

# **Proposal for a Lunar Exploration/Science Campaign: A commercially-leveraged, science-focused, lunar exploration program**

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**Background** - The private sector is going to space. From daily, piloted suborbital passenger flights to robotic missions to the lunar surface, commercial companies are investing hundreds of millions of dollars to exploit the space frontier. Projects that had previously only been attempted by governments such as launch vehicles, orbital habitats and lunar landings are now being planned and funded by the private sector. Commercial interest in the moon is high, and at least 18 corporate and academic teams are actively working to put robotic landers on the moon. NASA and many members of the international community as well as the commercial sector all have interests in the moon. All of these organizations will require new infrastructure and lunar services. NASA and its international partners interests are for scientific and exploration activities. Commercial interests are focused on business and economic activities. This paper proposes to address the collaborative potential between these various projects and stakeholders as a way to leverage commercial interests and investments. This will enable NASA to do what it does what best... human exploration of the moon and beyond while giving industry what they need most, early paying customers.

**Current NASA strategy for lunar commercial services** - Over the last two years, there has been significant growth in interest from the commercial sector in engaging NASA early in its lunar efforts. This early engagement is not so much selling “parts and subsystems”...rather it involves “services” that NASA can supplement into its lunar vision. Some of these commercial capabilities are believed to be on-track to be demonstrated by early 2011! Likewise, NASA has spent the last two years developing strategies and acquisition planning for early use of these emerging commercial capabilities. Examples of companies which have invested such resources, made recent announcements or approached NASA with relevant lunar interests include both traditional and non-traditional aerospace companies such as Cisco, Raytheon, SpaceX, Orbital, Lockheed, ATK, Boeing, Astrobotic Technology, Odyssey Moon, [Next Giant Leap](#) and INTELSTAT. Commercial interests range from lunar data provision, lunar payload/experiment delivery, lunar communication /navigation, energy exploration and other commercially-provided services at the moon. Commercialization is a key imperative if NASA is going to meet its exploration goals within this budget constrained environment.

NASA has completed some preliminary due-diligence into several of the high-value, low-cost commercial service areas...to include lunar communications and navigation systems, small lunar landers with robotic systems, commercial lunar O<sub>2</sub> extraction, landing site preparation, and space transportation, all of which have begun to attract significant commercial investment. NASA and its International partners are encouraged by the possibility of leveraging this commercial interest and investment to further government lunar scientific and exploration programs.

A recent forward-thinking NASA study on commercializing communications and navigation (C&N) services at the moon included a request-for-information (RFI) from commercial firms. The responses found that industry is definitely interested, capable, and willing to invest in commercializing C&N at the moon. However, a significant concern was that the size of the market needs to be sufficiently large to justify private investment. One means of achieving this goal is through dialogue to enable purchasers of services to act together, so that providers can lower costs by serving more than one customer with the same commercial offerings. Aggregation of demand could include the NASA directorates (especially SMD and ESMD), other nations' space agencies, and commercial as well as government lunar initiatives (e.g., private surface facility

operators). Relevant to international demand aggregation is the recently released “Global Exploration Strategy Framework,” signed by NASA and 13 other space agencies around the globe, which states that: “Space exploration... offers significant entrepreneurial opportunities by creating a demand for new technologies and services.”

To maximize opportunities, industry has expressed interest in public-private partnerships. One example involves a two year NASA study, aimed at developing a strategy with acquisition plans that employ a commercially-leveraged type investment approach. Similar to the model used for the Commercial Orbital Transportation Services (COTS), this model leverages commercial interest and investment to develop new lunar capabilities which, once demonstrated, will lead to new fixed price contracting of low cost commercial services for NASA.

**America needs a better balanced NASA lunar program...**not just Orion/ARES/Human, but also a precursor robotics lunar surface program (ala Apollo and Surveyor). NASA needs to encourage commercial space development (for lunar exploration) by leveraging commercial investment in lunar operations into early involvement in the NASA lunar program for service-based acquisitions of demonstrated capabilities from industry. Additionally, NASA must develop acquisition mechanisms and funding for these commercial services such that the agency has “contracts-in-waiting” *prior* to demonstrated capability from private sector.

**Early commercial robotic exploration will enhance NASA exploration.** Early commercial robotic exploration will provide important information on lunar environment and resources, scientific and operational reconnaissance, information on unknown or poorly understood processes and lunar history. It will reconnoiter areas and sites to make subsequent human exploration more productive (ala mid-60’s Surveyor). Early commercial exploration will create public excitement and help sustain the vision for lunar exploration. This will include lunar data purchase and/or NASA lunar instrument delivery that can be used to support design reviews for pending NASA lunar architecture....thus it will mitigate risks and reduce costs for the human lunar program. It will provide fiscal and political sustainability by linkage to the later human program and serve to recruit/re-build a bevy of new lunar researchers in addition to those developed in India, Japan and China. Pre-landed machines can also prepare sites and emplace equipment for later human use.

Utilization of emerging commercial capability to land payloads on the Moon will help demonstrate the value of inserting an early robotics lunar program into a human lunar program. It will obtain early lunar data for NASA through commercial services by using the emerging commercial capability to land payloads on the Moon. Initial cost-modeling indicates that leveraging these lunar services will cost NASA much less than a dedicated NASA robotic mission. It is expected that the commercial lunar lander capability will have near-term technology demonstration on the surface as early as the beginning of 2011...not 2020.

**Implementation:** NASA needs to understand its time-phased, integrated NASA-needs list for science, applied-science, and technology demonstration. This effort has already been started. Secondly, NASA needs to create a Lunar Commercial Office that can provide the leadership in acquisition-planning toward coupling these aggregate lunar “needs” of NASA (SMD, ESMD, and SOMD) and the emerging commercial-service initiatives within the private sector. As such, the office will understand NASA’s lunar “needs”, understand the emerging lunar commercial capabilities, and lead the development of FY10-11 budget submit to implement a NASA acquisition strategy for early access to the lunar surface.

**Summary:** NASA should foster the continued development of commercial space operations, both in low earth orbit and on the moon, and wherever America chooses to explore. Additionally, because NASA and commercial organizations have complementary interests, they should cooperate whenever feasible, allowing NASA and industry to each do what they do best—NASA accelerating science and exploration; industry profiting through opening a new lunar marketplace; and society benefiting from the inclusion of the moon into our economic sphere.