

Commercial Leverage

Commercial Leverage Requirements

- ◆ **NASA and commercial sector technology and product goals to align**
- ◆ **Existence of (or future likelihood of) a paying customer other than NASA**
- ◆ **Low development risk**
 - Little or no technology development
- ◆ **Commercial partner needs to be able to fund a portion of the development cost (skin in the game)**
- ◆ **Milestone based payments**
- ◆ **Oversight procedures by NASA need to be scaled back**
- ◆ **COTS is an great example**



Business Model comparison

Category	Apollo Era	Commercial-leveraged Era
Owner	NASA	Industry
Contract fee-type	Cost+	Fixed Price
Contract arrangement	Prime Contractor	Partnership/IDIQ
NASA as customer	"THE" customer	"A" customer
Funding for capability demonstration	NASA procures capability; funds per performance evaluation board	NASA provides seed-investment via milestone payment
DDTE responsibility	NASA	Industry
Maintainability/Disposition	NASA	Industry
Procurement length		Multi-year buy
Business approach	System/component buy	Service-based buy
NASA's role in capability development	NASA defines "WHAT" and "HOW"	NASA defines only "WHAT" Industry defines "HOW"
Critical path	NASA only	\$/unit measure
Requirements definition	NASA defines <u>detailed requirements</u>	NASA define top-level <u>capabilities needed</u>
Cost structure	Total cost	\$/unit measure

Tuesday, September 28, 2010

3



NASA Commercial Space Workshop

- ◆ Led by the Office of the Chief Technologist (OCT)
- ◆ Goal: *Opportunities for Fostering Commercial Space Industries for NASA and National Benefit*
- ◆ Addressing multiple commercial space market areas
 - Low-Cost, Reliable Access to Space (LCRATS)
 - Commercial In-Space Services
 - Propellant Depots
 - Satellite Repair-Maintenance
 - Orbital Debris Removal
 - Commercial Human Spaceflight, Education & Entertainment
 - Commercial Lunar & NEO



Common Barriers to Commercial Space Development

- ◆ **NASA strategic risk - NASA “weighing-in”**
- ◆ **Government ownership risk**
 - Undefined roles between government agencies
- ◆ **Market risk**
- ◆ **Investment risk**
- ◆ **Regulatory risk**



Commercial Lunar Landers

- ◆ **Industry's consistent message:**
 - Don't need any additional technology to initiate this service
 - but future generation versions could definitely incorporate new technology
 - Range from "very interested" to "very close" to making a commitment to develop this system via a 100% private investment
 - Some residual "customer/market" risk remains, and waiting for NASA to “weigh-in”



NASA “Weighs-In”

**NASA SEEKS DATA FROM
INNOVATIVE LUNAR
DEMONSTRATIONS**

ILDD



INNOVATIVE LUNAR DEMONSTRATION DATA (ILDD)

- ◆ **BAA Release on:** August 6, 2010
- ◆ **Proposal Due:** September 8 (now 15)
- ◆ **Goal:** NASA has interest in proving, testing, and verifying specific capabilities that will be useful for the eventual landing of a human vehicle through the utilization of small robotic landers.
 - BAA is a specific data-purchase resulting from industry efforts to test and verify vehicle capabilities through demonstrations of small robotic landers.



Innovative Lunar Demonstrations Data (ILDD)

- ◆ **Objective: Challenges industry to demonstrate Earth-to-lunar surface flight system capabilities and test technologies.**
- ◆ **BAA business approach:**
 - multiple small firm-fixed price indefinite-delivery/indefinite-quantity contracts
 - a total value up to \$30.1 million through 2012.
 - \$10 million max per company



ILDD OVERVIEW

- ◆ **Data on the design and demonstration of an end-to-end lunar landing mission.**
- ◆ **This includes data associated with:**
 - hardware design,
 - development and testing;
 - ground operations and integration;
 - launch;
 - trajectory correction maneuvers;
 - lunar braking,
 - burn and landing;
 - and enhanced capabilities.



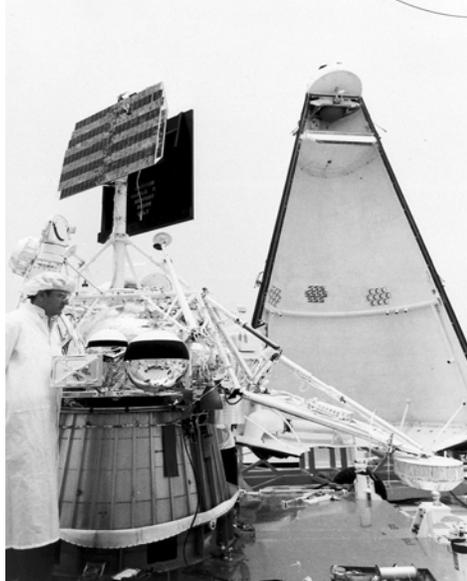
Four Major Technical Areas

1. Critical Component Demonstration
2. Ground Test/Mission Simulation of Flight Hardware
3. Basic Capabilities
4. Enhanced Capabilities



ILDD LANDER BASIC CAPABILITIES

1. Prelaunch readiness of the flight spacecraft systems





ILDD LANDER BASIC CAPABILITIES

2. In-Flight Activities



ILDD LANDER BASIC CAPABILITIES

3. Spacecraft lunar landing





Enhanced Lander Capabilities

◆ Information beneficial in risk-reduction to a human lunar lander design and capability

- landing using a human mission profile
- identification of hazards during landing
- precision landing
- imagery
- long-duration surface operations.



ILDD Task Descriptions

CLIN	CLIN Title	Value (\$M)
1.	Critical Component Demo	0.5
2.	Ground Test/Mission Simulation of Flight Hardware	0.6
3.	Basic Capabilities	2
3.1	Pre-mission - \$0.5M	
3.2	In-flight Activities - \$0.5M	
3.3	Survival - \$1M	
4.	Enhanced Capabilities	6.9
4.1	Human Mission Profile Landers - \$2.5M	
4.2	Identification of Hazards During Landing - \$1M	
4.3	Precision Landing - \$2M	
4.4	Video Survival Lander Post-Landing - \$0.9M	
4.5	Imagery of Landing Path - \$0.5M	
4.6	Post-lander Exploration - \$0.5M	
4.7	Extended Duration Operations - \$2M	
TOTAL		10



Result: Lessons-learned by teams attempting to implement low cost, innovative solutions.



LOFT-y Goal

- ◆ **Identify potential early “demand” for flight instrumentation for early lunar lander flights.**
- ◆ **List focuses on “orphan” flight equipment**
 - “Sunk-cost” equipment
 - Pre-existing
 - Flight spares, flight qual units, or engineering units
- ◆ **55 instruments identified**
 - 22 science
 - 33 technology



Representative Flight Listing

RA	Robotic Arm to acquire regolith materials for analytical instruments	Flight for Phoenix	Flt Unit
MECA OM	Optical microscope to characterize regolith particle shapes	Flight for Phoenix	Flt Unit
MECA WCL	Wet Chemistry Lab to characterize solution chemistry	Flight for Phoenix	Flt Unit
Gamma Ray Spectrometer	SCIENCE INSTRUMENTS	3272044/327204	Mars Odyssey
AtmosInstrument	SCIENCE INSTRUMENTS	F000993	ATMOS
1 electrostatic ion analyzer		2011	flight

Tuesday, September 28, 2010

19



LOFT: Next Steps...

- ◆ **Assessing potential high value data at low cost**
- ◆ **Study in-work to assess placement of LOFT list on ESMD website.**
 - Solicit other inputs and scrub list
- ◆ **Cross-link the orphan against Exploration desirement lists and investigations:**

Tuesday, September 28, 2010

20



Partnership with NASA Lunar Science Institute

- ◆ **NLSI, through its role in the community and in partnership with LEAG, will provide the following towards development of this program at a minimum:**

1. Analysis and Strategy

Development of strategic analyses on various items, including broad scientific basis for precursor flights (from SCEM and LEAG Roadmaps, amongst other sources)

Development of payload concepts (e.g., water detection follow-on missions) through internal workshops

2. Community Support

Through the annual Lunar Science Forum, annual LEAG meeting and other forums, bring concepts and developments in the program to the broad lunar science community

Continuing support to the Lunar Commerce Focus Group, established in 2009.

Focus group consists of a mixture of scientists and industry interested in promoting lunar commerce