



The Tour Not Taken: The Comet Nucleus Tour (CONTOUR)

Leadership ViTS Meeting

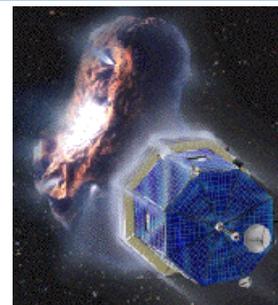
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THE MISHAP

The Comet Nucleus Tour (CONTOUR) was developed to gain insight into the nature of comets. While in orbit, CONTOUR fired its motor to put itself on the trajectory toward its first comet. The control team did not have telemetry coverage during the burn, but they expected to regain contact once the burn was over. The signal did not return after the burn, and the team spent the next several months trying to locate the spacecraft. Communication was never reestablished.



Figure 1: Assembling CONTOUR

CONTOUR was part of NASA's Discovery Program, a series of low-cost, highly focused missions. CONTOUR's mission was to help scientists understand the composition of comets. A researcher at Cornell University led the scientific discovery aspects of the mission, while John's Hopkins Applied Physics Laboratory (APL) constructed and managed the spacecraft.

What Happened?

July 3, 2002 - CONTOUR launched.

August 15, 2002 4:49 am EDT - The control team fired up CONTOUR's solid rocket motor (SRM) to steer the spacecraft onto the trajectory toward its first comet. They could not communicate with the spacecraft during the burn.

August 15, 2002 5:35 am EDT - The control team expected to regain contact, but received no signal.

August 22, 2002 – Alternative communication methods aboard CONTOUR were scheduled to kick-in, but there was still no signal on the ground.

Meanwhile... outside data supported the team's growing belief that the spacecraft was lost:

- The U.S. Military observed a flare in the same location as CONTOUR during the SRM burn.
- A space watch laboratory at the University of Arizona noticed three objects on the same trajectory CONTOUR would have followed, if its SRM burn had been a few seconds too short.

Early December 2002 – After months of trying to re-gain contact, the mission officially declared CONTOUR lost.



Figure 2: The Solid Rocket Motor (SRM)



PROBABLE PROXIMATE CAUSE

As there was no telemetry coverage during the burn, investigators could not identify a conclusive proximate cause. One likely explanation is that the SRM was nested too far into the body, and heat from the motor's exhaust destroyed the spacecraft.

UNDERLYING ISSUES

- Inadequate project team SRM expertise.
 - Only one person at APL had experience with SRMs, and that person was not assigned to work on the CONTOUR project.
- Insufficient rigor in contracting and design reviews.
 - APL relied on a design-test-design strategy rather than design reviews; it was not practical to test the assembled SRM design before launch.
- Significant reliance on subcontractors who were not integrated into the project.
 - Relied on the SRM manufacturer and a consultant for expertise; channels of communication between subcontractors were not clear.
- Reliance on heritage designs.
 - The STAR 30 BP SRM had a strong record of success (only 2 failures in 86 flights), but previous designs did not match CONTOUR's specifications.
- Focus on project goals at the expense of programmatic objectives.
 - The decision to forego telemetry was defensible from a project perspective, but not from a programmatic perspective.

FOR FUTURE NASA MISSIONS

Project Team Integration

- Involve subcontractors early to give them insight into the entire project.
- Don't restrict subcontractors to a small, overly-defined role.
- Confirm that you have identified and communicated all essential information to the subcontractor.

Design Test and Validation

- Verify that contractors, manufacturers and consultants use models that are valid for the specific application.
- Use independent validation to confirm conclusions.
- Don't allow consultants to work from inaccurate assumptions.

Perspective

- Think from a programmatic perspective rather than a project perspective.

