



Space Exploration: Who, What, When, Where, Why?

**10th Annual International Symposium
International Space University
30 November – 2 December 2005**

**Robotic Solar System Exploration: The Unique Contributions
Private Space Enterprise Can Make Cooperatively Towards
Advancing Space Exploration Goals**

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ROBOTIC SOLAR SYSTEM EXPLORATION: THE UNIQUE CONTRIBUTIONS PRIVATE SPACE ENTERPRISE CAN MAKE COOPERATIVELY TOWARDS ADVANCING SPACE EXPLORATION GOALS.

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“By preserving over all obstacles and distractions, one may unfailingly arrive at his chosen goal or destination” – Christopher Columbus

Abstract

This new century presents many challenges and holds much promise along the uncharted pathways of solar system exploration and beyond. To better understand the role private space enterprise can play in robotic space exploration, this paper defines the imperatives and discusses the unique contributions private space enterprise can make in terms of cooperation, innovation, competition, and investment in science and technology. This paper also discusses how a realistic, viable, and truly cooperative framework between government, commerce, and the scientific community will benefit these key stakeholders and contribute to the development of robotic space exploration¹ initiatives. Finally, this paper defines four mission architectures (inner planets, the Moon and Mars, outer planets, and beyond our solar system) for future robotic space exploration that features key elements of a cooperative approach that advances space exploration goals.

1. Introduction – Private Space Enterprise Initiatives Complementing Civil Space Programs.

The new vision for space exploration (Reference 1) challenges both the civil and private space enterprise (commercial) space sectors, in the US and internationally, to embrace and pursue innovative policies, methodologies, best practices, and new technologies in the pursuit of a bold and energizing set of space exploration goals. New and innovative approaches to achieving robotic space exploration goals are opportunities to facilitate the advancement of the new space exploration vision. As the reality of political and budgetary constraints begins to weigh heavily on decision makers and key stakeholders, a shift in space exploration priorities jeopardizes the future of a robust program of science missions. Consequently, this shift in priorities will redirect resources towards the development of relevant science missions that specifically support the new vision for space exploration (Reference 2). Therefore, it is evident that a significant gap in other future robotic solar system exploration programs will exist. To address the need to continue a robust, comprehensive, and systematic program of robotic exploration of our solar system and beyond, a non-traditional approach to advance future space science objectives for robotic solar system exploration must be undertaken. It will require the full participation of civil, private, and scientific stakeholders within the space community embracing the concept of, and working together to build the framework for broader cooperation. A viable and realistic framework of broader cooperation advancing space exploration goals is a valuable operational construct that has the potential of expanding space science programs further, that otherwise may be lost to other programmatic priorities. Private space enterprise initiatives, as complimentary programs to civil space, addresses this fundamental problem with a solution that contributes responsibly to the continuance of the purposeful (scientifically driven) and successful pursuit of robotic solar system exploration while advancing civil and commercial space exploration goals.

2. Unique Contributions

The proposed framework of cooperation between civil space and private space enterprise encompasses a non-traditional innovative approach towards achieving space exploration goals. The importance of space industry competitiveness, innovation, and investments in technology are key

¹ Unmanned planetary spacecraft, surface explorers, flyers, and balloons.

contributions that will further promote the success of future robotic solar system exploration. These contributions coupled with a unique complimentary approach of robotic solar system exploration, will also result in the robust development and growth of viable and sustainable space business initiatives.

3. Cooperation –The Framework for Success in Space Exploration.

The building blocks for a viable and realistic framework of broader cooperation between civil space, private space enterprise, and the science community, nationally and internationally, are the technological and scientific achievements gained by all who share in the pursuit of, participation in, and contribution to, a shared vision of making cooperative initiatives in robotic solar system exploration a reality.

4. Future Science Missions – A Robotic Solar System Exploration Architecture

The application of sound and relevant scientific rationale creates clear scientific objectives, which are key considerations in the design and development of programs in space exploration seeking to answer complex scientific questions. Therefore, an imperative for future science missions must be to advance basic space science research further. The development of new instrumentation for space science missions and an increased number of science missions are critical to a robust program of exploration of the Moon, Mars, inner planets, outer planets, and beyond our solar system. To achieve this goal, a complimentary mission architecture (Figure 1) is necessary to define a starting point for the design and development of future robotic science missions.

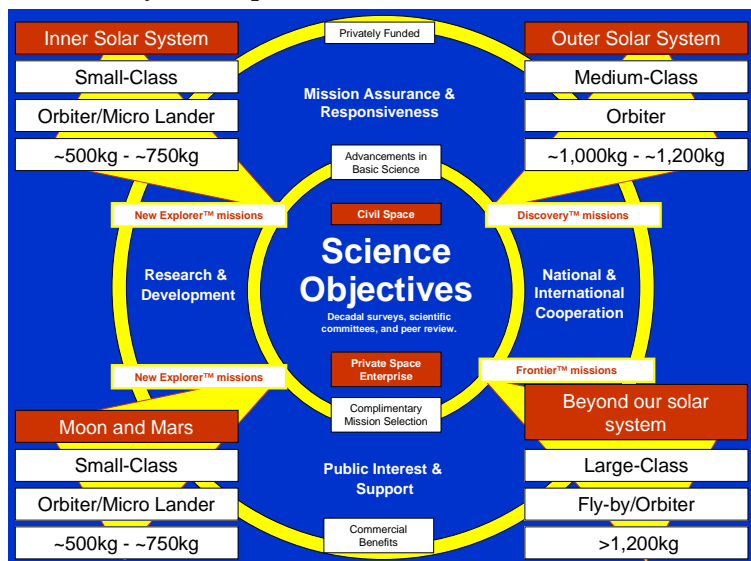


Figure 1. Robotic Solar System Exploration Architecture.

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5. Conclusions

The private space enterprise dynamic introduces unique capabilities and competencies that will contribute to the achievement of space exploration goals; 1) through cooperative efforts between private space enterprise, civil space, and the scientific community, and 2) towards the achievement of scientific goals as they relate to generally accepted areas of interest within the science community. Additionally, private space enterprise can uniquely contribute through its pursuit of independent commercially viable activities, when the results are achievable within the context and spirit of “good science”. Future science missions, civil and private, will most certainly be more effective when developed as complimentary space exploration initiatives. The way forward compels all key stakeholders and decision makers to consider how best to achieve collectively their space exploration goals. The resultant cooperative efforts will yield substantive benefits, nationally and internationally, to space science and commerce. This is an important and noteworthy undertaking today, and it must continue to be so for the future generations of scientists, engineers, space entrepreneurs, explorers, and individuals everywhere.

References

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2. *Science in NASA’s Vision For Space Exploration*, National Research Council of the National Academies, National Academies Press, Washington, D.C., 2005