

Space Resources Utilization Roundtable

Exploration and Mining Subgroup

Recommendations and Action Items

Recommendations (General recommendations for further discussion)

To answer the question: What must be done to initiate space resource exploration and mining?

- 1) Educate the minerals industry (mining, energy, equipment, *etc.*) as to what resources/markets **may** be available.
- 2) Define the requirements for the exploration of a resource with inputs from the minerals industry.
 - a) Define *resource* explicitly, as well as its usage in relation to how one is utilized.
 - b) Define *exploration* explicitly, as well as outlining its explicit meaning in the current context of space resource exploration.
 - c) What needs to be identified to make a resource/market combination viable?
- 3) Each mining/resource concept should have a detailed business plan **and** a detailed mission plan at least through initialization of pilot operations.
- 4) Government entities (U.S. entities including NASA, NSF, USGS, and others, as well as other governments) should support initialization of high risk projects in terms of:
 - a) Knowledge needs
 - b) Technology needs
- 5) Political and public (press) education and support should be inclusive at every level and every step in the coordination of utilization of space resources.

Action Items (Items to be produced from this particular Roundtable)

- 1) Identification of the following needed for initialization of space resource exploration and mining:
 - a) core knowledge (*i.e.*, What do we **really** know?)
 - b) core technologies (*i.e.*, What can we **really** do?)
- 2) Initialization plans for resource concepts of operation (CONOPS) submitted for review should include phased implementation plans (in the narrow sense of year-by-year) with milestones and summaries of probable data output for each milestone.
- 3) The formation of a peer-review committee to review space resource exploration and mining concepts submitted to the Roundtable. Concepts reviewed that have made minimal progress from past Roundtable discussions should be downgraded in presentation (*e.g.*, poster presentations instead of talks) at future Roundtable meetings. The criteria may be based on the structure given below. The reviews will be informal and may be forwarded to parties interested in the evaluation of such concepts whether for scientific, economic, or investment reasons (*e.g.*, NASA, NSF, USGS, USAF, USN, other government entities, both US and foreign).

Structure for Criteria of Space Resources CONOPS Review

Glossary:

The following levels may be considered "Exploration":

Action	Question action will answer
Prospecting	What resources may be available to a particular market?
Exploration	What resources are available, located, and studied?
Evaluation	Of the resources/markets studied, which are economic?

The following levels may be considered "Mining":

Action	Question action will answer
Initialization	Actions leading up to, and including, pilot operations
Ramp-up	High-risk enlargement of operations after pilot
Industrialization	Making the operations profitable
Closure	How do you close a particular mine operation

Suggested Questions in Review of Space Resources CONOPS:

What level does the concept address?

Are levels previous to the concept addressed by referenced projects?

What competing exploration concepts exist for similar resources?

What is the cost delta in trades? What is the information delta in trades?

What are the technology needs? What are the knowledge needs? Do these needs exist?

Does a mission plan exist (*e.g.*, spacecraft or ground-based, in what number, to what density of launches, to what timeline)?