Suzaku Mission Status
(Presentation in the US senior review)

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Suzaku Mission Status

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What is Suzaku?

• High-sensitivity wide-band X-ray spectrometer, all in one observatory

• High-sensitive soft X-ray spectrometer for spatially extended emission

• Soft X-ray spectrometer with the best CCD spectral response, in particular, in low energy range (0.4-1 keV)

• Well calibrated, well understood instruments

   Unique and Powerful observatory
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- High-sensitive soft X-ray spectrometer, in particular, for spatial extended emission
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Unique and Powerful observatory

Wide-band spectroscopy

XRT (X-ray Telescope)

XIS (X-ray Imaging Spectrometer)

HXD (Hard X-ray Detector)
What is Suzaku?

- High-sensitivity wide-band X-ray spectrometer all in one observatory

- High-sensitive soft X-ray spectrometer, in particular, for spatial extended emission

- Soft X-ray spectrometer with the best CDD spectral response, in particular, for spatially extended emission (0.4-1 keV)

- Well calibrated, well understood instruments

Beyond the virial radius of clusters
What is Suzaku?

- High-sensitivity wide-band X-ray spectrometer all in one observatory
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What is Suzaku?

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Unique and Powerful observatory
Spacecraft status

• Orbit
  – Prigee > 530km; 3 more years till it reaches < 500km

• Attitude control system
  – Four gyros out of five are healthy. One is noisy, but usable

• Power system
  – A rapid degradation of –200W/year was observed in 2011-2012, but it returned steady degradation of –30W/year now. Reduction of power generation was mitigated by reducing power consumption by e.g. stopping cryocooler technical demonstration.
  – Degradation in one side of battery is being mitigated by heater operation. (more details are shown later)

• Program status in Japan
  – The steering committee of space science recommended ISAS to support Suzaku operation at least until July 2015. We will submit a new proposal next year and expect approval for continuing the mission. (because Suzaku is highly rated in the recent annual review of ISAS)
  – We plan to continue GO program as far as a pointing observation with a single XIS sensor is possible.
Longest lifetime among 5 Japanese X-ray astronomy satellites

(~500 km low earth orbit)
Power system
(1) Solar cells

PCU_IN_OUT_PLOT_cycle.dat

July 2005
~20 W/year
July 2011
~200 W/year
July 2012
~30 W/year
March 2014

~3 years till we need to turn off a part of science instruments.
Power system
(2) Batteries -1

• Suzaku carries two independent sets of batteries, BAT-A and B. They are not redundant in design; we supposed to use both to fully operate the satellite.

• Capacity of BAT-B reduced significantly around January 12, 2014. We suspect semi-shortage of some of battery cells of BAT-B. (Please notice that Suzaku in LEO, and batteries experienced ~48,000 charge/discharge cycles.) Only ~1/10 of power can be taken out from BAT-B.

• The spacecraft turned into the safe-hold mode because of power shortage.

• We reduced the power in sun shade by turning off most of heaters. Instead we warm up the spacecraft in sun light by larger heater power. It is like charging energy in a form of heat instead of electricity.

• It took more than a month to establish this new power mode.

• The spacecraft recovered from the safe-hold mode and restarted ordinary GO observation resumed on February 19, 2014.

• Degree of discharge of BAT-A increased, although the present value, 15%, is the nominal designed value. We are carefully monitoring the charge/discharge behavior of BAT-A.
Power system
(2) Batteries -2

8 Dec. 2013

22 Feb. 2014

Power (W)

Heater

BAT-A

BAT-B

DOD~10%

DOD~15%

Power consumption

Sunlight

Shade

BAT out

Power consumption

Sunlight

Shade

BAT out

BAT-A

BAT-B
Power system
(2) Batteries -2

8 Dec. 2013

Power consumption

Sunlight Shade

BAT out

DOD~10%

Heater

500

400

300

200

100

0

Power (W)

22 Feb. 2014

Power consumption

Sunlight Shade

BAT out

DOD~15%

Heater

500

400

300

200

100

0

Power (W)
Power system
(2) Batteries -3

8 Dec. 2013

22 Feb. 2014

Power consumption

DOD~10%

DOD~15%

Power (W)

Sunlight Shade BAT out

Sunlight Shade BAT out

Heater

BAT-A

BAT-B

BAT-A

BAT-B

HXD

XIS

Single XIS sensor
Status of observation program

GO regular proposal over-subscription rate

Reserved ToO (GO)  Real-time ToO (DDT)

Exposure (ks)  # of Obs.

Key project: from cycle 4

Collaboration with other observatories

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Japan-US Interdependence
Since October 2011

US | Japan | joint | parallel

S/C tracking, data receiving & commanding
Observation scheduling

Spacecraft & bus instruments
HXD  XRT  XIS

Remote proposal system
Proposal selection
Contact scientists
Data distribution

Analysis software system
Analysis helpdesk

Processing software
Calibration database
Pipeline processing

US archive
Japan archive

US PIs
J PIs
Plans for next upcoming years

- Best use of “final” two years of Suzaku.
  - Observations which strengthen or complete excellent previous Suzaku results
  - Observations which optimize the Astro-H program
- Continue GO observations as far as pointing observations with ≥1 XIS sensor(s) are possible.
- Continue Key projects, though their scientific purpose must be fulfilled within single GO cycle (1 year).

ASTRO-H, scheduled for launch in 2015 (JFY).