Rosetta Mission Status Update

Hal Weaver (JHU/APL)
Col on Rosetta-Alice UV Spectrograph
(with help from Art Chmielewski, JPL)
Wake Up Rosetta, *Please!*

Hibernating since June 2011
Wakeup by timer on:
2014-Jan-20 10:00 UTC
Stay Tuned!
Rosetta Mission is Ambitious

• The Rosetta mission will achieve many historic landmarks:
  – Rosetta will be the first spacecraft to orbit a comet's nucleus.
  – It will be the first spacecraft to fly alongside a comet as it heads towards the inner Solar System.
  – Rosetta will be the first spacecraft to examine from close proximity how a frozen comet is transformed by the warmth of the Sun.
  – Shortly after its arrival at the comet, the Rosetta Orbiter will dispatch a robotic Lander for the first controlled touchdown on a comet nucleus.
Rosetta Mission and Milestones

• Mission to rendezvous with Comet 67P/Churyumov-Gerasimenko where it will study the nucleus of the comet and its environment for nearly two years, and land a probe on its surface.
• Launch date: 2 March 2004
• Journey milestones:
  – 1st Earth gravity assist: 4 March 2005
  – Mars gravity assist: 25 February 2007
  – 2nd Earth gravity assist: 13 November 2007
  – **Asteroid Steins flyby**: 5 September 2008
  – 3rd Earth gravity assist: 13 November 2009
  – **Asteroid Lutetia flyby**: 10 July 2010
  – Enter deep space hibernation: 8 June 2011
  – Exit deep space hibernation: 20 January 2014
  – Major comet rendezvous maneuver: May 2014
  – **Arrive at comet**: August 2014
  – Philae lander delivery: November 2014
  – Closest approach to Sun: 13 August 2015
• Prime Mission end: 31 December 2015

You are here now
Rosetta Orbiter: 11 Instruments

- ALICE Ultraviolet Imaging Spectrometer
- CONSERT Comet Nucleus Sounding
- COSIMA Cometary Secondary Ion Mass Analyser
- GIADA Grain Impact Analyser and Dust Accumulator
- MIDAS Micro-Imaging Analysis System
- MIRO Microwave Instrument for the Rosetta Orbiter
- OSIRIS Rosetta Orbiter Imaging System
- ROSINA Rosetta Orbiter Spectrometer for Ion and Neutral Analysis
- RPC Rosetta Plasma Consortium
- RSI Radio Science Investigation
- VIRTIS Visible and Infrared Mapping Spectrometer
Rosetta Lander (Philae): 10 Instruments

- APXS Alpha Proton X-ray Spectrometer
- ÇIVA / ROLIS Rosetta Lander Imaging System
- CONsert Comet Nucleus Sounding
- COSAC Cometary Sampling and Composition experiment
- MODULUS PTOLEMY Evolved Gas Analyzer
- MUPUS Multi-Purpose Sensor for Surface and Subsurface Science
- ROMAP RoLand Magnetometer and Plasma Monitor
- SD2 Sample and Distribution Device
- SESAME Surface Electrical and Acoustic Monitoring Experiment, Dust Impact Monitor
Rosetta Payload: US Contributions

Orbiter Teams
1. *ALICE - UV spectrometer
2. CONSERT – tomography/radio sounding
3. COSIMA – chemistry
4. GIADA – dust analysis
5. *IES - ion and electron sensor
6. IPA – plasma analyzer
7. MAP – magnetometer
8. MIDAS – atomic force microscope (dust particles)
9. MIP – magnetic impedance probe
10. *MIRO - microwave spectrometer / radiometer
11. LAP – Langmuir probe
12. OSIRIS – camera
13. *ROSINA – mass spectrometer
14. RSI – radio science
15. VIRTIS – IR spectrometer

Lander Teams
16. APXS – X-ray spectrometer, similar to that of Mars Pathfinder
17. CIVA -lander visible - IR camera (omnidirectional)
18. COSAC – lander mass spectrometer
19. MODULUS – gas analyzer
20. MUPUS – probe
21. ROLIS – lander descent camera
22. ROMAP – lander magnetometer/material magnetism
23. SESAME – seismic data
24. CONSERT (2) – tomography/radio sounding

Legend:
US hardware contribution
US investigation contribution
US Hardware Contributions

• ALICE
  – PI: Alan Stern (SWRI)

• IES
  – PI: Jim Burch (SWRI)

• MIRO
  – PI: Sam Gulkis (JPL)

• ROSINA
  – Dual Focus Mass Spectrometer (DFMS) Electronics
  – PI: Katrin Altwegg (UBern)
  – US lead co-I: Stephen Fuselier (SWRI)
The US Contributions to Rosetta

- 3 + instruments
- 3 PIs, PS, IDS
- 50 CoIs
- DSN 70 m tracks and 34 m support
- ASPEN scheduling software for science observations
- SPICE support
- Comet modeling
- Shadow navigation for flight dynamics verification
- PDS Archiving (SBN)
- Scientists contribute to 67P observing campaign
Recent/Current Rosetta Activities

• Major Operations Reviews in fall 2013

• Preparing for wakeup in 12 days!
  – Spacecraft and instrument checkouts during Jan-May 2014

• Finalizing plans for rendezvous and characterization of comet
  – Characterize physical properties of nucleus (size, shape, rotation, surface morphology, …)
  – Measure comet activity levels (High, Medium, Low?)
  – Landing site selection and characterization

• Intensive planning of activities for Escort Phase (Nov 2014-EOM)
  – Long term (LTP; 1 yr), Medium term (MTP; 1 month), Short term (STP; 1 week) plans worked by 4 Discipline Groups and SOWG
Potential Rosetta Concerns

- Wake up

- Propulsion system leak
  - If pressure lower than expected, could affect ops and mission duration

- Reaction wheel anomalies
  - Loss of wheel(s) would affect ops and scope of science activities

- Observation planning
  - Late development of planning tools and interactions with Flight Dynamics, system robustness, and conflict resolution (i.e., different instruments want different strategies) constrain science
Landing Site Selection Milestones

1. Selection of landing site regions
   - Limited selection criteria: crude comet geometry and illumination profile
   - Input to flight dynamics analyses

2. Selection of candidate landing sites
   - Preliminary but global analysis of the comet characteristics
   - A list of landing sites will be established for a more precise examination during the following Close Observation phase

3. Classification of the best landing sites
   - Precise analysis of the candidate landing sites taking into account many scientific and technical aspects
   - Best 5 landing sites identified and ranked

4. Final selection of the landing site
   - An evaluation taking into account the latest operational conditions and constraints will drive the final landing site selection