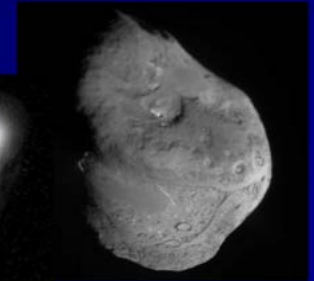
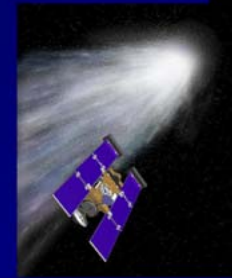


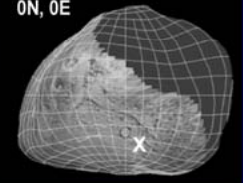
STARDUST-NExT

A MISSION TO COMPLETE
THE EXPLORATION OF COMET
TEMPER 1 WITH STARDUST

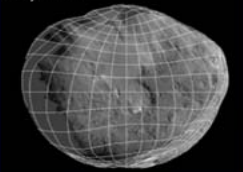
NExT Update for SBAG
J. Veverka
February 13, 2009



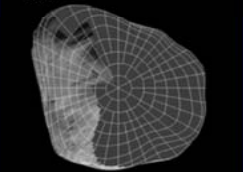
0N, 0E



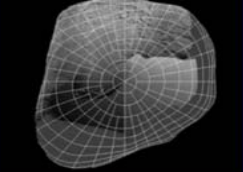
0N, 270E



90N



90S



What is NExT?

- NExt (New Exploration of Tempel) is a Discovery MOO which uses the Stardust Spacecraft to complete and extend the study of comet Tempel 1 initiated by Deep Impact in 2005.
- NExT will flyby Tempel 1 at 200 km on Feb. 14, 2010 (about one comet year after DI).

Mission Status: Great!

- Spacecraft and Team continue to perform flawlessly.
- The three instruments onboard have been checked out and are ready for the Tempel 1 encounter.
- The camera (NAVCAM) underwent its first in-flight photometric/geometric calibration in December 2008.
- All TCM's continue to be executed as planned.
- An EGA is scheduled for January 14 (tomorrow).
- Following tomorrow's EGA spacecraft will be on its encounter trajectory to Tempel 1.
- Next important event will occur in Feb. 2010 when a TOA (Time of Arrival Adjustment) will be made.

Provides Important Science

Stardust-NExT is the FIRST mission to:

- Document the surface changes on a comet nucleus between successive perihelion passages
- Measure with identical instruments the dust properties of two comets (Wild 2 and Tempel 1)

The ONLY mission that can

- Provide additional information on enigmatic layering and flow features discovered by Deep Impact
- Determine how the Deep Impact experiment modified the surface of Tempel 1 (e.g., crater size)

Major Objectives

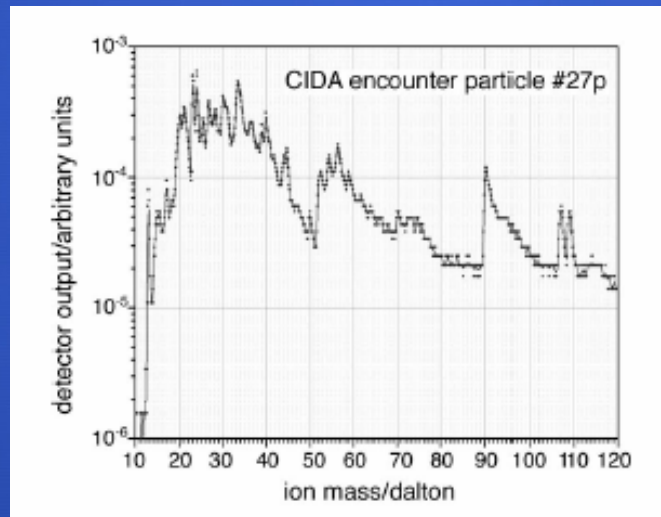
1. Document surface changes between two perihelion passages
2. Extend geologic mapping to elucidate nature of layering and constrain models of interior structure
3. Extend study of smooth flows to understand sources and origin
4. Image the Deep Impact crater to understand crater formation on comets and derive further information of the structure of the outer layers of the nucleus.

Capable Payload

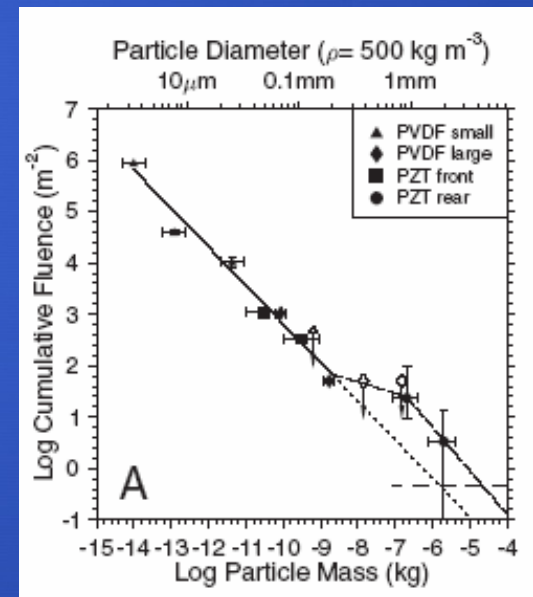
- Three-instrument payload
 - Camera (NAVCAM)
 - Comet Interstellar Dust Analyzer (CIDA)
 - Dust Flux Monitor Instrument (DFMI)



NAVCAM Wild 2



CIDA: Dust Composition



Dust Analyzer: Dust Size

Summary Data Return

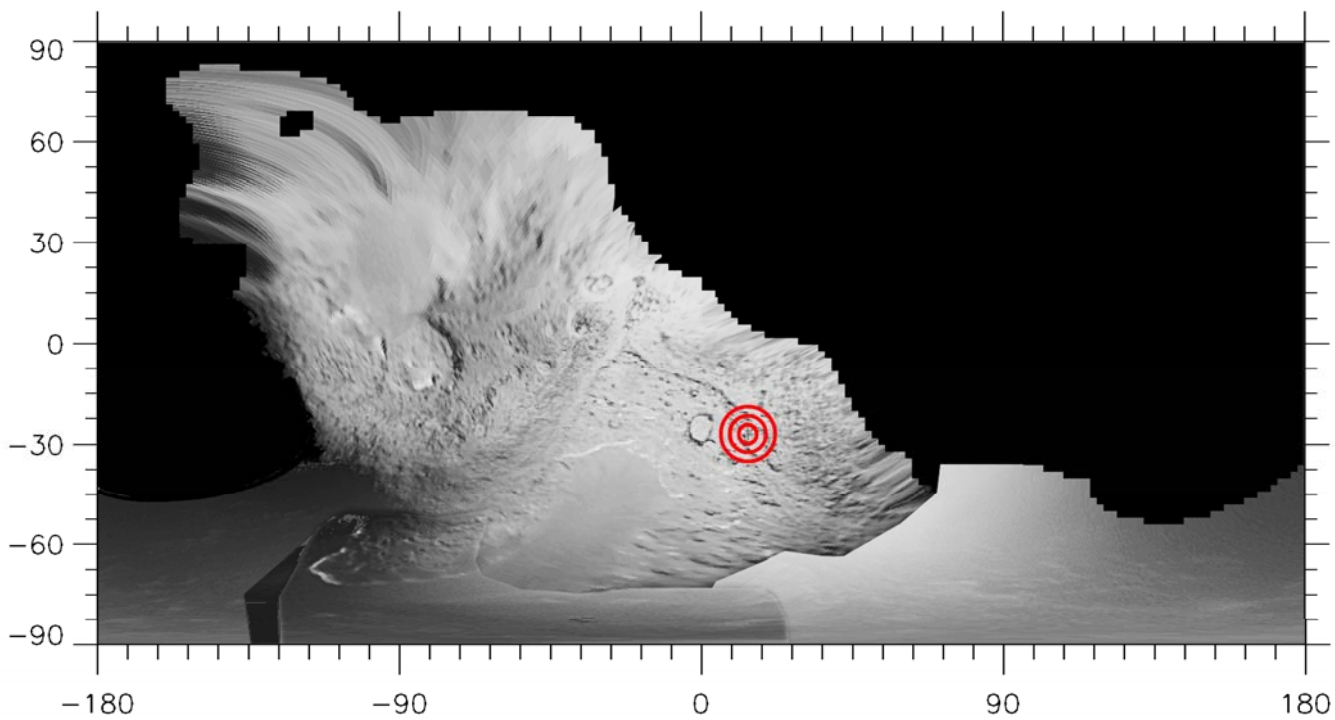
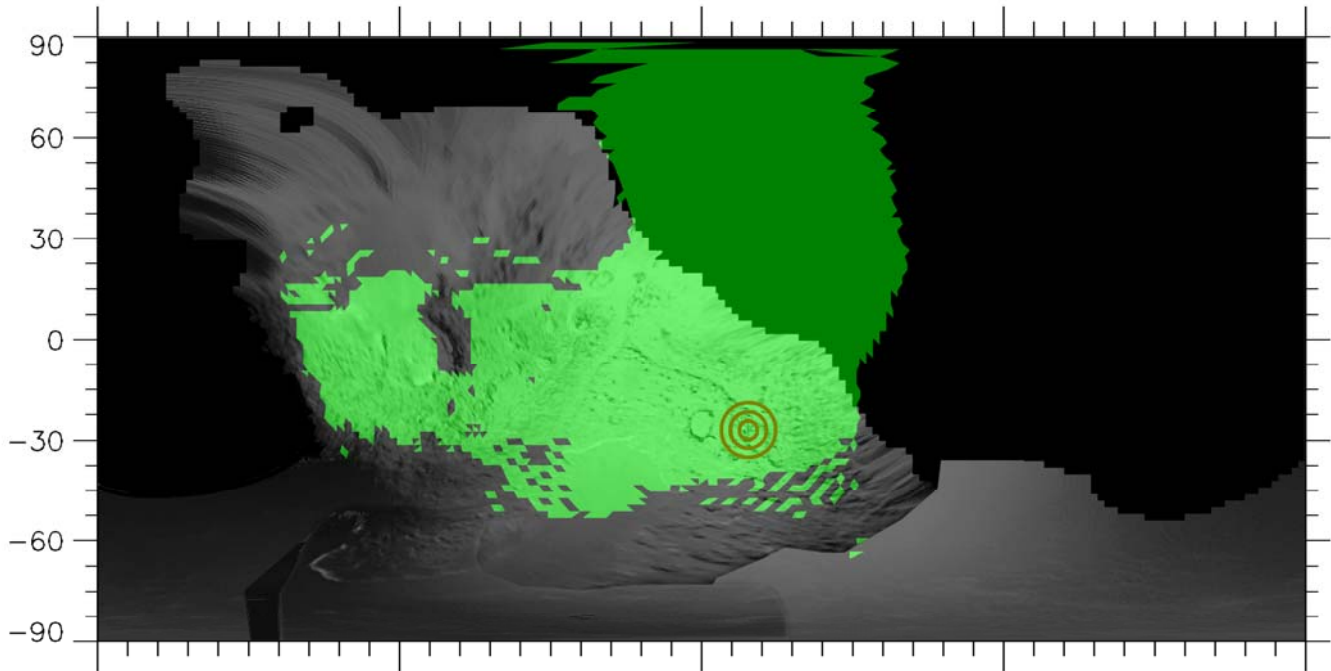
IMAGING

- Distant Imaging begins at -60 days
- Total Number of Images = $5760 \times 200 \times 200$ Subframes
- Encounter Imaging = 72 images (600 Mbits)
- Best Resolution = 12 m/pxl
- Number Images Better Than 80 m/pxl = 40

DUST SCIENCE

- Dust Counter (DFMI): 16 Mbits from -15 to $+15$ minutes
- CIDA: 104 Mbits from -1 to $+1$ hour

Planned
NExT
Coverage



What Are Our Challenges?

Determining the rotation phase at time of flyby

- Expect to predict rotation phase with needed accuracy
- Tempel 1 is one of the best-behaved comets
- Extensive observational program in place to measure lightcurves
- Detailed lightcurve analysis program in place (Additional refinements planned)

Time of Arrival Adjustment

- Plan to encounter comet at a time when the crater made by Deep Impact is in optimum position for imaging.
- An extensive program of telescopic observations of Tempel 1 is continuing under the direction of Co-I Karen Meech to monitor the rotation state of Tempel 1.
- Two independent programs of lightcurve analysis are in place to analyze the observations:
 - One in Tucson (Co-I Mike Belton),
 - The other at JPL (Co-I Steve Chesley).
- Anticipate having information need to make accurate TOA in 2010.
- Spacecraft retains enough delta- V to adjust the arrival time by about ± 20 hrs. The comet's spin period is about 40 hrs.

Dust Environment at Encounter

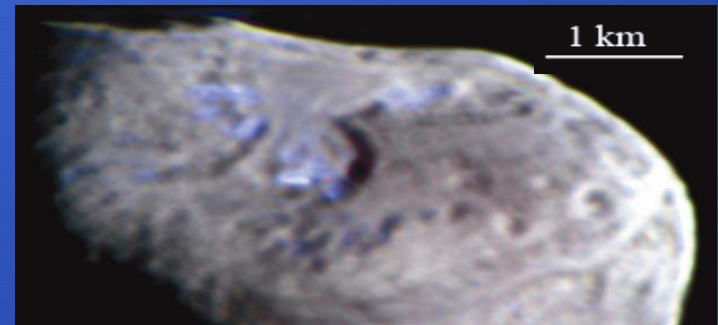
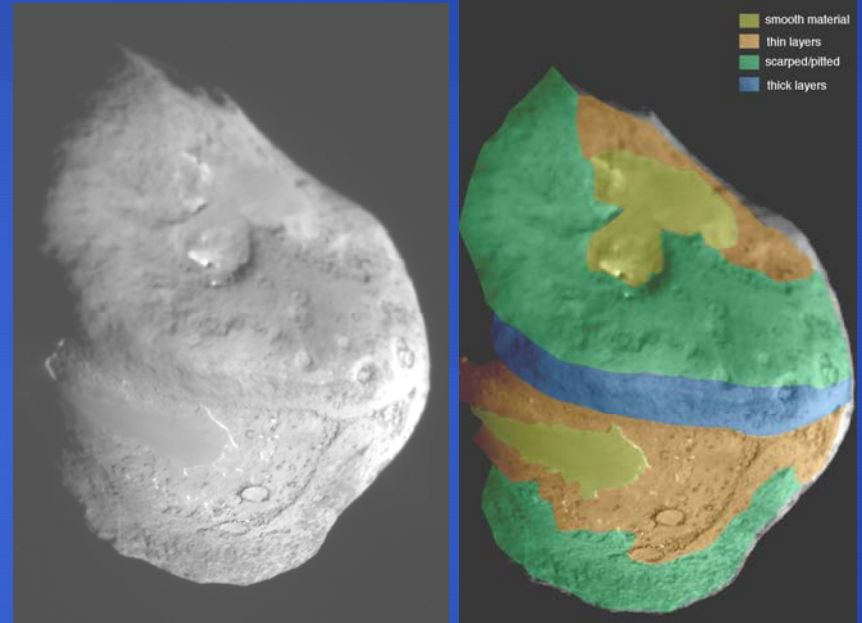
- Dust environment at Tempel 1 is not a problem
- Can safely target to a 200 km flyby
- Proven encounter sequence similar to that at Wild 2

Additional Slides

(Backup)

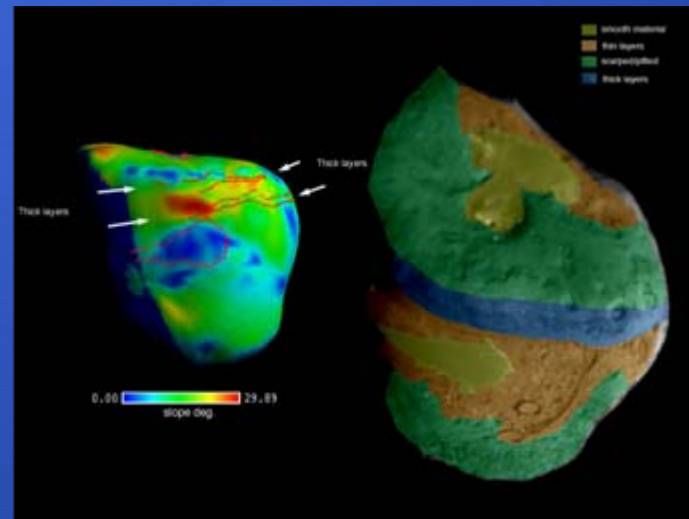
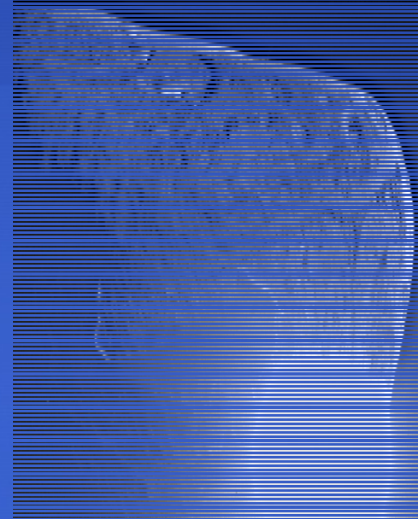
What We Will Learn: Sublimation Processes

- How much does a comet's surface change between perihelion passages
- Is sublimation erosion global, regional or restricted to small active areas
- Has obvious scarp retreat happened since 2005
- What are the rates of erosion → age of surface features
- How much do water ice rich exposures change from perihelion to perihelion
- What fraction of the comet's surface is covered by higher albedo (possibly water ice rich) patches



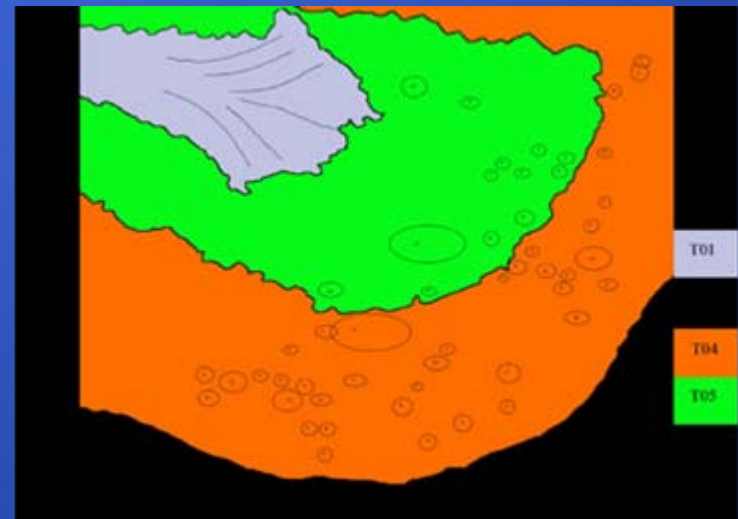
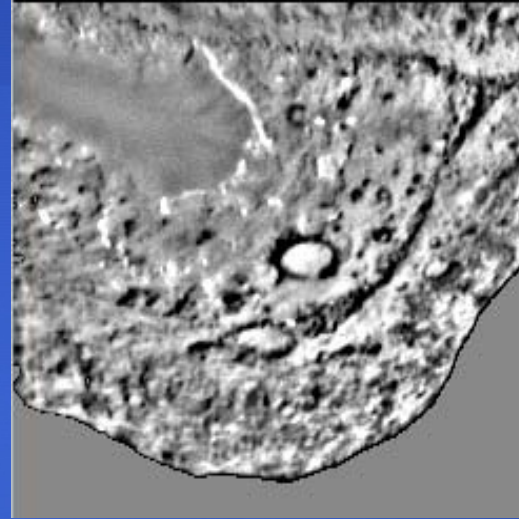
What We Will Learn: Layering

- How extensive (global or regional) are the layers?
- Do comets accrete in “layers” rather than in “clumps”



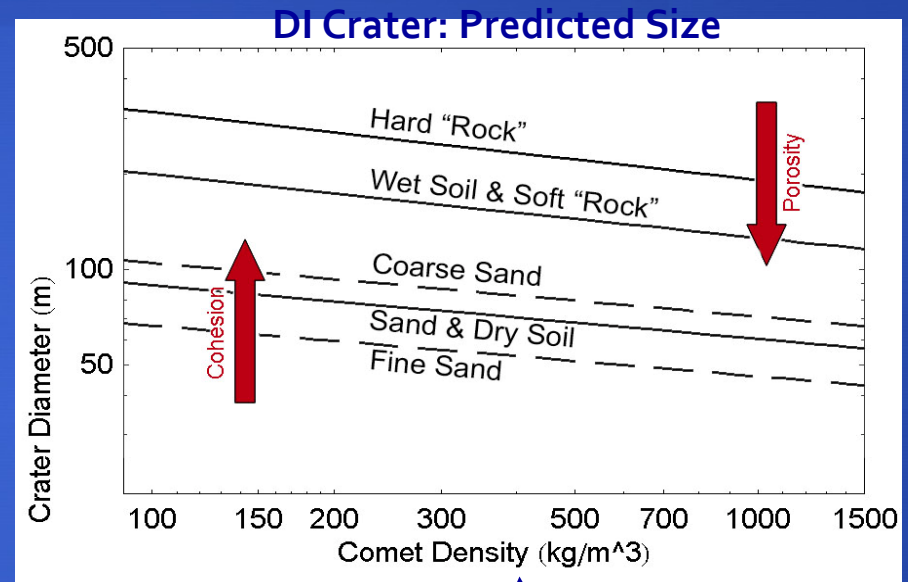
What We Will Learn: Smooth Flows

- Are there other smooth flows on Tempel 1?
- What are the source areas?
- Are they related to active regions?
- Outstanding questions:
 - How do smooth flows form?
 - Why don't they occur on Wild 2?



What We Will Learn: DI Crater

- What do fresh craters on comets look like
- How big is the DI crater
- Size will better constrain mechanical properties (porosity, cohesion of surface)
- How well preserved and extensive are ejecta on the surface
- Crater could provide additional information on layering



Tempel 1 Density ~ 400
(kg/m³)