Status of X-ray Astronomy Satellite Hitomi (ASTRO-H)

April 1st, 2016

Revised April 6th, 2016

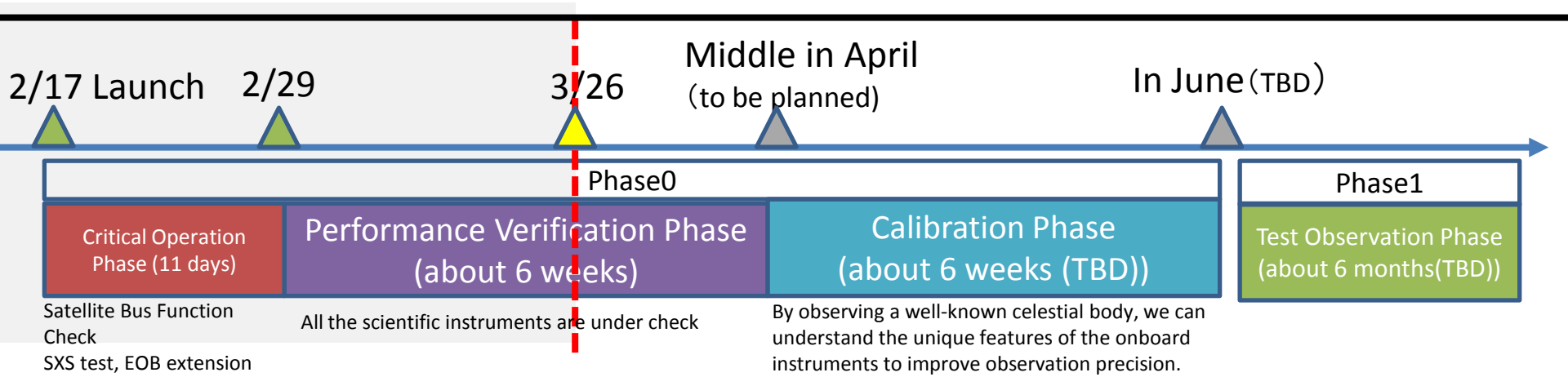
JAXA

Time in this material is expressed in JST.

(1) Hitomi Operation

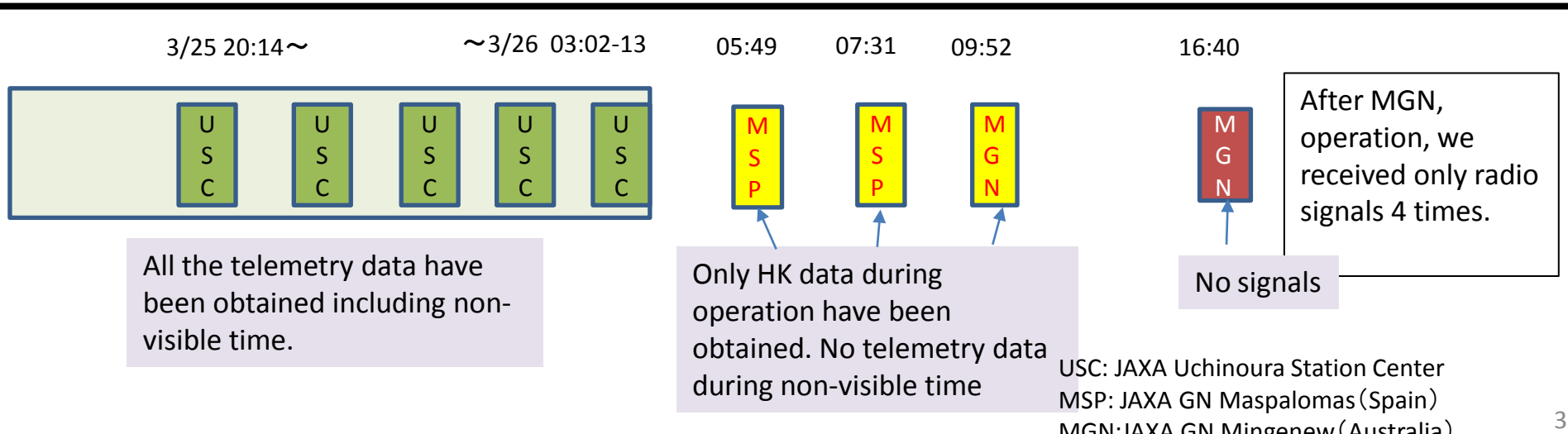
- The health check for all the scientific instruments% has been completed on 26th March, 2016. It was scheduled to proceed with the calibration phase in the middle of April.
- Observations for performance verification were conducted on 25th & 26th March, 2016 as preparation for the calibration phase.

%Soft X-ray Spectrometer（SXS）, Soft X-ray Imager（SXI）, Hard X-ray Imager（HXI）, Soft Gamma-ray Detector（SGD）



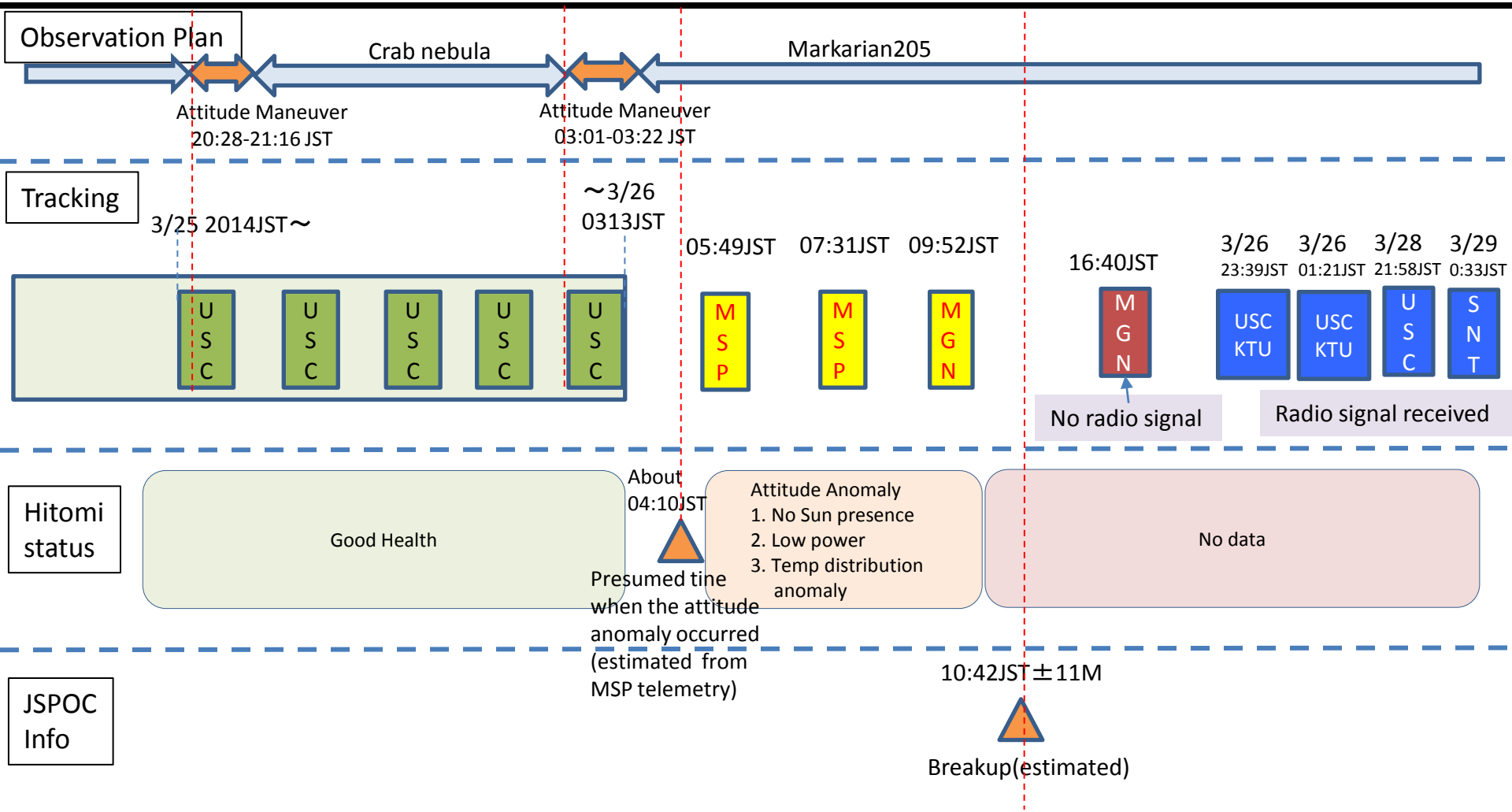
(2) Obtained Telemetry Data

- The plan was to practice Command/Telemetry Operation in USC and Ranging operation for trajectory determination in MSP or MGN.
- All the telemetry data including non-visible time have been obtained till USC operation, which ends at 03:02 on March 26.
- Only HK data during visible time have been obtained by MSP/MGN operation.



(3) Hitomi Sequence of Event

This shows the observation plan and satellite tracking condition based on events, including the JSpOC information.



Summary of Hitomi Condition based on the last 4 operation HK data

Time(JST)	Station	Attitude	Power	Communication	Data Handling	Temperature Distribution
3/26 03:02-03:13	USC	Normal	Normal	Normal	Normal	Normal
3/26 05:49-06:02	MSP	Anomaly	Lower power	Normal	Normal	Some parts higher, other parts lower than expected
3/26 07:31-07:44	MSP	Anomaly	Night time	Normal	Normal	Some parts higher, other parts lower than expected
3/26 09:52-10:04	MGN	Anomaly	Lower power (during day time)	Normal	Normal	Some parts higher, other parts lower than expected

(4) Status of Hitomi operation after Anomaly

- Receiving the telemetry data is our top priority to understand the current status of Hitomi.
- After communication anomaly, JAXA ground tracking stations are assigned. In the effort of obtaining the telemetry data from Hitomi, JAXA continues to send the command to the estimated trajectory.
- JAXA has received radio signals 4 times as follows, but not received telemetry data yet, therefore the health status has not been confirmed.
  - 3/26 23:49～23:52（for 3 min）@USC、23：48～23:51（for 3 min）@KTU
  - 3/27 01:23～01:27（for 4 min）@USC、01:21～01:27（for 6 min）@KTU
  - 3/28 22:06（for about 10 sec）@USC
  - 3/29 00:33（for about 6 sec）@SNT
- As far as JAXA understands, no other satellite was present when JAXA received these 4 radio signals. JAXA believes it is likely that these signals came from Hitomi.

Normal Condition

Hitomi

Command
(...01000...101...)

Telemetry
(...0010...00111...)

Antenna

Current Condition
（Only radio signals）

Hitomi

Command
(...01000...101...)

No Telemetry
(・・・・・・・・・・・・・)

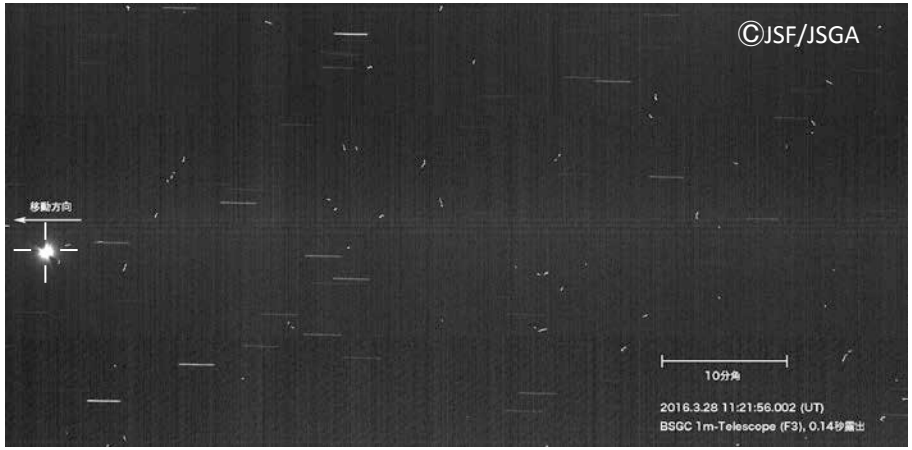
Antenna

(5) Observation Results by Radar or Telescope

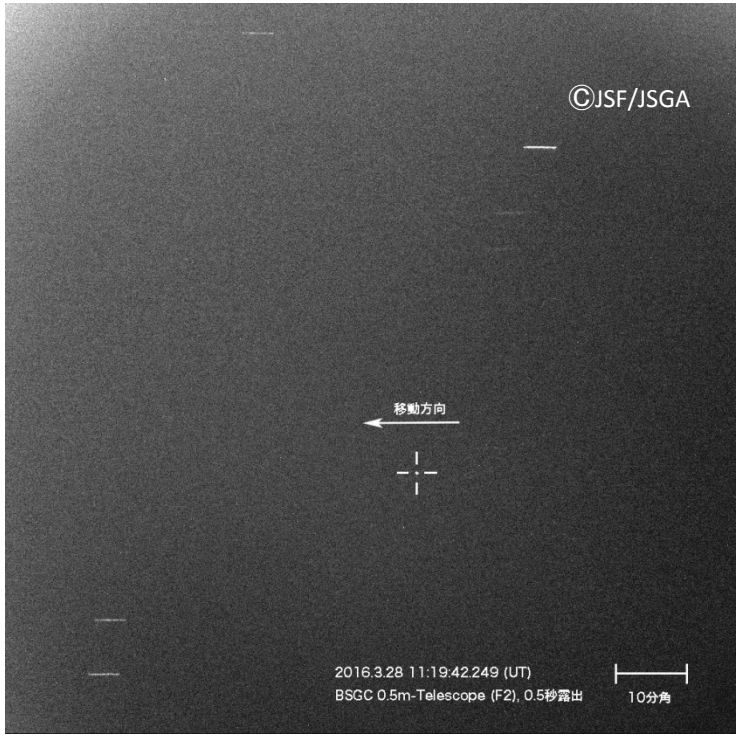
- After communication anomaly, Kamisaibara space guard center（KSGC）tries to capture Hitomi by radar, and Bisei space guard center（BSGC）tries to observe Hitomi by optical telescope.
- JSpOC announced five pieces were separated from HITOMI, but JAXA confirmed the trajectory of two pieces.
- By backtracking the trajectory of the two objects, it is confirmed that they were on almost the same trajectory as Hitomi at 10:37 on 26 March. That shows that the two objects are from Hitomi satellite.
- The estimated break-out time by JAXA is consistent with the time (10:42±11M), JSpOC reported.

JSpOC： Joint Space Operations Center

[Ref] Observation results by ground telescope



Picture 1： Image taken by Bisei Telescope at 20:21:56 on 28 March 2016 （1m caliber,0.14sec exposure）, 3-7 magnitude（The object on the image shows 3.2 magnitude）



Picture 2： Image taken by Bisei Telescope at 20:19:42 on 28 March 2016 （0.5m caliber,0.5sec exposure）, 5-9 magnitude（The object on the image shows 5.4 magnitude）

JSF: Japan Space Forum, JSGA: NPO Japan Space Guard Agency

(6) Current Operation for Recovery and Fault Analysis

- The first priority is to re-establish communications with Hitomi. JAXA is making the best effort for establishing the communication with Hitomi by sending the radio signals with commands by using the most possible chances of JAXA ground stations in Japan as well as in foreign countries.

- And also the detailed analysis and recovery schemes on the following events in under investigating by analyzing the obtained telemetry data, estimating the state of Hitomi, conducting fault tree analysis, etc.

1. Attitude Anomaly
2. Some Objects Separation
3. Communication Anomaly