

you presented in your analysis. As a researcher I wish to bring this information to your attention (my comments are italicized), since you have displayed such concern and expertise in this subject:

1) excerpt after ABC News (July 30, 2000): "Concorde supersonic jets had at least a dozen blown tire incidents before the crash of an Air France Concorde earlier this week, according to safety reports obtained by ABCNews.com from U.S. aviation agencies and accounts by British Airways. Evidence released Friday by French authorities suggests a tire blowout during takeoff of the Air France Concorde at Paris' Charles de Gaulle airport **initiated a sequence of events** that led to the crash Tuesday (...). *(I'm aware that there's a major difference here: tire blow-out at Concorde's take-off, max. cruising speed inflight - Mach 2, while Columbia was traveling at Mach 23 at an altitude of 231,304 ft upon landfall at California coast, RMC)*

**Debris from a blown tire can rupture fuel tanks and fuel lines** and be sucked into engines, which are uniquely located above the open landing gear on a Concorde. (...) *(the engine & fuel tanks on the shuttle are located well behind and above the wheel well, although in close proximity to it and to the hydraulic lines, electrical wiring...etc., RMC)*

French authorities said Friday they believe one tire and possibly two burst as the Concorde was accelerating down the runway. (...) But a ruptured tire on a Concorde can be especially serious, experts say, because of the aircraft's unique design, which allows it to cruise at twice the speed of sound. (...) The most serious incident occurred at Washington's Dulles International Airport in **June 1979, when two tires blew out on the left landing gear** (!). **Debris punctured three fuel tanks, severed hydraulic lines and electrical wires** (!) *(emphasis added, RMC)*, and damaged the No. 2 engine. Fuel poured out of the wing, but didn't catch fire.

[http://abcnews.go.com/sections/world/DailyNews/concordesafety\\_000729.html](http://abcnews.go.com/sections/world/DailyNews/concordesafety_000729.html)

2) excerpt after BBC News.com (July 28, 2000): "Concorde has experienced **"potentially catastrophic" problems with tyres** prior to Tuesday's fatal crash, according to US safety officials. (...) In Washington, the National Transportation Safety Board (NTSB) has released details of four incidents in which Air France Concordes blew tyres on take-off. (...) In 1981, the NTSB said that in June 1979 an Air France Concorde experienced blow-outs of tyres numbers five and six on the left-hand side while taking off from Washington's Dulles Airport. **Tyre debris and wheel shrapnel, it said, resulted in damage to number two engine, the puncture of three fuel tanks and the severance of several hydraulic and electrical wires. A large hole was also torn in the skin of the top wing.**" (!) *(emphasis added, RMC)* <http://news.bbc.co.uk/1/hi/world/europe/856173.stm>

3) excerpt from safe-skies.com (Sept. 1, 2002): "The July 25 accident shows that the **destruction of a tire, an event that we cannot say will not recur, had catastrophic consequences in a short period of time, preventing the crew from rectifying the situation.** UN-grounding the Concorde will be difficult!" [http://www.safe-skies.com/concorde\\_crash.htm](http://www.safe-skies.com/concorde_crash.htm) *(There was nothing that the Columbia crew could have done had they been aware of this last-minute potentially fatal danger, but how can we continue to resign shuttle crews to such helplessness?)*

In terms of Columbia's tires: we know, thusfar, that one of its radial tires has been recovered near Hemphill, Texas as confirmed by NASA. Has it been determined which of the shuttle's tires was found and if the incurred damage was the result of a rupture inflight, or as a result of impact when it fell to the ground?

Mr. Daugherty, I appreciate your patience in reviewing this communication from a concerned, but keen observer. I am still dealing with the extreme grief I feel over this terrible loss and I wish I could do more to help in the investigative process. I've also been tuning in daily to NASA briefings and those of CAIB. Please feel free to call on me or to forward this information to the appropriate individuals at NASA. Sometimes, the observations of an outsider can bring some relevance or validity to issues at hand. It is my constant prayer that the future will bring more thorough preventive measures for shuttle crew safety and concrete escape contingency plans for the crew in event of **any type of safety breach**. The latter should, in my opinion, be of utmost importance to address and resolve (whatever the monetary cost involved), before the next manned-shuttle mission takes flight. It is unacceptable, in my opinion, to send people into space, who are willing to risk their lives, without the possibility of giving them realistic options for survival (e.g. reaching a safe bailout altitude; ejections seats...etc.) when faced with such danger as was the experience of the unforgettable Columbia Seven.

Alan H. Phillips, 06:02 PM 2/18/2003 -0500, Fwd: Main Gear Breach Concerns re: Columbia STS 10

God bless you and your colleagues. Godspeed with the investigation!

Thank you again for your work and please stay in touch, if possible.

Respectfully yours..

Buckman Laboratories International, Inc.  
1256 N. McLean Blvd.  
Memphis, TN 38108-1241

--  
Mark J. Shuart, PhD  
Director for Structures & Materials  
NASA Langley Research Center  
Hampton, VA 23681

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\*\*\*\*\*  
Alan H. Phillips  
Director, Office of Safety and Mission Assurance  
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Building 1162, Room 112C  
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Hampton, VA 23681

(757)864-3361 Voice  
(757)864-6327 Fax  
\*\*\*\*\*

Richard Patrican, 04:30 PM 2/3/2003 -0500, Fwd: Re: Shuttle PRA

---

X-Sender: rpatrica@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Mon, 03 Feb 2003 16:30:24 -0500  
To: prutledg@hq.nasa.gov, mstamate@hq.nasa.gov, mkowales@hq.nasa.gov  
From: Richard Patrican <rpatrica@hq.nasa.gov>  
Subject: Fwd: Re: Shuttle PRA

FYI, The HQCAT has asked for data on the Shuttle PRA - this is to keep you in the loop.

Date: Mon, 03 Feb 2003 10:44:59 -0500  
To: "ERMINGER, MARK D. (JSC-NC) (NASA)" <mark.d.erminger@nasa.gov>, ymarshall  
From: Richard Patrican <rpatrica@hq.nasa.gov>  
Subject: Re: Shuttle PRA

Done, Jan has a telecon at 10:30 with his team and will discuss this - he doesn't believe it will be too hard to accomplish.

At 09:28 AM 2/3/2003 -0600, you wrote:  
We are all in the MRT right now. Suggest calling Jan Railsback

-----Original Message-----

From: Richard Patrican <rpatrica@hq.nasa.gov>  
To: MARSHALL, YOLANDA Y. (JSC-NA) (NASA) <yolanda.y.marshall@nasa.gov>;  
ERMINGER, MARK D. (JSC-NC) (NASA) <mark.d.erminger@nasa.gov>  
Sent: Mon Feb 03 09:24:12 2003  
Subject: Shuttle PRA

Yolanda/Mark, Kostelnik has asked for a one pager on the Space Shuttle PRA effort. This would include a discussion of the overall top level pre Columbia accident numbers for ascent and mission, overall status of the PRA effort, and prediction on possible changes to the numbers due to Columbia. I have spoken to Bill Harris right before the HCAT, called you but you were in the 10:00 ET telecon and also called Roger Boyer and left a voice mail to the same effect. Please roll this through the program before being sent up here. Thanks.

Rich Patrican  
Manager, International Space Station  
Office of Safety and Mission Assurance  
Headquarters Office 5X35  
Phone: 202-358-0569  
Fax: 202-358-2772

Rich Patrican  
Manager, International Space Station  
Office of Safety and Mission Assurance  
Headquarters Office 5X35  
Phone: 202-358-0569  
Fax: 202-358-2772

James Lloyd, 08:03 AM 2/4/2003 -0500, Re: Questions for Your Use/Pursuit

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X-Sender: jlloyd@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Tue, 04 Feb 2003 08:03:30 -0500  
To: "Alan H. Phillips" <a.h.phillips@larc.nasa.gov>  
From: James Lloyd <jlloyd@hq.nasa.gov>  
Subject: Re: Questions for Your Use/Pursuit  
Cc: Dr Peter Rutledge <prutledg@mail.hq.nasa.gov>, boconnor <boconnor@hq.nasa.gov>, GarriH@kscems.ksc.nasa.gov, yolanda.y.marshall@nasa.gov, prichard@hq.nasa.gov

Alan, Thanks for the input. Maybe Bert and Yolanda can start tugging at the answers for some of these questions at KSC and JSC. We will place these into the growing list as suggestions for Gehman's Board to address.

At 07:40 AM 2/4/2003 -0500, Alan H. Phillips wrote:  
Bryan,

These questions have surfaced here and wanted you to have them for your use as you see fit.

- 1) Has corrosion of Orbiter components (from an aging aircraft perspective) been addressed and eliminated as a primary or contributing cause of the mishap?
- 2) Have inspections or maintenance activities identified any concerns?
- 3) What, if any, areas of the Orbiter do the current inspection plans not cover?

Best wishes to you and your Board members. Let us know if we can be of assistance.

Alan

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\*\*\*\*\*  
Alan H. Phillips  
Director, Office of Safety and Mission Assurance  
NASA Langley Research Center  
5A Hunsaker Loop  
Building 1162, Room 112C  
Mail Stop 421  
Hampton, VA 23681  
  
(757)864-3361 Voice  
(757)864-6327 Fax  
\*\*\*\*\*

Jim

Alan H. Phillips, 07:40 AM 2/4/2003 -0500, Questions for Your Use/Pursuit

X-Sender: a.h.phillips@pop.larc.nasa.gov  
Date: Tue, 4 Feb 2003 07:40:50 -0500  
To: boconnor <boconnor@hq.nasa.gov>  
From: "Alan H. Phillips" <a.h.phillips@larc.nasa.gov>  
Subject: Questions for Your Use/Pursuit  
Cc: Dr Peter Rutledge <prutledg@mail.hq.nasa.gov>,  
James D Lloyd <jlloyd@mail.hq.nasa.gov>

Bryan,

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- 1) Has corrosion of Orbiter components (from an aging aircraft perspective) been addressed and eliminated as a primary or contributing cause of the mishap?
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Alan

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Hampton, VA 23681

(757)864-3361 Voice  
(757)864-6327 Fax  
\*\*\*\*\*

Vernon W Wessel, 08:00 AM 2/4/2003 -0500, Re: Supporting Bryan on the Columbia Accident Inve

X-Info: ODIN / NASA Glenn Research Center  
X-Sender: rwessel@popserve.grc.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 5.1.1  
Date: Tue, 04 Feb 2003 08:00:32 -0500  
To: pruffledg@hq.nasa.gov  
From: Vernon W Wessel <Vernon.W.Wessel@nasa.gov>  
Subject: Re: Supporting Bryan on the Columbia Accident Investigation Board (CAIB)

Good Morning Pete,

I sent a request to our entire OSAT staff yesterday as to questions they might ask. I'll compile them and send to you in the next couple of days. Sometimes there are a few gems in lists like this. My question would be the construct on the event mishap sequence timeline probably only looking a reentry to vehicle loss initially. Probably has been accomplished but can lead to real insight when placed against the 100 plus data points of successful vehicle return. Then of course the tougher issue is the finalization of the set of failure events for the fault trees and MORT diagrams. Assume Bryan is on top of this and with no more information than I have I cannot do much more than think process.

Here Lois has been working the PBMA element of the investigation with Steve, and Frank is looking into a Payload Hazard Summary. I'll get the listing of possible questions to you ASAP. If nothing else it will let you know the things in the mind of a somewhat educated public.

Thank You,  
Bill

At 07:40 AM 2/3/2003 -0500, you wrote:

Pete,  
Just to let you know, I have requested from Yolanda's folks the ET TPS hazards (received this AM) and the PRA scenarios that lead to early entry LOV. Soon, all our requests will be focused through a single point of contact called the NASA Task Force Action Center. But for now, it's a bit of a flail. It will be easy, if we are not careful, to overwhelm the system, so once that system is up and running, all our ins and outs will be run through that entity. By the way, I'm very impressed with our Board and especially its chairman. We are up and running a full 4 weeks at least ahead of schedule compared to the Challenger BRP. Having said that, the board has a lot of work to do before they are smart enough to begin to digest...but I am optimistic.  
Best,

At 07:49 PM 2/2/2003 -0500, you wrote:  
Code Q staff members,

As you may know Bryan is the ex-officio member of the Columbia Accident Investigation Board. He left for Barksdale AFB this afternoon around noon time. That is where he will meet up with the other CAIB members.

One of our main jobs in the immediate future will be to support him. We can support him in at least three ways: 1. We can respond to his requests. 2. We can collect, on our own initiative, data that could be of use to him (but we need to proceed most carefully on this one). 3. We can suggest questions or avenues of investigation that he might be able to inject into the work of the board.

Attached is a rough list we prepared today of investigative areas--for the most part these are areas in which the SMA community has some special expertise. For each area we have tentatively named an OSMA lead (and in some cases more than one person to work together). If you can think of other areas that we have not captured, and should, let me know. If we've associated you with the wrong area(s) or failed to associate you with the right area(s), let me know. We don't want to disrupt the investigation--we want to be prudent; we want to help Bryan. Think about whether and how you might be able to be helpful in these areas; then, before you take any action, write down your plan in a clear, concise manner, and send it to me--state what you might be able to do and how you would propose to do it. Then wait for a go-ahead from Jim or me. Keep in mind that we have asked the SMA directors at

Vernon W Wessel, 08:00 AM 2/4/2003 -0500, Re: Supporting Bryan on the Columbia Accident Inve

JSC, MSFC, KSC, LaRC, ARC, and SSC to work with us as needed, so this can be part of your plan, if appropriate.

We have also asked all 10 SMA directors to think of questions or issues that Bryan might pursue with the CAIB. I will be collecting these inputs. Your questions and issues are solicited, as well. Put your investigator hat on, think about this; do your own personal fault trees and hazard analyses, send me your ideas. I'll collect them up, as well, to send to Bryan.

Let's do a great job for Bryan on this important matter.

Thanks,

Pete

---

Peter J. Rutledge, Ph.D.  
Director, Enterprise Safety and Mission Assurance Division  
Acting Director, Review and Assessment Division  
Office of Safety and Mission Assurance  
NASA Headquarters, Code QE, Washington, DC 20546

ph: 202-358-0579  
FAX: 202-358-2778  
e-mail: [pete.rutledge@hq.nasa.gov](mailto:pete.rutledge@hq.nasa.gov)

Mission Success Starts with Safety!

O'C

Bryan O'Connor  
Associate Administrator  
Office of Safety and Mission Assurance

Vernon W. (Bill) Wessel  
Director, Safety and Assurance Technologies Directorate

National Aeronautics and Space Administration  
John H. Glenn Research Center  
Mail Stop: 3-6  
21000 Brookpark Road  
Cleveland, Ohio 44135

Phone: (216) 433-2350  
FAX: (216) 977-7005  
E-Mail: [Vernon.W.Wessel@grc.nasa.gov](mailto:Vernon.W.Wessel@grc.nasa.gov)

Mission Success Starts With Safety

Faith Chandler, 09:32 AM 2/4/2003 -0500, Re: Fwd: Data systems support for wreckage recovery a

X-Sender: fchandle@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Tue, 04 Feb 2003 09:32:24 -0500  
To: Pete Rutledge <prutledg@hq.nasa.gov>  
From: Faith Chandler <fchandle@hq.nasa.gov>  
Subject: Re: Fwd: Data systems support for wreckage recovery at Barksdale

Pete,

FYL..

I also recommended this to Bryan.  
He and I spoke about it on Sunday.

At 09:29 AM 2/4/2003 -0500, you wrote:  
Yuri,

Yes, in fact we (Pat Martin) had gone to Theron Bradley (on Saturday) and asked if, based on his CONTOUR experience with IO, he would want us to call on ECS to support the Columbia AIB. He suggested we hold off a decision on that. We mentioned it to Bryan, as well, as a useful option, so it was on his mind, as well. I'm glad that connection ended up being made one way or the other. I think IO will be a valuable tool for the board.

Pete

At 09:14 AM 2/4/2003 -0500, you wrote:  
Pete,

Just to give you a heads up we've sent a team down to Shreveport last night to support Vern and his folks. We've also assembled a tiger team at ARC to work some of the scaling and interface issues of IO based on the initial feedback from the CONTOUR mishap.

I'll keep you posted as events warrant.

tx, -yuri

-----  
Vern,

be advised that James Williams and Ian Sturken from NASA Ames will arrive in Shreveport late tonight and will contact you on your cell in the morning.

They are bringing laptops that with web access will provide access to Investigation Organizer on the Ames server. They will also bring a copy of the software that can be loaded onto a local machine if necessary. They are ready to work with you and others to structure the data fields and data relationships to meet the requirements of the investigation. We can then work out the procedures and resources for training and data entry.

I'll be in contact with them throughout the days but feel to contact me directly as well.

take care,  
Tina

-----  
From: Ellingstad Vern <Ellingv@ntsb.gov>  
To: "Yuri Gawdiak (E-mail)" <ygawdiak@mail.arc.nasa.gov>  
Cc: "Tina L Panontin (E-mail)" <Tina.L.Panontin@nasa.gov>,  
"whill@hq.nasa.gov" <whill@hq.nasa.gov>,  
Benzon Robert  
<BENZONR@ntsb.gov>, Hilldrup Frank <HILLDRF@ntsb.gov>,  
"Richard.M.Keller@nasa.gov" <Richard.M.Keller@nasa.gov>,  
Clark John  
<clarkj@ntsb.gov>

Subject: Data systems support for wreckage recovery at Barksdale

Date: Mon, 3 Feb 2003 14:35:18 -0500

X-OriginalArrivalTime: 03 Feb 2003 19:26:28.0625 (UTC)



FILETIME=[2645A810:01C2CBBA]

As I indicated in our conversation, there is an urgent need to quickly implement a database to capture information pertinent to each piece of wreckage that is recovered from Columbia. I believe that the Investigation Organizer that Tina Panontin and her group at Ames have developed provides the proper infrastructure to accomplish this.

The most important immediate need is to implement a procedure to associate a unique identifier to each recovered piece (or collection of pieces) along with a basic set of descriptive information. It is my understanding that the MIT has implemented a tagging system that uses the name of the recovery team leader and a sequential number to uniquely identify each part, and records the following information:

- \* Lat/long
- \* Date tagged
- \* Rough description
- \* Hazardous material (yes/no)
- \* Photo # (will need to be tied to whatever photo db is established)
- \* Part Number (if present)
- \* Batch identifier for small parts.

Obviously we can broaden this set of variables if appropriate. It will also be important to provide hooks to other datasets, such as radar target tracks, etc.

I intend to fly to Shreveport in the morning. I would suggest that you launch two or three people from NASA Ames and that we tag up in the morning. I will let you know when I have found a place to stay. I assume that we will have facilities available at Barksdale and will try to work that out with our folks on the ground there (Benzon and Hilldrup) before I head out.

I would suggest that the Ames people bring along whatever hardware they need to set up the data system and provide for data entry. We will probably need to anticipate training people to do data entry.

Please let me know if there are any difficulties with this plan. Thanks.

Vern Ellingtad

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Peter J. Rutledge, Ph.D.  
Director, Enterprise Safety and Mission Assurance Division  
Acting Director, Review and Assessment Division  
Office of Safety and Mission Assurance  
NASA Headquarters, Code QE, Washington, DC 20546

ph: 202-358-0579  
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e-mail: [pete.rutledge@hq.nasa.gov](mailto:pete.rutledge@hq.nasa.gov)

Mission Success Starts with Safety!

---

Faith Chandler

NASA Headquarters  
Office of Safety and Mission Assurance  
Code Q Rm 5x40

Faith Chandler, 09:32 AM 2/4/2003, 0500, Re: Fwd: Data systems support for wreckage recovery a

300 E Street, S.W  
Washington, D.C 20546

202-358-0411  
202-358-2778 (fax)

~~~~~

Lawrence Davis, 03:40 PM 2/3/2003 -0500, Re: Support for Bryan O'Connor on Columbia Accident

X-Sender: lawrence.davis@mail.dfrc.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 5.0.2  
Date: Mon, 03 Feb 2003 15:40:01 -0500  
To: Pete Rutledge <prutledg@hq.nasa.gov>,  
"Bryan O'Connor" <boconnor@mail.hq.nasa.gov>  
From: Lawrence Davis <lawrence.davis@dfrc.nasa.gov>  
Subject: Re: Support for Bryan O'Connor on Columbia Accident Investigation Board (CAIB)

Bryan & Pete

Additional Ideas:

1. The AFFTC has offered their resources to help any efforts.
2. The Dryden Range Safety personnel in association with the AFFTC have a software prediction algorithm to predict the profile of an object falling through the atmosphere. Larry Schilling has volunteered to help with that analysis, even backtracking through any photos to intersect the positional data. Variations in estimates of anything that might have fallen free will provide a larger footprint but at least it will be limited somewhat. We used this capability to find the ER-2 hatch a while ago and it led us directly to the hatch.
3. The Range here collected data from the Columbia as it traveled north of our position, although not tasked to do so. We have impounded that data. We have that data, if you need it. We were at work supporting a UCAV mission, anyway. Analog tracking radar such as recorded here may provide a secondary return enabling establishment of actual separation events with size, velocity and time.
4. Bill Shelton, AFFTC, and our Range personnel also are pursuing working with the doppler FAA radars to correlate any secondary returns in the re-entry path with our radar tracking data.
5. NORAD may have data to establish space debris patterns.

Lawrence

Richard Patrican, 04:30 PM 2/3/2003 -0500, Fwd: Re: Shuttle PRA

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X-Sender: rpatrica@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Mon, 03 Feb 2003 16:30:24 -0500  
To: prutledg@hq.nasa.gov, mstamate@hq.nasa.gov, mkowales@hq.nasa.gov  
From: Richard Patrican <rpatrica@hq.nasa.gov>  
Subject: Fwd: Re: Shuttle PRA

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Date: Mon, 03 Feb 2003 10:44:59 -0500  
To: "ERMINGER, MARK D. (JSC-NC) (NASA)" <mark.d.erminger@nasa.gov>, ymarshall  
From: Richard Patrican <rpatrica@hq.nasa.gov>  
Subject: Re: Shuttle PRA

Done, Jan has a telecon at 10:30 with his team and will discuss this - he doesn't believe it will be too hard to accomplish.

At 09:28 AM 2/3/2003 -0600, you wrote:  
We are all in the MRT right now. Suggest calling Jan Railsback

-----Original Message-----

From: Richard Patrican <rpatrica@hq.nasa.gov>  
To: MARSHALL, YOLANDA Y. (JSC-NA) (NASA) <yolanda.y.marshall@nasa.gov>;  
ERMINGER, MARK D. (JSC-NC) (NASA) <mark.d.erminger@nasa.gov>  
Sent: Mon Feb 03 09:24:12 2003  
Subject: Shuttle PRA

Yolanda/Mark, Kostelnik has asked for a one pager on the Space Shuttle PRA effort. This would include a discussion of the overall top level pre Columbia accident numbers for ascent and mission, overall status of the PRA effort, and prediction on possible changes to the numbers due to Columbia. I have spoken to Bill Harris right before the HCAT, called you but you were in the 10:00 ET telecon and also called Roger Boyer and left a voice mail to the same effect. Please roll this through the program before being sent up here. Thanks.

Rich Patrican  
Manager, International Space Station  
Office of Safety and Mission Assurance  
Headquarters Office 5X35  
Phone: 202-358-0569  
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Rich Patrican  
Manager, International Space Station  
Office of Safety and Mission Assurance  
Headquarters Office 5X35  
Phone: 202-358-0569  
Fax: 202-358-2772

**James Lloyd, 04:53 PM 2/3/2003 -0500, SMA Teleconferences**

---

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-smadir using -f

X-Sender: jlloyd@mail.hq.nasa.gov

X-Mailer: QUALCOMM Windows Eudora Version 4.3.2

Date: Mon, 03 Feb 2003 16:53:57 -0500

To: smadir@hq.nasa.gov

From: James Lloyd <jlloyd@hq.nasa.gov>

Subject: SMA Teleconferences

Sender: owner-smadir@lists.hq.nasa.gov

Dear SMA Director,

Yolanda Marshall has been assisting us with the setup of a teleconference each day at 1PM Eastern Standard. We are using this forum of less than 1 hour to discuss activity and status in direct SMA support of Columbia mishap. I have asked Yolanda to pull all the SMA Directors into the telecon the next time we have one scheduled, which is Wednesday at 1pm. This is our attempt to keep the community focused on this situation and to offer an avenue for SMA Directors to provide input.

I would like to continue this daily until it ceases to have value in support of that objective. Yolanda will provide you some information shortly.

Regards,

Jim

Nelson Keeler, 04:56 PM 2/3/2003 -0500, Fwd: IV&V Items related to STS-107

---

X-Sender: keeler@orion.ivv.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 5.1  
Date: Mon, 03 Feb 2003 16:56:28 -0500  
To: Pete Rutledge <prutledg@hq.nasa.gov>  
From: Nelson Keeler <Nelson.H.Keeler@nasa.gov>  
Subject: Fwd: IV&V Items related to STS-107  
Cc: jiloyd@mail.hq.nasa.gov, Wetherholt <mwetherh@mail.hq.nasa.gov>, raque@ivv.nasa.gov, jackson@ivv.nasa.gov

Pete:

As discussed Sunday, we have impounded all our Shuttle data, particularly as associated with STS-107, both by our contractors at JSC and all of us at the Facility. We have backed up all the soft copies and made additional copies of the hard copies.

Please note Steve Raque's email below. We have been asked to forward some of our data to Darrell Stamper at JSC. As I understand it, this is a proactive request and not the result of a request from one of the investigative boards.

Ned

X-Sender: raque@orion.ivv.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 5.1  
Date: Mon, 03 Feb 2003 13:51:29 -0500  
To: "Stamper, Darrell" <darrell.e.stamper1@jsc.nasa.gov>  
From: Steven Raque <Steven.M.Raque@nasa.gov>  
Subject: IV&V Items related to STS-107  
Cc: "Keeler, Nelson" <Nelson.H.Keeler@ivv.nasa.gov>

Darrell,

Just a note to ensure we understood what to deliver to you regarding STS-107. We will have hard copies of the following items to you by 4:00 pm CST tomorrow (Feb 4).

1. SRR reports and presentations for both the initial STS-107 SRR on 6/20/2002 and the final one on 12/12/2002
2. Final SIRs related to STS-107 that were delivered with other SRR reports
3. All other SRR reports and presentations, and their related SIRs for OI-29.
5. TIMs related to STS-107 and OI-29
6. For analyst notes, tool reports, and preliminary SIRs, we will look for any information (especially entry related) that surfaced in these items that we feel should be noted to you as significant.

If I captured any of this incorrectly, please let me know.

-Steve..

Steven M. Raque  
NASA IV&V Facility  
100 University Drive  
Fairmont, WV 26554  
Phone: 304-367-8216  
Fax: 304-367-8203

Nelson (Ned) H. Keeler  
Director, NASA IV&V Facility  
(304) 367-8201

James Lloyd, 05:02 PM 2/3/2003 -0500, Re: FW: Israeli daily carries photo apparently showing shuttle

X-Sender: jlloyd@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Mon, 03 Feb 2003 17:02:34 -0500  
To: "JOHNSON, GARY W. (JSC-NA) (NASA)" <gary.w.johnson@nasa.gov>  
From: James Lloyd <jlloyd@hq.nasa.gov>  
Subject: Re: FW: Israeli daily carries photo apparently showing shuttle  
had cracked wing  
Cc: hcat@hq.nasa.gov, boconnor@mail.hq.nasa.gov, prutledg@hq.nasa.gov  
X-MIME-Autoconverted: from quoted-printable to 8bit by boig.public.hq.nasa.gov id RAA05094

Thanks Gary.

I was led to believe that the leading edges were difficult to see from the crew compartment. I am not familiar with the geometry from the viewing windows. Was this something that just happened to be picked up in a photo op or did the crew know about the cracks? I am passing this information to our action center on the chance they might not have heard of this and Bryan for their information.

At 03:47 PM 2/3/2003 -0600, you wrote:

FYI, the photo/video group is working on looking at this video.

> -----Original Message-----

> From: HASHIMOTO, RICK (REMOTE-JSC)

> Sent: Monday, February 03, 2003 10:07 AM

> Subject: Israeli daily carries photo apparently showing shuttle had

> cracked wing

>

>

> Israeli daily carries photo apparently showing shuttle had cracked wing

> JERUSALEM (AFP) Feb 03, 2003 -- The Israeli daily Maariv on

> Monday published a picture of the US Columbia space shuttle

> apparently showing two cracks on its left wing.

> The picture was taken 11 days before the shuttle exploded on its

> way back to Earth Saturday, killing all seven crew onboard.

> The photograph was extracted from footage taken by a camera

> onboard the shuttle during a live satellite video conference

> between Israeli Prime Minister Ariel Sharon and Colonel Ilan

> Ramon, the first Israeli to travel to space.

> During 15-minute conversation with Sharon and other Israeli

> officials, Ramon offered to share his view of Earth from the

> shuttle.

> Filming the blue planet, the video caught part of the shuttle's

> left wing, showing two "long" cracks, wrote the paper, which

> highlighted the alleged damage.

> The fissures could have been the cause of the technical problems

> experienced by the shuttle which led to its explosion over Texas,

> 16 minutes before it was due to land last Saturday, the paper

> charged.

> Maariv wrote that "even if NASA had discovered the cracks that

> appeared at take-off, it would not have been able to do anything"

> to save the crew.

> NASA space shuttle programme director Ron Dittemore said Sunday

> Columbia had seen a significant rise in temperature on the left

> side in the minutes leading up to its disintegration.

James Lloyd, 05:02 PM 2/3/2003 -0500, Re: FW: Israeli daily carries photo apparently showing shuttle

- > Dittmore said the drag on the left increased and the onboard
- > computer tried to correct it by bringing the shuttle to the
- > right.
- >
- > The NASA official said the drag could be "indicative" of a
- > missing heat tile or a rough tile on one of the wings.
- >
- > The shuttle had 24,000 tiles that resist the intense heat that
- > envelopes the shuttle as it hits the Earth's atmosphere.
- >
- > Dittmore emphasised that there was no firm theory as to the
- > cause of the disaster, stressing the investigation was
- > continuing.
- >
- > Concern about small cracks found along the metal liners used to
- > direct the fuel flow inside the main propulsion system had forced
- > NASA to delay Columbia's launch, originally scheduled for July 16
- > last year.
- >
- > All rights reserved. © 2003 Agence France-Presse.
- >

\*\*\*\*\*

James D. Lloyd (Jim)

Acting Deputy Associate Administrator  
Office of Safety and Mission Assurance  
Headquarters Room 5U11  
desk phone 202-358-0557

fax 202-358-3104

"Mission success stands on the foundation of our unwavering commitment to safety"  
Administrator Sean O'Keefe January 2003



**JOHNSON, GARY W. (JSC-NA) (NASA), 04:31 PM 2/3/2003 -0600, RE: FW: Israeli daily carries photo**

From: "JOHNSON, GARY W. (JSC-NA) (NASA)" <gary.w.johnson@nasa.gov>  
To: "James Lloyd" <jlloyd@hq.nasa.gov>  
Cc: hcat@hq.nasa.gov, boconnor@mail.hq.nasa.gov, prutledg@hq.nasa.gov,  
"MARSHALL, YOLANDA Y. (JSC-NA) (NASA)" <yolanda.y.marshall@nasa.gov>,  
"HOLSOMBACK, JERRY B. (JSC-OE) (NASA)" <jerry.b.holsomback@nasa.gov>  
Subject: RE: FW: Israeli daily carries photo apparently showing shuttle had cracked wing  
Date: Mon, 3 Feb 2003 16:31:10 -0600  
X-Mailer: Internet Mail Service (5.5.2653.19)

This would have been viewed from the side hatch window, hatch the crew enters the vehicle prior to launch. Should be able to see some of the leading edge & upper wing surface.

I quickly passed this information to the Photo/Video Team. They are working to try & get a hold of this video from that PAO event.

Seperate item the following Buildings are closed tomorow due to the ceremony till 2:00Pm (1,2N,3,4N,4S,7,12,16 & our building 45). We are working on our Directorate phones to be transferred to another Building, so you hopefully can still reach us.

-----Original Message-----

From: James Lloyd [mailto:jlloyd@hq.nasa.gov]  
Sent: Monday, February 03, 2003 4:03 PM  
To: JOHNSON, GARY W. (JSC-NA) (NASA)  
Cc: hcat@hq.nasa.gov; boconnor@mail.hq.nasa.gov; prutledg@hq.nasa.gov  
Subject: Re: FW: Israeli daily carries photo apparently showing shuttle had cracked wing

Thanks Gary.

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At 03:47 PM 2/3/2003 -0600, you wrote:

> FYI, the photo/video group is working on looking at this video.

> > -----Original Message-----

> > From: HASHIMOTO, RICK (REMOTE-JSC)

> > Sent: Monday, February 03, 2003 10:07 AM

> > Subject: Israeli daily carries photo apparently showing shuttle had cracked wing

> >

> >

> >

> > Israeli daily carries photo apparently showing shuttle had cracked wing

> > JERUSALEM (AFP) Feb 03, 2003 -- The Israeli daily Maariv on

> > Monday published a picture of the US Columbia space shuttle

> > apparently showing two cracks on its left wing.

> > The picture was taken 11 days before the shuttle exploded on its way back to Earth Saturday, killing all seven crew onboard.

> > The photograph was extracted from footage taken by a camera

> > onboard the shuttle during a live satellite video conference

> > between Israeli Prime Minister Ariel Sharon and Colonel Ilan

> > Ramon, the first Israeli to travel to space.

JOHNSON, GARY W. (JSC-NA) (NASA), 04:31 PM 2/3/2003, -0600, RE: FW: Israeli daily carries phot

>>  
>> During 15-minute conversation with Sharon and other Israeli  
>> officials, Ramon offered to share his view of Earth from the  
>> shuttle.  
>>  
>> Filming the blue planet, the video caught part of the shuttle's  
>> left wing, showing two "long" cracks, wrote the paper, which  
>> highlighted the alleged damage.  
>>  
>> The fissures could have been the cause of the technical problems  
>> experienced by the shuttle which led to its explosion over Texas,  
>> 16 minutes before it was due to land last Saturday, the paper  
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>> appeared at take-off, it would not have been able to do anything"  
>> to save the crew.  
>>  
>> NASA space shuttle programme director Ron Dittmore said Sunday  
>> Columbia had seen a significant rise in temperature on the left  
>> side in the minutes leading up to its disintegration.  
>>  
>> Dittmore said the drag on the left increased and the onboard  
>> computer tried to correct it by bringing the shuttle to the  
>> right.  
>>  
>> The NASA official said the drag could be "indicative" of a  
>> missing heat tile or a rough tile on one of the wings.  
>>  
>> The shuttle had 24,000 tiles that resist the intense heat that  
>> envelopes the shuttle as it hits the Earth's atmosphere.  
>>  
>> Dittmore emphasised that there was no firm theory as to the  
>> cause of the disaster, stressing the investigation was  
>> continuing.  
>>  
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>> direct the fuel flow inside the main propulsion system had forced  
>> NASA to delay Columbia's launch, originally scheduled for July 16  
>> last year.  
>>  
>> All rights reserved. © 2003 Agence France-Presse.  
>>

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James D. Lloyd (Jim)

Acting Deputy Associate Administrator  
Office of Safety and Mission Assurance  
Headquarters Room 5U11  
desk phone 202-358-0557

tax 202-358-3104

"Mission success stands on the foundation of our unwavering commitment to  
safety"

Administrator Sean O'Keefe, January 2003

JOHNSON, GARY W. (JSC-NA) (NASA), 04:50 PM 2/3/2003 -0600, FW: Special Instructions for The

From: "JOHNSON, GARY W. (JSC-NA) (NASA)" <gary.w.johnson@nasa.gov>  
To: "'Lloyd, James(Code Q)'" <jlloyd@hq.nasa.gov>, "Prutledg (E-mail)" <prutledg@hq.nasa.gov>

Subject: FW: Special Instructions for The STS 107 Memorial Service

Date: Mon, 3 Feb 2003 16:50:36 -0600

X-Mailer: Internet Mail Service (5.5.2653.19)

X-MIME-Autoconverted: from quoted-printable to 8bit by bolg.public.hq.nasa.gov id SAA29247

FYI

> -----Original Message-----

> From: HR E-Mail Notification System

> Sent: Monday, February 03, 2003 3:41 PM

> To: DL JSC Civil Servants; DL JSC Contractors

> Subject: Special Instructions for The STS 107 Memorial Service

> Special Instructions for JSC Employees Concerning The STS-107 Memorial Service

> The JSC memorial service for STS-107 will be conducted tomorrow, February 4, in the mall area between Buildings 12 and 16. Families and friends of the STS-107 crew and a large number of dignitaries, including the President of the United States are expected to attend.

> All NASA-badged employees, retirees, and contractors are invited to attend. Access to the mall area will be controlled by gates equipped with metal detectors. Attendees should avoid bringing backpacks, brief cases, or objects that would trip the metal detectors and cause a delay in their admission. The employee entrance gate will be located between Building 7 and 4. This entrance gate will open at 9:00am and will close at 11:00am. The service is scheduled to begin at 12 noon.

> There will be limited seating for the families and some of the visitors. These individuals will have special badging for the seating area. Most attendees should expect to stand for this event. Individuals who wish to attend this event and have special needs should call extension 36270.

> Parking may be difficult Tuesday morning because of the large number of people expected to attend the service. The Building 30 south parking lot will be closed beginning at 6:00pm this evening through the end of the memorial service. Additional parking and transportation to the site will be available at Space Center Houston tomorrow beginning at 8:00am.

> Because of security considerations, several of the mall-area buildings (1, 2N, 3, 4N, 4S, 7, 12, 16 and 45, will not open for normal business until the conclusion of the memorial ceremony (approximately 2:00pm). Building 30 will be open using the north entrance. Managers and supervisors who have employees located in these buildings should assure that all building occupants are made aware of these plans and do not attempt to enter these buildings until the ceremony has concluded.

> Occupants of the closed buildings are encouraged to attend the memorial service in the mall. The ceremony may also be viewed from the Building 30 Auditorium, the Building 11 cafeteria and any television-equipped lobby or conference room in buildings that will not be affected by the closing. Occupants of the closed buildings may also elect to view the ceremony from an off-site location such as Space Center Houston, the University of Houston Clear Lake auditorium, or their residence. In order to provide an opportunity to view the ceremony, duty time is authorized for all civil service employees who are scheduled to work Tuesday morning. Contractor employees should check with their management.

> The Clear Creek Independent School District is scheduled for an early release of students on February 4. However, CCISD has made arrangements

JOHNSON, GARY W. (JSC-NA) (NASA), 04:50 PM 2/3/2003 -0600, FW: Special Instructions for The

> to care for students until the end of the regular school day for those  
> parents who made need this service in order to attend the memorial  
> service. Please contact your child's school to make arrangements for this  
> service.  
>

Michael Card, 06:17 PM 2/3/2003 -0500, Fwd: RE: STS-107 Payloads

---

X-Sender: mcard@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Mon, 03 Feb 2003 18:17:36 -0500  
To: pefe Rutledge <prutledg@hq.nasa.gov>  
From: Michael Card <mcard@hq.nasa.gov>  
Subject: Fwd: RE: STS-107 Payloads

Payload data requested, see below. Mike

From: "CIANCONE, MICHAEL L. (JSC-NC) (NASA)" <michael.l.ciancone@nasa.gov>  
To: "MORELAND, DEAN (JSC-NC) (NASA)" <dean.moreland-1@nasa.gov>  
Cc: "CIANCONE, MICHAEL L. (JSC-NC) (NASA)" <michael.l.ciancone@nasa.gov>, "CARD, MIKE (JSC-REMOTE)" <mcard@hq.nasa.gov>  
Subject: RE: STS-107 Payloads  
Date: Mon, 3 Feb 2003 16:26:04 -0600  
X-Mailer: Internet Mail Service (5.5.2653.19)

Dean,

Mike is interested in essentially the same info that we're preparing for others, i.e., the beefed up payload safety summary. In addition, he needs enough info to assess whether or not payloads contributed in some fashion to the loss of Columbia. Please include him on dist when this info becomes available. And reflect on the doc log at that time.

M

-----Original Message-----

From: CARD, MIKE (JSC-REMOTE)  
Sent: Monday, February 03, 2003 10:12 AM  
To: CIANCONE, MICHAEL L. (JSC-NC) (NASA)  
Subject: STS-107 Payloads

Mike, I have been asked to pull together as much background information as possible on STS-107 payloads in anticipation of support for Bryon O'Connor. As a start do you have a complete list of payloads and a summary of respective safety issues, or please tell me where I might find such data. I guess you may be working on a similar type of analysis. Please call me 202-358-4481 so that we can talk. thanks. Mike Card

boconnor, 10:45 PM 2/3/2003 -0500, Fwd: Soon to be available briefing packages

X-Sender: boconnor@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Mon, 03 Feb 2003 22:45:57 -0500  
To: prutledg@hq.nasa.gov  
From: boconnor <boconnor@hq.nasa.gov>  
Subject: Fwd: Soon to be available briefing packages

Pete,  
I'll take them both. Thanks to you and Faith and Wayne.  
We're still in the early flail mode here...these guys have a lot to learn before they can even begin  
to look for root cause.  
Best,

Date: Mon, 03 Feb 2003 21:03:57 -0500  
From: Pete Rutledge  
Subject: Soon to be available briefing packages  
To: boconnor@hq.nasa.gov  
Cc: james.d.lloyd@hq.nasa.gov, wayne.frazier@hq.nasa.gov,  
faith.chandler@hq.nasa.gov  
X-Mailer: Microsoft Outlook Express 6.00.2800.1106

Bryan,

Hope all is going well. A couple of briefing packages should be ready for you tomorrow, Tuesday, if you want them. One is a briefing about NASA mishap investigation requirements, updated to include the formation of the Mishap Investigation Team and your Columbia Accident Investigation Board. This is an update of the briefing used for the NTSB meeting; Wayne updated it today. It could probably be e-mailed to you early tomorrow. It mostly (maybe entirely) PowerPoint text, so shouldn't take too long to download at modem speed. The second will be a briefing about the mishap investigation process; i.e., what a mishap board should do; e.g., constructing mishap timeline, interviewing witnesses, constructing fault trees, analyzing data, etc. Faith is working on this one and I suspect it would be available later in the day tomorrow. Do you want either or both of these? Or do you have any more specific needs on these or anything else?  
I'm e-mailing you from home, but please respond to my work e-mail address.

Thanks,

Pete

O'C

Bryan O'Connor  
Associate Administrator  
Office of Safety and Mission Assurance

**Phil Napala, 12:12 PM 2/3/2003 +0000, Orbital Debris Information**

---

From: Phil Napala <pnapala@hq.nasa.gov>  
To: <wfrazier@hq.nasa.gov>  
CC: <prutledg@hq.nasa.gov>, <jlloyd@hq.nasa.gov>, <jmullin@hq.nasa.gov>, <yolanda.y.marshall@nasa.gov>, <jlemke@hq.nasa.gov>  
X-your-intranet: <http://107team.intranets.com>  
X-Intranets-helpdesk: <mailto:help@intranets.com>  
Date: Mon, 03 Feb 2003 12:12:42 GMT  
X-mailer: AspMail 4.0 4.03 (SMT412E7EF)  
Subject: Orbital Debris Information  
X-OriginalArrivalTime: 03 Feb 2003 12:12:43.0210 (UTC) FILETIME=[8DEA7AA0:01C2CB7D]

Wayne,

The amount of debris from Shuttle and the collection effort is an opportunity to update our survive/demise models.

We need to think about what data we need to ask for in order to create a standard data sheet for all debris found.

Perhaps, we could get JSC and KSC to develop a palm pilot data collection checksheet to be passed out to all collection teams.

This information could be use to help determine STS107 failure mode and also aid in developing better ways to protect the public on future NASA missions both in estimating debris field and better design for minimal damage.

Phil

Lawrence Davis, 03:40 PM 2/3/2003 -0500, Re: Support for Bryan O'Connor on Columbia Accident

X-Sender: lawrence\_davis@mail.dfrc.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 5.0.2  
Date: Mon, 03 Feb 2003 15:40:01 -0500  
To: Pete Rutledge <prutledg@hq.nasa.gov>;  
"Bryan O'Connor" <boconnor@mail.hq.nasa.gov>  
From: Lawrence Davis <lawrence.davis@dfrc.nasa.gov>  
Subject: Re: Support for Bryan O'Connor on Columbia Accident Investigation Board (CAIB)

Bryan & Pete

Additional ideas:

1. The AFFTC has offered their resources to help any efforts.
2. The Dryden Range Safety personnel in association with the AFFTC have a software prediction algorithm to predict the profile of an object falling through the atmosphere. Larry Schilling has volunteered to help with that analysis, even backtracking through any photos to intersect the positional data. Variations in estimates of anything that might have fallen free will provide a larger footprint but at least it will be limited somewhat. We used this capability to find the ER-2 hatch a while ago and it led us directly to the hatch.
3. The Range here collected data from the Columbia as it traveled north of our position, although not tasked to do so. We have impounded that data. We have that data, if you need it. We were at work supporting a UCAV mission, anyway. Analog tracking radar such as recorded here may provide a secondary return enabling establishment of actual separation events with size, velocity and time.
4. Bill Shelton, AFFTC, and our Range personnel also are pursuing working with the doppler FAA radars to correlate any secondary returns in the re-entry path with our radar tracking data.
5. NORAD may have data to establish space debris patterns.

Lawrence



Wayne R. Frazier, 11:54 AM 2/5/2003 -0500, Re: Fwd: Questions/issues for Bryan's use

X-Sender: wfrazier@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Wed, 05 Feb 2003 11:54:15 -0500  
To: prichard@hq.nasa.gov  
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>  
Subject: Re: Fwd: Questions/issues for Bryan's use  
Cc: jlemke@hq.nasa.gov, Pete Rutledge <prutledg@hq.nasa.gov>

02/05/03 11:55 Wayne Frazier

I surmise that at the altitude where thermal escapes within the wing and fuselage structure were first noted, that there is not enough O2 in the atmosphere to support combustion. Therefore oxydizers would have to be present (if it was a chemical based fire) to support combustion, i.e. a leak in an O2 line. I am sure the teams will look at the LOX tanks and lines in the wing root structure and fuselage for signs of leakage, loss of pressure, etc. What is the cert on those tanks and lines? What about their cycle life?

Wayne

At 12:20 PM 2/4/2003 -0500, you wrote:

Jim,

Attached is first batch of questions/issues for Bryan's use on the Columbia Accident Investigation Board. These are a combination of inputs from SMA Directors and from OSMA staff members; Pam Richardson is pulling them together and maintaining the list. We would propose that you send to Bryan daily--only the new questions/issues (to minimize e-mail download time on Bryan's end). They are numbered sequentially and in chronological order, so it will be easy to send just the new ones. By means of this e-mail, I'm sending the list of questions/issues to all OSMA staff members. As Ron Moyer suggested, seeing these questions/issues may prompt thoughts of new ones.

Suggest sending this batch to Bryan ASAP.

Thanks,

Pete

X-Sender: prichard@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Tue, 04 Feb 2003 11:19:40 -0500  
To: Pete.Rutledge@hq.nasa.gov  
From: Pamela Richardson <prichard@hq.nasa.gov>  
Subject:

---

Pamela F. Richardson  
Aerospace Technology Mission Assurance Manager  
Enterprise Safety and Mission Assurance Division, Code QE  
Office of Safety and Mission Assurance, NASA Headquarters  
300 E. Street, S. W., Washington, DC 20546  
phone: 202-358-4631, fax: 202-358-2778

---

"The meek can \*have\* the Earth. The rest of us are going to the stars." --- Robert Heinlein

"We have to learn to manage information and its flow. If we don't, it will all end up in turbulence." --- RADM Grace Hopper

---

Wayne R. Frazier, 11:54 AM 2/5/2003 -0500, Re: Fwd: Questions/issues for Bryan's use

---

Peter J. Rutledge, Ph.D.  
Director, Enterprise Safety and Mission Assurance Division  
Acting Director, Review and Assessment Division  
Office of Safety and Mission Assurance  
NASA Headquarters, Code QE, Washington, DC 20546

ph: 202-358-0579  
FAX: 202-358-2778  
e-mail: [pete.rutledge@hq.nasa.gov](mailto:pete.rutledge@hq.nasa.gov)

Mission Success Starts with Safety!

---

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"

Malone, Roy, 03:01 PM 2/5/2003 -0600, Code Q request

---

From: "Malone, Roy" <Roy.W.Malone@nasa.gov>  
To: "prichard@mail.hq.nasa.gov" <prichard@mail.hq.nasa.gov>  
Cc: "prutledg@mail.hq.nasa.gov" <prutledg@mail.hq.nasa.gov>, "Goodson, Amanda" <Amanda.H.Goodson@nasa.gov>, "Hartline, Tom" <Thomas.W.Hartline@nasa.gov>  
Subject: Code Q request  
Date: Wed, 5 Feb 2003 15:01:02 -0600  
X-Mailer: Internet Mail Service (5.5.2653.19)

Pam, attached are the suggested questions for Bryan to use in the investigation and a list of MSFC experts. For the experts, we used the HQ format posted on the PBMA website. Please let me know if you have any questions.

R/Roy <<Columbia Mishap Areas to Investigate Further.doc>> <<OSMA Support to Bryan O.doc>>



Columbia Mishap Areas to Investigate Further.doc



OSMA Support to Bryan O2.doc

## Columbia Mishap Investigation Team Areas to Investigate Further

Tom Hartline/ MSFC/QS10

256-544-0052

Thomas.w.Hartline@nasa.gov

2/3/03

1. Has the shape of the debris field been examined to determine if there is an initial distribution area, followed by a larger distribution area. Whatever component initially departed the vehicle (possibly a wing section), it would have a different debris field, possibly at a slightly different angle than the reentry angle. This could give you a clue of where the initial failure occurred on the vehicle.
2. One of the key pieces of evidence used in mishap investigations is the different types of fracture surfaces based on how the structure failed. Whether the fracture surface was ductile overload, or fatigue failure could determine which components failed from the initiating event, which failed from subsequent breakup and which failed due to ground impact. However, with the high temperatures encountered during the reentry phase as breakup was occurring, the fracture surfaces may not have the normal fracture surfaces encounter in a typical aircraft investigation. Has any testing been done to try to determine what the different fracture surfaces would look like after exposure to high reentry temperatures? Although much of the fracture surface details may be lost, it is possible that some evidence may remain. Photos or samples of these tests may be useful to the on-site Investigation Team to help determine which debris components could have been involved in the initiating event.
3. Does the MIT have personnel with significant experience in the Space Shuttle Main Engine hardware, who would be able to aid in identifying recovered SSME components? Much of the SSME turbine hardware may survive the high temperatures of reentry. Although items such as turbine blades might be obvious, items such as inter-turbine coolant tubes, may not be.

2/4/03

1. Are there plans to do impact tests (aviation chicken gun) with material of the size and density of the ET insulation to determine:
  - Could the foam crack the reinforced carbon-carbon (RCC) leading edge.
  - Could it impact the tiles to cause cracks or failure of the tiles.
  - Could it impact tiles with a glancing blow which would weaken the tile-bonding, causing tile loss when encountering reentry forces.
2. If there was a loss of thermal integrity on the left wing, which caused internal heating, is it possible that heating of the aerosurface hydraulic systems would have caused an incorrect mechanical output to the elevons to the point where the orbiter departed from controlled flight, causing the catastrophic breakup? Could this have resulted in the loss of the orbiter without having an initial structural failure being the initiating event?

3. If there is a loss of the triple redundant hydraulic pressure sensor system in the elevon control due to causes, such as thermal overheating of the components such as wiring, how does the actuator system fail? If the aerosurface system requires manual intervention, would there be enough time for the crew to react prior to departure from controlled flight.

As of: February 5, 2003

SMA Support to Bryan O'Connor as Ex-Officio member of Space Shuttle Mishap Investigation Board (SSMIB)

| SMA-Related Investigative Area | Remarks                                                                                                                              | OSMA Lead               | MSFC S&MA Subject Matter Expert (SME) and Qualifications                |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------|
| <p>[REDACTED]</p>              | <p>Relates to work of Space Shuttle System Safety Review Panel (SSRP); especially pertaining to ET foam; e.g., impact on Orbiter</p> | <p>Mark K., Bill B.</p> | <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> |
| <p>[REDACTED]</p>              | <p>Accepted risks for this mission?</p>                                                                                              | <p>Mark K., Bill B.</p> | <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p>                   |
| <p>[REDACTED]</p>              | <p>Relates to work of Payload Safety</p>                                                                                             | <p>Mike Card, John</p>  | <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p>                   |

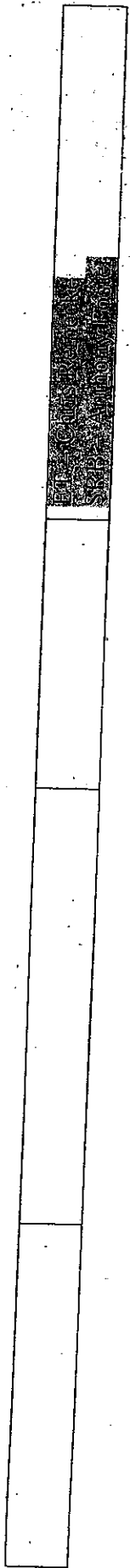
|                   |                                                                                                                                                                |                                                        |                   |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------|
| <p>[REDACTED]</p> | <p>Review Panel (PSRP). Interest includes potential for hazardous payloads to have caused catastrophe..</p>                                                    | <p>Castellano</p>                                      | <p>[REDACTED]</p> |
| <p>[REDACTED]</p> | <p>Includes radiological and other hazardous payload contents</p>                                                                                              | <p>John Lyver/Gil White</p>                            | <p>[REDACTED]</p> |
| <p>[REDACTED]</p> | <p>Relates to Problem Reporting and Corrective Action (PRACA); initially PRs dealing with ET foam problems may be of most interest?</p>                        | <p>Paul Boldon (SW PRs), Mark K., Bill B. (HW PRs)</p> | <p>[REDACTED]</p> |
| <p>[REDACTED]</p> | <p>Material Review Board actions, repairs, etc., initially especially in regard to foam and tile installation and repair; contractor/supplier surveillance</p> | <p>Tom Whitmeyer</p>                                   | <p>[REDACTED]</p> |

|                   |                                      |                                                                                                                                         |                   |
|-------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <p>[REDACTED]</p> | <p>[REDACTED]</p>                    | <p>[REDACTED]</p>                                                                                                                       | <p>[REDACTED]</p> |
| <p>[REDACTED]</p> | <p>Michael Stamatelatos</p>          | <p>Initial interest includes 1990 Pate-Cornell PRA of Shuttle tile installation process, as well as current Shuttle PRA</p>             | <p>[REDACTED]</p> |
| <p>[REDACTED]</p> | <p>Mark K., Bill B.</p>              | <p>Includes Pre-launch Assessment Reviews, Mission Safety Evaluations, waivers, deviations, rules changes, limited life items, etc.</p> | <p>[REDACTED]</p> |
| <p>[REDACTED]</p> | <p>Pat Martin (with Maria Tobin)</p> | <p>Includes collecting/using data from this mishap to calculate Ec for Shuttle re-entry</p>                                             | <p>[REDACTED]</p> |



|                          |                                                                                                                                 |                                                               |            |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|------------|
| [REDACTED]               | Includes software changes, software hazard analysis                                                                             | Paul Boldon, Sharyl Butler (JSC), Martha Wetherholt, IV&V Ctr | [REDACTED] |
| SMA Policy               | Emergency Preparedness, system safety, R&M, mishap investigation, etc.                                                          | Wil Harkins, Jon Mullin                                       |            |
| Contingency Planning     | A post-mishap look at correctness/effectiveness of our contingency plans; do we need updates/changes?                           | Gill White                                                    |            |
| [REDACTED]               | Includes any NSRS reports or alerts pertaining to foam, tile, ingredients, etc., as well as any current Shuttle-related reports | Eric Raynor                                                   | [REDACTED] |
| [REDACTED]               | Are there any pertinent LL in the database? Ensuring that these new lessons get into the LLIS in the long run.                  | Eric Raynor                                                   | [REDACTED] |
| [REDACTED]               | OEP, PV, FMR spot checks, staff assistance visits, other periodic center visits (including MAF)                                 | Steve Newman, Art Lee, John Lyver                             | [REDACTED] |
| Aerospace Advisory Panel | Includes any pertinent findings                                                                                                 | Len Sirota                                                    | [REDACTED] |

|                                  |                                                                                                                                        |                                                                              |            |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------|
| [REDACTED]                       | Of workers on the floor— certification and training for insulation application, repair, etc.                                           | Eric Raynor                                                                  | [REDACTED] |
| [REDACTED]                       | We were about to benchmark what USAF does for aging aircraft. Any implications for what NASA does?                                     | Tom Whitmeyer, SLEP Panel (Obs. & Sustainment), Bill Bihner, John Castellano | [REDACTED] |
| [REDACTED]                       | Supporting with info on NPDs, NPGs, root cause methods, training for MIB members, briefing packages, etc.                              | Wayne Frazier, Faith Chandler                                                | [REDACTED] |
| [REDACTED]                       | What opportunities were there for human factors to contribute to the mishap?                                                           | Faith Chandler                                                               | [REDACTED] |
| Post-mishap implications for ISS | Keeping up-to-date information on affect of this mishap on ISS supportability, etc.                                                    | Rich Patrican, Gil White                                                     |            |
| MIB Web-based work group area    | PBMA work group to support information and communication needs of the MIB, including IT security of the posted/transmitted information | Steve Newman, Steve Wander                                                   |            |
| DoD data                         | Data that DoD might have that could be useful                                                                                          | Mike Card                                                                    |            |
| [REDACTED]                       | Background and details of the manufacturing process.                                                                                   | Len Sirota                                                                   | [REDACTED] |



James Lloyd, 09:54 AM 2/4/2003 -0500, Fwd: STS 107 Investigation Organization Overview.ppt

X-Sender: jlloyd@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Tue, 04 Feb 2003 09:54:40 -0500  
To: boconnor@mail.hq.nasa.gov  
From: James Lloyd <jlloyd@hq.nasa.gov>  
Subject: Fwd: STS 107 Investigation Organization Overview.ppt  
Cc: prutledg@hq.nasa.gov

Bryan,

If you haven't already been sent a copy of this; this relates how the Agency believes it interfaces with the CAIB. Your single POC is intended to be the HCAT at Headquarters which is being managed by Bill Hill. I believe the concept of operations is that all requests from the Chairman of the CAIB are funneled into HCAT and they will assign the action. The response will flow back through that process to the CAIB. This is the single face to CAIB Has your Chairman agreed with this?

X-Sender: wfrazier@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Tue, 04 Feb 2003 09:20:55 -0500  
To: jlloyd@hq.nasa.gov, jlemke@hq.nasa.gov, fchandle@hq.nasa.gov,  
prutledg@hq.nasa.gov  
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>  
Subject: STS 107 Investigation Organization Overview.ppt

Fresh from Bill Hill

~~~~~  
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"



STS 107 Investigation Organization Overview11.ppt

Jim

**ERMINGER, MARK D: (JSC-NC) (NASA), 10:29 AM 2/4/2003 -0600, MIB Ideas**

From: "ERMINGER, MARK D: (JSC-NC) (NASA)" <mark.d.erminger@nasa.gov>

To: "H - O'Connor Bryan (boconnor@mail.hq.nasa.gov)"  
<boconnor@mail.hq.nasa.gov>

Cc: "h - Rutledge Pete (h - Rutledge, Pete)" <prutledg@hq.nasa.gov>  
"H - Kowaleski Mark (mkowales@mail.hq.nasa.gov)"  
<mkowales@mail.hq.nasa.gov>

Subject: MIB Ideas

Date: Tue, 4 Feb 2003 10:29:15 -0600

X-Mailer: Internet Mail Service (5.5.2653.19)

See attached



Columbia MIB Suggestions for Bryan O'Conner.doc

Michael Stamatelatos, 04:04 PM 2/5/2003 -0500, Question

X-Sender: mstamate@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Wed, 05 Feb 2003 16:04:03 -0500  
To: pruffledg@hq.nasa.gov  
From: Michael Stamatelatos <mstamate@hq.nasa.gov>  
Subject: Question  
Cc: mgreenfi@hq.nasa.gov

Pete:  
Attached is my answer to Michael's question.  
Please, let me know if you have additional questions.  
Michael



Question.doc

\*\*\*\*\*

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"

James Lloyd, 08:18 AM 2/6/2003 -0500, Re: KSC STS-107 Questions

---

X-Sender: jilloyd@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Thu, 06 Feb 2003 08:18:23 -0500  
To: "Garrido-1, Humberto (Bert)" <Humberto.T.Garrido@nasa.gov>,  
"prichard@hq.nasa.gov" <prichard@hq.nasa.gov>  
From: James Lloyd <jilloyd@hq.nasa.gov>  
Subject: Re: KSC STS-107 Questions  
Cc: "prutledg@hq.nasa.gov" <prutledg@hq.nasa.gov>,  
"Lebron-1, Edmundo (Eddie)" <Edmundo.J.Lebron@nasa.gov>,  
Toledo-1 Oscar <Oscar.Toledo-1@nasa.gov>

Thanks Bert. These are helpful

At 05:30 PM 2/5/2003 -0500, Garrido-1, Humberto (Bert) wrote:  
<<107 questions020503.doc>>

Pam-

As directed by Pete Rutledge, we are sending you unedited questions for Bryan's consideration. This is the second set from KSC compiled through the SMA community. Pete suggested not to edit these as Bryan and the Code Q staff may use them in brainstorming, and he prefers to have questions "as submitted."

We will send you more as these are submitted to us.

Regards,

Bert

Jim

Jim



**Garrido-1, Humberto (Bert), 05:30 PM 2/5/2003 -0500, KSC STS-107 Questions**

---

From: "Garrido-1, Humberto (Bert)" <Humberto.T.Garrido@nasa.gov>  
To: "prichard@hq.nasa.gov" <prichard@hq.nasa.gov>  
Cc: "prutledg@hq.nasa.gov" <prutledg@hq.nasa.gov>,  
"jilloyd@hq.nasa.gov" <jilloyd@hq.nasa.gov>,  
"Lebron-1, Edmundo (Eddie)" <Edmundo.J.Lebron@nasa.gov>,  
Toledo-1 Oscar <Oscar.Toledo-1@nasa.gov>  
Subject: KSC STS-107 Questions  
Date: Wed, 5 Feb 2003 17:30:56 -0500  
X-Mailer: Internet Mail Service (5.5.2653.19)

<<107 questions020503.doc>>

Pam-

As directed by Pete Rutledge, we are sending you unedited questions for Bryan's consideration. This is the second set from KSC compiled through the SMA community. Pete suggested not to edit these as Bryan and the Code Q staff may use them in brainstorming, and he prefers to have questions "as submitted."

We will send you more as these are submitted to us.

Regards,

Bert



[107 questions020503.doc](#)

Garrido-1, Humberto (Bert), 01:58 PM 2/4/2003 -0500, Questions for Brian O'Connor's consideration

From: "Garrido-1, Humberto (Bert)" <Humberto.T.Garrido@nasa.gov>  
To: "snewman@hq.nasa.gov" <snewman@hq.nasa.gov>  
Cc: "Lebron-1, Edmundo (Eddie)" <Edmundo.J.Lebron@nasa.gov>, Toledo-1 Oscar <Oscar.Toledo-1@nasa.gov>, "jiloyd@hq.nasa.gov" <jiloyd@hq.nasa.gov>, "prutledg@hq.nasa.gov" <prutledg@hq.nasa.gov>  
Subject: Questions for Brian O'Connor's consideration:  
Date: Tue, 4 Feb 2003 13:58:41 -0500  
X-Mailer: Internet Mail Service (5.5.2656.59)

<<107 Board Questions.doc>>

Steve-

As requested by Jim and Pete we have polled the KSC SMA community to suggest potential questions for Brian. Here is what we have to date. We will pass to you any additional suggested questions as we receive them.

Regards;

Bert



107 Board Questions.doc

Garrido-1, Humberto (Bert), 02:12 PM 2/4/2003 -0500, RE: Questions for Brian O'Connor's consid

From: "Garrido-1, Humberto (Bert)" <Humberto.T.Garrido@nasa.gov>  
To: "Pete Rutledge" <prutledg@hq.nasa.gov>  
Cc: "Lebron-1, Edmundo (Eddie)" <Edmundo.J.Lebron@nasa.gov>  
Subject: RE: Questions for Brian O'Connor's consideration:  
Date: Tue, 4 Feb 2003 14:12:15 -0500  
X-Mailer: Internet Mail Service (5.5.2656.59)

Pete-

We will be preparing a second set.

Bert

-----Original Message-----

From: Pete Rutledge [mailto:prutledg@hq.nasa.gov]  
Sent: Tuesday, February 04, 2003 2:06 PM  
To: Garrido-1, Humberto (Bert)  
Subject: Re: Questions for Brian O'Connor's consideration:

Thanks, Bert. These will go in tomorrow's e-mail shipment to Bryan. We just sent him a first batch.

Pete

At 01:58 PM 2/4/2003 -0500, you wrote:

> <<107 Board Questions.doc>>

>

> Steve-

>

> As requested by Jim and Pete we have polled the KSC SMA community to  
> suggest potential questions for Brian. Here is what we have to date. We  
> will pass to you any additional suggested questions as we receive them.

>

> Regards,

>

> Bert

---

Peter J. Rutledge, Ph.D.  
Director, Enterprise Safety and Mission Assurance Division  
Acting Director, Review and Assessment Division  
Office of Safety and Mission Assurance  
NASA Headquarters, Code QE, Washington, DC 20546

ph: 202-358-0579

FAX: 202-358-2778

e-mail: pete.rutledge@hq.nasa.gov

Mission Success Starts with Safety!

HIMEL, MALCOLM J. (JSC-NX) (NASA), 02:10 PM 2/4/2003 -0600, INFO: Columbia Accident Invest

From: "HIMEL, MALCOLM J. (JSC-NX) (NASA)" <malcolm.j.himel@nasa.gov>

To: "boconnor@mail.hq.nasa.gov" <boconnor@mail.hq.nasa.gov>,  
"prutledg@hq.nasa.gov" <prutledg@hq.nasa.gov>

Cc: "MARSHALL, YOLANDA Y. (JSC-NA) (NASA)" <yolanda.y.marshall@nasa.gov>,  
"HOLSOMBACK, JERRY B. (JSC-OE) (NASA)" <jerry.b.holsomback@nasa.gov>,  
"rpatrica@hq.nasa.gov" <rpatrica@hq.nasa.gov>

Subject: INFO: Columbia Accident Investigation Board Questions

Date: Tue, 4 Feb 2003 14:10:57 -0600

X-Mailer: Internet Mail Service (5.5.2653.19)

<<Bryan Columbia Accident Investigation Board.doc>>

Bryan/Pete, per your request, attached are a set of very preliminary questions that I worked last night. We will continue to work on other questions for your use with the CAIB.

Regards,

Mac Himel/NA  
JSC IA Manager  
281 483-4086



Bryan Columbia Accident Investigation Board.doc

HIMEL, MALCOLM J. (JSC-NX) (NASA), 02:20 PM 2/4/2003 -0600, INFO: Suggestions for Bryan CA

From: "HIMEL, MALCOLM J. (JSC-NX) (NASA)" <malcolm.j.himel@nasa.gov>  
To: "boconnor@mail.hq.nasa.gov" <boconnor@mail.hq.nasa.gov>;  
"prutledg@hq.nasa.gov" <prutledg@hq.nasa.gov>  
Cc: "MARSHALL, YOLANDA Y. (JSC-NA) (NASA)" <yolanda.y.marshall@nasa.gov>;  
"HOLSOMBACK, JERRY B. (JSC-OE) (NASA)" <jerry.b.holsomback@nasa.gov>  
Subject: INFO: Suggestions for Bryan CAIB  
Date: Tue, 4 Feb 2003 14:20:52 -0600  
X-Mailer: Internet Mail Service (5.5.2653.19)

<<Columbia MIB Suggestions for Bryan O'Conner.doc>>

Bryam/Pete, attached are suggestions from Mark Erminger. More later.



Columbia MIB Suggestions for Bryan O'Conner1.doc

**Martha Wetherholt, 05:06 PM 2/4/2003 -0500, Software, mostly, questions for Bryan**

---

X-Sender: mwetherh@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Tue, 04 Feb 2003 17:06:59 -0500  
To: prutledg@hq.nasa.gov, James Lloyd <jlloyd@hq.nasa.gov>, jlemke@hq.nasa.gov,  
prichard@hq.nasa.gov  
From: Martha Wetherholt <mwetherh@hq.nasa.gov>  
Subject: Software, mostly, questions for Bryan  
Cc: sbrookov@hq.nasa.gov, pboldon@hq.nasa.gov

**!! Some last minute additions, please use this version and discard the previous one. !!!**

Sorry, Martha

Sorry for the massive distribution but it seems everyone needs to know what and to whom we are sending things so here you all go!

This is my first cut at Software type questions and while they are mostly just that, they are not strictly limited to software.

I have not contacted Sharyl Butler as she is directly involved and will input her questions through a different venue, nor have I opened this up to IV&V and other S&MA SA offices yet. This is just your HQ, Code QS, input for the time being.

Martha



Columbia SW Questions plus1.doc

\* \* \* \* \* ~~~~~ \* \* \* \* \*

**Martha S. Wetherholt  
NASA HQ Code QS**

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

~~~~~  
\* \* \* \* \* ~~~~~ \* \* \* \* \*

James Lloyd, 08:00 AM 2/4/2003 -0500, Fwd: Questions for Your Use/Pursuit

---

X-Sender: jlloyd@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Tue, 04 Feb 2003 08:00:21 -0500  
To: prichard@hq.nasa.gov  
From: James Lloyd <jlloyd@hq.nasa.gov>  
Subject: Fwd: Questions for Your Use/Pursuit  
Cc: prutledg@hq.nasa.gov, a.h.phillips@larc.nasa.gov,  
boconnor@mail.hq.nasa.gov

Pam,  
Here are questions from Alan Phillips re: possible clues on causation. Incorporate this into the growing list of questions/suggestions so we can provide Bryan a compiled list at some point when the CAIB is ready to start sorting through factors. I have told Bryan that he should not be personally concerned with the compilation of these inputs and that we would handle that until his CAIB is organized enough to handle themselves. Let's wait a day or so more for more input and then we'll give Bryan a first cut at the compiled list. Bryan thinks the CAIB work will be done in the DC area.

X-Sender: a.h.phillips@pop.larc.nasa.gov  
Date: Tue, 4 Feb 2003 07:40:50 -0500  
To: boconnor <boconnor@hq.nasa.gov>  
From: "Alan H. Phillips" <a.h.phillips@larc.nasa.gov>  
Subject: Questions for Your Use/Pursuit  
Cc: Dr Peter Rutledge <prutledg@mail.hq.nasa.gov>,  
James D Lloyd <jlloyd@mail.hq.nasa.gov>

Bryan,

These questions have surfaced here and wanted you to have them for your use as you see fit.

- 1) Has corrosion of Orbiter components (from an aging aircraft perspective) been addressed and eliminated as a primary or contributing cause of the mishap?
- 2) Have inspections or maintenance activities identified any concerns?
- 3) What, if any, areas of the Orbiter do the current inspection plans not cover?

Best wishes to you and your Board members. Let us know if we can be of assistance.

Alan

-----  
\*\*\*\*\*  
Alan H. Phillips  
Director, Office of Safety and Mission Assurance  
NASA Langley Research Center  
5A Hunsaker Loop  
Building 1162, Room 112C  
Mail Stop 421  
Hampton, VA 23681

(757)864-3361 Voice  
(757)864-6327 Fax  
\*\*\*\*\*

Jim

Garrido-1, Humberto (Bert), 11:07 AM 2/4/2003 -0500, RE: Questions for Your Use/Pursuit

From: "Garrido-1, Humberto (Bert)" <Humberto.T.Garrido@nasa.gov>  
To: "James Lloyd" <jlloyd@hq.nasa.gov>,  
"Phillips, Alan" <a.h.phillips@larc.nasa.gov>  
Cc: Dr Peter Rutledge <prutledg@mail.hq.nasa.gov>,  
boconnor <boconnor@hq.nasa.gov>, Humberto.T.Garrido@nasa.gov,  
yolanda.y.marshall@nasa.gov, prichard@hq.nasa.gov  
Subject: RE: Questions for Your Use/Pursuit  
Date: Tue, 4 Feb 2003 11:07:08 -0500  
X-Mailer: Internet Mail Service (5.5.2653.19)

Jim, Alan-

Thanks for the questions. Although the Shuttle program has a very good corrosion control program, these are areas that deserve further attention. I will pass these to our Shuttle Directorate.

Bert

-----Original Message-----

From: James Lloyd [mailto:jlloyd@hq.nasa.gov]  
Sent: Tuesday, February 04, 2003 8:04 AM  
To: Alan H. Phillips  
Cc: Dr Peter Rutledge; boconnor; Humberto.T.Garrido@nasa.gov;  
yolanda.y.marshall@nasa.gov; prichard@hq.nasa.gov  
Subject: Re: Questions for Your Use/Pursuit

Alan, Thanks for the input. Maybe Bert and Yolanda can start tugging at the answers for some of these questions at KSC and JSC. We will place these into the growing list as suggestions for Gehman's Board to address.

At 07:40 AM 2/4/2003 -0500, Alan H. Phillips wrote:

>Bryan,  
>  
>These questions have surfaced here and wanted you to have them for your  
>use as you see fit.  
>  
>  
>1) Has corrosion of Orbiter components (from an aging aircraft  
>perspective) been addressed and eliminated as a primary or contributing  
>cause of the mishap?  
>2) Have inspections or maintenance activities identified any concerns?  
>3) What, if any, areas of the Orbiter do the current inspection plans not  
>cover?  
>  
>  
>Best wishes to you and your Board members. Let us know if we can be of  
>assistance.

>Alan

>-----  
>\*\*\*\*\*  
>Alan H. Phillips  
>Director, Office of Safety and Mission Assurance  
>NASA Langley Research Center  
>5A Hunsaker Loop  
>Building 1162, Room 112C  
>Mail Stop 421  
>Hampton, VA 23681  
>



Garrido-1, Humberto (Bert), 11:07 AM 2/4/2003 -0500, RE: Questions for Your Use/Pursuit

---

>(757)864-3361 Voice

>(757)864-6327 Fax

>\*\*\*\*\*

Jim

Faith Chandler, 08:11 AM 2/4/2003 -0500, Re: Question/issue for Bryan

---

X-Sender: fchandle@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Tue, 04 Feb 2003 08:11:29 -0500  
To: Pete Rutledge <  
From: Faith Chandler <fchandie@hq.nasa.gov>  
Subject: Re: Question/issue for Bryan  
Cc: prutledg@hq.nasa.gov

Pam,

Per Pete's request:  
Here are some quick thoughts.

The foam insulation could have produced damage for a number of reasons. One possibility is that the foam was denser than originally believed, consequently making the analysis inaccurate.

The materials could have been denser/harder than originally believed due to some of the following:

- a) Problems with the quality/age of the material used (perhaps the materials used to produce the foam insulation were not the type, chemical composition, or quality that were required).
- b) Changes/errors in the manufacturing process.
- c) Problems with the quality, age, or type of adhesive materials used (if any).
- d) Changes/errors in applying the foam.
- e) Changes/errors in preparing the ET surface (Perhaps paint or other came off the ET when the foam came off during launch).
- f) Debris (e.g., FOD or other material) intentionally or unintentionally placed under the foam.
- g) Changes/errors in final preparation of the outer foam surface after application.
- h) Ice build up on the foam.
- i) Another possibility is that other debris was flying in the same air stream as the foam (perhaps behind it) and this (which may not have been visible to the camera because the foam blocked the view) may have caused significant damage.

At 08:30 PM 2/3/2003 -0500, you wrote:  
Faith,

Please write down and send to Pam your idea about ET foam insulation possibly being harder/denser than normal, allowing it to create more damage than expected.

Thanks,

Pete

-----  
Faith Chandler

NASA Headquarters  
Office of Safety and Mission Assurance  
Code Q Rm 5x40  
300 E Street, S.W  
Washington, D.C 20546

202-358-0411  
202-358-2778 (fax)  
-----