Deep Impact Lessons Learned
8/10/10

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Deep Impact Mission

The Orbit of Comet Tempel 1

- Tempel 1 at Launch
- Earth at Launch
- Mars
- Tempel 1 at Encounter
- Earth at Encounter
- Jupiter
The Spacecraft
Deep Impact Encounter Schematic

- **Tempel 1 Nucleus**
- **AutoNav/ADCS Control** E-2 hr
- **Impactor Release** E-24 hours
- **ITM-1** E-90 min
- **ITM-2** E-35 min
- **ITM-3** E-7.5 min
- **ADCS aligns ITS Control frame with Relative velocity E-4 min
- **2-way S-band Crosslink**
- **500 km**
- **Impact!**
- **Look-back Imaging E+45 min**
- **Shield Attitude Entry**
- **Flyby S/C Science Real-time Data**
- **Flyby S/C Science Data Playback to 70-meter DSS**
- **Science and AutoNav Imaging to Impact + 800 sec**
- \( \phi = 0.6 \text{ mrad} \)
- **Shield Attitude through Inner Coma ADCS aligns shield with relative velocity**
- **ADCS aligns shield with relative velocity**
- **ITM**
- **64 kbps**
- **Flyby S/C Deflection Maneuver Release + 12 min (101 m/s)**
- **TCM-5 at E-30 hours**
- **AutoNav/ADCS Control frame with Relative velocity**
- **E-4 min**
- **E-90 min**
- **E-35 min**
- **E-7.5 min**
- **E-2 hr**
- **E-24 hours**
Comet Tempel 1
Impactor Approach

High Resolution Imager of Impact

Medium Resolution Imager of Impact
Zeroing In on Target
Major Lessons Learned:

- Plan to be surprised!
  - Tempel 1 didn’t look like we thought it would.
  - Tempel 1 didn’t react to stimulus (in this case, impact) the way most thought it would.
  - Material was much finer than was planned for.

- This probably means that a pre-cursor mission to the specific initial target body is a must for mission confidence and safety.

- It doesn’t mean you don’t need to pre-plan activities and events to the nth degree, because the pre-plan and exercise will help to establish firm baselines.

- It does mean there must be a well established and exercised process for handling the unexpected and adapting the plan dynamically during the mission.