



AKATSUKI RETURNS TO VENUS

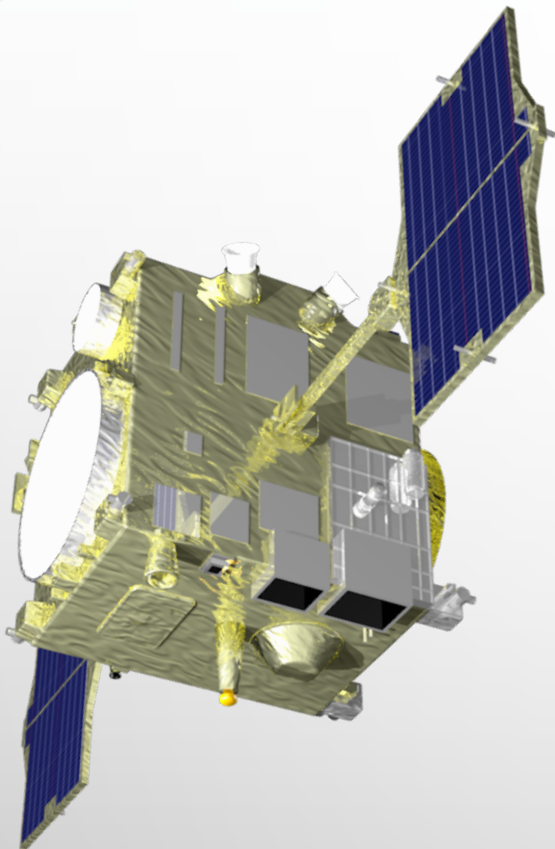
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AKATSUKI PROJECT TEAM

VENUS SEEN ON JANUARY 1, 2016



Akatsuki is now orbiting this planet ...

SPACECRAFT



Body	1.04 [m] x 1.45 [m] x 1.40 [m]	
Weight	(dry) 321 kg (wet) 518 kg (@launch) (wet) 377 kg (2015/5/1)	
Mission instruments	1 μ m camera (IR1) 2 μ m camera (IR2) Long infrared camera (LIR) UC imager(UVI) Lightning and Airglow camera (LAC) Ultra Stable Oscillator (USO)	
Propulsion system	Orbital maneuver engine (OME): Reaction control system(RCS):	500N class 23N class x 8 3N class x 4
Antenna	HGA-T/R (X band) MGA-A/B (X band) LGA-A/B (X band)	

Launch

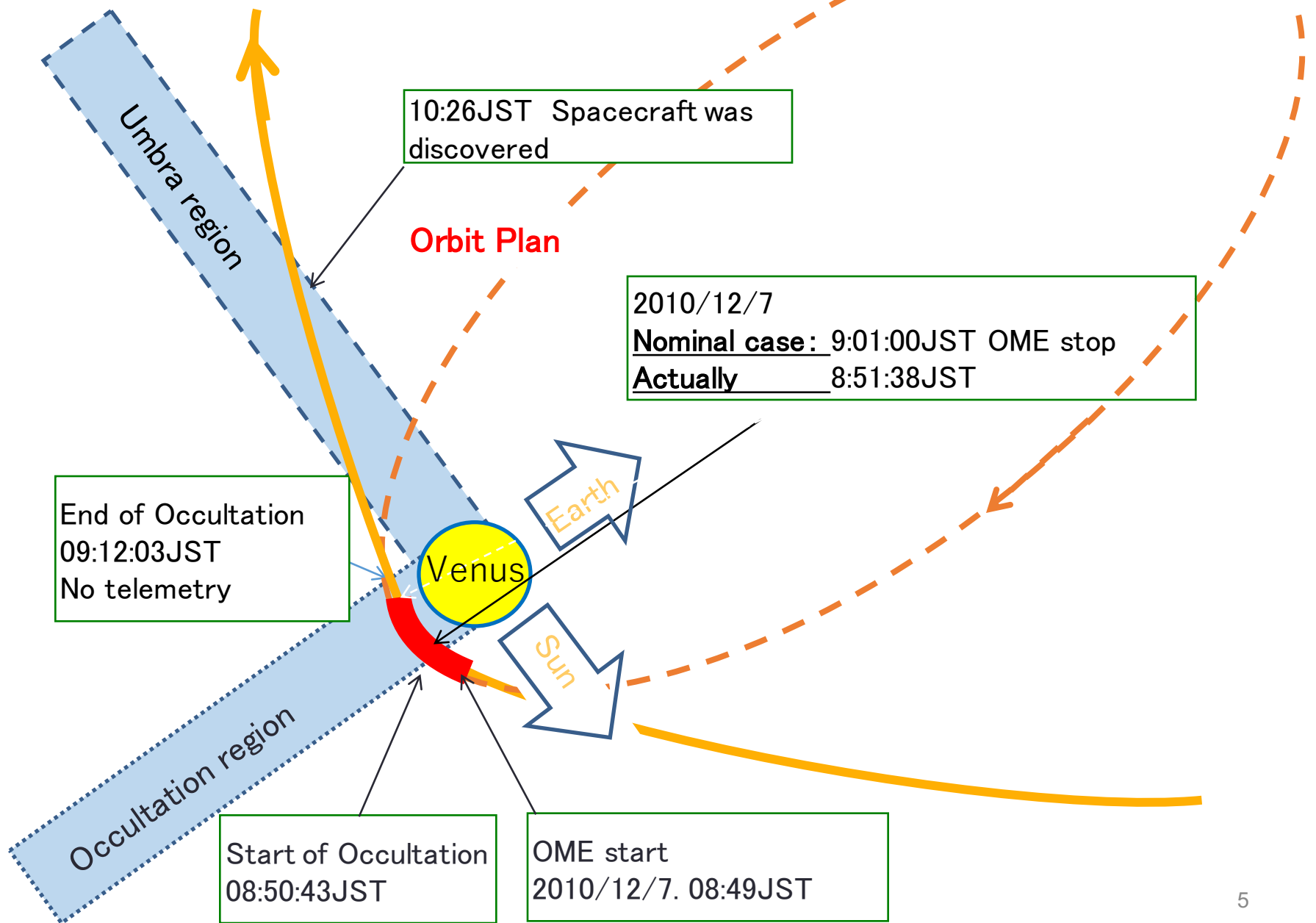
May 21st 2010 6:58:22JST



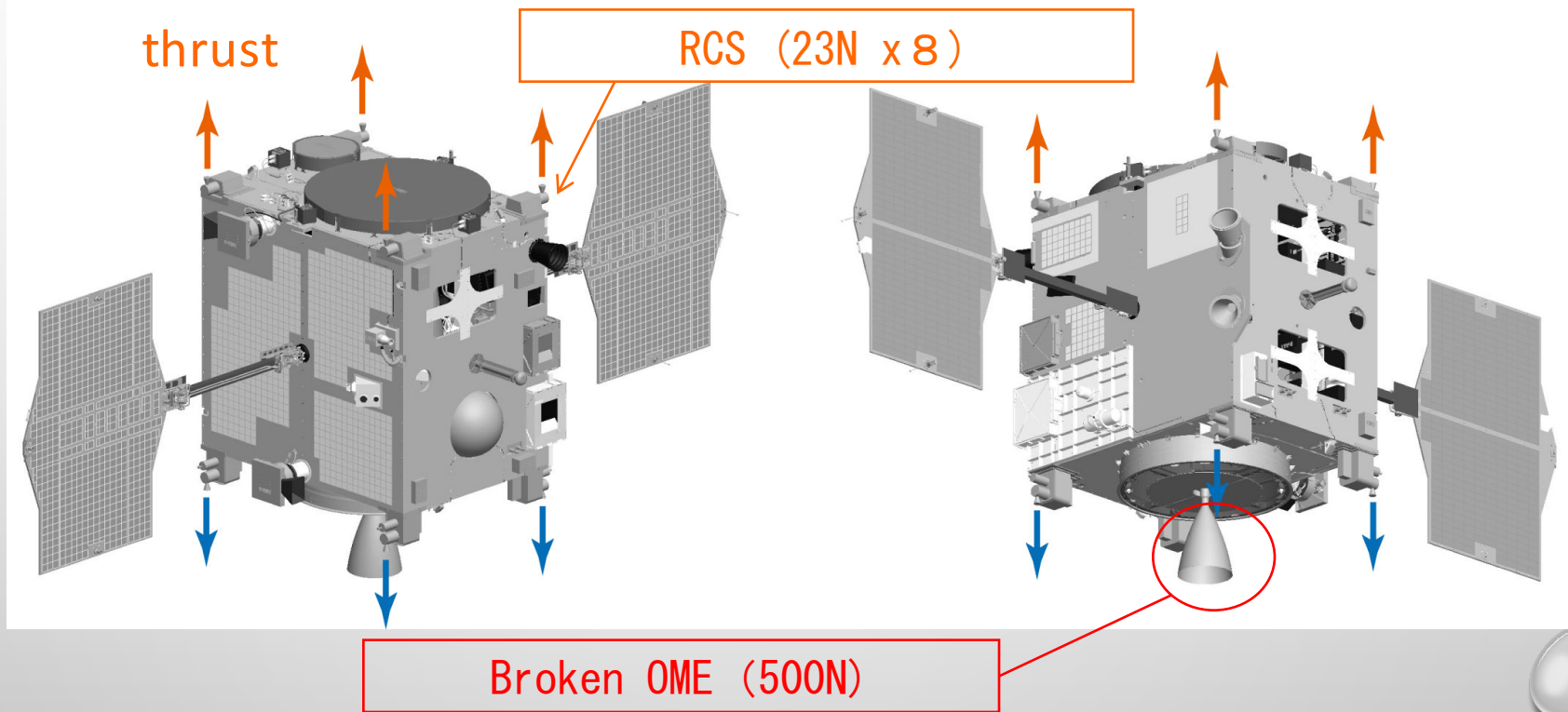
7:25
Spacecraft
separation



Failure of VOI on December 7th, 2010

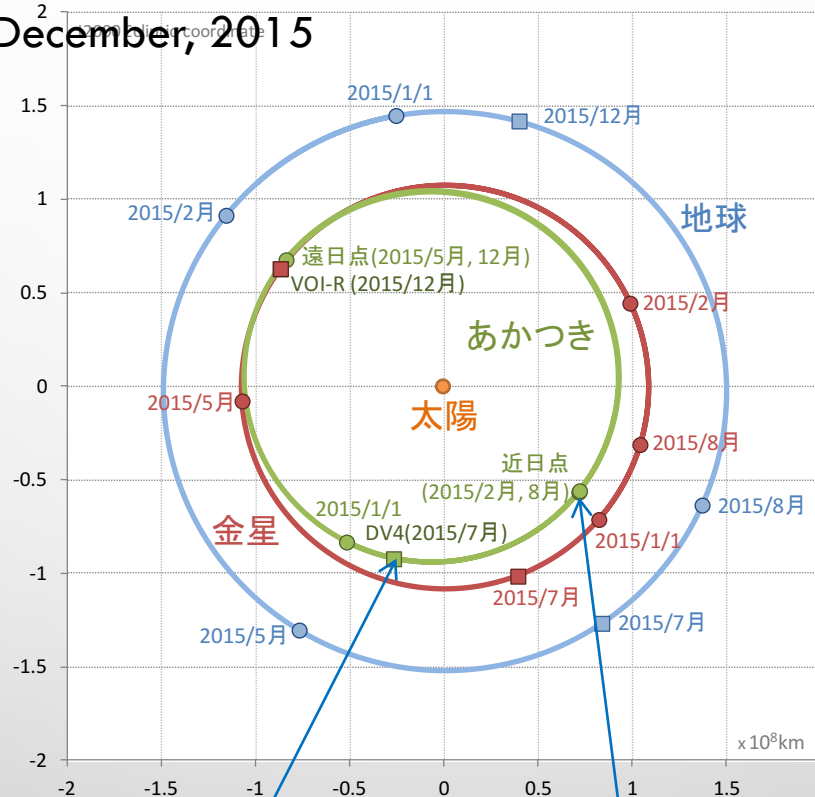


Reaction Control System should be used for orbital maneuver instead of broken OME



ORBITAL MANEUVER (2011-2015)

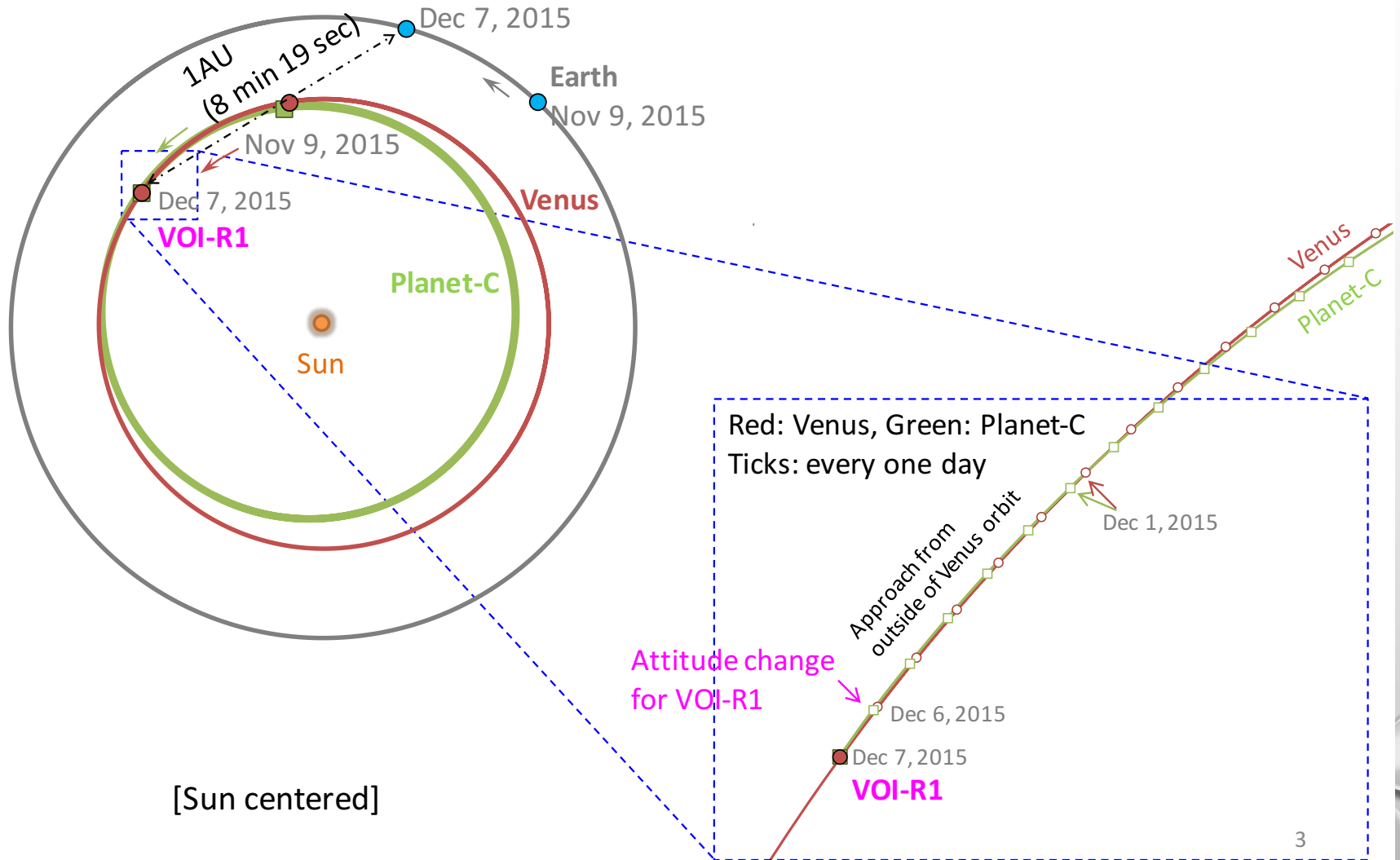
- 2011
- Orbital maneuver (DV1-3) was done to meet VENUS on 22 November, 2015
- Orbit analysis revealed that the spacecraft would crash with Venus very shortly
- July 2015 additional maneuvers (DV4-1,2,3) was done to correct the orbit to meet Venus on 7 December, 2015



DV4
2015/07 ΔV 89m/s

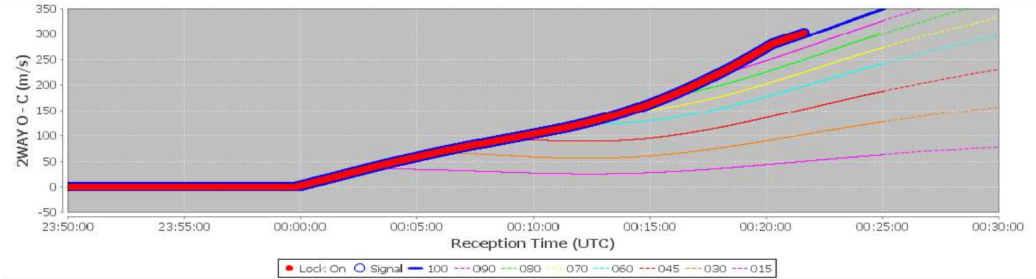
Last perihelion
2015/8/30

VOI-R1 Geometry (Sun center)

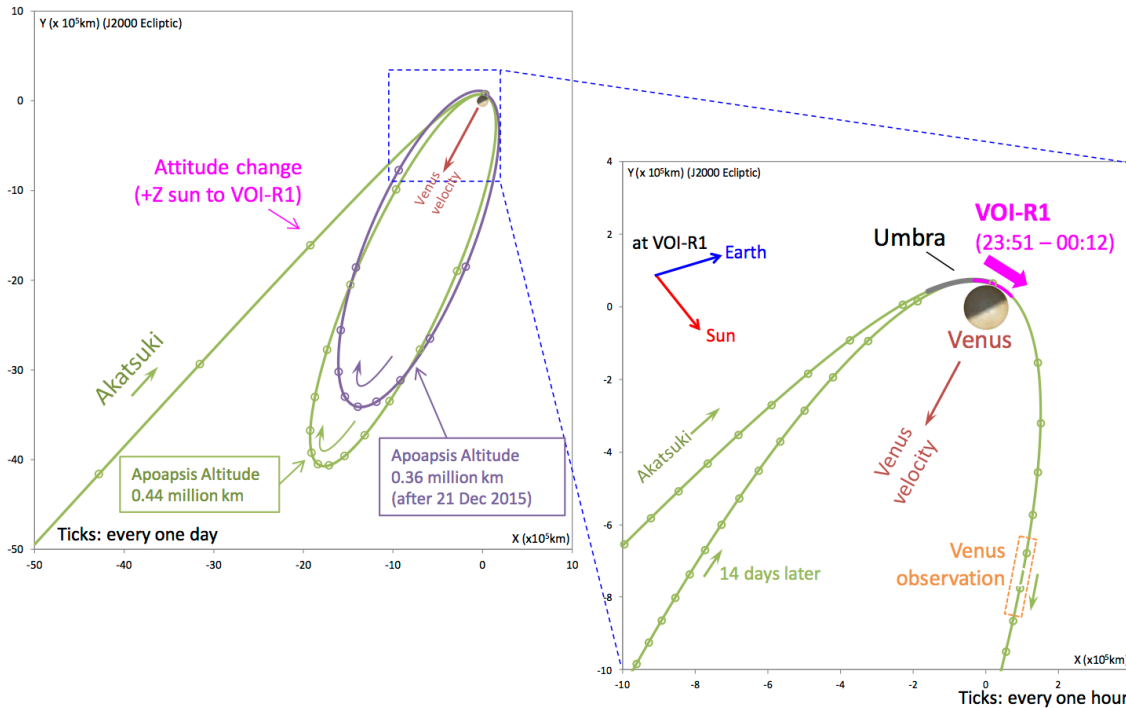


VOI-R1 ON 7 DECEMBER, 2015

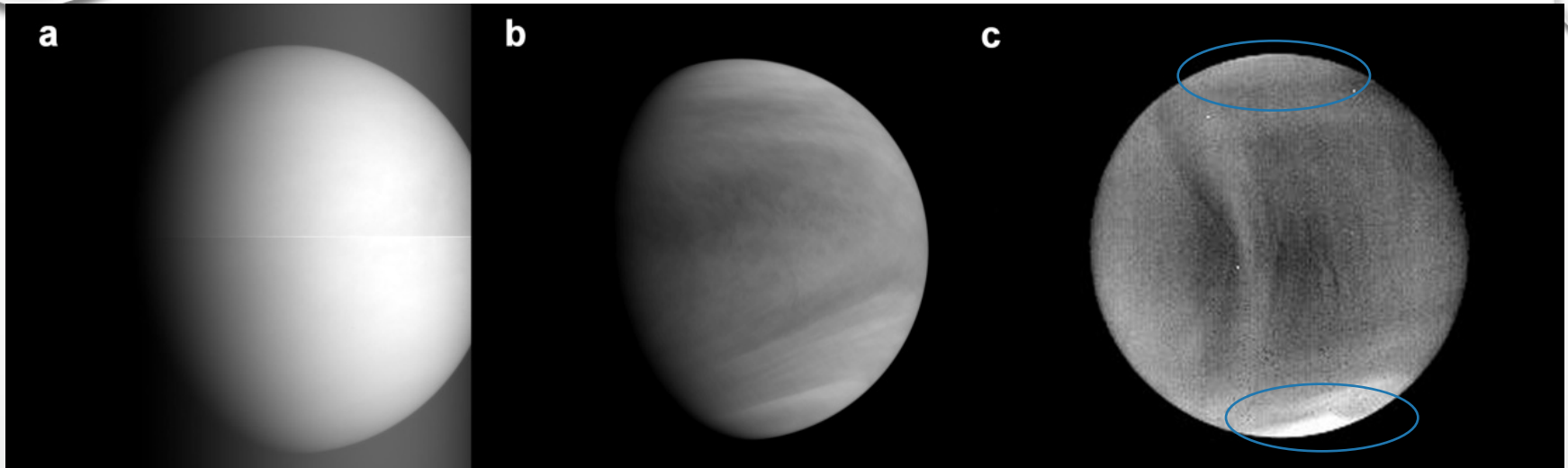
Doppler monitor



VOI-R1 Geometry (Venus center)



First images by IR1, UVI, and LIR



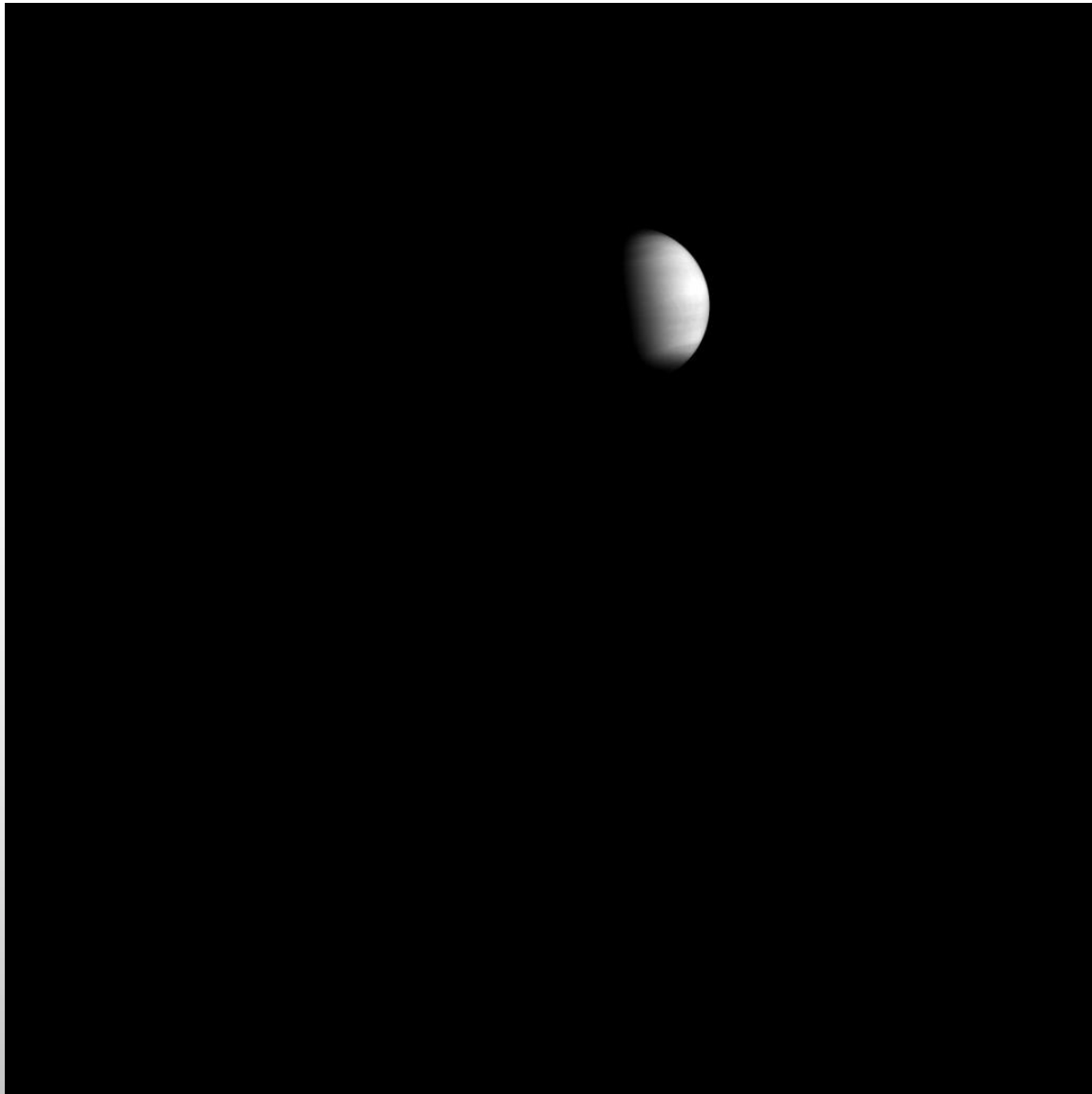
IR1

UVI

LIR

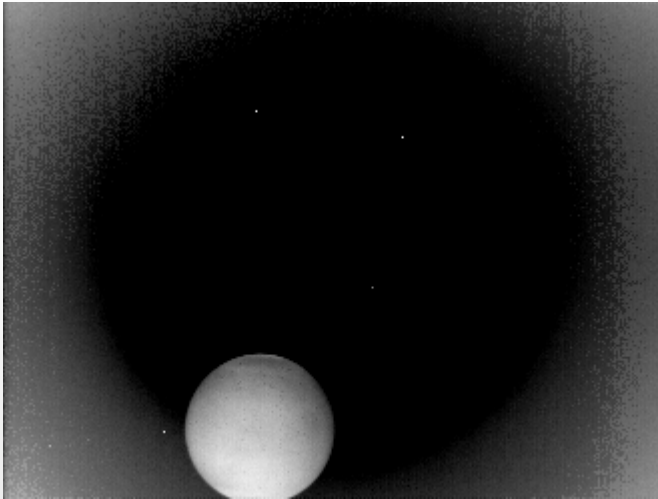
	IR1	UVI	LIR
Observation date [Year/Mon/Day/Time in UT]	2015/12/7 4:51:56	2015/12/7 5:19:53	2015/12/7 5:26:02
Wavelength	0.90 μm^{a}	283 nm	8-12 μm
Exposure time (s)	3.0	0.25	34 ^b
Distance between AKATSUKI and Venus (km)	6.8×10^4	7.2×10^4	7.3×10^4
Spatial resolution (km/pixel) ^d	14.2	15.1	63.9
target	Solar radiation scattered by the upper clouds	solar radiation attenuated by SO2 absorption and of upper haze	thermal radiation emitted from the cloud top
	Base of the upper cloud (58-64km)	the cloud top altitudes (62-70km)	the cloud top altitudes (~65km)

IR2 WAS TURNED ON 4 DAYS LATER

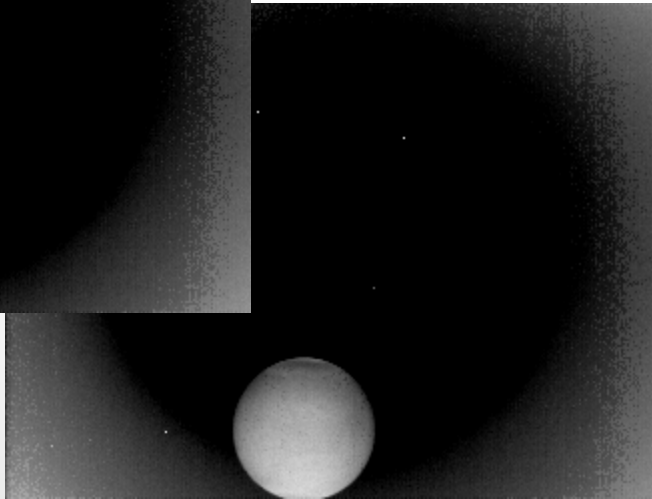


LIR IMAGE (2016/1/22)

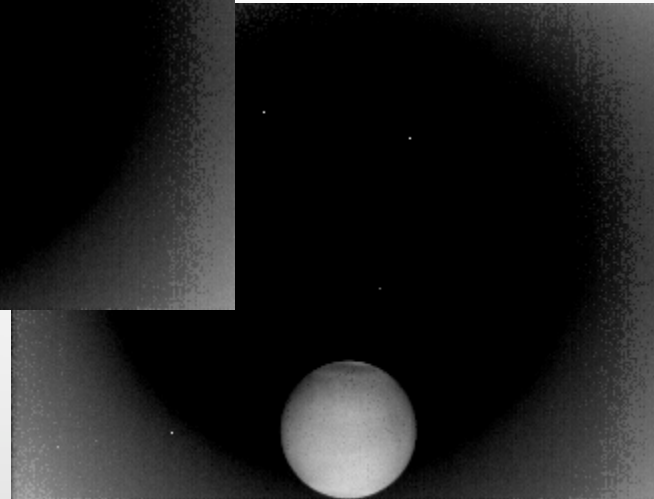
S/C-Venus: 0.16 million km



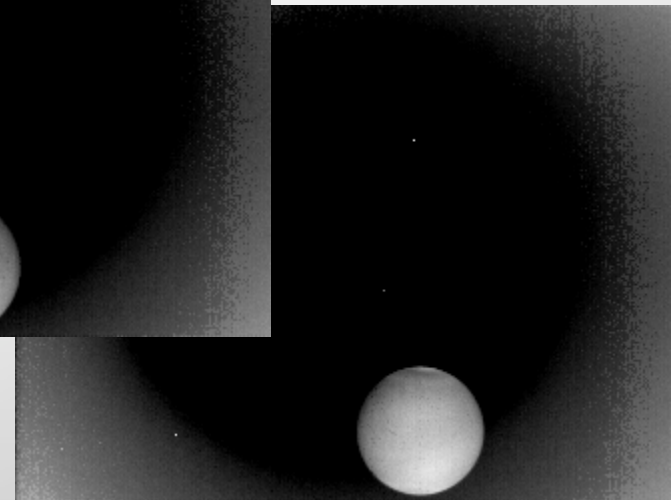
5:05UT



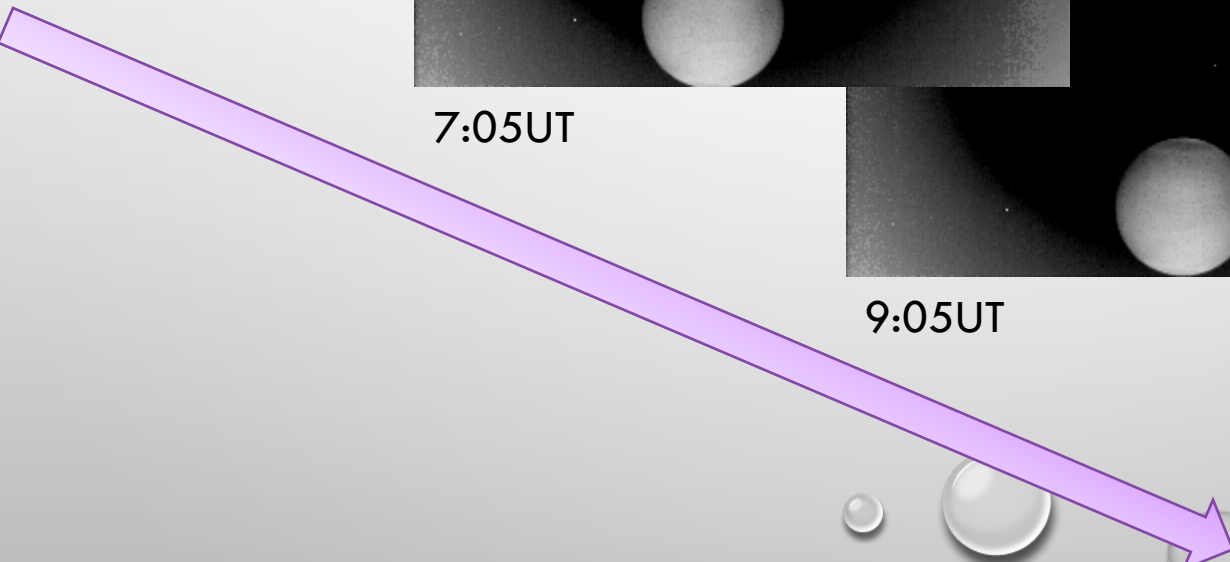
7:05UT



9:05UT



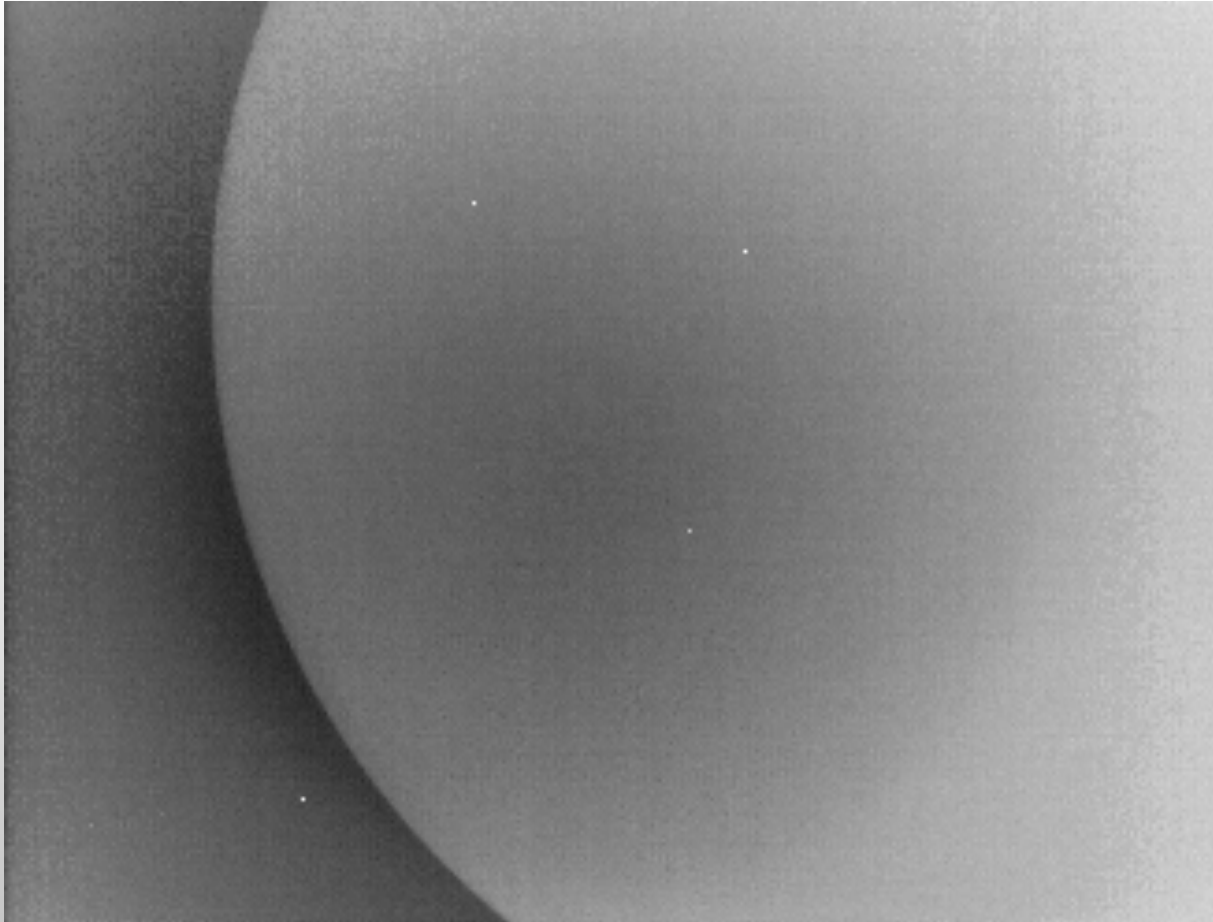
13:05UT



LIR IMAGE (2016/1/21)

1:40UT

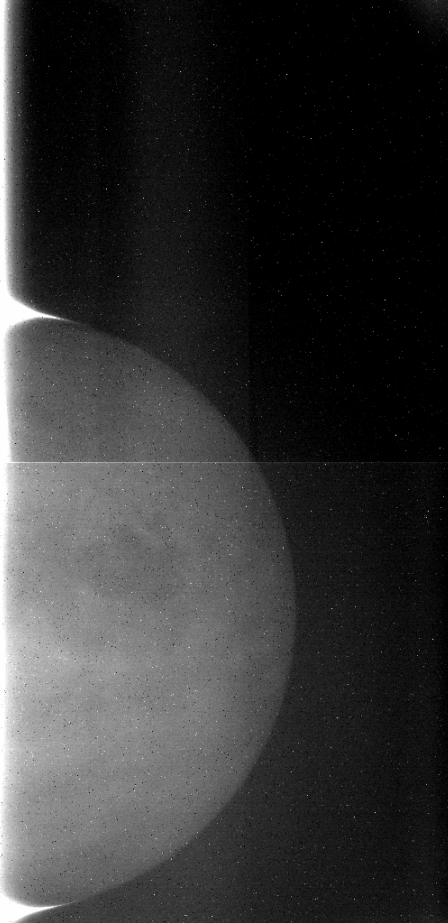
S/C-Venus: 0.05million km



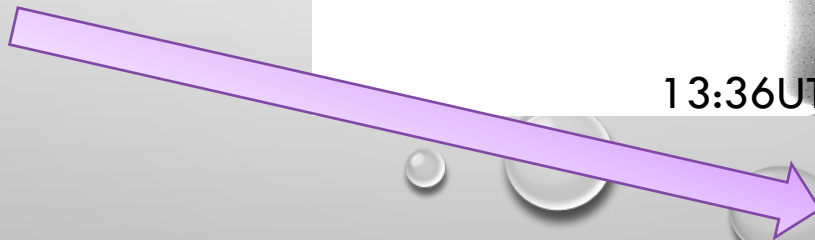
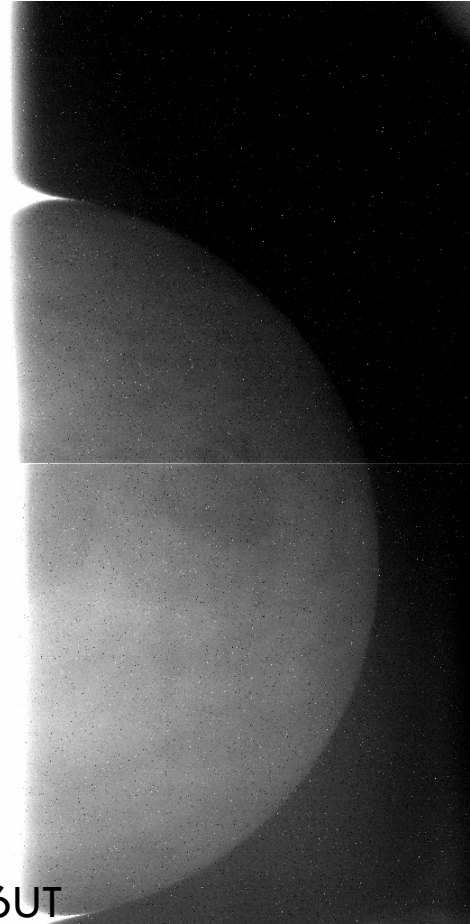
IR1IMAGE (2016/1/31)

S/C-Venus: 0.10 – 0.08million km

11:36UT



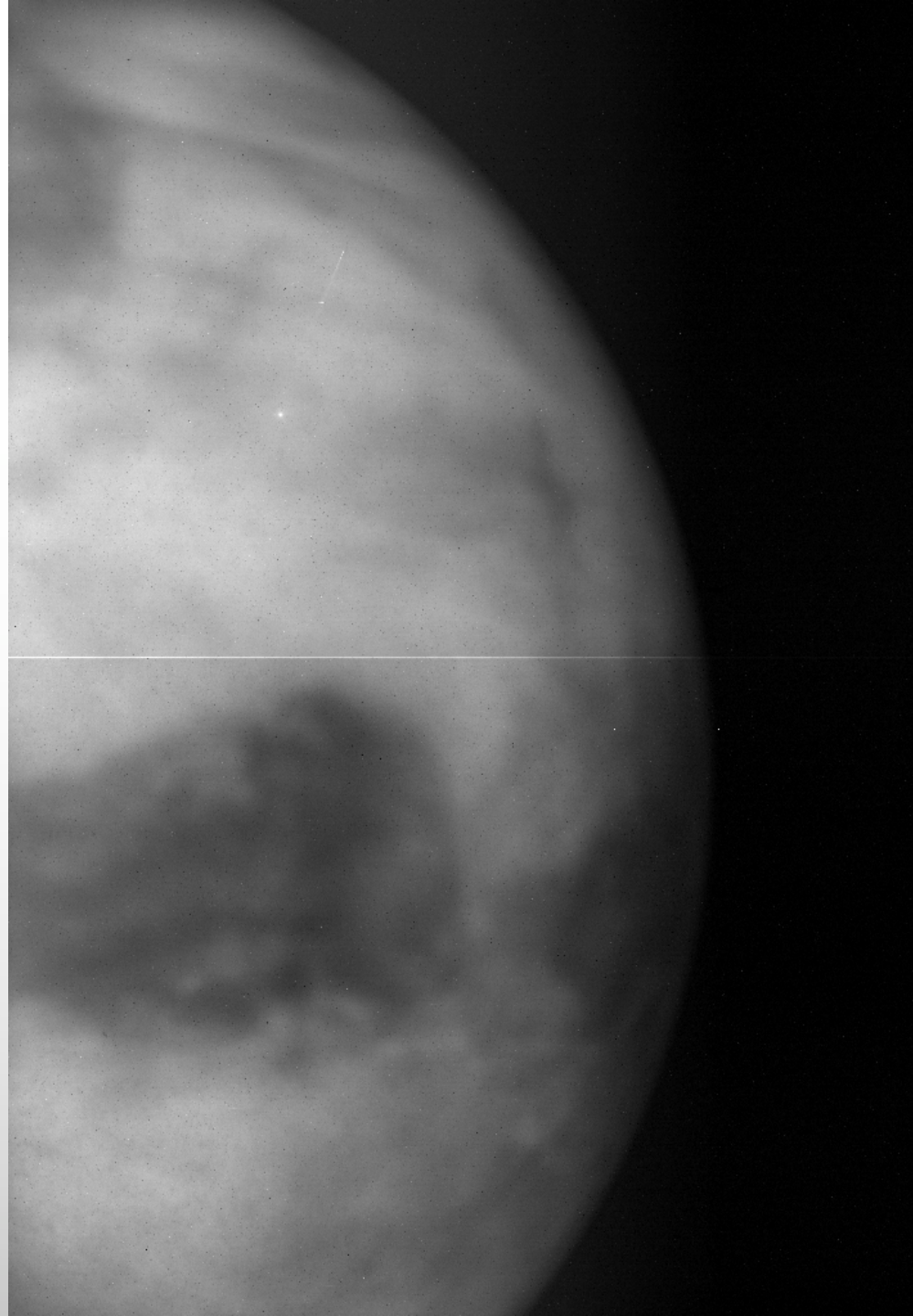
13:36UT



IR1 IMAGE (NIGHT SIDE)

S/C-Venus: 0.05million km

2016/01/21 00:38UT



SCHEDULE

1/10	Longest Umbra
1/12	MGA -> HGA
1/15~	10h/day Observation (interval 2hours)
1/20	Umbra
	LAC HV turned on (100V)
2/1	USO on
2/1~	15h/day observation (interval 2hours)
2/8	Stability evaluation of USO
2/15~	15h/day observation (interval 1hour)
<hr/>	
3/ 3~	bit rate 16kbps -> 8kbps

SUMMARY

- Akatsuki became the 1st Japanese probe orbiting other planet 15 years after the proposal to ISAS.
- All the sub systems are working almost perfectly.
- Akatsuki will send data over two years to us, and it means that Japan's exploration enters the new era when Japan deliver the continuously changing planet's data to the world.

AKATSUKI returns to Venus, Nakamura et al., submitted to Earth, Planets and Space, 2016