

## Research Questions and Hypotheses

By Bob Krone, Provost, Kepler Space Institute

Beginning in 2004 with the building of the book, *Beyond Earth: The Future of Humans in Space*, edited by Bob Krone (Apogee Space Press, 2006), the Kepler Team of professionals has been identifying research questions needing answers for success in the forthcoming Space Epoch. There are multiple known challenges linked to the permanent move of humans to space and an infinite number of now unknown others that will be identified in the future.

Since Kepler space Institute (KSI) and its follow-on Kepler Space University (KSU) will have a strong research focus, hypotheses are one output of research. They provide expectations for the future. Hypotheses have four possible outcomes: (1) future events and research may validate them; (2) they may prove them to be invalid; (3) they may discover some mix of truth in the projection; or (4) insufficient evidence may be found to state any findings or conclusions.

The research questions and hypotheses in this article, listed alphabetically by subject, cover a large array of science, engineering, management, governance, policy, and human factors subjects. But they represent only a small illustrative set of what lies ahead. Authors and readers of *The Journal of Space Philosophy* will make additions to this list in perpetuity.

### 1. Bacteria

\* Hypothesis. Bacteria will be inside the human settlement bubble in space. These bacteria will be used for recycling, for the production of new materials from substances to be brought from the external environment, for supporting the life of other organisms, to keep our immune system in shape, and for all other functions of bacteria to sustain life on Earth. [Dr. Eshel Ben-Jacob](#)

### 2. Breakthroughs

\* Hypothesis. A breakthrough is not a function of what is known, but a function of the domains in which it is known. We can know the future of space in a domain of ideas and science, we can know it in a domain of experience and action, and we can know it in a domain of adventure, risk, and myth. All those domains will be needed for the major human move to space. [Dr. Charles E. Smith](#)

### **3. Challenge**

\* Research Question. How do we solve the greatest challenges of human life, which are the mysteries of the universe that tempt us from without, but also the mysteries of ourselves, which lie within the human consciousness, human knowledge, and human compassion? [Langdon Morris](#)

### **4. Children Today – Tomorrow’s Space People**

\* Research Question. A harsh evaluation by today’s youth is that they do not feel they have a part in the planning process for opening the space frontier. How should we go about giving them a voice and involving them in the planning process now? [Lonnie Schorer](#)

\* Research Question. Is a child’s sense of wonder a valuable asset in our quest for answers about the Universe? [Lonnie Schorer](#)

\* Research Question. Would it be feasible to utilize Satellite Space Technology to create Virtual Field Trips for kids as a way to stimulate interest in Space Technology for schoolchildren everywhere in the world? We already have the technology to do this in Orbital Space, on the Moon, and on Mars. [Dr. Elliott Maynard](#)

\* Research Question. In an effort to integrate children into the vast expanse of knowledge that has been generated since the golden age of human space pioneering in the 1960s, how can more experienced generations best share the “great unknowns” of deep space pioneering with more newly arrived generations? [Dr. Martin Schwab](#)

### **5. Debris in Space**

\* Research Question. The accumulation of debris in space is an increasing problem with potential damage to space operations. How can international research and specific plans be created to deal with this problem? [Dr. Feng Hsu](#)

### **6. Education**

\* Research Question. What private-public education and human capital development model can successfully integrate the international resources and interest of government, industry, and academe that will be involved with the future space enterprise?

\* Research Question. What emerging telecommunications and information system technologies will transform space-related education and human capital development worldwide?

\* Research Question. What economic and financial structure will be needed to support and sustain the private-public education and human capital development model developed for the future space enterprise?

**Dr. Michael J. Wiskerchen**

## **7. Energy**

\* Hypothesis. The permanent solution to earth's energy needs has begun with biofuels conversion for vehicles and will be finally resolved by a mix of solar energy from space with alternatives to oil-based energy sources on earth. **Howard Bloom**

## **8. Evolution**

\* Hypothesis. Some kind of movement of humanity into space is inevitable. But this great step is likely to be far more successful and meaningful if it is guided and energized by awareness of the wider evolutionary trajectories that will eventually determine the significance of humanity in the universe. **John Stewart**

## **9. Genetics**

\* Research Question. How do we determine and accomplish needed human genetic intervention or manipulation to insure the survival of humankind off earth? **Lynn Harper**

## **10. Governance**

\* Research Question. What can be learned from historic shifts of epochs?

\* Research Question. What widespread wishful thinking hinders realistic steps towards human settlement of space, such as trust that goodwill, civil society, and business interests can be relied upon to do most of the job.

\* Research Question. What are the most critical characteristics of governance essential for human settlement of space?

\* Research Question. How can those critical characteristics be realistically realized?

\* Research Question. What can be done to prepare the ground for moving humanity beyond earth before a suitable governance system emerges?

**Professor Yehezkel Dror**

## **11. Gravity and Humans in Space**

\* Research Question. How will the brain and its psychology adapt to microgravity and hypergravity? **Dr. Sherry E. Bell**

## **12. Human Survival**

\* Research Question. How can human civilization best integrate our global systems of government, business, academia, and faith to ensure human survival and the generation of knowledge, prosperity, and spiritual well-being across our solar system over the next twenty generations? **Dr. Martin Schwab**

## **13. Intelligence**

\* Research Question. Development of an information theory that is extendable to fantomark-coded messages and streaks would be crucial, as it would facilitate the invention of superior intelligent artifacts; could this hold a key to communication with extraterrestrial modes of intelligence and eventually help us understand our cosmic ancestry and the relationship between implicate and explicate orders, as envisioned by David Bohm? **Dr. Joel Isaacson**

## **14. International Cooperation**

\* Research Question. What aspects of the human psyche in general pose the greatest problems for creating a successful worldwide society based on mutual responsibility, enthusiasm, cooperation, and commitment to the general welfare of all participants and how do we successfully ensure they do not continue to prevent a fully functional worldwide society capable of cooperative existence?

\* Research Question. How can we stop the destruction of war that has been draining the world and all people of its resources for millennia so that we can collaborate to achieve those things we naturally desire as part of our heritage in the Cosmos?

\* Research Question. How do we deal with imminent earth climatic changes which could devastate a significant portion of its land and populations of humans and wildlife so that we can fulfill our future heritage in a cooperative collaboration of international peace?

**Michael Hannon**

## **15. Law**

\* Research Question. What is the most effective formulation of a transnational public and/or private corporation business entity to exercise independence and sovereignty to identify, recover, and commercially exploit space resources for the benefit of all humankind?

\* Research Question. How do we formulate a legal operating relationship between international/transglobal military entities (administration/protection) and private entrepreneurs operating in space? This might be an appropriate variation of the English

charters of the late sixteenth century (e.g. Virginia Company, Hudson's Bay Company, or East India Company).

\* Research Question. How do we formulate curricula for engineering students and graduate science students that will teach them routine and full involvement with global space law and economics, such as that being developed at the Georgia Tech engineering department?

\* Research Question. How do we establish a globally effective legal infrastructure to encourage and protect the process of obtaining "informed public consent" for all space activities that are designed to allow broad human interaction or interference with extraterrestrial life, consistent with applicable principles of metalaw?

\* Research Question. How do we create a new jurisprudence allowing independent personhood and legal accountability of transhumans, telepresences, and advanced artificially intelligent biorobotics functioning in near and deep space?

**Dr. George S. Robinson**

## **16. Leadership**

\* Research Question. How do we train people to balance order, control, and results focus in a context of what is good for humanity locally and at large? **Dr. Charles E. Smith**

## **17. Militaries in Space**

\* Research Question. What missions in outer space (besides planetary defense) are best suited for the military systems of our world, which can create political accord among the major world powers?

\* Research Question. Could a negotiation framework at the presidential level be initiated by the United States to allow *small, annual, incremental, and reciprocal* transfers in terms of percentages from military budgets to an international civil space pioneering and defense budget or private fund?

**Dr. Martin Schwab**

## **18. Moon**

\* Hypothesis. In 2013, the 56th anniversary of the commencement of the civil space age will take place, as will the 407th anniversary of the founding of Jamestown, the first permanent "*New World*" English colony in America in 1607. 2013 commences the second half-century of the civil space age and will also mark the beginning of a program

to create the first city on the Moon with the initiation of the permanent expansion of the World's human civilization beyond the Earth. **Thomas F. Rogers**

### **19. Music and Arts**

\* Hypothesis. Music and Arts programs throughout the world will increasingly establish programs or departments that focus the creative energy of youth toward music and the arts for humans in space. **Dr. Bob Krone**.

### **20. Nature's Cosmic Intelligence**

\*Hypothesis. One of our latest thoughts regarding Article 7, "Nature's Cosmic Intelligence," is the following syllogism:

- \* IF nature's Cosmic RD-based Intelligence is universal, autonomous and not created by humans, e.g. like gravity;
- \* AND human capabilities to harness it for good or evil are unknown in 2012;
- \* THEN the human challenge is to understand it better to determine if influence for the GOOD can occur.

**Joel Isaacson, PhD & Bob Krone, PhD**

### **21. New Frontier**

\* Research Question. How do we create a new sense of purpose, a new set of goals, a new frontier to move once again with might and majesty, with a sense of zest that makes life worth living, through the world in which we live? One of the most challenging frontiers left to us hangs above our heads. **Howard Bloom**

### **22. Popular Support for Space**

\* Hypothesis. Only when regular citizens recognize the far-reaching humanitarian advantages or can personally experience the technological advantages of the space program will a national or international space policy have broad support.

**Dr. David Livingston**

### **23. Quality Sciences and Space Sciences**

\* Hypothesis. Quality Control and Management has been a continual emphasis for space missions. A formal merging of Quality Sciences and Space Sciences will occur for Human-to-Space Migration. **Dr. Bob Krone**

### **24. Risk, Safety, Reliability**

\* Research Question. What R&D efforts into accident theories are needed to understand better the complexities in accident propagations and how phenomenological events that often cause catastrophic system failure occur?

\* Research Question. What R&D efforts are needed to understand the influences of human dynamics on the development and evolution of man-machine interfaced technological systems and how do the factors of human elements play a key role in the safety risk of all technological systems?

\* Research Question. Does absolute safety exist for manned space vehicle systems? Is it possible to eliminate accident by design? What are the design philosophies and strategies that can achieve such goals?

\* Research Question. How do we systematically model, understand, and control the interactive complexities that pose great threats to the safety of socio-technical systems?

**Dr. Feng Hsu**

## **25. Self-Destruction**

\* Research Question. The views of some past and current global leaders indicate that while military relationships continue to dominate the political agenda on Earth, the lure of human space pioneering can still deliver us from our dangerous propensity for self-destruction. How can global society now build upon this concept? **Dr. Martin Schwab**

## **26. Spaceflight Systems**

\* Hypothesis. NASA and global space entities should never again be confined to SINGLE and static human spaceflight architectures. If greater budgetary and capital investments were demanded, exponential increases in the quality of human life would occur, based on proven records of success. **Dr. Martin Schwab**

## **27. Space Trips for Peace**

\* Hypothesis. Space Trips for Peace would create crews composed of members from nations marginally friendly, hostile, or even at war with each other. Space, new to civilization and without territorial boundaries or national sovereignties, would be the ideal frontier for demonstrating that people of all cultural beliefs and religious backgrounds are able to set aside differences and work harmoniously for goals mutually considered good. **Astronaut Buzz Aldrin and Thomas F. Rogers**

## **28. Win-Win Global Consciousness**

\* Hypothesis. Both research and the search of human experience will be necessary to bring win-win benefits of space to the mainstream global consciousness.

**Dr. Elliott Maynard**

**29. X-Prizes**

\* Research Question. How have, and could, X-Prizes, positively impact the future of exploration and development of space? **Howard Bloom**

**Readers of the Journal of Space Philosophy are urged to e-mail their research questions and hypotheses to [BobKrone@aol.com](mailto:BobKrone@aol.com)**

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