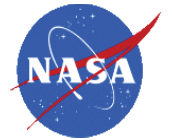


Reduction in *Hinode* mission operations: Test results and implementation plans

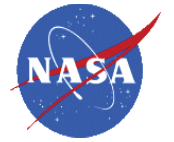
Sabrina Savage, on behalf of the U-side Instrument teams



Background



- **Plans for Necessary Reduction in CO Duty**
 - As per the NASA Senior Review assessment, mission operations must be reduced under a budget reduction while maintaining or increasing science output.
- Assumptions
 - The CO reduction should not incur a significant extra load on JAXA or UK contributions to instrument operations.
 - For the purpose of this discussion, we assume no additional resources from JAXA and the UK are available.

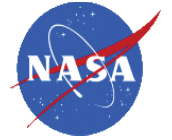


Review of Hinode Focused Mode Test Results Part I

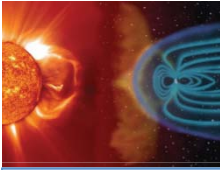
2014 Jan 9 – Feb 6



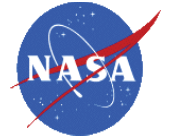
Planning [Positive]



- After the daily meeting, making the timelines in one day is not a problem for the COs.
 - timelines expected to be more difficult to put together during eclipse season (test in June)
- SOT planning software adjustments made easily; more features planned for automation.
 - need to add less trivial changes to planning software for dealing with telemetry



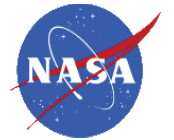
Planning [Negative]



- Very long daily meetings; delays work start
- Large number of pointings needs to be planned for in advance; not always possible due to time slots chosen during daily meeting
- Limited by the number of pointing commands available per timeline
- Coordinating the 3 instruments for long observations is difficult and must be improved
 - Dealing with several HOPs (some internal) and overall pointing schedule for 7 days is hard on the CP and COs; run out of time to even discuss coordination – need to organize better with the monthly meeting (although this was attempted by the SSC)
 - **Would not be tractable if coordinating with IRIS
 - Planners felt that the priorities for the science targets were not well-communicated to the observers from the SSC
- EIS planning tool needs to be modified to accommodate 7-day plans more easily



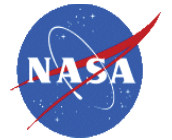
Telemetry [Positive]



- Nothing noted.



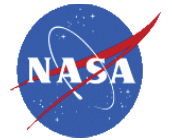
Telemetry [Negative]



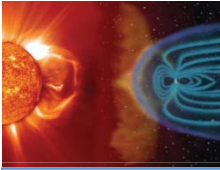
- Major challenge allocating telemetry over 7 days; 3 of 4 weekly timelines had telemetry problems
 1. an empty data recorder (which wastes station passes);
 - may have been caused by SOT communication gap (next slide)
 2. observing paused because SOT hit its telemetry limit temporarily;
 3. the data recorder completely filled (stopping everyone's observing and collection of instrument status).
 - The reasons for these need to be understood, and perhaps some corrective changes to instrument or CP software or procedures are warranted.
- EIS attempt to work with XRT flare trigger for major flare watch response was limited by the telemetry
 - instrument would not be able to operate for the last 3 days of the week due to daily telemetry allocation plus table upload limits and pressure from random trigger responses
- Difficult for EIS to support pointing-intensive core HOPs (e.g., 79 & 130) due to table upload limit
 - only one can be run during a 7-day upload



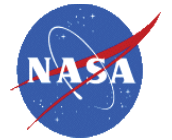
Trouble-shooting [Positive]



- SOT had an error in communication with the MDP that stopped observing; well-known error that happens a few times a year.
 - prompt response for re-start from CO & CP
 - 43-hour interruption (normal)



Trouble-shooting [Negative]



- CO & CP must be **on-call** at all times (no down time)
- Errors in plan difficult to correct
 - cannot adjust programs and run again in next plan as normal
 - can take 2-3 weeks to get the telemetry, correct the error, run the observation again, and see results
 - **Cannot run untested programs for long durations
- Need to establish better communication between COs and CPs for appropriate meeting times to resolve issues (e.g., to change pointing)
 - perhaps setting a deadline for meeting requests



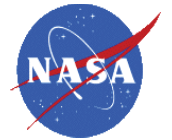
Science [Positive]



- Good scientific long-duration observations



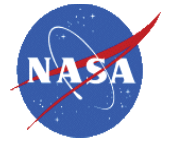
Science [Negative]



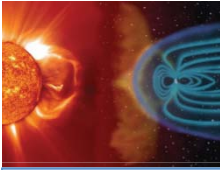
- Need improved coordination
- Scientific return degraded by gaps— especially for flare observations
 - missed one M flare due to a synoptic program gap (not completely avoidable)
 - SOT missed parts of two others during SOT telemetry limit gaps (requires more investigation to mitigate)
- Reducing to one synoptic pointing a day caused problems for the AIA/XRT alignment software
 - re-implemented two per day in the last week of testing
 - may need to be re-reduced during runs of HOPs that require many pointings due to a limit in pointing commands
- Cannot respond to targets quickly
 - missed an opportunity to observe a new region (AR 11967) when it first became the target of a major flare watch – anticipated science loss for Focused Mode
 - EIS unable to reliably use XRT flare trigger due to telemetry issues
- EIS alignment and engineering studies have to be interrupted



Suggestions for Improvements during Hinode eclipse season



- SSC to provide the planners with a focused email detailing the science priorities for upcoming Focused Mode times
- Create software to better allocate telemetry
- Modification of EIS planning tool to handle 7-day timelines
- Minor modification of SOT planning tool for automation
- Planners to have correct list of pointings prepared in advance for pointing intensive HOPs (i.e., 130 & 79) to avoid loss of valuable planning time

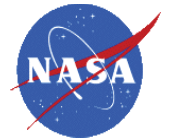


Review of Hinode Focused Mode Test Results Part II

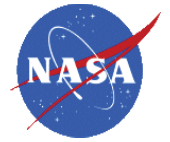
2014 May 31 – June 27



Planning [Positive]



- EIS:
 - Relatively easy to plan for the week.
- XRT:
 - Bakeout timelines, which are complicated under normal circumstances, were not any more difficult to execute.
- SOT
 - Due to software changes made in advance, making a 7-day plan was not a problem although it took longer.
 - Suggest that US RCOs start on Thursday evening after the weekly meeting instead (although this may be changed further due to the need to upload during a week day)
 - More attention was given to telemetry usage, and as a result there were none of the problems we had in January with under- and over-use of telemetry.
- Overall: Easier to create week-long timelines during this test.

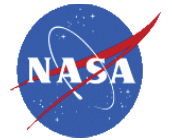


Planning [Negative]

-
- EIS
- Need better advance coordination and communication (to prepare for certain targets)
 - Need to make sure that contact information is current and accessible for current **and upcoming** COs
 - More software development would be useful to make better-adapted long duration observation programs.
-
- XRT
- Planning software slow for long timelines at SAO (but not on the J-side). (This is being worked.)
 - Difficult to coordinate targets
 - Change targets during the middle of the 7-day timeline?
 - What to follow without a good target?
 - Targets for Quiet Sun?
-
- SOT
- Changing targets on the morning of the upload made re-planning difficult, but was necessary due to the long-duration observations in order to ensure optimal target choice
 - Strongly request no software or hardware changes during focused mode operations
-
- SOT & XRT
- Strongly recommend change of day for timeline generation and upload.
 - Understandably, J-side personnel are not always available to mitigate issues that arise during the upload process on Saturday



Planning: Revised OP Uploads



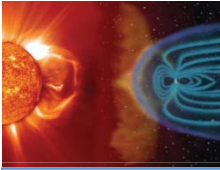
- The lack of OP slots was accommodated with Option III “Revised OP Uploads”
 - The Saturday OP upload is revised to include fewer downlink commands.
 - An additional set of downlink commands is uploaded on Tuesday in order to accommodate the rest of the week’s downlinks.

Usage of slots (OGs)

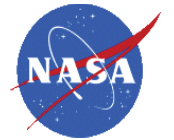
Date	Days	SOT	XRT	EIS	AOCS	S/C ¹⁾	Survival ²⁾	Total (Main)	Total (inc. BU)
31/5/14	7	2094	533	98	35	659	354	3383	3773
07/6/14	7	1896	858	88	32	661	356	3502	3892
14/6/14	7	2191	831	107	30	495 ³⁾	355	3614	4009³⁾
21/6/14	7	1936	515	98	33	655	356	3206	3593

- 1) Downlink commands for the ground stations scheduled in Saturday-Tuesday.
 - 2) Commands required for spacecraft survival for one month without uploading OP.
 - 3) The number of slots was over the 4095 limit, when the downlink commands for the ground stations scheduled in Saturday-Tuesday. So the number of slots was reduced to below the limit, by including fewer downlink commands for Saturday-Monday and the revised OP upload was performed on Monday, not on Tuesday.
- The test runs conclude that Option III “Revised OP Uploads” is acceptable.

****Contributed by Shimizu**



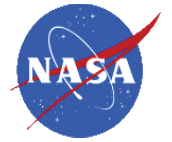
Telemetry [Positive]



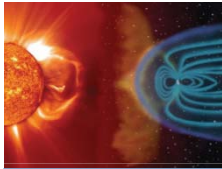
- No reported telemetry issues from the teams
 - e.g. no significant over or under runs on telemetry as was reported from the first test



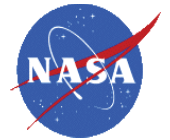
Telemetry [Negative]



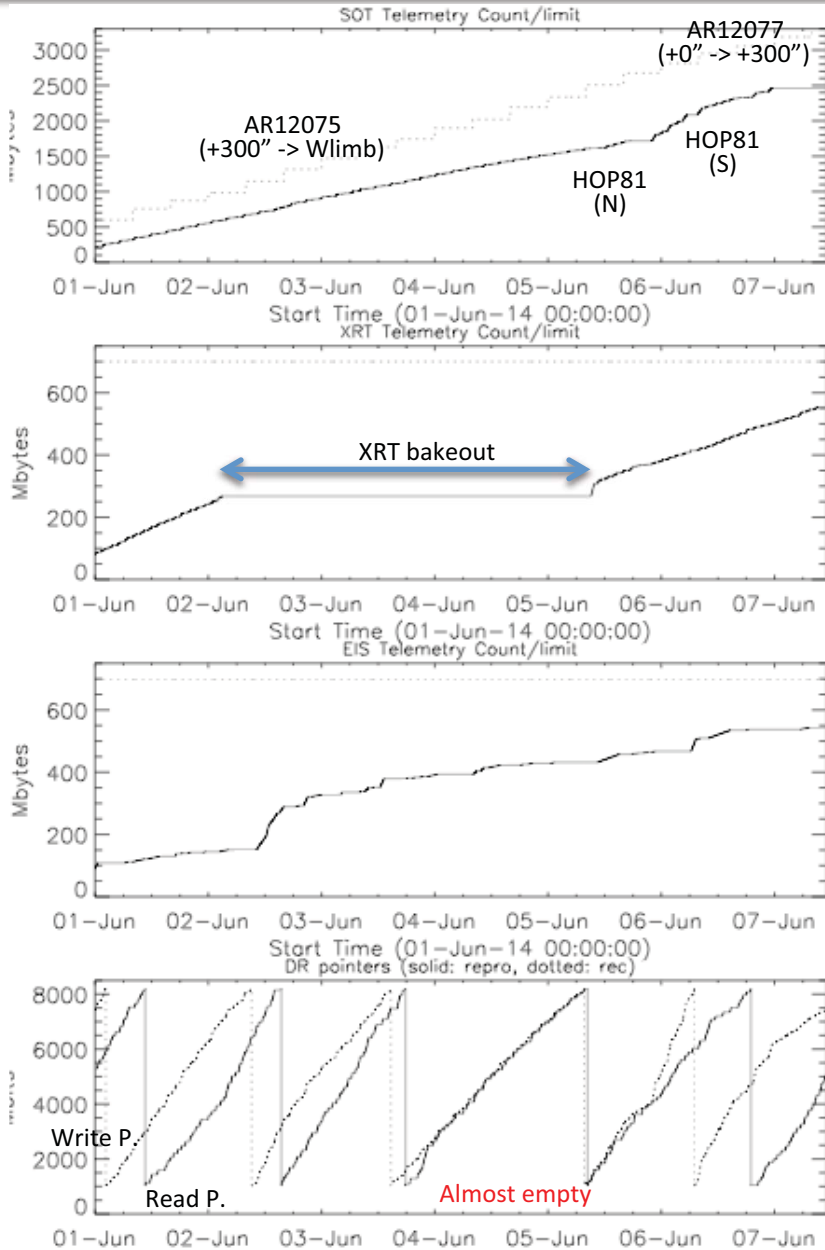
- The telemetry history records are in the next 2 pages.
 - Continuous tracking of active region in most of times. SOT produced telemetry at a constant rate.
 - DR became close to empty or full situation at latter part of the period.
 - Considering the situation, it would be difficult to fully avoid empty or full situation. Accept this situation.



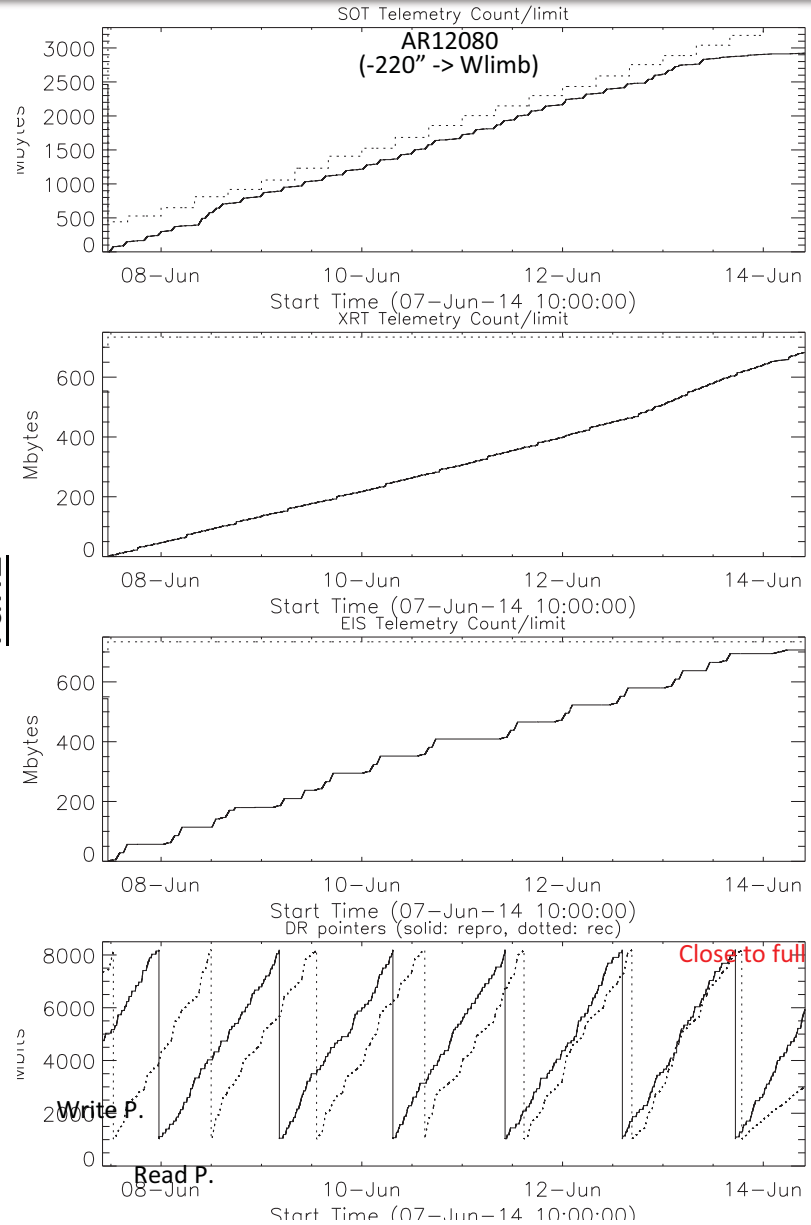
Record (1): Data output and DR usage



run1



run2



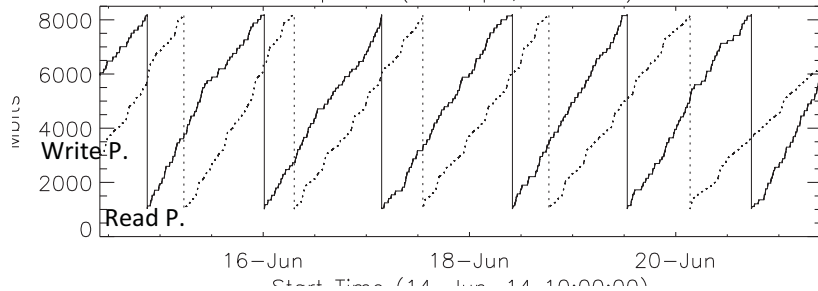
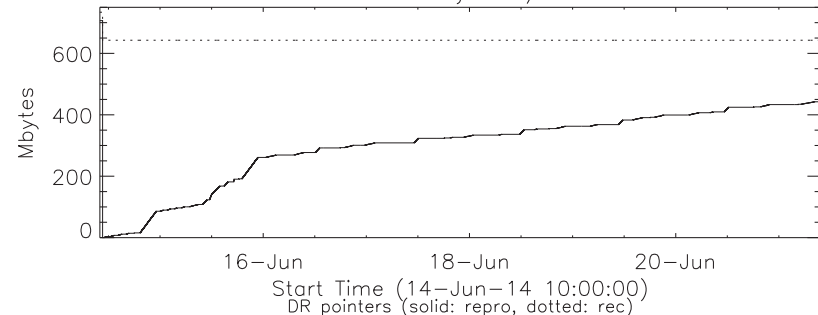
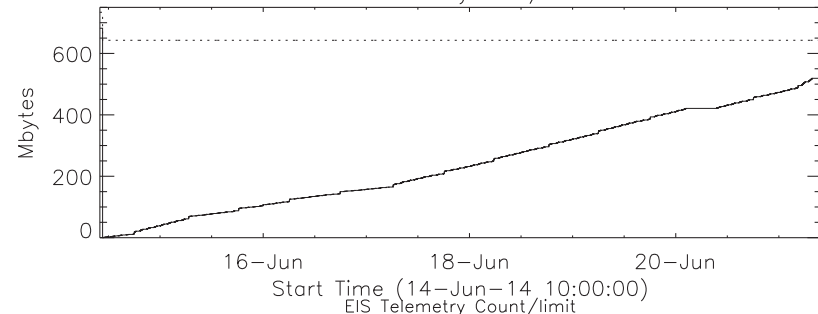
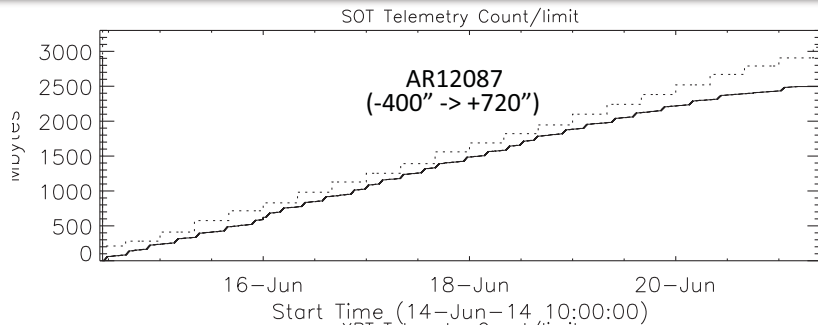
**Contributed by Shimizu



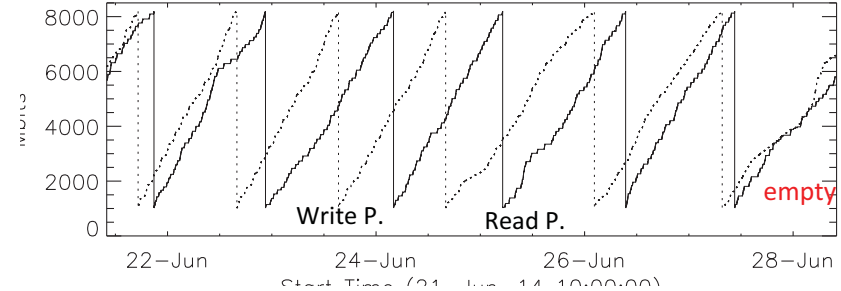
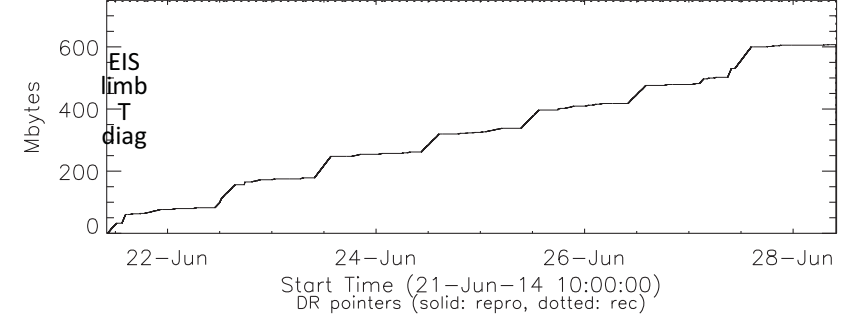
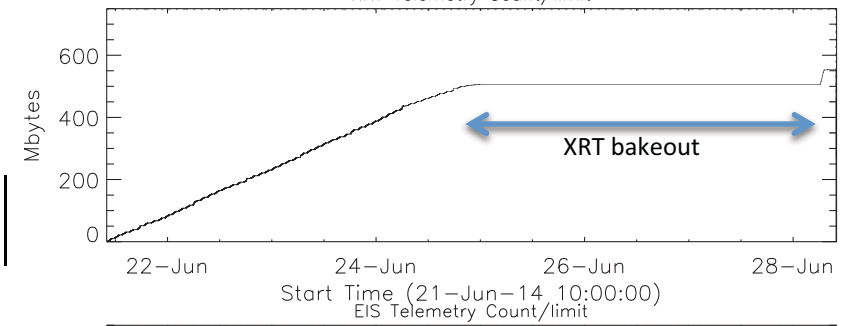
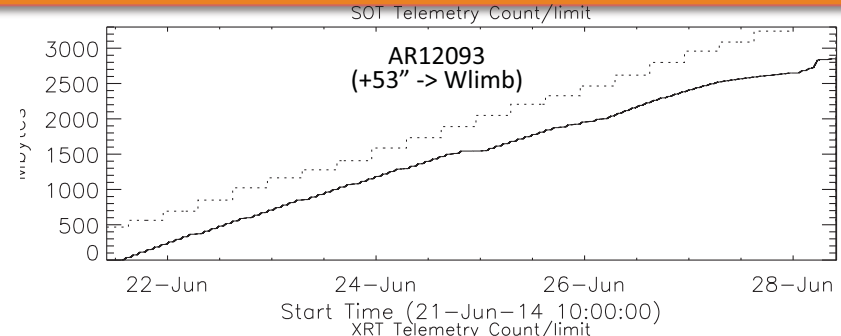
Record (2): Data output and DR usage



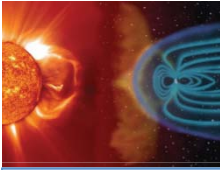
run3



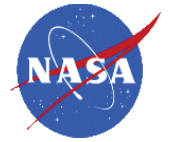
run4



*Contributed by Shimizu



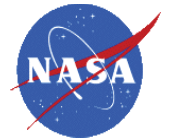
Trouble-shooting [Positive]



- The issue that arose prior to timeline upload due to a corrupted file was mitigated by the J-side and the CP, despite the weekend operations. The COs were continually updated on the issue and progress.



Trouble-shooting [Negative]



- Strong recommendation to change the day of timeline upload to a weekday instead of Saturday
 - Issues that arose from upload difficulties due to non-compliant files (likely stemming from a software upgrade) nearly resulted in an idle week for SOT observations, which would have also resulted in a large amount of lost telemetry.
 - If changing the operation week is not an option due to spacecraft constraints, then we request the implementation of a policy for efficiently handling issue mitigation to reduce impact to operations and operators.
- A software glitch resulted in the loss of obtaining QuickLook images efficiently by two of the instrument teams and made planning more difficult. This issue was not resolved for several days, but the time lag was not directly due to the Focused Mode Operations.



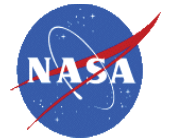
Science [Positive]



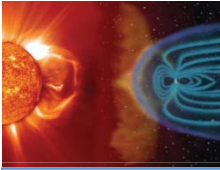
- Overall: Nice consistent data sets.



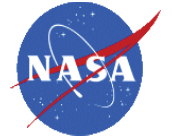
Science [Negative]



- Unclear what to target during fully Quiet Sun conditions.
- Target priorities from the SSC not effectively communicated to the COs throughout the entire test.



Science [Negative?]



- The plan could not be changed when major flare watch was issued during the focused mode.

10 June 2014 22:14JST

Solar activity is at a high level. The region previously numbered NOAA 12065 is currently rotating over the South East limb and has produced two low X-class flares in the last two hours (an X2.2 on 10-Jun-2014 at 11:36 UT and an X1.5 on 10-Jun-2014 at 12:36 UT). Although this active region is too close to the limb to determine an accurate magnetic complexity, its flare productivity means that at this time we are commencing a MM#003 Major Flare Watch. C-class activity is expected in the next 24 hours, with a good chance for further flaring above the M5 level.

The approximate position of this region on 10-Jun-2014 at 13:00 UT is: S19E89, (-893", -308")

13 June 2014 23:06JST

The level of solar activity remains high. Three active regions (NOAA 12085, 12087, 12089) have produced low M-class flares in the past 24 hours. 12087 is the most flare productive (having been the source of 2 C-class flares and 3 M-class flares) and it has been reclassified as a beta-gamma-delta/D-type sunspot group. The MM#003 Major Flare Watch will continue for the next 24-48 hours, as NOAA 12087 maintains the potential for further flaring above the M5 level.

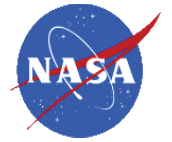
The position of NOAA 12087 on 13-Jun-2014 at 14:00 UT is: S18E35, (-521", -303")

- The plan uploaded on June 7 completely monitored the 7-days evolution of AR 12080, which were on the solar disk (E-hemisphere to W-hemisphere). **The continuous monitoring of such an AR evolution is one of important data only available from the focused mode.** The region produced an M-class and C-class flares (the data has not been checked).
- **A clear scientific guideline is needed for acting for major flare watch.**

****Contributed by Shimizu**



ISAS comments to schedule shift

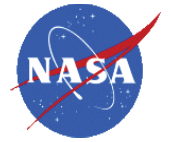


Change the day of timeline upload to a weekday instead of Saturday?

- It is possible to change the day of timeline upload to a weekday, for example, on Tuesday, if the Hinode team understands the following potential issues.
- The main driver for the Saturday upload is to manage the DR memory most accurately.
 - All the downlink passes for the next week (fully covering all the 7 days of the focused mode) can be confirmed from the stations by Friday. Based on the final confirmed downlink schedule, the most accurate DR allocation can be provided to COs.
 - When the upload days on a week day, the accuracy of the DR allocation may be slightly reduced, although it is expected to be small.
- When will each instrument have weekly telecon?



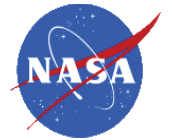
Suggestions for Improvements / Action Items



- **Avoid hardware and software changes during Focused Mode**
 - If issues arise, potentially long time lag in observations and large telemetry loss may result.
 - If changes are critical, implement a policy that will avoid, manage, and mitigate disruptions to reduce impact to operations and operators.
- **Consider changing the days of timeline creation and upload to week days due to lack of available ISAS support over the weekend**
 - If continued Saturday operations necessary:
 - need very experienced CP's and CO's scheduled during Focused Mode Operations
 - implement a policy for efficiently handling issue mitigation to reduce impact to operations and operators
- **Need better advanced coordination and communication to prepare for targets**
 - Need to ensure that contact information is current and easily accessible for current ****and upcoming**** COs
 - During Focused Mode Operations, the COs may need to communicate a week in advance with upcoming COs.
- **SSC action items (To be discussed in 2-3.)**
 - Determine a more consistent and effective method to communicate the SSC monthly recommendations to the COs.
 - Determine appropriate targets for Quiet Sun campaigns.



Modified “Low” Weekly Schedule



- ** *What will this look like with a week-day upload date?*
- *** *Which day will be used for extra downlink command upload?*
Is this only needed during Hinode eclipse season?
Does this require another test run?

Japan Time

Day? Daily Meeting to agree to Day? upload pointing for 7 days

Day? COs finish plan prior to 10:00 am JST
Daily Meeting to revise pointing (10:30 am JST)
COs check plan, ~4pm JST upload

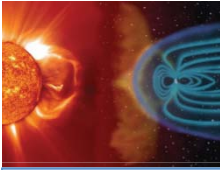
Day? No scheduled duties

Day? No scheduled duties

Day? No scheduled duties
Extra downlink command upload

Day? No scheduled duties

Day? No scheduled duties



2014 Proposed Schedule Guidance



2014

January						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	Test 1		17	18	
19	20			24	25	
26	27			31		

April						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

October						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

February						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

May						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

March						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	Test 2		13	14	
15	16			20	21	
22	23	24	25	26	27	28
29	30					

September						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Prime IRIS Coordination

Hinode Eclipse

IRIS Eclipse

Low = 1 upload per week

High = 3 uploads per week



2014 Proposed Schedule Guidance



2015

January						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

April						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

July						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

October						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

May						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

August						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

November						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

March						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

September						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

December						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

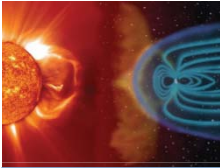
Prime IRIS Coordination

Hinode Eclipse

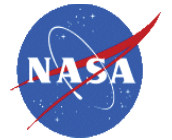
IRIS Eclipse

Low = 1 upload per week

High = 3 uploads per week



Suggested Schedule Guidance



2015

**** Note: This is an approximate schedule guideline to be confirmed and refined by the satellite operators and instrument teams with at least the following considerations:**

- The days of operation will need to be examined in detail and disbursed as evenly as possible between the international institutions.
- The exact eclipse dates for Hinode and IRIS will have to be determined and adjusted well in advance in order to create schedules in an appropriate time frame.
- **High weeks will need to be inserted every ## weeks during Focused Mode in order to accommodate certain pointing-intensive HOPs such as HOP 130.**

Hinode Eclipse

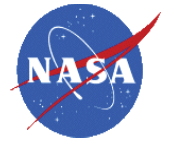
IRIS Eclipse

Low = 1 upload per week

High = 3 uploads per week



Additional Action Items



- **Preparing for Senior Review / expected budget cuts.**
 - Discussion of sufficient reduction in operations.
 - Discussion of positive and negative impacts.
- **Target selection clarification**
 - QS to be discussed in 2-3.
 - **What to do about Flare Watches during Focused Mode?**
 - Are flare response programs sufficient?
 - Does the pointing have to be changed? Or can we have a reasonable back up plan? Can we monitor active regions expected to come around the East limb with STEREO, etc.?
 - SSC needs to be very selective about HOP approvals during Focused Mode to avoid complicated timelines.
- **Need eclipse season dates (IRIS & Hinode).**