digital Real Media	Digital Video Processing	Columbia Images Repository STS107CLIP0005		ISD TM	JF
10	02/03/03	Columbia_fullcomp_large02.wmv, emailtext.txt		Digital WMV	Digital Video Processing	Columbia Images Repository STS107CLIP0006		ISD TM	JF
11	02/04/03	107film1.pdf, E212.mpg, emailtext.txt	David.p.tancreli@usago.ksc.nasa.gov	Digital MPEG	Digital Video Processing	Columbia Images Repository STS107CLIP0007		ISD TM	JF
12	02/04/03	100_0360.mov, 100_0360.txt		Digital Quicktime	Digital Video Processing	Columbia Images Repository STS107CLIP0009		ISD TM	JF
13	02/04/03	STS-107MIT DVCAM ID 1-6	MIT/Barksdale/Ellington	DVCAM Tape	MIT DVCAM Processing	Bldg.8 Mission Video		ISD TM	JF
14	02/04/03	MarioValverde_020303_0730pm.avi MarioValverde_020303_0730pm.txt	P	Digital AVI	Digital Video Processing	Columbia Images Repository STS107CLIP0008		ISD TM	
15	02/05/03	Columbia 4 Seconds.MPG, email.txt		Digital MPEG	Digital Video Processing	Columbia Images Repository STS107CLIP0010		ISD TM	TH
16	02/05/03	Space Shuttle.WMV, emailtext.txt	[	Digital WMV	Digital Video Processing	Columbia Images Repository STS107CLIP0014		ISD TM	TH
17	02/05/03	Space Shuttle.WMV, email.txt		Digital WMV					
18	02/05/03	columbiamesquite2.avi, columbiamesquite2.txt	FTP_columbiamesquite2	Digital AVI	Digital Video Processing	Columbia Images Repository STS107CLIP0011		ISD TM	TH

STS-107 Investigation: Global Tracking List

Ref ID	Date Rcvd	Media Identification and attached materials	Received From	Media Type	Process	Media Destination Location	EOC / MIT # Number	Release Authority	Op
19	02/05/03	DanMcNew.mpg, DanMcNew.txt		Digital MPEG	Digital Video Processing	Columbia Images Repository STS107CLIP0013		ISD TM	TH
20	02/05/03	P2010077.mov, emailtext.txt		Digital Quicktime	Digital Video Processing	Columbia Images Repository STS107CLIP0012		ISD TM	TH
21	02/05/03	STS-107MIT DVCAM ID 007	MIT / Ellington	MiniDV	MIT DVCAM Process	Bldg. 8 Mission Video		ISD TM	
22	02/06/03	STS-107 H-8mm Onboard ID# 001 (Damaged)		H-8mm		JSC Bldg. 8 Mission Video	SKO205-008	ISD TM	SZ
23	02/06/03	EOC Delivery: EOC 2-4-001 - 0016	EOC-Beck	Various	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0001- 2-4-0016	ISD TM	SZ
24	02/06/03	EOC Delivery: EOC 2-4-017 - 0031	EOC-Beck	Various	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0017- 2-4-0031	ISD TM	SZ
25	02/06/03	EOC Delivery: EOC 2-4-032 - 0034	EOC-Beck	Various	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0032- 2-4-0034	ISD TM	SZ
26	2/07/03	EOC Delivery: EOC 2-4-0035 - 0037	EOC-Beck	Various	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0037	ISD TM	
27	2/07/03	EOC Delivery: EOC 2-4-0041 - 0054	EOC Beck	Various	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0041- 2-4-0054	ISD TM	
28	2/07/03	STS-107 MIT DVCAM 008-012	MIT - Field	Mini DV	MIT Process	JSC-Bldg.8 Mission Video			
29	2/07/03	EOC Delivery: EOC 2-4-0055 - 0059	EOC-Tony	Various	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0055- 2-4-0059	ISD TM	
30	2/08/03	EOC Delivery: EOC 2-4--0060	EOC-Beck	Beta SP	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0060	ISD TM	
31	2/08/08	EOC Delivery: EOC 2-4-0061	EOC-Beck	Beta SP	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0061	ISD TM	
32	2/08/03	EOC Delivery: EOC 2-4-0062	EOC-Beck	Beta SX	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0062	ISD TM	
33	2/08/03	AnthonyRandall020503_1818.rm		Digital Real Media	Digital Video Process	Columbia Images Repository STS107CLIP0020		ISD TM	
34	2/08/08	EOC Delivery 02-4-0064 and 0065	EOC	Various	EOC Process	JSC-Bldg.8 Mission Video EOC-2VHS Analysis- 1 D2	2-4-0064- 2-4-0065	ISD TM	
35									
36									
37									
38									
39									

STS-107 Investigation: Digital Files

Tape Format: **Various** | Civil Service Recipient: | Date Received: | IMPASS Recipient: | Date Received:

Serial Numbers, Other Information:

ISD Contacts: Ed Wilson 483-7736, Patrick Chimes 483-2397, Rick Slater 483-7723

Description of * (asterisk) in Data Stamp column: **F- Full Data Stamp, P - Partial Data Stamp, N - No Data Stamp, S - Data Stamp starts and stops**

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Logging/timing start date/time: | Processing start date/time: | Processing completion date/time:

Ref ID	Date Rcvd	Media File Name	Received From:	Media Type	Content	Original File Name	Length	Release Authority	Op
1	02/01/03	STS107CLIP0001		Digital AVI Movie	Columbia reentry, day	Billjanes2.zip, full.avi,	0:01:44	ISD TM	JF
2	02/01/03	STS107CLIP0002		Digital Real Media	Columbia reentry, night	Fredbruenjes_020103_1005pm.rm Fredbruenjes_020103_1005pm.txt	0:0:13	ISD TM	JF
3	02/01/03	STS107CLIP0003		Digital MPEG	Columbia reentry, night	MOV00439-2.MPG	0:00:11	ISD TM	JF
4	02/01/03	STS107CLIP0004		Digital MPEG	Columbia reentry, day	thomastrissell_020103am.mpg thomastrissell_020103am.txt	0:02:25	ISD TM	JF
5	02/03/03	STS107CLIP0005		Digital Real Media	Columbia reentry, night	Columbia.rm, emailtext.txt	0:00:32	ISD TM	JF
6	02/03/03	STS107CLIP0006		Digital WMV	Columbia reentry, day	Columbia_fullcomp_large02.wmv, emailtext.txt	0:01:26	ISD TM	JF
7	02/04/03	STS107CLIP0007	David.p.tancrell@usago.ksc.nasa.gov	Digital MPEG	KSC Ice and Debris team film analysis	107film1.pdf, E212.mpg, emailtext.txt STS107CLIP0007	0:00:17	ISD TM	JF
8	02/04/03	STS107CLIP0008		Digital AVI	Columbia reentry, day	MarioValverde_020303_0730pm.avi MarioValverde_020303_0730pm.txt	0:00:54	ISD TM	JF
9	02/04/03	STS107CLIP0009		Digital Quicktime	Columbia reentry, day	100_0360.mov, 100_0360.txt	0:00:24	ISD TM	JF
10	02/05/03	STS107CLIP0010		Digital MPEG	Columbia reentry, day	Columbia 4 seconds.mpg, email.txt		ISD TM	TH
11	02/05/03	STS107CLIP0011	FTP_Columbiamesquite2	Digital AVI	Columbia Reentry, day	Columbiamesquite2.avi Columbiamesquite2.txt		ISD TM	TH
12	02/05/03	STS107CLIP0012		Digital Quicktime	Columbia Reentry, night	P2010077.mov Emailtext.txt		ISD TM	TH
13	02/05/03	STS107CLIP 0013		Digital MPEG	Columbia Reentry, day	DanMcNew.mpg, DanMcNew.txt		ISD TM	TH
14	02/05/03	ST107CLIP0014		Digital WMV	Columbia Reentry, day	Space Shuttle.wmv, emailtxt.txt		ISD TM	TH
15	2/06/03	ST107CLIP0015	Ahutchison@mail.arc.nasa.gov	Digital MPEG	Santa Cruz, Airplane?	Shuttle.mpg	0:00:15	ISD TM	JF
16	2/06/03	ST107CLIP0016		Digita MPEG	Shuttle Launch	columbia_Clip.mpg	0:00:06	ISD TM	JF
17	2/06/03	ST107CLIP0017		Digita WMVI	Columbia entry, Lubbock	Space Shuttle.wmv	0:00:47	ISD TM	JF
18	2/06/03	ST107CLIP0018		Digita AVII	Columbia Launch	Feb06_05.avi, Feb06_06.avi, Feb06_24.avi	0:00:10	ISD TM	JF
19	2/06/03	ST107CLIP0019		Digital MPEG	Columbia Launch	Columbia Launch.mpg	0:00:43	ISD TM	JF

STS-107 Investigation: Digital Files

Ref ID	Date Rcvd	Media File Name	Received From	Media Type	Content	Origianl File Name	Lengtrh	Release Authority	Op
20	2/7/03	ST107CLIP0020		Digital RealMedia	Reentry, night. Duplicate of EOC imagery	AnthonyRandall020503_1818.rm	0:46:00	ISD TM	
21									
22									
23									
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39									
40									

STS-107 EOC and Hand Delivered Tapes

Tape Format: **Various** | Civil Service Recipient: Patrick Chimes | Date Received: 02/06/2003 | IMPASS Recipient: Susan C. Zarella | Date Received: 02/06/2003

Serial Numbers, Other Information:

ISD Contacts: Ed Wilson 483-7736, Patrick Chimes 483-2397, Rick Slater 483-7723

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Logging/timing start date/time: | Processing start date/time: | Processing completion date/time:

Ref ID	Date Rcvd	Title	Received From:	Cut #	Digibeta #	SMPTE START	SMPTE STOP	Length	Tape Format	Content	EOC #	Release Authority	Op
1	02/06/03	Non-Debris – Clear Lake Park,Clear Lake, TX		7	716117	22:24:30	22:26:55	0:02:25	VHS	2 to 3 seconds of breakup from Clear Lake Park.	2-4-0001	ISD TM	SZ
2	02/06/03	Shuttle Break-up 30 Mi. North of Dallas, TX from ABC News Frame by Frame		4	716117	21:15:00	21:22:55	0:07:55	BSCP	C/U of Columbia Flying overhead real time, then frame by frame.	2-4-0003	ISD TM	SZ
3	02/06/03	Shuttle 2/1/03 Over SW Utah		2	716117	20:00:30	20:05:30	0:05:00	VHS	Video-non debris	2-4-0005	ISD TM	SZ
4	02/06/03	Sighting in El Cajon, CA		8	716117	22:36:00	22:39:14	0:03:14	8mm	Video is of after Colombia passes - Contrails	2-4-0006	ISD TM	SZ
5	02/06/03	Vapor Trails in Chino, CA							VHS		2-4-0007	ISD TM	SZ
6	02/06/03	Shuttle as seen from Ivins, Utah (May be duplication of 0005)							VHS	No Video on Tape	2-4-0008	ISD TM	SZ
7	02/06/03	Pass Over Central California w/ TC IMPASS NOTE:Original Video recorded twice		1 2	716117 716091	19:50:00 01:01:39	19:52:25 01:03:53	0:02:25 0:02:14	Digi 8 / VHS	Real Time Video - Good shot	2-4-0009 A 2-4-0009 B	ISD TM	SZ
8	02/06/03	Traffic Video								Contrails-not processed	2-4-0004		SZ
9	02/06/03	Sighting – 17 Miles NE of San Antonio		3	716117	20:54:48	20:55:20	0:00:32	VHS (EP)	Video-Sighting	2-4-0010	ISD TM	SZ
10	02/06/03	Sighting – 50 Mi North of Houston		6	716117	22:12:30	22:12:50	0:00:20	H-8mm	Video-sighting	2-4-0011	ISD TM	SZ
11	02/06/03	Sighting – The Colony, TX – 30 Miles N. of Dallas		5	716117	21:44:15	21:46:20	0:02:05	VHS		2-4-0012	ISD TM	SZ
12	02/06/03	Sighting – Converse, TX		1	716091	01:00:00	01:01:29	0:01:29	H-8mm	Airplane after mishap	2-4-0013	ISD TM	SZ
13	02/06/03	Launch Video							VHS		2-4-0016	ISD TM	SZ
14	02:06:03	Reentry DuncanVille TX 32.67N 96.89W		9	716117	22:54:00	22:58:38	0:04:38	VHS CD	Day shot over house and through trees.	2-4-0018A 2-4-0018B	ISD TM	SZ
15	02/06/03	Sparks Nevada from amateur astronemer CD is movie and stills captured from tape		10	716117	23:04:30	23:06:22	0:01:52	HI-8mm/ CD	Entry-night.	2-4-0026A 2-4-0026B	ISD TM	SZ
16	02/06/03	Sighting: From KTVK-TV Phoenix, AZ		3	716091	01:04 :03	01:07:40	0:03:37	H8mm	Good Video	2-4-0017	ISD TM	SZ
17		From this point forward,EOC number will match Ref. Number.Blank lines are Photo/Still											
18		Line Intentionally Left Blank											

STS-107 EOC and Hand Delivered Tapes

Ref ID	Date Rcvd	Title	Received From	Cut #	Digibeta #	SMPTE START	SMPTE STOP	Length	Tape Format	Content	EOC#	Release Authority		Op
19	2/6/03	Launch, Cocoa Beach Pier		4	716091	01:08:00	01:10:45	0:02:45	Dig-8	Shuttle launches behind hotel, no detail.	2-4-0019	ISD TM		SK
20	2/6/03	Landing, NE Fort Worth. VHS dub of camcorder		11	716117	20:56:00	20:57:40	0:01:40	VHS		2-4-0020	ISD TM		JF
21	2/6/03	St. George, Utah		12	716117	03:06:00	03:07:16	0:01:16	VHS		2-4-0021	ISD TM		JF
22	2/6/03	KCEN-TV Shuttle Columbia Footage Eddy, Texas looking North		6	716091	01:13:00	01:14:21	0:01:21	DVCPro VHS		2-4-0022a 2-4-0022b	ISD TM		SK
23	2/6/03	Columbia, Feb. 1,2003 8am CST Carrolton, TX		13 14	716117 716117	03:19:00 03:26:00	03:20:13 03:27:05	0:01:13 0:01:05	8mm VHS		2-4-0023a 2-4-0023b			
24	2/6/03	Columbia Reentry		15	716117	03:53:00	03:58:39	0:05:39	MiniDV CD	Re=entry Blue Sky Full, 1/2 speed and 2X, DVCAM Clone provided	2-4-0024a 2-4-0024b	ISD TM		JF
25	2/6/03	Columbia Shuttle Camp Swift Bastrop, TX		21	716117	06:50:00	06:53:27	0:03:27	VHS	EP Mode. Can not dub at this time	2-4-0025	ISD TM		JF
26		Line Intentionally Left Blank										ISD TM		JF
27		See Photo Log												
28	2/6/2003	Columbia over St. Gearge Utah, copyright VIP Media		16	716117	04:33:00	04:37:56	0:04:56	MiniDV CD	Dark sky, Columbia overhead DVCAM clone provided	2-4-0028a 2-4-0028b	ISD TM		JF
29	2/6/03	STS-107 Re-entry Cerillos, New Mexico		17	716117	04:47:00	04:48:42	0:01:42	VHS	Very detailed info attached.	2-4-0029	ISD TM		JF
30	2/6/03	Space Shuttle Columbia Re-entry Las Vegas, NV. West Northwest to East		5	716091	01:11:00	01:12:39	0:01:39	Dig-8		2-4-0030	ISD TM		SK
31	2/6/2003	KTVK Video of Columbia 2/1/03		7	716091	01:14:40	01:17:46	0:03:06	Beta SX	Looks like a dub from camcorder.	2-4-0031	ISD TM		SK
32	2/6/03	Shuttle Columbia Disaster Video 7:59:20 Laffeyette, LA 30d09'30.2" 92d02' 05.2"		18	716117	05:08:00	05:10:30	0:02:30	VHS	Chief Meteorologist Elevation 29 feet	2-4-0032	ISD TM		JF
33	2/6/03	Space Shuttle exit 23 I-15 Southern Utah facing East Prints to Photo		19	716117	05:18:00	05:21:24	0:03:24	MiniDV	Dark	2-4-0033A	ISD TM		JF
34	2/6/2003	STS-107 Re-entry Bissenger/Reno, NV Shuttle Pass, Clock and Camera		20	716117	05:35:00	05:50:32	0:07:32	BetaSP	Timing information listed on EOC attachment	2-4-0034	ISD TM		JF
35		Photo												
36		Photo												
37	2/6/2003	KDFW/FOX Views from Corsicana		8	716091	16:07:00	16:08:21	0:01:21	Beta SP	Some closeups, through trees	2-4-0037	ISD TM		
38	02/07/03	KABC-TV Glendale, CA Mt. Santiago Facing 80 – 90 Degrees 9am-12noon							Beta SP	Maybe of debris falling from sky.		ISD TM		
39	02/07/03	DAT Tape of Sonic Boom in Petaluma, CA IMPASS NOTE: GIVEN TO ACR FOR 1 VHS							DAT Tape	Sonic Boom				

STS-107 EOC and Hand Delivered Tapes

Ref ID	Date Rcvd	Title	Received From	Cut #	Digibeta #	SMPTE START	SMPTE STOP	Length	Tape Format	Content	EOC#	Release Authority	Op
40		Photo											
41		Photo											
42	02/07/03	Sighting: Groveton, Tx		14	716091	08:13:01	08:14:31	0:01:30	VHS-C	Good Video of Break-up	2-4-0042	ISD TM	CD
43		Photo											
44	02/07/03	Sighting: south of Hanksville, Utah GPS 110 degrees 43' 65" 38 Degrees 14' 20"		9	716091	07:08:18	07:09:48	0:01:30	VHS		2-4-0044	ISD TM	CD
45	02/07/03	Data and Images from Starfire and AMOS							CD	CD copy made for Analysis	2-4-0038	DOD	JF
46		Photo											
47	02/07/03	Video is of Fox News							VHS	Camera set up to record Fox News	2-4-0047	ISD TM	
48		Photo											
49	02/07/03	Sighting: Washington, Utah		10	716091	07:16:30	07:17:50	0:01:20	H-8mm	Good View	2-4-0049	ISD TM	CD
50	02/07/03	Sighting: 06:56 am MST. St. George, Utah		11	716091	07:33:05	07:33:30	0:00:25	Digi 8	Good View	2-4-0050	ISD TM	CD
51	02/07/03	Sighting: Haltom City, Tx. South of Dallas / Fort Worth		15	716091	08:21:00	08:21:54	0:00:54	VHS	Good View	2-4-0051	ISD TM	CD
52													
53													
54	2/10/03	Sighting: Euless TX			716091	17:25:05	17:26:03	0:00:58	VHS	Good view of break up but video is ver shaky.	D101-0009	ISD TM	LM
55	2/07/03	STS-107 Re-entry Video over Sparks, NV		16	716091	08:26:00	08:27:35	0:01:35	Hi-8mm		2-4-0055	ISD TM	CD
56	2/07/03	Video from Lick Observatory MT. Hamilton, CA		12	716091	07:56:34	07:58:21	0:01:47	Hi-8mm	This ID contains a mini DV copy of this HI-8mm tape	2-4-0056	ISD TM	CD
57	2/07/03	Video from Weather Camera in Los Angeles On Santiago Peak		17	716091	08:38:26	08:39:33	0:01:07	Beta SP	Time Lapse Video 1 frame every 10 seconds	2-4-0057	ISD TM	CD
58	2/07/03	Re-entry from Whitaker Park, CA		13	716091	08:02:45	08:04:08	0:01:23	Mini DV		2-4-0058	ISD TM	CD
59	2/07/03	Sighting: Coarsegold, CA		18	716091	08:46:32	08:47:51	0:01:19	Mini DV		2-4-0059	ISD TM	CD
60	2/08/2003	Sighting: Southern UTAH		19	716091	20:56:00	20:58:18	0:02:18	Beta SP	Views of video that we have seen before.	2-4-0060	ISD TM	JF

STS-107 EOC and Hand Delivered Tapes

Ref ID	Date Rcvd	Title	Received From	Cut #	Digibeta #	SMPTE START	SMPTE STOP	Length	Tape Format	Content	EOC#	Release Authority	Op
61	2/8/03	Sighting: Over Arizona DUPLICATE VIDEO							BetaSP VHS		2-4-0061	ISD TM	LM
62	2/08/03	7 views of Columbia deorbit From CBS News							BetaSX		2-4-0062	ISD TM	CD
63													
64	2/10/03 2/10/03	Lockheed Missile & Space Fairfeild, CA Lockheed Missile & Space Fairfeild, CA (Data Code)			716091	20:00:41 00:51:28	20:52:18 00:51:44	0:01:37 0:00:16	Digi 8mm	5:51am Columbia Shuttle, Fairfield California, Lionel Machado	2-4-0064	ISD TM	LM
65	2/10/03	Sighting: Richardson, TX			716092	22:28:01	20:30:41	0:02:40	VHS		2-4-0065	ISD TM	LM
66													
67													
68													
69													
70													
71													
72													
73													
74													
75													
76													
77													
78													
79													
80													

STS-107 MIT Video Tape List

Tape Format: DVCam | Civil Service Recipient: Ed Wilson / Patrick Chimes | Date Received: 02/04/03 | IMPASS Recipient: David Tharp | Date Received: 02/04/03

Serial Numbers, Other Information:

ISD Contacts: Ed Wilson 483-7736, Patrick Chimes 483-2397, Rick Slater 483-7723

Description of * (asterisk) in Data Stamp column: F- Full Data Stamp, P - Partial Data Stamp, N - No Data Stamp, S - Data Stamp starts and stops

Logging Team: | Opr.Team Members: BT - Trainor, C -, CD - Dupla, DD - Duling, JC - Clemons, JF - Fennelly, JW – Wheeler, LS - Salazar, RG-Geeseman, SK - Knarr, SZ - Zarella, TH - Henson, TS - Starks, O-KirkOlson, Y-MitchYouts

Logging/timing start date/time: | Processing start date/time: | Processing completion date/time:

Tape ID	Date Rcvd	Tape Label Text	CUT #	Conv. DigiBeta#	PART #	Data Stamp *	Data Stamp Start	Data Stamp Stop	SMPTE Start	SMPTE Stop	Total Time	A	Op
1 R	02/04/03	OTHER – 1 Army Flir 2/1/03	1	716087		N			23:46:00	23:48:47	0:02:47	Y	JF
2 R													
3 R	02/04/03	Team 1 Aerials: Bar – 2 2/2/03	3	716087		N			16:43:00	16:57:47	0:14:47	Y	SZ
4 R	02/04/03	Gregory Interview B-Roll Bar – 3 02/02/03	4	716087		N			17:04:15	17:11:07	0:06:52	Y	SZ
5 R	02/04/03	Team 4 T4-1 2/02/03	5	716087		N			17:16:30	17:27:03	0:10:33	Y	SZ
6 R	02/04/03	2/02/03 MIT MTG B-Rolll	6	716087		N			17:39:30	17:52:36	0:13:06	Y	SZ
7 R	02/05/03	Bar-4 Crew Transfer 2/05/03	7	716087		S	02/05/03 09:13:17	02/05/03 10:21:05	14:26:30	14:52:06	0:25:36	Y	SZ
8	02/06/03	2/2/03 1 MIT M for B-Roll	8	716087		N			10:52:00	11:05:26	0:13:26	Y	SK
9	02/07/03	Bar – 5 02/05/03 debris	9	716087		S	02/05/03 16:17:22	02/05/03 16:36:51	19:09:00	19:19:10	0:10:10	Y	SZ
10	02/07/03	Bar – 6 1st Big Debris Shipment 2/6/03	1	716118		S	02/06/03 18:39:58	02/06/03 20:14:19	19:32:00	19:43:44	0:11:44	Y	SZ
11	02/07/03	Bar – 7 Nose Cone Arrival at Barksdale Feb. 6, 2003	2	716118		S	02/06/03 21:42:43	02/06/03 22:13:20	19:49:05	20:04:47	0:15:42	Y	SZ
12	02/07/03	Bar-8 PAO Debris 2/7/03	3	716118		S	02/07/03 11:26:32	02/07/03 11:38:42	22:09:00	22:14:05	0:05:05	Y	JF
13													
14													
15													
16													
17													

From: "HILL, PAUL S. (JSC-DA8) (NASA)" <paul.s.hill@nasa.gov>
To: DL ESAT <DL-ESAT@ems.jsc.nasa.gov>,
"BRISCOE, ALAN L. (LEE) (JSC-DA) (NASA)" <alan.l.briscoe@nasa.gov>,
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"TEMPLIN, KEVIN C. (JSC-MV6) (NASA)" <kevin.c.templin@nasa.gov>
Subject: FW: Rev 12.1 Time Line Maps
Date: Wed, 12 Feb 2003 14:00:09 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

> -----Original Message-----
> From: RASK, JOHN D. (DOUG) (JSC-DM4) (NASA)
> Sent: Wednesday, February 12, 2003 1:42 PM
> To: MCCORMACK, DONALD L. (DON) (JSC-MV6) (NASA)
> Cc: STICH, J. S. (STEVE) (JSC-DA8) (NASA); ADAMS, RANDALL W. (JSC-MA2)
> (NASA); ALTMAN, SCOTT D. (JSC-CB) (NASA); HILL, PAUL S. (JSC-DA8) (NASA);
> SERIALE-GRUSH, JOYCE M. (JSC-EA) (NASA)
> Subject: Rev 12.1 Time Line Maps
>
> Rev 12.1 came out this morning, and we have revised our maps accordingly.
> Also, we verified the Mach number we used for sequence number 54, as
> requested, and added a note clarifying that the Mach and Altitude apply to
> 13:58:03, the center of the range of times associated with this event. We
> also included the full time span in the header for the note box covering
> sequence numbers 57-58.7. This did not leave enough room to include the
> "GMT" label, but it should be obvious from the context. Finally, we
> removed one bullet from the explanatory notes on page 2. Because there
> are now so many events on the maps over the Pacific, that there is no
> longer a need for Lat/Lon reference notes that are not associated with an
> event. We had removed these for Rev 12, but forgot to delete the
> reference to them in the explanatory notes.
> <<STS-107 AI R12_1 Ground Tracks.pdf>>
> John D. (Doug) Rask
> DM42 (Descent Analysis Group)
> (281) 483-1939
>


STS-107 AI R12_1 Ground Tracks.pdf

STS-107 Accident Investigation Ground Track and Events Summary
Based on the Rev 12.1 Master Time Line
(Baselined, 02/12/03, 09:00 a.m.)

February 12, 2003

X-Sender: boconnor@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 13 Jan 2003 08:54:51 -0500
To: Michael Stamatelatos <mstamate@hq.nasa.gov>
From: boconnor <boconnor@hq.nasa.gov>
Subject: Fwd: FW: BSTRA Probabilistic Risk Assessment (PRA)
Cc: Pete Rutledge <prutledg@hq.nasa.gov>,
Mark Kowaleski <mkowales@hq.nasa.gov>, wbihner@hq.nasa.gov,
david.m.browne@nasa.gov, yolanda.y.marshall1@jsc.nasa.gov

Michael,

I pass this presentation to you with a request that you look at it for process and presentation approach. This is a quick quantitative look at the BSTRA ball bearing problem developed by Dave Browne and Roger Boyer for the shuttle PM. The PM (and I) want to be sure that it is properly assessing the risk...proper assumptions, use of statistical data and presentation of uncertainty and confidence levels. Please give Roger a call and let him know you are reviewing it. This needs to be right by tomorrow PM if it is not already.

I will compare notes with you later today.

Thanks,
O'C

From: "BROWNE, DAVID M. (JSC-NC) (NASA)" <david.m.browne@nasa.gov>
To: '"boconnor@mail.hq.nasa.gov"' <boconnor@mail.hq.nasa.gov>
Subject: FW: BSTRA Probabilistic Risk Assessment (PRA)
Date: Sun, 12 Jan 2003 15:46:30 -0600
Importance: high
X-Mailer: Internet Mail Service (5.5.2653.19)

-----Original Message-----
From: REISTER, LEAH L. (JSC-NC) (SAIC)
Sent: Sunday, January 12, 2003 1:36 PM
To: MARTINEZ, HUGO E. (JSC-NC) (GHG); 'White, Doug'; 'Rigby, David A'; 'Reith, Timothy W'; 'Martingano, Trina A'; 'Burghardt, Michael J'; 'Christensen, Scott V'; 'Curtis, Cris E'; 'Dunham, Michael J'; ALBRIGHT, JOHN D. (JSC-EP4) (NASA); ALLISON, RONALD L. (JSC-MV6) (NASA); APPLEWHITE, JOHN (JSC-EP) (NASA); BAIRD, R. S. (SCOTT) (JSC-EP) (NASA); BROWNE, DAVID M. (JSC-NC) (NASA); GRUSH, GENE R. (JSC-EP111) (NASA); JACOBS, JEREMY B. (JSC-ES4) (NASA); KRAMER, JULIE A. (JSC-EA4) (NASA); 'Madera, Pamela L'; OUELLETTE, FRED A. (JSC-MV6) (NASA); TEMPLIN, KEVIN C. (JSC-MV6) (NASA); WAGNER, HOWARD A., PHD (JSC-EP) (NASA); 'Fineberg, Laurence H.'; 'Frazer, John W.'; 'Harrison, Steve'; 'Mulholland, John P'; 'Peller, Mark E'; 'Pickens, Mark S'; 'Saluter, Brett D'; 'Snyder, Michael J'; 'Stefanovic, Mike'; 'Young, Michael L'; 'Paul Munafo (E-mail)'; 'alison.dinsel-1@ksc.nasa.gov';
[illegible]om'; RINGO, LESLIE A. (JSC-CB) (USA); ANTONELLI, DOMINIC A. (JSC-CB) (NASA); MELCHER, JOHN C. (JSC-DF55) (NASA); 'Collins, Thomas E'; BENNETT, JAY E. (JSC-ES4) (NASA); 'Russell, Richard W'; MAYEAUX, BRIAN M. (JSC-ES4) (NASA); 'Lubas, Dave L.'; 'Solomon, Marcella'; 'Wagner, Howard E'; PREVETT, DONALD E. (DON) (JSC-EP) (NASA); SERIALE-GRUSH, JOYCE M. (JSC-EA) (NASA); SHACK, PAUL E. (JSC-EA42) (NASA); LANE, WILLIAM F. (JSC-DF) (NASA);
[illegible]Don Blank (E-mail)'; 'Curtis, Cris E'; HERNANDEZ, JOSE M. (JSC-ES4) (NASA); 'Steven J. Gentz (E-mail)'; DINSEL, ALISON J. (JSC-ES5) (NASA);
[illegible]'linda.combs@usahq.unitedspacealliance.com'; 'Hirakawa, Earl M'; ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA); 'Russell, Richard W'; 'Charlie Abner (E-mail)'; 'Stenger-Nguyen, Polly'; 'Combs, Linda A'; 'Blank, Donald E'; 'Beil, Bob'; BROWNE, DAVID M. (JSC-NC) (NASA); BOYER, ROGER L. (JSC-NC) (SAIC); SCHICK, TIMOTHY D. (JSC-NC) (SAIC); REISTLE, BRUCE C. (JSC-NC) (SAIC); CAZES, DAVID (JSC-NA) (SAIC)
Cc: ROE, RALPH R. (JSC-MV) (NASA); 'Wilder, James'; 'Mulholland, John P'; 'Mike Leinbach (E-mail)'
Subject: BSTRA Probabilistic Risk Assessment (PRA)
Importance: High


BSTRA-PRA-Charts-111.ppt

BSTRA Probabilistic Risk Assessment (PRA)

STS-107

JSC SR&QA

Roger Boyer
Hugo Martinez
Tim Schick

MSFC S&MA

Jim Rogers
Ken Johnson

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Success Criteria

- SSME Project Office accepts FOD based on size and mass for each set of fluid lines
  - LOX critical dimensions (based on cleanliness):
    - 800μ particle or larger can clog xxx
    - 0.0023 gm particle or larger can damage
  - LH2 critical dimensions (based on cleanliness):
    - 400μ particle or larger can clog injectors
    - 0.0003 (gm) particle or larger can damage

Assumptions

- Mission Relevant Test Ball (MRTB) is 1.75" Ball, S/N 7, no notch
- Assume ~20% of the ball surface area available to release "rafts" or chips to the flow field
- More likely that large islands break into smaller rafts
- Large rafts released under the cup are more likely to be broken up
- Rafts are generated from islands

Assumptions

- Ignition is not considered in this assessment
- A raft of greater than 400 microns may not successfully pass through the SSME and will conservatively result in LOCV

Approach

- Determine probability of having a crack prior to a mission
- Determine probability for a raft of a given size breaking away
- Determine probability of large raft getting into flow stream
- Take no credit for reduced probability of raft actually imposing damage on the SSMEs

BSTRA PRA Approach

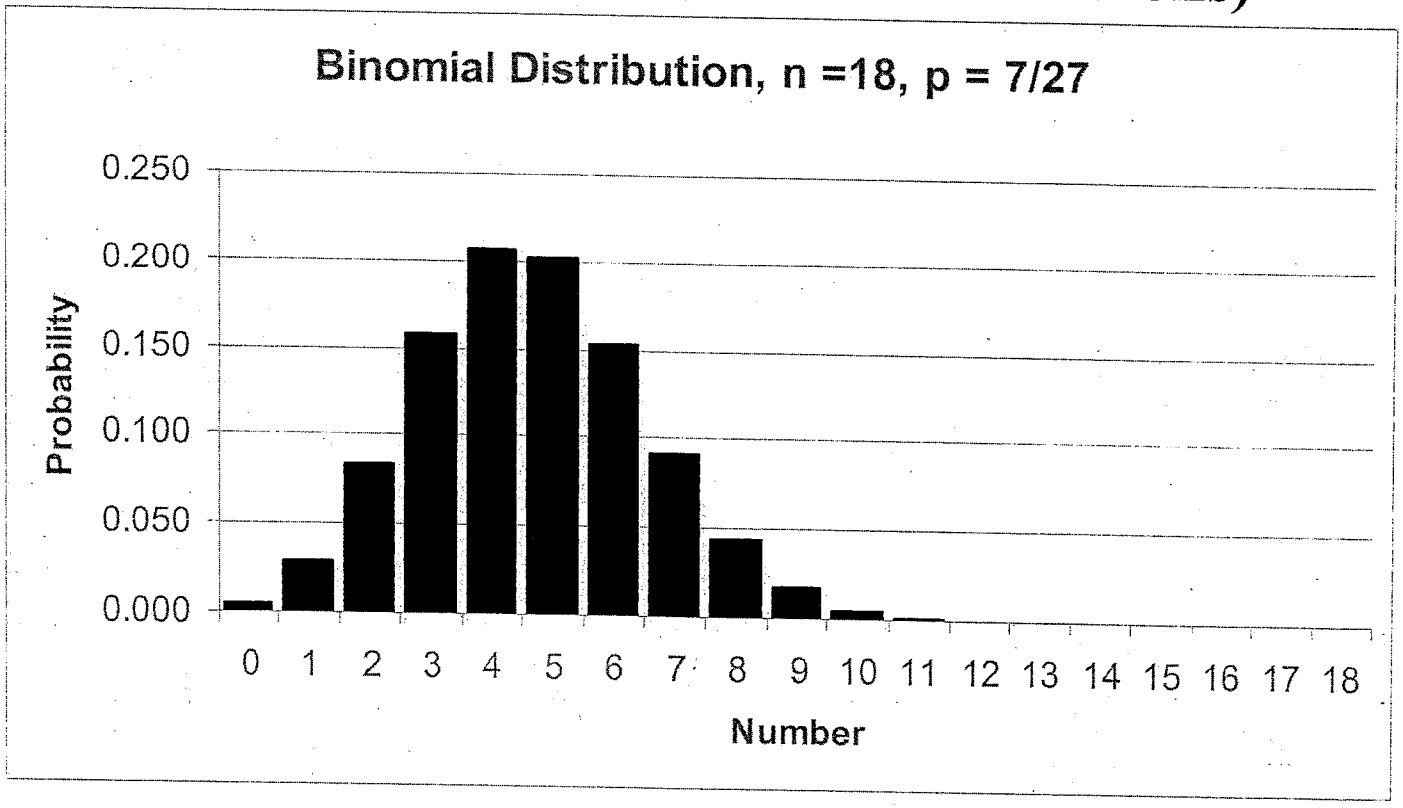
Event Sequence

- **Critical SSME Damage**
- **Passes thru SSME**

} **Assumed to be occur**

- **Exposed Raft** — What is the likelihood that a raft is exposed to the flow?
- **>400μ FOD** — What is the likelihood that a raft of 400μ or larger is released?
- **Crack Frequency** — What is the likelihood of having a crack per mission?

Binomial Distribution for Crack Occurrence on a Vehicle (based on initial subsurface indications)



BSTRA PRA Approach

Crack Frequency

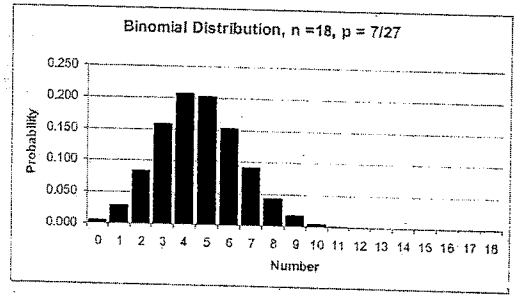
What is the likelihood of having a crack per mission?

- 1 out of 54 on Vehicle balls has a visible crack.
- **7 out 27 spares has subsurface indications.**
- First crack on 1.75" –7 test ball occurred after 145 thermal cycles.
- 128 thermal cycles to date on OV-103, -104, & -105.
- OV-102 has 50 thermal cycles to date.

Use Binomial distribution

m = 0.22

Random probability



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