

ERMINGER, MARK D. (JSC-NC) (NASA), 12:34 PM 2/3/2003 -0600, Shuttle Standup Notes

From: "ERMINGER, MARK D. (JSC-NC) (NASA)" <mark.d.erminger@nasa.gov>
To:
Subject: Shuttle Standup Notes
Date: Mon, 3 Feb 2003 12:34:07 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

Ron

- * He appreciates everyone's efforts throughout the program with the utmost professionalism under very difficult circumstances
- * Employee Assistance Program services are available
- * Memorial Noon Tuesday
- * Columbia Accident Investigation Board - Admiral Gehman leading
- * HQ Contingency Action Team (HCAT)
- * Linda Ham leading Mishap Response Team (MRT)
- * Mishap Investigation Team and Engineering Teams report to the MRT
- * The MIT is at Barksdale AFB
- * Records Team meeting this afternoon at 4 PM

Future Ramifications

- * Continue processing OV-103 OMDP
- * There may be additional inspections
- * OV-105 continue processing
- * OV-104 in VAB - leave in VAB
- * USA find out how long we can leave in the VAB stacked
- * Cancelled Supplier Symposium
- * Our highest priority is to support Accident Investigation Board and

MRT

- * Continue normal work if not involved in investigation
- * Will decide what to do with SLEP

Roe

- * Vehicle Engineering Working Group is organized much the same way as for large problems recently.

McCool

- * Have 5 teams
- * Paul Monafu team is at MAF developing ET Fault Tree

KSC

- * 80 people in the field supporting Dave Whittle

MOD

- * Still supporting 3 crewmembers on orbit
- * 10P docking is tomorrow

Norbraten

- * Will recover the history and rationale for Safety Upgrades we have implemented

Ham

- * 1/560 will be tied into the MRT

Fred Gregory

- * MR O'Keefe is briefing the White House today
- * Fred spent some time with the teams at Barksdale yesterday

Ron Dittmore

- * No FRR on 2/20
- * Leave everything else as it was
- * Go into a holding pattern

Jonathan B. Mullin, 11:24 AM 2/28/2003 -0500, Fwd: FEMA Emergency Support Team (White EST)

X-Sender: jmullin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Fri, 28 Feb 2003 11:24:10 -0500
To: hcat@hq.nasa.gov
From: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>
Subject: Fwd: FEMA Emergency Support Team (White EST)
Cc: jilloyd@hq.nasa.gov, prichard@hq.nasa.gov, jlemke@hq.nasa.gov,
Arthur.Lee@hq.nasa.gov, jlyver@hq.nasa.gov

For your information, Code QS spoke to FEMA, Mr. Pleasant Mann at 202-646-3161 concerning the stand down of the FEMA EST which is cited in the message below.

Mr. Mann indicated that the functions of the EST that related to the "Columbia" activity would now be worked through the individual offices at FEMA, not through a formal EST.

Regards, Jon

From: FEMA OPERATIONS CENTER <FEMA.OPERATIONS.CENTER@fema.gov>

To: "ESF-01 DOT (E-mail)" <janet.benini@rspa.dot.gov>,
"ESF-02 NCS (E-mail)" <NCS@ncs.gov>, ESF-02 NCS Herr <herrf@ncs.gov>,
"ESF-02 NCS Perry (E-mail)" <perryrc@ncs.gov>,
"ESF-02-NCS Oconnor (E-mail)" <oconnorj@ncs.gov>,
"ESF-04 USDA/FS Latapie (E-mail)" <blatapie@fs.fed.us>,
ESF-04 USDA/FS Schultie <jschultie@fs.fed.us>,
ESF-04 USDA/FS Terry
<bterry@fs.fed.us>,
"ESF-05 FEMA Murray (E-mail)" <john.muarry@fema.gov>,
"ESF-05 FEMA Price (E-mail)" <Bruce.Price@fema.gov>,
"ESF-06 ARC Blystad (E-mail)" <blystadt@usa.redcross.org>,
"ESF-06 ARC Corliss (E-mail)" <CorlissE@usa.redcross.org>,
"ESF-06 ARC JENKINS (E-mail)" <jenkinsg@usa.redcross.org>,
"ESF-06 ARC Rostosky (E-mail)" <Rostoskyc@usa.redcross.org>,
"ESF-07 GSA Montgomery (E-mail)" <Kathy.Montgomery@gsa.gov>,
"ESF-08 HHS Jevic (E-mail 2)" <rjevec@osophs.dhhs.gov>,
"ESF-09 FEMA Webb (E-mail)" <Dave.Webb@fema.gov>,
"ESF-10 EPA Danielczyk (E-mail)" <sdanielczyk@comdt.uscg.mil>,
"ESF-10 EPA EOC (E-mail)" <eoc.epahq@epa.gov>,
"ESF-10 EPA Kelly (E-mail)" <kelly.sheila@epa.gov>,
"ESF-10 EPA Mjones (E-mail)" <mjones.mark@epa.gov>,
"ESF-10 EPA Thorne (E-mail)" <thorne.leanne@epa.gov>,
"ESF-11 USDA/FNS Sheffey (E-mail)" <Grace.Sheffey@FNS.USDA.Gov>,
"ESF-11 USDA/FNS Warner (E-mail)" <david_warner@FNS.USDA.Gov>,
"ESF-12 DOE CAVERLY (E-mail)" <jim.caverly@hq.doe.gov>,
"ESF-12 DOE Ops (E-mail)" <doehqeoc@oem.doe.gov>,
"ESF-12 DOE Puzzilla (E-mail)" <tonyl.puzzilla@hq.doe.gov>,
"ESF-12 DOE Townsend (E-mail)" <wade.townsend@hq.doe.gov>,
"DOC (E-mail)"
<HMitche2@doc.gov>,
"DOI Land (E-mail 2)"
<IMCEAUNKNOWN-Unknown@fema.gov>,

Jonathan B. Mullin, 11:24 AM 2/28/2003 -0500, Fwd: FEMA Emergency Support Team (White EST)

"DOI OPS CENTER (E-mail)"

<doi_watch_center@ios.doi.gov>,

"DOL EOC (E-mail)" <EOC@dol.gov>, "DOS (E-mail)" <MockA@state.gov>,

"DOT OPS - 1 (E-mail)"

<tioc-01@rspa.dot.gov>,

"FCC (E-mail)" <comm-ctr@fcc.gov>,

"FCC Bonnie Gay (E-mail)" <bgay@fcc.gov>,

"HUD McCarthy (E-mail)"

<bruce_e._mccarthy@hud.gov>,

"NASA Lloyd (E-mail)" <JLloyd@hq.nasa.gov>,

"NASA Mullin (E-mail)" <JMullin@hq.nasa.gov>,

"OPM Jacobs (E-mail)"

<gmjacobs@opm.gov>,

treas <Ron.Bearse@do.treas.gov>, TVA

<smcrawford@tva.gov>,

tva <thalford@tva.gov>, USPS

<pmendonc@email.usps.gov>,

usps <Farvonio@email.usps.gov>, VA

<Emshg.Operations@med.va.gov>,

"DOD/DOMS Lacrosse (E-mail)"

<thomas.lacrosse@doms.army.mil>,

"DOMS (E-mail)" <foxhole@doms.army.mil>,

DOMS Sullivan <ricki.sullivan@doms.army.mil>,

"Porter, Larry"

<Larry.Porter@fema.gov>,

"Riddle, Margaret" <Margaret.Riddle@fema.gov>,

"DOT Carney (E-mail)" <brian.carney@rspa.dot.gov>,

"DOT Medigovich (E-mail)" <bill.medigovich@rspa.dot.gov>,

"DOT OPS 2 (E-mail)" <tioc-02@rspa.dot.gov>,

"HOWARD. EDWARDS (E-mail)"

<HOWARD.EDWARDS@rspa.dot.gov>,

"USACE Acosta (E-mail)"

<louis.a.acosta@hq02.usace.army.mil>,

"USACE Hecker (E-mail)"

<edward.j.hecker@usace.army.mil>,

"USACE Irwin (E-mail)"

<william.e.irwin@usace.army.mil>,

"USACE Miller (E-mail)"

<lizabeth.h.miller@usace.army.mil>,

USACE OPS <ce-uoc@usace.army.mil>

Subject: FEMA Emergency Support Team (White EST)

Date: Thu, 27 Feb 2003 16:35:01 -0500

X-Mailer: Internet Mail Service (5.5.2656.59)

All Departments and Agencies are advised that the FEMA Emergency Support Team (EST White Team) will cease operations at COB today, February 27, 2003.
Jonathan B. Mullin

Jonathan B. Mullin, 11:24 AM 2/28/2003 -0500, Fwd: FEMA Emergency Support Team (White EST)

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"

X-Sender: a.h.phillips@pop.larc.nasa.gov
Date: Thu, 27 Feb 2003 16:27:01 -0500
To: "Pamela F. Richardson" <Pamela.Richardson@hq.nasa.gov>
From: "Alan H. Phillips" <a.h.phillips@larc.nasa.gov>
Subject: Correspondence to LaRC Personnel/Forwarded for your Use
Cc: "Peter J. Rutledge" <prutledg@mail.hq.nasa.gov>,
Jim Lloyd <Jlloyd@hq.nasa.gov>

Below is a compilation of e-mails that have been sent to us and they are being forwarded to you so that they may be sent to the responsible parties. Note that they have all been forwarded to the HCAT.

Alan

Date: Mon, 24 Feb 2003 17:02:30 -0500
To: hcat@hq.nasa.gov
From: "Mark J. Shuart" <m.j.shuart@larc.nasa.gov>
Subject: Fwd: Columbia fao mark j shuart
Cc: "SAUNDERS, MARK P" <M.P.SAUNDERS@larc.nasa.gov>,
"PHILLIPS, ALAN H" <A.H.PHILLIPS@larc.nasa.gov>,
"WYATT, CYNTHIA A" <C.A.WYATT@larc.nasa.gov>,
"CLEGHORN, CHERYL W" <C.W.CLEGHORN@larc.nasa.gov>
To Whom It May Concern:

More information on landing gear/doors.

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

=====
From: <
Date: Mon, 24 Feb 2003 06:43:42 EST
Subject: Fwd: Columbia fao mark j shuart
To: m.j.shuart@larc.nasa.gov

Return-path: <
From: <
Full-name: Vincehallam
Message-ID: <
Date: Mon, 24 Feb 2003 06:36:46 EST
Subject: Columbia fao mark j shuart
To: m.j.shtuart@pop.larc.nasa.gov
MIME-Version: 1.0
Content-Type: text/plain; charset="US-ASCII"
Content-Transfer-Encoding: 7bit

Date: Tue, 25 Feb 2003 13:31:59 -0600

To: m.j.shuart@larc.nasa.gov

From:

Subject: Columbia LTE - please forward to CAIB

Dear Mark: Please forward this to the CAIB. I have considerable expertise on this issue, having testified regarding the harms of the H-1B visa program in the U.S. House of Representatives.

Posted and published on Tue, Feb. 11, 2003

<http://www.dfw.com/mid/dfw/5154249.htm>

In the aftermath of Columbia

Star-Telegram (Fort Worth, Texas, USA)

"Faster, better, cheaper" -- with the accent on cheaper -- has been NASA's mantra since the *Challenger* disaster in 1986.

What many ***Star-Telegram*** readers may not know is that a special federal visa program called H-1B probably will be seen as one of the systemic causes of the *Columbia* disaster on Feb. 1.

As a former NASA employee, I know that the agency strives to maintain a positive public image. This probably is the reason that few holders of H-1B visas are directly employed by NASA, as shown by the unique public-access database at www.ZaZona.com.

Instead, the H-1Bs are employed -- for lower wages -- by such contractors as Science Applications International Corp. (SAIC), with more than 1,000 visa applications, and Lockheed Martin, with about a quarter of that number, and by many other contractors.

Hiring holders of H-1B visas tends to permanently displace American scientists, engineers and programmers. **The specialized knowledge of sophisticated space systems is lost when these jobs are cut.**

When the post-mortem is complete, it is likely that a systemic problem will be revealed, similar to Lockheed Martin's erroneous transmission of nonmetric units of force to NASA-Jet Propulsion Laboratory in September 1999 that resulted in the *Mars Polar Orbiter* burning up while entering the Mars atmosphere.

Please use the free citizen-activism tools at www.NumbersUSA.com to press for reform before the next space disaster.

Watch for my upcoming book: **An American Scam - How Special Interests Undermine American Security with Endless "Techie" Gluts**
e-mail the author for a 22 - page special Congressional Summary,
released in September, 2002

See the draft of my August 5, 1999 Oral Testimony
before the House Immigration and Claims Subcommittee,
in particular the final two paragraphs.

<http://www.house.gov/judiciary/nels0805.htm>

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

Date: Tue, 25 Feb 2003 16:18:13 -0500
To: hcat@hq.nasa.gov
From: "Mark J. Shuart" <m.j.shuart@larc.nasa.gov>
Subject: Fwd: Shuttle Main Gear Breach Possibility
Cc: "SAUNDERS, MARK P" <M.P.SAUNDERS@larc.nasa.gov>,
"PHILLIPS, ALAN H" <A.H.PHILLIPS@larc.nasa.gov>,
"WYATT, CYNTHIA A" <C.A.WYATT@larc.nasa.gov>,
"CLEGHORN, CHERYL W" <C.W.CLEGHORN@larc.nasa.gov>
To Whom It May Concern:

Some discussion of sensor information/interpretation.

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

=====
From: <
Date: Wed, 19 Feb 2003 21:41:09 EST
Subject: Shuttle Main Gear Breach Possibility

To: m.j.shuart@larc.nasa.gov
Mr. Shuart:

Two points:

1.

Get a desktop model of a shuttle, one with wheels down. Then hold it up to light so that it is silhouetted as was the telescopic shuttle image from the AF. Angle the model just right so that it's silhouette is very close to that shown in the publicized image. If that is done, then a segment of the left landing gear can protrude ahead of the shadow of the leading edge of the left wing. (At least on my model.) The point is that a portion of the wheel may have been the "blob" in the original photo.

2.

Some say that the telemetry transducers all indicated that the gear was in the full up position. I submit that all the sensors may have really shown was that the circuitry itself was in the wheels retracted mode, but that the wheel assembly, having been actuated by an outside force, may have been deployed to some extent.

former electronic engineer in early ABMA days at Redstone.

If you reply, please do so from the email address to which this was sent. Other responses may be filtered out.

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

Date: Tue, 25 Feb 2003 16:32:58 -0500

To: hcat@hq.nasa.gov

From: "Mark J. Shuart" <m.j.shuart@larc.nasa.gov>

Subject: Fwd: Thermal protection for future shuttle missions?

Cc: "SAUNDERS, MARK P" <M.P.SAUNDERS@larc.nasa.gov> ,

"PHILLIPS, ALAN H" <A.H.PHILLIPS@larc.nasa.gov> ,

"WYATT, CYNTHIA A" <C.A.WYATT@larc.nasa.gov> ,

"CLEGHORN, CHERYL W" <C.W.CLEGHORN@larc.nasa.gov>

To Whom It May Concern:

The concept below may not be realistic, but FYI.

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

Date: Sat, 22 Feb 2003 11:08:14 -0800 (PST)
From:
Subject: Thermal protection for future shuttle missions?
To: r.h.daugherty@pop.larc.gov
Cc: m.j.shuart@larc.nasa.gov

Dear Robert,

First off my condolences on NASA's and America's loss of the crew of Columbia.
Secondly, I have an idea on a much better protection setup for future shuttle missions and want you to pass it on, if it's feasible.

According to documents and stories on NASA's website there are three ways the shuttle can be protected. Two of these ways are foam insulating tiles and the other is a applied coat of heat absorbing "paint" or some such substance.

The reason the coat was not chosen was that it would have to be re-applied after each mission and the cost would be immense.

How about this.

You apply a coat covering the shuttles primary areas needing protection from the heat and on top of that coating the tiles can be applied?

Since there would be an initial coat and the tiles the safety factor would greatly increase. I hope this idea is feasible and helps get NASA back up and running soon.

Sincerely,

Do you Yahoo!?
[Yahoo! Tax Center](#) - forms, calculators, tips, and more

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

Date: Tue, 25 Feb 2003 16:37:15 -0500
To: hcat@hq.nasa.gov
From: "Mark J. Shuart" <m.j.shuart@larc.nasa.gov>
Subject: Fwd: Shuttle Damage
Cc: "SAUNDERS, MARK P" <M.P.SAUNDERS@larc.nasa.gov>,
"PHILLIPS, ALAN H" <A.H.PHILLIPS@larc.nasa.gov>,
"WYATT, CYNTHIA A" <C.A.WYATT@larc.nasa.gov>,
"CLEGHORN, CHERYL W" <C.W.CLEGHORN@larc.nasa.gov>
To Whom It May Concern:

More scenario "what-if's".

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

=====
Date: Sat, 22 Feb 2003 14:40:06 -0700

From:

X-Accept-Language: en

To: M.J.SHUART@larc.nasa.gov

Subject: Shuttle Damage

I have written several e-mails since immediately after the disaster hoping to broaden the scenarios being considered. I served as an engineering illustrator on Apollo and MoonLander projects and have been a pilot since 1967

Having been an Aeronautical Engineer in another life and worked on the Apollo and MoonLander control systems, I have been more than a little more observant about the potential for damage to the shuttle.

First, noting that the Israeli satellite photo showing cracks in the top surface of the left wing. No little 12X16X4 2.67 lb piece of rigid foam

could cause structural damage

Second, Note that the piece of foam that NASA has been concentrating on,

broke off with almost no external forces what ever.

The shuttle had not fully cleared the tower. G force must have been nearly 1 G. Wind forces must have been 10 MPH or less.

The Main (Orange) tank was an original LT tank made in the 1960s, one of

two left in inventory.

No press statement that the insulation was ever tested during preflight to see if it was still bonded to the metal skin of the tank.

NOW COMES THE WHAT IF... suppose that after the shuttle rolls inverted and is some miles down range, going through 30 to 40,000 ft at mach 1 to

2.

Suppose the High Mach slipstream slamming into the gapping hole in the insulation suddenly got underneath the foam and peeled off a huge section several feet wide and half way down the side of the tank

This would weigh several hundred pounds and slam into the wing structure

with enormous energy. Enough to cause major structural damage in addition to a significantly large area of compromised tiles.

I think this is what happened.

From all the other parameters of the mission their lives were over at that moment.

I hope they will try to locate the main fuel tank for recovery or for photography by a remote submersible.

I have tried to find a way to communicate with the (I am sure "too busy" for me) investigating team, but maybe ANN has enough clout to be read by some of the right people at Houston of the cape.

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

Date: Tue, 25 Feb 2003 16:56:45 -0500
To: hcat@hq.nasa.gov
From: "Mark J. Shuart" <m.j.shuart@larc.nasa.gov>
Subject: Fwd: Re: Columbia
Cc: "SAUNDERS, MARK P" <M.P.SAUNDERS@larc.nasa.gov>,
"PHILLIPS, ALAN H" <A.H.PHILLIPS@larc.nasa.gov>,
"WYATT, CYNTHIA A" <C.A.WYATT@larc.nasa.gov>,
"CLEGHORN, CHERYL W" <C.W.CLEGHORN@larc.nasa.gov>
To Whom It May Concern:

Some more scenario info.

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

=====
Date: Mon, 24 Feb 2003 15:03:57 -0500
To: "
From: "Robert H. Daugherty" <r.h.daugherty@larc.nasa.gov>
Subject: Re: Columbia
Cc: M.J.SHUART@larc.nasa.gov, carlisle.c.campbell1@jsc.nasa.gov

Thank you for your very interesting email. My expertise is not in aerodynamics but your background and cogent remarks are noteworthy. I am forwarding your message to my

Director for Structures and Materials who has told me that this information will be forwarded to an appropriate part of the organization. Also, I believe you will find a link on the NASA Columbia website that provides a direct mailing address to the Investigation Board should you wish to pursue that avenue also. Thanks once again for your input.

With very best regards,
Bob Daugherty

At 12:59 PM 2/24/2003, you wrote:

Mr. Daugherty:

I am a former flight controller for the shuttle and have been following the Columbia accident investigation. I was an Instrumentation Officer and had command and control responsibility for the onboard telemetry systems and, thus, was very familiar with various telemetry signatures - and whether such signatures were likely the result of failed sensors, signal conditioners, etc.

Early on, I suspected there may have been a breach or at least some cause leading to elevated temperatures inside the left wheel well. After some research, I spoke with an engineer at the company that manufactures the pyrotechnic devices used for backup deployment of the landing gear (in case of hydraulic failure). The engineer informed me that the devices would self-detonate at around 400F. I don't know what the actual temperature reading was in the left wheel well, but suspected it may have been high enough to cause the release of the landing gear. I know that this possibility has been considered, but apparently dismissed. I wonder, however, if the dismissal might be because of a belief that if the pyros did release the gear it would have fully deployed. At the nose-up attitude (I believe 40 degrees) the vehicle was in, is it possible that the aerodynamic forces against the landing gear door might have prevented the gear from fully deploying? If so, a release of the landing gear may have caused the door to only partially open into the airstream . . . resulting in a more prolonged failure. This scenario might explain why so much time elapsed from the onset of abnormal telemetry until loss of vehicle.

Kind regards,

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

Date: Wed, 26 Feb 2003 12:45:28 -0500
To: hcat@hq.nasa.gov

From: "Mark J. Stuart" <m.j.shuart@larc.nasa.gov>
Subject: Fwd: Columbia Failure Investigation
Cc: "SAUNDERS, MARK P" <M.P.SAUNDERS@larc.nasa.gov>,
"PHILLIPS, ALAN H" <A.H.PHILLIPS@larc.nasa.gov>,
"WYATT, CYNTHIA A" <C.A.WYATT@larc.nasa.gov>,
"CLEGHORN, CHERYL W" <C.W.CLEGHORN@larc.nasa.gov>
To Whom It May Concern:

Some good insites on cryo-pumping in ET foam.

Mark J. Stuart, PhD
Director for Structures & Materials
NASA Langely Research Center
Hampton, VA 23681

Date: Sat, 22 Feb 2003 10:14:42 -0800
To: m.j.shuart@larc.nasa.gov
From: '
Subject: Columbia Failure Investigation
Cc: '

This is a resend - I mis-spelled you name on the first transmittal (my apologies).
I have also sent this email, with attachment, to Bob Daughterty.

I am sending you this email because I am not sure the attached memo is getting through to the right people on the Failure Investigation Board (I faxed the memo to but I am not sure he is at his main office location very often).

I got your email addresses from the pdf file that is posted on the net re the email traffic between the two of you re the potential for problems that you were investigating during the time Columbia was in orbit.

I am on the USAF mission assurance team and perform risk assessments for expendable launch vehicles. I am familiar with closed cell foam and wanted the attached memo reviewed by the appropriate people within NASA and on the board as part of their failure investigation effort.

Anything you can do to make sure the attached memo gets to the appropriate people within NASA and on the board would be greatly appreciated.

Please feel free to contact me if you have any questions.

Thanks

Attachment converted: Macintosh HD:022203_letter_to_Hallock_re_foa (WDBN/MSWD)
(0002828B)

--
Mark J. Stuart, PhD
Director for Structures & Materials

NASA Langely Research Center
Hampton, VA 23681

Date: Wed, 26 Feb 2003 13:03:45 -0500
To: hcat@hq.nasa.gov
From: "Mark J. Stuart" <m.j.stuart@larc.nasa.gov>
Subject: Fwd: Severity of insulation impact
Cc: "SAUNDERS, MARK P" <M.P.SAUNDERS@larc.nasa.gov>,
"PHILLIPS, ALAN H" <A.H.PHILLIPS@larc.nasa.gov>,
"WYATT, CYNTHIA A" <C.A.WYATT@larc.nasa.gov>,
"CLEGHORN, CHERYL W" <C.W.CLEGHORN@larc.nasa.gov>
To Whom It May Concern:

More general info.

Mark J. Stuart, PhD
Director for Structures & Materials
NASA Langely Research Center
Hampton, VA 23681

=====
Date: Fri, 21 Feb 2003 19:43:32 -0500
From:
Subject: Severity of insulation impact
To: m.j.stuart@larc.nasa.gov
Importance: Normal
X-Priority: 3 (Normal)
Mr. Stuart:

Please accept my regards for the incredible work you and your team are doing in investigating the possible cause or causes relating to the loss of OV-102.

I am writing this as a private citizen in the hopes that in some small way I might be able to make a small contribution.

While I understand that this may be a long shot and a very un-scientific mode of calculation, I want you to be aware that I may have found a way to prove (or at least reinforce the possibility) that the debris falling from the external fuel tank during the launch of STS-107 was comprised of a heavier substance than just the foam insulation. That being said, if in fact I am correct, and the angle of impact is true to my estimates, it could have and most likely would have caused a material breach of the wing at or near the port side landing gear compartment.

There is a frame by frame animation of hi-res video taken during the launch which I viewed on msnbc.com.

(You may view it here: <http://www.msnbc.com/news/867336.asp?0cv=CB10>)

It is looped, enabling me to test my theory (to an extent) many times. Here is what I have found:

At the moment of impact the relational angle between the orbiter and the external fuel tank/SRBs changes. By matching the angle of the SRB to a straight object over the screen, it becomes much easier to see the relational angle become much different. The tank/SRBs

retain a constant angle, the orbiter does not. The orbiter appears to heave slightly to starboard and the nose pitch also increases slightly. Not enough to cause a problem with the coupling to the tank/SRB combination, but enough of an impact to rule out just foam. There would have to be far more weight involved in the object to cause a shudder of a visible magnitude as illustrated in the video. While there is some shot-stability changes in the animation, there is not enough camera movement to discount the angle shift between the launch units.

The angle of deflection would seem to indicate that there was a stright impact, rather than a glancing blow. There also appears to be a vapor residue, post-impact. Foam would tend to break into chunks, but as there is no "moisture" in the insulation compound, the only way to generate vapor would be the presence of water. That would mean ice, and a large piece at that. Based on size estimates, there would be a lot more weight involved that the original estimate of 2 1/2 pounds of foam. A 20 pound chunk of ice at the right velocity and angle of attack could have serious implications. I.E: Perhaps tile damage is not an initial factor. The seal on the gear compartment door may have been comprimised enough to cause issues. If the door is not perfectly flush to the fuselage, even out of the slightest tolerances, you've got drag problems and breach issues. Think of it like putting a dent on the front of your car's fender. If you hit it just the right way, with just the right force, you can misalign the door enough to cause problems. Simple? Yes. But simple usually works.

While I was able only to perform this analysis using a standrd PC/Monitor combination, I would suggest that someone take a closer look at this using more advanced tools. If nothing else than to rule out a theory. I hope this can be of some help.

Again, please accept my sincere regards.

Respectfully,

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



022203 letter to _____ re foa

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



22 Feb 2003

Subject: Columbia External Tank Foam Questions

As I mentioned in the phone message I left, I am a member of the USAF Mission Assurance Team - which is charged with developing independent risk assessments for the expendable launch vehicles used to launch missions of national interest. I have been involved in the design and launch of expendable launch vehicles for over 40 years.

Based on what I have read of the Columbia failure, and my past experience with the closed cell foam used for insulation on the Centaur launch vehicle, several questions have come to my mind that I submit to you for your consideration. Part of the reasoning behind these questions relates to a comment I read somewhere that the external tank foam formulation was changed in 1999 - and then some 'minor modifications' to the foam mixture were made after that. Having been associated with launch vehicle failures associated with 'minor' modifications, I distrust all minor modifications until those changes, and the assumptions, ground-rules, and tests/analyses associated with those changes, have been carefully checked by an independent set of reviewers.

All of these questions should be asked in the context of the exact foam chemical composition, and processing, used for the foam flown on the Columbia external tank.

- 1) Has a test been made to check what the density increase is, of the exact formulation of the foam used on the Columbia tank, after long term exposure to LH2 temperatures on one side of the foam surface, where the other side of the foam surface is at external ambient conditions.

Rationale for the question:

The individual cells within the foam are supposed to be able to stand a vacuum so that, when the gases inside the closed cell freeze, which is essential to the insulating characteristics of the foam, more ambient gas will not cryo-pump into the frozen cells and in turn be frozen. The only way to check to make sure ambient gas is not cryo-pumping into the frozen cells is to make a density measurement of a block of foam while one side of the foam is at LH2 temperatures after a long LH2 soak on one side and ambient air on the other side. This is not an easy test to make.

Most times, the community will assume the closed cells are gas tight if the cells do not explode after a long LH2 soak and the foam is returned to ambient. If the cells are cryo-pumping ambient air, the density of the frozen section of the foam, and hence it's mechanical characteristics (hardness and tensile strength) could be quite different than what is thought.

- 2) Has a test been made of the mechanical characteristics of the foam after a long term LH2

exposure of the foam to LH2 temperatures.

Rationale for the question:

In my associations with the Centaur fixed foam, I do not remember any tests being made to determine the harness parameters of the frozen foam as we/General Dynamics were not using the foam as a structural element. Our main worry was that the foam adhered to the tank and that the shear stresses inside the foam as the tank shrank would not cause the foam to fail. Given that the gases inside the closed cells are freezing and forming a ice/vacuum ball/frozen ice foam mechanical structure, the mechanical properties of the foam at LH2 temperatures could be far different than thought.

- 3) What measures have been taken to ensure there is no path from the external air to the inside of the foam – and is there a potential for breach of that barrier if the foam is not rigidly adhered to the tank in that area.

Rationale for the question:

If the foam is not rigidly adhered to the tank, and if the foam is breached somehow, then gaseous ice will form on the underside of the foam. This ice layer is brittle and more likely to shatter due to tank vibration and movement than is the foam itself.

All of these questions are designed to better anchor the assumption that the foam is not hard, nor rigid, enough to damage the leading edge of the wing should a piece of the foam break away during ascent. It is imperative that the correct values for the foam mechanical characteristics be used in any simulation of foam striking the leading edge of the wing or the tiles. It is also imperative that, if any tests are run, that those tests are run using foam at LH2 temperatures.

If I can be of any further assistance in this regard, please let me know.

I have informed
information/these questions, to NASA.

that I have submitted this

Sincerely

Wayne R. Frazier, 06:57 AM 2/6/2003 -0500, Fwd: Gehman Letter

X-Sender: wfrazier@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 06 Feb 2003 06:57:15 -0500
To: prichard@hq.nasa.gov, snewman@hq.nasa.gov
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Fwd: Gehman Letter

for the files and PBMA website.

X-Sender: dthomas1@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Wed, 05 Feb 2003 12:41:31 -0500
To: w R Frazier <wfrazier@mail.hq.nasa.gov>
From: Daniel Thomas <dthomas1@hq.nasa.gov>
Subject: Fwd: Gehman Letter

X-Sender: mroberts@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Wed, 05 Feb 2003 12:06:58 -0500
To: Daniel.Thomas@hq.nasa.gov
From: Margaret Roberts <mroberts@hq.na:
Subject: Gehman Letter

Dan Thomas
Office of the General Counsel
NASA Headquarters
Washington, D.C.
(202) 358-2085

 Gehman.doc

Wayne R. Frazier, 06:57 AM 2/6/2003 -0500, Fwd: Gehman Letter

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"

National Aeronautics and
Space Administration
Office of the Administrator
Washington, DC 20546-0001



February 2, 2003

Admiral Hal Gehman
3725 Lynnfield Drive
Williamsburg, VA

Dear Admiral Gehman:

This letter is to advise you that, pursuant to 42 U.S.C. §2473 (c)(1), Section 203 (c)(1) of the National Aeronautics and Space Act of 1958, as amended, and as a result of the loss of the Space Shuttle Columbia, I have formally activated the Columbia Accident Investigation Board. I am appointing you to be Chairman of this Board.

I am requesting your immediate and full cooperation with the investigation of the STS-107 Space Shuttle mishap of February 1, 2003. As Chairman of the Board, you are charged with all activities and responsibilities described in but not limited to the Columbia Accident Investigation Board Charter.

Among other things, the Board shall independently determine the facts, as well as the actual or probable causes of the Shuttle accident and recommend preventative or other appropriate actions to preclude recurrence of a similar nature. Our regulations stipulate that the Board issue a final report within 60 days from this date. However, if you feel that you need additional time to arrive at a responsible conclusion, do not hesitate to request such additional time as you deem fit. You are free to pursue whatever avenue you deem appropriate. A copy of the Charter is attached for your reference.

I have designated Mr. David Lengyel and Mr. Steven Schmidt from my staff to be your key points of contact. We will also make other staff available to directly support the Board's activities.

I am grateful for your dedication and service to our country in this time of great need. I trust that you will be diligent, thorough, and unrelenting in your work to determine the cause and prevent the recurrence of this tragedy.

Respectfully,

A handwritten signature in black ink, appearing to read "Sean O'Keefe".

Sean O'Keefe
Administrator

James Lloyd, 06:14 PM 2/6/2003 -0500, Re: 02-05-03 S&MA Noon Teleconference Minutes

X-Sender: jlloyd@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 06 Feb 2003 18:14:54 -0500
To: "TAYLOR, SHARON J. (JSC-NC) (SAIC)" <sharon.j.taylor1@jsc.nasa.gov>, "snewman@mail.hq.nasa.gov" <snewman@mail.hq.nasa.gov>
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: Re: 02-05-03 S&MA Noon Teleconference Minutes
Cc: "NAKAMURA, STACEY T. (JSC-NS) (NASA)" <stacey.t.nakamura@nasa.gov>, "JOHNSON, GARY W. (JSC-NA) (NASA)" <gary.w.johnson@nasa.gov>, prichard@hq.nasa.gov, "prutledg@mail.hq.nasa.gov" <prutledg@mail.hq.nasa.gov>

Sharon,

Thanks for taking the excellent notes. I made a few changes where I was probably not speaking as clearly as I should or jumping from thought to thought and you captured it faithfully! We will post on the 107 team intranet and forward to the SMA Directors.

Sincerely,

At 10:45 AM 2/6/2003 -0600, TAYLOR, SHARON J. (JSC-NC) (SAIC) wrote:
<<2-5-03 SMA noon teleconference_.doc>>

Sharon Jo Taylor
NASA-JSC/SR&QAPayload Safety
Bldg. 45, Rm. 613
sharon.j.taylor1@jsc.nasa.gov
281-483-9551 Office

"A person is not old until regrets take the place of dreams."

 2-5-03 SMA teleconference Lloyd final.doc

James D. Lloyd (Jim)

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

cellular

fax 202-358-3104

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

**Safety and Mission Assurance (S&MA)
TELECONFERENCE MEETING 12:00 PM CST
SHUTTLE COLUMBIA INVESTIGATION
MINUTES OF MEETING
FEBRUARY 5, 2003**

1.0 INTRODUCTION

1.1 General: The NASA S&MA representatives from the various centers met via teleconference at 12:00 PM CST on February 5, 2003, to discuss the Shuttle Columbia investigation. Attachment 1 lists attendees.

2.0 SIGNIFICANT SAFETY DISCUSSION

2.1 Day 5, February 5, 2003 10:00 AM EST NASA Director's conference: Q/J. Lloyd provided the following overview of updates resulting from NASA Administrator S. O'Keefe's 10:00 AM EST conference this morning.

2.1.1 Investigation: HQ/A/S. O'Keefe provided the investigation status, reporting good progress to this point and cautioning attendees to avoid determining conclusions or identifying root causes to the incident too quickly. He further offered that all are aware the investigation focus remains on the left wing and the foam insulation but in his experience, more often than not, the first cause theories turn out to be erroneous; and that fault-tree analyses were being performed to narrow down all possible causes.

Mr. O'Keefe reiterated the need for free data exchange within the S&MA community and the investigation board; and directed the attendees to maintain focus on their principal business if not involved in Columbia accident analysis efforts directly and ensure that investigation workers get adequate rest.

2.1.2 International Space Station: ISS personnel assured the Administrator that they are comfortable that NASA is doing everything possible to further the investigation, that they are supplied to do their jobs adequately, and they have complete confidence in the space program.

2.1.3 Task Force: A new entity was formed today, a Task Force, which will work for the Columbia Accident Investigation Board (CAIB) to interface with the rest of the agency. HQ/M-4/Frank Buzzard will chair the Task Force and new organizational charts will reflect this new entity. MRT and MIT operations will be put more in line with the CAIB.

2.1.4 CAIB: The NASA Office of Inspector General (OIG), who works for the U.S. Congress, was added as an observer to the CAIB to ensure an independent investigative process and objective data acquisition and control. Questions arose regarding whether the addition of the OIG affected witness statement "privileged status" if the investigation went to a criminal category, with HQ/Q/J. Lloyd accepting an action to voice the concern to the NASA general legal counsel.

2.1.5 Mishap Response Teleconference (MRT): Mr. Lloyd offered that the MRT would be utilizing a more disciplined approach starting immediately and move away for a "war room" approach, including one-page daily summary statements. Their focus will be on the Mishap Investigation Team (MIT), who are detecting, documenting the location, photographing,

labeling, bagging, and gathering the shuttle debris for relocation to Barksdale Air Force Base, Louisiana.

2.1.6 Debris: The debris field has been extended to the US west coast, with findings in California, Nevada, and Texas. Dryden Flight Research Center, California and KSC will provide support in locating debris in California and Arizona respectively.

2.1.7 Vehicle: JSC, KSC, Marshall Space Flight Center (MSFC), and Michoud are performing vehicle engineering to analyze orbiter information. They are also using fault-tree analysis to initiate a process of elimination for possible causes.

JSC/NA/G. Johnson offered that JSC/MV/R. Roe's Vehicle Engineering Working Group shifted into a more formal role as a "board" and would provide information to outside boards. Their meetings will now be held at 3:00 PM CST daily. The teams will be broken down into individual working groups who will report to Mr. Roe. Mr. Roe will then report to the task force, which is headed by Mr. Buzzard.

2.1.8 Third-party information: Mr. Lloyd cautioned the attendees regarding processing any investigation information, such as photographs, videotapes, etc., provided by third parties (not federal government or NASA contractor employees). He offered that a legal issue could exist regarding protecting the ownership of the third parties' intellectual information if said third parties allow NASA to use their information for the investigation, but want exclusive rights for releasing the information to the public and/or media.

2.2 Headquarters: Mr. Lloyd stated that NASA is scheduled to provide investigation testimony to Congress on February 13, 2003. Headquarters is brainstorming possible questions and/or issues that may be addressed, and offered that additional support data may be requested from the various NASA centers. Code Q/Dale Moore provided a briefing regarding data that might be requested soon. This included staffing data for fiscal years (FYs) 2002, 2001, and 2000, as well as projections for FY 2003, to include civil servants, contractors, and prime contractors. Ms. Moore offered that a template defining S&MA functions would be forwarded for use when providing the data. She cautioned that the data request could have a turnaround time of 30 days or less. Mr. Johnson recommended that Ms. Moore relay this information to the attendees at the 2:00 PM Headquarters Meeting and the MRT to notify more people.

2.2.1 Data: Mr. Lloyd stated that HQ is using a Process-Based Mission Assurance (PBMA) Working Group "software environment," headed by HQ/QE/Steve Newman, to feed data and information developed at headquarters into the PBMA website. He raised concerns regarding data security, offering that the website would have secured access that would be arranged separately. Attendees may submit their PBMA membership information and requests to Mr. Newman or HQ/QE/P. Rutledge. Mr. Lloyd stated that he expects the first questions from S&MA directors for HQ/Q/Bryan O'Connor to be forwarded to the website shortly, with daily updates thereafter. Two packages will be prepared for Mr. O'Connor, one to provide the mishap investigation requirements and one for mishap investigation methods used by NASA. These will be posted to the PBMA intranet website under the name of "107 team."

HA/QE/Pam Richardson will compile and coordinate Code Q actions and data flow, including the S&MA directors' questions. Ms. Richardson stated that she categorizes each email containing investigation data, and then forwards it to Dr. Rutledge and Mr. Newman once per day. Each center's S&MA representatives in attendance at this teleconference agreed to provide Dr. Rutledge and Mr. Lloyd with information (email addresses, voicemail, pager numbers, etc.) regarding their respective points-of-contact and backups, so that communication and data requests could be processed more efficiently. Attendees were encouraged to work cooperatively to gather information and present questions to ensure a more forthright investigative process. They were also reminded that technical data requests should take precedence over data related to the S&MA process. Dr. Rutledge agreed to provide a refreshed Fault-Tree Analysis for Aerospace Handbook to attendees to expedite the investigation analyses.

Mr. O'Connor and HQ/AE/T. Bradley traveled to Barksdale AFB yesterday, February 4, 2003, to obtain a status of the shuttle debris retrieval process. They will travel to Houston today, and Houston will be the center of operations for the CAIB.

2.2.2 Headquarters Contingency Action Team (HCAT): Code M-1/W. Hill and Code QE/W. J. Bihner are coordinating the HCAT.

2.3 Legal: Mr. Lloyd reported that studies of shuttle safety performed since the Challenger incident of 1986 are being collected and may be requested later in this investigation process. He reminded attendees that all paper copies of any documents related to this investigation must stand separately to be archived as historical records in the future. Mr. Johnson suggested sending electronic copies of all the shuttle reports/studies to Mr. Newman for compilation.

2.4 Comments from NASA centers:

2.4.1 Ames Research Center: L. Doty requested a clarification regarding processing information received from third parties, including private citizens and the news media. Mr. Lloyd advised her to contact the AMES General Counsel for guidance, or to contact HQ/GS/J. Steptoe, who provided a briefing on this subject at HQ earlier today.

2.4.2 Glenn Research Center: B. Russell provided a summary of GRC actions, including appraising their STS-107 Hazard Reviews for four payloads that were on Columbia. He offered that the GRC Director, D. Campbell, was impressed by the PBMA and has signed on to use it.

2.4.3 Langley: A. Phillips reported that they were reviewing JSC technical requirements and conducting Technical Interchange Meetings today to identify ways to support the investigation.

2.4.4 JSC: NS/S. Nakamura offered that the NASA Medical Office provided Enhanced Hazardous Materials Personal Protection Equipment (PPE) information to be relayed to debris recovery coordinators in the field, so that workers could use proper PPE when handling shuttle debris. The information was also sent to the Occupational Health organizations across the agency to be used to protect workers. He hopes to disseminate the information to the Federal Emergency Management Agency and their volunteers.

Mr. Nakamura also stated that White Sands Test Facility would be distributing pictures of shuttle hardware that may be contaminated with or contain hypergolic materials so that the public could more easily identify possible shuttle debris in their region.

2.4.5 KSC: QA/H. T. Garrido reported that about 220 people are working the shuttle investigation, and they have begun rotating shifts every two weeks to protect them from

excessive fatigue. KSC will coordinate with Code AM, the KSC Center Director, and Legal Office regarding time limits for recovery people; with the expectation of the release of a policy letter soon.

The KSC Columbia Crew Memorial Service will be held Friday, February 7, 2003, and should be attended by Mr. O'Keefe and Mr. Gregory.

The KSC hangar where the shuttle reconstruction will be performed is currently being cleared in preparation.

KSC/UB-F3/J. Dollberg reported that some payload customers were frustrated with the slow release of hardware due to the Columbia disaster. Also, recovery efforts located one intact payload locker for the Commercial Instrumentation Technology Associates Biomedical Experiments (CIBX).

Mr. Dollberg stated that they are using 1.5 years for the estimated time that hardware will sit on the ground as a result of the investigation, and reported that some hardware may need to be de-integrated due to its battery acid and/or ammonia contents.

2.4.6 MSFC: A. Adams reported that the MSFC Columbia Memorial Service was earlier today. He stated that MSFC requested the release of the Reusable Solid Rocket Motor (RSRM) hardware at this morning's MRT, so that engine personnel could test it before it corrodes. He reported that JSC/MA2/L. Ham approved the hardware processing today.

MSFC is compiling a list of resident S&MA experts who may assist in the investigation.

2.4.7 Stennis: Stennis personnel reported that their Columbia Memorial Service is tomorrow at 7:45 AM CST. He offered that Stennis personnel reached an effective compromise to process data collection for the investigation by requiring both the civil servant and contractor to sign off on the data release, with the expectation that the contractor will receive the data when the investigation is over.

2.5 Impoundment and data release: It was noted that this issue presented an obstacle across the agency, with the attendees agreeing to compile any notes regarding successful data management for the investigation process to be used as future lessons learned. The attendees were reminded that Ms. Ham is coordinating data release and that the CAIB is instrumental in this process. Mr. Nakamura offered that the institutional safety data was released. Most data was released after ensuring that the original and a copy were on hand, with only the copy being released.

3.0 CONCLUSION

The next S&MA teleconference meeting is scheduled for 12:00 PM CST tomorrow, February 6, 2003, with the same attendees.

Original signed by:

JSC/NC44/S. J. Taylor
Technical Writer

Safety and Mission Assurance (S&MA)
 Daily 12:00 PM CST Teleconference
 Shuttle Columbia Investigation

Date: February 5, 2003

NASA Mail Code	Name	Employer (if not NASA)	Phone Number	Email Address
AMES	Laura Doty			
	Bob Navarro			
GRC	Ken O'Connor			
	John Reagan			
	Bill Russell			
HQ/QS	Bill Loewy			
QE	Mike Card			
QE	Pam Richardson			
QE	Eric Raynor			
QS	Jim Lloyd			jllloyd@mail.hq.nasa.gov
Q	Will Harkins			"

NASA Mail Code	Name	Employer (if not NASA)	Phone Number	Email Address
QS	Pete Rutledge			prutledg@mail.hq.nasa.gov
Q	Lynne Loewy			
QS	Wayne Frazier			
QS	John Lyver			
Q	Dale Moore			
QE	Pepper Phillips			
QE	Faith Chandler			
QS	Tom Whitmeyer			
QS	Martha Wetherholt			
QE	Steve Newman			snewman@mail.hq.nasa.gov
QS	Jonathan B. Mullin			
JSC/ NA	Gary Johnson			
NA	Frank Culbertson	SAIC		
NA	Joyce Abbey	SAIC		

NASA Mail Code	Name	Employer (if not NASA)	Phone Number	Email Address
NC	Sharon Taylor	SAIC		
NS	Stacey Nakamura			
KSC/ UB-F3	John Dollberg			
QA	H.T. (Bert) Garrido			
Langley	Alan Phillips			
	Don Porter			
MSFC	Alex Adams			
	Laura Malone			
Stennis	John Stealey			
	Mike Smiles			

X-Sender: keeler@orion.ivv.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 5.1
Date: Fri, 07 Feb 2003 11:16:18 -0500
To: prichard@mail.hq.nasa.gov
From: Nelson Keeler <Nelson.H.Keeler@nasa.gov>
Subject: Fwd: Re: Fwd: IV&V Items related to STS-107
Cc: Pete Rutledge <prutledg@hq.nasa.gov>, jbruner@pop500.gsfc.nasa.gov,
raque@ivv.nasa.gov, gatto@ivv.nasa.gov

Copy provided
to John Lyver
2/7/02
12:15pm

Pam:

Thanks for the call this morning. The ASCB stands for the Avionics Software Control Board. It is part of the International Space Station program and chaired by Bill Painter at JSC.

I've also forwarded you the message I was referencing with respect to input we have provided to the Shuttle program. That action was completed by COB on 4 February 2003. By the way, the Shuttle has a similar board to the one above, SASCB, the Shuttle Avionics Software Control Board and it is chaired by Darrell Stamper (name referenced in email that data was delivered to).

I have one additional concern that I think someone should be working or preparing for a question about. It stems from the following 2/5/03 Computerworld article:

NASA seeks clues to on board computer actions

NASA investigators are questioning whether adjustments made by the Columbia's on board control computers could have played a role in the Feb. 1 disaster.

<http://computerworld.com/newsletter/0%2C4902%2C78201%2C0.html?nlid=AM>

When you work through the article and its companion articles it states that there is a 1999 GAO report that faults NASA for not having an IV&V software capability on Shuttle. It tries to use this to support its contention that the on board computers could have been part of the problem. The actual GAO report was written in 1991 (not 1999 as improperly sited) and is one aspect that led to the implementation of IV&V on the Shuttle program and the creation of the IV&V Facility. There is IV&V done on the Shuttle software today contrary to the contention of the article and it is managed by the Facility.

Hope this helps.

Ned

X-Sender: prutledg@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 03 Feb 2003 17:52:00 -0500
To: Nelson Keeler <Nelson.H.Keeler@nasa.gov>
From: Pete Rutledge <prutledg@hq.nasa.gov>
Subject: Re: Fwd: IV&V Items related to STS-107

Thanks for closing the loop, Ned.

Pete

At 04:56 PM 2/3/2003 -0500, you wrote:

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

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

Mission Success Starts with Safety!

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SPECIAL The Loss of Columbia

View our continuing coverage of the Space Shuttle Columbia tragedy.

NASA seeks clues to onboard computer actions

By DAN VERTON
FEBRUARY 05, 2003

Content Type: Story
Source: Computerworld

□ NASA investigators want to know if adjustments made to the position of the space shuttle *Columbia* during its last minutes by the vehicle's onboard control computers could have played a role in its breakup during re-entry Feb. 1.

In a revised timeline of events released Feb. 3, Ron Dittmore, NASA's space shuttle program manager, said that at 8:59 a.m. EST, *Columbia's* five onboard computer systems began to detect a significant increase in drag on the vehicle's left wing and ordered two of the shuttle's four yaw jets to fire for 1.5 seconds to compensate for the

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change.

Investigators aren't sure yet whether the adjustments ordered by the computer played a role in the shuttle's breakup. "It was well within the flight control system's capability to handle the [maneuver]," said Dittermore. "But what is becoming interesting to us now is the rate of change."

While Dittermore acknowledged that NASA may never be able to determine the exact root cause of the crash, he said investigators are now studying all of the data from the launch process as well as the shuttle's flight control systems.

The focus on *Columbia's* flight control systems could be significant. On Feb. 3, *Computerworld* reported that *Columbia* and other space shuttles have a history of computer glitches that have been linked to control systems, including left-wing steering controls ([see story](#)).

Although officials said it's too early in the investigation to pin the blame for the crash on the control computers, William Readdy, deputy administrator of NASA, said officials are actively searching for any of the shuttle's five onboard computer systems. Although it's unlikely they survived the crash, he said, the computers have "memory resident in them" that could shed light on the status of the shuttle after communications were lost with ground control.

Each computer's memory stores "telemetry of thousands of parameters that affect the flight of the shuttle," Readdy said.

Columbia and other space shuttles have experienced a series of control computer failures during the past two decades, including one that had a direct link to the spacecraft's left-wing control systems. During a March 1996 return flight, NASA officials discovered a computer circuit problem that controlled steering hardware on *Columbia's* left wing. The computer circuit was responsible for controlling the spacecraft's left rudder, flaps and other critical landing functions.

Speaking at a news conference prior to *Columbia's* landing in March 1996, NASA spokesman Rob Navius downplayed the seriousness of the computer problem.

"There are three additional paths of data that are up and running in perfect shape, and there's multiple redundancy that would permit a safe landing," he said. Although *Columbia* landed without incident that time, NASA officials said the failure was significant enough that had it happened earlier in the flight, the agency would likely have ordered the shuttle home early.

The General Accounting Office, the investigative arm of Congress, has also criticized NASA in the past for relying on the same commercial contractors to develop, test and validate the space shuttle software ([see story](#)).

However, Donna Shirley, the former manager of NASA's Mars Exploration Program and the team that built the Sojourner Microver, said there is no evidence yet that flaws in NASA's software-validation program had



anything to do with the disaster.

COLUMBIA SPACE SHUTTLE

Recent Headlines

- GPS/GIS mapping helps narrow search for shuttle debris
- NASA seeks clues to onboard computer actions
- Q&A: Data recovery on the shuttle
- GPS key to mapping shuttle debris in Texas

Resources

- You can post your thoughts on the loss of *Columbia* in our discussion forum.
- [Additional Web resources on the *Columbia*](#)





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Coverage of the space shuttle Columbia tragedy.

Source: Computerworld

Image credit: Nasa

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X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 10 Feb 2003 11:23:51 -0500
To: prichard@hq.nasa.gov
From: "Jonathan B. Mullin" <jnullin@hq.nasa.gov>
Subject: Fwd: FW: RIV, Possible Shuttle Debris Discovery

More history for logging. Jon

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Subject: FW: RIV, Possible Shuttle Debris Discovery
Date: Thu, 6 Feb 2003 13:58:54 -0500
X-Mailer: Internet Mail Service (5.5.2656.59)

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

> From: Dupree, Annette
> Sent: Thursday, February 06, 2003 12:11 PM
> To: R4-INCIDENT-LIST; Evans, Charleen W; R06-ROC-ESF5; EST-ESF05PLNC
> Subject: RIV, Possible Shuttle Debris Discovery

>
> The following entry has been posted in the NEMIS journal, Incident
> Activity Manager under the Shuttle Mishap:

>
> A citizen in Wilson County reported the discovery of several pieces of
> what looked like metal corrugated (cardboard) type of material. The
> Sheriff's Department (HazMat Team) has the items secured and are holding
> for investigation. The items were found last night 02/05/03.

>
> Another local in Murfreesboro, Rutherford County, found some small green
> tinted "rocksalt" type material. These were found Tuesday, about 7:30 PM,
> but had been thrown in the trash. When they heard the news they removed
> them and called and reported the findings to the Rutherford County EMA.
> The local Sheriff's Department has the item.

>
> Both discoveries were reported to NASA.

>
>
>
>
> Annette Dupree
> Emergency Management Program Specialist
> R4, Response and Recovery Division
> Response Operations Branch
> 402 S. Pinetree Blvd.
> Thomasville, GA 31792
> v: 229/225-4579
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>
>
Jonathan B. Mullin
Manager Operational Safety
Emergency Preparedness Coordinator
Headquarters National Aeronautics and Space Administration

Jonathan B. Mullin, 11:23 AM 2/10/2003 -0500, Fwd: FW: RIV, Possible Shuttle Debris Discovery

Phone (202) 358-0589

FAX (202) 358-3104


"Mission Success Starts with Safety"

Jonathan B. Mullin, 12:53 PM 2/11/2003 -0500, Columbia Report

X-Sender: jmullin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 11 Feb 2003 12:53:07 -0500
To: prichard@hq.nasa.gov
From: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>
Subject: Columbia Report
Cc: snakamur@ems.jsc.nasa.gov, jlemke@hq.nasa.gov, sbrookov@hq.nasa.gov

This is the first JSC IRIS Report on Columbia. Regards, Jon

Jonathan B. Mullin
Manager Operational Safety
Emergency Preparedness Coordinator
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Phone (202) 358-0589
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"Mission Success Starts with Safety"

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Special Case Criteria Listing

Report Criteria: Site = "A"; Year = 2003; Case Status = "A"; Case Category = "A"; Investigator/Monitor = "A"; Org. Type = "A"; Responsible Org. = "A"

Report
e
Number
C-2003-103

Status	Category	DOI	Responsible Organization	Investigator/Monitor	Incident Description	Final Cost
Open	A	2/1/2003 12:00 am	Flight Crew Operations Directorate (NACA)	Unknown		


X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: dmoore@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Wed, 12 Feb 2003 08:50:07 -0500
To: code-q@lists.hq.nasa.gov
From: Dale Moore <dmoore@hq.nasa.gov>
Subject: Fwd: Moving On After Columbia
Sender: owner-code-q@lists.hq.nasa.gov

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-smadir using -f
From: "Goodson, Amanda" <Amanda.H.Goodson@nasa.gov>
To: smadir@hq.nasa.gov
Subject: Moving On After Columbia
Date: Tue, 11 Feb 2003 12:25:14 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)
Sender: owner-smadir@lists.hq.nasa.gov

I thought you might find the attached information useful. It is a presentation and other material that was presented to my office 2/10/03, by Martha Baker, Psy.D., and N. Jane Roark, MD. The presentation is entitled "Moving On After Columbia" - What managers and staff need to know, to help their people continue to function after STS-107.

Thanks
Amanda Goodson
Director
Safety & Mission Assurance
(256) 544-0043
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 [Moving On After Columbia.pdf](#)

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MOVING ON AFTER COLUMBIA

Presenters: Martha E. Baker, Psy.D. and N. Jane Roark, M.D.

Dr. Baker is a clinical psychologist in private practice in Huntsville, Alabama. Her practice includes individual, marital, and family psychotherapy and psychological evaluation with adults, senior adults, and adolescents. Prior to establishing her practice eight years ago, Martha earned her doctorate in psychology at Nova University and completed her pre-doctoral internship at the University of Alabama at Birmingham. She also holds a master's degree in clinical psychology from Nova University, a master's degree in movement therapy from Antioch/New England Graduate School, and a bachelor's degree from Goddard College. A Huntsville native, Martha worked in Miami at Jackson Memorial Hospital's psychiatric center for seven years, before returning to Alabama.

Dr. Roark is a board certified psychiatrist with a long-standing interest in trauma, resiliency, and impaired professionals. After completing her training at the University of Cincinnati, where she also served as chief resident, she served for two years on the medical teaching faculty. She is on the volunteer faculty currently for the University of Alabama medical school. Jane is a certified mental health disaster specialist with the Red Cross; her most recent assignment was as a technician and supervisor at Ground Zero. Jane has worked locally and at the state level to facilitate recognition and development of administrative policy towards impaired physicians. Jane has been in psychiatric practice for eighteen years, currently with an outpatient practice in Huntsville, Alabama.

MOVING ON AFTER COLUMBIA

Things to Remember When Trying to Understand Disaster Events

- No one who sees a disaster is untouched by it.
- Profound sadness, grief, and anger are normal reactions to an abnormal event.
- Acknowledging our feelings helps us recover.
- Focusing on our strengths and abilities will help you to heal.
- We each have different needs and different ways of coping.

(1.)

What happens to people after a disaster or other traumatic event?

Shock and denial are typical responses to disasters and other kinds of trauma, especially shortly after the event. Both shock and denial are normal protective reactions.

Shock is a sudden and often intense disturbance of your emotional state that may leave you feeling stunned or dazed. Denial involves your not acknowledging that something very stressful has happened, or not experiencing fully the intensity of the event. You may temporarily feel numb or disconnected from life.

As the initial shock subsides, reactions vary from one person to another. The following, however, are normal responses to a traumatic event:

- Feelings become intense and sometimes are unpredictable. You may become more irritable than usual, and your mood may change back and forth dramatically. You might be especially anxious or nervous, or even become depressed.
- Thoughts and behavior patterns are affected by the trauma. You might have repeated and vivid memories of the event. These flashbacks may occur for no apparent reason and may lead to physical reactions such as rapid heart beat or sweating. You may find it difficult to concentrate or make decisions, or become more easily confused. Sleep and eating patterns also may be disrupted.
- Recurring emotional reactions are common. Anniversaries of the event, such as at one month or one year can trigger upsetting memories of the traumatic experience. These "triggers" may be accompanied by fears that the stressful event will be repeated.
- Interpersonal relationships often become strained. Greater conflict, such as more frequent arguments with family members and coworkers, is common. On the other hand, you might become withdrawn and isolated and avoid your usual activities.
- Physical symptoms may accompany the extreme stress. For example, headaches, nausea and chest pain may result and may require medical attention. Pre-existing medical conditions may worsen due to the stress.

1. Adapted from the United States Department of Health and Human Services, Substance Abuse and Mental Health Services Administration's web site (<http://www.mentalhealth.org/publications/allpubs/KEN-01-0097/default.asp>), *After a Disaster: Self-Care Tips for Dealing with Stress*.

How do people respond differently over time?

It is important for you to realize that there is no one "standard" pattern of reaction to the extreme stress of traumatic experiences. Some people respond immediately, while others have delayed reactions - sometimes months or even years later. Some have adverse effects for a long period of time, while others recover rather quickly.

And reactions can change over time. Some who have suffered from trauma are energized initially by the event to help them with the challenges of coping, only to later become discouraged or depressed.

A number of factors tend to affect the length of time required for recovery, including:

- The degree of intensity and loss. Events that last longer and pose a greater threat, and where loss of life or substantial loss of property is involved, often take longer to resolve.
- A person's general ability to cope with emotionally challenging situations. Individuals who have handled other difficult, stressful circumstances well may find it easier to cope with the trauma.
- Other stressful events preceding the traumatic experience. Individuals faced with other emotionally challenging situations, such as serious health problems or family-related difficulties, may have more intense reactions to the new stressful event and need more time to recover.

How should I help myself and my family?

There are a number of steps you can take to help restore emotional well being and a sense of control following a disaster or other traumatic experience including the following:

- Give yourself time to heal. Anticipate that this will be a difficult time in your life. Allow yourself to mourn the losses you have experienced. Try to be patient with changes in your emotional state.
- Ask for support from people who care about you and who will listen and empathize with your situation. But keep in mind that your typical support system may be weakened if those who are close to you also have experienced or witnessed the trauma.
- Communicate your experience in whatever ways feel comfortable to you - such as by talking with family or close friends, or keeping a diary.
- Try to find groups led by appropriately trained and experienced professionals. Group discussion can help people realize that other individuals in the same circumstances often have similar reactions and emotions.
- Engage in healthy behaviors to enhance your ability to cope with excessive stress. Eat well-balanced meals and get plenty of rest. If you experience ongoing difficulties with sleep, you may be able to find some relief through relaxation techniques. Avoid alcohol and drugs.
- Establish or reestablish routines such as eating meals at regular times and following an exercise program. Take some time off from the demands of daily life by pursuing hobbies or other enjoyable activities.

How do I take care of children's special needs?

The intense anxiety and fear that often follow a disaster or other traumatic event can be especially troubling for children. Children may be more prone to nightmares and fear of sleeping alone. Performance in school may suffer. Other changes in behavior may include throwing tantrums more frequently, or withdrawing and becoming more solitary.

There are several things parents and others who care for children can do to help alleviate the emotional consequences of trauma, including the following:

- Spent more time with children and let them be more dependent on you during the months following the trauma - for example, allowing your child to cling to you more often than usual. Physical affection is very comforting to children who have experienced trauma.
- Encourage older children to speak with you, and with one another, about their thoughts and feelings. This helps reduce their confusion and anxiety related to the trauma. Respond to questions in terms they can comprehend. Reassure them that you care about them and that you understand their fears and concerns.
- Keep regular schedules for activities such as eating, playing, and going to bed to help restore a sense of security and normalcy.

Should I seek professional help?

Some people are able to cope effectively with the emotional and physical demands brought about by a traumatic experience by using their own support systems. It is not unusual, however, to find that serious problems persist and continue to interfere with daily living. For example, some may feel overwhelming nervousness or lingering sadness that adversely affects job performance and interpersonal relationships.

Individuals with prolonged reactions that disrupt their daily functioning should consult with a trained and experienced mental health professional. These professionals work with individuals affected by trauma to help them find constructive ways of dealing with the emotional impact.

(2.)

Ways to Ease the Stress

- Talk with someone about your feelings - anger, sorrow, and other emotions--even though it may be difficult.
- Take steps to promote your own physical and emotional healing by staying active in your daily life patterns or by adjusting them. This healthy outlook will help yourself and your family, i.e., healthy eating, rest, exercise, relaxation, meditation.
- Maintain a normal household and daily routine, limiting demanding responsibilities of yourself and your family.
- Spend time with family and friends.
- Participate in memorials, rituals, and use of symbols as a way to express your feelings.
- Use existing support groups of family, friends, and church.

(3.)

(2.) Adapted from the American Psychological Association's HelpCenter web site (<http://helping.apa.org/daily/traumaticstress.html>), *Managing Traumatic Stress: Tips for Recovering From Disasters and Other Traumatic Events*, March 2002.

(3.) Adapted from the U. S. Department of Health and Human Services, SAMSA Administration's web site (<http://www.mentalhealth.org/publications/allpubs/KEN-01-0097/default.asp>), *After a Disaster: Self-Care Tips for Dealing with Stress*.

ADMINISTRATIVE ROLE IN STRESS MANAGEMENT

NASA's administration is demonstrating emotional resilience following the loss of the courageous crew of STS-107 and of the Space Shuttle Columbia. Those in leadership roles have acknowledged the grief and loss felt by our nation and by the NASA team. They have recognized the professionalism demonstrated by NASA employees in the hours and days following the accident. They have encouraged the NASA family to support one another and to make use of the Employee Assistance Program (EAP).

What recommendations do we have for managers, in addition to the affirmative attitudes already demonstrated? We recommend that managers promote positive coping mechanisms among their staff by modeling healthy behaviors, such as eating meals at regular times, exercising, and getting adequate rest. While many employees worked long hours in the days immediately following the accident, managers now need to set reasonable limits. It is our opinion that an effective workforce is one that maintains a balanced lifestyle of work, rest, and relaxation:

We recommend that managers encourage their staff to attend educational intervention meetings and critical incident stress debriefings. Finally, we recommend that managers refer any individuals about whom they are concerned for further evaluation. Individuals who exhibit the following behaviors are particularly in need:

- Violence or threats of violence to self or others
- If problems do not resolve within weeks to three months after disaster
- If avoidance and emotional numbing persist for weeks after disaster
- If problems interfere with personal or professional functioning, especially problems with eating or sleeping
- Unable to focus or concentrate
- Extreme fear of leaving home
- Inability to experience pleasure from activities that usually produce pleasurable feelings

In addition to services offered at EAP, employees needing assistance can contact their insurance plans for a listing of trained and experienced mental health professionals in their area.

What can employers do after a traumatic event?

- Be sympathetic and sensitive about the event and the grief it caused.
- Understand that trauma impacts individuals differently.
- Provide information and educational material about what has happened, what to expect, and how individuals can take control.

What can employers do after a traumatic event? (continued from previous page)

- Encourage and support communication among employees and with managers and company leadership.
- Appreciate that employees may experience a short-term reduction in focus and productivity.
- Educate managers and supervisors on signs of emotional distress and how to provide support and help.
- Temporarily reconsider expectations about productivity, travel, and time away from the office or workplace.
- Provide ongoing communication until employees indicate the need has passed. (4.)

(4.) Adapted from The National Partnership for Workplace Mental Health, *When Disaster Strikes: Managing Mental Health in the Workplace*.

Moving on After Columbia:

What managers and
staff need to know to
help their people
continue to function
after STS 107

Martha Baker, Psy.D.

Jane Roark, M.D.

February, 2003

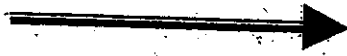


**Disaster is an Equal Opportunity
Employer**

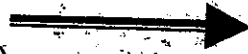
Anyone can be affected

Distress is universal

Disasters



Cause Distress and
Psychological Trauma



Which Precipitates a variety
of Responses, Physical and
Psychological

A person witnesses/
experiences/
is confronted

with an event

That involves Threat to Self
or others

And Suffers Fear/
Helplessness/
Horror

Horror



Responses to Disaster-physical

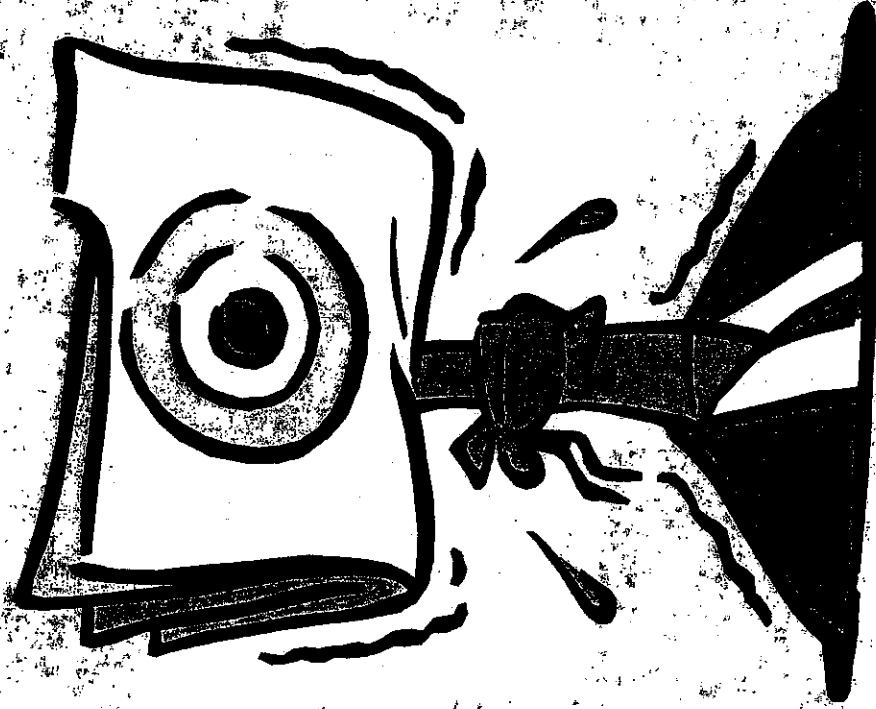
NE from locus ceruleus-
memory and fight or flight
response

Hormones from
hypothalamus-pituitary-
adrenal axis-normalize
arousal state

Acoustic startle reflex-marker
or result of hyper-arousal
5HT-impulsivity and
aggression

Endogenous opioids-stress
induced analgesia

Memory function-arousal
affects types of memories
retrieved and emotional
valence



Responses to Disaster

Over time, responses
normalize for most individuals

Physical

Mental

Sense of Attachment to institutions or other individuals

Emotion: Anxiety, Anger, Depression, Irritability

Consciousness: normal alertness, feeling foggy, feeling in a void
Losing time

Memory: fragmentary or intrusive flashes/images

Sense of Self: disengaged from others, feeling more connected

Spectrum of Responses

Adaptive

Individual Moves on
with Life

Efforts to Adapt Fail

Personal/Professional Function

Deteriorates

Typical Psychological Reactions

Initial

Later

Who needs words?



Initial Responses

- Shock
- Fear
- Disbelief
- Disorientation
- Feeling Numb
- Feeling Overwhelmed
- Needing Information
- Needing to Contact Family
- Difficulty Making Decisions

Initial Responses (Continued)

- Temporary Memory Loss
- Reluctance to Abandon Property/Worksite
 - Apathy
 - Startle Reactions
 - Muscle Tremors
 - Fatigue
 - Nightmares
- Isolating from Family/Friends

Later ...

(weeks to months after Disaster)

Responses Seen Later...

- Changes in appetite/digestion
 - Headache
- Sleep Disruption/Nightmares
- Increased Susceptibility to Allergies, Cold, Flu
- Persistent Depression
- Uncontrollable Crying
- Moodiness/ Irritability

Later

(Continued)

- **Frustration**
- **Feelings of Powerlessness over the Future**
- **Anxiety**
- **Survivor Guilt**
- **Disappointment with/anger at outside help**
- **Domestic Abuse**
- **Alcohol/Drug Abuse**

Coping Styles influence Responses

- Seek more information (rational/intellectual)
- Talk with others to relieve stress (shared concern)
- Laugh it off; make light of situation (reversal of affect)
- Try to forget; put it out of mind (suppression)
- Do other things to distract self (displacement and diffusion)
- Accept, but find something favorable to deal with (redefinition) Take firm action based on present understanding (confrontation)

Coping Styles

page 2

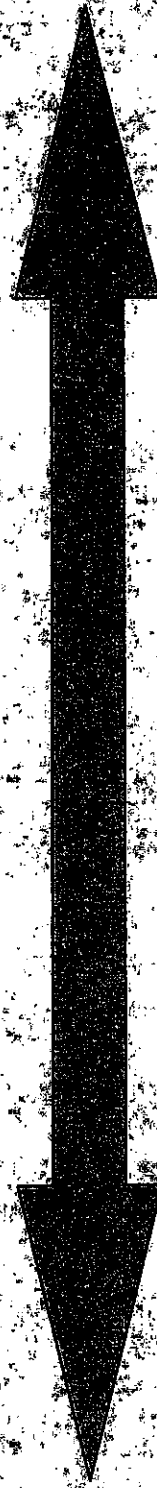
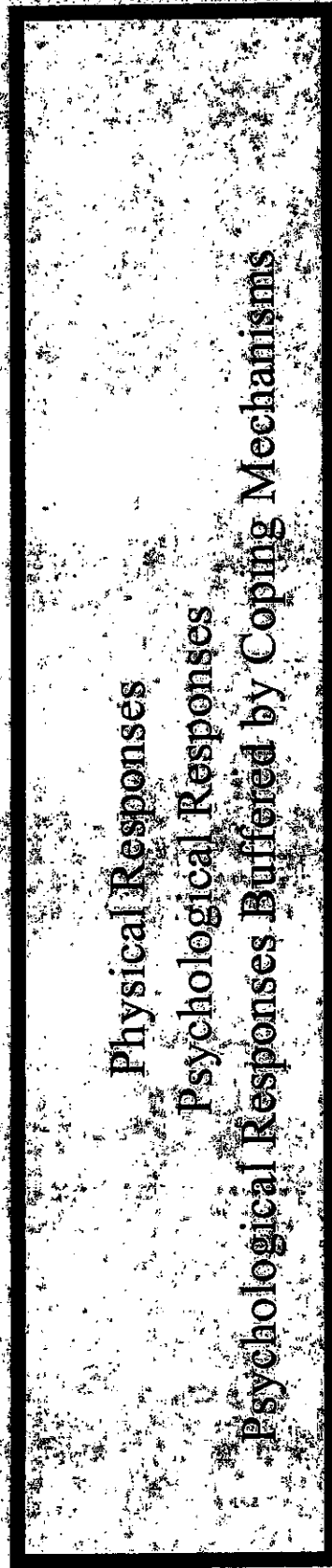
- Submit, accept the inevitable, say nothing can be done (fatalism)
- Do something, anything, however reckless or impractical (acting out)
- Negotiate feasible alternatives (if x, then y)
- Reduce tension by drinking, eating or taking drugs (tension reduction)

Coping Styles

page 3

- Withdraw into isolation (stimulus reduction)
- Blame someone or something (disown responsibility; externalize)
- Seek direction from an authority and go along (compliance)
- Blame yourself, sacrifice or atone (self-pity or surrender)

Spectrum of Responses



Adaptive - Survivor moves on with life
Efforts to adapt fail - Personal/Professional function deteriorates

Increased Risk of Acute or Posttraumatic Stress Disorder

- Degree of disaster exposure
- Preexisting Mood or Anxiety Disorder
- Involvement of loved one
- Postdisaster avoidance and numbing
- History of previous trauma

Other Problems after Disaster

- Panic attacks
- Major Depression, as part of Unipolar or Bipolar Disorder
 - Suicidal thoughts and feelings
 - Alcohol or drug abuse
 - Feeling alienated, isolated
 - Feeling mistrustful, betrayed
 - Anger, irritability
 - Violence
- Severe impairment in daily functioning
 - Strange beliefs

NEVER WORRY ALONE

Use resources: EAP Program,
Medical Department, Local Mental
Health Specialists

When to Worry/Refer

- Violence or threats of violence to self or others
- If problems do not resolve within weeks to three months after disaster
- If avoidance and emotional numbing persist for weeks after disaster
- If problems interfere with personal or professional functioning, especially:

Problems with eating or sleeping

Anhedonia

Unable to focus or concentrate

Extreme fear of leaving home

Remember

- Many people (3 in 4) survive disasters without developing significant psychological problems.
- Most PTSD responses normalize by 3 months after disaster; up to 1/3 may not fully remit.

Remember- Support Coping Mechanisms

- Act on facts, not fear or speculation.
- If TV increases your distress, minimize exposure.
- Take control of what you can.
- Find ways to distract (gardening, volunteer, movies, basketball game, etc.)
- Keep informed about new information or developments.
- If you feel anxious, angry or helpless, talk about it.
- When you worry about the unknown, change the subject.
- Refuel on your off days; a change in routine decreases preoccupation.
- If you are a manager, know that staff need limits to hours worked. If you are staff, know that managers also need limits.

Remember our children

- Try not to over assume what the tragedy means to children.
- Young people are remarkably resilient.
- If you receive difficult questions from children try to understand these before answering them. Parents can say, What made you think of that? Can you tell me what you were thinking about? What ideas do you have?
- Straight talk (even if you have to admit you don't know) is usually more comforting than false reassurances.
- Routines and reassurance (even just your presence) can be very comforting to children.

Remember

When the immediate crisis is over,
it's not over.....

Remember

To Prevent disability, improve efficiency and function

Plan for reminders about stress management - eating, sleeping, refueling, limits on work hours and time to

TALK, TALK,

AND THEN

TALK SOME MORE.

Summary

➤ **DISASTER** results in psychological **TRAUMA**

Trauma defined: Exposure/Witness/Involvement
in Event
causing Fear/Horror/Helplessness.

➤ **DISASTER IS EQUAL OPPORTUNITY
EMPLOYER-All are potentially affected.**

➤ **Distress is Universal.**

Summary

page 2

- Responses to disaster are initially **adaptive**; these are normal physical and psychological reactions to an abnormal situation.
- These responses are influenced by individual coping styles and risk factors.
- Responses to disaster occur on a spectrum, from adaptive to problematic.

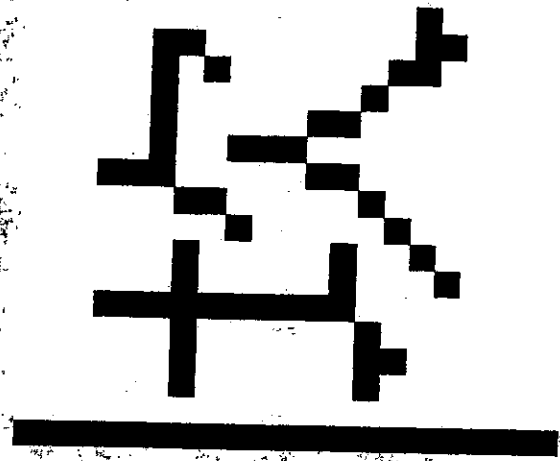
Summary

page 3

➤ **Problems: Acute or Posttraumatic Stress Disorder, Major Depression, Panic attacks, Domestic Abuse, Alcohol/Drug abuse, Violence**

➤ **Do not worry alone: when to worry/refer.**

Moving on after Columbia



Jonathan B. Mullin, 08:19 AM 2/12/2003 -0500, Fwd: Log of Events

X-Sender: jmullin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Wed, 12 Feb 2003 08:19:16 -0500
To: prichard@hq.nasa.gov
From: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>
Subject: Fwd: Log of Events

More log material. Regards, Jon

From: "Kee-1, Wayne" <Wayne.M.Kee@nasa.gov>
To: "Mullin, Jonathan" <jmullin@mail.hq.nasa.gov>,
"Brophy-1, JoAnn" <JoAnn.L.Brophy@nasa.gov>,
"Perry-1, Sheila" <Sheila.M.Perry@nasa.gov>,
"Klotz-1, Patrick" <Patrick.M.Klotz@nasa.gov>,
"Maust-1, Linda" <Linda.A.Maust@nasa.gov>,
"Burch-1, Michele" <Michele.J.Burch@nasa.gov>

Subject: Log of Events

Date: Wed, 12 Feb 2003 07:01:41 -0500
X-Mailer: Internet Mail Service (5.5.2653.19)

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"



Log of Events 10 Feb.doc

Log of Events

Log of Events
NASA/KSC Security, LE, and EP Office
MIT Barksdale AFB, LA

		February 10, 2003
Feb 10	0830	Delivery to TMF
Feb 10	1330	Notified of a delivery inbound from San Augustine ETA 20 Minute
Feb 10	1340	Shipment arrived from Nacogdoches
Feb 10	1430	Notified truck at Nose Dock from San Augustine.
Feb 10	1950	Delivery from Jasper, TX
Feb 10	2015	Delivery From Palestine, TX
		February 11, 2003
Feb 11	0035	Delivery to TMF from Hemphill TX

X-Sender: prutledg@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 10:35:04 -0500
To: prichard@hq.nasa.gov
From: Pete Rutledge <prutledg@hq.nasa.gov>
Subject: Fwd: Volunteer List

Pam,

There are a number of names of people offering help in the following sequence of messages. Some of them include text descriptive of their areas of expertise. Others, you can probably assume are more general aerospace SMA talent. Finally, there is a flier from Aerospace Corp. on what the company has to offer.

Pete

From: "PATTERSON, DESIREE C. (JSC-NT) (NASA)"
<desiree.c.patterson@nasa.gov>
To: "Hopson, Pat" <phopson@ems.jsc.nasa.gov>,
"prutledg@mail.hq.nasa.gov" <prutledg@mail.hq.nasa.gov>
Subject: Volunteer List
Date: Mon, 3 Feb 2003 17:26:17 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

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

From: SCHENFELD, STEVE M. (JSC-OB) (NASA)
Sent: Monday, February 03, 2003 9:42 AM
To: MARSHALL, YOLANDA Y. (JSC-NA) (NASA);
Subject: Volunteer.

If I can help in any way with the Columbia investigation or anything else, please let me know.

Steve Schenfeld

From: /
Sent: Monday, February 03, 2003 8:28 AM
To: MARSHALL, YOLANDA Y. (JSC-NA) (NASA);
(NASA)
Subject: Volunteer

Yolanda, Jerry,

You may already have more help than you need but if I can be of assistance, please call on me. I have had the DOE accident investigation course which was offered at JSC and ran two accident investigation boards several years ago. I can be available if needed.

Bob A.

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

From: HUMPHRIES, MARK B. (JSC-OL) (JEC)
Sent: Monday, February 03, 2003 7:36 AM
To: MARSHALL, YOLANDA Y. (JSC-NA) (NASA)
Subject: Information

Yolanda, it's been a long time since the SR&QA days with Loral and Calspan. Maybe one of these days we can reminisce, however, I know you are extremely busy with the situation at hand.

The reason for this note is to volunteer my services if I could be of assistance at all. I know resources for the recovery effort are stretched thin. With the task at hand, please let me know if I can possibly be of service on the MRT. Besides my years of S&MA experience, I was also a trained MORT and Mishap Investigator by NASA and DOE. I also have 17 years of law enforcement experience in working crime scenes and evidence recovery with DPS, County, and various municipalities. Some of this experience did include catastrophic events such as a pipeline explosion.

I just wanted to let you know that if I can be of service at all please let me know.

Sincerely,
Mark Humphries

Mark Humphries
ISS Program Data Integration Team
OL - Spacehab/Johnson Engineering
281-244-7201

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

From: Higgins-1, William [<mailto:William.C.Higgins@nasa.gov>]
Sent: Sunday, February 02, 2003 4:56 PM
To: MARSHALL, YOLANDA Y. (JSC-NA) (NASA)
Subject: SMA Telecon

Yolanda,

I would like to be tied in to the STS-107 S&MA telecons that are taking place daily. Is there a call in number that I can use? Phones here at Barksdale are numerous, but far from exclusive. I check my email pretty regularly, so if you could let me know how I can tie in I would appreciate it. I may not be able to support the 10am Eastern telecon on Monday, but I would like to participate on subsequent calls including the 3 pm Eastern call Monday. If I get the info and I can work it, I'll tie in Monday morning, but that's iffy at best. Thanks!!!!

Bill Higgins

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

> From: CHOBAN, PETER S. (PETE) (JSC-NQ) (AEC)
> Sent: Sunday, February 02, 2003 12:43 PM
> To: MARSHALL, YOLANDA Y. (JSC-NA) (NASA)
> Cc: HIMEL, MALCOLM J. (JSC-NX) (NASA); BAKER, HUGH A. (JSC-NQ) (NASA)
> Subject: FW: Aerospace capabilities text attached
> Importance: High

>
>
>
> Subject: Aerospace capabilities text attached
> Importance: High

>
<<Aerospace Capability.doc>>



Aerospace Capability.doc

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!

03/06/03, 3:00 PM

Offers of assistance submitted to NASA Headquarters Office of Safety and Assurance.

Offers are listed in the chronological order in which they were received. They are separated into offers from NASA personnel and other Government personnel, NASA contractors and outside NASA.

NASA offers:

1. NASA employees:

- a. Steve M. Schenfeld (Steve.M.Schenfeld@nasa.gov)
- b. Mark B. Humphries (Mark.B.Humphries@nasa.gov), SMA, trained in MORT, mishap investigator for NASA and DOE, 17 yrs law enforcement working crime scenes and evidence recovery, worked a pipeline explosion.
- c. Vince Zoby (E.V.Zoby@larc.nasa.gov), experience in Shuttle aerodynamic heating, major PI during the Orbiter Experiments Program.
- d. Dick Powell (R.W.Powell@larc.nasa.gov), significant experience on Shuttle and other entry vehicle trajectory, aeroheating, and flight mechanics analysis.
- e. Charles Miller (C.G.Miller@larc.nasa.gov), significant experience working entry and hypersonic aerodynamics.
- f. Mark Shuart (M.J.Shuart@larc.nasa.gov), head of the LaRC Structures and Materials Competency with experts in structures and materials, including aluminum and composite structures and TPS designs. Responsible for the landing loads facility with expertise in landing gear and tire design.
- g. Scott Jenson (Scott.A.Jenson@nasa.gov, 281-332-0021), worked on Challenger investigation fault tree analysis, would like to assist in this area.
- h. Timothy Adams (Timothy.C.Adams@nasa.gov, 321-867-2267, KSC), has a comprehensive and current release of reliability software by Relex and a tool that analyzes data visually up to five dimensions (3 axes, colored points, and different diameter for plotted points) from Excel spreadsheets.
- i. Steve Venski (Stephen.A.Venski@nasa.gov, NASA QA, JSC, Mission Control Center), says that quite a few in the Directorate who have aircraft/crash investigation/explosive ordnance experience will volunteer to assist those currently in the field. He has 20 years of aircraft maintenance experience, crash investigation and would pack his bags in an instant to deploy to the field to relieve others or assist.

2. 02/02/03, 9:02 PM, Dennis Vernon (Dennis.Vernon@eh.doe.gov), DOE

- a. DOE Accident Investigation Program Manager, Office of Special Projects and Investigations, Corporate Safety Assurance, Environment, Safety and Health, experience with accident investigations.
3. 02/03/03, 2:14 pm, Tom Ambrose (Tom.W.Ambrose@nasa.gov), OSMA, DFRC
 - a. DFRC sent the following equipment to support the Columbia investigation. The equipment and satellite system phone numbers are in the name of Ralph Anton (\$6.75/minute)
 - #2097456 Satellite system including hardware and laptop (1 each, \$28K)
 - #2097457 Satellite system including hardware and laptop (1 each \$28K)
 - #2097457 Advantage laser system with hardware (1 each \$5K)
 - #1648784 GPS mapping kit (1 each \$7K)
 - #2097488 HP Deskjet printer (1 each \$.5K)
 4. 02/03/03, 3:40 PM, Lawrence Davis (Lawrence.R.Davis@nasa.gov), OSMA, DFRC
 - a. Expertise-wise, Ken Illif may be available for any re-entry aerodynamics and controls. He's retired but living in the local area.
 - b. Dryden has test-bed aircraft available for any thermal investigative activity.
 - c. Our proximity to the Shuttle Modification Facility at Palmdale makes it easy to support any investigation needed there. We understand this was the first flight since the OMM was done there (*Pam input here, I think it was the second*). We also suggest that any records of that activity be impounded. Since that operation has moved to Florida, we are not certain where the records would be kept.
 - d. The ER-2's are available for any photographs of the impact areas, including eastern California or along the path for the earliest debris. The DOD photo reconnaissance capability could also be a valuable resource to locate parts earlier in the flight.
 - e. Our hazmat and accident investigation personnel can support any activity.
 - f. Our proximity to possible debris impact in the California, Nevada or New Mexico areas enables us to react to a search with aircraft, ground vehicles and/or personnel.
 - g. The AFFTC has offered their resources to help any efforts.
 5. 02/04/03, 9:14 AM, Yuri Gawdiak (Yuri.Gawdiak@hq.nasa.gov), Code R
 - a. James Williams and Ian Sturken from NASA Ames will arrive in Shreveport late tonight (02/04) to support Vern Ellingtad and will contact him on his cell in the morning. They are bringing laptops that with web access will provide access to InvestigationOrganizer 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 Vern 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. Yuri Gawdiak will be in contact with them throughout.

6. 02/04/03, 10:50 AM, Patrick Martin, Code QE

- a. Randy Stone, the SRQA Director for the Missile Defence Agency (MDA) offered independent investigation support if desired. Randy has been personally involved with several ELV (Delta) MIBs., 703-693-9051,

7. 02/05/03, 7:52 AM, Faith Chandler, Code QE

- a. Darcy Miller (NASA) provided information to Faith Chandler about software for use in crash and crime scene investigation from the OPTIMUS Corporation (AutoDOCS) using GPS technology, piloted with NTSB. Information was sent to the HCAT by Faith 02/05/03.

8. 02/05/03, 10:08 AM, Wayne Frazier, Code QS

- a. Offer of DIA services to overfly the crash site with a hyperspectral scanner (3" resolution for hard objects in vegetation). Various phone calls to other Agencies and this is in the works.

9. 02/12/03, 4:12 PM, Bill Wessel (vernon.w.wessel@grc.nasa.gov), SATD, GRC

- a. Bill provides a list of employees, their contact information and their areas of expertise as assistance. The file was sent directly to Bryan O'Connor, 02/13/03, 10:50 AM.

NASA Contractor and Outside NASA:

1. Contractor employees:

- a. _____, DOE accident investigation course, ran two accident investigation boards several years ago.

2. Outside NASA:

- a. _____, colleague and friend of Laurel Clark, medical doctor (former NASA flight surgeon), retired Navy, university professor, expertise in physiological effects of space flight. **Have bio (faxed in) if needed.**
- b. _____, probabilistic risk assessment, quantitative/qualitative risk assessment/management.
- c. Chuck Mertz (650-604-2323, ARC/Hernandez Engineering), safety.

3. 02/02/03, 12:43 PM, Aerospace Corporation Support to Return to Flight

Aerospace Corporation offers the full scope of its resources to contribute to the Shuttle's return to flight. Local Aerospace contact at JSC is Mr. Pete Choban at (281) 483-4890; E-mail: peter.s.choban1@jsc.nasa.gov

- **Organizational characteristics** – Since 1960, Aerospace, a non-profit firm, has focused on solving space problems as a trusted agent for the Government. Aerospace operates an FFRDC for the USAF and NRO (\$500M annually) and does not compete with US for-profit firms nor build hardware. We provide technical support to every USAF launch and when necessary, failure investigation. Additionally we support NASA space programs at JSC, KSC, MSFC, JPL, LaRC, GSFC and HQ. Over 2000 scientists and engineers provide all clients the benefit of this cumulative experience.
- **Technical capability**
 - a. Full spectrum technical support to the National Security Space program
 - b. Image reconstruction and enhancement, extracting faint data for post-launch reviews
 - c. Fusion of electro-optic, radar and IR data sets taken from multiple sensors
 - d. Debris metallurgy, re-entry modeling, analysis and visualization
 - e. Failure analysis with specialties in metal fatigue and re-entry fragment analysis
 - f. Materials: Forensics of metal failure and DoD's science lead for LDEF
 - g. Structural mechanics, fluid mechanics, dynamics and thermal analysis
 - h. Telemetry analysis and weak signal extraction
 - i. Launch vehicle communications link analysis during dynamic flight regimes
 - j. Engines: Hydrazine and cryogenic modeling, simulation and analysis
 - k. Flight visualization with high fidelity, for example high speed airflow and re-entry
 - l. Remote sensing engineering insight into National Security Space sensors
- **Unique facilities include:**
 - a. Center for Orbital Debris and Re-entry: High fidelity modeling of re-entry breakup
 - b. Spacelift Telemetry Acquisition & Reporting System-Analyzes ELV vehicle telemetry from each USAF launch. Provides failure analysis support.
 - c. Database of all space program failure mechanisms
 - d. Law Enforcement Center-Under direction from US DOJ, assists local law enforcement with forensic analysis methods and accident reconstruction support
 - e. \$100 M in space investigation tools used to re create accident timelines
- **Relevant experience**
 - a. White House Space Launch Broad Area Review
 - b. Integrated multiple observations to produce highly accurate re-entry trajectory for GRO and MIR

- c. Certify flight readiness of all military launches
 - d. Independent Assessment support to the ISS
4. 02/05/03, 10:35 AM,
- a. Disabled person, formerly worked for Hughes aircraft suggests putting a net or screen around the top of the ET to keep pieces of foam from hitting the Orbiter.
5. 02/05/03, 11:00 AM, NASDA offer of assistance
- a. [redacted] of NASDA offers any assistance they possibly can ([redacted]). Mark Kowaleski responded back to him thanking him for his gracious offer and that we would, if needed, contact them as well as keep them informed for future missions involving NASDA.
6. 02/05/03, 11:03 AM, [redacted], Futron Corporation
- a. [redacted] of Futron offers services of herself and the company in any way they can. ([redacted]) and indicates they are standing by.
7. 02/06/03, 6:44 PM, [redacted], Battelle
- a. [redacted] -- highly qualified -- twice Commander of the Naval Safety Center, now working at Battelle Memorial Institute (with access to tons of super technology capabilities at Battelle)
 - b. [redacted] Chairman of the NTSB (during Bush I); currently with Fulbright & Jaworski; former Marine pilot; aviation specialist.
 - c. [redacted] NTSB Investigator In Charge (IIC) -- led the ValuJet investigation and many others in 20 years at NTSB. Now a consultant based in Colorado.
8. 02/06/03, 9:51 AM, [redacted] System Safety Development Center
- a. [redacted] is a registered Professional Electrical Engineer. He has a Degree in Electrical Engineering from the University of Utah. He is also a Certified Crime Scene Investigator. He has conducted hundreds of accident investigations for over the past forty years, and has taught thousands of people the principles of accident investigation and mishap analysis. [redacted] is currently the director of the System Safety Development Center (SSDC); a continuation of the SSDC established by the Atomic Energy Commission (AEC). The SSDC has developed and taught the principles of accident investigation to The AEC, IAEC, DOE, DOE Contractors, NASA, OSHA, MSHA, NTSB, other governmental agencies, and industry in the United States and other countries. The SSDC developed the investigation techniques of MORT Charting, Fault Tree Analysis, Barrier Analysis, Change Analysis, Events and Causal Factors Charting, and Root Cause Analysis. The SSDC has been the leader in

causal factor determination and corrective action implementation for over three decades. (

9. 02/10/03, 9:00 AM, Thomas Kuper (robert.kuper@us.army.mil) recommends Prediction Probe Inc. in PRA.
10. 02/11/03, 10:23 AM, _____ recommends _____ (e-mail to Faith Chandler), CEO of Cognitech (_____ to process videos for enhancing purposes. He has some significant high profile experience in de-blurring video most likely outlined on the website. _____ passes along that _____ may be the right person to de-blur the launch video.
11. 02/18/03, 4:14 PM, _____ offers some points on ET tank materials and their installation and his assistance if needed. (Original offer came in 02/02/03, 9:36 AM to Jon Mullin at home). Jon reported it 02/18/03.

To: Tom Ambrose <Tom.Ambrose@dfrc.nasa.gov>
From: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>
Subject: Re: Fwd: DP loaned Equipment
Cc: john-piasecky,Lloyd_James,Jack Vechil,lemke-john,Wayne Kee <Wayne.Kee-1@ksc.nasa.gov>
Bcc: Richardson_Pamela,Mullin_Jonathan
Attached:

Tom, who will be paying for the air time? I would hope that it is not included in the RTOP. Thanks for the note.

Regards, Jon

At 08:35 AM 2/4/2003 -0800, you wrote:

Jon, per your request, below is the equipment deployed with DFRC Security to Lufkin, Tex. I relayed your cautionary message, in terms of care with and safe return of these items purchased with your 323 funds.

Tom

X-Sender: ralph_anton@mail.dfrc.nasa.gov
X-Priority: 1 (Highest)
Date: Mon, 03 Feb 2003 14:14:13 -0800
To: ~~tom.ambrose~~
From: Ralph Anton <ralph.anton@mail.dfrc.nasa.gov>
Subject: DP loaned Equipment

Tom, Here is equipment that we are sending to support the Columbia Investigation. The equipment and the satellite system phone minutes are in my name. Ralph

#2097456	Satellite system including hardware and laptop.	1 each	28k
#2097457	Satellite system including hardware and laptop.	1 each	28k
#2097421	Advantage laser system with hardware	1 each	5k
#1648784	GPS mapping kit	1 each	7k
#2097488	HP Deskjet printer	1 each	.5k
		Total =	68.5k

Airtime minutes are \$6.75 per minute

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"

X-Sender: prutledg@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 10:47:38 -0500
To: prichard@hq.nasa.gov
From: Pete Rutledge <prutledg@hq.nasa.gov>
Subject: Fwd: Re: Support for Bryan O'Connor on Columbia Accident Investigation Board (CAIB)

Pam,

Looks like 1 would be an SME, while 2 thru 5 I would include as issues on the questions/issues listing.

Pete

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

Peter J. Rutledge, Ph.D.
Director, Enterprise Safety and Mission Assurance Division
Acting Director, Review and Assessment Division
Office of Safety and Mission Assurance

Pete Rutledge, 06:17 PM 2/3/2003 -0500, Re: Support for Bryan O'Connor on Columbia Accident

X-Sender: prutledg@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 03 Feb 2003 18:17:36 -0500
To: Lawrence Davis <lawrence.davis@dfrc.nasa.gov>
From: Pete Rutledge <prutledg@hq.nasa.gov>
Subject: Re: Support for Bryan O'Connor on Columbia Accident
Investigation Board (CAIB)
Cc: prichard@hq.nasa.gov

Lawrence,

Thank you for the generous, conscientious, and considered response. I believe it's the first from any of the SMA Directors. We will add your contributions to our lists of subject matter experts and questions/issues for Bryan's possible use.

Regards,

Pete

At 09:43 AM 2/3/2003 -0500, you wrote:

Bryan & Pete

All of Dryden is ready to help with whatever is required but here's our immediate thoughts about helping from our Acting Director Bob Meyer and our OSMA staff:

1. Expertise wise _____ may be available for any re-entry aerodynamics and controls. He's retired but living in the local area.
2. Dryden has test-bed aircraft available for any thermal investigative activity.
3. Our proximity to the Shuttle Modification Facility at Palmdale makes it easy to support any investigation needed there. We understand this was the first flight since the OMM was done there. We also suggest that any records of that activity be impounded. Since that operation has moved to Florida, we are not certain where the records would be kept.
4. The ER-2's are available for any photographs of the impact areas, including eastern California or along the path for the earliest debris. The DOD photo reconnaissance capability could also be a valuable resource to locate parts earlier in the flight.
5. Our hazmat & accident investigation personnel can support any activity.
6. Our proximity to possible debris impact in the California, Nevada or New Mexico area enables us to react to a search with aircraft, ground vehicles and/or personnel. It seems like the astronomer that has photos of a possible event near Bishop, California may provide a time and impact prediction that should be scoured for the earliest clues. It will be worse than a needle in a haystack but again, a tile could have survived and landed in a remote area but easily seen from an aircraft or ground vehicle. Much of that area is restricted to the public and I have had some access previously that might be easier to activate, if an impact area may prove to be inside these areas.
7. A PRADO should be done to establish trend information on tile damage.
8. We understand the LOX tank was an older model. The age and condition of that tank should be investigated and data impounded.
9. The APU's should be investigated since they are critical to powering the flight controls.

Of course, we are all still in shock over the events but are ready to support with whatever assignments deemed necessary by the CAIB. I'll send more thoughts as they are assembled.