

IAC-14,A3,4.5x21592

Preparing for Dawn's Mission at Ceres



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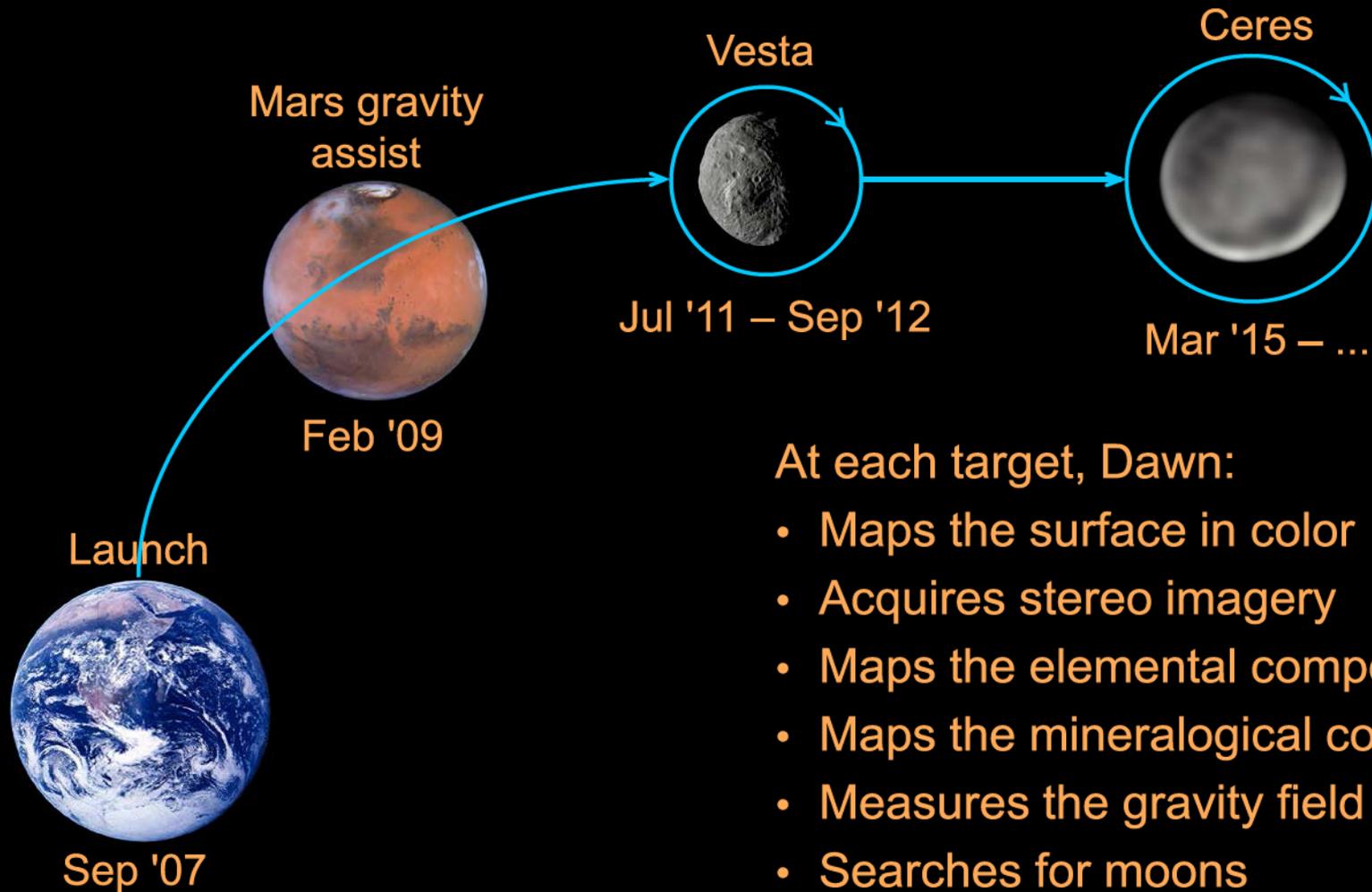
UCLA

JPL *Orbital*



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Mission Itinerary



At each target, Dawn:

- Maps the surface in color
- Acquires stereo imagery
- Maps the elemental composition
- Maps the mineralogical composition
- Measures the gravity field
- Searches for moons

Note: Text not to scale.

Vesta and Ceres Size

Mathilde

Lutetia



Vesta



Ceres



Pluto

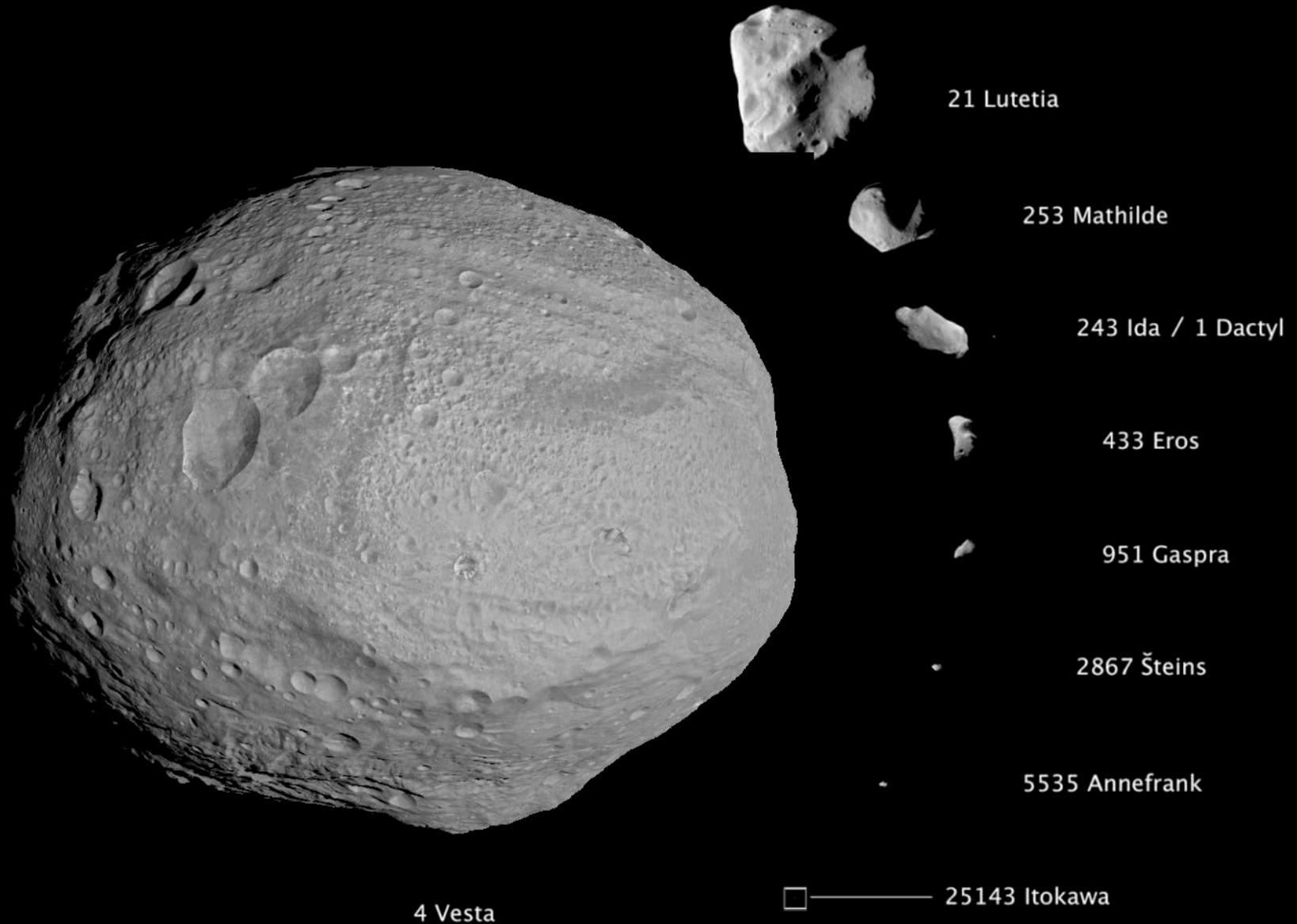


California
(smog not shown)



Earth's moon

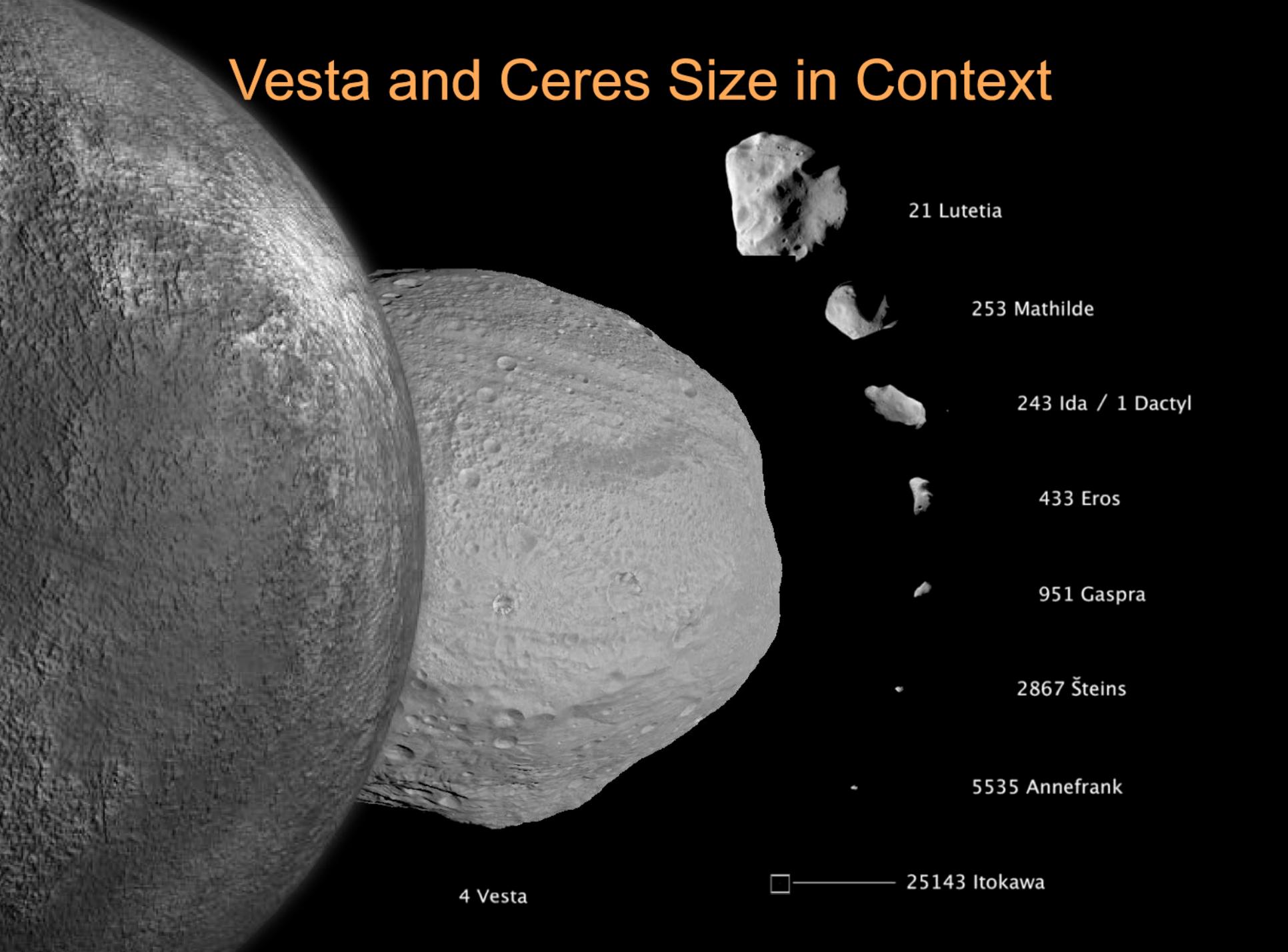
Vesta and Ceres Size in Context







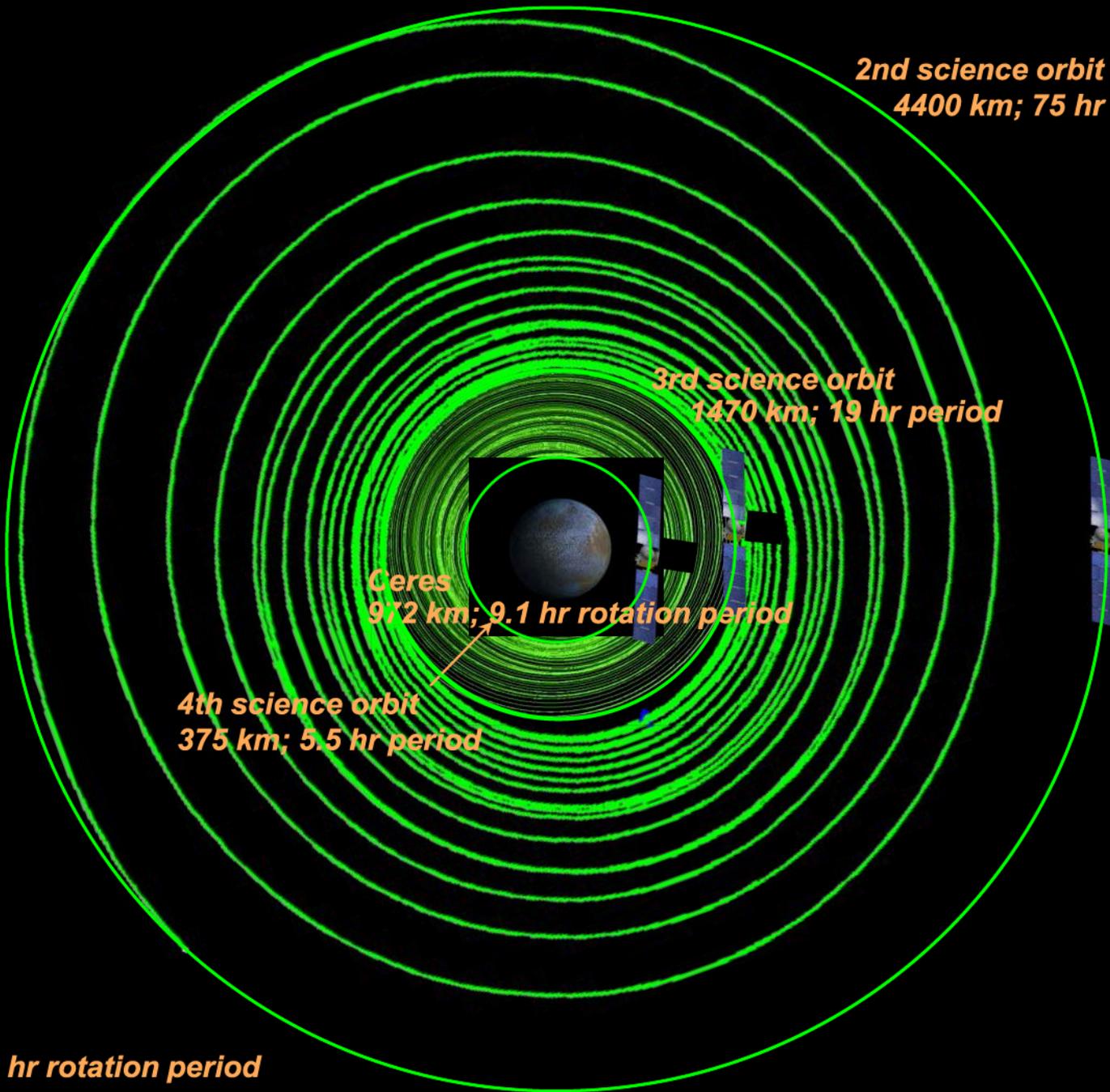
Vesta and Ceres Size in Context



Ceres

Thin, dusty
crust





2nd science orbit
4400 km; 75 hr period

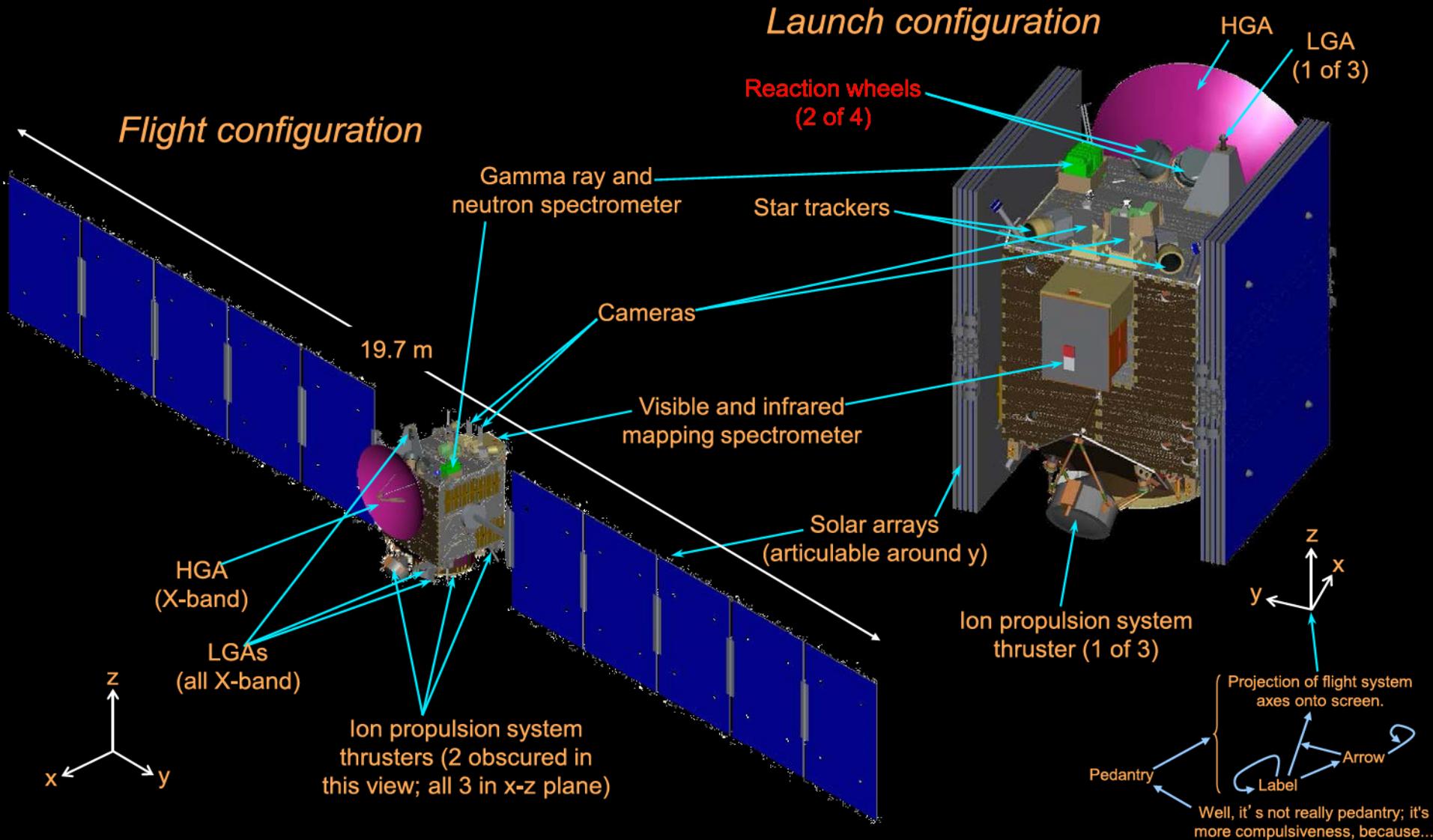
3rd science orbit
1470 km; 19 hr period

Ceres
972 km; 9.1 hr rotation period

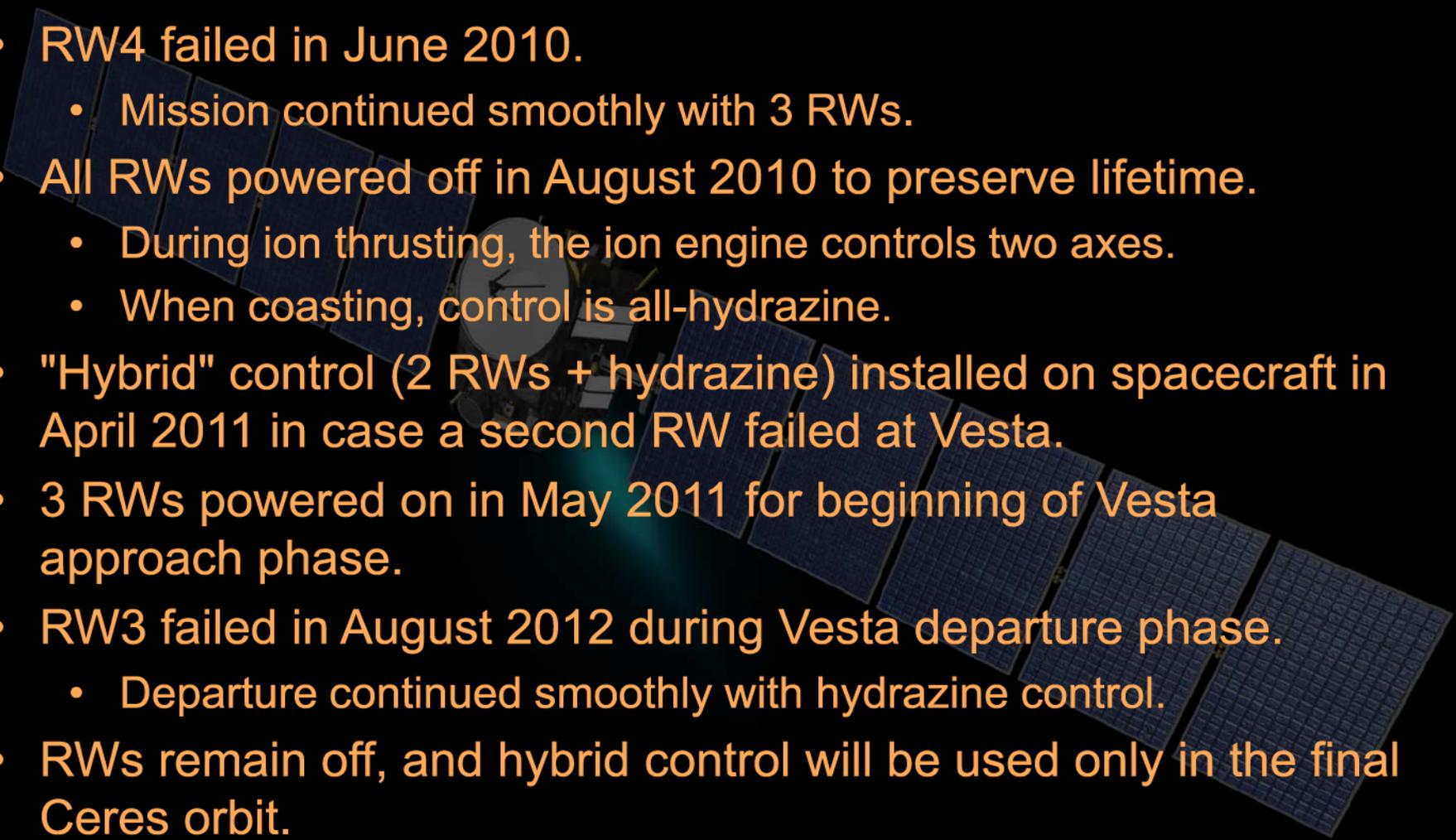
4th science orbit
375 km; 5.5 hr period

Ceres
972 km; 9.1 hr rotation period

Flight System Overview

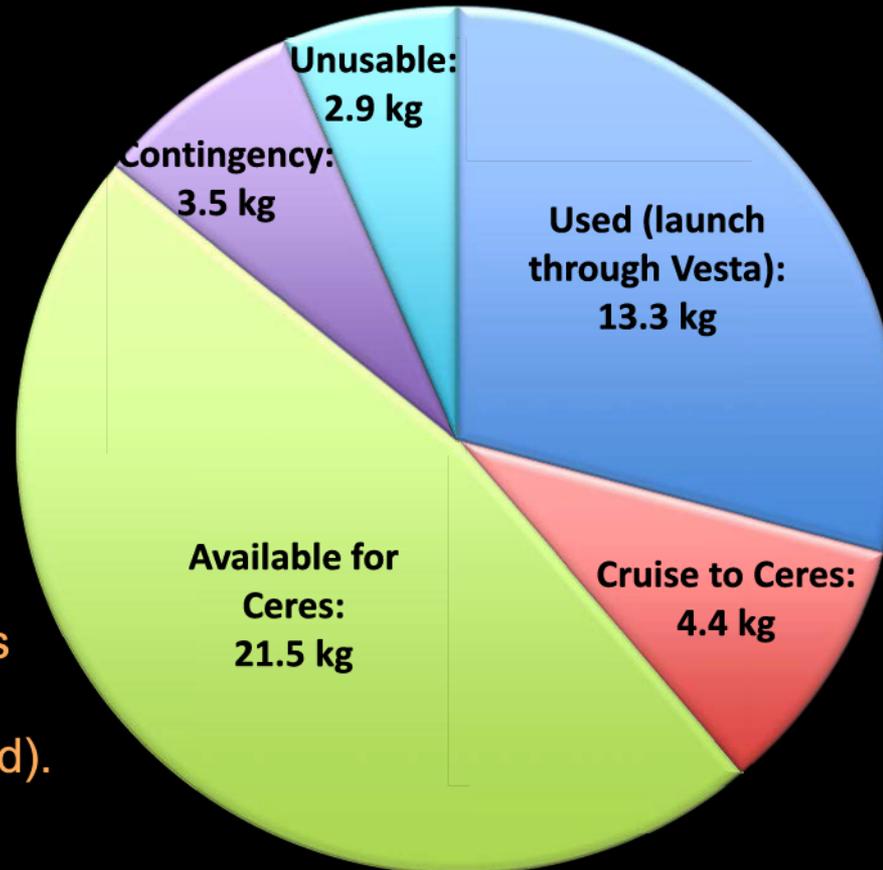


Reaction Wheel (RW) History

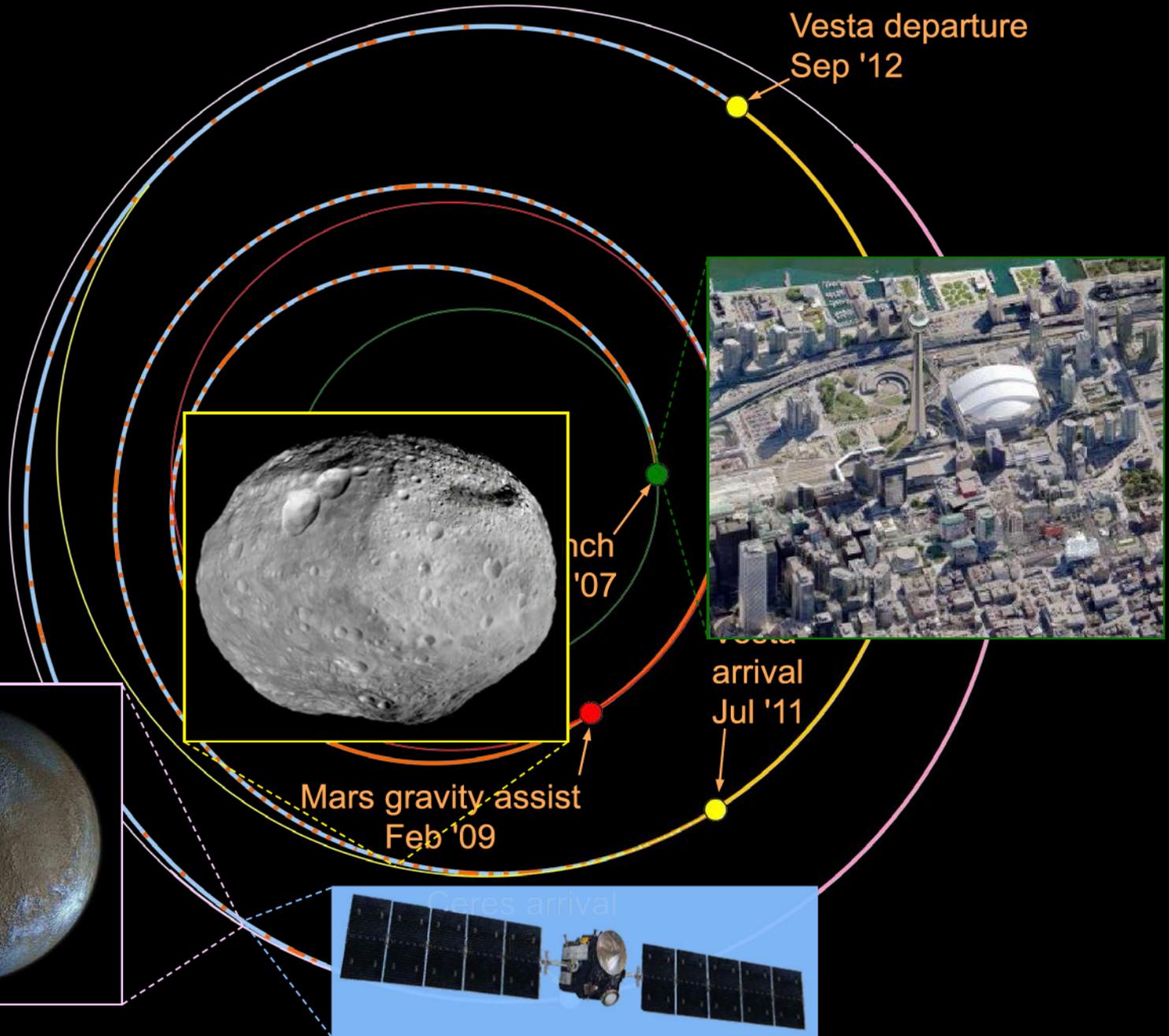
- RW4 failed in June 2010.
 - Mission continued smoothly with 3 RWs.
 - All RWs powered off in August 2010 to preserve lifetime.
 - During ion thrusting, the ion engine controls two axes.
 - When coasting, control is all-hydrazine.
 - "Hybrid" control (2 RWs + hydrazine) installed on spacecraft in April 2011 in case a second RW failed at Vesta.
 - 3 RWs powered on in May 2011 for beginning of Vesta approach phase.
 - RW3 failed in August 2012 during Vesta departure phase.
 - Departure continued smoothly with hydrazine control.
 - RWs remain off, and hybrid control will be used only in the final Ceres orbit.
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Hydrazine Conservation

- The day the second RW failed, the project began an intensive hydrazine conservation campaign, assessing ~ 50 changes.
 - That effort was extremely productive. Among the changes implemented:
 - We reduced the spacecraft rotation rate from 0.1°/s to 0.025°/s.
 - We increased the interval between pauses in thrusting for telecom from 1 week to 4 weeks.



Ceres plan requires
 16.2 ± 4 kg
(assuming no hybrid).



Vesta departure
Sep '12

March
'07

arrival
Jul '11

Mars gravity assist
Feb '09

Ceres arrival

Ion Thrusting Progress

The Dawn spacecraft is shown in the center, with its two large blue solar panel arrays extended. A bright blue ion thruster plume is visible behind the spacecraft. The Earth is in the bottom right, and Mars is in the top left.

- Dawn has achieved the greatest propulsive Δv and the longest powered flight by any spacecraft.
- Δv
 - Today: 10.2 km/s
 - End of mission: 11 km/s \approx Delta II 7925H Δv
- Powered flight time
 - Today: 4.8 years
 - › 68% of time since launch
 - › $3.4 \cdot 10^{-8}$ % of time since Big Bang
 - End of mission: 5.5 years

