



# The Rosetta mission

***Matt Taylor,  
ESA Project Scientist***



# The Rosetta mission

- Solar System and comets
- Comet observations
- Rosetta and 67P / Churyumov-Gerasimenko
- Where are we now?



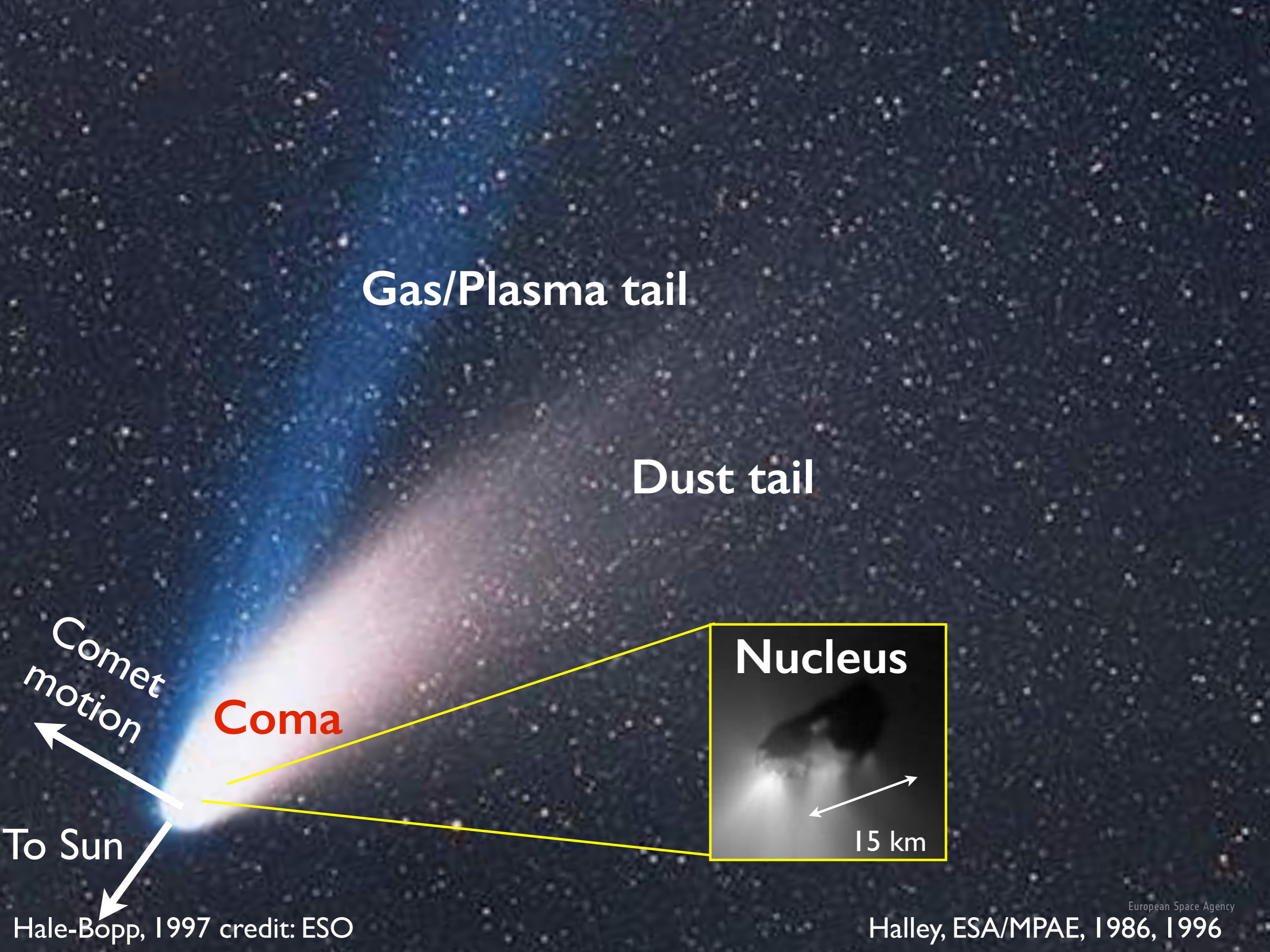












Gas/Plasma tail

Dust tail

Nucleus

Coma

Comet motion

To Sun

15 km



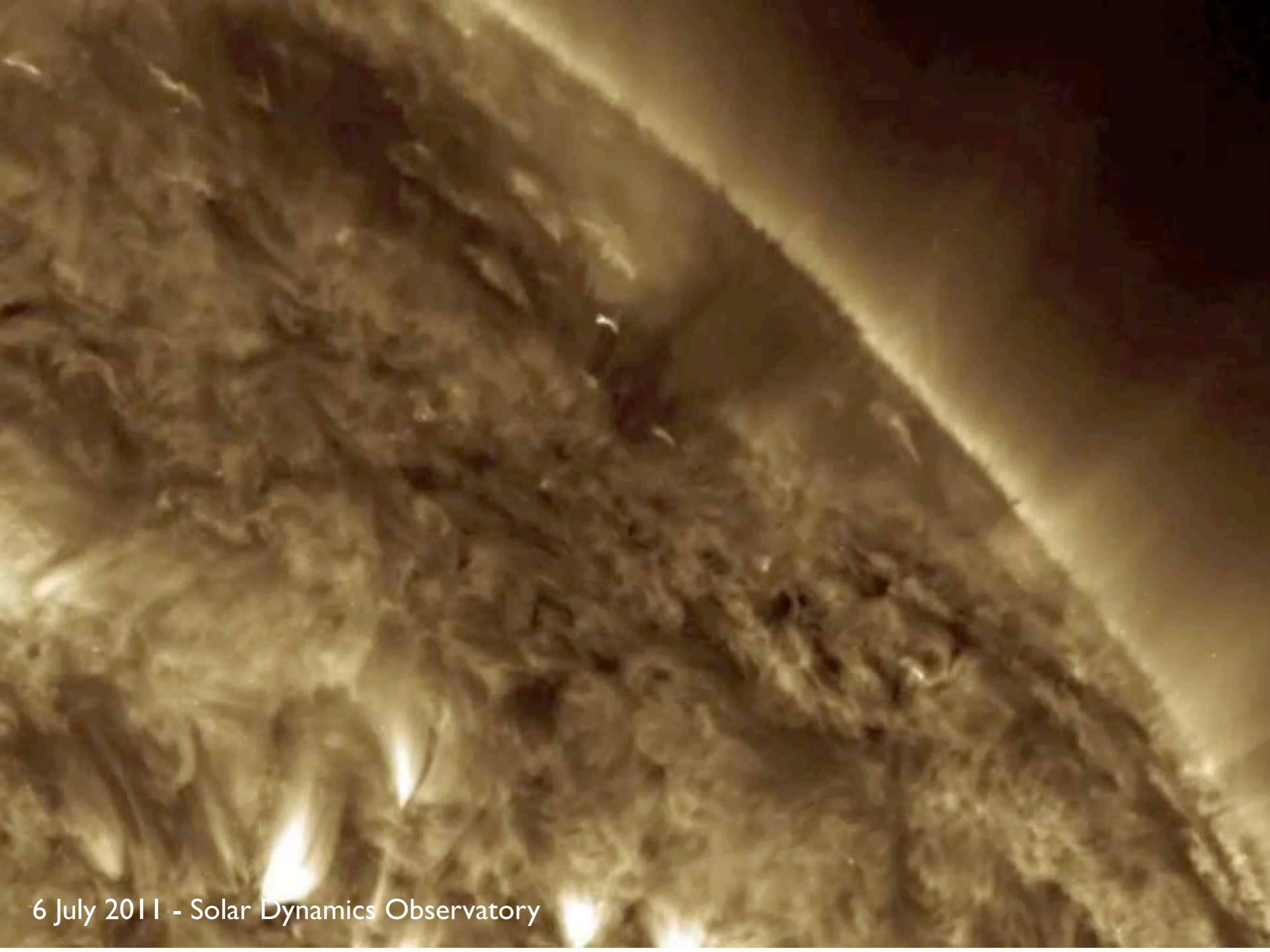






2011/10/01 00:18

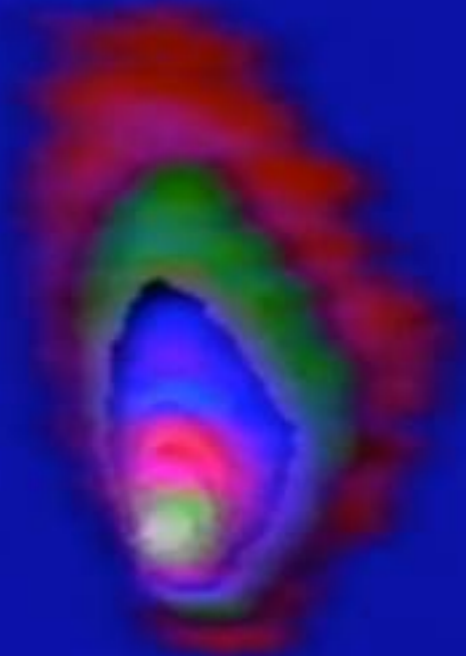




6 July 2011 - Solar Dynamics Observatory



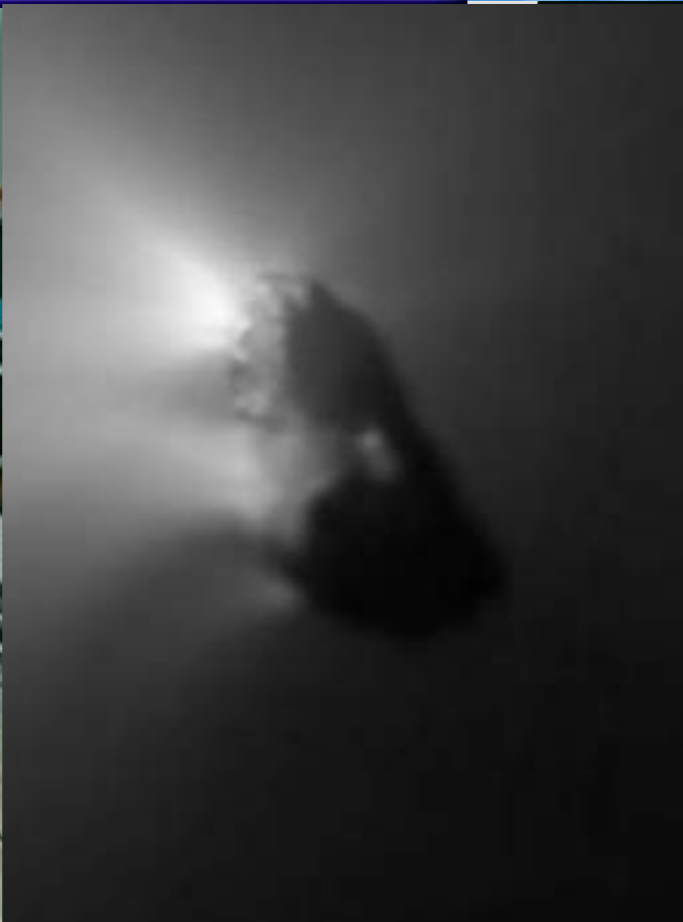
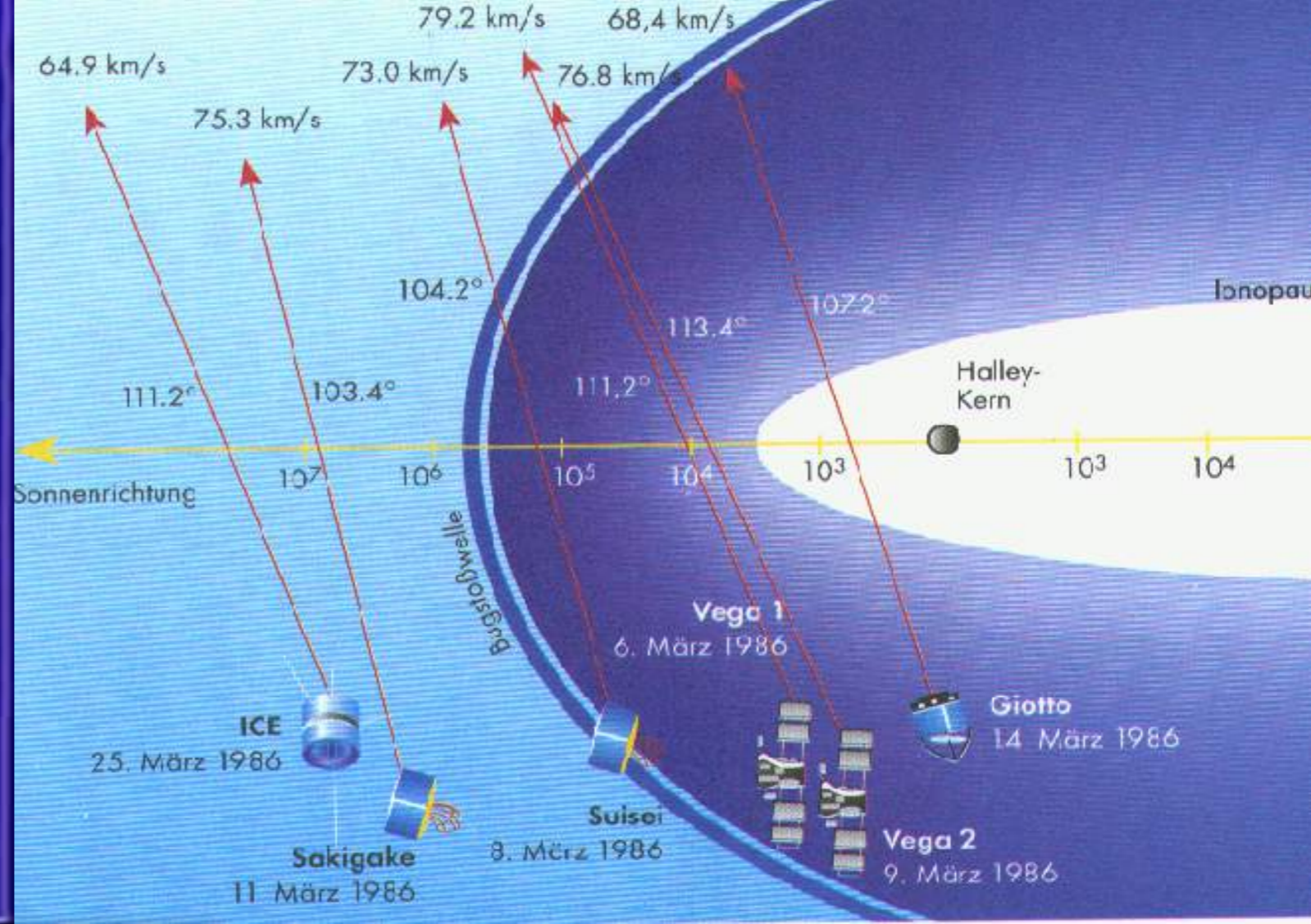
H M C HALLEY MULTICOLOUR CAMERA



© MPAE 1986

MPI FÜR AERONOMIE

2540





esa SP-1125



# ROSETTA

## COMET-NUCLEUS SAMPLE RETURN

MISSION AND SYSTEM DEFINITION DOCUMENT



## Spacecraft Visits to Comets (imaged)

- The Halley Armada  
     Giotto, Vega 1 and 2, Suisei,  
     Sakigake
- Deep Space 1 (Borrelly)
- Stardust (Wild 2)
- Deep Impact (Tempel 1)
- EPOXI (Hartley 2)

Fly by's - 100's km  
 10's km/s



81P/Wild 2  
 5.5 × 4.0 × 3.3 km  
 Stardust, 2004



103P/Hartley 2  
 2.2 × 0.5 km  
 Deep Impact, 2010

Wild 2

010  
 5.5 × 4  
 Star



## Spacecraft Visits to Comets (imaged)

- The Halley Armada  
  - Giotto, Vega 1 and 2, Suisei, Sakigake
- Deep Space 1 (Borrelly)
- Stardust (Wild 2)
- Deep Impact (Tempel 1)
- EPOXI (Hartley 2)
- **Rosetta (C-G)**

<< 100 km at m/s

× 3.3 km  
 it, 2004

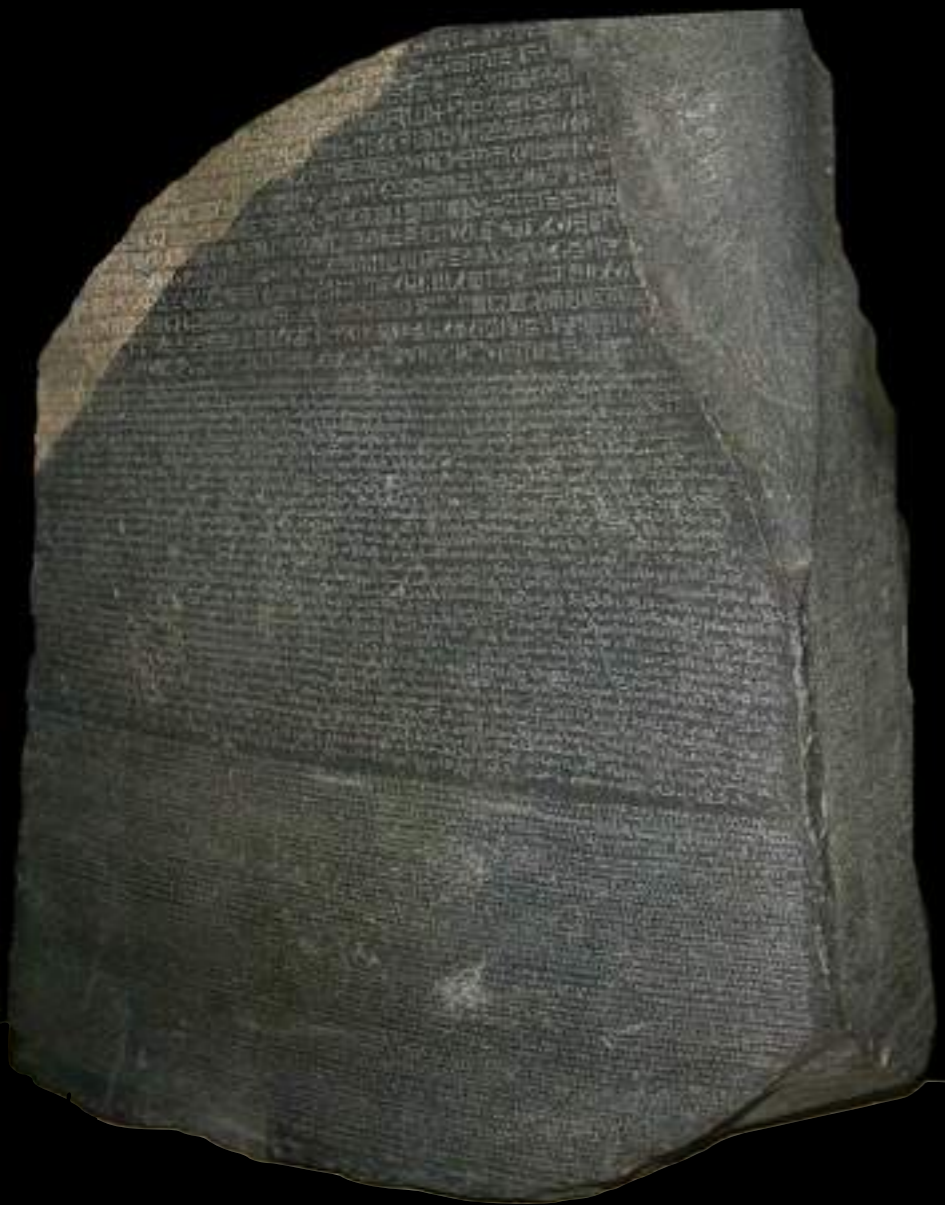


Wild 2

103P/Hartley 2  
 2.2 × 0.5 km  
 Deep Impact, 2010



# The Rosetta Stone



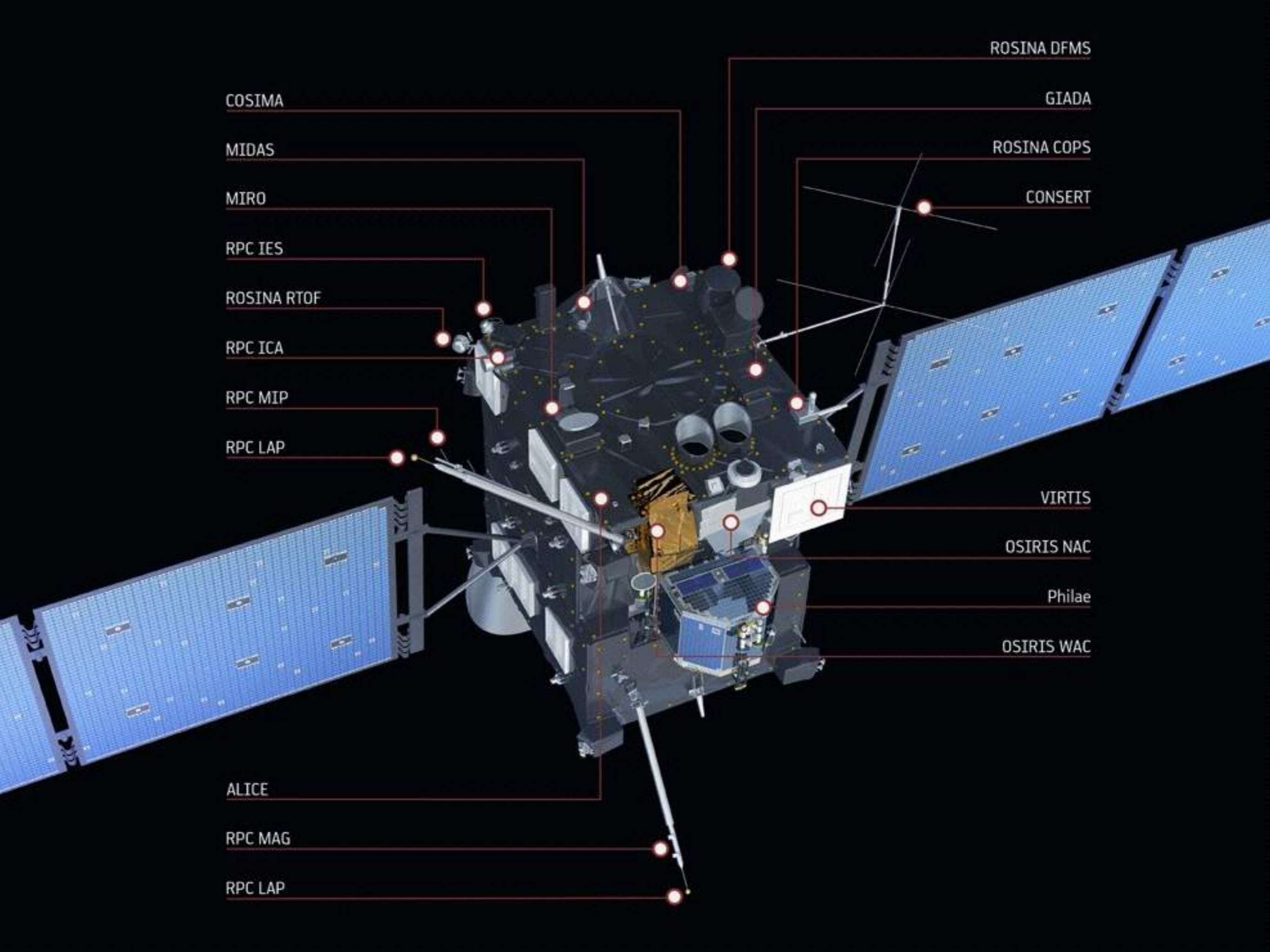
# Philae temple of Isis











COSIMA

MIDAS

MIRO

RPC IES

ROSINA RTOF

RPC ICA

RPC MIP

RPC LAP

ALICE

RPC MAG

RPC LAP

ROSINA DFMS

GIADA

ROSINA COPS

CONSERT

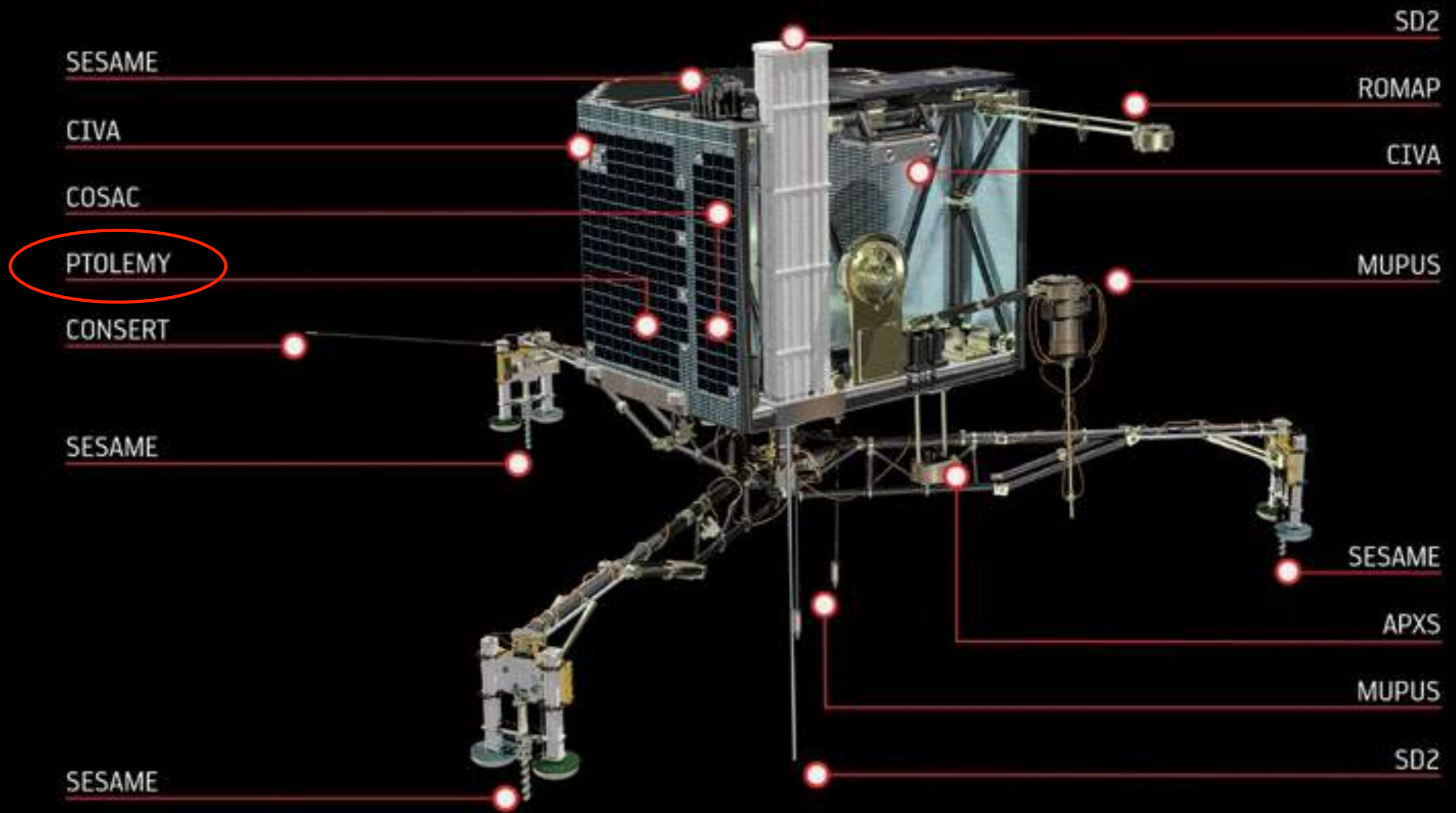
VIRTIS

OSIRIS NAC

Philae

OSIRIS WAC







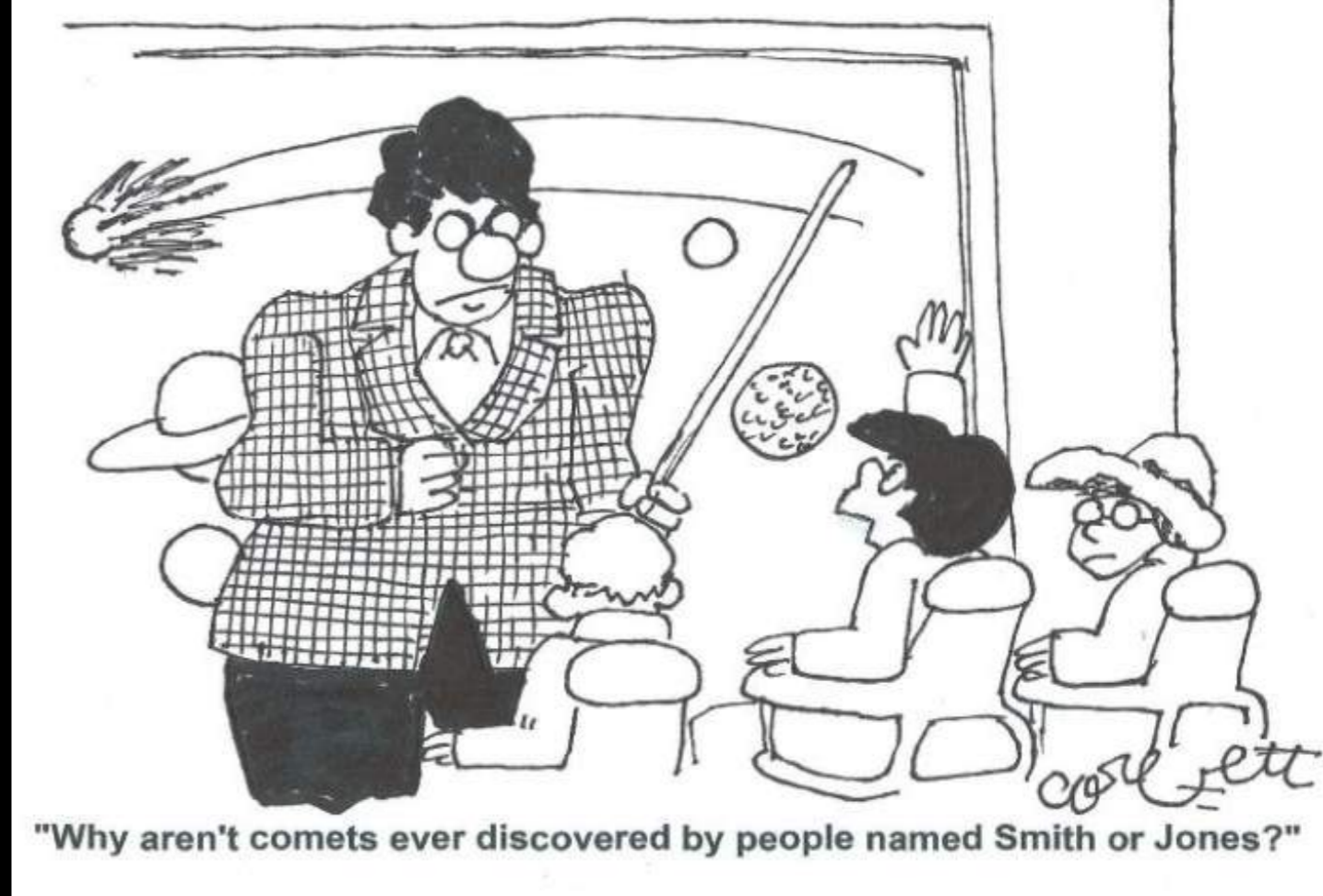
after the delivery of Ptolemy FM



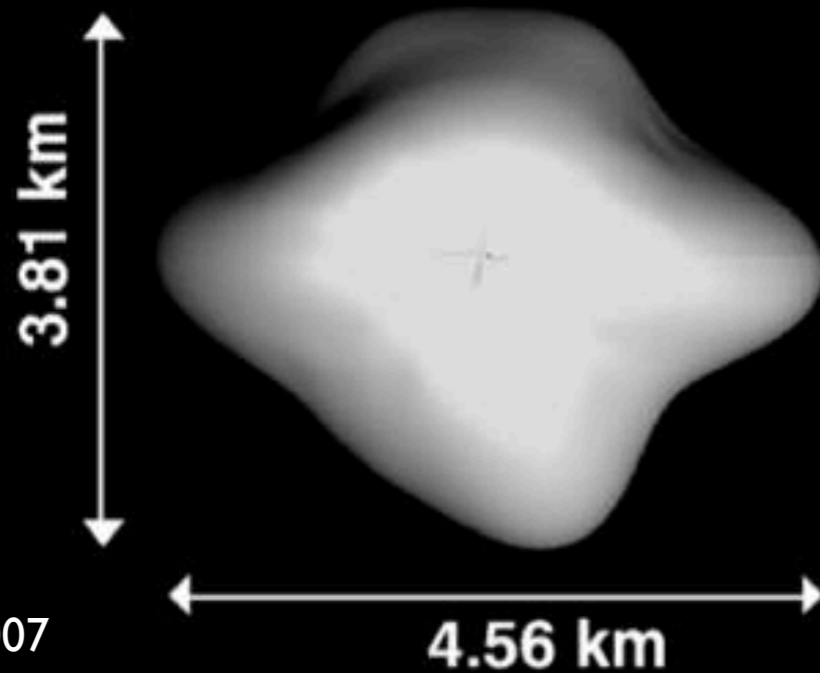




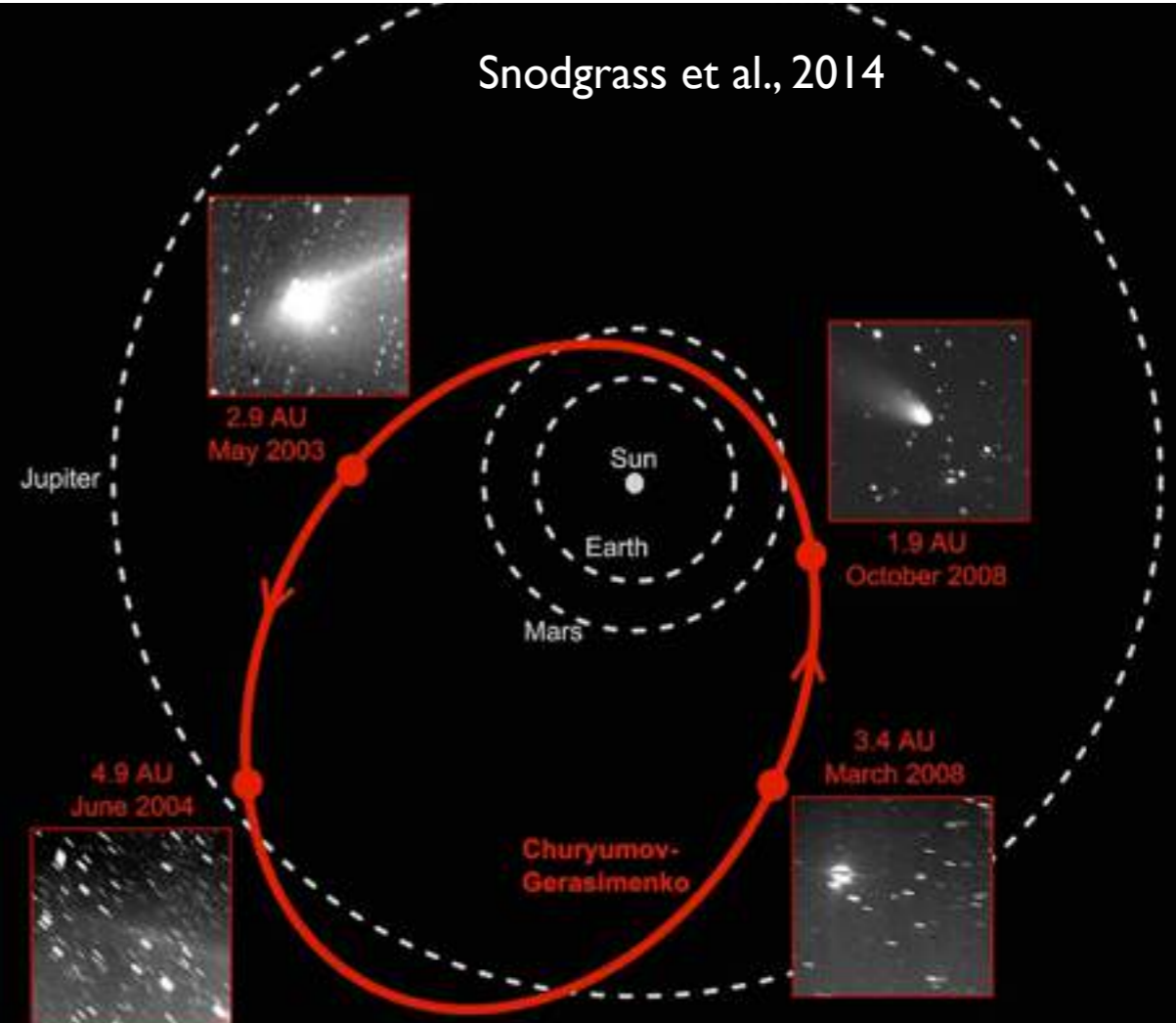
Klim Churyumov, Jean-Jacques Dordain (ESA), & Svetlana Gerasimenko at Rosetta launch



Discovery 1969  
 Perihelion 1.2458 AU  
 Aphelion 5.6839 AU  
 Orbital 6.45 yr

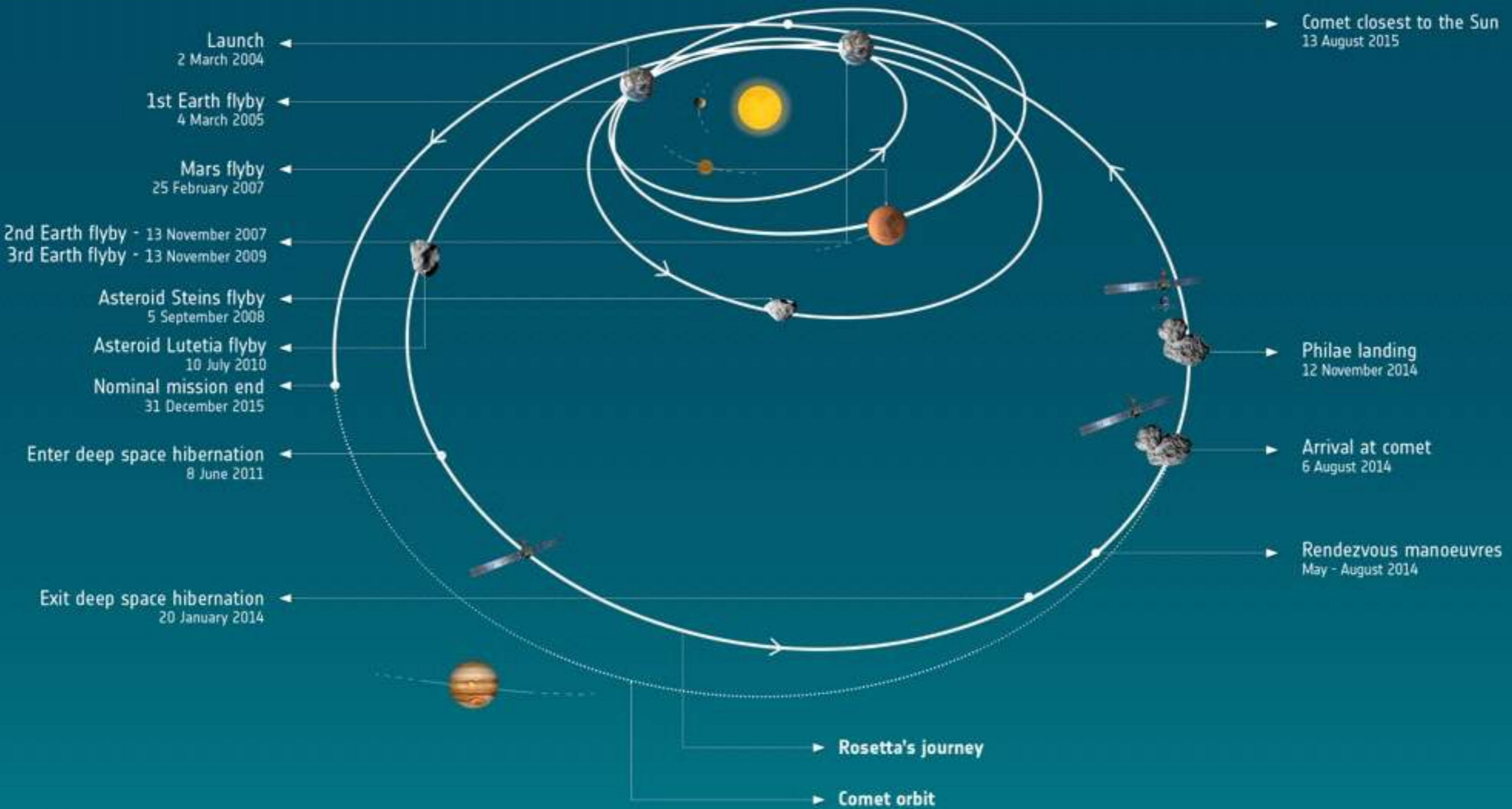


Lamy et al., 2007





# → ROSETTA'S JOURNEY



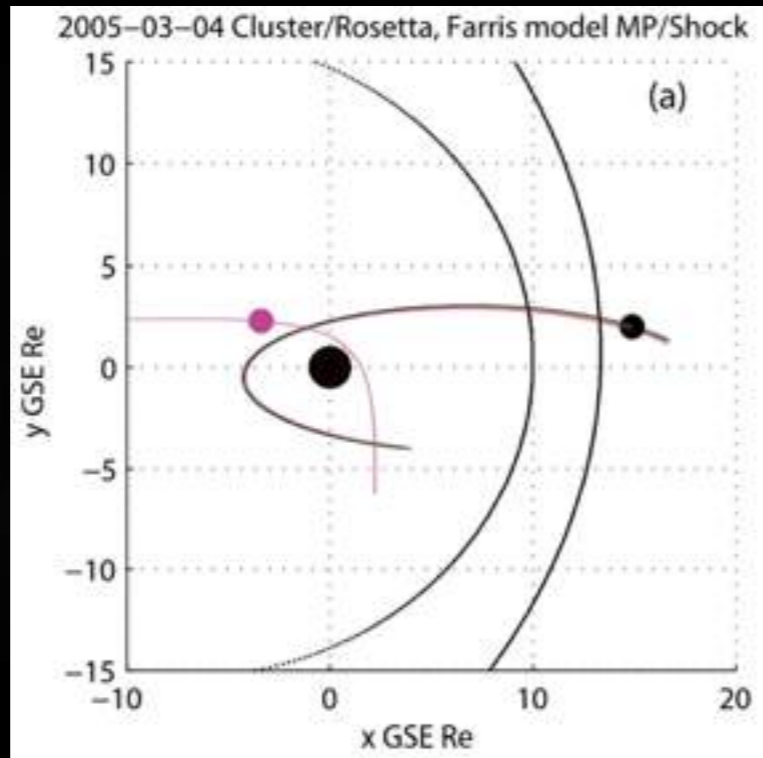


Near closest approach at 1,000km, February 25, 2007 / ESA





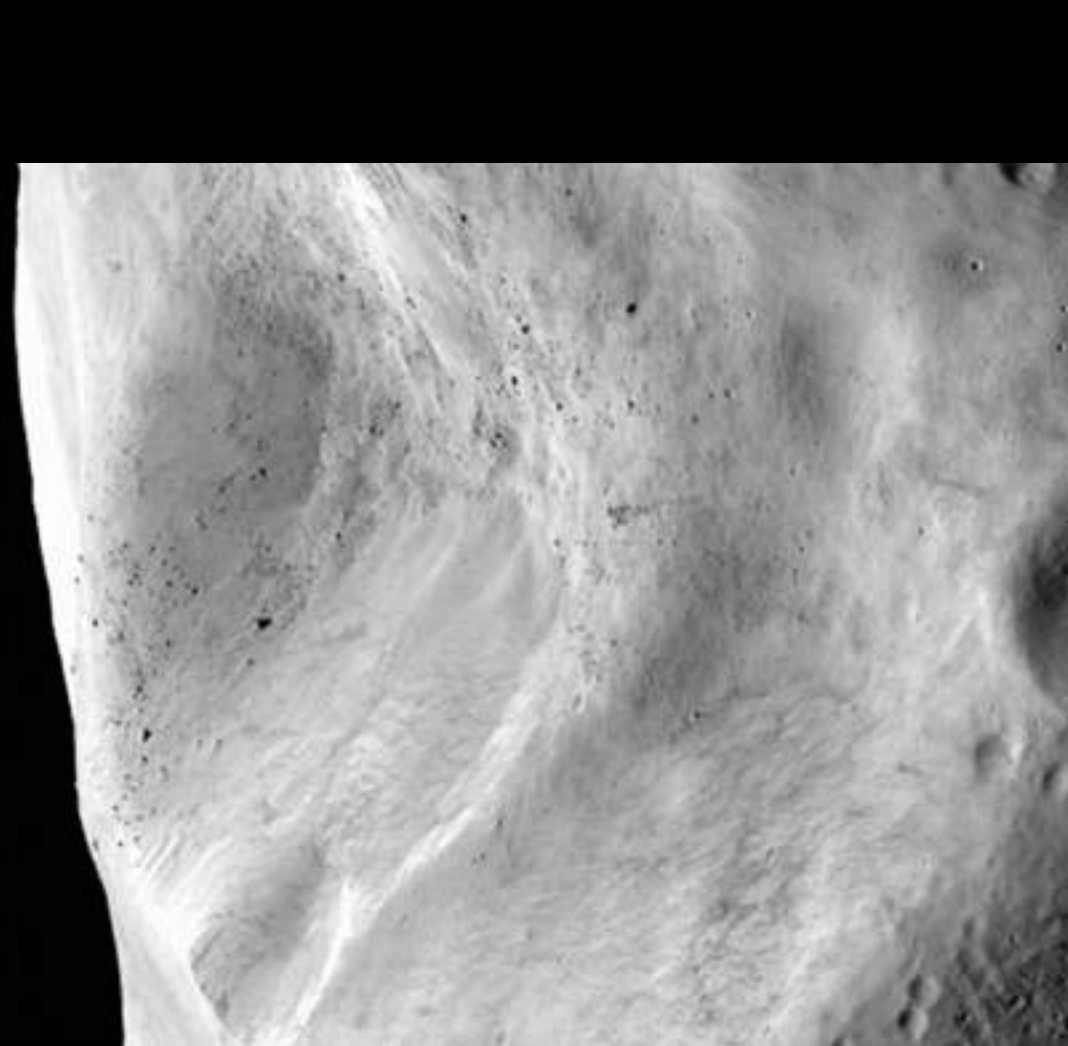
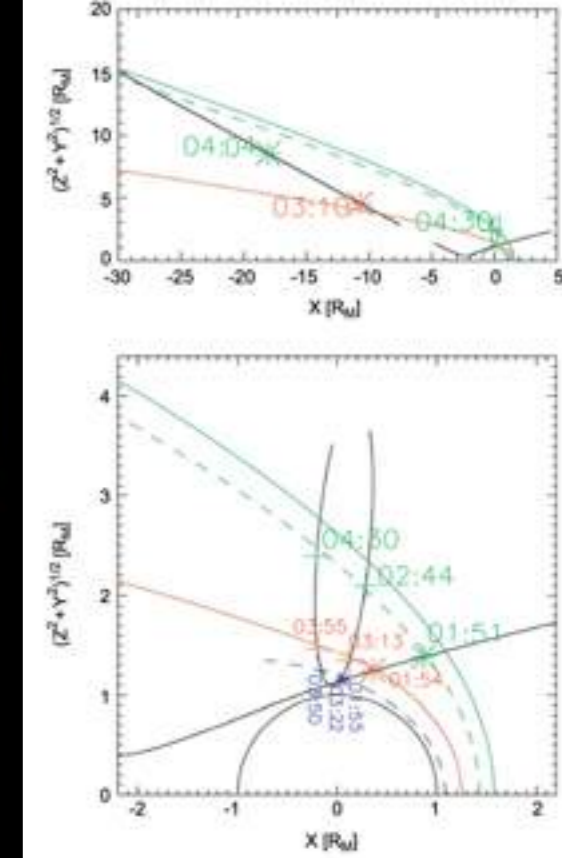
NavCAM image on March 4, 2005 / ESA



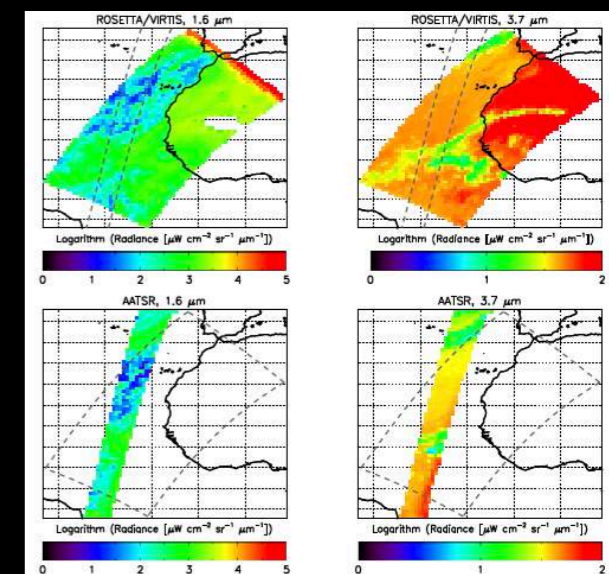
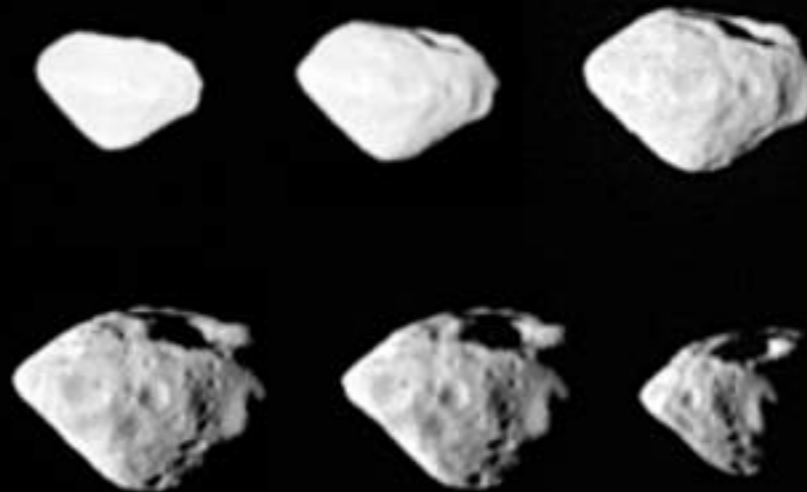
Eastwood et al., JGR, 2011



Ederberg et al., 2009a+b



thanks N. Howes



European Space Agency

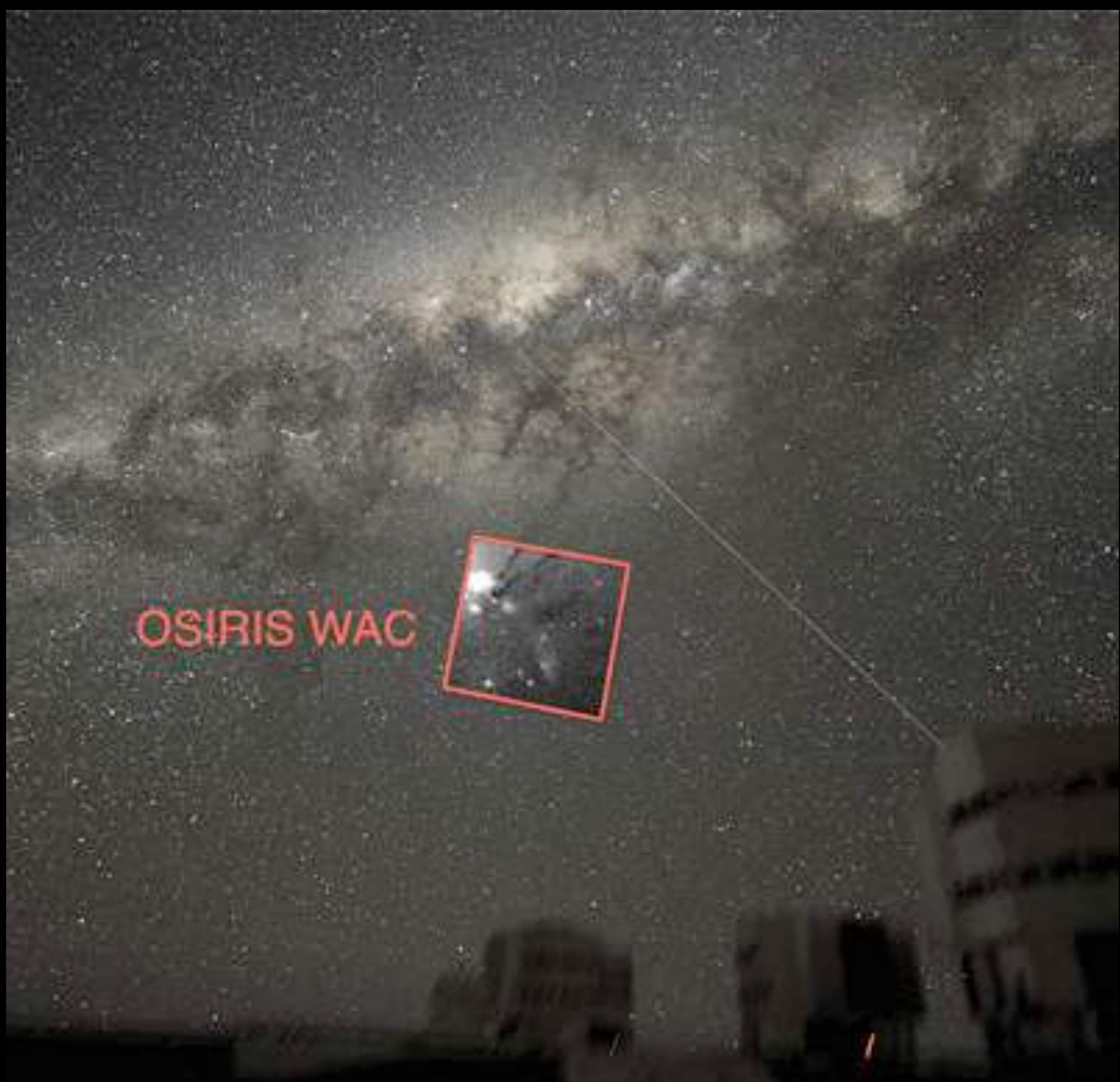
Hurley et al., 2014



# → ROSETTA'S JOURNEY







OSIRIS WAC



20 January 2014



**#WakeUpRosetta**

Help us shout out to Europe's  
comet chaser!







C.E.T.	19:17
U.T.C.	18:17
Goldstone	10:17
Canberra	05:17
Perth/MNO	03:17
Marsae	16:17
Cabreros	19:17
Kourou	15:17

Goldstone	
17:00:00 Spacecraft	ROSE • TX ON
17:45:00 Goldstone	
18:00:00 Goldstone	
18:10:00 Goldstone	
18:15:00 Canberra	
18:45:00 Spacecraft	ROSE • UPLINK and • RCVR LOCK

# europaean space operations centre

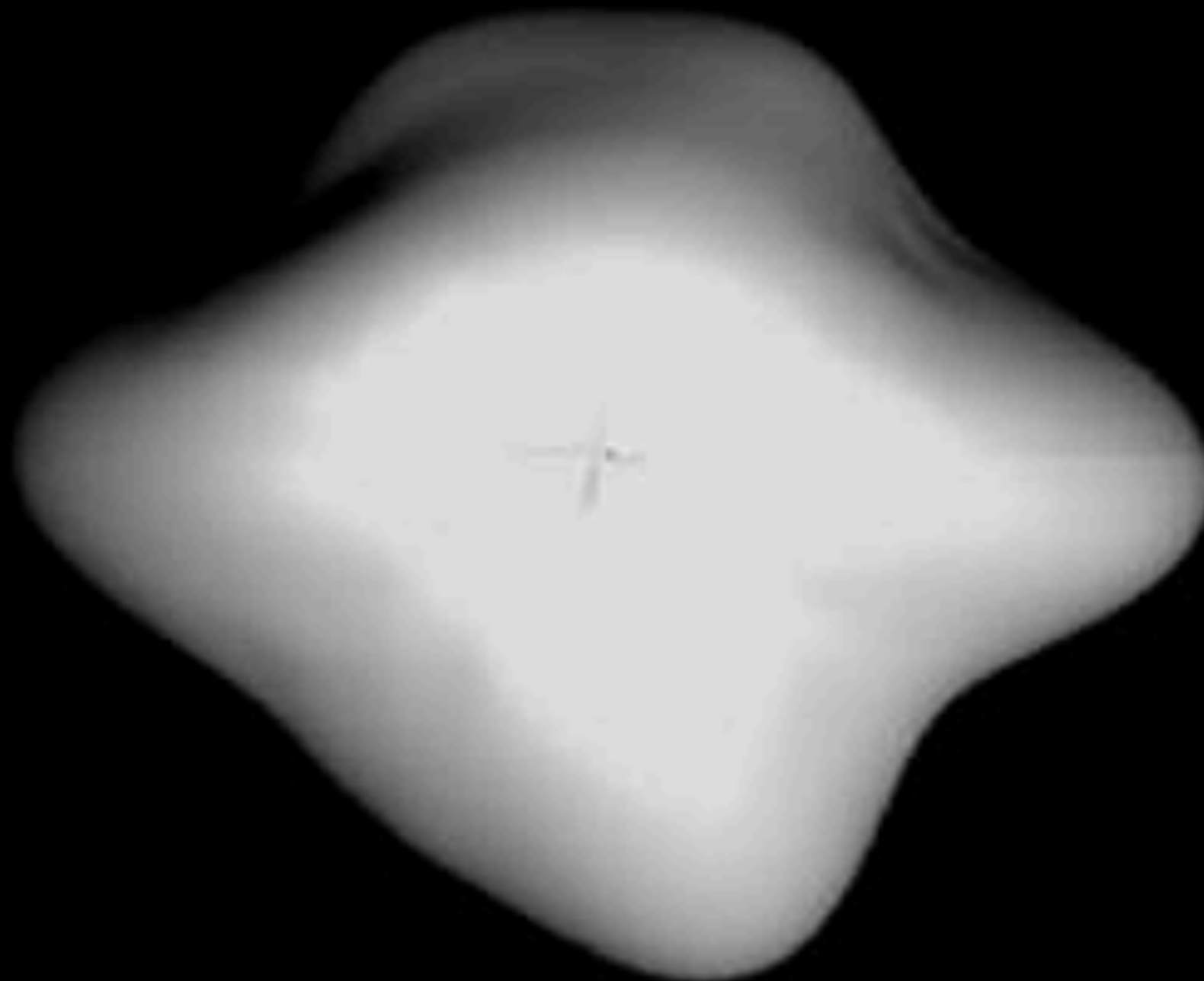






Target: 67P/Churyumov-Gerasimenko

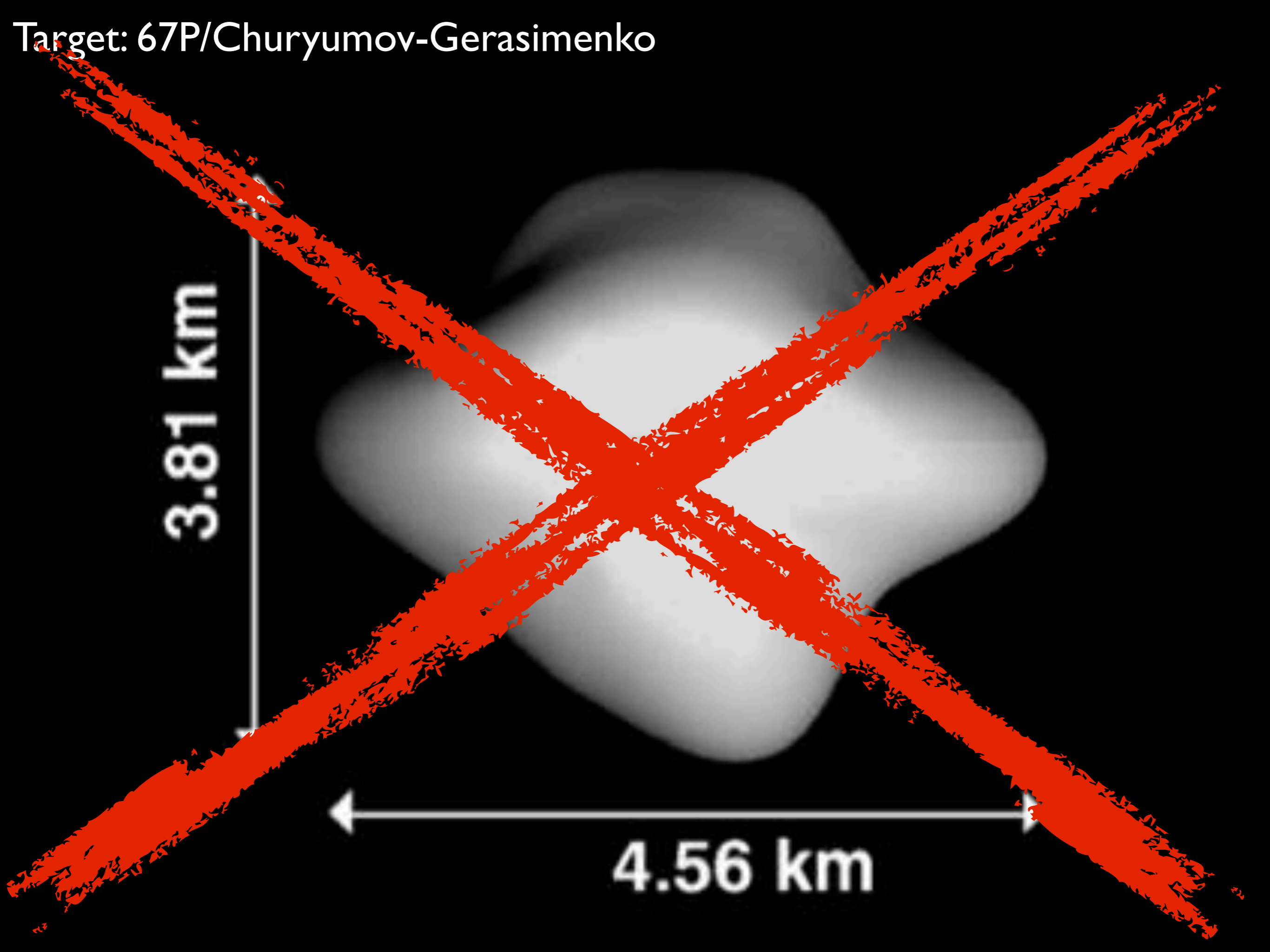
3.81 km



4.56 km

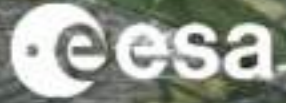


Target: 67P/Churyumov-Gerasimenko





→ LONDON



Big Ben

Tower of London

4100 m



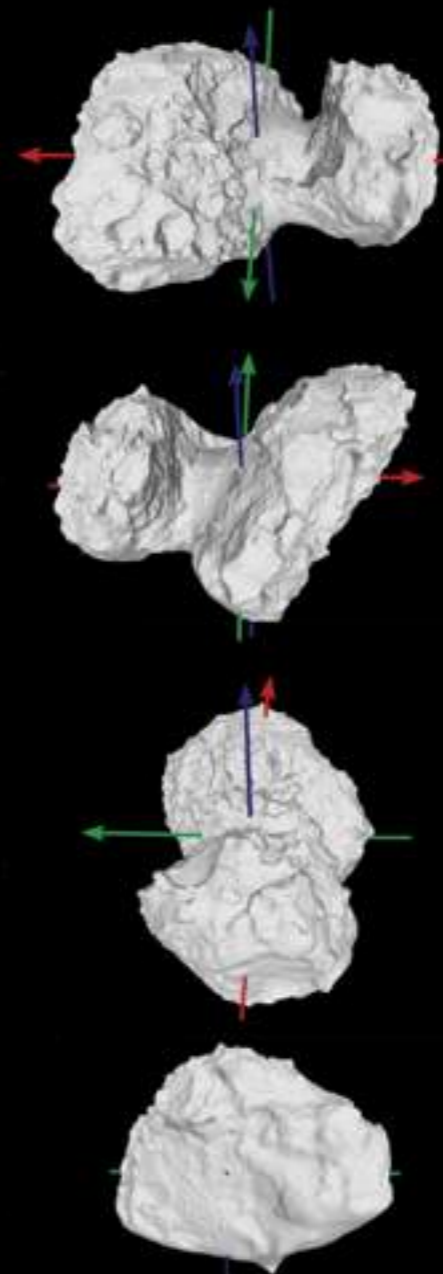
# → COMET 67P/C-G'S VITAL STATISTICS

**21.4 km<sup>3</sup>**  
Volume

**1.0 × 10<sup>13</sup> kg**  
Mass

**470 kg/m<sup>3</sup>**  
Density

**70-80%**  
Porosity



Rotation period  
**12.4043** hours

Spin axis:  
**69.3°**  
Right Ascension

**64.1°**  
Declination

**52°**  
Obliquity of the  
comet's rotational axis

X, Y Equatorial axes  
Z Spin axis

**4**  
Dust/gas ratio

**5.3 × 10<sup>-4</sup>**  
D/H ratio

Average water vapour production

**300 ml/s** → June

**600 ml/s** → July

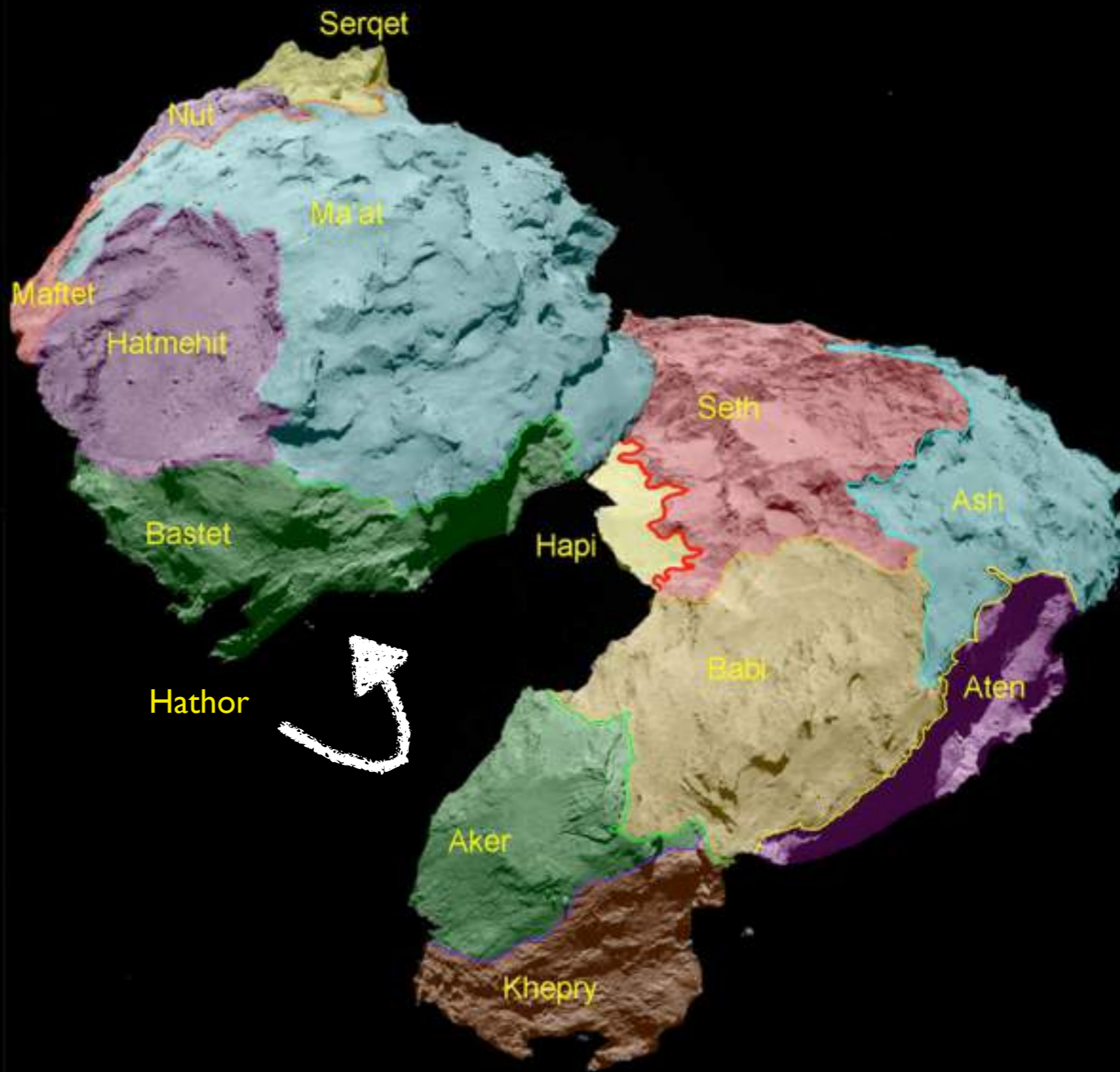
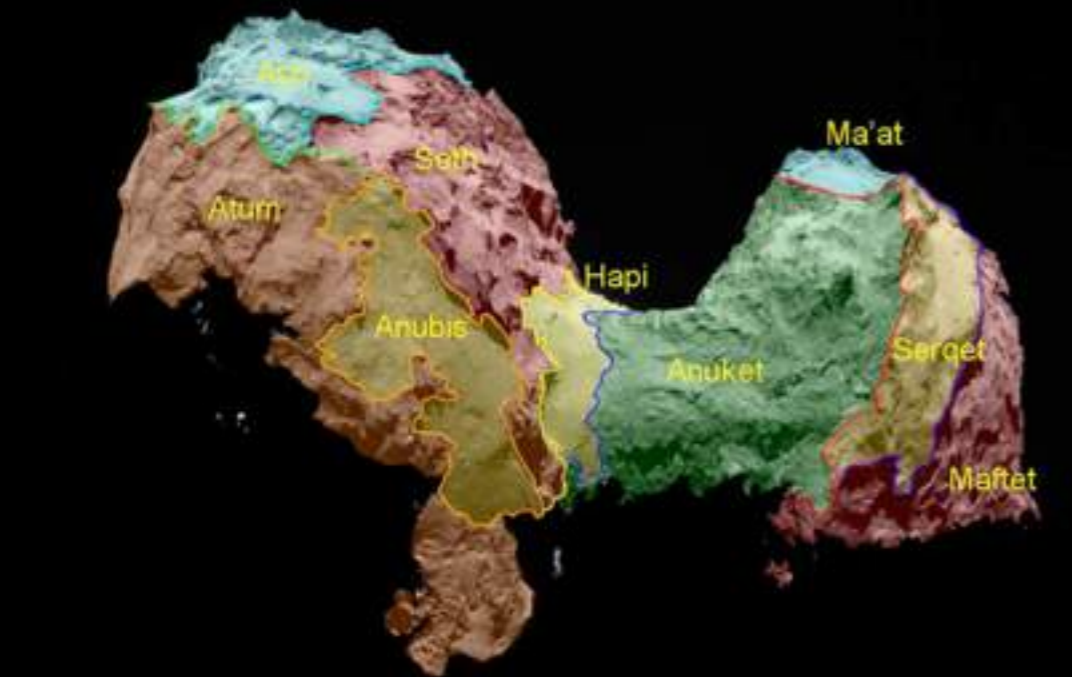
**1200 ml/s** → August

**-93°C – -43°C**  
Surface temperature

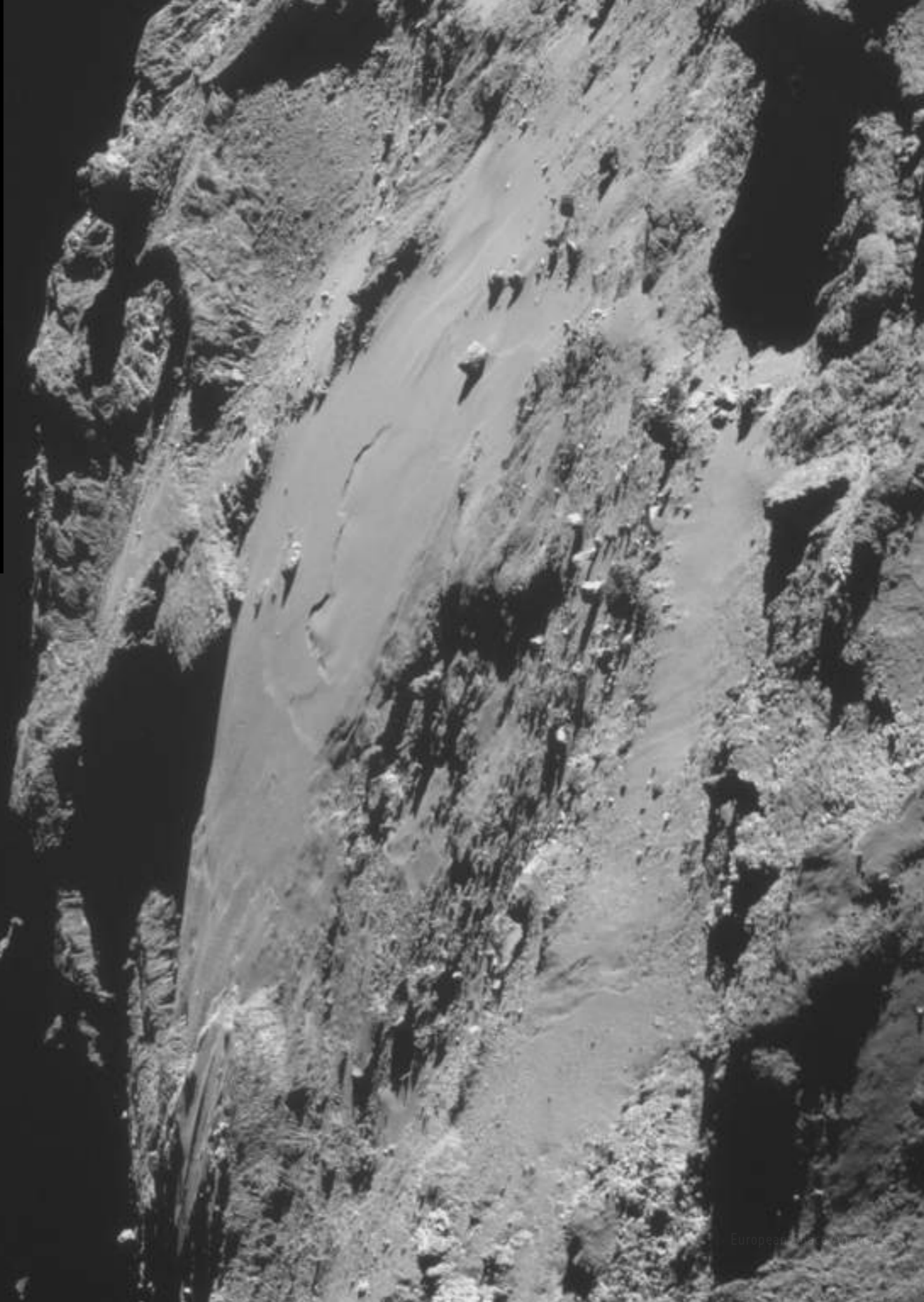
**-243°C – -113°C**  
Subsurface temperature

**6%**  
Average albedo







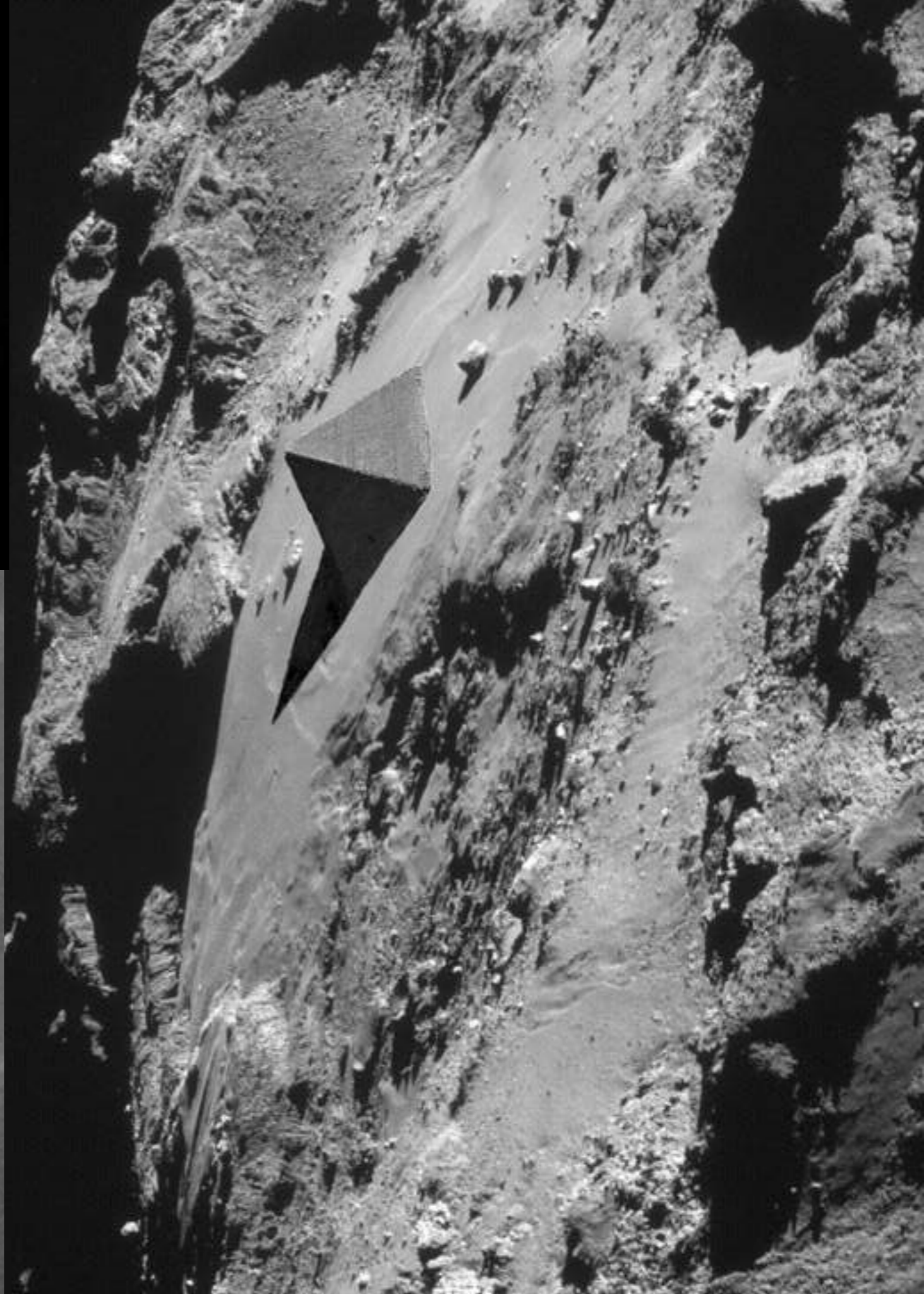


'Cheops'

ESA/ROSETTA/NAVCAM  
ESA/ROSETTA/OSIRIS

European





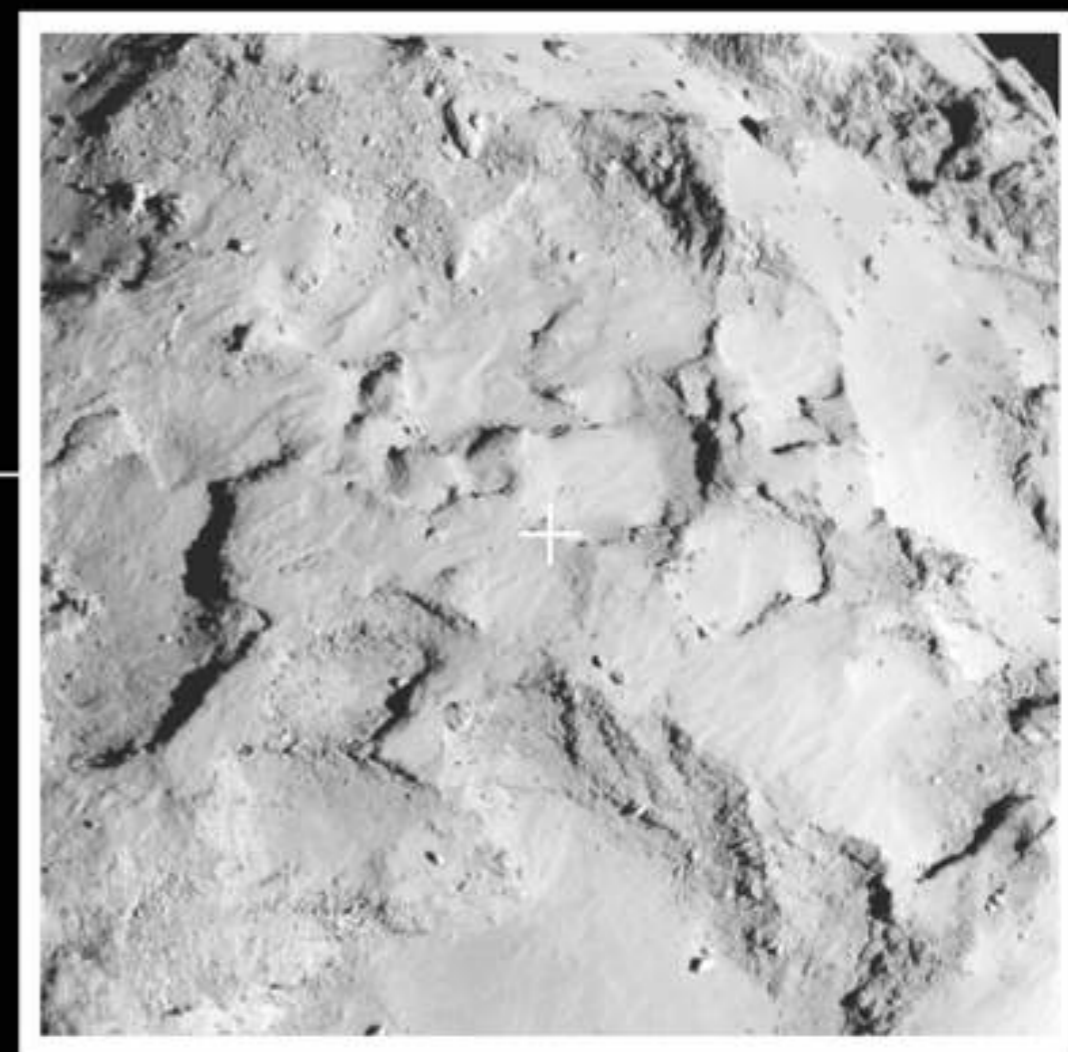
‘Cheops’

ESA/ROSETTA/NAVCAM  
ESA/ROSETTA/OSIRIS













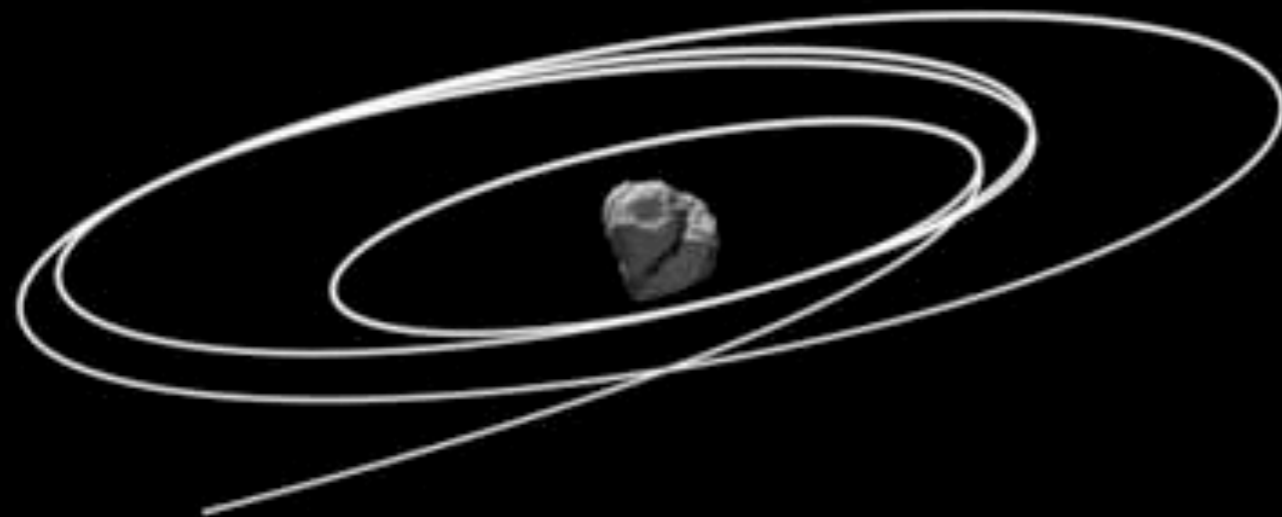
7 September 2014





8 October 2014



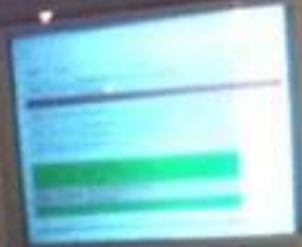


1 Oct – 19 km orbit  
15 Oct – 10 km orbit





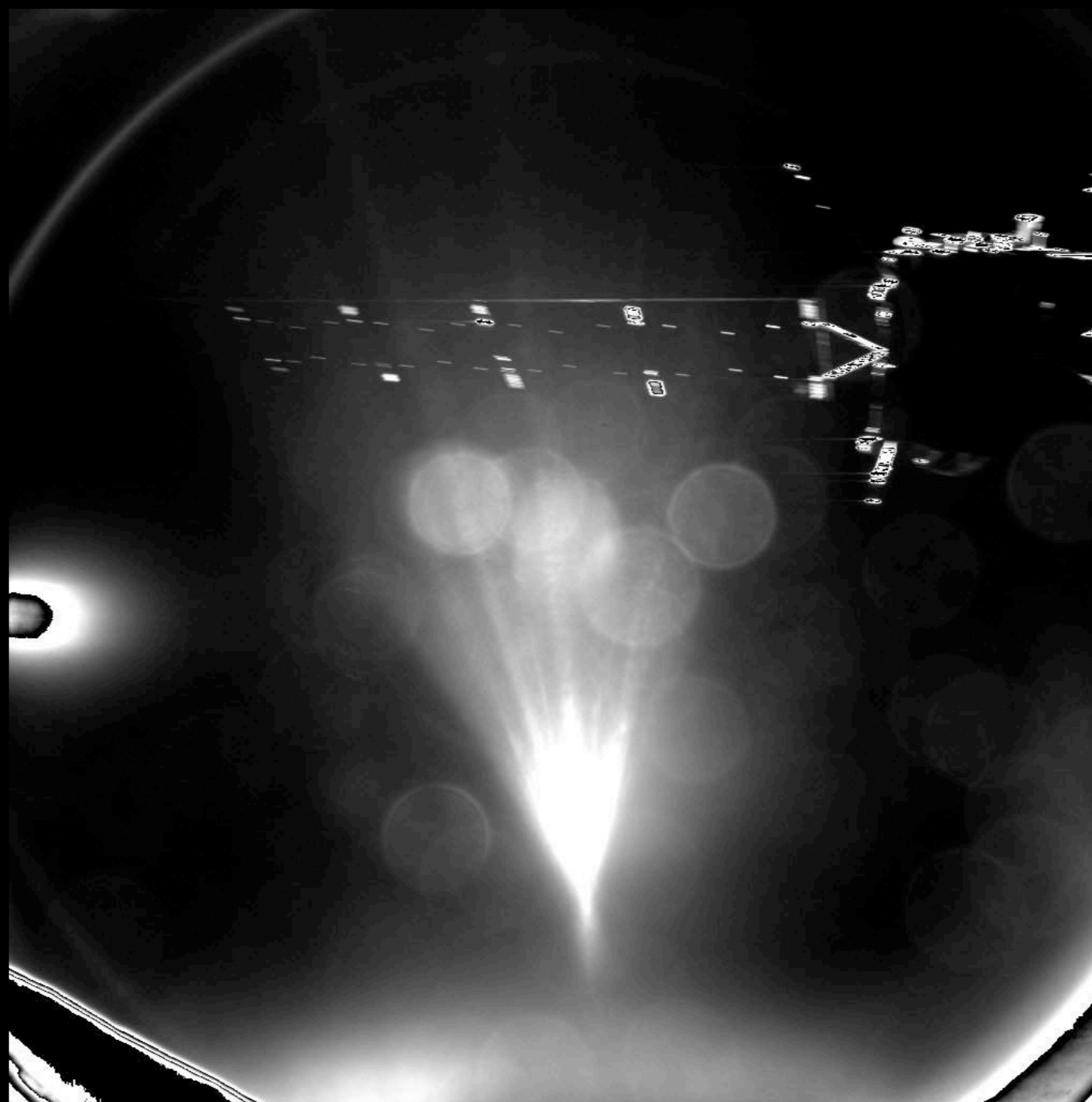
esa  
esoc



315 2064/34  
- 0114076

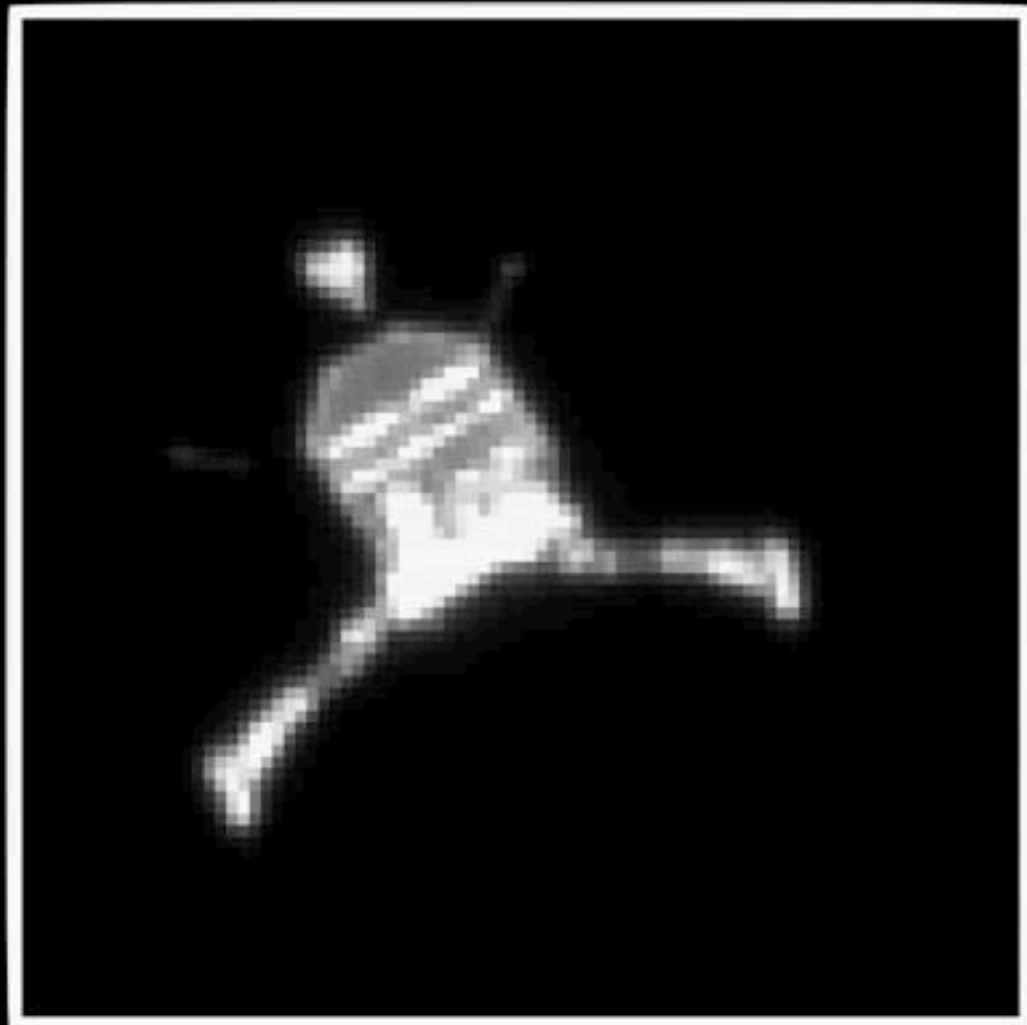
5G



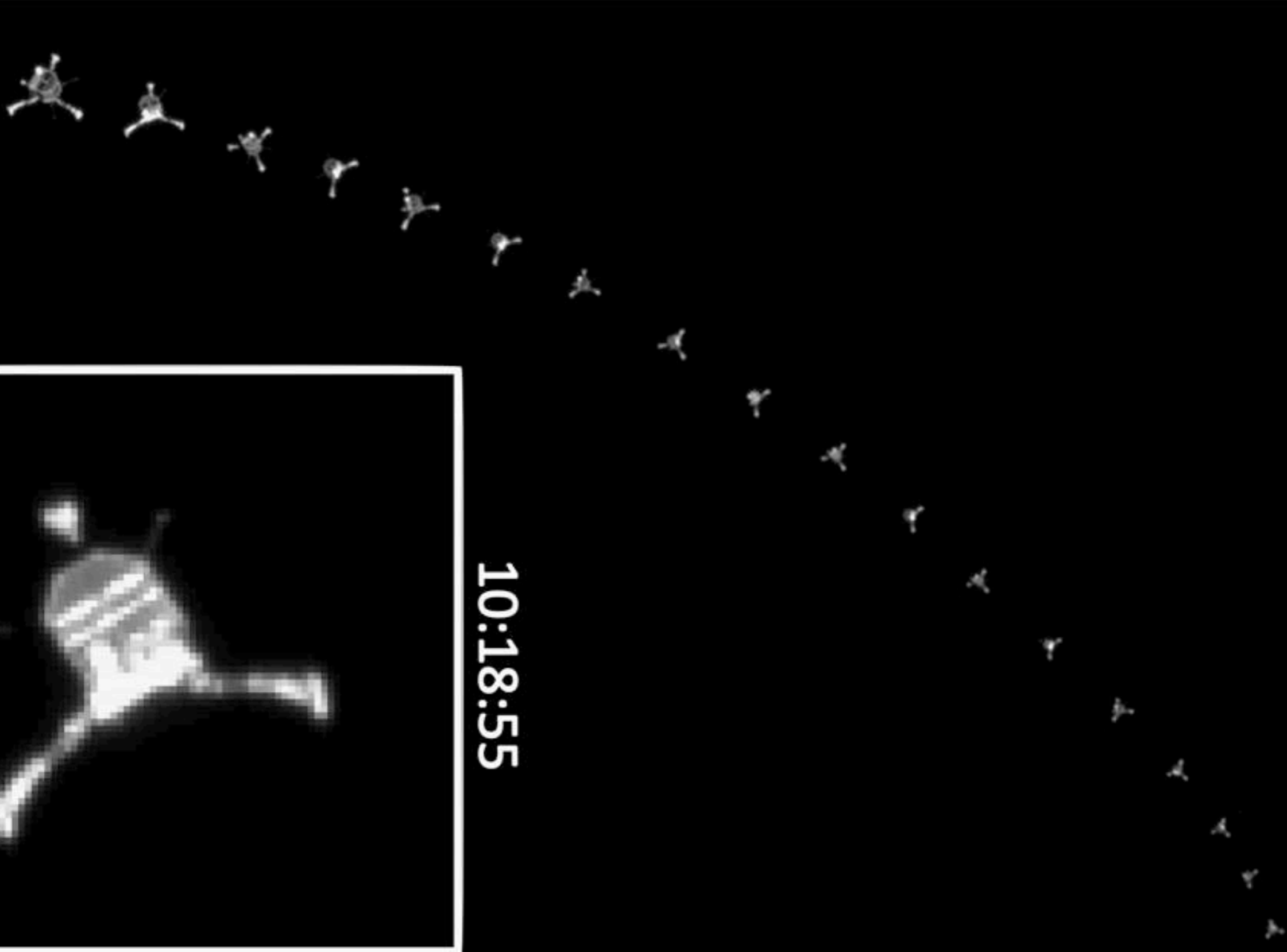


ESA/Rosetta/Philae/CIVA





10:18:55





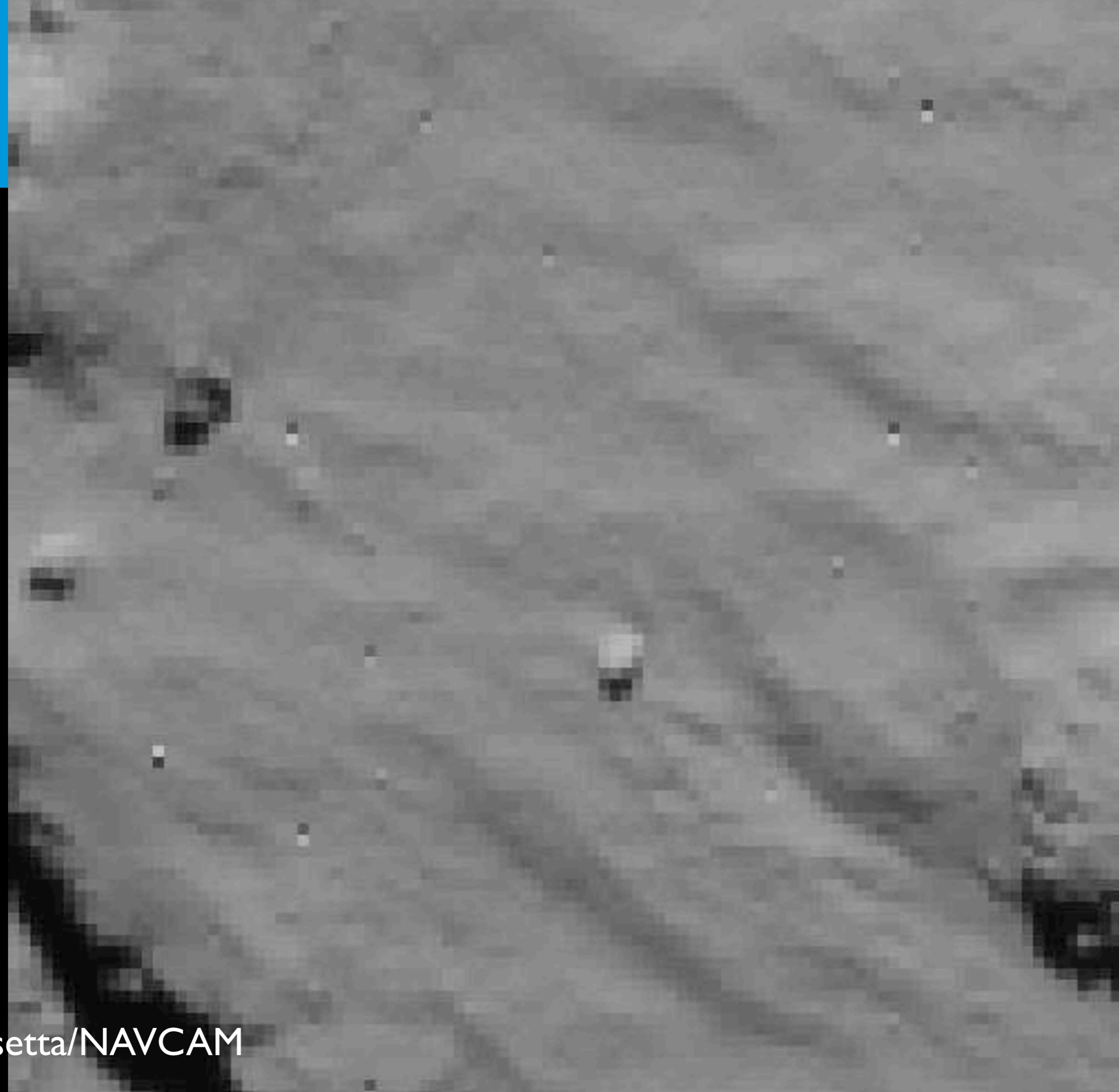


**ESA/Rosetta/Philae/Rolis**





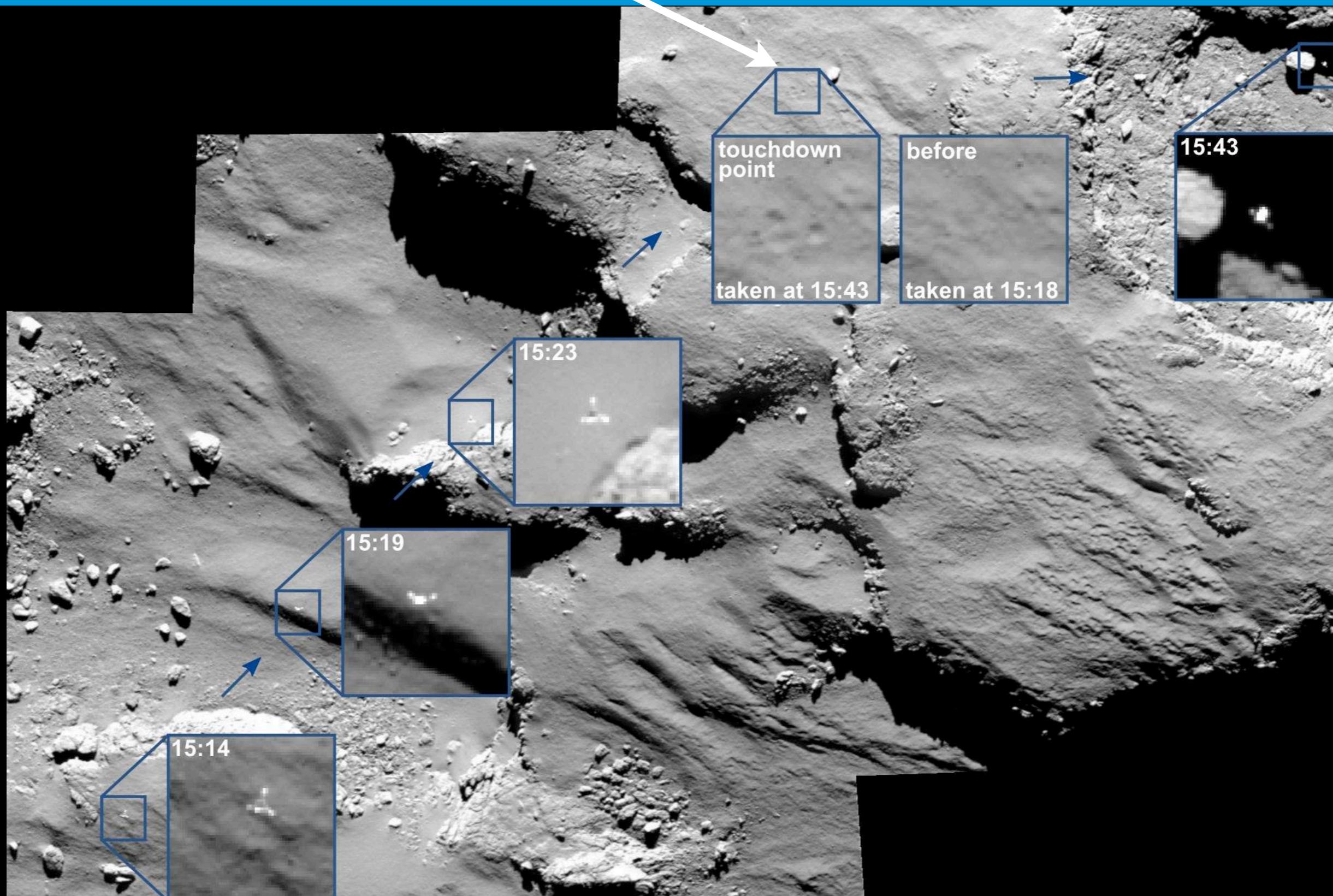




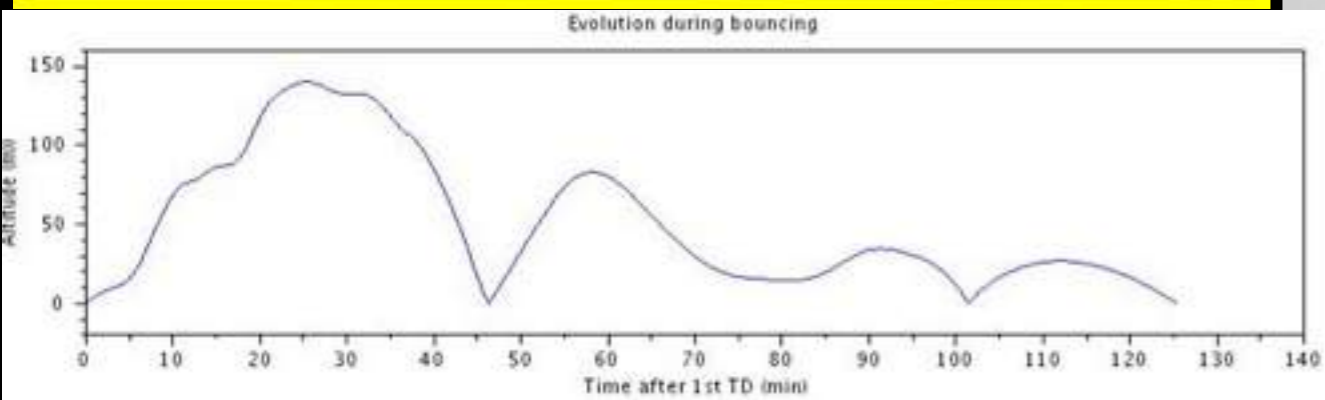
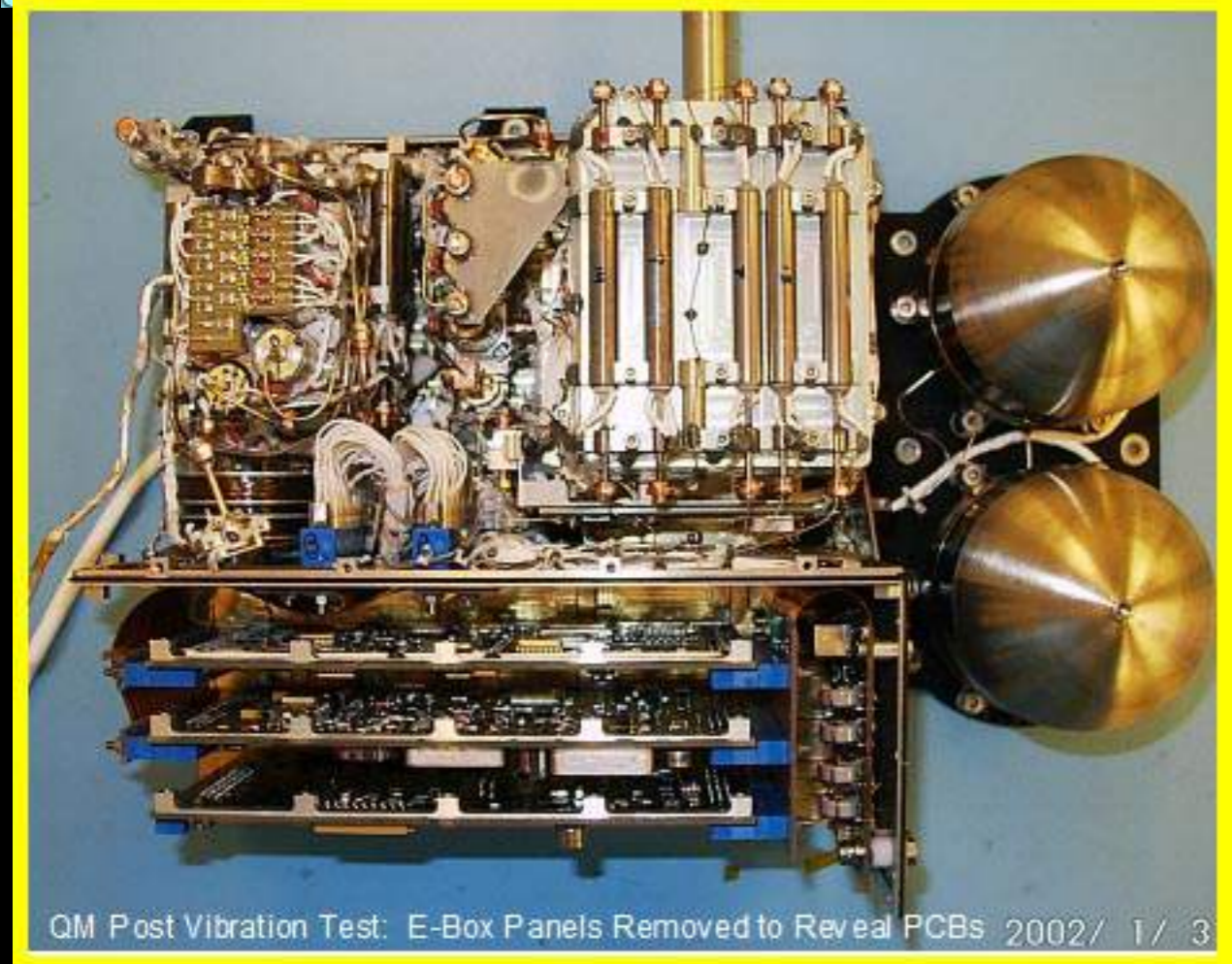
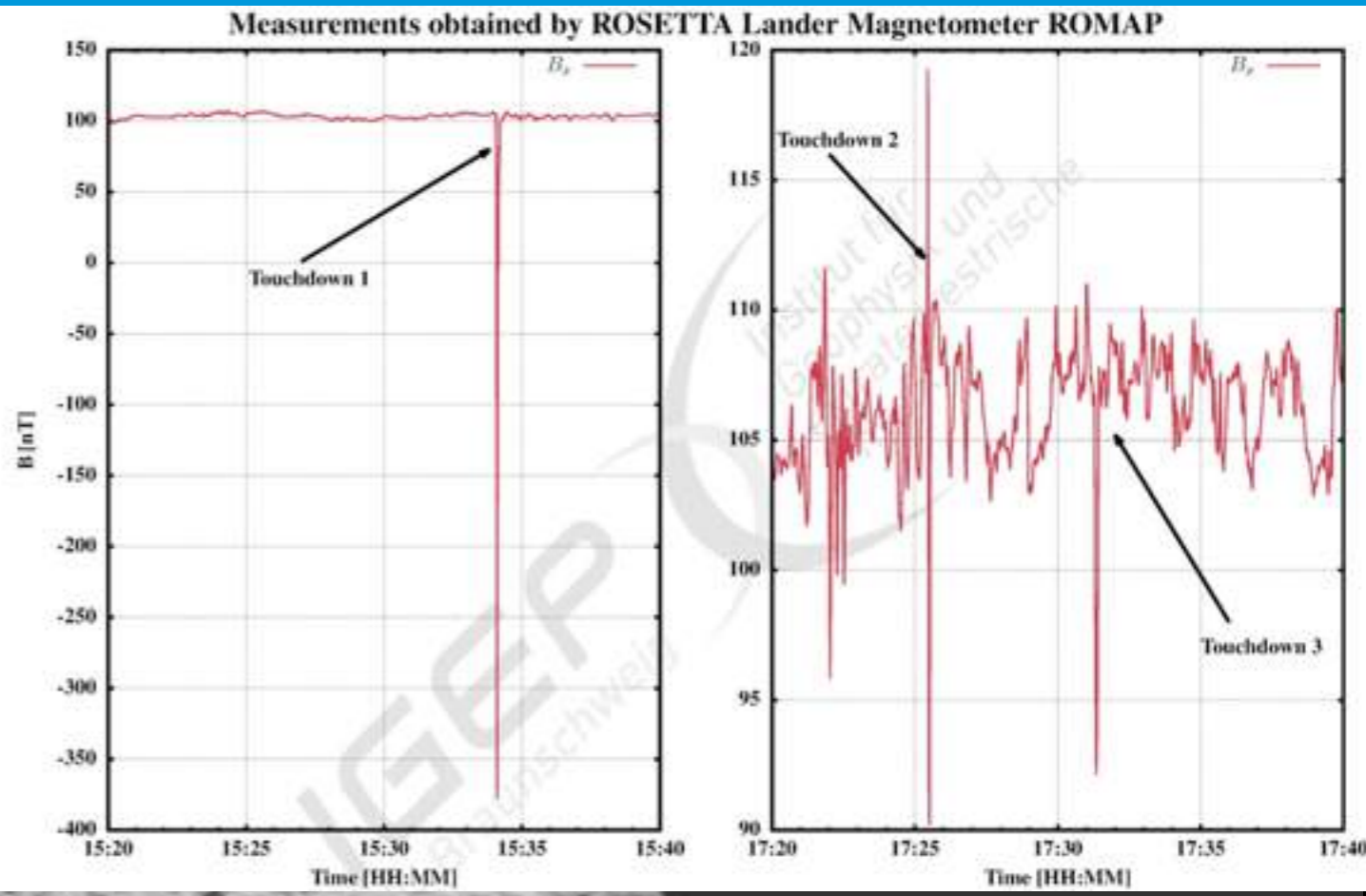
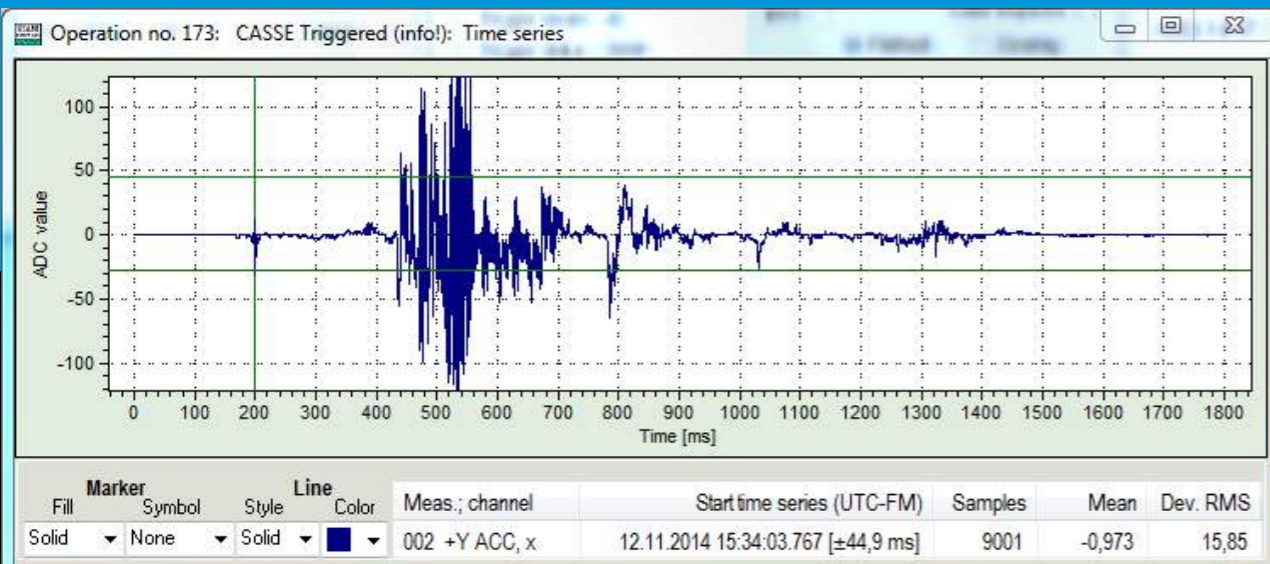


Touchdown within 120m

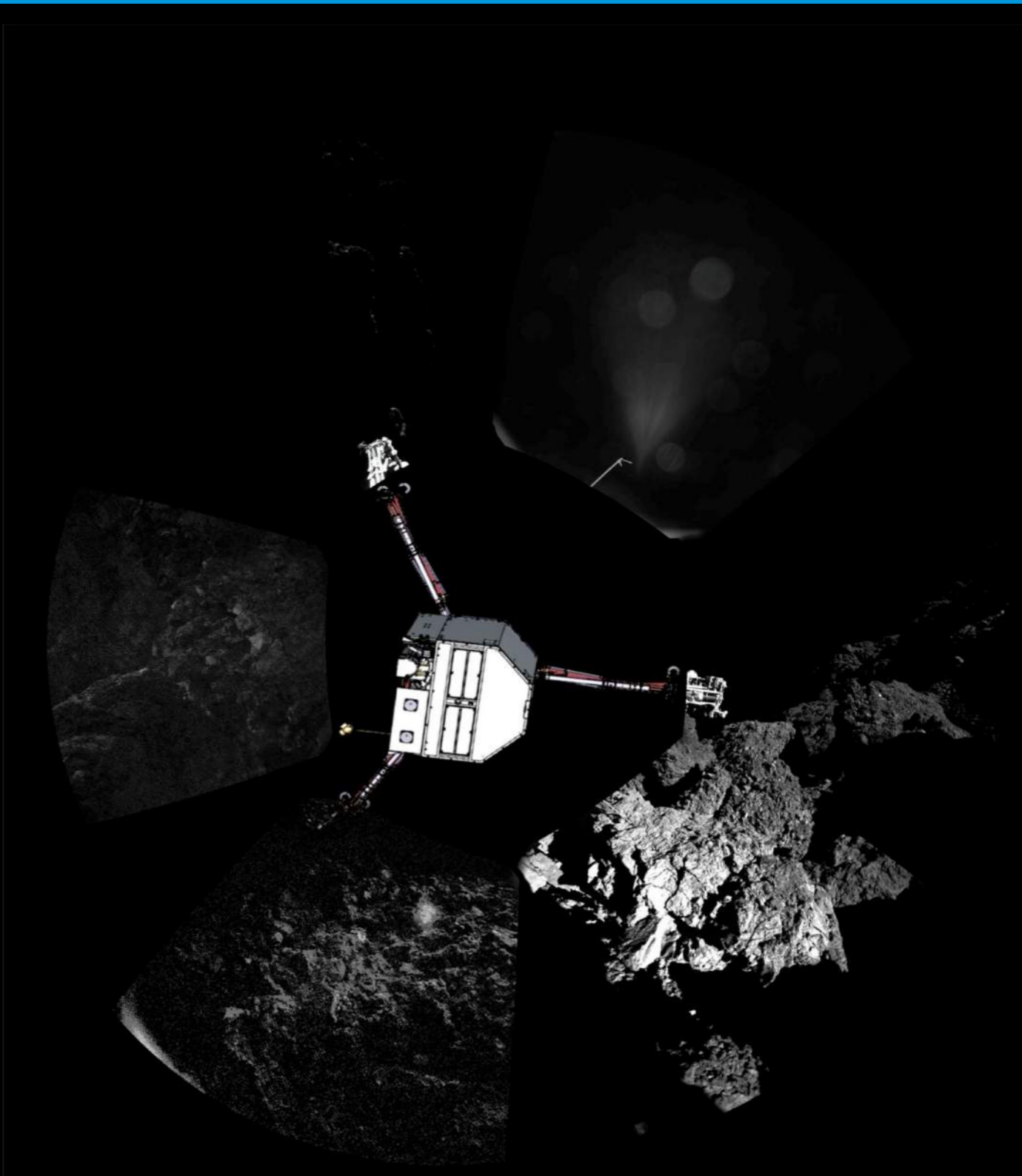
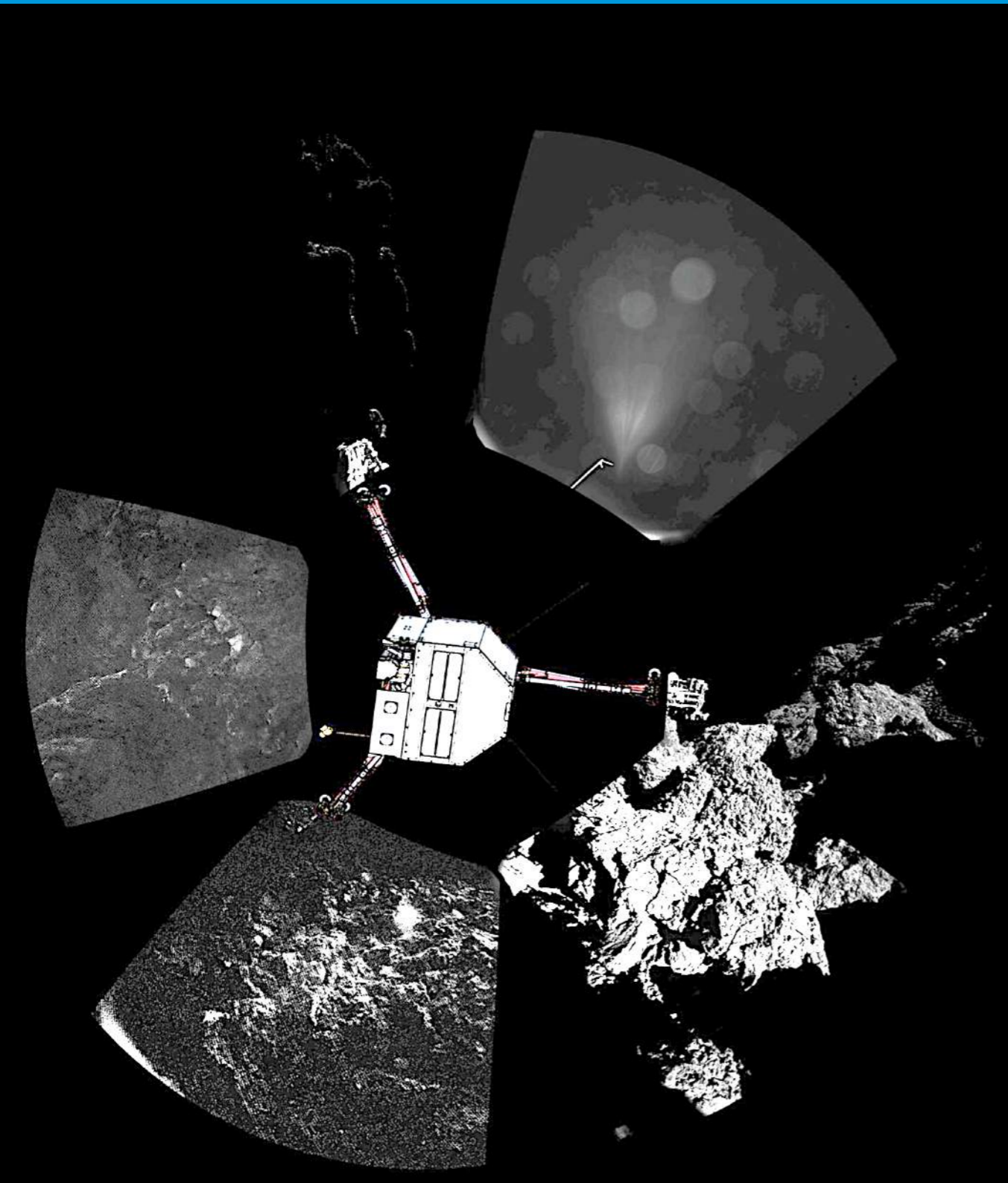
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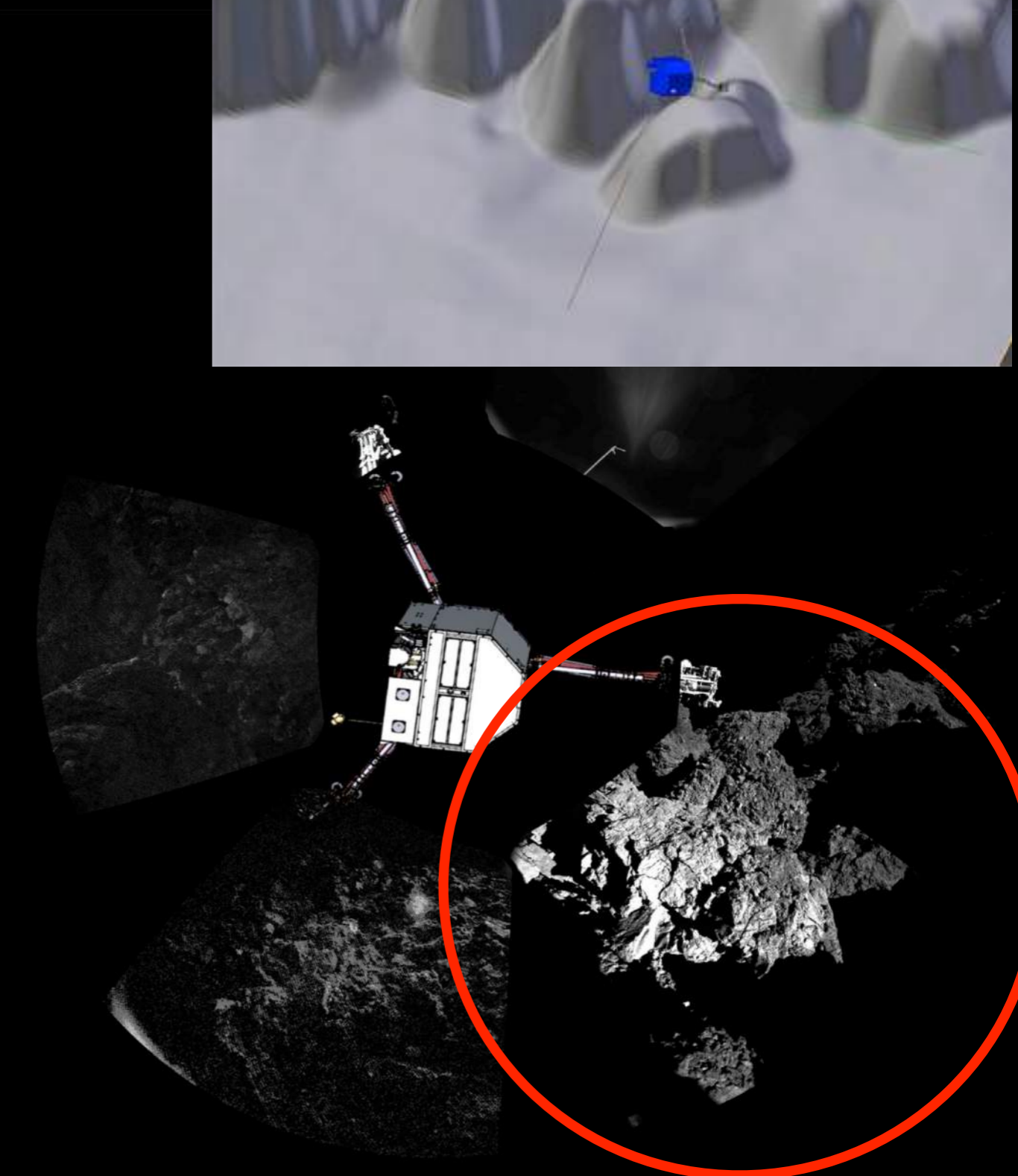
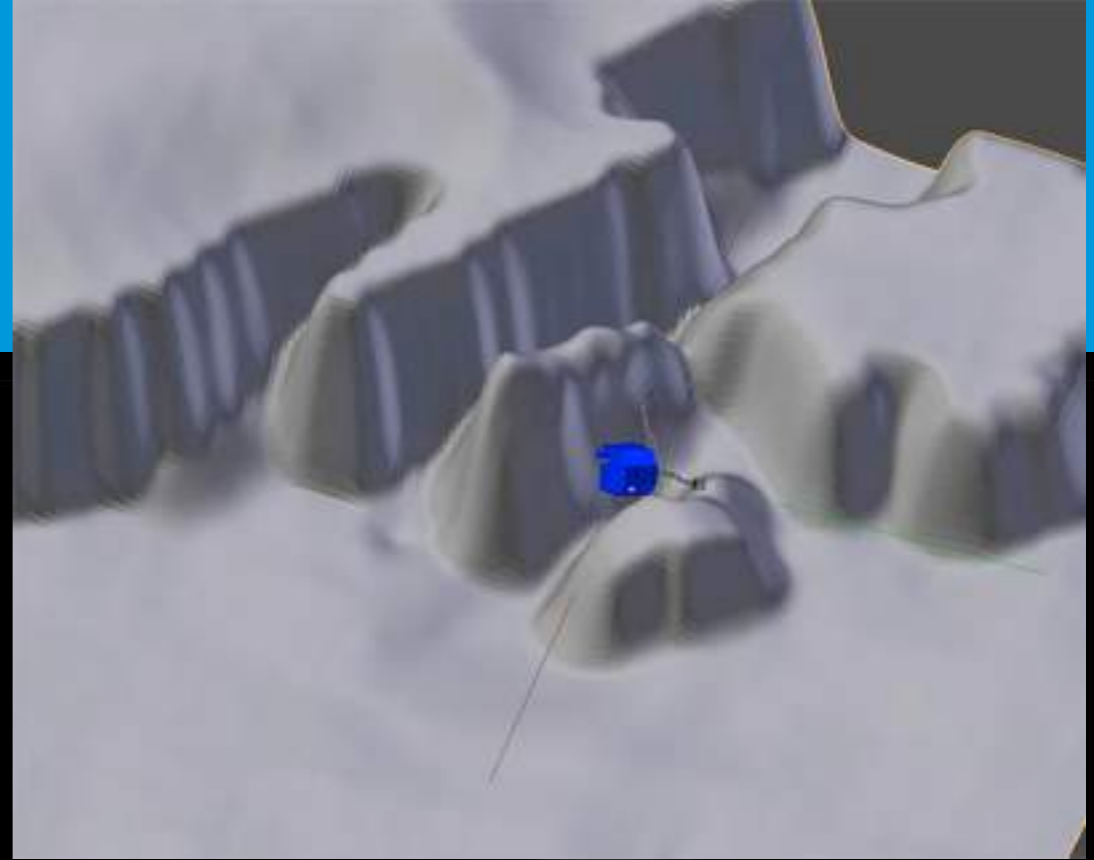
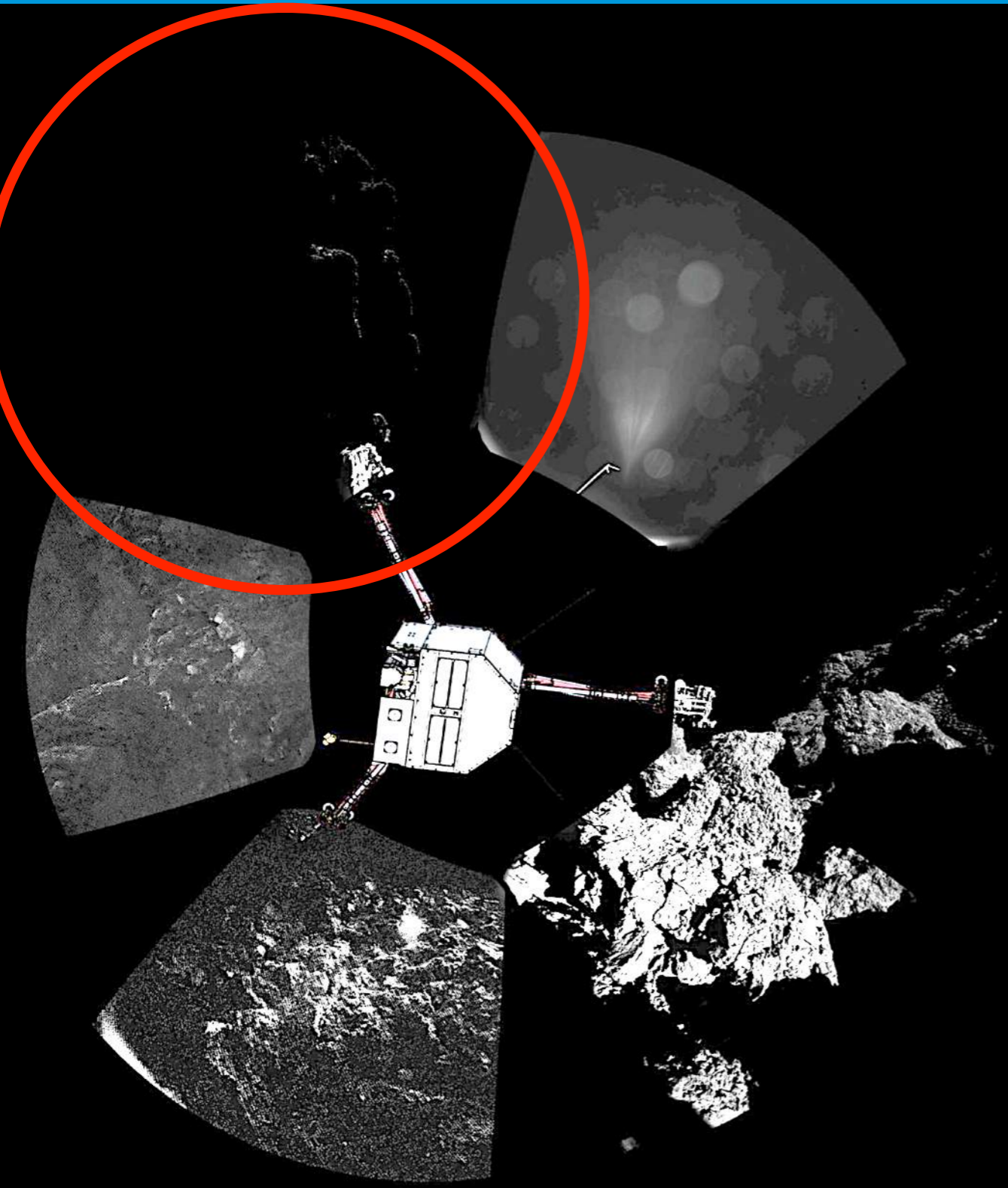






ESA/Rosetta/Philae/CIVA





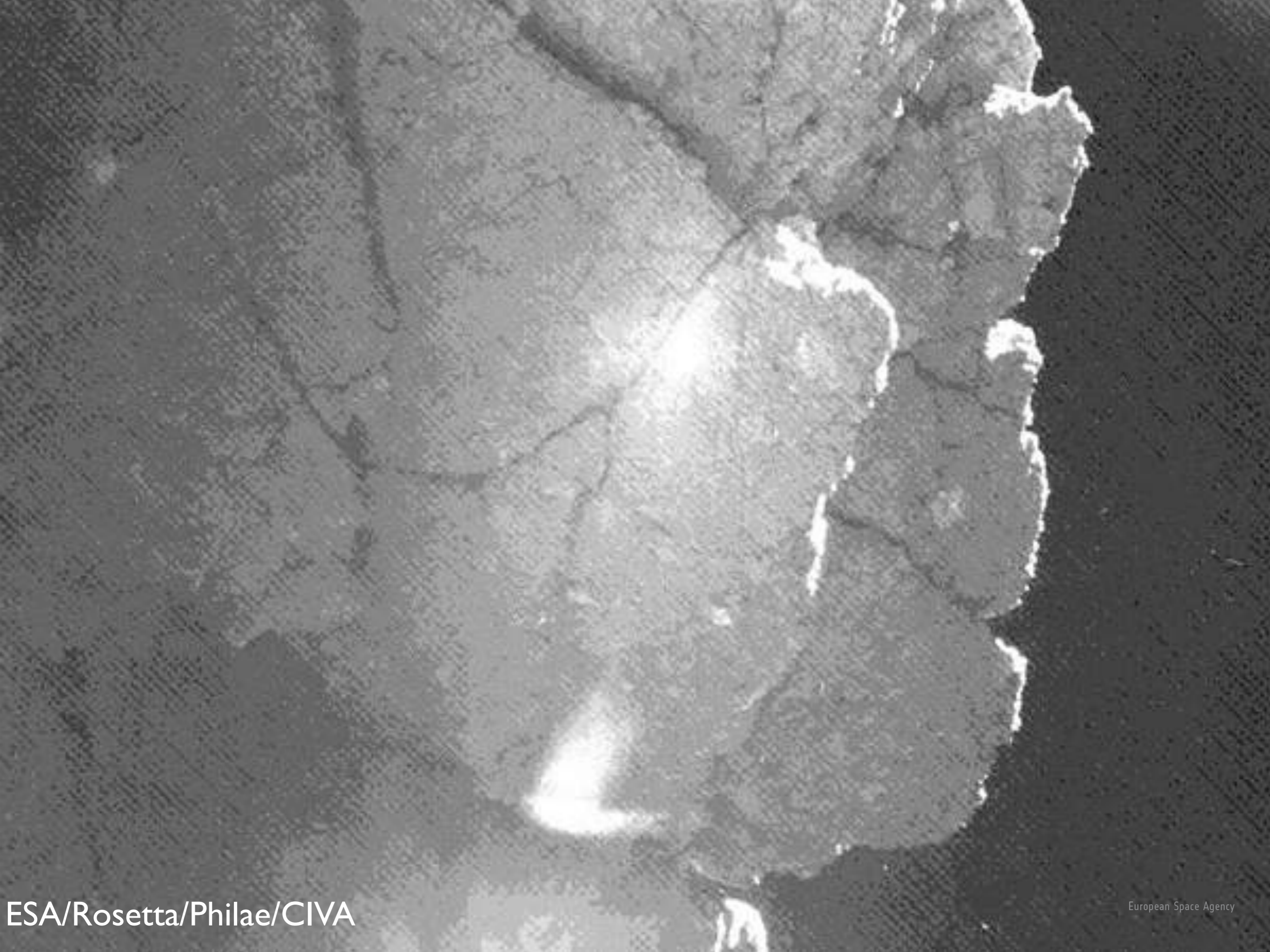
ESA/Rosetta/Philae/CIVA



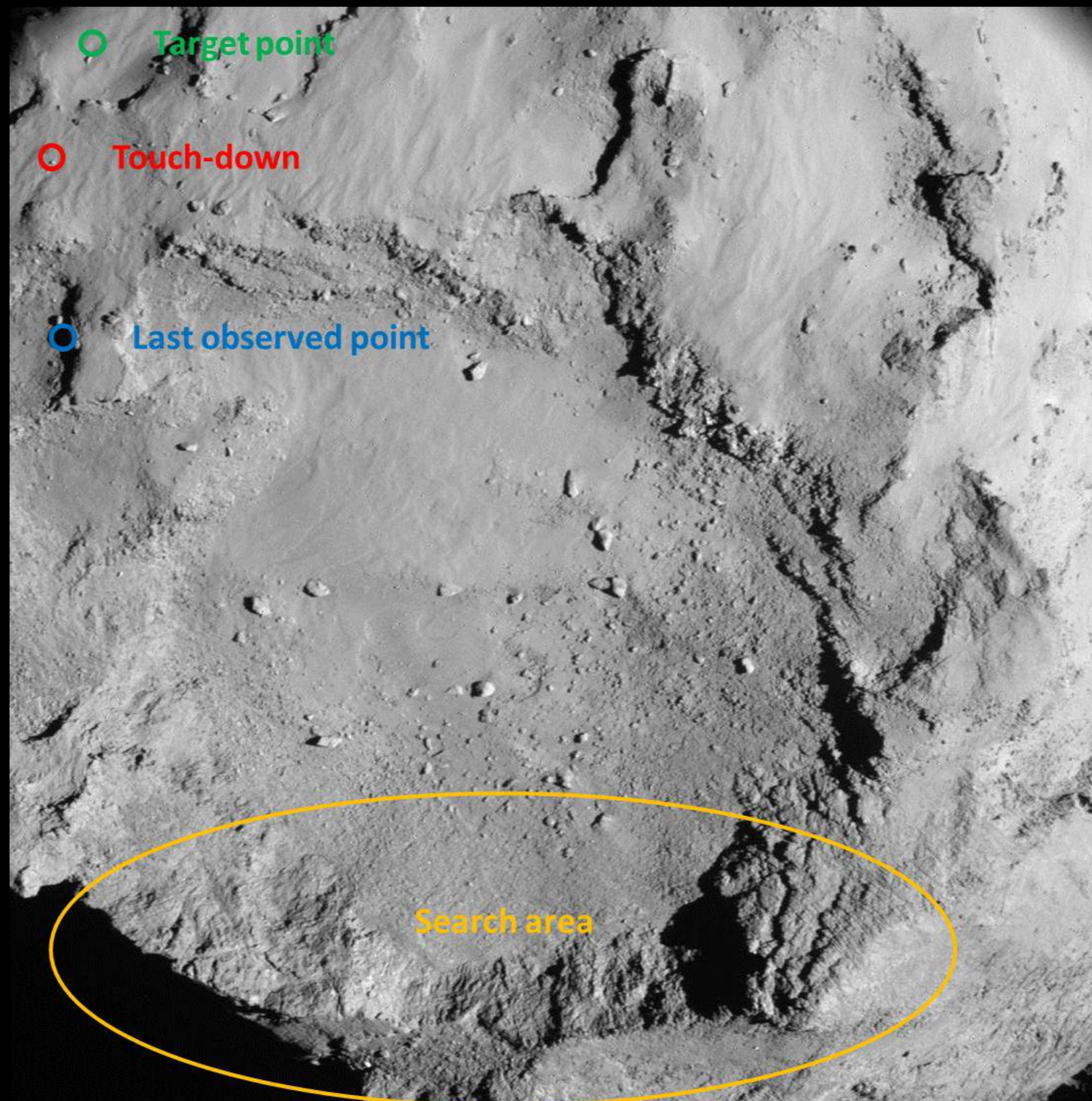
ESA/Rosetta/Philae/CIVA



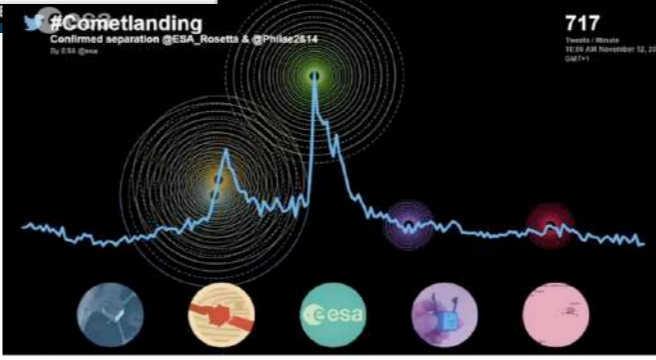
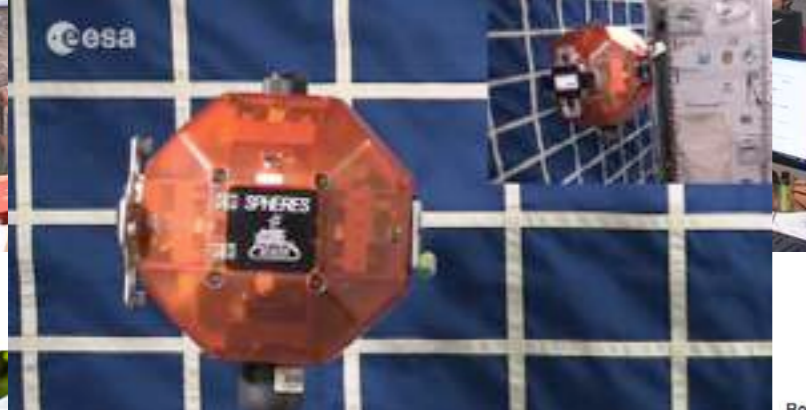




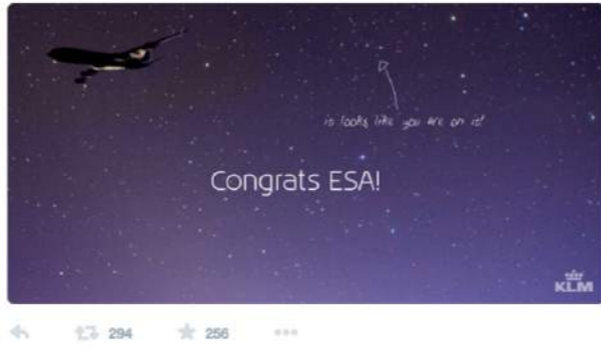








Royal Dutch Airlines @KLM - Nov 12  
 Congratulations @esa! #CometLanding



Intel @intel - Nov 13  
 From our engineers to yours, job well done! Congratulations, @esa! #cometlanding

Royal Mail News @royalmailnews - Nov 14  
 Who's excited about our #CometLanding postmark? We are! Celebrating the amazing @esa @ESA\_Rosetta @Philae2014 mission



Prompted Awareness	Germany	France	Italy	UK
Rosetta	75%	72%	70%	69%



# Andrew Baxter







04 Feb – 26 km

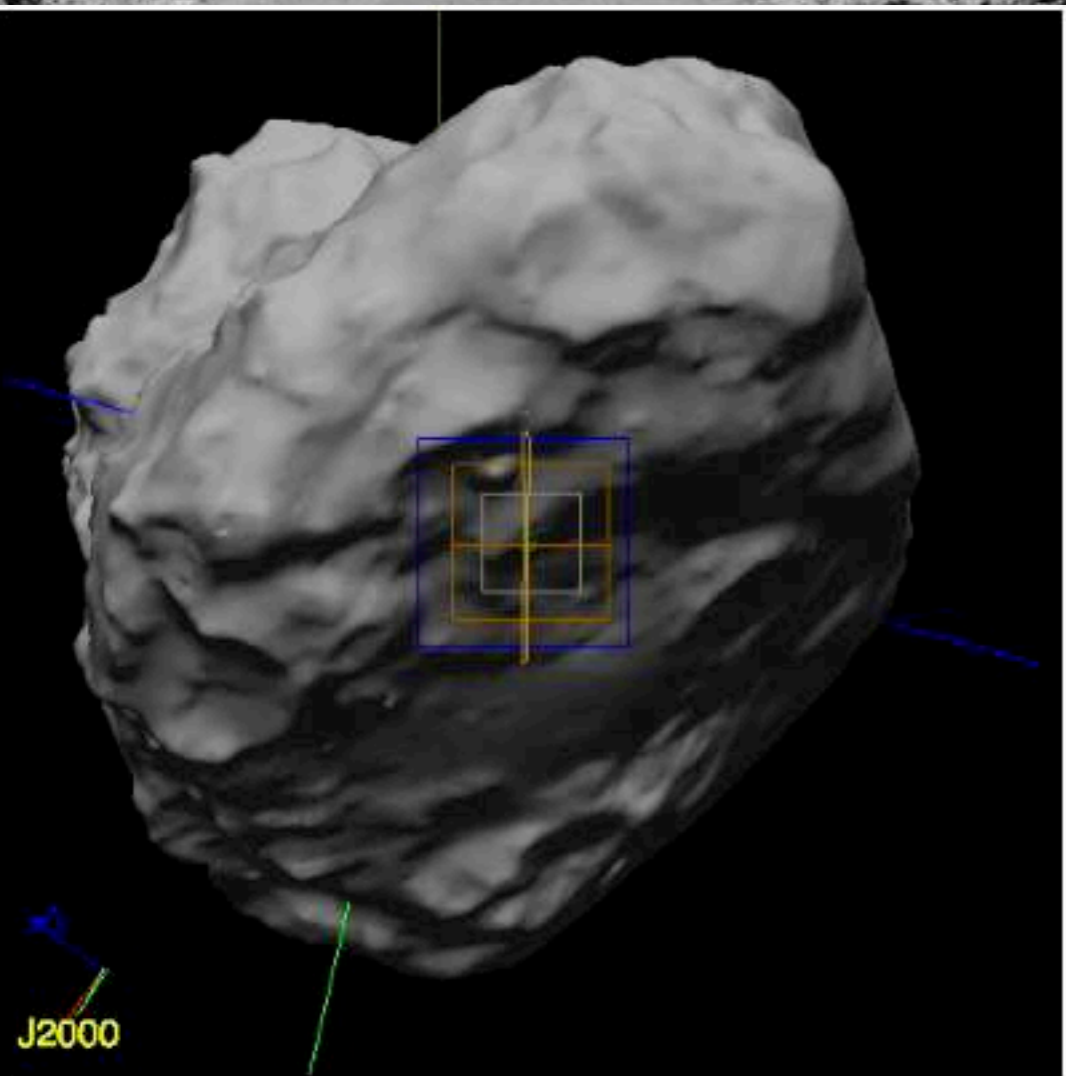
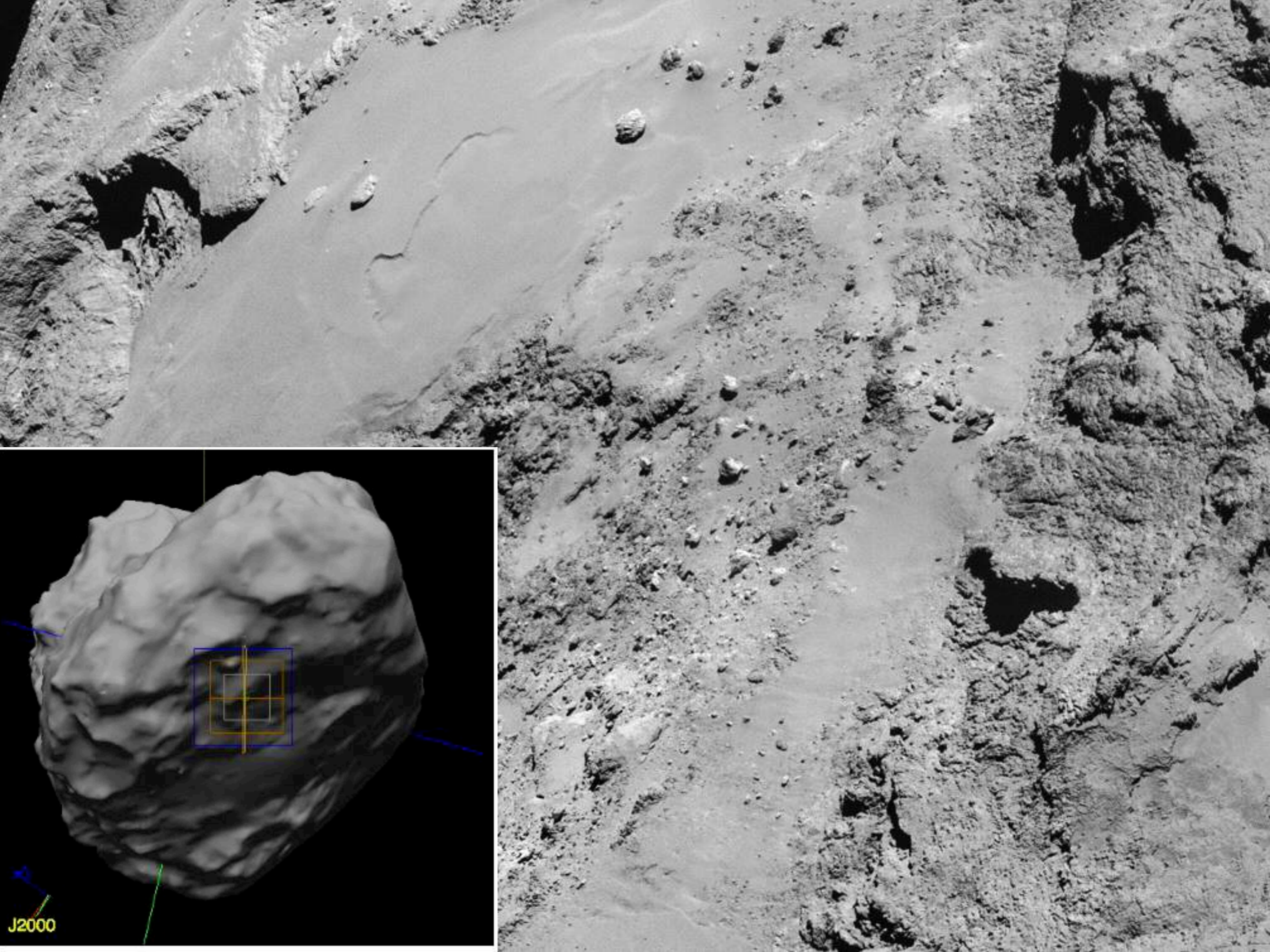
07 Feb – 142 km

11 Feb – 101 km

14 Feb – 48 km

**14 Feb – 6 km**





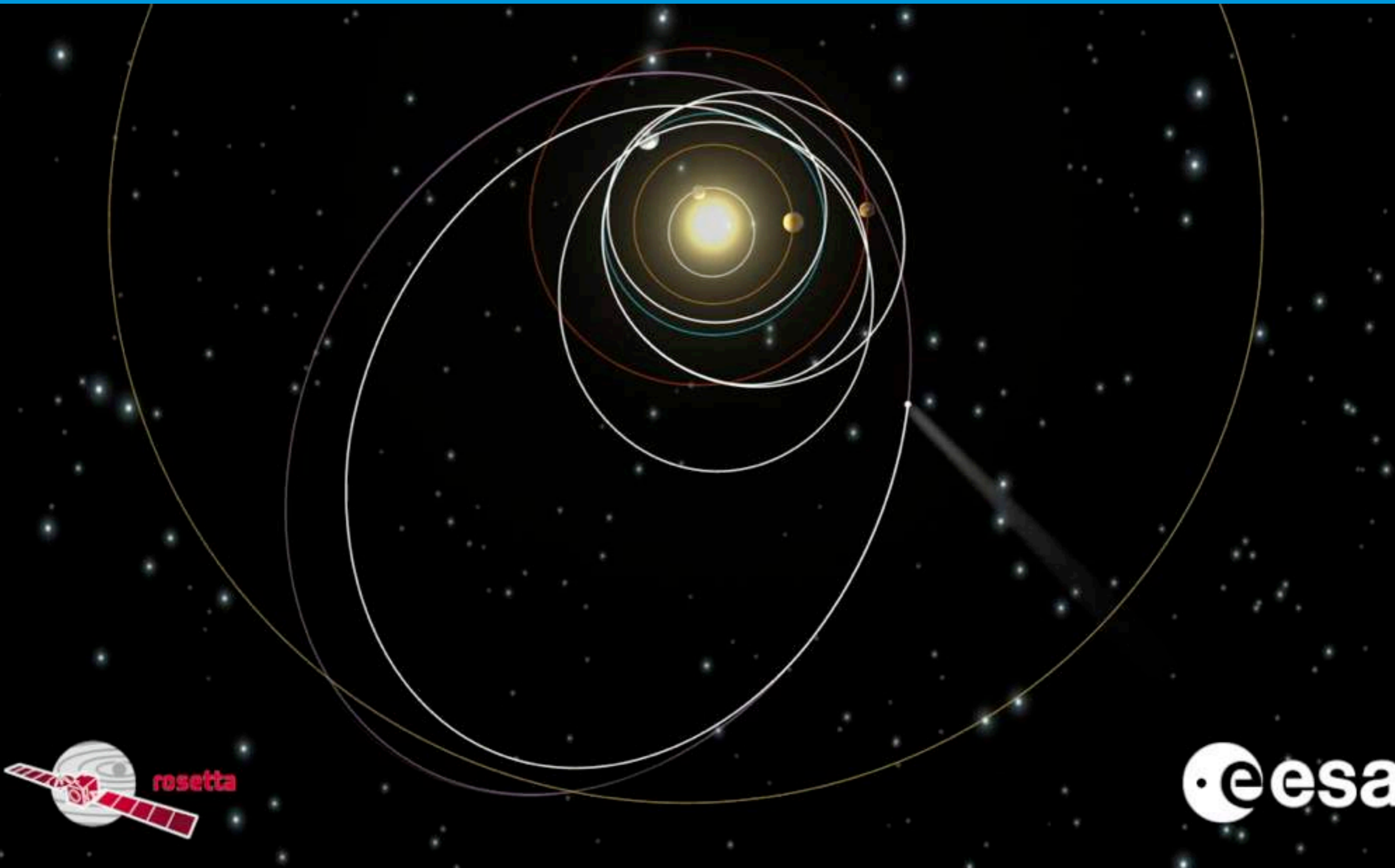












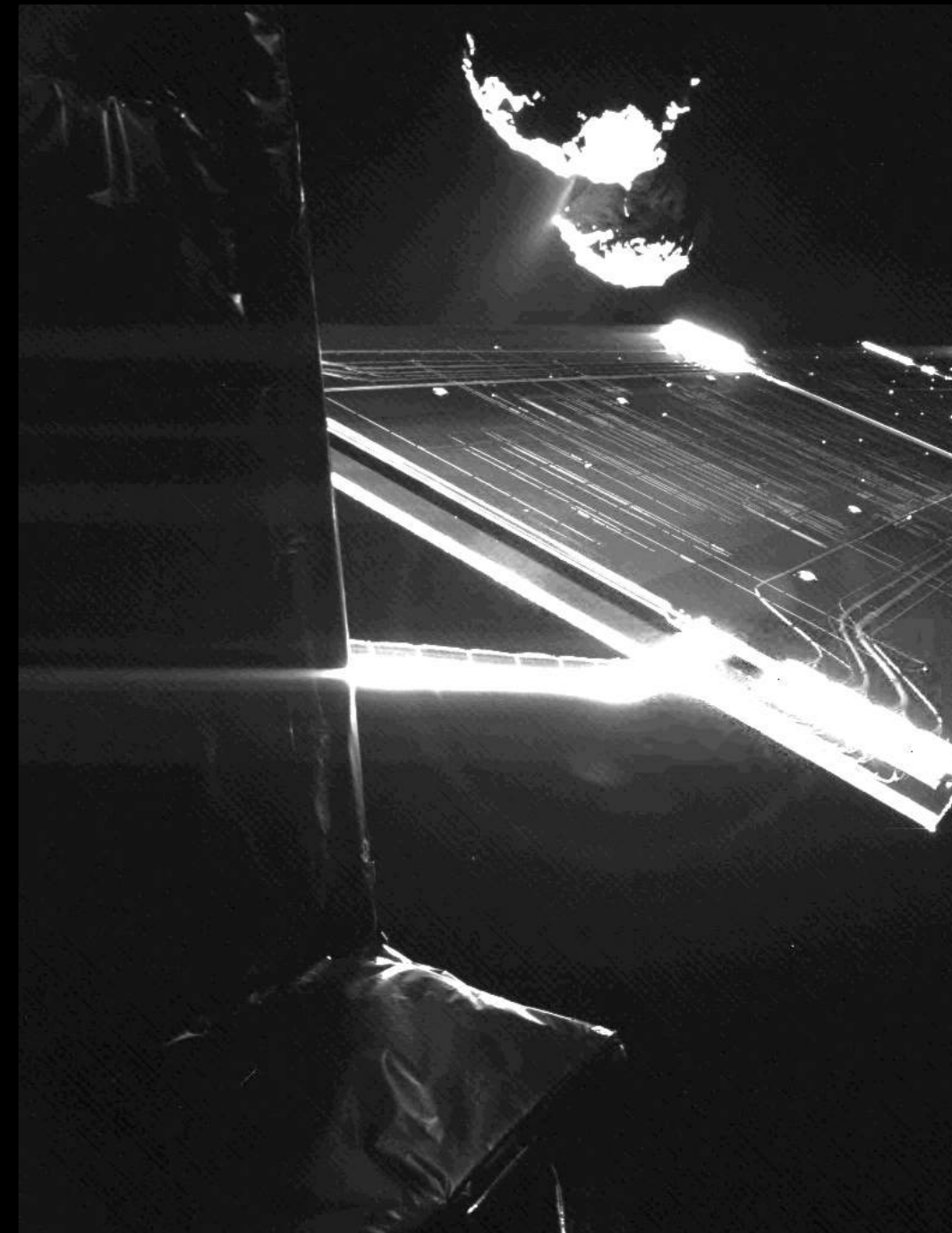


Rosetta is the first mission to shadow a comet, travelling at a relative walking pace with respect to the comet.

It has delivered Philae to the comet to get ground truth from insitu measurements.

It has, is and will continue to provide the most detailed study of a comet during its closest approach to the Sun

It has also captured the imagination of millions and hopefully inspired many future scientists and engineers







@ESA\_Rosetta  
<http://blogs.esa.int/rosetta/>



August 2015  
December 31, 2015

Perihelion  
Nominal end-of-mission

