

# SBAG ROADMAP: SAMPLE RETURN

## OUTLINE

### 1. **Science**

#### a. Superior science of sample return

- Use analysis technology at time of sample return rather than mission inception
- Analysis with instruments that cannot be miniaturized for spacecraft
- Analyses performed by entire sample community
- Samples archived for future improvements in laboratory instrumentation

#### b. Stardust as an example

- Major discovery re: solar nebula mixing
- Amino acids detected

# SBAG ROADMAP: SAMPLE RETURN

## OUTLINE -- continued

- 2. Comet Sample Return
  - Surface sample return
    - \* Generally non-volatile materials
  - Sub-surface sample return
    - \* How deep to obtain primitive ices?
  - Warm vs. cold vs. cryogenic samples
    - \* How cold?  $-40\text{ C}$ ,  $150\text{ K}$ ,  $110\text{ K}$  ?
  - Target selection?
    - \* Visited before?
    - \* High versus low activity?
    - \* Big versus small nuclei
  - Surface heterogeneity
    - \* How many sample sites?

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## OUTLINE -- continued

- 3. Asteroid Sample Return
  - Why? What is science justification if we already have thousands of meteorites?
  - Target selection
    - \* Taxonomic type?
    - \* NEO sample return
    - \* Main belt asteroid
    - \* Volatile rich asteroids (main belt comets)
    - \* Trojans and beyond
  - Sampling depth?
    - \* How deep to get below space weathered surface?
  - Surface heterogeneity
    - \* How many sample sites?

# SBAG ROADMAP: SAMPLE RETURN

## OUTLINE -- continued

- 4. Dust Sample Return
  - U2 Aircraft
    - \* Campaigns during meteor showers
  - Space exposure facilities (e.g. LDEF, ISS)
- 5. Laboratory Analysis
  - Improvements to current instrument facilities
- 6. Curation Facilities
  - Improvements to current facilities
  - Cold and cryogenic facilities
  - Transport of cold and/or volatile samples

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## OUTLINE -- continued

- 7. Technology Requirements
  - Sample collection
    - \* Drill, scoop, brush-wheels, sticky tape ?
  - Autonomous touch-and-go
  - Autonomous landing
  - Anchoring
    - \* Necessary for drilling
  - Propulsion
    - \* Chemical, SEP, NEP
  - Re-entry and recovery
  - Thermal control of sample
    - \* “Bring ‘em back cold!”
  - Cleanliness: don’t want to study contamination