

# MINING ASTEROIDS AND OTHER CELESTIAL BODIES

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# A Conference in Miniature

Recalling our Conference Objectives:

- ▣ Generalized benefit?
- ▣ Identification of Challenges and Solutions to Commercialization
- ▣ Balancing opportunities of Commercial Reward with Economic Development
- ▣ Seek Models of Public-Private Relationship in the development of extraterrestrial resources

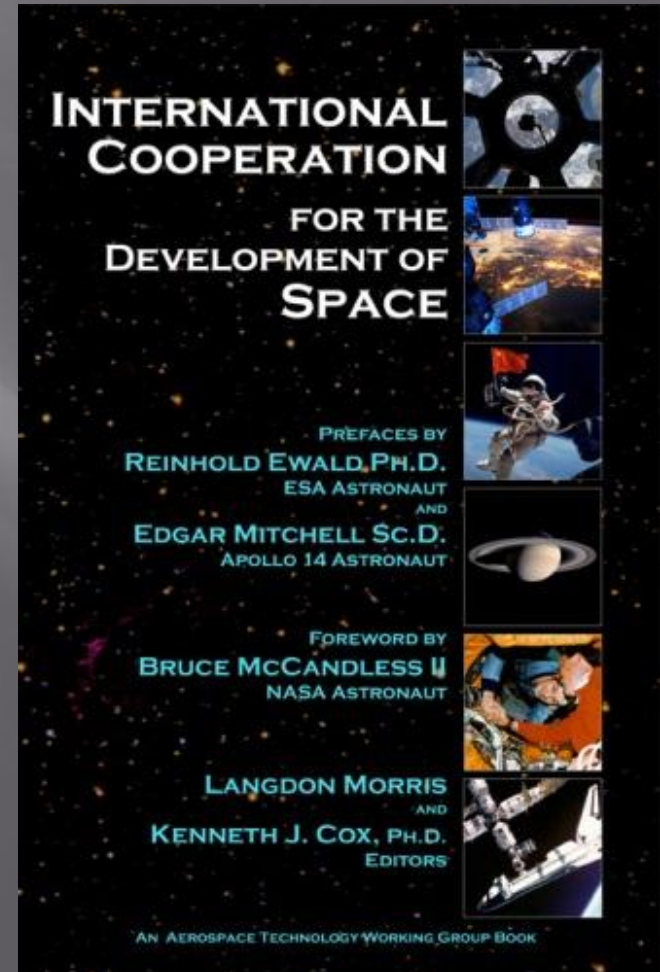
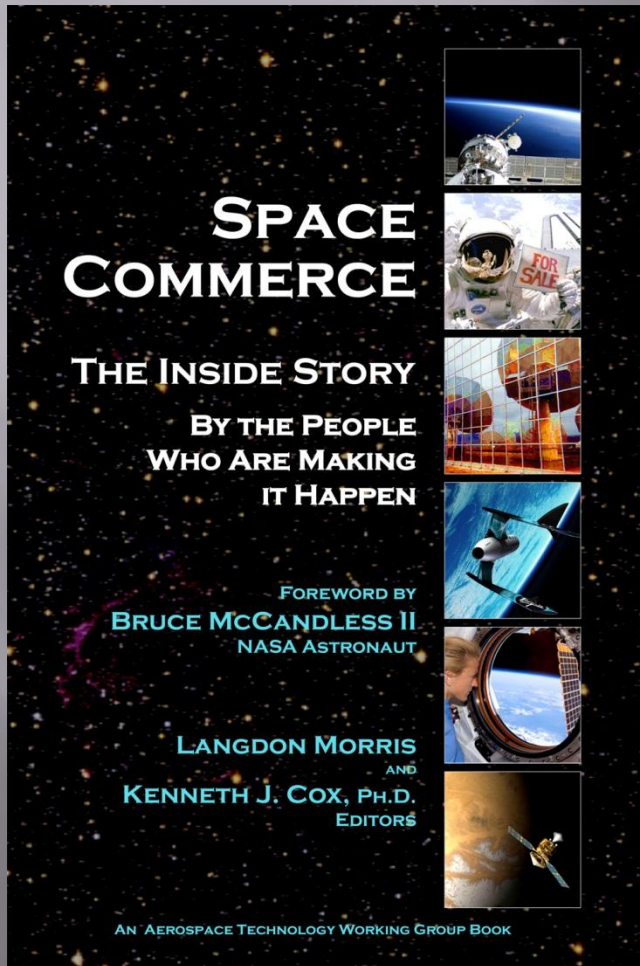
# Space Commerce Isn't Rocket Science

$$\Delta v = v_e \ln \frac{m_0}{m_1}$$

# Often it's a lot Harder



# But Sometimes Light Prevails





# Generalized Benefit: Legal Issues

- ▣ Unresolved Debate
- ▣ Key Issues:
- ▣ OST (1967)
  - No claims of sovereignty allowed
  - Meaning of “Appropriation?”
  - Limits, if any, to “use.”
- ▣ Lunar Treaty (1984)
  - “The Moon and its Natural Resources are the Common Heritage of Mankind.” Art. 11, 1
  - “International regime,” Art. 11, 5

# Generalized Benefit: Economic Issues

- ▣ Guarantee of cost recovery and right to profit seem to be the greatest threats to those societies possibly equal to bearing the required investment burden.
- ▣ Impact on Commodity Prices might be greatest threat to Developing Countries.
- ▣ Could an international regime address these threats effectively?

# Challenges and Solutions (1)

- ▣ Physical
  - At least 500 thousand NEO's
  - RDV is very difficult
- ▣ Legal
  - National laws govern mission approvals
  - Liability for material return may be uninsurable without state sponsor
  - International debate creates market uncertainties



# Challenges and Solutions (2)

- ▣ Economic
  - Investment outflows before return are likely to be enormous.
  - May be offset by intermediate technology returns.
- ▣ Practical
  - Engineering is not ready
  - Prospecting and surveying will be very difficult.
  - Logistics are daunting
  - Can't stake a claim
  - OST may even make it unlawful to maintain a "trade secret."

# Commercial Reward vs. Economic Development

- ▣ Zero Sum Game?
- ▣ Does a Rising Tide Lift all Boats?
- ▣ How much regulation can a risk averse new market tolerate?
- ▣ How much does it need?
- ▣ Complicated by ideology
- ▣ International regime?

# Public-Private Relationship

- ▣ Regulation
  - Inevitable given need for launch and reentry permission.
  - Main parties may all benefit
    - ▣ Clarification of beneficial interest
    - ▣ Positive impact on Economic Development
- ▣ Investor/Partner
  - May include niche investments accessible to many
  - Could facilitate solutions to the liability problem
  - Could include purchase of collateral services
- ▣ Neutral Intermediary?

# Assessment

- ▣ Extraterrestrial mining is scientifically possible
- ▣ The engineering required is not yet developed
- ▣ Initial investment required would be very high
- ▣ Potential value of material orbiting “close” to Earth is enormous.
- ▣ Property rights debatable
- ▣ Neither entrepreneurs nor activists can feel confident of their rights in off earth material
- ▣ Stalemate?

# Resolution?

- ▣ An international regime as suggested by the Lunar Treaty may be the only way around the current uncertainty.
- ▣ Many possible forms
  - Treaty organization
  - Voluntary association
    - ▣ Exchange of recognized rights in returned material for concrete, enforceable pledges of development investment.
    - ▣ Ability to function in any state accepting a chapter
  - Coordinated national legislation

# Conclusion

- ▣ Broad participation in the fruits of asteroid mining is possible.
- ▣ Engineering and economic challenges to commercial development of off-Earth materials are greater than the legal ones.
- ▣ Ideology may be the largest barrier to international agreement on resource sharing.
- ▣ A window for creating structured cooperation internationally is open but may close if individual states begin to act alone.