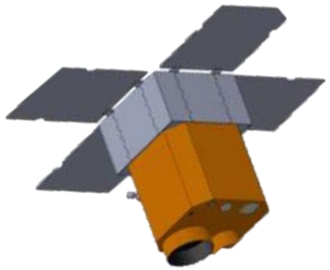


Japanese spaceborne hyperspectral sensor constellation project

Takahiro Kawashima[1], Akira Iwasaki[1], Takayoshi Fukuyo[2], Ryo Suzumoto[2], Ryo Ui[2], Keita Ito[3], Takashi Sukegawa[4], Haosheng Lin[5], Hirofumi Kasahara[6]

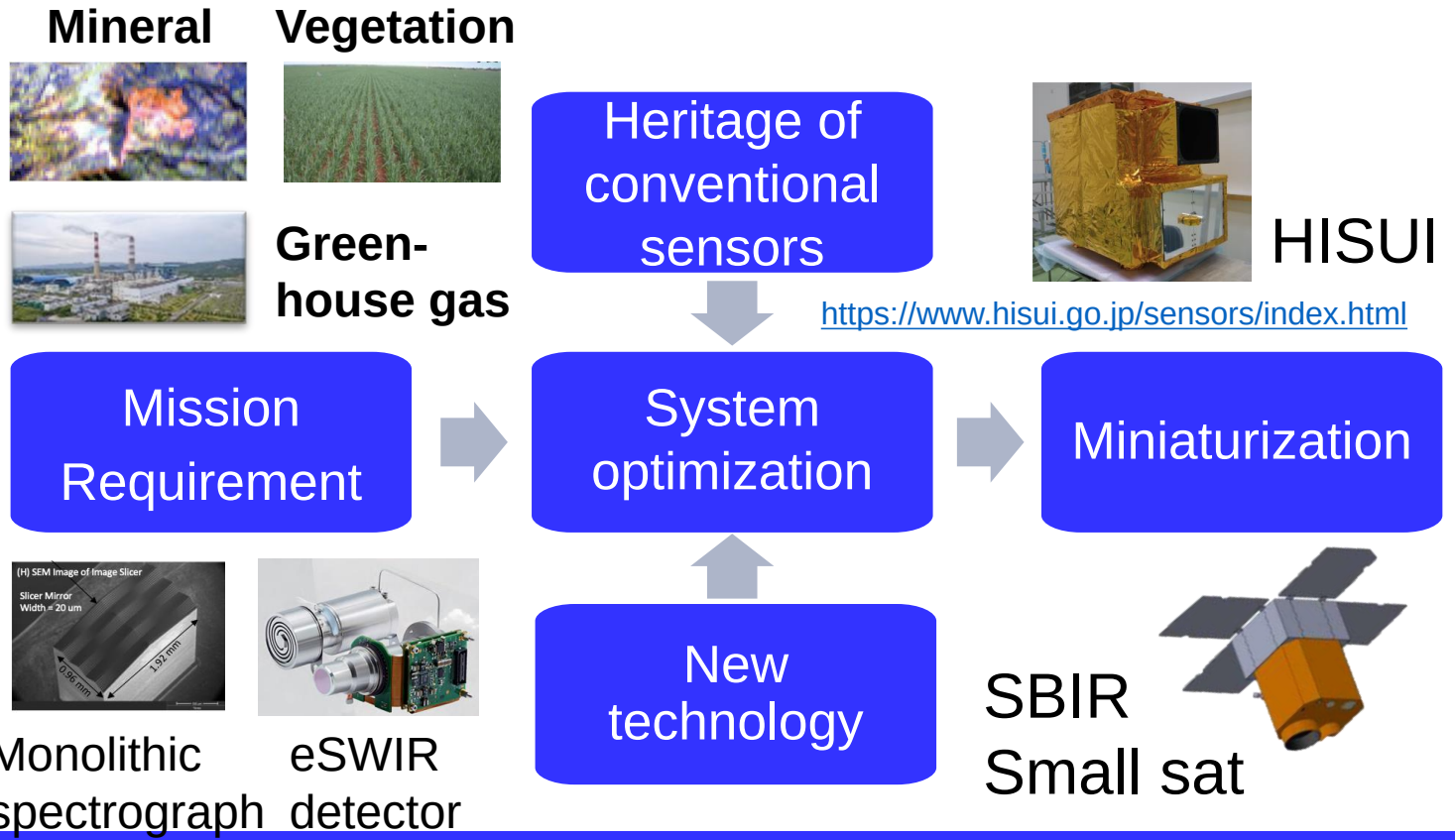
[1]The University of Tokyo,
[2]ArkEdge Space Inc., [3]Space BD Inc.,
[4]CANON Inc., [5]HI-Spectral LLC, [6]MUFG Bank Ltd.

Overview

- The Small Hyperspectral Sensor Satellite Project is being newly developed under the Small Business Innovation Research (SBIR) program, led by Japanese Ministry of Economy, Trade, and Industry (METI) and scheduled for launch in 2027
- While the observation specifications are similar to those of the ISS-borne HISUI, it aims to reduce both mass and cost to about 1/10th of the HISUI.

<Main Specification>

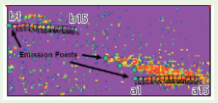
Type	**Hyperspectral sensor (grating type)**
Scan method	**Push-broom scan**
Wavelength region	**400 - 2500 nm**
Spectral sampling	**10 nm**
GSD	**30m**
Swath	**19km**
SNR	**~250**
Size and mass (allocated for payload)	**200 x 200 x400mm (12U), 20~25kg**



Miniaturization from HISUI to SBIR hyperspectral sensor

Target	Satellite	Scanning method	Telescope	Spectrometer	Detector	Signal processor

Mineral

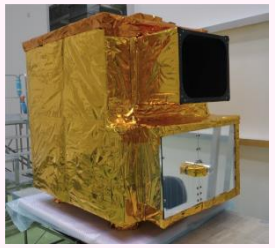


Coast

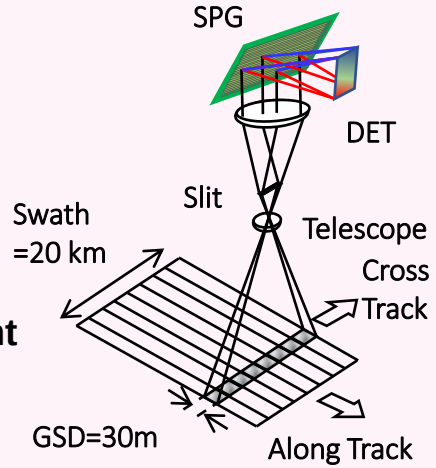
Agriculture
Vegetation
etc..

Green
House gas

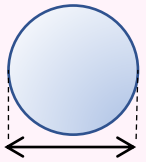
https://www.hisui.go.jp/sensors/index.html



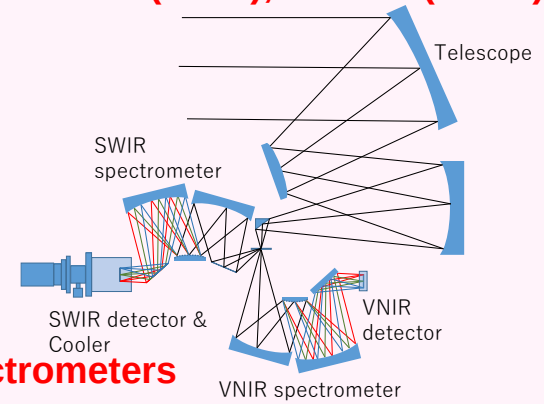
HISUI (2019)
190kg (instrument only)
***Borne on ISS**



Wavelength region:
400 - 2500nm
Spectral sampling :
10nm (VNIR), 12.5nm (SWIR)



Aperture:
300mm

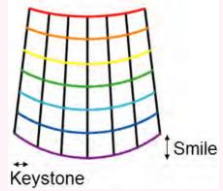


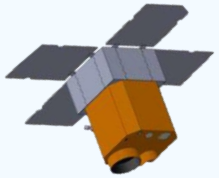
2 spectrometers

Custom-made detectors for VNIR&SWIR each
Pixel pitch : 30μm

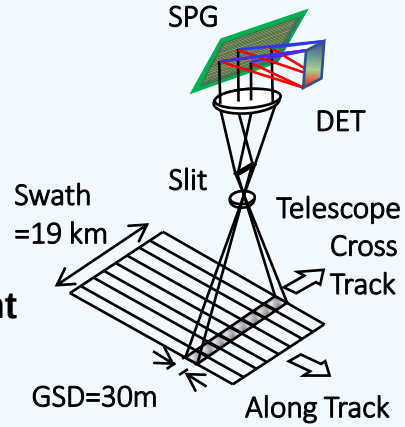
HgCdTe for SWIR (120K)
※sample image

- **Data compression**
- **Binning**
- **Radiometric correction**
- **Smile correction**

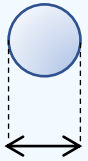




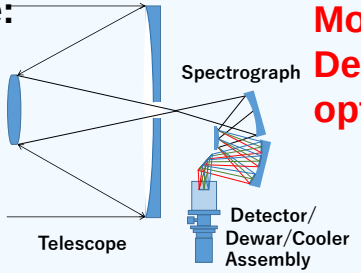
SBIR sat (2027)
~25kg (instrument only)
~100kg (Bus + Panchromatic senor)



Wavelength region:
400- 2500nm
Spectral sampling:
10nm

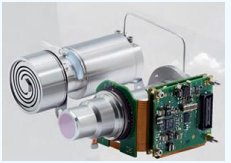


Aperture:
170mm



1 spectrometer
Monolithic&
Demagnification optics

Commercial detector (VNIR/SWIR integrated)
Pixel pitch : 15μm



HgCdTe for SWIR (180K)
⇒miniature cooler
※sample image

***Additional for data reduction**

- **Cloud removal**

Development plan

- Engineering and flight models will be manufactured over the next two years.
- To shorten the development term, an EFM method, i.e. an EM compatible with the FM, will be manufactured, tested and evaluated, and then refurbished into the FM.
- An end-to-end simulator is developed, and correlation with hardware to increase the accuracy of performance simulation, accelerate design evaluation, and reduce rework due to defects to realize short term delivery of a total of two years.