> that is overlayed to the STS-107 ET208 image of the debris strike to the
> Orbiter left wing can be seen at the following address:
>
> http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/index107.sh
> tml
</blockquote></x-html>
<x-html>
<blockquote type=cite> From: "ERMINGER, MARK D. (JSC-NC) (NASA)" <mark.d.erminger@nasa.gov>
To: "H - Kowaleski Mark (E-mail)" <mkowales@mail.hq.nasa.gov>
Subject: FW: STS-107 Debris Strike and Previous Mission Information - Prel
<x-tab>   </x-tab>iminary
Date: Wed, 5 Feb 2003 07:51:18 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

> -----Original Message-----
> From:
<x-tab>   </x-tab>DISLER, JONATHAN M. (JON) (JSC-SX) (LM)
> Sent:<x-tab> </x-tab>Wednesday, January 22, 2003 1:03 PM
> To:<x-tab>   </x-tab>Armando Oliu (E-mail); BAHR, PATRICIA A. (PAT) (JSC-SJ) (NASA);
> BARBARA A. CONTE (JSC-DM) (E-mail); Bill Lamkin; BOBBIE G. SWAN (JSC-CA)
> (E-mail); Brenda Eliason; BRIAN K. BALU (JSC-NC) (E-mail); Carlos
> Ortiz-Longo; Chris "The Man" Cloudt; Chris Hadfield (E-mail); Chris
> Lessmann; Christine Boykin; Curt Larsen / MS2; Dan Clements / NC-GH2;
> David Brown / CB (STS-107); David Moyer / MER Manager (E-mail); DAVID R.
> BRETZ (JSC-SN) (E-mail); David Rigby / MPS SSM (E-mail); DENA S. HAYNES
> (JSC-EV) (E-mail); Don Prevett; DONALD L. (DON) MCCORMACK (JSC-MV)
> (E-mail); Doug White; Douglas Powell (MAF); FRED F. MAYER (JSC-NC)
> (E-mail); Gail Hargrove Boeing-Houston Imagery Scrn.; Greg Katnik; Gregory
> Galbreath; GREGORY J. BYRNE (JSC-SN3) (E-mail); JAMES B. (BRITT) WALTERS
> (JSC-SF2) (E-mail); 'James Feeley' (E-mail); James Walters; JAVIER J.
> JIMENEZ (JSC-EA) (E-mail); Jeff Goodmark (E-mail); Jene Richart / MS2;
> Jill Lin; Jim Harder; 'John McKee' (E-mail); John Ventimiglia; JONATHAN M.
> (JON) DISLER (JSC-SN) (E-mail); Jorge Rivera; Julie Kramer; Karen Alfaro
> (E-mail); KENNETH L. BROWN (JSC-MV) (E-mail); KEVIN L. CROSBY (JSC-SN)
> (E-mail); 'L Lohrli' (E-mail); Malcolm Glenn; MARK D. ERMINGER (JSC-NC)
> (E-mail); Mark Erminger; MARK L. HOLDERMAN (JSC-MS) (E-mail); MARSHA S.
> IVINS (JSC-CB) (E-mail); MARTINEZ, HUGO E. (JSC-NC) (GHG); Michael
> Anderson / CB (STS-107); MICHAEL W. SNYDER (JSC-SN) (E-mail); Mike Cagle

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/</div>
<div>&gt; Boeing Film Screen; Mike O'farrell; P J. (JEFF) BERTSCH (JSC-DD)
(E-mail);</div>
<div>&gt; Pam Madera (E-mail); PAUL F. DYE (JSC-DA8) (E-mail); PAYNE, ROBERT
W.</div>
<div>&gt; (JSC-SA13) (LM); 'Philip Kopfinger' (E-mail); Philip Peterson /
Boeing</div>
<div>&gt; Film Screen (E-mail); Philip Reid / Boeing Film Screen; PREMKUMAR
SAGANTI</div>
<div>&gt; PhD (JSC-SN) (E-mail); RANDALL W. ADAMS (JSC-MS2) (E-mail); Raymond
Jones</div>
<div>&gt; / Manager Boeing Flt. Syst. Analysis; RAYMOND T. (RAY) SILVESTRI
(JSC-DM4)</div>
<div>&gt; (E-mail); Rick Husband / CB (STS-107); Robbie Robbinson; Robert
Page;</div>
<div>&gt; ROBERT SCHARF (JSC-SN) (E-mail); Robert Speece; ROBERT W. FRICKE JR</div>
<div>&gt; (JSC-MV) (E-mail); Rodney Rocha / ES2 (E-mail); Rodney Wallace;
Rohit</div>
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<div>&gt; Tom Wilson; 'Treith' (E-mail)</div>
<div>&gt; Subject:<x-tab>      </x-tab>STS-107 Debris
Strike and Previous Mission Information -</div>
<div>&gt; Preliminary</div>
<div>&gt; </div>
<div>&gt; For those that are outside of JSC, the following link should be used
to</div>
<div>&gt; access the information on the STS-107 debris strike:</div>
<div>&gt; </div>
<div>&gt; <a
href="http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/debris_repo"
EUDORA=AUTOURL>http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/debris
_repo</a></div>
<div>&gt; rt/107_debris_report.shtml</div>
<div>&gt; </div>
<div>&gt; Thank you-</div>
<div>&gt; </div>
<div>&gt; </div>
<div>&gt; Preliminary - Information, including views on the STS-107 debris strike
to</div>
<div>&gt; the left wing can be found at the following web site:</div>
<div>&gt; </div>
<div>&gt; <a
href="http://sn-isag/shuttleweb/mission_support/sts-107/debris_report/107_debris"
EUDORA=AUTOURL>http://sn-isag/shuttleweb/mission_support/sts-107/debris_report/107_d
ebris</a></div>
<div>&gt; _report.shtml</div>
<div>&gt; </div>
<div>&gt; STS-112 and STS-50 both had debris damage caused by missing TPS from
the</div>
<div>&gt; ET forward bipod ramp.  </div>
<div>&gt; </div>
<div>&gt; Measurement of the debris size on STS-107 and the debris size seen
on</div>
<div>&gt; STS-112 are shown.</div>
<div>&gt; </div>
<div>&gt; Information from previous missions STS-112 and STS-50 are included.</div>
<div>&gt; </div>
<div>&gt; Jon Disler / SX3 - LM</div>
<div>&gt; </div>
<div>&gt; </div>
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<blockquote type=cite><div>From: &quot;ERMINGER, MARK D. (JSC-NC) (NASA)&quot;
&lt;mark.d.erminger@nasa.gov&gt;</div>
<div>To: &quot;H - Kowaleski Mark (E-mail)&quot;
&lt;mkowales@mail.hq.nasa.gov&gt;</div>
<div>Subject: FW: JSC STS-107 Launch Film Review Status</div>
<div>Date: Wed, 5 Feb 2003 07:50:30 -0600 </div>
<div>X-Mailer: Internet Mail Service (5.5.2653.19)</div>
<br>
<br>
<br>
<div>&gt;  -----Original Message-----</div>
<div>&gt; From:
<x-tab>        </x-tab>DISLER, JONATHAN M.
(JON) (JSC-SX) (LM)  </div>
<div>&gt; Sent:<x-tab> </x-tab>Saturday, January 18, 2003 6:05 PM</div>
<div>&gt; To:<x-tab>   </x-tab>Armando Oliu (E-mail); BAHR, PATRICIA
A. (PAT) (JSC-SJ) (NASA);</div>
<div>&gt; BARBARA A. CONTE (JSC-DM) (E-mail); Bill Lamkin; BOBBIE G. SWAN
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<div>&gt; (E-mail); Brenda Eliason; BRIAN K. BALU (JSC-NC) (E-mail); Carlos</div>
<div>&gt; Ortiz-Longo; Chris &quot;The Man&quot; Cloudt; Chris Hadfield (E-mail);
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<div>&gt; Lessmann; Christine Boykin; Curt Larsen / MS2; Dan Clements /
NC-GH2;</div>
<div>&gt; David Brown / CB (STS-107); David Moyer / MER Manager (E-mail); DAVID
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<div>&gt; BRETZ (JSC-SN) (E-mail); David Rigby / MPS SSM (E-mail); DENA S.
HAYNES</div>
<div>&gt; (JSC-EV) (E-mail); Don Prevett; DONALD L. (DON) MCCORMACK (JSC-MV)</div>
<div>&gt; (E-mail); Doug White; Douglas Powell (MAF); FRED F. MAYER (JSC-NC)</div>
<div>&gt; (E-mail); Gail Hargrove Boeing-Houston Imagery Scrn.; Greg Katnik;
Gregory</div>
<div>&gt; Galbreath; GREGORY J. BYRNE (JSC-SN3) (E-mail); JAMES B. (BRITT)
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<div>&gt; (JSC-SF2) (E-mail); 'James Feeley' (E-mail); James Walters; JAVIER
J.</div>
<div>&gt; JIMENEZ (JSC-EA) (E-mail); Jeff Goodmark (E-mail); Jene Richart /
MS2;</div>
<div>&gt; Jill Lin; Jim Harder; 'John McKee' (E-mail); John Ventimiglia; JONATHAN
M.</div>
<div>&gt; (JON) DISLER (JSC-SN) (E-mail); Jorge Rivera; Julie Kramer; Karen
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<div>&gt; (E-mail); KENNETH L. BROWN (JSC-MV) (E-mail); KEVIN L. CROSBY
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<div>&gt; (E-mail); 'L Lohrli' (E-mail); Malcolm Glenn; MARK D. ERMINGER
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<div>&gt; (E-mail); Mark Erminger; MARK L. HOLDERMAN (JSC-MS) (E-mail); MARSHA
S.</div>
<div>&gt; IVINS (JSC-CB) (E-mail); MARTINEZ, HUGO E. (JSC-NC) (GHG); Michael</div>
<div>&gt; Anderson / CB (STS-107); MICHAEL W. SNYDER (JSC-SN) (E-mail); Mike Cagle
/</div>
<div>&gt; Boeing Film Screen; Mike O'farrell; P J. (JEFF) BERTSCH (JSC-DD)
(E-mail);</div>
<div>&gt; Pam Madera (E-mail); PAUL F. DYE (JSC-DA8) (E-mail); PAYNE, ROBERT
W.</div>
<div>&gt; (JSC-SA13) (LM); 'Philip Kopfinger' (E-mail); Philip Peterson /
Boeing</div>
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SAGANTI</div>
<div>&gt; PhD (JSC-SN) (E-mail); RANDALL W. ADAMS (JSC-MS2) (E-mail); RAYMOND
T.</div>
```

> (RAY) SILVESTRI (JSC-DM4) (E-mail); Rick Husband / CB (STS-107);
Robbie
> Robbinson; Robert Page; ROBERT SCHARF (JSC-SN) (E-mail); Robert
Speece;
> ROBERT W. FRICKE JR (JSC-MV) (E-mail); Rodney Rocha / ES2 (E-mail);
Rodney
> Wallace; Rohit Dhawan; Ronald Clayton / MS2; Roy Glanville; Rudy Ramon;
SA
> REP; Sara Brandenburg; Scott Otto; Stephen Frick / CB; Steve Derry;
Tom
> Rieckhoff; Tom Wilson; 'Treith' (E-mail)
> Subject:<x-tab>   </x-tab>JSC STS-107
Launch Film Review Status
>
> JSC STS-107 Launch Film Screening Status
>
> JSC Image Science and Analysis Group Human Exploration Science Office /
SX
>
> The screening of the STS-107 long range tracking camera films is
complete
> except for the viewing of camera film E204 which will be screened
Sunday
> morning (1/19). Camera E212 provided an additional look at the
Orbiter
> left wing at the time of the debris strike (described in the
previous
> report on the video screening). No significant new information
was
> learned from today's film screening.
>
> Crew acquired down linked video imaging the External Tank (ET),
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> the source of the debris that struck the Orbiter left wing, was
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> provided no information as to the source of the debris object. A
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> camera did not image the suspected impact area.
>
> Enhanced movie loops of the debris strike event have been placed on
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> web at the following address:
>
> <a
href="http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/launch_vide"
EUDORA=AUTOURL>http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/launch
_vide
> o/107launchvideo.shtml
>
> Screening of the remaining STS-107 launch films is expected to be
> completed Sunday afternoon and a report will be sent to distribution
on
> Monday January 20th.
>
> Jon Disler / SX3-LM
> Chris Cloudt / SX3-HEI
</blockquote></x-html>
<x-html>
<blockquote type=cite> From: "ERMINGER, MARK D. (JSC-NC) (NASA)"

<mark.d.erminger@nasa.gov>
To: "H - Kowaleski Mark (E-mail)"
<mkowales@mail.hq.nasa.gov>
Subject: FW: JSC STS-107 Launch Film Review Status
Date: Wed, 5 Feb 2003 07:50:19 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

> -----Original Message-----
> From:
<x-tab>   </x-tab>DISLER, JONATHAN M.
(JON) (JSC-SX) (LM)
> Sent:<x-tab> </x-tab>Saturday, January 18, 2003 6:05 PM
> To:<x-tab>   </x-tab>Armando Oliu (E-mail); BAHR, PATRICIA
A. (PAT) (JSC-SJ) (NASA);
> BARBARA A. CONTE (JSC-DM) (E-mail); Bill Lamkin; BOBBIE G. SWAN
(JSC-CA)
> (E-mail); Brenda Eliason; BRIAN K. BALU (JSC-NC) (E-mail); Carlos
> Ortiz-Longo; Chris "The Man" Cloudt; Chris Hadfield (E-mail);
Chris
> Lessmann; Christine Boykin; Curt Larsen / MS2; Dan Clements /
NC-GH2;
> David Brown / CB (STS-107); David Moyer / MER Manager (E-mail); DAVID
R.
> BRETZ (JSC-SN) (E-mail); David Rigby / MPS SSM (E-mail); DENA S.
HAYNES
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> (E-mail); Gail Hargrove Boeing-Houston Imagery Scrn.; Greg Katnik;
Gregory
> Galbreath; GREGORY J. BYRNE (JSC-SN3) (E-mail); JAMES B. (BRITT)
WALTERS
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M.
> (JON) DISLER (JSC-SN) (E-mail); Jorge Rivera; Julie Kramer; Karen
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> (E-mail); 'L Lohrli' (E-mail); Malcolm Glenn; MARK D. ERMINGER
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> (E-mail); Mark Erminger; MARK L. HOLDERMAN (JSC-MS) (E-mail); MARSHA
S.
> IVINS (JSC-CB) (E-mail); MARTINEZ, HUGO E. (JSC-NC) (GHG); Michael
> Anderson / CB (STS-107); MICHAEL W. SNYDER (JSC-SN) (E-mail); Mike Cagle
/
> Boeing Film Screen; Mike O'farrell; P J. (JEFF) BERTSCH (JSC-DD)
(E-mail);
> Pam Madera (E-mail); PAUL F. DYE (JSC-DA8) (E-mail); PAYNE, ROBERT
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> (JSC-SA13) (LM); 'Philip Kopfinger' (E-mail); Philip Peterson /
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Robbie
> Robbinson; Robert Page; ROBERT SCHARF (JSC-SN) (E-mail); Robert

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Speece;</div>
<div>&gt; ROBERT W. FRICKE JR (JSC-MV) (E-mail); Rodney Rocha / ES2 (E-mail);
Rodney</div>
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SA</div>
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Tom</div>
<div>&gt; Rieckhoff; Tom Wilson; 'Treith' (E-mail)</div>
<div>&gt; Subject:<x-tab>     </x-tab>JSC STS-107
Launch Film Review Status</div>
<div>&gt; </div>
<div>&gt; JSC STS-107 Launch Film Screening Status</div>
<div>&gt; </div>
<div>&gt; JSC Image Science and Analysis Group Human Exploration Science Office /
SX</div>
<div>&gt; </div>
<div>&gt; The screening of the STS-107 long range tracking camera films is
complete</div>
<div>&gt; except for the viewing of camera film E204 which will be screened
Sunday</div>
<div>&gt; morning (1/19).  Camera E212 provided an additional look at the
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<div>&gt; left wing at the time of the debris strike (described in the
previous</div>
<div>&gt; report on the video screening).  No significant new information
was</div>
<div>&gt; learned from today's film screening.  </div>
<div>&gt; </div>
<div>&gt; Crew acquired down linked video imaging the External Tank (ET),
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<div>&gt; the source of the debris that struck the Orbiter left wing, was
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<div>&gt; </div>
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the</div>
<div>&gt; web at the following address:</div>
<div>&gt; </div>
<div>&gt; <a
href="http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/launch_vide"
EUDORA=AUTOURL>http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/launch
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<div>&gt; o/107launchvideo.shtml</div>
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<div>&gt; Screening of the remaining STS-107 launch films is expected to be</div>
<div>&gt; completed Sunday afternoon and a report will be sent to distribution
on</div>
<div>&gt; Monday January 20th. </div>
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<div>&gt; Jon Disler / SX3-LM</div>
<div>&gt; Chris Cloudt / SX3-HEI</div>
</blockquote></x-html>
<x-html><br>
<blockquote type=cite><div>From: &quot;ERMINGER, MARK D. (JSC-NC) (NASA)&quot;
&lt;mark.d.erminger@nasa.gov&gt;</div>
<div>To: &quot;H - Kowaleski Mark (E-mail)&quot;
&lt;mkowales@mail.hq.nasa.gov&gt;</div>
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Subject: FW: JSC STS-107 Launch Film Screening Report
Date: Wed, 5 Feb 2003 07:51:04 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

> -----Original Message-----
> From:
<x-tab>   </x-tab>DISLER, JONATHAN M. (JON) (JSC-SX) (LM)
> Sent:<x-tab> </x-tab>Sunday, January 19, 2003 8:30 PM
> To:<x-tab>   </x-tab>Armando Oliu (E-mail); BAHR, PATRICIA A. (PAT) (JSC-SJ) (NASA);
> BARBARA A. CONTE (JSC-DM) (E-mail); Bill Lamkin; BOBBIE G. SWAN (JSC-CA)
> (E-mail); Brenda Eliason; BRIAN K. BALU (JSC-NC) (E-mail); Carlos
> Ortiz-Longo; Chris "The Man" Cloudt; Chris Hadfield (E-mail); Chris
> Lessmann; Christine Boykin; Curt Larsen / MS2; Dan Clements / NC-GH2;
> David Brown / CB (STS-107); David Moyer / MER Manager (E-mail); DAVID R.
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> Wallace; Rohit Dhawan; Ronald Clayton / MS2; Roy Glanville; Rudy Ramon; SA
> REP; Sara Brandenburg; Scott Otto; Stephen Frick / CB; Steve Derry; Tom
> Rieckhoff; Tom Wilson; 'Treith' (E-mail)
> Subject:<x-tab>   </x-tab>JSC STS-107 Launch Film Screening Report
>
> STS-107
> Launch Film Screening Report
> January 20, 2003
> JSC Image Science and Analysis Group
> Human Exploration Science Office / SX
>
>
> ANOMALY
>
> E204, E208, E212- During ascent at approximately 81 seconds MET, a large
> light-colored piece of debris was seen to originate from an area near the
> ET/Orbiter forward attach bipod. The debris appeared to move outboard in
> a -Y direction, then fell aft along the left Orbiter fuselage, and struck
> the underside (-Z) of the leading edge of the left wing. The strike
> appears to have occurred on or relatively close to the wing glove near the
> Orbiter fuselage. After striking the left wing, the debris broke into a
> spray of white-colored particles that fell aft along the underside (-Z
> side) of the Orbiter left wing. The spray of particles was last seen near
> the LSRB exhaust plume.
>
> Comparison views of the strike area immediately before and after the event
> were examined for indications of damage to the wing. The resolution on
> the films and videos is insufficient to see individual tiles. However, no
> indications of damage at a larger scale as indicated by changes in
> brightness of the wing surface area(s) that may indicate damage was noted.
>
>
> Still views and enhanced movie loops of this event are available for at
> the following web address:
>
> http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/launch_vid> eo/107launchvideo.shtml>
>
> The times of this event are as follows:
>
> Debris first seen near ET/Orbiter forward attach: 016:15:40:21.699 UTC
> Debris contacted left wing:
> 016:15:40:21.882 UTC

>
> Crew acquired down linked video imaging the External Tank (ET), probably
> the source of the debris that struck the Orbiter left wing, was reviewed.
> Unfortunately the view is of the far side of the ET and provided no
> information as to the source of the debris object.
>
> A down linked view of the Orbiter left wing upper surface from a payload
> bay camera did not image the suspected impact area.
>
> OBSERVATIONS:
>
> Selected launch views are available for viewing at:
>
> http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/launch_fil> m/107launchfilm.shtml>
>
> Other launch film screening event observations similar to those seen on
> previous missions are:
> On the launch video screening report dated 1/16/03 we reported that the
> right elevon motion may have been greater on STS-107 than has been
> typically seen. A comparison of the elevon motion was done with views
> from STS-113 and the previous Columbia flight (STS-109). It was concluded
> that the motion on STS-107 was normal in that it was similar to the elevon
> motion seen on STS-113 and STS-109.
>
> E5, E17, E18, E19, E20 - Orange vapor (possibly free burning hydrogen) was
> seen forward of the SSME rims and near the base heat shield during SSME
> ignition. The orange vapor on the STS-107 films appeared to be similar to
> those typically seen on previous mission films and videos.
>
> E19, E20, E76 - During SSME start-up, the SSME Mach diamonds formed in the
> expected sequence (3, 2, 1). The times for the Mach diamond formation
> given below are from the engineering film E76:
>
>
<x-tab>   </x-tab><x-tab>   </x-tab>SSME #3 - 15:38:56.736 UTC
>
<x-tab>   </x-tab><x-tab>   </x-tab>SSME #2 - 15:38:56.816 UTC
>
<x-tab>   </x-tab><x-tab>   </x-tab>SSME #1 - 15:38:57.227 UTC
>
> The start times for SSME ignition based on the E76 film were:
>
>
<x-tab>   </x-tab><x-tab>   </x-tab>

bsp;   </x-tab>SSME #3 - 15:38:55.215 UTC
>
<x-tab>   </x-tab><x-tab>   &n
bsp;   </x-tab>SSME #2 - 15:38:55.355 UTC
>
<x-tab>   </x-tab><x-tab>   &n
bsp;   </x-tab>SSME #1 - 15:38:55.455 UTC
>
> E5, E76 - Movement of the SSME #3 Dome Mounted Heat Shield (DMHS)
blanket
> was seen during SSME ignition on camera E5. On camera E76, SSME #2
and
> SSME #3 DMHS blanket movement was seen during SSME ignition
(15:38:56.466
> UTC). This event has been seen on previous mission films.
>
> E1, E2, E4, E5, E20, E31 - Typical of previous missions, multiple
pieces
> of ice debris were seen falling from the ET/Orbiter umbilicals and
along
> the body flap during SSME ignition through liftoff. Ice debris was
seen
> falling near the LH2 umbilical four inch recirculation line. None of
the
> debris were seen to contact the launch vehicle.
>
> E5, E18, E20, E31 - A line of frost was visible at the juncture of
the
> base of SSME #2 and the Dome Mounted Heat Shield (DMHS) during
liftoff.
>
> E18, E20 - Typical of previous missions, small areas of tile surface
> material erosion were seen forming on the base heat shield and on the
RCS
> stingers at the following times:
>
>
<x-tab>   </x-tab><x-tab>   &n
bsp;   </x-tab>15:38:56.000 UTC - Erosion mark inboard of the left
RCS
> stinger
>
<x-tab>   </x-tab><x-tab>   &n
bsp;   </x-tab>15:38:56.562 UTC - Erosion mark outboard of SSME #2
near the
> body flap
>
<x-tab>   </x-tab><x-tab>   &n
bsp;   </x-tab>15:38:57.329 UTC - Erosion mark on the tip of the left
RCS
> stinger
>
<x-tab>   </x-tab><x-tab>   &n
bsp;   </x-tab>15:38:58.639 UTC - Erosion mark on the left OMS pod
between
> the OMS nozzle and vertical stabilizer
>
> E2, E19- Faint, light-orange-colored flashes were seen in the SSME
exhaust
> plumes, possibly debris induced, during SSME ignition and through
liftoff
> at the times shown below:
>

>   SSME #1 - 15:38:57.728 UTC
>   SSME #1 - 15:38:58.385 UTC
>   SSME #1 - 15:38:58.779 UTC
>   SSME #1 - 15:38:59.019 UTC
>   SSME #3 - 15:38:57.395 UTC
>   SSME #3 - 15:38:59.532 UTC
> <x-tab>   </x-tab>
> Flashes in the SSME exhaust plume prior to liftoff have been seen on
> previous mission films.
>
> E17 - Several small, dark-colored pieces of debris (possibly paint chips)
> were seen falling from a seam line on the -Z side of the LO2 TSM just
> before liftoff (15:38:59.566 UTC).
>
> E1, E5, E17, E52 - As typically seen on previous missions, multiple pieces
> of SRB throat plug and/or SRB flame duct debris were seen near the right
> and left SRBs during liftoff. On camera E1, two pieces of SRB flame duct
> debris were seen arcing between the two SRB's and falling aft along the -Z
> side of the body flap during liftoff (15:39:00.4 UTC). On camera E17, a
> large appearing, light-colored piece of probable SRB throat plug material
> was seen aft of the vehicle during liftoff (15:39:01.873 UTC). At
> liftoff, light-colored debris was seen falling aft near the +Y side of the
> RSRB aft skirt (15:39:02.456 UTC). On camera E52, debris from the base of
> the SRB's was seen traveling north of the MLP at liftoff (15:39:02.203
> UTC).
>
> E5- A light-colored piece of debris was seen falling aft from near the
> ET/RSRB aft attach during liftoff (15:39:01.235 UTC).
>
> E8 - SRB ignition was at 15:39:00.000 UTC based on the observation of the
> PIC firing at RSRB holddown post M-2.
>
> E18 - A dark-colored, flexible, strap or tag-like object was seen on the
> LH2 TSM T-0 umbilcal disconnect prior to liftoff.
>
> E19 - A long, dark-colored, flexible, strap-like object was seen coming
> from the top of the LH2 TSM T-0 door before detaching and falling aft in
> front of the TSM T-0 door after liftoff (15:39:03.582 UTC)
>
> E8, E13 - The left and right SRB GN2 purge lines appeared wrapped,

> upright, and intact until they were obscured by exhaust plumes at
> 15:39:00.000 UTC (right purge line) and 15:39:00.003 UTC (left purge
> line).
>
> E7, E10, E11, E14 - The left and right SRB north holddown post blast
> shields closed prior to when the SRB nozzle exit plane rose past the
level
> of the SRB holddown post shoes, as they are designed to do. However,
the
> holddown post M4 blast shield may have closed quicker than typical.

>
> E33, E34, E36, E39, E52- The GH2 vent arm retraction appeared
normal. Ice
> and vapors were seen falling aft along the ET during the vent arm
> retraction. The GH2 vent arm contact with the deceleration cable on
the
> E39 camera close-up view from inside the FSS of the vent arm capture
was
> visible. As designed, the arm appeared to make contact very close to
the
> center position of the deceleration cable. The vent arm appeared to
latch
> normally with no rebound. A measurement of the position of the vent
arm
> with respect to the center of the deceleration cable at the time of
> initial contact will be made and reported separately.
>
> E207, E212 - An assessment of the body flap motion during ascent
compared
> to that seen on previous missions could not be made because of the
soft
> focus on the STS-107 long range tracking camera views.
>
> E52, E212, E213, E222, E223- Multiple pieces of debris, too numerous
to
> count (mostly umbilical ice and RCS paper debris), were seen falling
aft
> of the launch vehicle during ascent. Umbilical ice and RCS paper
debris
> during ascent has been seen on previous mission films and videos.
> Examples are:
>
> 15:39:17.021 UTC: Forward RCS paper debris noted falling aft along
the
> right wing (E52)
> 15:39:20.093 UTC: RCS paper debris noted. (E223)
> 15:39:20.169 UTC: Spray of RCS paper debris noted aft of the
SSMEs.
> (E222)
> 15:39:23.9 UTC: Debris from ET/Orbiter umbilicals noted falling aft
along
> body flap. (E213)
> Frame 960: RCS paper debris noted falling aft of SSME exhaust
plume.
> (E212)
>
> E5, E20, E31, E52, E212, E222 - Pieces of orange-colored umbilical
purge
> barrier material were seen falling aft along the -Z side of the body
flap
> during SSME ignition (15:38:57.703 UTC). On camera E20, three pieces
of

> light-orange colored umbilical purge barrier material were noted
falling
> aft near SSME #2 prior to liftoff (15:38:58.394 UTC). Umbilical
purge
> barrier material was seen falling along the body flap during tower
clear
> on camera E52. On camera E222, a piece of umbilical purge
barrier
> material was seen near the Orbiter right wing during liftoff
(15:39:03.014
> UTC). During early ascent, multiple pieces of umbilical purge
barrier
> material were seen falling aft of the left wing on the camera E52
view.
> On camera E212, a piece of umbilical purge barrier material was seen
> falling along the body flap. On camera E222, a piece of umbilical
purge
> barrier material was seen falling aft of the body flap at approximately
32
> seconds MET (15:39:31.840 UTC). Purge barrier material falling from
the
> ET umbilicals has been typically seen on previous mission tracking
camera
> views.
>
> Cameras E52, E213, E220, E222, E223 - Light-colored flares (possibly
> debris induced) were seen in the SSME exhaust plumes during ascent on
the
> intermediate and long range tracking camera films. Examples of the
flares
> observed are:
>
> 15:39:14.576 UTC: Flare noted in SSME exhaust plume (E52)
> 15:39:33.178 UTC: Flare seen in SSME exhaust plume (E213)
> 15:39:33.424 UTC: Flare seen in SSME exhaust plume (E213)
> 15:39:33.471 UTC: Flare seen in SSME exhaust plume (E222)
> 15:39:33.475 UTC: Flare seen in SSME exhaust plume (E213)
> 15:39:35.469 UTC: Flare seen in SSME exhaust plume (E213)
> 15:39:35.633 UTC: Flare seen in SSME exhaust plume (E213)
> 15:39:37.175 UTC: Flare seen in SSME exhaust plume (E222)
> 15:39:37.177 UTC: Flare seen in SSME exhaust plume (E213)

> 15:39:40.367 UTC: Flare seen in SSME exhaust plume (E213)
> 15:39:33.168 UTC: Flare seen in SSME exhaust plume (E213)
> 15:39:41.992 UTC: Flare seen in SSME exhaust plume (E213)
> 15:39:51.001 UTC: Flare seen in SSME exhaust plume (E220)
> 15:39:57.060 UTC: Flare seen in SSME exhaust plume (E223)
>
> Flares in the SSME exhaust plumes have been seen on previous
missions
> films and videos.
>
> E204, E207, E220, E222, E223 - As on previous missions, debris was
seen
> exiting the SRB exhaust plumes. The debris exiting the SRB exhaust
plumes
> during the majority of ascent is probably instafoam from the aft end
of
> the SRBs. The more dense appearing debris near the time of tail-off,
just
> prior to SRB separation, is probably SRB slag debris. Examples of
this
> debris are:

>
> 15:39:27.186 UTC: Debris seen falling along SRB exhaust plume (E223)
> 15:39:48.926 UTC: Debris seen falling along SRB exhaust plume (E220)
> 15:39:49.350 UTC: Debris seen falling along SRB exhaust plume (E223)
>
> SRB separation was timed at 15:41:06.536 UTC on camera E207.
>
> Other normal events observed included: RCS paper debris, ice and vapor
> from the LO2 and LH2 TSM T-0 umbilicals prior to and after disconnect, ET
> twang, multiple pieces of debris in the exhaust cloud after liftoff
> including rope-like debris (probable water baffle material), acoustic
> waves in the exhaust cloud after liftoff, charring of the ET aft dome, ET
> aft dome outgassing, vapor off the SRB stiffener rings, expansion waves,
> linear optical effects, recirculation, SRB plume brightening, and SRB slag
> debris after SRB separation.
>
> Normal Pad events observed included: Hydrogen igniter operation, MLP
> deluge water activation, FSS deluge water operation, LH2 and LO2 TSM door
> closure, and sound suppression system water operation.
>
> NOTES:
>
> Twelve 16 mm films, thirteen 35 mm films, and 24 launch videos were
> screened. The focus on several of the long range tracking camera film
> views was very soft which hindered imagery analysis and the analysis of
> the debris strike to the Orbiter wing.
>
> This concludes the routine JSC STS-107 launch film and video screening.
> Image enhancements of the debris strike event, web site updates, or other
> special support requests, will be performed prior to landing.
>
> Jon Disler / SX3-LM
> Chris Cloudt / SX3-HEI
> Joe Caruana / SX3-LM
>
>
>
</blockquote></x-html>
<x-html>
<blockquote type=cite> From: "ERMINGER, MARK D. (JSC-NC) (NASA)" <mark.d.erminger@nasa.gov>
To: "H - Kowaleski Mark (E-mail)" <mkowales@mail.hq.nasa.gov>
Subject: FW: STS-107 Debris Strike and Previous Mission Information - Prel
<x-tab>   </x-tab>iminary
Date: Wed, 5 Feb 2003 07:51:12 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

> -----Original Message-----
> From:
<x-tab>   </x-tab>DISLER, JONATHAN M.
(JON) (JSC-SX) (LM)
> Sent:<x-tab> </x-tab>Wednesday, January 22, 2003 12:53 PM
> To:<x-tab>   </x-tab>Armando Oliu (E-mail); BAHR, PATRICIA
A. (PAT) (JSC-SJ) (NASA);
> BARBARA A. CONTE (JSC-DM) (E-mail); Bill Lamkin; BOBBIE G. SWAN
(JSC-CA)
> (E-mail); Brenda Eliason; BRIAN K. BALU (JSC-NC) (E-mail); Carlos
> Ortiz-Longo; Chris "The Man" Cloudt; Chris Hadfield (E-mail);
Chris
> Lessmann; Christine Boykin; Curt Larsen / MS2; Dan Clements /
NC-GH2;
> David Brown / CB (STS-107); David Moyer / MER Manager (E-mail); DAVID
R.
> BRETZ (JSC-SN) (E-mail); David Rigby / MPS SSM (E-mail); DENA S.
HAYNES
> (JSC-EV) (E-mail); Don Prevett; DONALD L. (DON) MCCORMACK (JSC-MV)
> (E-mail); Doug White; Douglas Powell (MAF); FRED F. MAYER (JSC-NC)
> (E-mail); Gail Hargrove Boeing-Houston Imagery Scrn.; Greg Katnik;
Gregory
> Galbreath; GREGORY J. BYRNE (JSC-SN3) (E-mail); JAMES B. (BRITT)
WALTERS
> (JSC-SF2) (E-mail); 'James Feeley' (E-mail); James Walters; JAVIER
J.
> JIMENEZ (JSC-EA) (E-mail); Jeff Goodmark (E-mail); Jene Richart /
MS2;
> Jill Lin; Jim Harder; 'John McKee' (E-mail); John Ventimiglia; JONATHAN
M.
> (JON) DISLER (JSC-SN) (E-mail); Jorge Rivera; Julie Kramer; Karen
Alfaro
> (E-mail); KENNETH L. BROWN (JSC-MV) (E-mail); KEVIN L. CROSBY
(JSC-SN)
> (E-mail); 'L Lohrli' (E-mail); Malcolm Glenn; MARK D. ERMINGER
(JSC-NC)
> (E-mail); Mark Erminger; MARK L. HOLDERMAN (JSC-MS) (E-mail); MARSHA
S.
> IVINS (JSC-CB) (E-mail); MARTINEZ, HUGO E. (JSC-NC) (GHG); Michael
> Anderson / CB (STS-107); MICHAEL W. SNYDER (JSC-SN) (E-mail); Mike Cagle
/
> Boeing Film Screen; Mike O'farrell; P J. (JEFF) BERTSCH (JSC-DD)
(E-mail);
> Pam Madera (E-mail); PAUL F. DYE (JSC-DA8) (E-mail); PAYNE, ROBERT
W.
> (JSC-SA13) (LM); 'Philip Kopfinger' (E-mail); Philip Peterson /
Boeing
> Film Screen (E-mail); Philip Reid / Boeing Film Screen; PREMKUMAR
SAGANTI
> PhD (JSC-SN) (E-mail); RANDALL W. ADAMS (JSC-MS2) (E-mail); Raymond
Jones
> / Manager Boeing Flt. Syst. Analysis; RAYMOND T. (RAY) SILVESTRI
(JSC-DM4)
> (E-mail); Rick Husband / CB (STS-107); Robbie Robbinson; Robert
Page;
> ROBERT SCHARF (JSC-SN) (E-mail); Robert Speece; ROBERT W. FRICKE JR
> (JSC-MV) (E-mail); Rodney Rocha / ES2 (E-mail); Rodney Wallace;
Rohit
> Dhawan; Ronald Clayton / MS2; Roy Glanville; Rudy Ramon; SA REP;
Sara

```
<div>&gt; Brandenburg; Scott Otto; Stephen Frick / CB; Steve Derry; Tom
Rieckhoff;</div>
<div>&gt; Tom Wilson; 'Treith' (E-mail)</div>
<div>&gt; Subject:<x-tab>      </x-tab>STS-107 Debris
Strike and Previous Mission Information -</div>
<div>&gt; Preliminary</div>
<div>&gt; </div>
<div>&gt; Preliminary - Information, including views on the STS-107 debris strike
to</div>
<div>&gt; the left wing can be found at the following web site:</div>
<div>&gt; </div>
<div>&gt; <a
href="http://sn-isag/shuttleweb/mission_support/sts-107/debris_report/107_debris"
EUDORA=AUTOURL>http://sn-isag/shuttleweb/mission_support/sts-107/debris_report/107_d
ebris</a></div>
<div>&gt; _report.shtml</div>
<div>&gt; </div>
<div>&gt; STS-112 and STS-50 both had debris damage caused by missing TPS from
the</div>
<div>&gt; ET forward bipod ramp.  </div>
<div>&gt; </div>
<div>&gt; Measurement of the debris size on STS-107 and the debris size seen
on</div>
<div>&gt; STS-112 are shown.</div>
<div>&gt; </div>
<div>&gt; Information from previous missions STS-112 and STS-50 are included.</div>
<div>&gt; </div>
<div>&gt; Jon Disler / SX3 - LM</div>
<div>&gt; </div>
<div>&gt; </div>
</blockquote></x-html>
<x-html><br>
<blockquote type=cite><div>From: &quot;ERMINGER, MARK D. (JSC-NC) (NASA)&quot;
&lt;mark.d.erminger@nasa.gov&gt;</div>
<div>To: &quot;H - Kowaleski Mark (E-mail)&quot;
&lt;mkowales@mail.hq.nasa.gov&gt;</div>
<div>Subject: STS-107 Ascent Debris Assessments</div>
<div>Date: Wed, 5 Feb 2003 08:28:52 -0600 </div>
<div>X-Mailer: Internet Mail Service (5.5.2653.19)</div>
<br>
<div>I spoke to Lambert Austin and he said that Bryan should request this</div>
<div>information from Ron Dittemore.  Systems Integration did an analysis and
so</div>
<div>did Orbiter.</div>
</blockquote></x-html>
<html>
Bryan,<br>
<br>
We have pursued multiple channels to obtain the ET debris and Orbiter TPS damage
assessment.<br>
<br>
As you can see, we have reached some brick walls.<br>
<br>
Mark Erminger requested the data on my behalf but was turned down by Lambert Austin
(see message below).<br>
<br>
I called Lambert's office but he never called back.<br>
<br>
I contacted Code M to ask for the data and I was told that the data is
&quot;restricted access.&quot;<br>
<br>
I finally got a copy by strong-arming someone in Code M but was told &quot;not to
divulge my source.&quot;<br>
```


The thermal

Mark

<blockquote type=cite cite>From: "ERMINGER, MARK D. (JSC-NC) (NASA)"
<mark.d.erminger@nasa.gov>
To: "H - Kowaleski Mark (E-mail)" <mkowales@mail.hq.nasa.gov>
Subject: STS-107 Ascent Debris Assessments
Date: Wed, 5 Feb 2003 08:28:52 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

I spoke to Lambert Austin and he said that Bryan should request this
information from Ron Dittemore. Systems Integration did an analysis and so
did Orbiter.</blockquote></html>
<html>
Launa, thanks. I understand.
Mark

At 11:56 AM 2/6/2003 -0500, you wrote:
<blockquote type=cite cite>Mark,

We were not part of the analyses mentioned, nor are we the subject matter
experts for the questions asked. I would expect JSC and MSFC to provide
the
information. Sorry I could not be more helpful.

Launa Maier

Launa M. Maier
Safety and Mission Assurance Division
Shuttle Processing Directorate
PH-P
(321)861-3053 fax (321)867-3154 cell
Launa.M.Maier@nasa.gov

-----Original Message-----
From: DeLoach-1, William
Sent: Wednesday, February 05, 2003 9:00 AM
To: Goodin-1, Ronald; Maier-1, Launa M
Cc: Canfield-1, Amy; Witter-1, Robyn; Long-1, Ronald; Hankins, Joe R;
Glenn-1, Malcolm
Subject: FW: ET Foam loss assessment

-----Original Message-----
From: Higgins-1, William
Sent: Tuesday, February 04, 2003 10:41 PM
To: DeLoach-1, William
Subject: FW: ET Foam loss assessment

FYI and help, if appropriate.
-----Original Message-----
From: Mark Kowaleski
To: william.j.harris1@jsc.nasa.gov; William.C.Higgins@nasa.gov;
mark.d.erminger1@jsc.nasa.gov; Daniel.J.Mullane@msfc.nasa.gov;
adams@hq.nasa.gov; david.m.browne1@jsc.nasa.gov;
Allan.K.Layne@msfc.nasa.gov; Rosalyn.M.Patrick@msfc.nasa.gov;
Joseph.C.Cianciola@nasa.gov; Randall.H.Tucker@msfc.nasa.gov;

m.s.johnson@nasa.gov
Cc: snewman@hq.nasa.gov; prichard@hq.nasa.gov
Sent: 2/4/2003 11:33 AM
Subject: ET Foam loss assessment

Hi Folks,

Here is the first round of questions:

1) Would someone please forward me the analysis that we did for the ET
foam
loss hit risk to Columbia's TPS?

I caught a glimpse of the package (about 20 pages) in Code M (Code M
says
they never saw it prior to this past weekend), but we never got it here
in
Code Q. This was to be presented at the STS-107 PAR, but we never got
to
it because of ITAR.

2) During STS-113, we discussed risk of bipod foam loss during STS-112.
At
that time we also mentioned bipod foam loss on STS-32 and ST-50.

Would you please send me any analysis you may have that was done for
STS-112 (priority) and for STS-32 and 50.

3) I understand that the ET O2 feedline for STS-107 uses a unique foam
(BX-265 ???).

4) I need an education on the different type of foams (if any) that are
used for bipod and other close-out items when preparing the tank.
How have these foams types and their application process changed over
time?

Many thanks for your support. More questions will follow.

I don't mind multiple submissions, we'll sort it out on this end.

Mark</blockquote></html>

<x-flowed>
STS-107 Mission Status
January 19, 2002

The STS-107 mission continues to go well. There have been a couple of additional funnies and a couple of items that folks are watching. Film review identified two instances of debris emanating from the forward ET bipod (forward ET/Orbiter attach structure), beginning at approximately T+81 seconds, and migrating to the glove area of the left wing where impact is witnessed, followed by a white shower of debris. Film and video review continue to verify this initial observation and assess any damage that might have resulted. A large chunk of ET bipod foam liberated during STS-112 and impacting the left-hand SRB Integrated Electronics Assembly box, with no adverse effects. Ground controllers are monitoring a slight degradation in the SpaceHab water cooling loop. There is no action planned other than monitoring for now. The largest cooling demand will come in the next day or two. More to come...

Think Safe, Be Safe
NASA's New Vision: To improve life here,
to extend life to there,to find life beyond.
NASA's new Mission Statement:
To understand and protect our home planet
To explore the universe and search for life
To inspire the next generation of explorers
....as only NASA can.

</x-flowed>
<x-flowed>
STS-107 Mission Status
January 27, 2003

The STS-107 mission continues to go well...the only new anomaly identified over the weekend was a problem with a 70mm Hasselblad camera, which seemed to be jammed. The batteries were replaced a second time and the problem cleared. A second 70mm Hasselblad camera failed earlier in the flight with a similar failure signature.

Plans are to prepare for a landing on Saturday morning at around 9:17 am EST...Weather outlook is favorable; however it is far too early to tell with any certainty.

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NASA's new Mission Statement:
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</x-flowed>
<x-flowed>
STS-107 Mission Status
January 17, 2003

The STS-107 mission is progressing well. Columbia and crew were safely launched at the opening of the window at 10:39 am EST. There were only a couple of minor issues worked through the countdown. Tanking started approximately 1 1/2 hour late due to the determined need to switch a secondary Front End Processor (FEP) from on uninterrupted power source (UPS) to a alternate to maintain redundancy with the primary FEP. The boosters are in tow and should be back in port this afternoon. There is a preliminary report of damage to one of the two SRB forward skirts in an area that had been previously damaged and repaired...more to come.

There have been two minor issues with Columbia systems thus far. One of the two internal communications loops between the orbiter and SpaceHab module is not working well...the primary loop is doing fine thus far. Prior to launch and again after achieving orbit, equipment on AC Bus 2, phase "B" exhibited sluggish performance due to low current. Equipment on AC Bus 2, phases "A" and "C" have operated nominally. Although there is only reduced performance by electrical motors on AC Bus 2, phase "B", such as certain vent doors, Ku-band deploy motor, and a port payload bay door motor, this anomaly is being evaluated to determine what is common among the effected units. There should be no impact on the mission resulting from this anomaly.

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

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STS-107 Mission Status
January 19, 2002

The STS-107 mission continues to go well. Film review identified two instances of debris emanating from the forward ET bipod (forward ET/Orbiter attach structure), beginning at approximately T+81 seconds, and migrating to the glove area of the left wing where impact is witnessed, followed by a white shower of debris. The External Tank Project, Systems Integration Office and Vehicle Engineering Office are investigating potential debris sources, possible impact locations and any possible effects on Orbiter entry. During flight day 3 the SpaceHab experienced significant water leakage from the water separator assembly (WSA). This has led to tripping of circuit breakers and required resetting of the Orbiter Flow Proportioning Valves (FPV) and the SpaceHab Air Bypass Valve (ABV) to provide more cooling and humidity control to the module. The flight control team is developing new in-flight maintenance (IFM) procedures to inspect the WSA, clean-up residual water and, and dry the rotary separator. The MMT will reconvene to review the updated IFM should the flight control team recommend implementation. On at least 4 occasions, the SSME 3 LH2 prevalve open B indication has failed off for one sample (0.080 sec). It appears to be a data problem as opposed to an indication of the state of the valve. JSC engineering will review data for further occurrences. The next MMT meeting is scheduled for Friday, January 24 at 9:00 a.m. EDT
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Doug Whitehead
NASA HQ Code M-1
dwhitehe@hq.nasa.gov
202-358-1452 Phone

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STS-107 FRR Topics

<u>SSME

</u>STS-113 Nozzle Coldwall Leak - nozzle #5007 had a known, in-specification leak (0.015 lbm/sec vs. 0.020 lbm/sec specification limit) prior to its use on STS-113. The nozzle tube bubble soap leak check was performed in the engine shop on December 18, several leak sites were identified; most were detected within a 50 tube range near where the fire was noticed on the launch film review. Similar leaks have originated in this location and have been attributed to corrosion of the coolant tubes. There was no perceptible impact on engine performance as a result of this leak. None of the STS-107 SSME nozzles have any measured leak; in-specification or otherwise.

<u>SRB

</u>Booster Separation Motor (BSM) Foreign Object Damage (FOD) - Paint chips were found in a batch of aluminum perchlorate (AP) pre-mix bowl. The paint chips originated from the exterior of the painted pre-mix bowl. Analysis of the potential for paint chips to be in the BSM propellant and impact the Orbiter during BSM firing is in work. The size and density of the chips are believed enveloped by the analysis performed last summer concerning RTV found in the BSM propellant.

SRB cable connectors found with possible defective sockets. The STS-107 SRB cables have been cleared for flight through inspection since this finding. A suspect connector was found on the STS-114 SRB stack and will be replaced prior to flight.

<u>RSRM

</u>No special topics; will provide the typical post flight assessment from STS-113.

<u>ET

</u>No special topics; will highlight that this is the first light-weight ET configuration that we have flown since the introduction of the SSME Block II cluster configuration. Until now, we have flown only super-light-weight configuration ETs with the Block II cluster.

<u>Orbiter

</u>Ball Strut Tie-Rod Assembly (BSTRA) ball crack on OV-103. The single BSTRA ball found cracked on OV-103 is the only one found cracked to date (keep in mind that only 25% of the ball can be inspected as installed in the BSTRAs).   A test program has been initiated to determine the thermal/mechanical loads and load cycles that result in ball crack initiation and to determine the propensity for crack growth, if any. The goal of the test program is demonstrate sufficient margin to clear the fleet for flight. It is anticipated that the test program will provide enough information and rationale for flight by

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the STS-107 FRR.<br>
<br>
<u>Integration<br>
<br>
</u>No special topics; have provided the analysis on the potential paint
chips in the BSM.<br>
<br>
Will discuss the problem re-installing the Plant Generic Bioprocessing
Apparatus (PGBA) into a middeck locker during preparation for entry on
STS-113.  Only six of eight bolts could be installed.<br>
<br>
<u>Flight Operations<br>
<br>
</u>No special topics<br>
<br>
<u>EVA<br>
<br>
</u>Will discuss the frayed cable found in the bio-med harness (STS-113
IFA) of the EVA Mobility Unit (EMU) during the last mission and clearance
for STS-107 flight.<br>
<br>
<u>Logistic<br>
<br>
</u>No special topics<br>
<br>
<u>Shuttle Processing<br>
<br>
</u>No special topics.  Will discuss the two assigned IFAs: 1)
Retractable platform contact with the RMS and 2) the internal hydraulic
leak in the Orbiter Access Arm that was caused by two valve being out of
configuration and would have resulted in a launch scrub if not
corrected.<br>

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<font color="#008080"><b><br>
Think Safe, Be Safe<br>
</font><font color="#FF0000">NASA's New
Vision</font><font color="#0000FF">: To improve life here, <br>
to extend life to there,to find life beyond.<br>
</font><font color="#FF0000">NASA's new Mission
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To understand and protect our home planet<br>
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STS-107 Foam Loss S&MA Involvement
Shuttle Program S&MA Activity compiled by Mark Erminger
2/8/03

1/16/03 excerpt from MER Safety Console e-mail after launch

STS-107 was successfully launched on January 16, 2003 at GMT 16:15:39 (09:30 CST)

1/16/03 excerpts from Jon Disler JSC STS-107 Launch Video Screening Report

ANOMALY CANDIDATES

No potentially anomalous events were noted during the screening of the STS-107 launch videos that were received. The long range tracking videos (second engineering replays) have not been sent via satellite to JSC. When the second replays are received they will be screened and a report will be sent to distribution.

OBSERVATIONS

The following observations are not considered anomalous but are worth noting:

OTV009, OTV054 *- Right inboard and outboard elevon motion was apparent during liftoff. Elevon motion during liftoff is a normal event. However, the elevon motion seen on STS-107 may have been greater than that typically seen.*

Mark Erminger comments: Nothing unusual in this report

1/17/03 excerpt from Jon Disler JSC STS-107 Launch Screening - Long Range Tracking Videos

ANOMALY

ET204, ET208, ET212 - During ascent at approximately 81 seconds MET, a large light-colored piece of debris was seen to originate from an area near the ET/Orbiter forward attach bipod. The debris appeared to move outboard in a -Y direction, then fell aft along the left Orbiter fuselage, and struck the leading edge of the left wing. The strike appears to have occurred on or relatively close to the wing glove near the Orbiter fuselage. After striking the left wing the debris broke into a spray of white-colored particles that fell aft along the underside (-Z side) of the Orbiter left wing. The spray of particles was last seen near the LSRB exhaust plume.

Still views and a movie loop of this event are being placed on our web site for viewing at the following address:

<http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/launch_video/107launchvideo.shtml>

The times of this event are as follows:

Debris first seen near ET/Orbiter forward attach: 016:15:40:21.699 UTC
Debris contacted left wing: 016:15:40:21.882 UTC

Mark Erminger comments: This is definitely a concern because it is a repeat anomaly and it clearly struck the Orbiter

1/18/03 excerpts from Jon Disler JSC STS-107 Launch Film Review Status

The screening of the STS-107 long range tracking camera films is complete except for the viewing of camera film E204 which will be screened Sunday morning (1/19). Camera E212 provided an additional look at the Orbiter left wing at the time of the debris strike (described in the previous report on the video screening). No significant new information was learned from today's film screening.

Crew acquired down linked video imaging the External Tank (ET), probably the source of the debris that struck the Orbiter left wing, was reviewed this afternoon. Unfortunately the view is of the far side of the ET and provided no information as to the source of the debris object. A down linked view of the Orbiter left wing upper surface from a payload bay camera did not image the suspected.

Mark Erminger comments: No information in this report as to the extent of the damage to the Orbiter as a results of foam impact.

1/19/03 excerpts from the MER Safety STS-107 Flight Day 3 Report

One item came to our attention yesterday after we sent out the daily report. High-speed film analysis from ascent showed a large, light-colored piece of debris break off the Orbiter/ET forward attach bipod at MET 81 seconds. The piece struck the wing leading edge of the left wing on or neat the wing glove and broke into a spray of white colored particles that streamed under the left wing and was last seen near the left SRB exhaust plume. Analysis of high speed and high resolution tracking films are being conducted to get more detail of this event. See the following URL:
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E204, E208, E212- During ascent at approximately 81 seconds MET, a large light-colored piece of debris was seen to originate from an area near the ET/Orbiter forward attach bipod. The debris appeared to move outboard in a -Y direction, then fell aft along the left Orbiter fuselage, and struck the underside (-Z) of the leading edge of the left wing. The strike appears to have occurred on or relatively close to the wing glove near the Orbiter fuselage. After striking the left wing, the debris broke into a spray of white-colored particles that fell aft along the underside (-Z side) of the Orbiter left wing. The spray of particles was last seen near the LSRB exhaust plume.

Comparison views of the strike area immediately before and after the event were examined for indications of damage to the wing. The resolution on the films and videos is insufficient to see individual tiles. However, no indications of damage at a larger scale as indicated by changes in brightness of the wing surface area(s) that may indicate damage was noted.

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A down linked view of the Orbiter left wing upper surface from a payload bay camera did not image the suspected impact area.

OBSERVATIONS:

Selected launch views are available for viewing at:

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Other launch film screening event observations similar to those seen on previous missions are:
On the launch video screening report dated 1/16/03 we reported that the right elevon

motion may have been greater on STS-107 than has been typically seen. A comparison of the elevon motion was done with views from STS-113 and the previous Columbia flight (STS-109). It was concluded that the motion on STS-107 was normal in that it was similar to the elevon motion seen on STS-113 and STS-109.

Mark Erminger comments: This report made me feel better about the foam impact on the wing because the foam broke into a spray of white-colored particles and that there did not appear to be larger scale damage to the wing. Also, they compare the elevon motion to previous flights of OV-102 and concluded it was normal.

1/20/03 was a Federal Holiday

1/20/03 excerpt from the MER Safety Console STS-107 Flight Day 04 Report

With respect to the debris hit on the left wing leading edge discussed in the Second Daily Report, JSC image analysis personnel have completed their review of the high-speed and high-resolution long-range tracking films. Comparison views of what can be seen of the strike area immediately before and after the event were examined for indications of damage to the wing. The resolution on the films and videos is insufficient to see individual tiles. However, no indications of larger scale damage were noted as indicated by the lack of changes in the brightness of the port lower wing surface.

1/22/03 excerpt from Jon Disler STS-107 Debris Strike and Previous Mission Information – Preliminary

Preliminary - Information, including views on the STS-107 debris strike to the left wing can be found at the following web site:

http://sn-isag/shuttleweb/mission_support/sts-107/debris_report/107_debris_report.shtml

STS-112 and STS-50 both had debris damage caused by missing TPS from the ET forward bipod ramp.

Measurement of the debris size on STS-107 and the debris size seen on STS-112 are shown.

Information from previous missions STS-112 and STS-50 are included.

1/23/03 excerpt from Shuttle Standup

ET

- *Aware of debris issue*
- *Know generally where the debris came from*
- *Will have to wait until the Orbiter gets back*

USA Orbiter

- *Working Debris Analysis*

USA Integration

- *Debris analysis completed a couple of runs looking at 20x10x6 and 20x16x6*
- *Provided input area, velocity, and impact angles to Orbiter*

Mark Erminger Comment: The size of the debris got my attention and I added this as a topic for the STS-114 PAR

1/24/03 excerpt from PAR-5 Minutes

STS-114/ULF1 (OV-104) FLIGHT MILESTONE DATES

Special Topics:

1. *SHUTTLE*
   A. *JSC*

*2. STS-107 ET Foam Loss (to be presented @ FRR Tagup) ******
(George Ishmael-)
B. MSFC
*2. ET: STS-107 ET Foam Loss (to be presented @ FRR Tagup) ******
(Keith Layne)

Mark Erminger comment: We scheduled this for the FRR Tag-Up because the PAR was on 1/31/03 the day before landing. We needed to get the post landing data in order to complete their assessment. This data included Orbiter Inspection and reviewing ET film that was on the Orbiter.

1/27/03 excerpt from Jon Disler Note CAD Showing Debris Strike to STS-107 Wing

A CAD drawing of the Orbiter showing the position of the landing gear door that is overlayed to the STS-107 ET208 image of the debris strike to the Orbiter left wing can be seen at the following address:

http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/index107.shtml

[redacted]

1/27/03 excerpts from Shuttle Standup

ET

- *Still need to look at the pictures from the disconnect area to find out where the debris came from on the last flight.*

USA Orbiter

- *Analysis of ET debris hit indicates that Orbiter tile damage is within family and not a safety of flight issue.*
- *Analysis showed we're OK with the loss of a couple of tiles around wheel well.*

Integration

- *Working to assure photo ops expedite hand held photograph processing.*

1/28/03 excerpt from MER Safety STS-107 Flight Day 12 Report

[redacted]

Mark Erminger Comments: Based on this report, this issue appears to be resolved for STS-107. I talked to Scott Johnson and he said this item was reviewed in the MER Engineering Meeting and was not thought to be a problem so they did not bring it to the Mission Management Team.

1/28/03 excerpt from STS-114 Orbiter Rollout-Out Review

Attended by Mark Erminger

The ET ProjectManager/Jerry Smelser made a verbal walk-on presentation about the STS-107 ET Foam Loss problem. Jerry said this was an Accepted Risk Hazard and will require ET camera film and review after landing.

Mark Erminger Comments: I made a comment after the ET Project presentation that this would become an STS-114 flight issue if we saw something post flight that we did not expect or pointed to something different on the tank. Linda Ham and the Jerry Smelser agreed. I recall Linda Ham saying that she wanted to expedite getting the film off the Orbiter and get it processed for ET to evaluate.

1/29/03 excerpt from Bob Page STS-107 Launch+4 Day Consolidated Film/Video Report

During ascent at approximately 81 seconds MET, debris was seen to originate from an area near the ET/Orbiter forward attach bipod. Due to lighting conditions in the area, it is not known whether debris originated as a single item which broke up or if it originated as several separate items. Four objects are seen or surmised from the data.

Object#1, the largest of the items, was a light colored piece of debris which appeared…to move outboard in a -Y direction, then fell aft along the left Orbiter fuselage and struck the underside (-Z) of the leading edge of the left wing… The strike appears to have occurred on or relatively close to the wing glove near the Orbiter fuselage. After striking the left wing, the debris broke into a spray of white-colored particles that fell along the underside (-Z side) of the Orbiter left wing. The spray of particles was last seen near the LSRB exhaust plume.

Object #1,, darker and smaller in appearance than the first, is visible in the frame immediately following the appearance of Object #1. Its travel path seems to be slightly more outboard and more in the -Z direction than the first. This object actually strikes the wing before Object #1. (A spray of particles is een traversing aft prior to the strike from Object #1).

Object #3 is not seen directly in any views. However, evidence of its existence comes from a second spray of particles at the same time as and parallel to the spray from Object #2.

Mark Erminger comment: This information is consistent with previous reports and this appears to not be a problem.

1/30/03 excerpt from Shuttle Standup

ET

•Nothing new on TPS issue

Linda Ham

•Working hard to get the cameras out on the runway to process for foam loss review

STS-107 Foam Loss S&MA Involvement
Shuttle Program S&MA Activity compiled by Mark Erminger
2/8/03

1/16/03 excerpt from MER Safety Console e-mail after launch

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The following observations are not considered anomalous but are worth noting:

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- *Working Debris Analysis*

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- *Debris analysis completed a couple of runs looking at 20x10x6 and 20x16x6*
- *Provided input area, velocity, and impact angles to Orbiter*

Mark Erminger Comment: The size of the debris got my attention and I added this as a topic for the STS-114 PAR

1/24/03 excerpt from PAR-5 Minutes

STS-114/ULF1 (OV-104) FLIGHT MILESTONE DATES

Special Topics:

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A. JSC

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(George Ishmael-)

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- *Working to assure photo ops expedite hand held photograph processing.*

1/28/03 excerpt from MER Safety STS-107 Flight Day 12 Report

[redacted]

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Object#1, the largest of the items, was a light colored piece of debris which appeared to move outboard in a -Y direction, then fell aft along the left Orbiter fuselage and struck the underside (-Z) of the leading edge of the left wing… The strike appears to have occurred on or relatively close to the wing glove near the Orbiter fuselage. After striking the left wing, the debris broke into a spray of white-colored particles that fell along the underside (-Z side) of the Orbiter left wing. The spray of particles was last seen near the LSRB exhaust plume.

Object #1, darker and smaller in appearance than the first, is visible in the frame immediately following the appearance of Object #1. Its travel path seems to be slightly more outboard and more in the -Z direction than the first. This object actually strikes the wing before Object #1. (A spray of particles is een traversing aft prior to the strike from Object #1).

Object #3 is not seen directly in any views. However, evidence of its existence comes from a second spray of particles at the same time as and parallel to the spray from Object #2.

Mark Erminger comment: This information is consistent with previous reports and this appears to not be a problem.

1/30/03 excerpt from Shuttle Standup

ET

•Nothing new on TPS issue

Linda Ham

•Working hard to get the cameras out on the runway to process for foam loss review

• Orbital Debris / Meteoroid Risk Assessment

source: Space Science Branch, SN3

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

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

STS-107 Launch Report
GMT 16:16:30

Shift Lead: Andy Foster
Ascent Ops Specialist: Andy Foster
Tanking/MPS Specialists: Bill Prince, Dan Clements
Mission Engineer: Megan Bell (OJT)

STS-107 was successfully launched on January 16, 2003 at GMT 16:15:39 (09:30 CST). While some IPR's were worked, there were no LCC violations during the prelaunch countdown. Weather was never a concern during the launch for KSC or at the TAL sites.

Performance during powered flight was nominal. MECO occurred on time and inserted the vehicle into an initial 156 x 43 nm orbit. ET sep and all subsequent events were nominal. OMS 2 occurred at 16:16:20 GMT. The 186.1 fps burn boosted the vehicle into a 156 x 146 nm orbit.

There are no vehicle anomalies at this time.

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STS-107 Flight Day 01 Report
GMT 017:14:30

Shift Leads: Andy Foster, Ross Engle, Jeff Peters
Mission Engineer: Megan Bell (OJT)

The STS-107 mission is progressing nominally. Payload bay door opening was nominal and the port radiator was deployed. Spacehab activation also was nominal though a bit late. Spacehab activities are progressing nominally at this time. Orbiter consumables are above the levels required for the planned mission. Twenty-two hours of margin were reported at the Engineering meeting this morning.

Two items are being carried as MER anomalies at this time.

AC2 Phase B exhibited sluggish performance during the prelaunch and post-insertion timeframes. Sluggish performance was first noted at T-31 seconds in the launch countdown and then twice during post-insertion activities. During the operation of three motors, AC2 phases A and C would increase to expected values while phase B would rise to only half of what

was expected but recover to nominal values within one second. Motor operation was nominal. The affected motors are: vent doors 8 and 9, Ku-band deploy motor 2, and port payload door open motor 2. There are no common circuits or motor control assemblies for these motors though they are all controlled via circuit breakers found on panel MA73C. However, other motors controlled by those circuit breakers are showing nominal operating signatures. Engineering is continuing to examine data, but there is no in-flight troubleshooting planned at this time. This anomaly holds no mission impact since all motors will operate nominally even if there were a complete failure of phase B. At this time, we believe the mission is at no additional risk. We are continuing to monitor and evaluate this anomaly.

During Spacehab activation, the crew reported they could not communicate to Spacehab from the Orbiter over the intercommunications (ICOM) B loop. ICOM A is working nominally, and this is considered to be a loss of redundancy impact. No mission impact is expected, and currently no in flight troubleshooting is planned.

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab

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STS-107 Flight Day 02 Report
GMT 18:13:08

Shift Leads: Andy Foster, Ross Engle, Jeff Peters
Mission Engineer: Megan Bell (OJT), Mike Penney

STS-107 mission is progressing nominally. The orbiter is currently in a 156X146 nm orbit. SpaceHab operations are progressing nominally at this time. Orbiter consumables are above the levels required by the mission plan. In fact, cryo margins are being monitored closely due to anticipated impacts to end of mission downweight and center of gravity. (SpaceHab is not drawing as much power as anticipated.)

There is one new MER anomaly. During performance of the O2 tank current level detector checkout, it was noted that the O2 tank 7 heater A1 and A2 ON discrete did not come on. Main bus current verified O2 tank 7 heater A did not come on. The B heaters functioned nominally and provided sufficient energy to the tank so there was no concern about being able to use it. The

heaters had not yet been used in the AUTO mode; when the BLUE Crew switched the heater to the AUTO position on MCC call, the EGIL console observed nominal heater cycles. The tank heater is operating nominally.

While SpaceHab operations are progressing nominally, the SpaceHab Water Loop is showing some degradation. The Payload Heat Exchanger and total flow rates for the SpaceHab water loop have been steadily decreasing. Also, the Subsystem Water Pump outlet pressure is also decreasing. These signatures indicate pump filter blockage or pump degradation. Currently, the system is being run on Pump 2 and operation on Pump 2 will continue as long as possible. MCC plans to swap to Water Pump 1 at GMT 018:13:29 and remain on Pump 1 for the remainder of the mission. No mission impact is expected.

At the time of this report, the Crew is on Flight Day 3 performing blood draws and infusions, ARMS activities, and MEIDEX operations.

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)

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STS-107 Flight Day 03 Report
GMT 019:13:30

Shift Leads: Andy Foster, Ross Engle, Jeff Peters
Mission Engineer: Megan Bell (OJT)

STS-107 is continuing with its investigation of various scientific activities in a micro-g environment. The mission is progressing nominally with only minor problems. The Orbiter is still in a 156 x 146nm orbit. Consumables are still above mission requirements.

At this time, there are no impacts associated with the Spacehab water loop degradation. We continue to run on pump 1.

One item came to our attention yesterday after we sent out the daily report. High-speed film analysis from ascent showed a large, light-colored piece of debris break off the Orbiter/ET forward attach bipod at MET 81 seconds. The piece struck the wing leading edge of the left wing on or neat the wing

glove and broke into a spray of white colored particles that streamed under the left wing and was last seen near the left SRB exhaust plume. Analysis of high speed and high resolution tracking films are being conducted to get more detail of this event. See the following URL:
http://sn-isag.jsc.nasa.gov/shuttleweb/mission_support/sts-107/index107.shtml.

There are two new MER anomalies, both minor GFE impacts.

The motor drive on one of the 70mm Hasselblad cameras (serial number 1036) jammed after 3 shots. The crew swapped out camera body batteries, motor drive batteries, and the film magazine; but the camera continued to jam. The crew is using the remaining 70mm camera.

The crew was attempting to use a PGSC for a data take utilizing the Fuel Cell Monitoring System (FCMS) but got error messages. After verifying the PGSC configuration, the crew replaced the FCMS cable with a backup and got good results.

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)

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STS-107 Flight Day 04 Report
GMT 019:13:30

Shift Leads: Andy Foster, Ross Engle, Denise Londrigan
Mission Engineer: Megaqn Bell (OJT)

The STS-107 mission is progressing nominally and all Orbiter subsystems are performing satisfactorily. No Orbiter issues have been reported in the previous 24 hours. The Orbiter consumables continue to remain above the levels required for completion of the planned mission.

With respect to the debris hit on the left wing leading edge discussed in the Second Daily Report, JSC image analysis personnel have completed their review of the high-speed and high-resolution long-range tracking films.

Comparison views of what can be seen of the strike area immediately before and after the event were examined for indications of damage to the wing. The resolution on the films and videos is insufficient to see individual tiles. However, no indications of larger scale damage were noted as indicated by the lack of changes in the brightness of the port lower wing surface.

There are no new MER anomalies

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)

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STS-107 Flight Day 05 Report
GMT 021:14:00

Shift Leads: Doug McMullen, Andy Foster, Denise Londrigran
Mission Engineer: Dan Zalit (OJT)

The STS-107 mission is progressing nominally and all Orbiter subsystems are performing satisfactorily. The Orbiter consumables remaining are above the levels required for completion of the planned mission.

The crew reported that the DSR20 video tape recorder (VTR) tapes were not incrementing. The crew worked the photo/television (TV) malfunction procedure for the VTR error. This ejected the micro-tape that was in the VTR. Power cycles of VTR and digital television (DTV) system were performed with no effect. A visual inspection and cleaning of the VTR was performed; however, the VTR would not accept tapes and place the tapes into the correct configuration inside the VTR. Standard-sized tapes were also rejected. Ground testing has been able to recreate this problem by failing parts of the tape transport. The workaround will be to use a V10 recorder to record the payload video and a Camcorder for playback.

There is one new MER anomaly

MER Anomalies:

MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)

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STS-107 Flight Day 06 Report
GMT 022:12:00

Shift Leads: Doug McMullen, Richard Foster, Denise Londrigran
Mission Engineer: Dan Zalit (OJT)

The STS-107 mission is progressing nominally and all Orbiter subsystems are performing satisfactorily. The Orbiter consumables remaining are above the levels required for completion of the planned mission.

One item currently under investigion is the Space Shuttle Main Engine (SSME) 3 liquid hydrogen (LH2) prevalve (PV6) open indicator "A" that initially failed to the off state at 016:17:25 GMT (00:01:46 MET). Four additional data dropouts of this same measurement have been observed in the last five days. The measurement in question is provided to the general purpose computer (GPC) via multiplexer/demutiplexer (MDM) flight aft (FA) 4 Card 08 Channel 00. Review of all measurements routed through the same MDM card and channel revealed four liquid oxygen (LO2) Pogo Valve Open indications that had also failed to the off state. Of the nine measurements that indicated a failed off state, only one LO2 and one LH2 indication occurred at the exact same time. The investigation of the cause of these indications is underway.

Shuttle held two meetings to address the SpaceHab Humidity/Water Separator Assembly (WSA) problems. Shuttle and Payload safety attended. There were two issues that the flight director wanted to address, (1) water loop valve modulation to reduce the temperature/humidity, and (2) an IFM to remove water and possible debris from RS#1, and an electrical troubleshooting. After the Valve Modulation didn't yield expected results the Program has decided to go ahead with the WSA IFM, which will repair one of the failed water separators, it is currently being modified to suit the current situation. A copy of the most current rev is at the console. The crew will continue to try and attain better results using the Valve Modulation, but

the program will probably look more to trying to recover one of the water separators if possible. The IFM will require MT approval before proceeding. Execution of the IFM at this time is TBD.

There is one new MER anomaly

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicater Failed Off

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STS-107 Flight Day 07 Report
GMT 023:13:00

Shift Leads: Doug McMullen, Richard Gardner, Denise Londrigran
Mission Engineer: Dan Zalit (OJT)

The STS-107 mission is progressing nominally and all Orbiter subsystems are performing satisfactorily. No Orbiter issues have been reported in the previous 24 hours. The Orbiter consumables remaining are above the levels required for completion of the planned mission.

There is one new MER anomaly

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicater Failed Off

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STS-107 Flight Day 08 Report
GMT 024:13:00

Shift Leads: Doug McMullen, Richard Gardner, Denise Londrigran
Mission Engineer: Dan Zalit (OJT)

The STS-107 mission is progressing nominally and all Orbiter subsystems are performing satisfactorily. The orbiter is currently in a 154 x 142 nm orbit. No Orbiter issues have been reported in the previous 24 hours. The Orbiter consumables remaining are above the levels required for completion of the planned mission.

MER anomaly # 7 has been changed from MPS to DPS (MDM), it is labeled #7A.

There are seven vehicle anomalies at this time. (no new anomalies)

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicater Failed Off
MER-07A MDM FA4 CD-08 CH-00 Has Intermittent Data Hits (ORB)

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STS-107 Flight Day 09 Report
GMT 025:13:00

Shift Leads: Jim Pendergast, Brandon Dick, Mike Etchells
Mission Engineer: Megan Bell (OJT)

The STS-107 mission is progressing nominally and all Orbiter subsystems are performing satisfactorily. The orbiter is currently in a 154 x 142 nm orbit. No Orbiter issues have been reported in the previous 24 hours. The Orbiter consumables remaining are above the levels required for completion of the planned mission. The SpaceHab is performing well and science continues to be conducted 24 hours a day.

There are eight vehicle anomalies at this time. (one new anomaly)

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicater Failed Off
MER-07A MDM FA4 CD-08 CH-00 Has Intermittent Data Hits (ORB)
MER-08 70 mm Hasselblad Camera S/N 1012 Motor Drive Binds/Jams (GFE)

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STS-107 Flight Day 10 Report

GMT 026:13:00

Shift Leads: Jim Pendergast, Jim Gardner, Mike Etchells
Mission Engineer: Megan Bell (OJT)

The STS-107 mission is progressing nominally and all Orbiter subsystems are performing satisfactorily. The orbiter is currently in a 154 x 142 nm orbit. No Orbiter issues have been reported in the previous 24 hours. The Orbiter consumables remain well above the levels required for completion of the planned mission. The SpaceHab is performing well and science continues to be conducted 24 hours a day.

There are eight vehicle anomalies at this time. (no new anomalies)

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicater Failed Off
MER-07A MDM FA4 CD-08 CH-00 Has Intermittent Data Hits (ORB)
MER-08 70 mm Hasselblad Camera S/N 1012 Motor Drive Binds/Jams (GFE)

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STS-107 Flight Day 11 Report
GMT 027:14:00

Shift Leads: Jim Pendergast, Brandon Dick, Mike Etchells
Mission Engineer: Megan Bell (OJT)

The STS-107 mission is progressing nominally and all Orbiter subsystems are performing satisfactorily. The orbiter is currently in a 154 x 142 nm orbit. No Orbiter issues have been reported in the previous 24 hours. Science continues and the ground has been very happy with the performance of the experiments.

There are eight vehicle anomalies at this time. (no new anomalies)

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicater Failed Off
MER-07A MDM FA4 CD-08 CH-00 Has Intermittent Data Hits (ORB)
MER-08 70 mm Hasselblad Camera S/N 1012 Motor Drive Binds/Jams (GFE)

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STS-107 Flight Day 12 Report
GMT 028:15:30

Shift Leads: David Witwer, Brandon Dick, Mike Etchells
Mission Engineer: Dan Zalit (OJT)

The STS-107 mission continues nominally in a 154 x 140 nm orbit with all Orbiter subsystems performing satisfactorily. No new Orbiter issues or anomalies have been reported in the previous 24 hours.

Our MER Manager released the following update on the debris hit on the left wing last during ascent. "Systems integration personnel performed a debris trajectory analysis to estimate the debris impact conditions and locations. This analysis was performed utilizing the reported observations from the ascent video and film. It was assumed that the debris was foam from the external tank. Based on the results of the trajectory analysis, an impact analysis was performed to assess the potential damage to the tile and reinforced carbon carbon (RCC). The impact analysis indicates the potential for a large damage area to the tile. Damage to the RCC should be limited to coating only and have no mission impact. Additionally, thermal analyses were performed for different locations and damage conditions. The damage conditions included one tile missing down to the densified layer of the tile and multiple tiles missing over an area of about 7 in by 30 in. These thermal analyses indicate possible localized structural damage but no burn-through, and no safety of flight issue."

Previous flight day reports discuss the eight MER anomalies listed below.

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicator Failed Off
MER-07A MDM FA4 CD-08 CH-00 Has Intermittent Data Hits (ORB)
MER-08 70 mm Hasselblad Camera S/N 1012 Motor Drive Binds/Jams (GFE)

STS-107 Flight Day 13 Report
GMT 029:15:30

Shift Leads: David Witwer, Brandon Dick, Mike Etchells
Mission Engineer: Dan Zalit (OJT)

The STS-107 mission continues nominally in a 151 x 140 nm orbit with all Orbiter subsystems performing satisfactorily. No new Orbiter issues or anomalies have been reported in the previous 24 hours. The Orbiter consumables remaining are above the levels required for completion of the planned mission.

Previous flight day reports discuss the eight MER anomalies listed below.

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicator Failed Off
MER-07A MDM FA4 CD-08 CH-00 Has Intermittent Data Hits (ORB)
MER-08 70 mm Hasselblad Camera S/N 1012 Motor Drive Binds/Jams (GFE)

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STS-107 Flight Day 14 Report
GMT 030:14:50

Shift Leads: David Witwer, Brandon Dick, Mike Etchells
Mission Engineer: Dan Zalit (OJT)

The STS-107 mission is progressing nominally with no issues being reported over the previous 24 hours. The Orbiter consumables remaining are above the levels required for completion of the planned mission.

The MER manager reported in reference to the intercommunications (ICOM) B problem discussed in the First Daily Report that, "the crew was asked to troubleshoot the problem by reconfiguring the ICOM system to ICOM B and performing a communications check. The crew reported that ICOM B worked satisfactorily and that the earlier problem was probably caused by a configuration error."

The weather for both landing opportunities at KSC looks good for Saturday with few to scattered clouds at 3500 ft, visibility 7 sm, and winds 10 knots or less.

Previous flight day reports discuss the nine MER anomalies listed below.

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in Spacehab
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicator Failed Off
MER-07A MDM FA4 CD-08 CH-00 Has Intermittent Data Hits (ORB)
MER-08 70 mm Hasselblad Camera S/N 1012 Motor Drive Binds/Jams (GFE)

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STS-107 Flight Day 15 Report
GMT 031:14:50, MET 14:23:10

Shift Leads: David Witwer, James Gardner, David Melendez
Mission Engineer: Dan Zalit (OJT)

The STS-107 mission continues nominally with two issues reported over the previous 24 hours. The Orbiter consumables are above the levels required

for completion of the planned mission. Weather forecasts for the two Saturday landing opportunities at KSC are well within flight rule limits; specifically scattered clouds at 3500 ft and 25,000 ft, visibility 7 sm, and crosswinds less than 10 knots.

Flight Control System (FCS) checkout is complete with FCS, APU and hydraulic system performance as expected. Following FCS checkout, the RCS hot-fire occurred satisfactorily. All thrusters fired at least once. The Orbiter is prepared for tomorrow's deorbit and landing.

However, two anomalies have been added to our MER Anomaly list. The first anomaly added is MER-09: SPACEHAB Water Loop Flow Degradation. Earlier in the flight (MET 01:21:21), the flight control team decided to use only SPACEHAB water pump 1. Recent data shows pump 1 is degrading, however the degradation is at a rate that will allow the flow to stay above nominal limits until the end of mission. SPACEHAB water pump 1 degradation does not currently have an impact to the mission. Post landing, a team at KSC will troubleshoot the Orbiter side of the interface to determine if Orbiter hardware either caused or impacted the problem.

The second anomaly added in the past 24 hours is MER-10: Forward DAP Auto A Contact Deselected. A review of the data indicates that the switch performed nominally until MET 13:04:49 and 13:05:53. At these two moments when the crew used the forward Digital Auto Pilot (DAP) auto push button switch, contact A did not close. Redundancy Management (RM) subsequently deselected contact A of the forward DAP. A switch tease, observed in the past on this type of switch, is the suspected cause. Although there is a loss of redundancy, no mission impact is expected and workarounds are in place for the next worst failure.

MER Anomalies:
MER-01 AC2 Phase B Sluggish Current Signature
MER-02 No ICOM B in SPACEHAB
MER-03 O2 Tank 7 Heater A Failed Off in Manual Mode (ORB)
MER-04 70MM Hasselblad Camera Motor Drive Binds/Jams (GFE)
MER-05 Suspect Fuel Cell Monitoring System (FCMS) Data Cable (GFE)
MER-06 Loss of DR20 Tape Recording and Playback (GFE)
MER-07 LH2 Prevalve Open B Indicator Failed Off
MER-07A MDM FA4 CD-08 CH-00 Has Intermittent Data Hits (ORB)
MER-08 70 mm Hasselblad Camera S/N 1012 Motor Drive Binds/Jams (GFE)
MER-09 SPACEHAB Water Loop Flow Degradation (ORB or PLD)
MER-10 Forward DAP Auto A Contact Deselected (ORB)

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STS-107
Report #19
Saturday, February 1, 2003 - 7:00 p.m. CST
Mission Control Center, Houston, Texas

The Space Shuttle Columbia and its seven astronauts were lost today when the vehicle broke up over north central Texas during its reentry from orbit.

Communications were lost with Columbia and its crew at around 8:00 a.m. CST, while the shuttle was traveling about 18 times the speed of sound at an altitude of 207,000 feet. Columbia was 16 minutes from landing at the Kennedy Space Center when flight controllers at Mission Control lost contact with the vehicle. Columbia was returning from a 16-day scientific research mission, its 28th flight, which launched on January 16.

Aboard Columbia were Commander Rick Husband, completing his second flight, Pilot William McCool, wrapping up his first mission, Mission Specialists Dave Brown, also completing his first mission, Kalpana Chawla, on her second flight, Laurel Clark, a first-time space traveler, Payload Commander Mike Anderson, ending his second flight, and Payload Specialist Ilan Ramon of the Israel Space Agency, on his first flight.

Prior to the loss of communications with Columbia, the shuttle's return to Earth appeared perfectly normal. After assessing some wispy fog near the shuttle's three-mile long landing strip at KSC before dawn, Entry Flight Director Leroy Cain gave approval for the firing of the shuttle's braking rockets to begin its descent from orbit.

Husband and McCool began the deorbit burn to allow Columbia to slip out of orbit at 7:15 a.m. CST. There was no indication of anything abnormal with Columbia's reentry until the last communications between Mission Control and the crew.

At Columbia's intended landing site, NASA Administrator Sean O'Keefe and Associate Administrator for Space Flight William Readdy met with the families of the astronauts to offer their condolences, vowed to uncover the cause of the accident and press ahead with the Shuttle program.

"This is indeed a tragic day for the NASA family, for the families of the astronauts who flew on STS-107, and likewise is tragic for the nation," said O'Keefe.

"We have no indication that the mishap was caused by anything or anyone on the ground," O'Keefe added.

In a briefing, Chief Flight Director Milt Heflin said that around 7:53 a.m. CST, just minutes before communications were lost with Columbia, flight controllers detected indications of a loss of hydraulic system temperature measurements associated with Columbia's left wing, followed three minutes later by an increase in temperatures on the left main gear tires and brakes. At 7:58 a.m., flight controllers noted a loss of bondline temperature sensor data in the area of the left wing followed a minute later by a loss of data on tire temperatures and pressures for the left inboard and outboard tires.

After several attempts to try to contact Columbia, Cain declared a contingency, whereby flight controllers began preserving documentation regarding the entry phase of the flight. Recovery forces fanned out from Texas to Louisiana to try to recover debris that will be pertinent to the mishap investigation.

Space Shuttle Program Manager Ron Dittemore said several teams have been organized to gather data for analysis and will report to an external investigation board that was appointed by Administrator O'Keefe. Dittemore added that no specific orbiter debris or crew remains have been positively identified at this time, and that there is no leading theory for the cause of the accident.

Dittemore said the processing of other shuttles at the Kennedy Space Center for future launches has been temporarily halted to enable engineers to review data regarding vehicle processing and to focus attention on capturing all pertinent information involving Columbia's prelaunch preparations.

NASA managers will be meeting on a regular basis to begin reviewing data associated with Columbia's investigation. The next status briefing from the Johnson Space Center is tentatively scheduled from the Johnson Space Center, Houston, TX at 12:00 p.m. CST Sunday. It will be seen on NASA Television with two-way question and answer capability for reporters from NASA centers.

NASA TV can be found on AMC-2, Transponder 9C, vertical polarization at 85 degrees West longitude, 3880 MHz, with audio at 6.8 MHz.

On the International Space Station, Expedition 6 Commander Ken Bowersox, Flight Engineer Nikolai Budarin and NASA ISS Science Officer Don Pettit were informed of the loss of Columbia and its crew shortly after a Russian Progress resupply vehicle undocked from the ISS. Filled with discarded items no longer needed on the ISS, the Progress was commanded to deorbit by Russian flight controllers and reentered the Earth's atmosphere.

A new Progress cargo ship will be launched Sunday from the Baikonur Cosmodrome in Kazakhstan at 6:59 a.m. CST (1259 GMT) filled with supplies for the Expedition 6 crew. It is scheduled to dock to the ISS Tuesday morning. ISS program officials say, if necessary, the current resident crew could remain in orbit until late June with the supplies being ferried to the station on the new Progress.

Additional status reports will be issued as new information becomes available.

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Software Assurance Questions:

Bolded areas are areas of concern: questions for those areas are beneath

Questions	Answers
Risk Management/Tools/Plans	
What risk management techniques have been applied to Software development, operations, maintenance, cost, safety and assurance?	NASA has an aggressive risk management approach. All projects are required to have and follow a risk management plan. Software is part of this process.
Where is the proof that this is performed?. What are Shuttle's risk management plan(s), records, mitigation strategies?	
What risks has the Shuttle program identified in the area of software flight controls? – What was done about them?	
Flight Readiness/Certification	
How is flight software certified for flight? When is this done?	FAR and PAR preparation and reporting of software issues.
What tests are performed? Who signs-off? NASA or USA or both?	
Software Requirements	
How are software requirements determined?	
How are software requirements assured for accuracy, completeness, correctness, verifiability,	
How are sw requirements tracked through development and test to delivery?	
What are the assurance and safety requirements for NASA software critical systems?	NASA has a SW Safety standard and Guidebook. Software safety and IV&V are required for sw safety critical systems.
IV&V	
How has IV&V been used to assure safer more reliable software?	• IV&V requirements and capabilities are defined, documented and controlled. • IV&V is conducted to a level appropriate to the risk and mission success criticality. • IV&V process is controlled and monitored by appropriate level of management.

Questions	Answers
What analyses techniques are used? – How are the results captured, analyzed and used?	There is a long list of analyses that can be applied. The best ones for a projects are determined based on an extensive assessment of each project based on criticality, cost, complexity.
What percentage of NASA projects utilize IV&V	At this time almost all projects are required to perform a self assessment for IV&V. The number of projects which have some level of IV&V are: **(Paul, your work for John Kelly would help here!)**
When did NASA start utilizing IV&V?	IV&V has transitioned over the years becoming more and more effective and policy now requires all PAPAC and projects with safety critical sw to be assessed for the need and amount of IV&V. Some projects, like shuttle were under way when IV&V became part of their process. IV&V now is an integral part of the Shuttle sw program.
Is NASA fully utilizing IV&V on its projects?	Since 2000, when the NPD for IV&V was issued and related sw and systems NPDs and NPGs have required the use of IV&V, IV&V is now applied to nearly ?? projects across NASA
What are the findings from IV&V analyses? What has been done about them? Have they all been addressed? If not why not? [may ask specific questions, if they have them, on IV&V findings]	These are provided to the project manager to be addressed
Who makes sure a project has IV&V and has sufficient IV&V for its need?	
Who assures the IV&V on projects is effective?	
SW Safety	
Who performs the safety analyses? If the contractors are responsible for the Safety Analyses and Reports, what role does NASA play?	
ASAP 1996 finding: project managers are allowed to tailor SW Safety plans without center level SMA approval of tailoring. What have we done to address this?	

Questions	Answers
ASAP 1997 reiterates this finding	
What is NASA's Software Safety policy?	NASA has a SW safety standard and guidebook, projects such as the Shuttle and ISS have their own SW safety requirements documents. NASA's software policy requires full risk management and analyses for all software projects.
Does the Shuttle have sufficient telemetry to detect, isolate, report on anomalies in flight?	
How is orbital debris and meteoroid damage detected and protected against? Can it be detected on orbit? To what extent. What is the safety margin for damage from this source? When is the shuttle most vulnerable?	See Protecting the Space Shuttle from Meteoroids and Orbital Debris study by National Research Council, 1997 Use of ORDEM96 to assess risk– a model of Orbital Debris Environment. DOD SSN can only warn against close conjunctions with cataloged orbiting objects.
SW Security (Attack/intrusion/hack/infiltration/compromise/integrity violation/etc.)	
How do we assure the integrity of the software from attack both operationally and developmentally	
Is it possible for the Shuttle control software to be hacked? To be operated by a hacker?	
How is ISS protected from computer tampering?	
What is NASA's software security policy?	
How is this policy implemented?	
Who assures this policy is up to date and is being followed?	
Problem Reporting and Corrective Action	
Are the NASA and contractor staff trained to detect software problems?	
Are software problems handled differently than hardware issues/problems ?	In some cases, during development, there are often software problem reporting systems created that eventually tie into the system PRACA

Questions	Answers
	System/
What weight is given to software issues and problems and corrective actions?	
What shuttle software control system problem reports have been reported? Where are they kept ? How have they been closed?	
Who assures they are closed and closed appropriately?	
What is USA's role? Is it different for different contracts or contractors?	
What is NASA's role?	
Who is responsible for assuring problems are reported, corrected, verified?	
SW Configuration Management/Change Control	
How is the software configuration managed? How is it assured that the proper software and data loads are loaded and installed for a particular flight or flight phase?	
How are changes to Shuttle (or any NASA controlled/owned projects) software agreed upon, tracked, documented, developed, and tested? Are they checked for safety impact? Are they checked for quality and reliability impact?	
Best practices	
How do you know that the best industry and or DOD practices are being used in the development of NASA's Software?	We have both the NPD 2820.1 NASA Software Policy, and the NASA Software Engineering Improvement Initiative which require and provide implementation toward use of best practices. This now includes directions to assess the contractors and to levy specific best practices on the contractor as well as on NASA internal software development.

Questions	Answers
SW Process Definition	
Who assures that both internally and for contracts, that appropriate software engineering, management and assurance procedures are created?	NASA Software Assurance Standard – currently undergoing updating. SW Engineering Initiative, NASA SW Policy 2820.1
SW Process Adherence	
How does NASA assure internal and contractual adherence to good software processes.	Ditto plus NASA has SW Assurance personnel at every Center
SW Product Assurance	
	ditto
SW Maintenance	
	Area to be addressed in newly updated NASA Software Assurance Standard
V&V of software	
V&V of Shuttle software	
SAIL: Shuttle Avionics Integration Lab – were there cut backs made in the personnel manning this ? If so what has been the effect? What was the justification for these cutbacks?	
Are the simulators used to checkout and test the software of sufficient detail?	
How are additions made to test scripts and the simulators to test newly discovered problems?	
How are simulation and test software maintained?	
What is NASA's role in verification planning and performance? Who assures the verifications of software are sufficient, correct, cover hazard controls and inhibits, performance, completeness, etc.	
SW Staffing issues:	
ASAP has repeatedly reported on the lack of software assurance support, often only one NASA or Support Service contractor at many NASA Centers: Has NASA	

Questions	Answers
addressed this critical area of safety and assurance:	
Software Working Group	
What role does the Software Working Group	Created and monitors the execution of NASA's Software Engineering Improvement Initiative. Creates, updates, concurs on software engineering policy and guidance for the agency. It reports to the EMC and will soon report to the newly commissioned Software Steering Board (SSB). It's charter and mission are on record in the Chief Engineer's office. It brings the one NASA to life in regards to NASA's software policies, guidelines and improvement efforts.
Software Assurance Group	
What role does the Software Assurance Group play?	Lead by Agency Software Assurance Manager in Code Q, works to develop, promote, document, and provide software safety, reliability, quality, and IV&V policy, guidance, standards, and training.
Software Assurance Research Program	
How does NASA stay current with the latest techniques for software safety and assurance?	For over 12 years, Code Q has sponsors this research program dedicated to improving the quality, safety and reliability of software through research in these and other software engineering and management areas. AS the software advances, so must the techniques to verify, validate, and safe it as well as the means to assure its quality and reliability.
Additional possible Questions from policy **NPD 2820.1 NASA Software Policy**	

Questions	Answers
	Manage, engineer, and assure software in accordance with common industry standards, processes, and best practices; document the use of standards, processes, and best practices in accordance with ISO 9000; and tailor standards, processes, and best practices to the development or acquisition.
	b. Implement and integrate software engineering processes and practices with other system development and program/project processes and practices. Develop a plan for acquisition and life-cycle management of the software as part of the program/project plan. This plan should be developed prior to selection of the provider and should address, at a minimum, design tradeoff management, risk management, requirements management, software project planning, project tracking and oversight, software product engineering, subcontract management, configuration management, quality assurance, and peer review.
	c. Develop and maintain a total estimated software life-cycle cost and, where appropriate, perform tradeoff studies which address use of COTS and GOTS software versus created software to satisfy requirements before software is created or acquired.
	d. Demonstrate that the provider of software to be developed has proven organizational capabilities and experience to deliver quality software on time and within budget; require acceptable evidence of the entity's software management, engineering, and assurance standards, processes,

Questions	Answers
	and practices to produce quality software. Examples of current acceptable evidence include an independent certification of ISO 9001 compliance as described in ISO 9000-3 or an independent assessment of a software Capability Maturity Model (CMM) rating of 3 or above. The provider shall develop a plan to manage software throughout the program/project life cycle before the software requirements specification is complete and software design and coding takes place. The plan shall address items required in 1.b.
	e. Document software as to its form and function and verify that such software performs the functions claimed on the platform(s) for which it is designed without harm to the systems or the data contained therein
	f. Develop risk analyses and management strategies; identify, analyze, plan, track, control, and communicate risks at each stage of the life cycle; document or reference (i.e., their location specified) the results of risk analyses and management strategies in program/project plans; and employ verification and validation techniques for risk mitigation, including Independent Verification and Validation (IV&V), as appropriate, based on cost, size, complexity, life span, risk, and consequences of failure.
	g. Facilitate reuse of NASA-funded software, as well as transfer, consistent with law and applicable agreements, for commercial, industrial, educational, and governmental purposes; and protect

Questions	Answers
	NASA-funded or -created software as valuable intellectual property during all phases of the life cycle.
Questions from ASAP findings /press/lesson learned DB/Reports/ etc.	
Computer World Magazine reported this week that anomalies in Shuttle flight control have been seen before and that NASA had stated that because the flight controls are redundant, some anomalies could be tolerated. Was this problem investigated, if so where are the results of the report and what actions were taken, if any. Were the reasons for taking or not taking action recorded somewhere? Who was responsible? Did Safety and QA follow-up on these and similar reports. What was SMA's response? What was Project Managements response?	
How is QRAS (Quantitative Risk Assessment System) used for software risks? Has the Shuttle? Or ISS? Used this analysis tool to assess their software risks? What are the Results? What has been done to address these areas?	QRAS was developed to assess risks on the shuttle. It is used to prioritize risks to be addressed.

GIDEP and NASA Advisories Q&A

What is GIDEP?

The Government-Industry Data Exchange Program is a cooperative activity between government and industry participants seeking to reduce or eliminate expenditures of resources by sharing technical information essential during research, design, development, production and operational phases of the life cycle of systems, facilities and equipment.

When was GIDEP established?

GIDEP began as the Interservice Data Exchange Program (IDEP) in1959 by mutual agreement of the Army, Navy & Air Force), and was intended to reduce duplicate testing being conducted on the same parts/components/materials.

When did NASA Join GIDEP?

NASA joined GIDEP in 1965 to support our data needs for space application parts. In 1966, NASA began to issue alerts on parts/components/materials that did not meet space requirements.

When did NASA begin sharing alerts/NASA advisories with GIDEP?

The NASA ALERTs were the start of the IDEP ALERT system and soon many IDEP participants were also exchanging ALERT information

What is GIDEP's Management Structure?

GIDEP is chartered by the Joint Logistics Commanders, with program management provided by the Navy (Office of the Assistant Secretary of Navy, Research, Development and Acquisition for Acquisition and Business Management [ASN(RDA)ABM], Arlington, VA.) A GIDEP Program Director manages the day-to-day operation of GIDEP, as directed by the Program Manager, at the GIDEP Operations Center in Corona, California. Bicameral advisory committees known as the Government Advisory Group and Industry Advisory Group provide guidance and advise on the current and future direction of GIDEP. NASA Headquarters is a standing member of the GAG, and JPL and most NASA prime contractors are standing members of the IAG.

Where is GIDEP located?

The GIDEP Operations Centers is located at the Naval Warfare Assessment Division in Corona, California.

How is GIDEP funded?

By members of the GIDEP GAG as a fixed percentage share of each agency's budget – NASA contributes to GIDEP funding annually in the 200K to 300K range.

What implementing policy does NASA have for GIDEP?

NPG 8735.1A – "Procedures for Exchanging Parts, Materials, and Safety Problem Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories"

What types of data does GIDEP have?

GIDEP has the following data types: DMSMS data, engineering data, failure experience data, metrology data, product information data, and reliability and maintainability data.

What types of data does NASA share with and extract from GIDEP?

NASA requires the disposition of all GIDEP failure experience data, and requires that all significant NASA problem and nonconforming data be shared with GIDEP. The dispositioning of all other types of GIDEP data within NASA is voluntary.

What types of data does NASA not share with GIDEP?

NASA does not share failure experience data that is subject to current NASA inspector general investigations without the consent of the NASA inspector general. Such data is released only with NASA as a NASA Advisory.

What is a NASA Advisory or NASA Alert?

A NASA Advisory, formerly known as a NASA Alert, is a NASA-only document for sharing information across NASA that is not appropriate for sharing outside or NASA or with GIDEP.

How is GIDEP Failure Experience Data disseminated across NASA?

Each NASA field center and component facility has a NASA civil-servant GIDEP representative who is responsible for disseminating GIDEP failure experience data within their installation, following locally established policies for doing so. These representatives are also responsible for coordinating NASA Advisories with other NASA facilities.

What training is available for NASA GIDEP Representatives?

NASA GIDEP representatives may receive training through an on-line course on the NASA SOLAR and by attending annual GIDEP training clinics and workshops.

How is GIDEP data accessed and how often is GIDEP data disseminated?

GIDEP data is accessible to NASA GIDEP representatives via a database available through the world-wide-web. NASA GIDEP representatives can choose to receive GIDEP data on a real-time or weekly basis by email subscription.

What records are retained by the NASA GIDEP program?

The GIDEP operations center is the official keeper of GIDEP records. Original copies of NASA Advisories are maintained by the issuing NASA GIDEP representative office.

Was any GIDEP data received that pertained specifically to STS-107?

TDB.

Who is the NASA point-of-contact for GIDEP?

Mr. Eric Raynor
NASA Liaison to GIDEP
Safety and Assurance Requirements Division – Code QS
Office of Safety and Mission Assurance
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001
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Fax: (202) 358-3104
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What is LLIS (Lessons Learned Information System)?

An on-line, automated information system designed to collect and make available for use the NASA lessons learned from over forty years in the aeronautics and space business. The LLIS enables the knowledge gained from past experience to be applied to current and future projects. Its intent is to avoid the repetition of past failures and mishaps, as well as the ability to share observations and best practices. Through this resource, NASA seeks to facilitate the early incorporation of safety, reliability, maintainability, and quality into the design of flight and ground support hardware, software, facilities, and procedures.

How many lesson entries are in the LLIS?

Over 1300.

How does one access the LLIS?
How does one search the LLIS?
How does on contribute a lesson to the LLIS?

On-line at http://llis.nasa.gov -the site has simple and advanced search capabilities as well as on-line lesson submission capability.

Who can access, search, or contribute to the LLIS?

Any NASA civil servant, on-site contractor, or off-site contractor (off-site contractors require user IDs and passwords.)

What is the PLLS?

The public lessons learned system, which makes NASA lessons learned available to anyone in the world with web access. This is an information only subset to the LLIS system, and does not have lesson submission or full search capability. PLLS replaces and enhances the now retired NASA International Safety Lessons Learned (ISLL) access portal. The LLIS and the PLLS contain the same lessons learned and are updated concurrently with new lessons.

When was the LLIS established and how has it evolved?

- Early 1990's – Code Q perceived the need for a system to collect and make available Agencywide SMA lessons learned
- 1994 – Code Q tasks GSFC to develop/test a rudimentary on-line capability
- 1995 – Rolled-out "LLIS" to the SMA community with on-line lesson submission, approval, and search capability
- 1996 – Made LLIS available for Agencywide use

•1998 – Established LLIS usage requirements in NPG 7120.5A
•1999 – Modified LLIS to accept and track PAPAC data
•2001 – Created Public Lessons Learned Information System (PLLS) for general public access after FOIA requests prompt a review of LLIS entries
•2001 – Established LLIS email subscription service to "push" new lessons to users according to their user profiles
•2002 – Reviewed LLIS entries for compliance with Section 508 requirements
•2002 – Upgraded LLIS webface to enhance user functionality

What is the LLIS Management Structure?

Oversight of the LLIS is provided by the Office of Safety and Mission Assurance (Code Q) at NASA HQ. The system and its content are managed by the NASA Lessons Learned Steering Committee (LLSC). This committee is composed of members from all NASA centers. The LLIS Curator, who serves under the direction of the LLSC Chairperson, has operational responsibilities for the system.

Where is the LLIS located?

On computer servers at the Goddard Space Flight Center.

Is the LLIS a database?

Technically, no. It is a series of html webpages linked together using PERL script software.

How are new lessons approved and incorporated into the system?

Lessons learned contributors first complete the submission of a lesson online. In turn, the system stores and tracks the submitted lesson through an internal multi-step approval process. Once a lesson is approved, the LLIS Curator adds it to the operational database. The LLIS also supplies the tools to support the internal review and approval process for submitted lessons.

What is the format of a lesson?

LLIS lessons, representing the experiences and observations of the NASA workforce, are composed of textual narrative presented mostly in HTML format. Some are also accompanied by images or other media. Each lesson is uniquely identified by a sequentially assigned number. It is this number that is used internally to track and retrieve the lesson and all its components. Once a lesson is retrieved, it can be saved or printed by the requesting user. The template for a lesson includes the following text fields: 1) subject/title/topic, 2) description of the driving event, 3) lesson(s) learned, 4)

recommendations, 5) evidence of recurrence control effectiveness, 6) applicable NASA enterprises, 7) applicable NASA crosscutting processes, 8) additional key phrases, and 9) submitter point-of contact information and submission date.

How is the LLIS funded?

By NASA HQ, Code Q.

What implementing policy does NASA have for LLIS?

There is no specific policy devoted exclusively to lessons learning at NASA. Several NASA safety and mission assurance policies and program/project management policy stipulate the requirements for contributing to the LLIS and dispositioning the contents of the LLIS.

What training is available for NASA LLIS users?

The on-line site is designed to be simple and intuitive…no training is required

Was any LLIS data received that pertained specifically to STS-107?

TDB.

Who is the NASA point-of-contact for the LLIS?

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