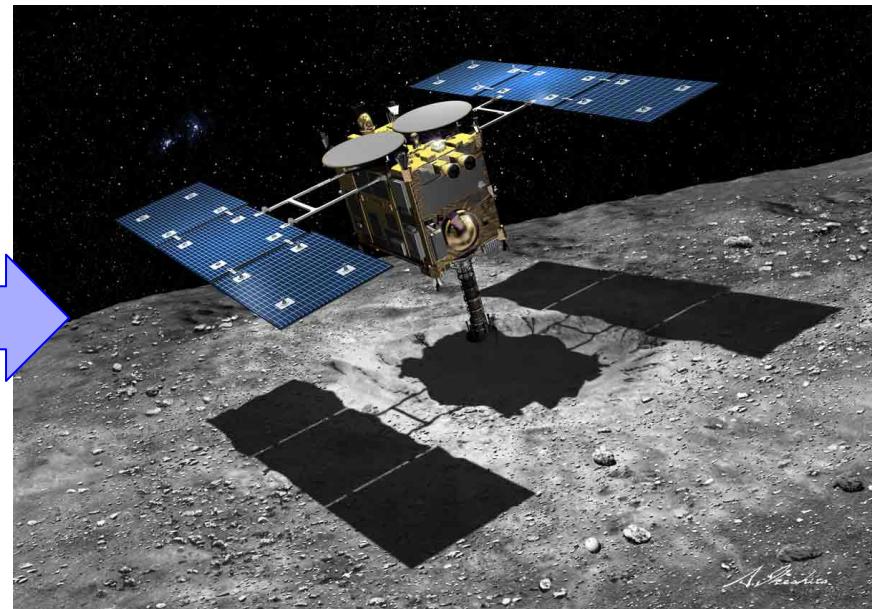
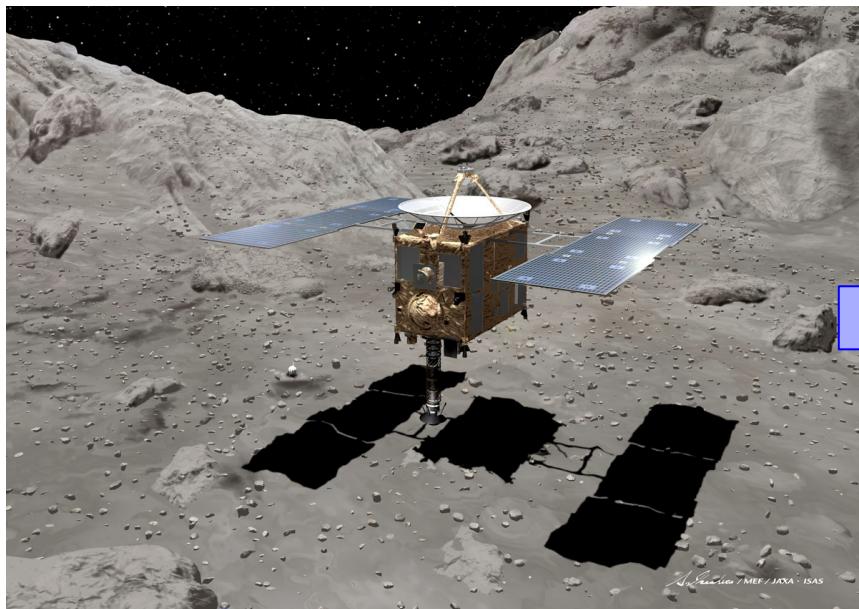


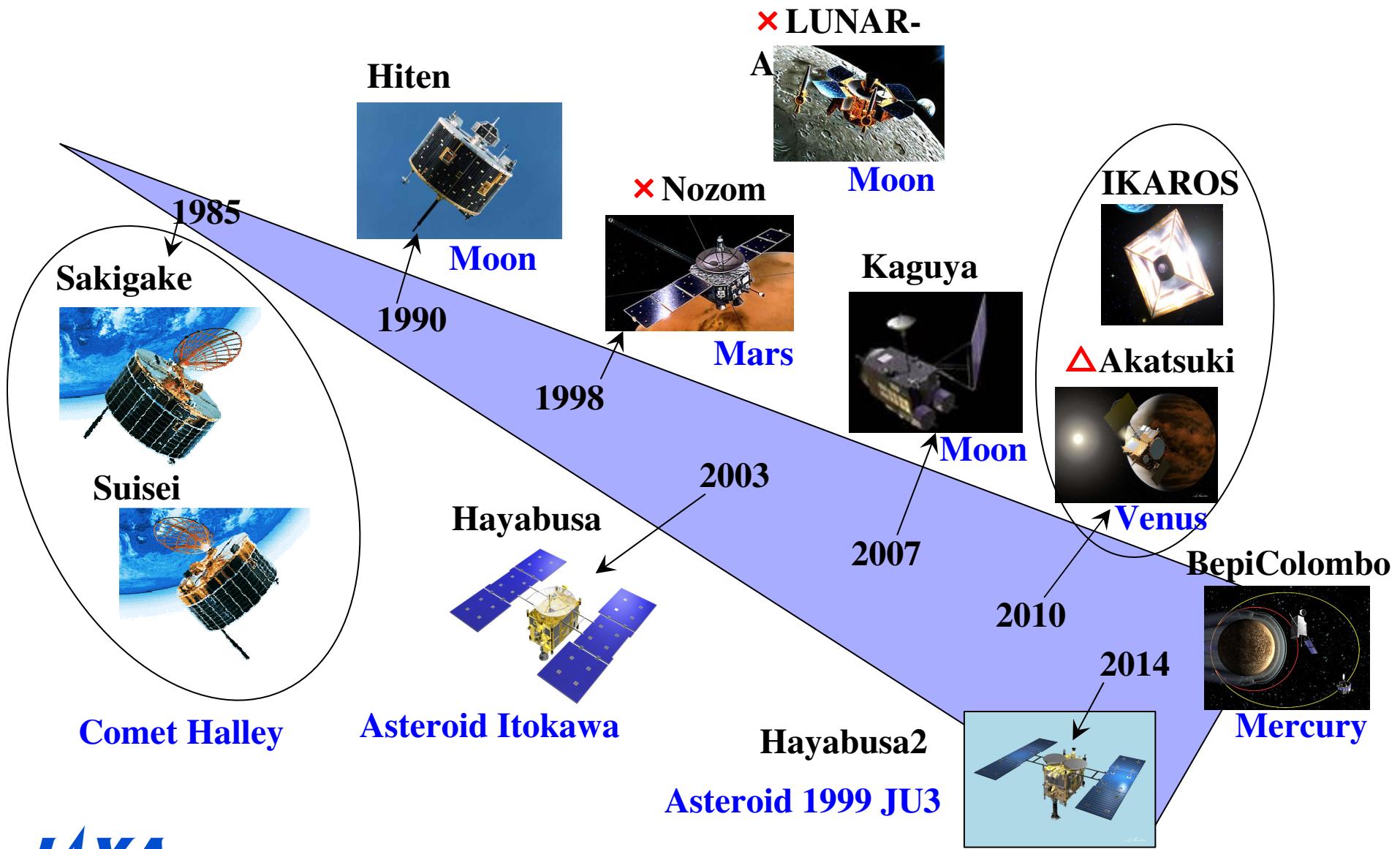
Japan's Asteroid Missions Hayabusa and Hayabusa2



COPUOS 2013
February 15, 2013, Vienna, Austria

Makoto Yoshikawa
Hayabusa & Hayabusa2 Project Team, JAXA

Lunar and Planetary Missions of Japan

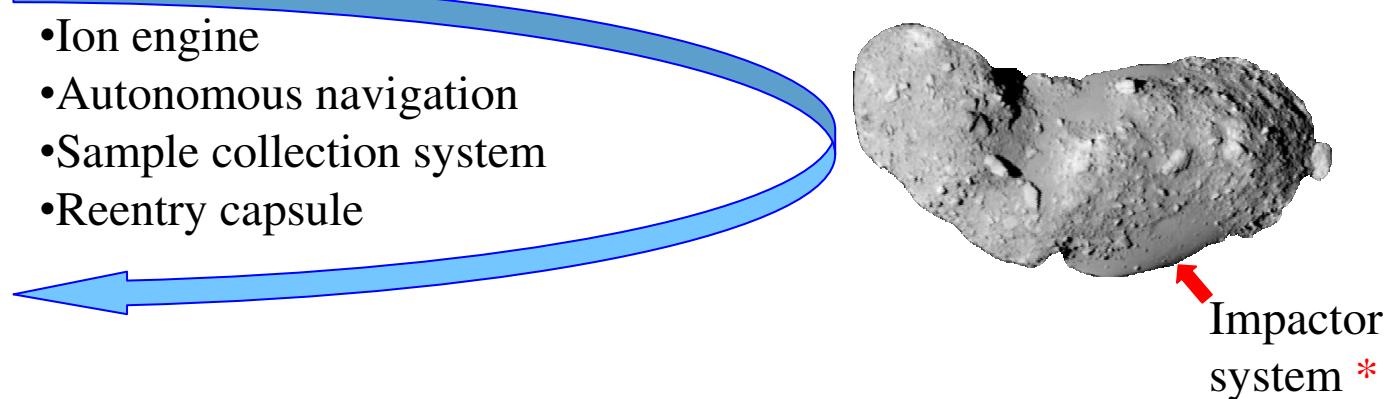


Challenges of Hayabusa and Hayabusa2

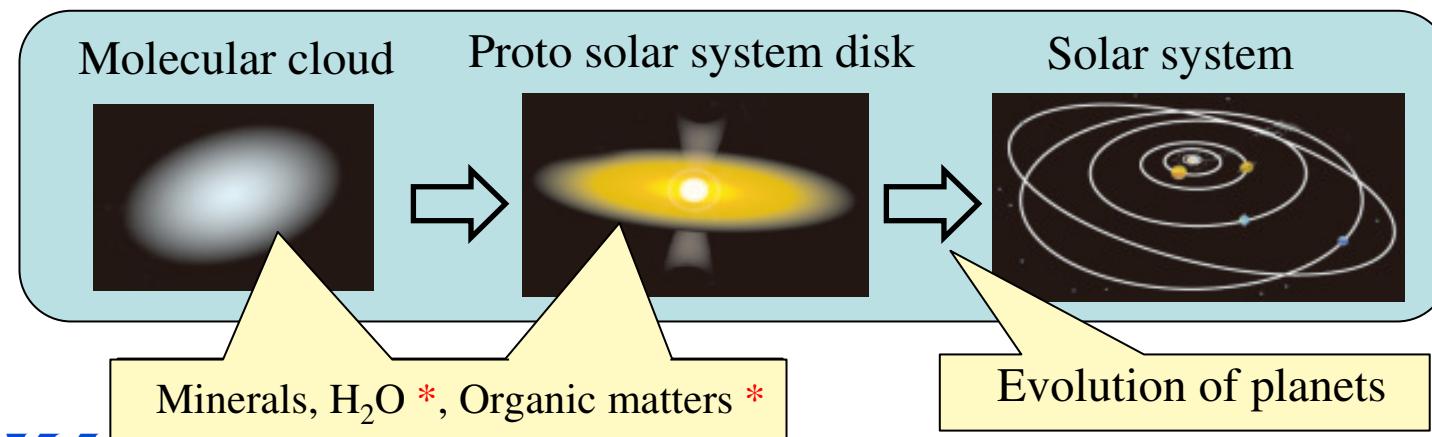
Development of the technology for asteroid sample return



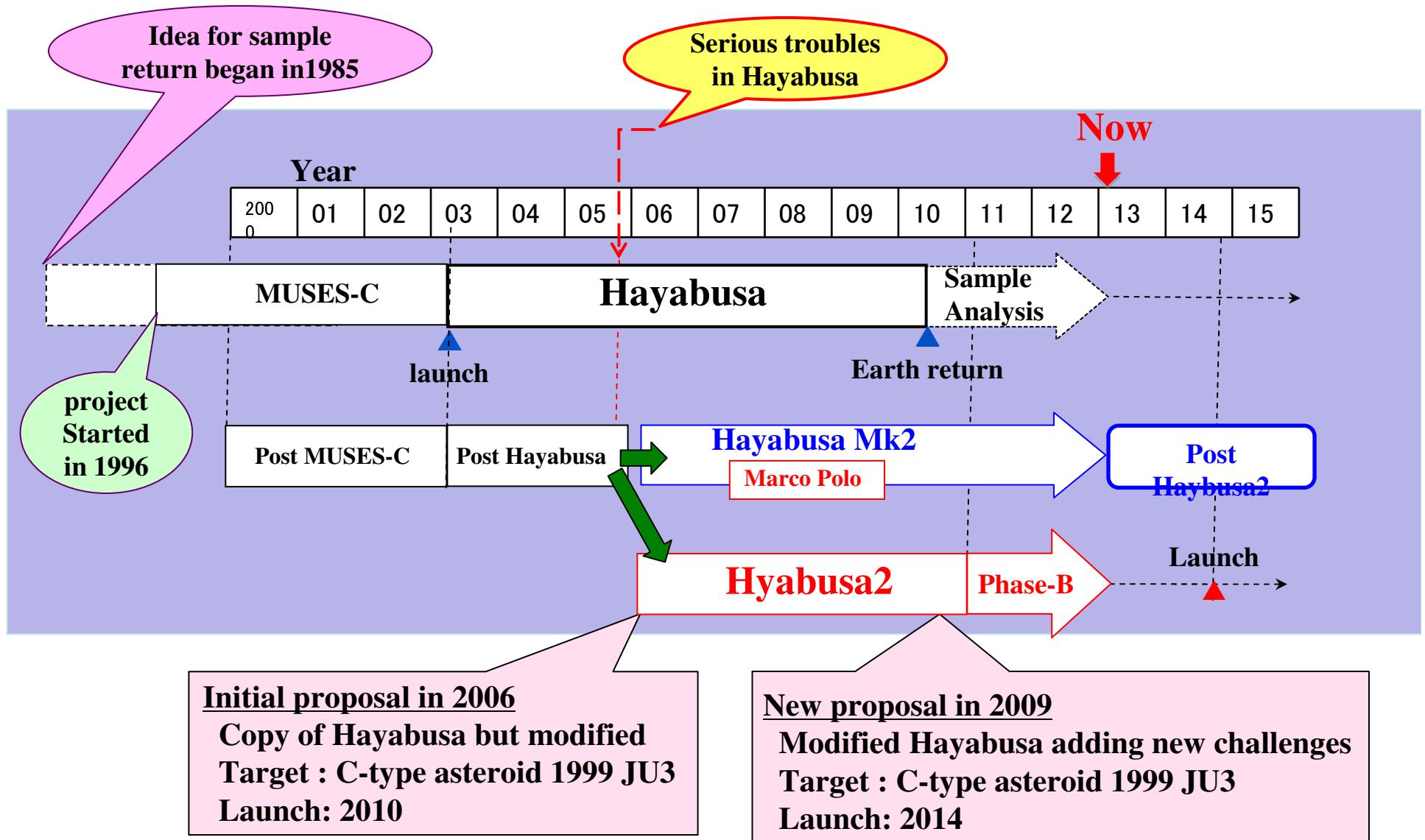
- Ion engine
- Autonomous navigation
- Sample collection system
- Reentry capsule



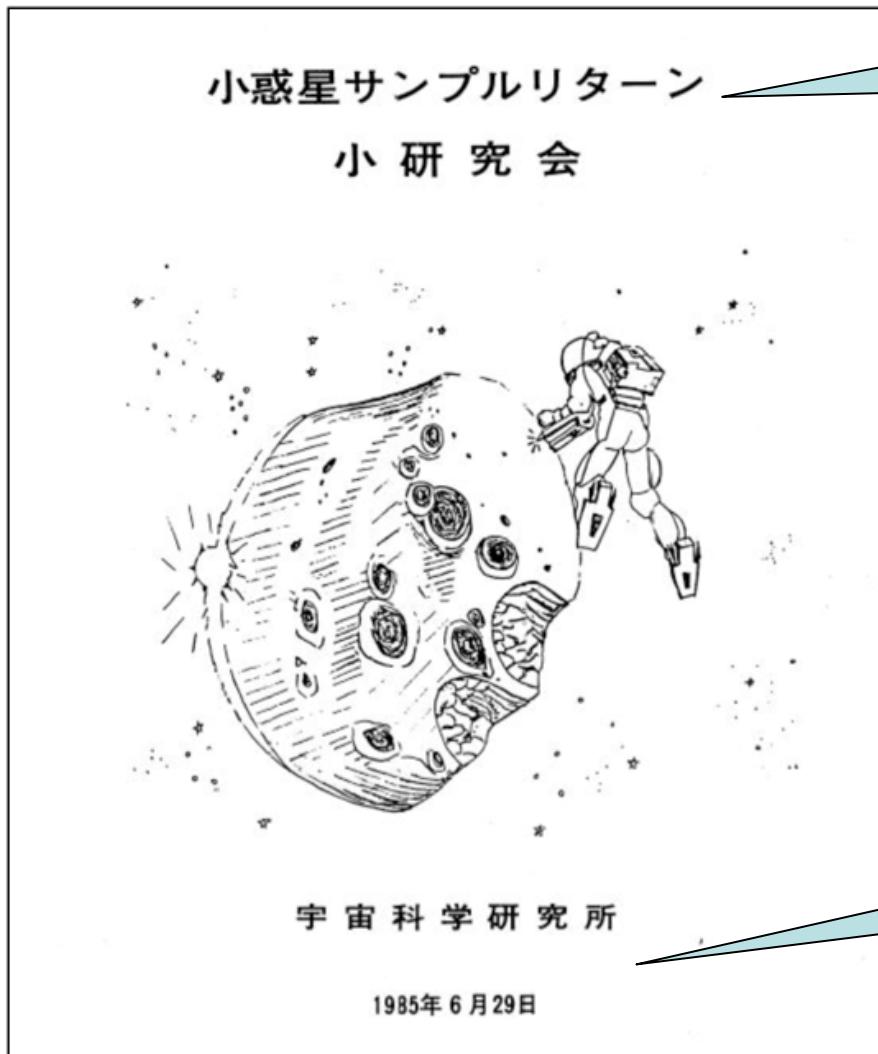
Study of the origin and evolution of the solar system



History of Hayabusa and Hayabusa2



Starting point of Hayabusa



Small Meeting for
Asteroid Sample Return
Mission

ISAS
June 29, 1985

Cover of meeting

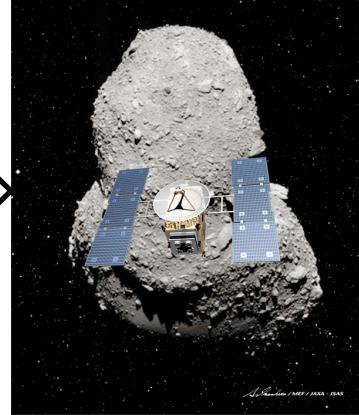
Mission Scenario of Hayabusa



Launch
9 May 2003

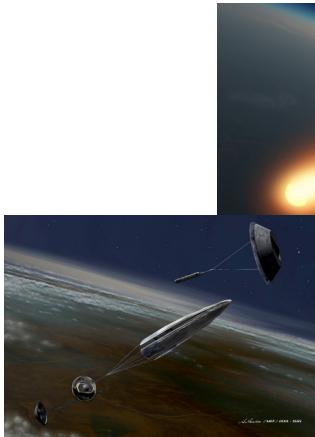


Earth Swingby
19 May 2004

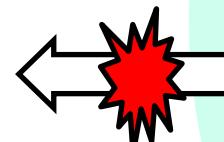


Asteroid Arrival
12 Sept. 2005

Observations, sampling



Earth Return
13 June 2010



Serious
troubles



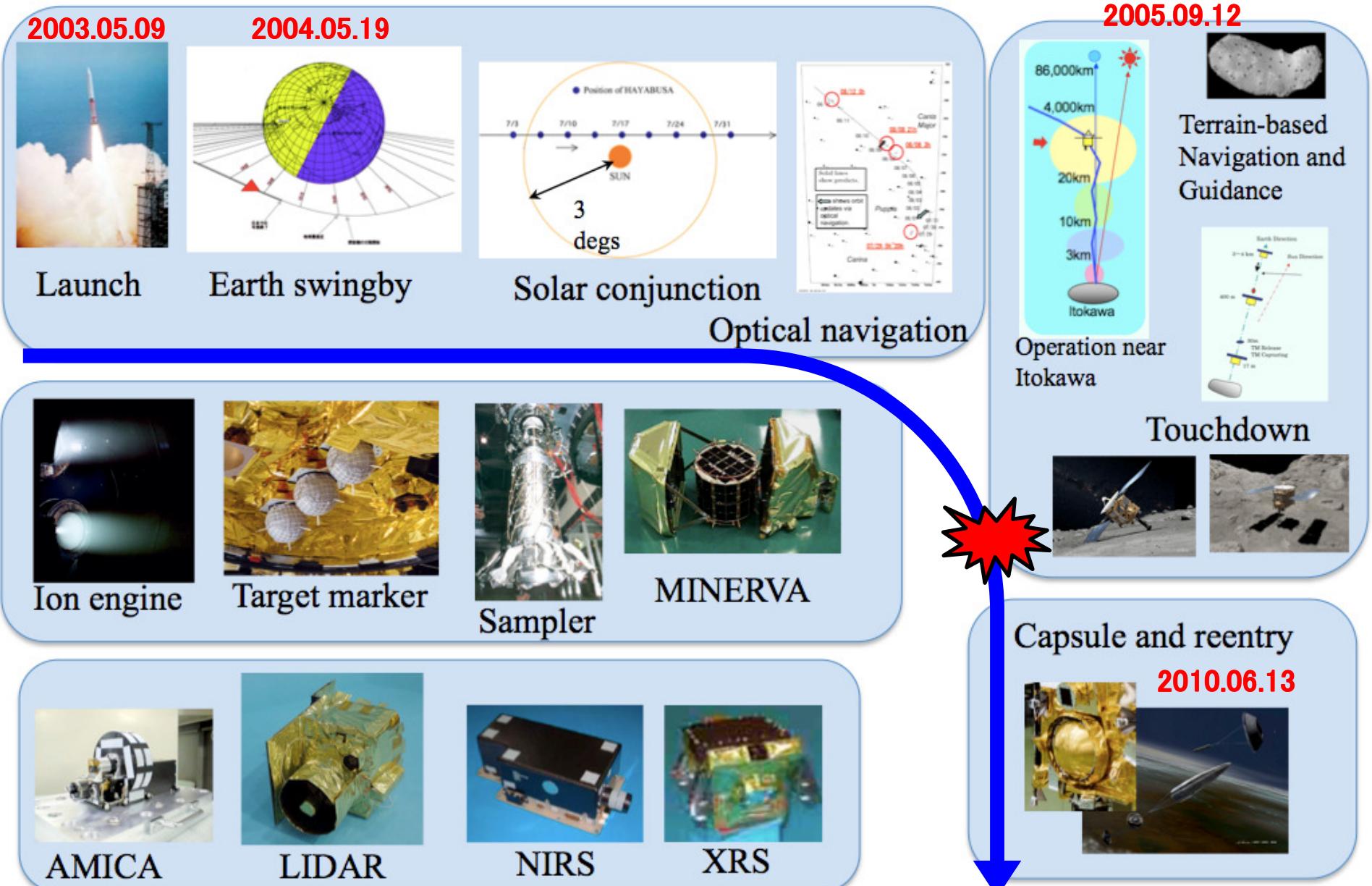


Fireball of the reentry capsule and spacecraft of HAYABUSA 2010/06/13/22:22 LST

Hayabusa Reentry Observation Team, National Astronomical Observatory of Japan

Photo by Dr. Kouji Ohnishi, @ Coober Pedy, South Australia

Engineering of Hayabusa



February 15, 2013

COPUOS 2013

Images of Itokawa

Eastern Side



Release 051101-1 ISAS/JAXA

Western Side



Release 051101-2 ISAS/JAXA

Release 051101-3 ISAS/JAXA

Head

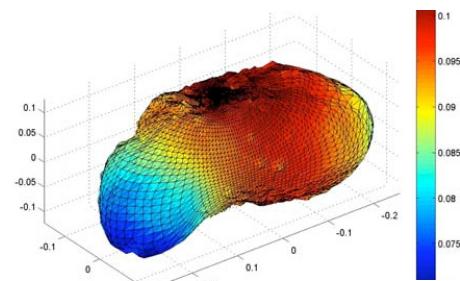
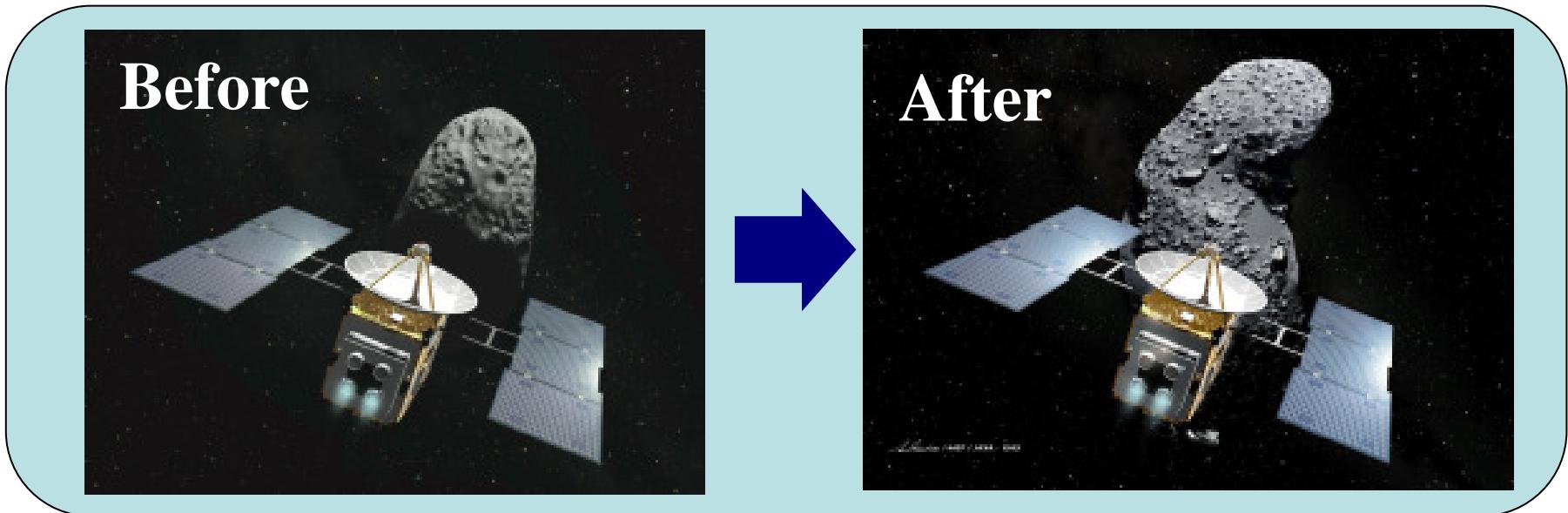


Bottom

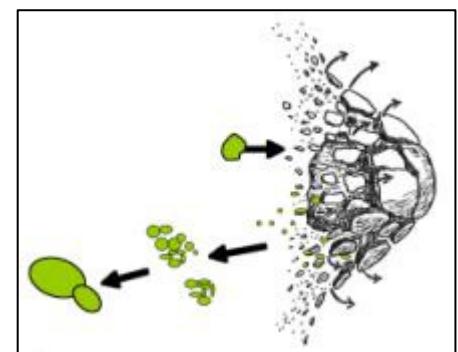
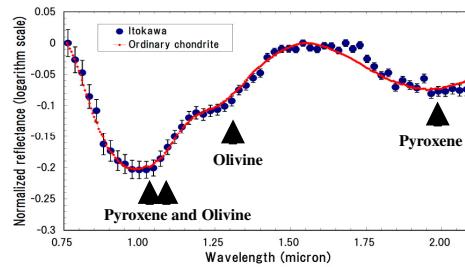
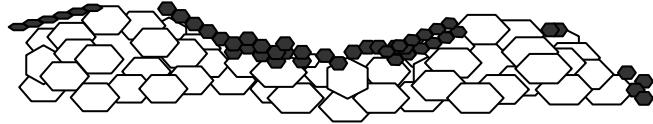


Release 051101-4 ISAS/JAXA

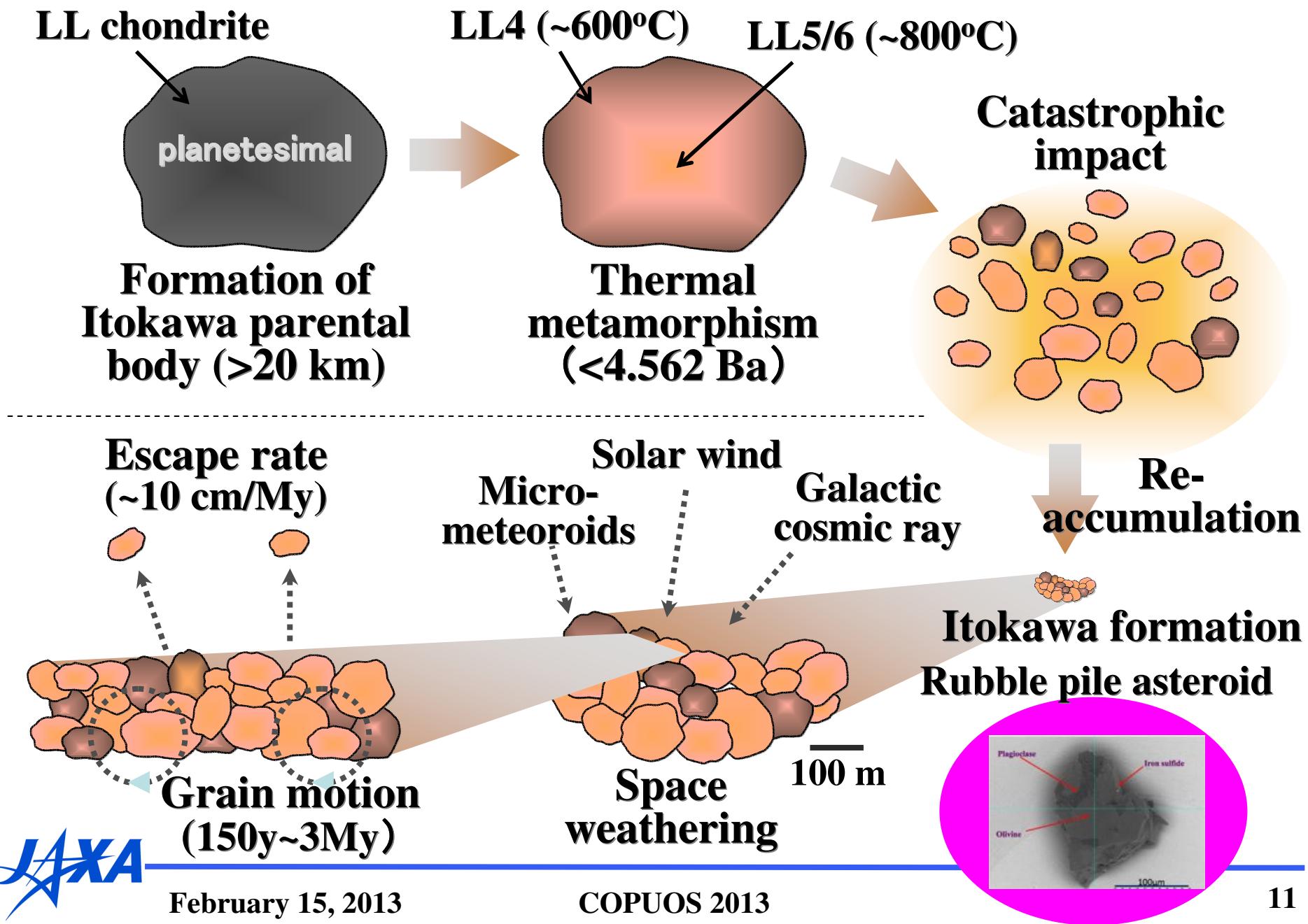
Scientific Results from Remote Sensing



- Mass
- Shape => volume
- Density



Scientific Results from Sample Initial Analysis



Science Publications

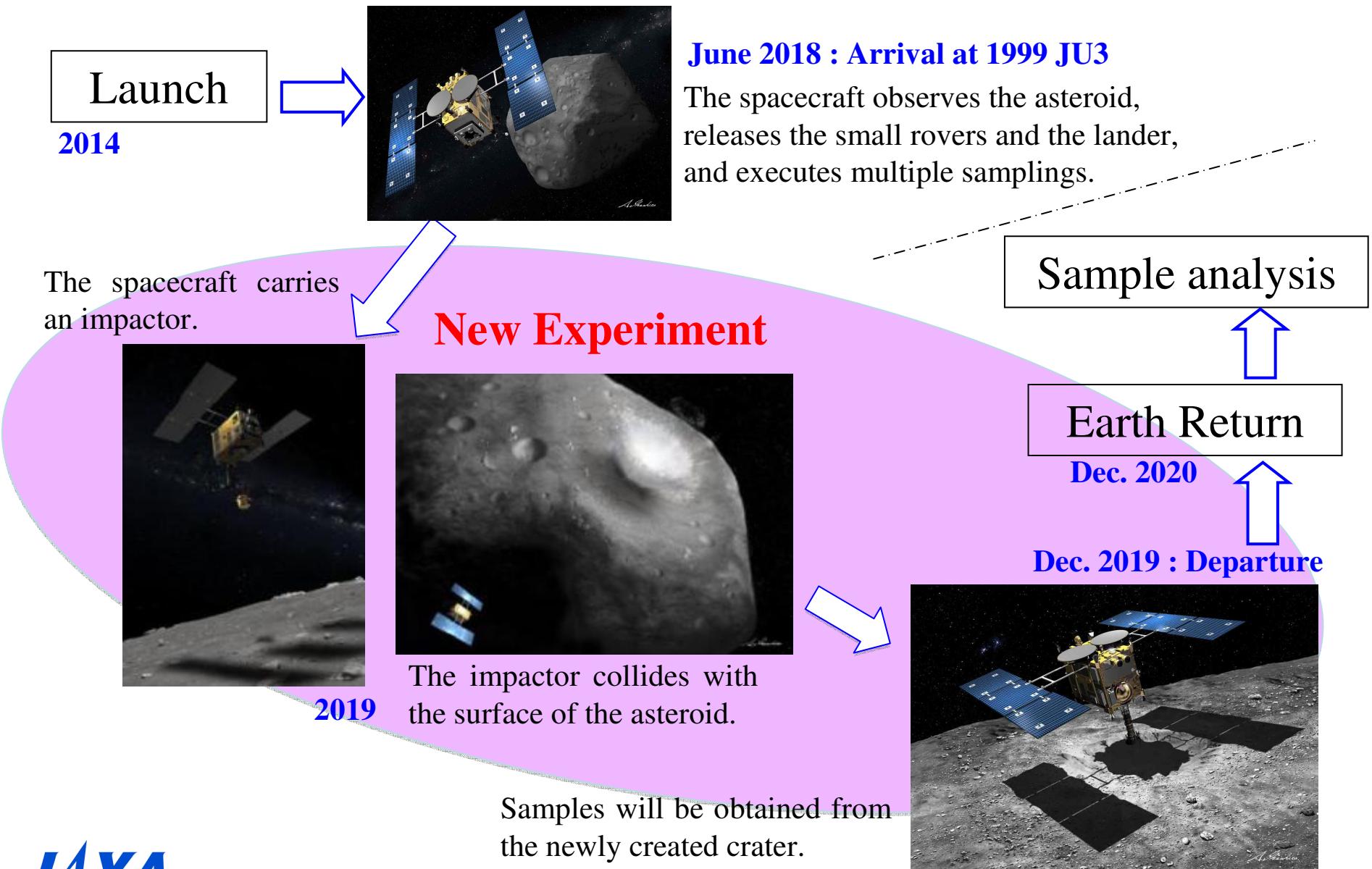


2 June 2006



26 August 2011

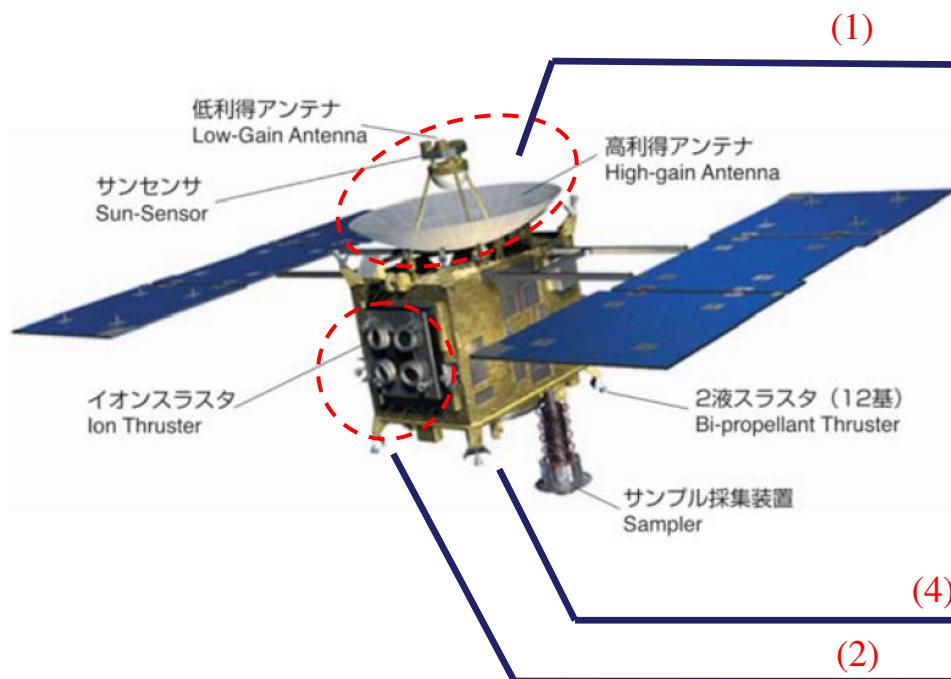
Hayabusa2 Mission Outline



Hayabusa vs. Hayabusa2

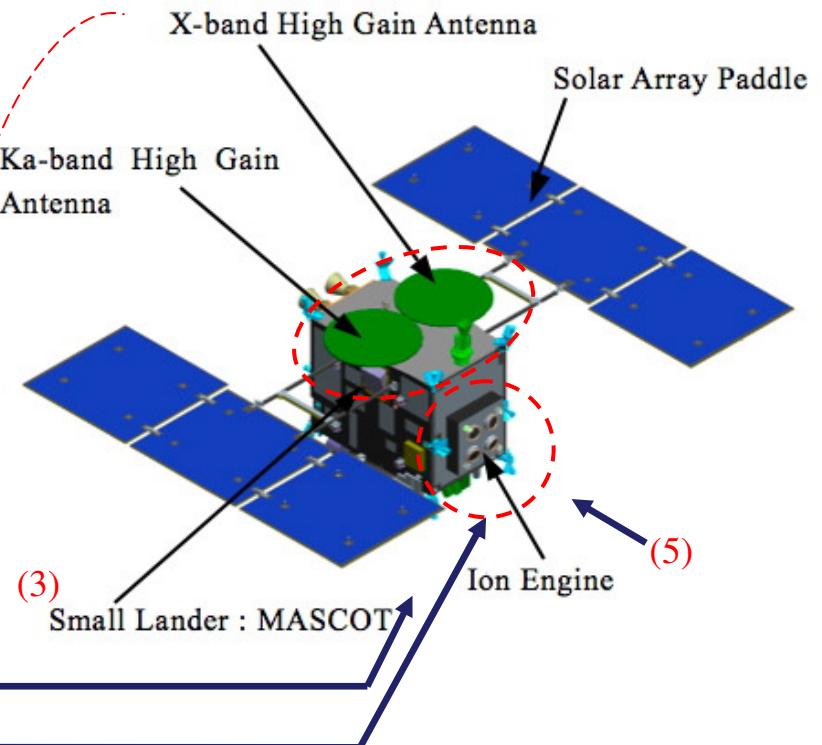
Hayabusa

Size : $1m \times 1.6m \times 1.1m$
(body)
Mass: 510kg (Wet)



Hayabusa2

Size : $1m \times 1.6m \times 1.25m$ (body)
Mass: 600kg (Wet)



- (1) Communication : X-band + Ka-band
- (2) Ion engine : modified
- (3) Small lander : MASCOT(Mobile Asteroid Surface Scout) from DLR
- (4) AOCS : 4 reaction wheels
- (5) Impactor

Target Asteroid : 1999 JU3

Current estimate:

Rotation period: 7.625 ± 0.003 h *¹

Shape : almost spherical *¹

Size : 0.87 ± 0.03 km *²

Albedo : 0.070 ± 0.006 *²

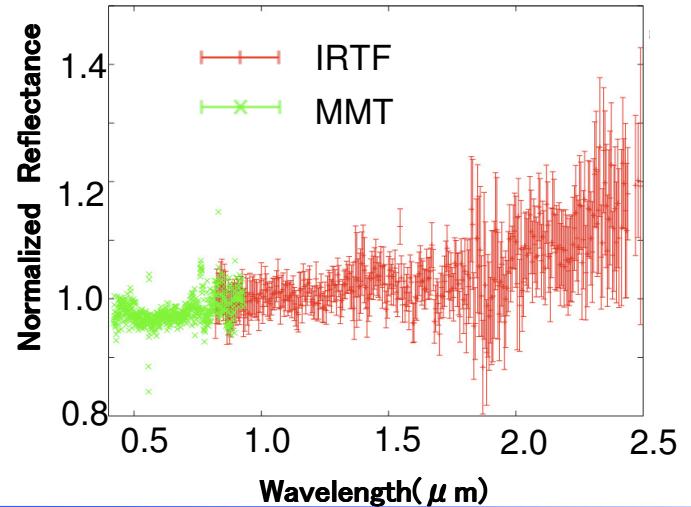
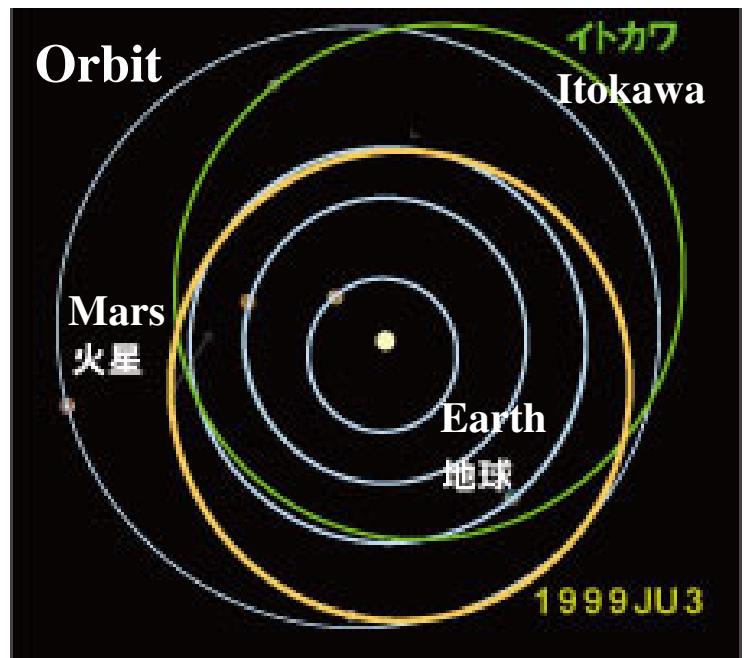
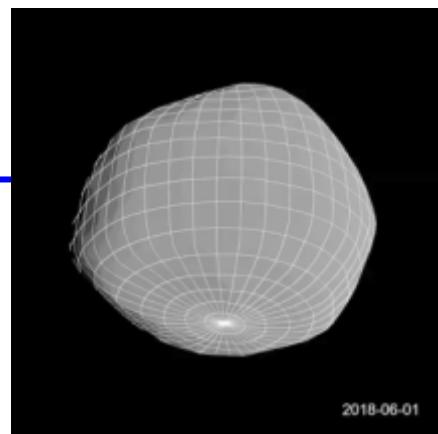
H= 18.69 ± 0.07 , G= -0.09 ± 0.03 *¹

Type : Cg

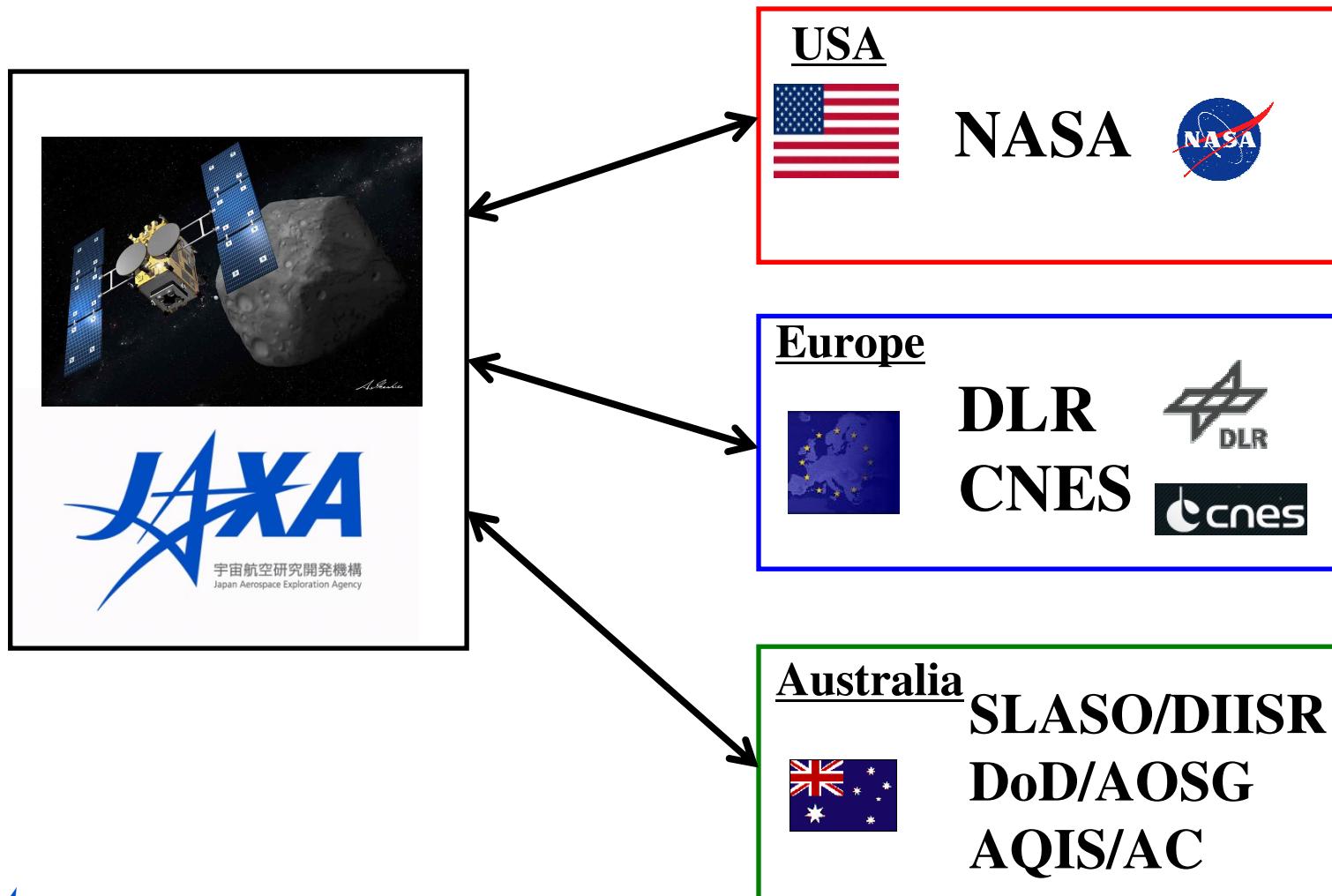
*¹:Kim et al. *²:Mueller et al



(by Mueller et al.)



International Cooperation on Hayabusa2



Importance of Small Solar System Bodies

