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**UnESS Concept Study
Kickoff Meeting**

Some Thoughts on Cost

By

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Why is so much cost detail needed in the Concept Study Guidelines?

- The reports submitted at the end of the Concept Study will be used to decide which projects will be selected for continuation
- NASA needs to be able to make independent assessments of the Cost Risk and the Cost Realism of each project to lessen the chance of mission failure
- **Cancellation**
 - Descope of Instrumentation
 - Loss of spacecraft/instrument
 - Loss of resolution
 - Reduced operational period
- The greater the cost definition, the more accurate the independent assessment

20-20 Hindsight: Cost Is Driving the Project

<http://www.nasa.gov/newsinfo/publicreports.html>

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Mars Polar Lander (Casani Report)

- **MPL mass margin at PDR was 15 percent; should have been at least 25 percent (5.1.2.1)**
- **Lack of all-up testing**
- **Single individual doing all of something without peer oversight/assistance**
- **Inadequate systems engineering**

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More 20-20 Hindsight...

Mars Climate Observer (Stephenson Report)

- Inadequate systems engineering**
- Inadequate problem reporting and follow-up procedures**
- Lack of communications within the project**
- Use one set of measurements - English or Metric - but not both.**

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And Still More...

**Mars Program Independent Assessment Team
Report (Young Report)**

- Inadequate resources and margins
- Incomplete systems testing
- Requirements creep
- Descoped telemetry (sub-optimization)

Some Cost Indicators...

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Mars Pathfinder vs. Mars Climate Observer plus Mars Polar Lander

Element	Pathfinder <u>cost %</u>	MCO + MPL <u>cost %</u>	Wertz & Larson <u>SMAD III*</u>	SAMPEX# <u>cost %</u>	Clementine# <u>cost %</u>
Project Management	5.6%	2.7%	15.2%**	8.3%	15.8%
Mission Engineering and Operations Development	5.1%	3.2%	incl. in PM	21.5%	52.8%
Flight System	68.4%	70.7%	56.3%***	54.2%	23.3%
Science and Instrument Development + Rover	19.9%	19.7%	21.1%	16.1%	8.0%
Other	1.0%	3.7%	-	-	-
\$/Kg	\$263K	\$571K/266K	-	\$341K	\$281K

*Wertz & Larson, "Space Mission Analysis and Design", Microcosm Press, 1999

**incl. LOOS

***incl. GSE

#Wertz & Larson, "Reducing Space Mission Cost", Microcosm Press, 1996