

Summary of Team Response to Radiation Events

EXAMPLE #1: STRONG SOLAR ACTIVITY AUGUST 2005

AND SO IT BEGINS!

From plucinsk@head.cfa.harvard.edu Mon Aug 22 08:22:50 2005
To: acisdude, das
Subject: minor storm in progress
Date: Mon, 22 Aug 2005 08:22:46 -0400
From: "Paul P. Plucinsky" <plucinsk@head.cfa.harvard.edu>

hi Royce,

There is a **minor low-energy proton storm in progress**. It is not a problem now, but we will need to watch it.

Paul

From owner-sot_lead@head.cfa.harvard.edu Mon Aug 22 14:16:23 2005
From: DOSS - Monitoring and Trends Analysis <mta@head.cfa.harvard.edu>
Date: Mon, 22 Aug 2005 14:15:01 -0400 (EDT)
To: sot_red_alert@head.cfa.harvard.edu
Subject: ACE_p3_scaled

A **Radiation violation of P3 (130keV)** scaled from P6 (761keV) has been observed by ACE
Observed = 1.2055e+08
(**limit = fluence of 1.2e8 particles/cm2-ster-MeV within 2 hours**)
see <http://cxc.harvard.edu/mta/ace.html>
This message sent to sot_red_alert

E1300 trips SCS107!

From owner-sot@head.cfa.harvard.edu Mon Aug 22 16:32:29 2005
To: sot, fot
cc: das, jgrindlay
Subject: SCS 107 ran
Date: Mon, 22 Aug 2005 16:26:46 -0400
From: Dan Schwartz <das@head.cfa.harvard.edu>

E1300 tripped SCS 107 at 19:40:20 GMT. (03:40pm EDT, Monday Aug 22)
Current pass is 19:50 to 21:05 GMT
13 errors in error log as expected
Pre-approved CAP to disable SCS 29 is planned to be executed later during this pass.

We need a **maneuver only load** for uplink at the 02:05 GMT pass later tonight. That will be built and an email announcement sent for a load review telecon.

TO resume science:
Plan A is to build a load which picks up with obsid 5421, Kelu-1, and would be uplinked at the 16:45 pass tomorrow. Products are expected out tonight. We'll have a radiation telecon following the 9am status in the morning, and if favorable for restart we will have a load review.

If radiation is high tomorrow morning, Plan B is to pick up after the next perigee passage, with obsid 5583 of RX J0720.4-3125, at 23:11 GMT on Wednesday.

There was an electron and very hard proton increase at about zero hours today, with two M class flares during the day and an electron shock at ~1800 GMT. The soft proton increases often follow the electrons by about 24 hours, so Plan A is very much at risk at the present time.

OBSID 5934, Limiting Window, was interrupted after 41 ks.

OBSID's 5730, 5806, and 5673 will definitely be postponed.

From owner-sot_yellow_alert@head.cfa.harvard.edu Tue Aug 23 02:26:18 2005
From: DOSS - Monitoring and Trends Analysis <mta@head.cfa.harvard.edu>
Date: Tue, 23 Aug 2005 02:25:02 -0400 (EDT)
To: 6172573986@mobile.mycingular.com, sot_yellow_alert@head.cfa.harvard.edu
Subject: **GOES Alert**

A **Radiation violation of GOES 11 P2 (4-9 MeV)** has occurred indicating a probable EPHIN P4GM trip.
Value: 93.30 p/cm2-s-sr-MeV
Limit: 90.91

PLAN B NEEDED!

From owner-sot@head.cfa.harvard.edu Tue Aug 23 07:02:57 2005
To: fot, sot
cc: das
Subject: **Radiation replan**
Date: Tue, 23 Aug 2005 07:00:08 -0400
From: Dan Schwartz <das@head.cfa.harvard.edu>

Based on GOES rates and the expected course of the on-going events, we decided last evening that **Plan A** restart **would not be feasible**.

We will discuss the radiation situation after the 9am status briefing, and hopefully can plan to proceed with restarting after perigee egress tomorrow night.

Dan

From owner-sot@head.cfa.harvard.edu Tue Aug 23 09:30:55 2005
To: fot, sot
cc: das
Subject: Radiation Telecon
Date: Tue, 23 Aug 2005 09:26:25 -0400
From: Dan Schwartz <das@head.cfa.harvard.edu>

We had a radiation telecon following the 9am status this morning.

Rates from the goes satellite indicate that the 4 million volt proton channel on ephin is about twice its trip limit. At the last pass, 0300 Greenwich time this morning, ephin protons and electrons were both above their trip limits. Ace soft protons are only about 5000, but are rising.

We'll **proceed with plan B**, to pick up observing at perigee egress at 23:11 GMT tomorrow. Last uplink opportunity is at 21:25-22:25 tomorrow. Product will be built today. We'll have a radiation telecon again tomorrow following the 9am status, and then follow with a load review if it looks promising for the restart. If the restart seems in jeopardy at that time we will develop an alternate plan.

Paul Viens confirmed that the procedure to disable stored command sequence 29 was run successfully during the 19:50 pass yesterday.

Dan

High Radiation Continues!

From owner-sot_lead@head.cfa.harvard.edu Wed Aug 24 04:45:41 2005
From: DOSS - Monitoring and Trends Analysis <mta@head.cfa.harvard.edu>
Date: Wed, 24 Aug 2005 04:45:02 -0400 (EDT)
To: sot_red_alert@head.cfa.harvard.edu
Subject: **ACE_p3**

A **Radiation violation of P3 (130Kev)** has been observed by ACE
Observed = 3.7644e+08
(**limit = fluence of 3.6e8 particles/cm2-ster-MeV within 2 hours**)
see <http://cxc.harvard.edu/mta/ace.html>
This message sent to sot_red_alert

From owner-sot@head.cfa.harvard.edu Wed Aug 24 09:23:15 2005

To: sot, fot
cc: das
Subject: Radiation replan telecon
Date: Wed, 24 Aug 2005 09:19:51 -0400
From: Dan Schwartz <das@head.cfa.harvard.edu>

A radiation replan telecon was held following the 9am status meeting this morning.

Ace soft proton fluxes are very high currently, about 50,000, but decreasing. The goes satellite proxy for ephin P4 shows just about at 1/3 the P4 trip level, so too uncertain to tell but the goes fluxes are also decreasing.

It is feasible but not certain that we can restart observing with august 2405A products, which would be uplinked at the pass starting at 5:15pm EDT today. There will be a radiation tagup telecon at 5:00pm today to assess the situation -- will need to look at the ace soft protons and at the ephin data from the pass. Use 405 244 5060 1165#

Dan

Paul and Royce discuss a possible CTI measurement

From plucinsk@head.cfa.harvard.edu Wed Aug 24 09:40:00 2005

From: Paul Plucinsky <plucinsk@head.cfa.harvard.edu>
Date: Wed, 24 Aug 2005 09:39:35 -0400 (EDT)
To: acidsdude@head.cfa.harvard.edu
Subject: **CTI measurement**

Hi Royce,

I agree that the **one hour CTI** is worth the effort of the ACIS operations team. Thanks for making the effort to get it in. I do want to be careful that we don't put too much stress on the Flight operations team. I was confused because I thought we would have gotten a much longer opportunity this time given where we were in the orbit.

Very slow dialup connection from N.H., arrgghhh.

thanks,
Paul

From owner-sot@head.cfa.harvard.edu Wed Aug 24 17:42:54 2005

To: sot, fot
Subject: Results of Radiation Go/No-Go telecon
Date: Wed, 24 Aug 2005 17:40:12 -0400
From: "Michael Juda" <juda@head.cfa.harvard.edu>

At 5PM EDT the GOES P2 (EPHIN P4GM surrogate) indicated that the EPHIN rate was likely to be below the 1/3 trip level.

ACE P3 levels were somewhat elevated at ~40000 but dropping. Eric noted that there was an indication in the ACE and SOHO solar-wind data that the latest shock had just passed and we might expect the ACE P3 flux to fall more rapidly. The current P3 level if maintained for the entire orbit is higher than the bare ACIS fluence budget. However, the first 35ks of the orbit is HRC-S/LETG allowing some time for the ACE flux to drop before ACIS is exposed. The ACIS observations are 50ks bare ACIS followed by ~50ks ACIS/HETG and ~10ks bare ACIS to complete the orbit. The anticipated low-E proton exposure to ACIS was deemed acceptable.

At the start of comm (21:15UT the EPHIN rates were all below the 1/3 trip level.

The decision was made to resume the science mission by running CAP 675 to re-enable SCS-107 and to uplink and activate the AUG2405B loads.

Not quite ready to restart yet!

From secproducts@noaa.gov Thu Aug 25 00:42:05 2005

From: <secpducts@noaa.gov>
To: <acidsdude@head.cfa.harvard.edu>

Subject: **ALERT: X-ray Flux exceeded M5**
Date: Thu, 25 Aug 2005 04:41:26 -0000

Space Weather Message Code: ALTXMF
Serial Number: 117
Issue Time: 2005 Aug 25 0439 UTC

ALERT: X-Ray Flux exceeded M5
Threshold Reached: 2005 Aug 25 0438 UTC
NOAA Scale: R2 - Moderate

From secproducts@noaa.gov Thu Aug 25 00:54:20 2005

From: <seproducts@noaa.gov>
To: <acisdude@head.cfa.harvard.edu>
Subject: **SUMMARY: X-Ray Event exceeded M5**
Date: Thu, 25 Aug 2005 04:53:53 -0000

Space Weather Message Code: SUMXM5
Serial Number: 62
Issue Time: 2005 Aug 25 0451 UTC

SUMMARY: X-ray Event exceeded M5
Begin Time: 2005 Aug 25 0431 UTC
Maximum Time: 2005 Aug 25 0440 UTC
End Time: 2005 Aug 25 0445 UTC
X-ray Class: M6.4
Optical Class: 1n
Location: N07E78
NOAA Scale: R2 - Moderate

In addition to continued elevated rates, EPHIN tripped after 1 sample

From owner-sot@head.cfa.harvard.edu Thu Aug 25 01:55:24 2005

To: sot, fot
Subject: result of SCS-107 run telecon
Date: Thu, 25 Aug 2005 01:53:20 -0400
From: "Michael Juda" <juda@head.cfa.harvard.edu>

SCS-107 ran at 2005:236:22:38, one EPHIN sample after RADMON enable. We need data to see the cause but a single high EPHIN sample at the time of RADMON enable may be the culprit.

The SCS-107 run occurred during an insertion of the LETG and as a result the insertion did not complete. The LETG potentiometer angle reads 44.21 degrees. A real-time procedure will be required to retract the LETG along with a flight software patch to reset a flag in the grating software before we can resume observing. Initial work on the development and test of the procedure will be performed overnight.

CAP 943 was run to re-enable the Sun and Spacecraft Momentum monitors that had been disabled as part of the daily load.

The spacecraft had been in telemetry format 4 at the time of the SCS-107 run due to the LETG insertion. The telemetry format was manually commanded to format 2.

There will be a tag-up at the 9AM tomorrow morning on 405-244-5060 1159# to discuss plans for recovery.

Paul and Royce continue the CTI discussion

From plucinsk@head.cfa.harvard.edu Thu Aug 25 07:38:24 2005

To: acisdude, das
Subject: radiation environment
Date: Thu, 25 Aug 2005 07:38:10 -0400
From: "Paul P. Plucinsky" <plucinsk@head.cfa.harvard.edu>

hi Royce,

Sorry this week has been so bad. It will be interesting to understand why EPHIN tripped. However, the radiation environment is certainly low enough for another long CTI measurement.
good luck,
Paul

From buehler@space.mit.edu Thu Aug 25 19:27:25 2005

Date: Thu, 25 Aug 2005 19:27:22 -0400

From: Royce Buehler <buehler@space.mit.edu>

To: "Paul P. Plucinsky" <plucinsk@head.cfa.harvard.edu>

Cc: das@head.cfa.harvard.edu, Joseph DePasquale <depasq@head.cfa.harvard.edu>, nadams@head.cfa.harvard.edu

Subject: Re: radiation environment

The CAP reviewers declined to review 975C, on the grounds that we will not know until late tonight at the earliest - more likely tomorrow - whether we have a firm enough diagnosis of the cause of the SCS107 trip to risk enabling RADMON yet.

If by any chance we should be prepared to enable RADMON, chances are also good that the AUG2605B products will be approved and ready to load up.

From buehler@space.mit.edu Fri Aug 26 10:16:31 2005

Date: Fri, 26 Aug 2005 10:16:14 -0400

From: Royce Buehler <buehler@space.mit.edu>

To: "Paul P. Plucinsky" <plucinsk@head.cfa.harvard.edu>

Cc: Royce Buehler <buehler@space.mit.edu>, acisdude@head.cfa.harvard.edu, das@head.cfa.harvard.edu

Subject: Re: radiation environment

On Fri, Aug 26, 2005 at 08:35:47AM -0400, Paul P. Plucinsky wrote:

> > The CAP reviewers declined to review 975C, on the grounds that we
> > will not know until late tonight at the earliest - more likely
> > tomorrow - whether we have a firm enough diagnosis of the cause of the
> > SCS107 trip to risk enabling RADMON yet.
> >
> >
> Whoops, I think I sent this only to Royce.
> >
> Bummer. We do need to understand why SCS107 ran. But if it is OK
> to resume the science load, why is it not OK to start a CTI
> measurement ?

The same conditions would have enabled both. By the time we got down to the CTI CAP on the agenda, it was clear that a science load, for upload at the same pass, would be ready for review within an hour; and obviously, if it became possible to do either one, the science load would bump the CTI.

It didn't seem likely that we'd be prepared to sanction either one, making the CTI doubly moot. Finally, we were just coming into contact, and some of the folks who should have been involved in the CTI CAP review were needed on console to handle the just-approved gratings CAP.

So I don't feel that we were blown off. Canceling the ACIS CAP review was indicated by proper priorities.

From buehler@space.mit.edu Fri Aug 26 16:00:41 2005

Date: Fri, 26 Aug 2005 16:00:27 -0400

From: Royce Buehler <buehler@space.mit.edu>

To: acisdude@head.cfa.harvard.edu, das@head.cfa.harvard.edu,

"Peter G. Ford" <pgf@space.mit.edu>

Subject: CTI CAPs and this week's RADMON anomaly

It now appears fairly certain that the cause of this week's anomalous RADMON trip was a timing glitch in the RADMON code, which allows the instrument for a few minor cycles to believe that actually stale data, from just prior to the previous RADMON trip, is current data. Eric is still investigating whether the vulnerability extends over 1 or 2 percent of each major frame, or some larger fraction.

It was decided that until an appropriate OBC patch is developed, the proper operational precaution is to run a CAP before each resumption of science from radiation induced SCS107, a CAP which, with SCS107 initially disabled, will enable RADMON briefly, long enough to get a few samples at low radiation levels, disable RADMON again, and then enable SCS107.

Fortunately, we already observe this order in our CTI RTS CAP. Do we want to consider waiting 120 seconds, rather than 60, between steps 4 (RADMON enable) and 5 (SCS107 enable), just to be on the safe side? Should we double check with Eric that it's not possible for the ground to see a fresh radiation value in telemetry, while

the RADMON process is still looking at a stale high value?

From owner-sot@head.cfa.harvard.edu Sat Aug 27 09:37:21 2005

Subject: Return to science operations

Date: Sat, 27 Aug 2005 09:27:21 -0400

From: "Ken Gage" <kgage@ipa.harvard.edu>

To: <sot@head.cfa.harvard.edu>, <fot@head.cfa.harvard.edu>, <marc.osborne@msfc.nasa.gov>, <Stephen.L.Odell@nasa.gov>, <keith.hefner@msfc.nasa.gov>, <paul.pohlen@ngc.com>, <Steven.C.Purinton@msfc.nasa.gov>, <Steve.Terry@msfc.nasa.gov>

CAP 977 has been run successfully to clear the RADMON radiation high flag and enable SCS 107. RADMON did not trip in the process and everything proceeded smoothly. AUG2705B command loads are on-board and active at this time with the first maneuver to start at 14:15 UT.

Kenneth R. Gage
Manager, Mission Planning
Chandra Flight Operations

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

From: Michael Juda [mailto:juda@head.cfa.harvard.edu]

Sent: Friday, August 26, 2005 1:58 PM

To: sot@head.cfa.harvard.edu; fot@head.cfa.harvard.edu; marc.osborne@msfc.nasa.gov; Stephen.L.Odell@nasa.gov; keith.hefner@msfc.nasa.gov; paul.pohlen@ngc.com; Steven.C.Purinton@msfc.nasa.gov; Steve.Terry@msfc.nasa.gov
Subject: Re: Unexpected RadMon Trip Investigation Tag-up

At the 11AM EDT telecon Eric Martin presented the result of his investigation of the code and review of the dump of memory locations associated with the data used in the RADMON process. The short answer is that the RADMON trigger can be explained and was expected based on the timing of the RADMON enable relative to the stages in processing. The identification of a continuing "high-radiation" environment by the RADMON process was due to the use of stale data from the E1300 channel.

The details of the extent of our vulnerability to the timing issue (i.e. how many minor cycles over which it could occur) are not yet understood. It is expected that a review of the code and review of the data from all past RADMON enables that followed an autonomous RADMON shutdown will help to resolve this question.

Our understanding of the situation is good enough for us to know how to clear the "high-radiation" condition in the RADMON process: with SCS-107 disabled and while in a low radiation environment, enabling the RADMON process will allow low counts reading from the EPHIN to clear the high-radiation condition.

Given that the nature of the RADMON trigger is understood it was decided that there was no reason not to resume the science mission. A CAP to clear the high-radiation condition and enable SCS-107 will be run before any new science loads are uplinked. We are planning on a resumption of the science mission after the next perigee exit.