



**NIAC**  
 NASA INSTITUTE  
 FOR ADVANCED CONCEPTS

**6th Annual Meeting**

**October 19-20, 2004**  
 Grand Hyatt Seattle  
 721 Pine Street  
 Seattle, Washington 98101  
 206-774-1234

**NIAC**  
 75 5th Street NW, Suite 318  
 Atlanta, GA 30308  
 404-347-9633, 404-347-9638 (fax)  
<http://www.niac.usra.edu>

***Creativity and imagination,  
 inspired by curiosity and the  
 eternal quest for knowledge,  
 are necessities, not luxuries.***





# NIAC Charter

- **Focus on Revolutionary Advanced Concepts for Architectures & Systems for NASA**

## **Operating Environment –**

**Enabling technologies may not be available**

**Science may not be totally understood**

**Aimed 10 to 40 years into the future**

***Actively seek credible, technical controversy***

- **Operate as an Independent, Technical Assessment Organization for NASA**

**Function as a Virtual Institute over the Internet**

**(<http://www.niac.usra.edu>)**

**Use Succinct Technical Proposal Requirements  
and Peer Review**

- **The genius is in the generalities, and not the details**

Einstein's Theory of Relativity

Darwin's origin of species

Galileo

Kepler

and many others

**Genius is the ability to transcend experience**

- The genius is in the generalities, and not the details.
- The new idea illuminates a pathway towards a significant expansion of knowledge.

A sense of malfunction can lead to crisis as a prerequisite to revolution.

May be the basis for a new tradition of normal science.

New paradigms seem revolutionary only to those whose paradigms are affected by them.

# What is *Revolutionary*?

- The genius is in the generalities, and not the details.
- The new idea creates a pathway that addresses a roadblock.
- **It inspires others to produce useful science and further elaboration of the fundamental idea.**

Imagination and visualization are, generally, the first step in learning, or creating, something radically new.

Revolutionary art and visionary physics are both investigations in the nature of reality.

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- It inspires others to produce useful science and further elaboration of the fundamental idea
- **It contributes to a major change in the framework of aerospace possibilities.**

*Scientific research is an art form in this sense: it does not matter how you make your discovery, only that your claim is true and convincingly validated -- Edward O. Wilson*

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- **It triggers a transformation of intuition**

Theories help to put observations into context and to create a framework for further understanding

Scientific theories are the product of informed imagination

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- It triggers a transformation of intuition
- Revolutionary paradigm shifts are often simple, elegant, majestic, beautiful and are characterized by order and symmetry

Creative paradigm changes are often the result of a non-linear, orthogonal imagination

Symmetry and order can be visually pleasing

Non-symmetry may be richer, more diverse and less boring

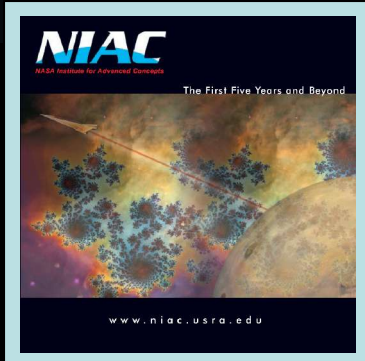
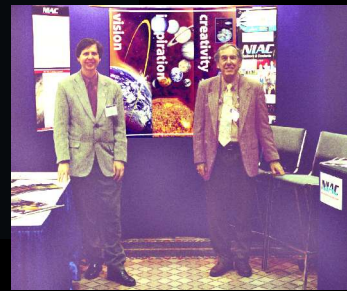
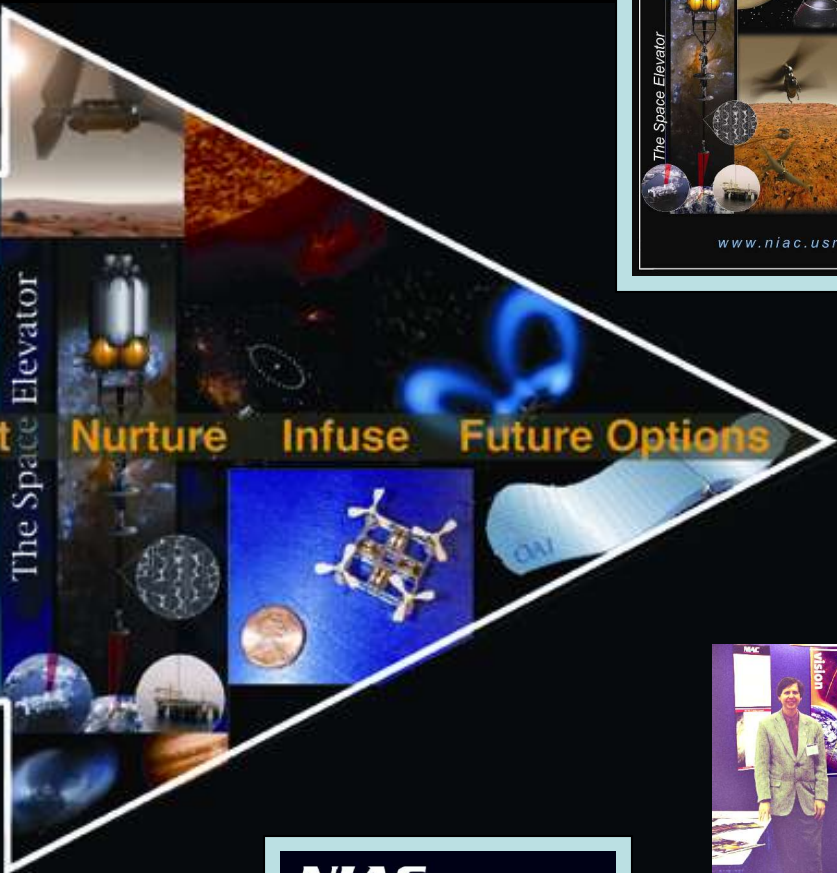
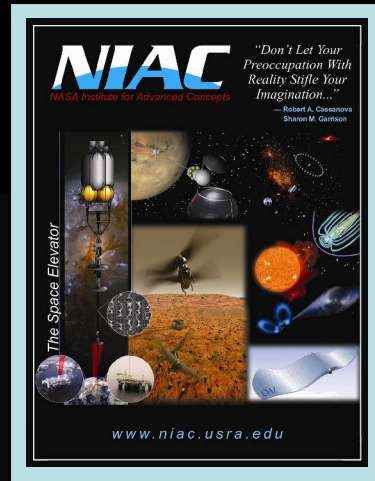
*Don't let your preoccupation with reality stifle your imagination.*

*Robert Cassanova and Sharon Garrison*

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- **Revolutionary paradigm shifts are often simple, elegant, majestic, beautiful and are characterized by order and symmetry**

*There is a subtle yet significant difference between a creative and credible concept, and an imaginary pursuit.*

*Robert Cassanova, Ronald Turner, Patricia Russell*



Revolutionary Aerospace Concepts

Education Feedback Connectivity Communication

# NIAC

Inspire **Solicit** Review Select Nurture Infuse Future Options

Management Collaboration Outreach Peer Review

Systems and Architectures



**Annual Calls for Proposals:  
Phase I  
Phase II  
Student (NSVFP)**

**NIAC**  
NASA Institute for Advanced Concepts

NIAC CP 04-01

**CALL FOR PROPOSALS**

PHASE I  
ADVANCED AERONAUTICAL/SPACE  
CONCEPT STUDIES

Proposals Due: June 7, 2004

**NIAC**  
NASA Institute for Advanced Concepts

NIAC CP 03-01

**CALL FOR PROPOSALS**

PHASE II ADVANCED AERONAUTICAL/SPACE  
CONCEPT STUDIES

Proposals Due: April 30, 2004

**ARE YOU A REVOLUTIONARY?**

**NIAC STUDENT VISIONS OF THE FUTURE PROGRAM ANNOUNCEMENT**

**WHO:** University Undergraduate Students

**WHAT:** Opportunity to Submit Revolutionary Aerospace Concept Ideas

**WHEN:** By September 1, 2004

**WHERE:** 3-Page Concept Description sent to: NIACStudents@niac.usra.edu

**HOW:** Imaginative, credible ideas for aerospace systems or architectures to be implemented 10-40 years in the future can be submitted by an undergraduate student(s), endorsed by a faculty advisor to compete for the opportunity to present a poster at the NIAC Annual Meeting to be held in the Seattle, WA in October, 2004. All expenses will be paid for the student(s) and advisor. (No more than 2 students per concept, please.)

**SEE:** <http://www.niac.usra.edu> for further program and application information.

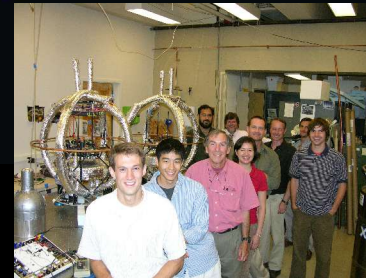
**NIAC**

**YOU ARE THE FUTURE. IMAGINE THE POSSIBILITIES!**

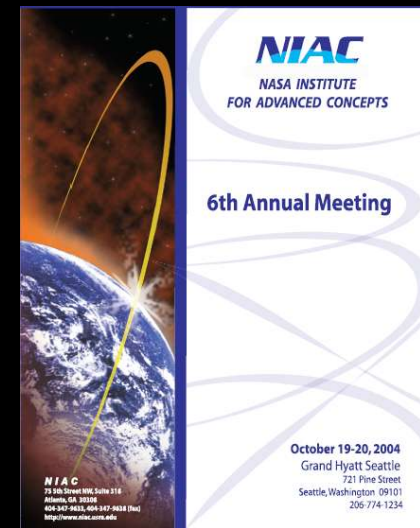


**Peer review process validated by  
NRC Committee**





- Active exposure through the NIAC website
- Briefings to NASA HQ AAs, technical and programmatic leaders and Centers Directors
- Site visits with Phase II contractors to encourage follow-on funding
- Annual Meetings and Fellow's Meetings

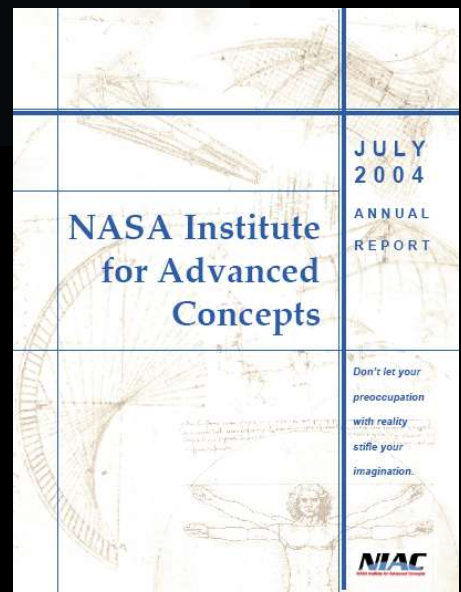




- Survey of enabling technologies
- Roadmaps of enabling technologies

- Actively seek follow-on funding for post Phase II development for most promising concepts
- Communicate with NASA technical and programmatic leaders
  - Annual reports
  - Focused briefings
  - Participation in NASA workshops

**Annual Report**



**Revolutionary Aerospace Concepts**

Education  
Feedback  
Connectivity  
Communication

# MIAC

Inspire Solicit Review Select

Management  
Collaboration  
Outreach  
Peer Review

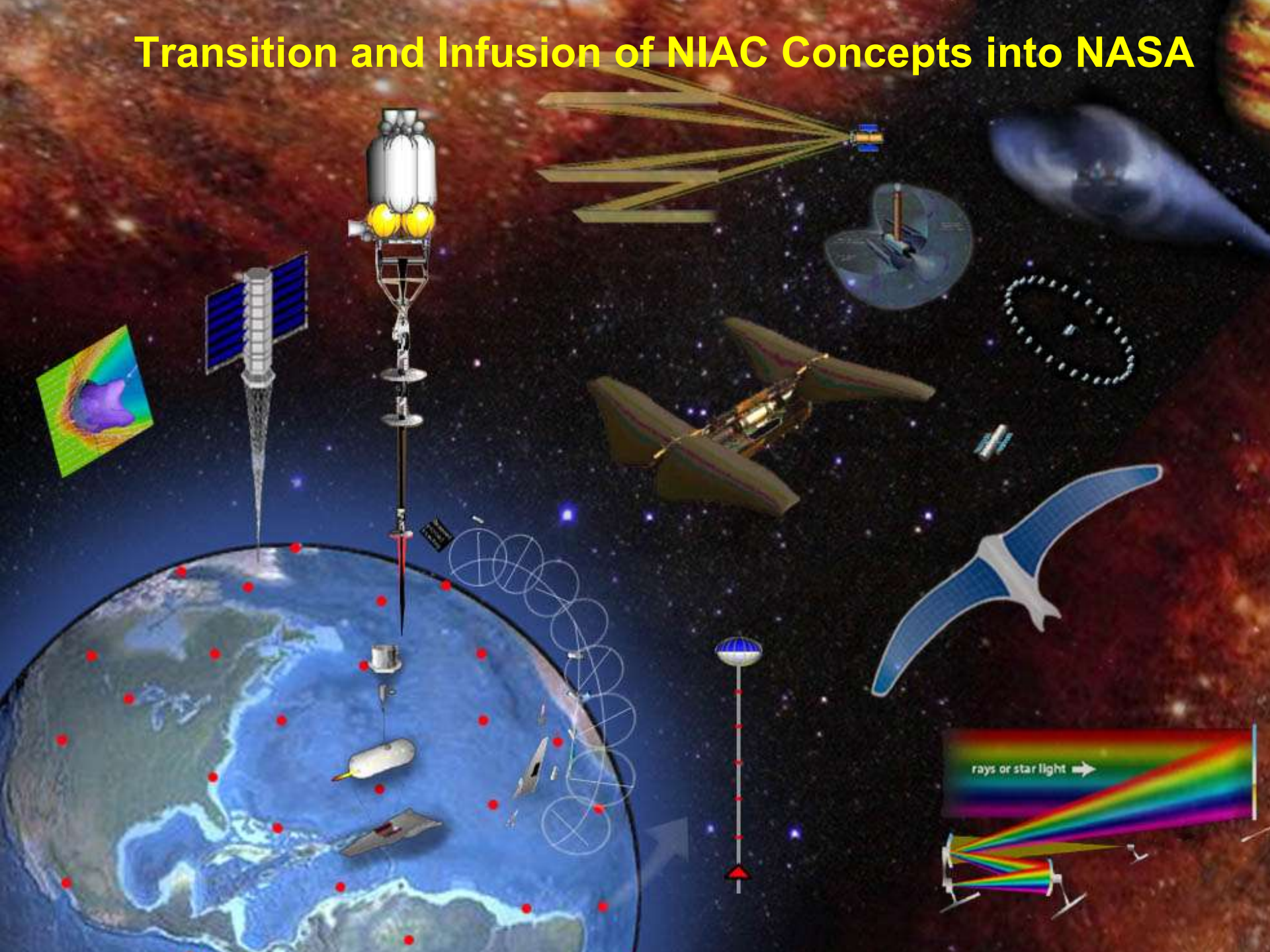
**Systems and Architectures**

The Space Elevator

Nurture Infuse

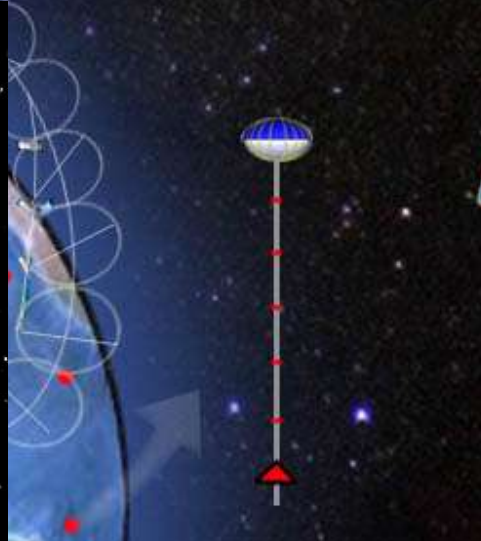
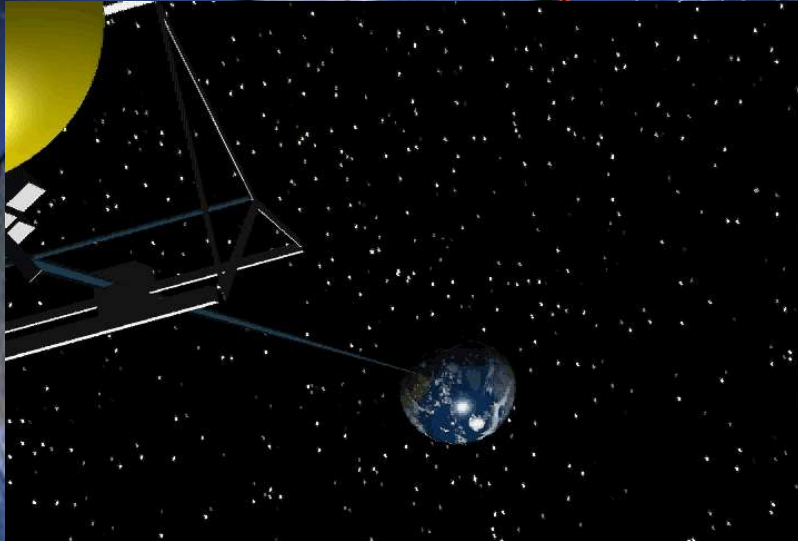
**Future Options**

# Transition and Infusion of NIAC Concepts into NASA



# Transition and Infusion of NIAC Concepts into NASA

And there are just a few details that need to be addressed.....






# *Future NIAC Events*


## *Phase I Fellows Meeting in March 2005*



*Phase I Call for Proposals to be released by  
early November 2004 with due date in early  
February 2005*



*NIAC Student Visions for the Future Program  
Call for Proposals with due date of  
January 31, 2005*



# CP 04-01 Phase I Grants

Performance Period: October 2004 through March 2005

**Poster Session**

*Creativity and Innovation are essential for the success of our nation. They are not luxuries.*

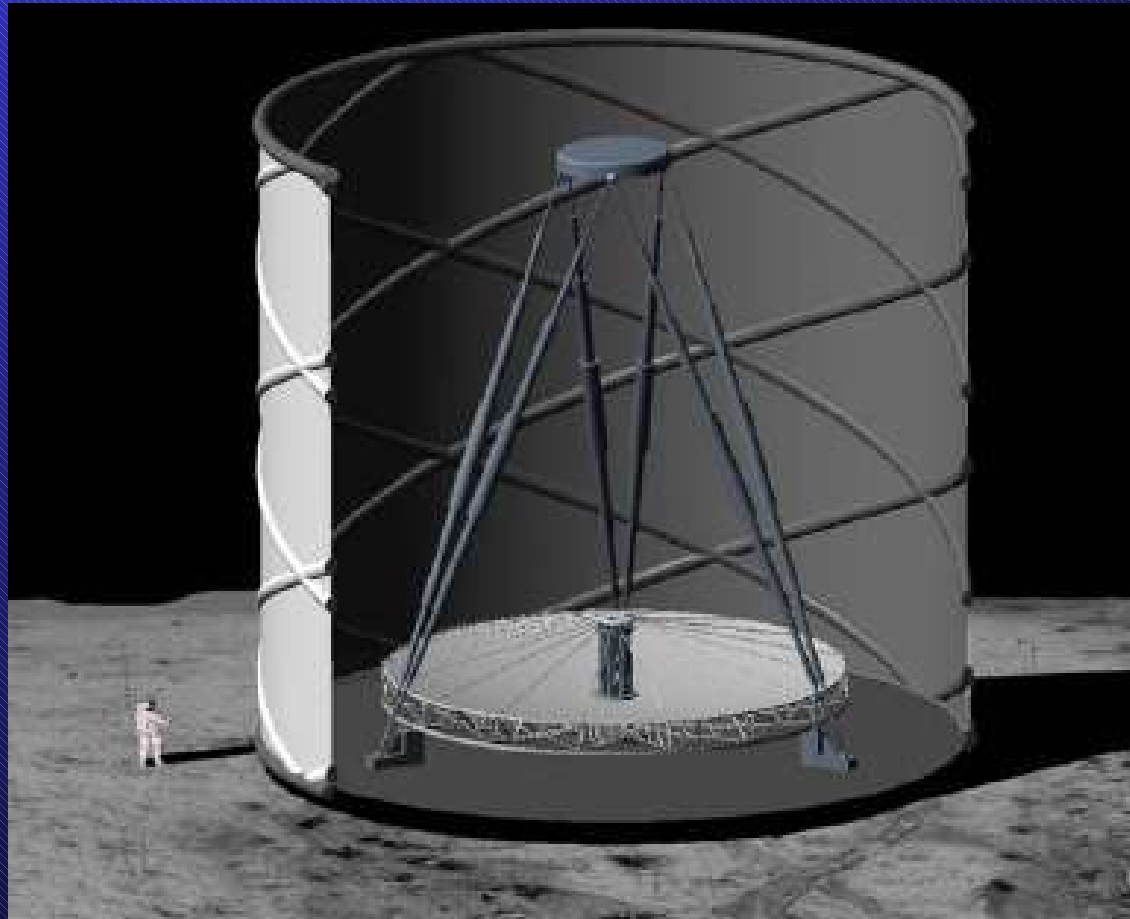
NSF



# A Deep Field Infrared Observatory Near the Lunar Pole

Roger J. Angel

University of Arizona

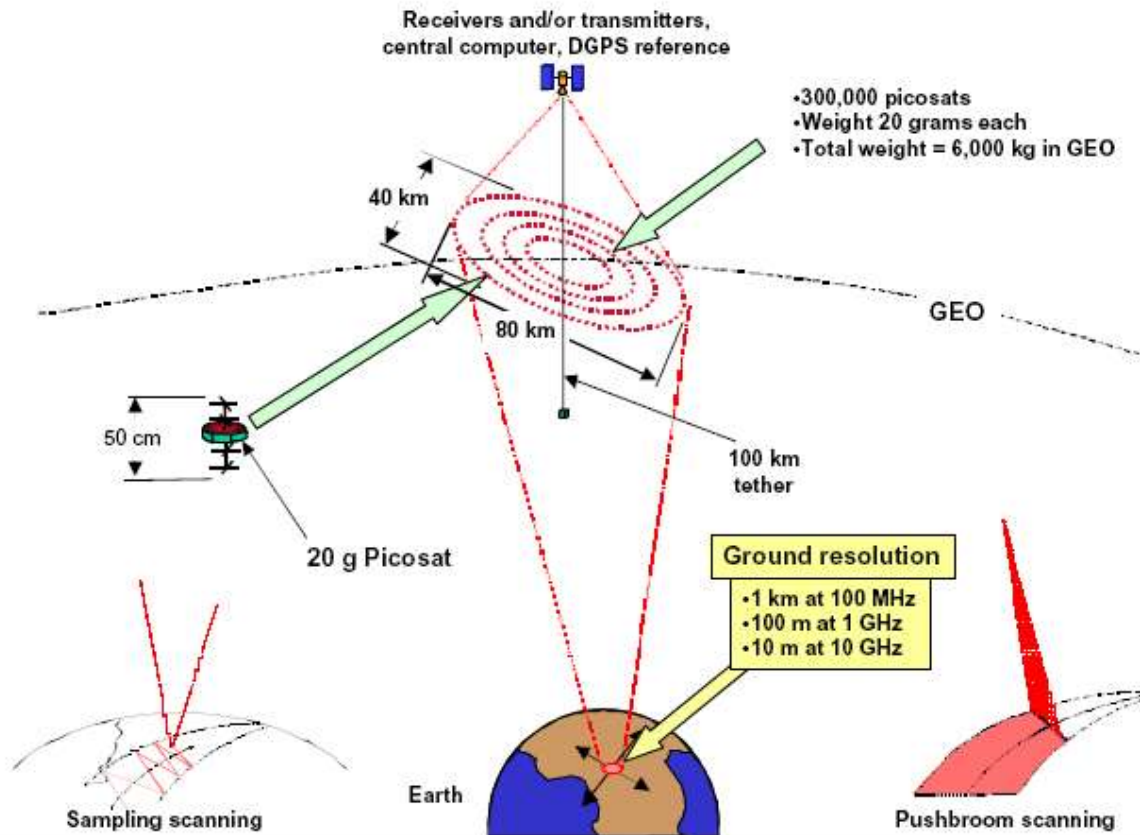


# Extremely Large Swarm Array of Picosats for Microwave/RF Earth Sensing, Radiometry and Mapping

Ivan Bekey

Bekey Designs Inc.

## LARGE PICOSAT SWARM ARRAY MICROWAVE/RF CONCEPT



Wendy Boss

North Carolina State University

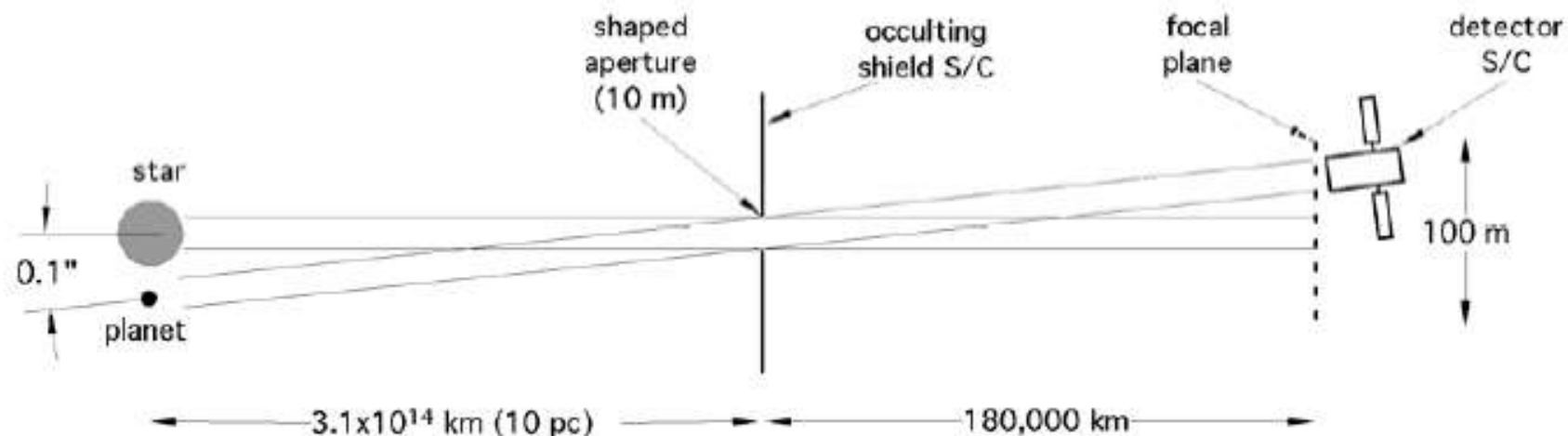
- **Reconsider life forms as we know them and design organisms for survival in the extreme conditions that exist in extraterrestrial environments.**
- **Selectively expressing in plants extremophile genes that will collectively enable functional life in hostile environments. As proof of concept, the phase I goal is to produce functional extremophile proteins in plants.**

# Analysis of a Lunar Base Electrostatic Radiation Shield Concept

Charles Buhler

ASRC Aerospace Corporation



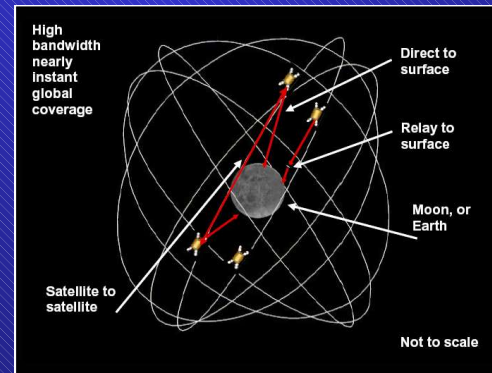
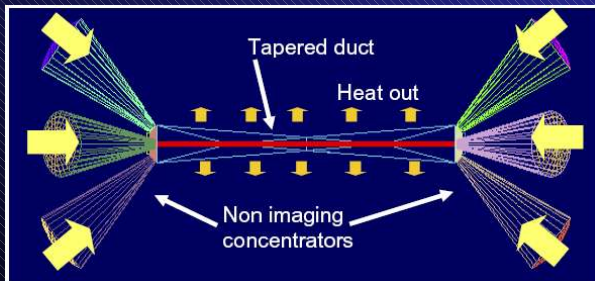
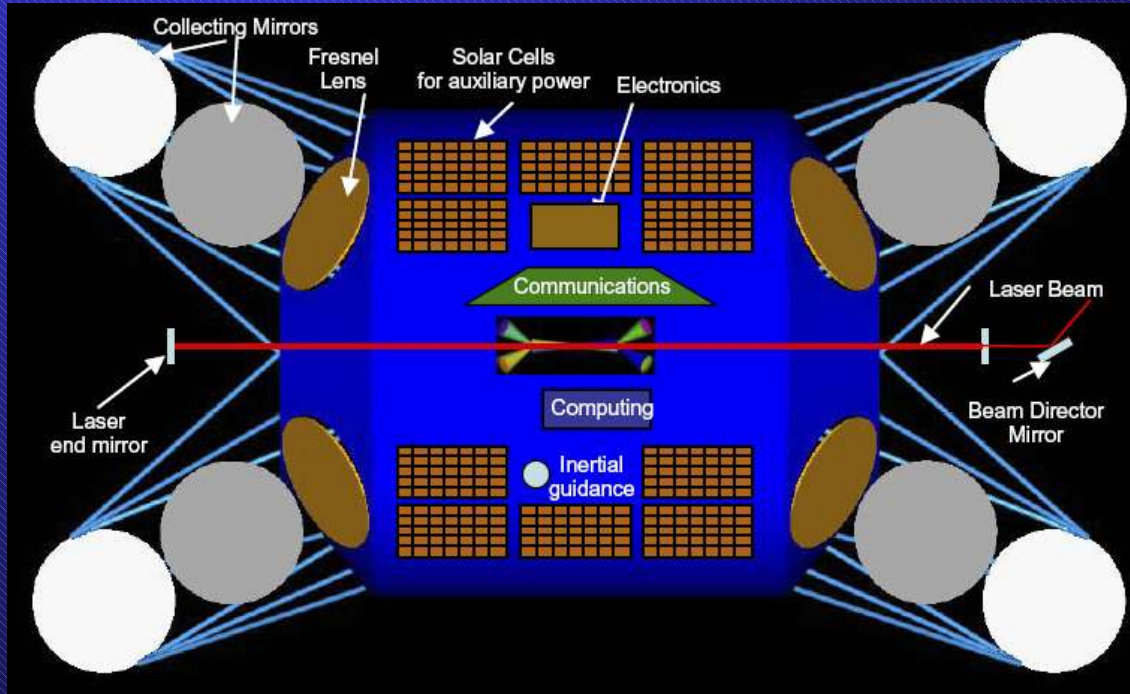


**Figure 4: A properly shaped aperture makes an ideal lens. This pinhole camera creates a large focal plane where the light from a planet is separated from its parent star *before* it reaches the telescope which then concentrates and analyzes the signal.**

# Efficient Direct Conversion of Sunlight to Coherent Light at High Average Power in Space

**Richard Fork**

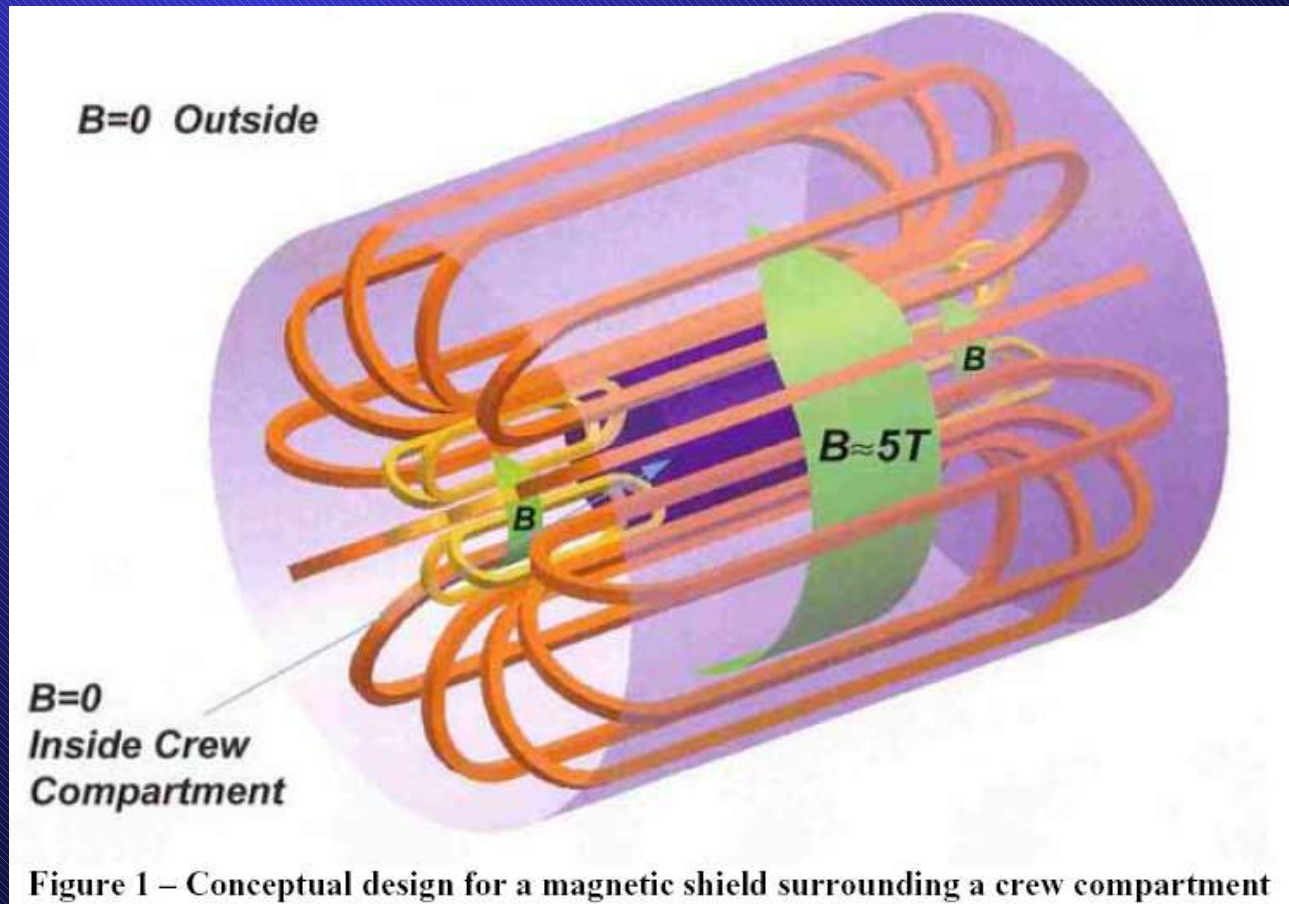
**University of Alabama, Huntsville**



# Use of Superconducting Magnet Technology for Astronaut Radiation Protection

**Jeffery Hoffman & Peter Fisher**

**MIT**



# Wide Bandwidth Deep Space Quantum Communications

**Ricky Morgan**

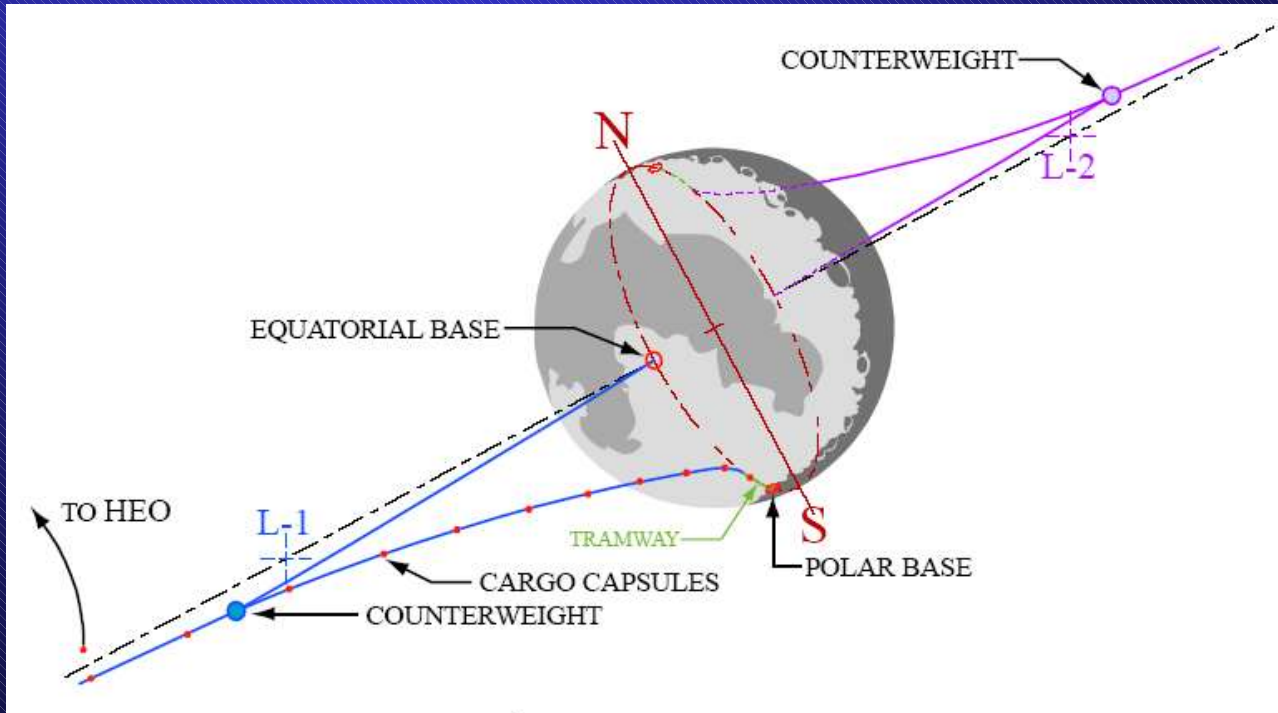
**Morgan Optics Corporation**

*The goal is to prove that at least an order of magnitude increase in the effective classical information bit rate can be accomplished for deep space missions, relative to the proposed classical microwave and laser communication systems, by using quantum communication transmission of quantum bits to implement communication complexity protocols over deep space channels using the same or less power and antenna gain as proposed deep space classical communication satellite systems.*

# Lunar Space Elevators for Cislunar Space Development

Jerome Pearson

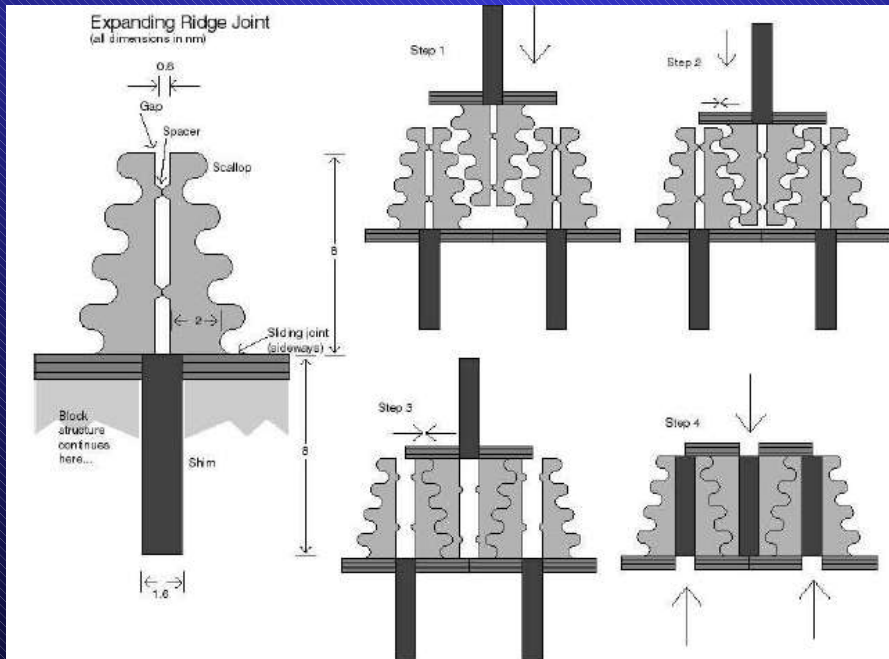
Star Technology & Research, Inc.



# Large-Product General-Purpose Design and Manufacturing Using Nanoscale Modules

Chris Phoenix

Center for Responsible Nanotechnology

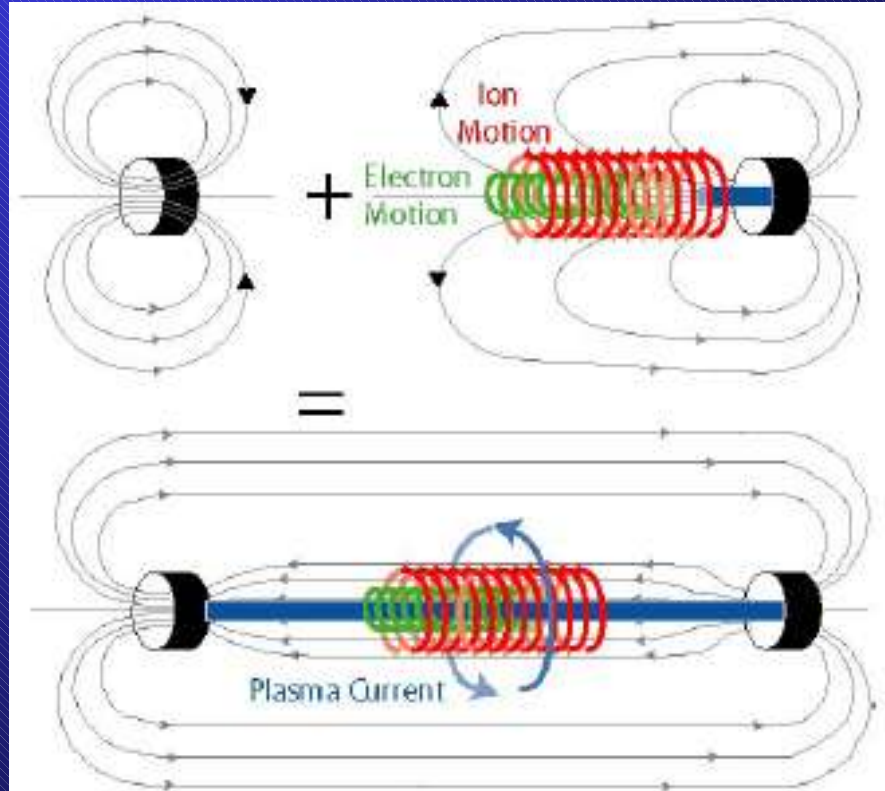


- Investigate the design, fabrication, and performance of human-scale products constructed from aggregates of nanoscale functional units.
- Investigate issues such as large-scale structures, curved sliding interfaces, fractal networks, and automated construction of awkwardly shaped products.

# Magnetized Beamed Plasma Propulsion (MagBeam)

Robert Winglee

University of Washington

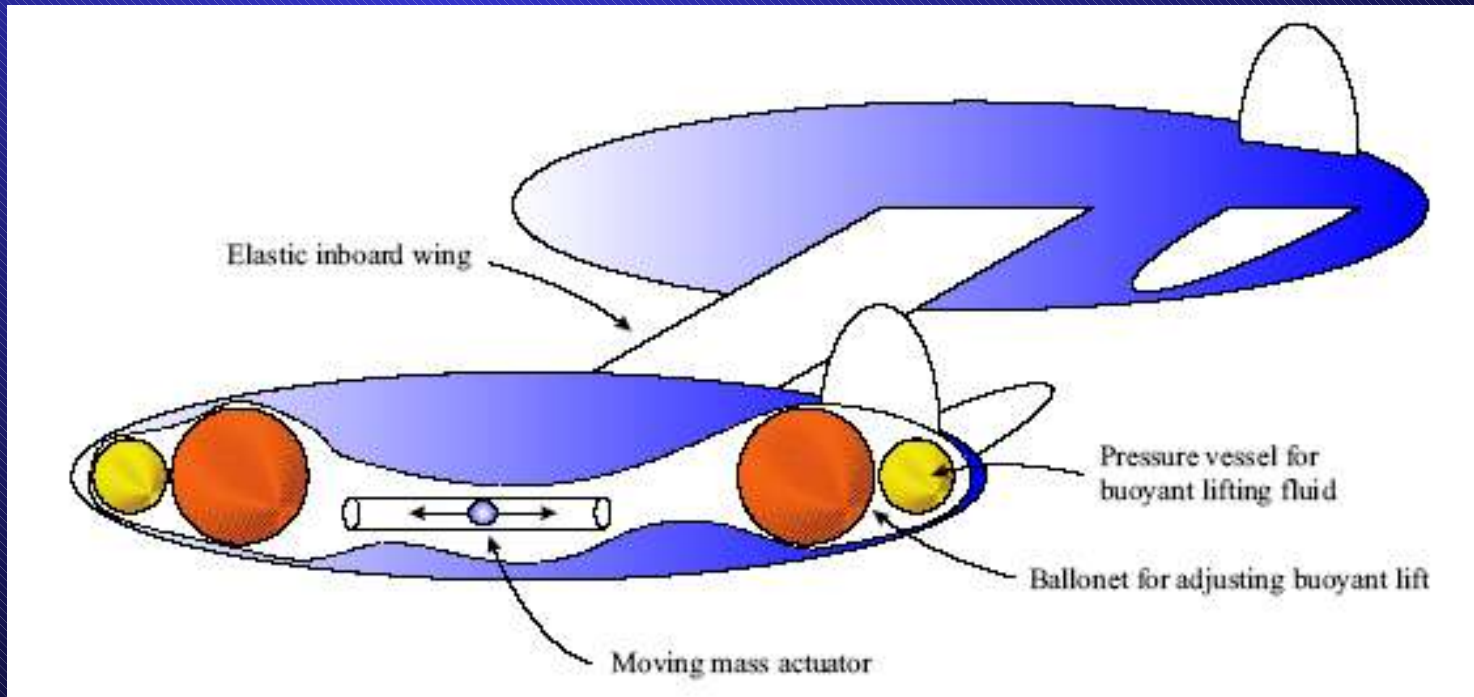


**Figure 2.** Schematic of the interaction of the beamed plasma with the payload. Due to reconnection the incident plasma will be funneled into the payload and an extended mirror device will be created.

# A Self-Sustaining, Boundary-Layer-Adapted System for Terrain Exploration and Environmental Sampling

Craig Woolsey

Virginia Polytechnic Institute





# NIAC Students Visions of the Future Program (sponsored by USRA)

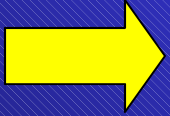
## Poster Session

*Creativity and innovation are essential for the success of the program. They are not luxuries.*

NIAC



# NSVFP Poster Session



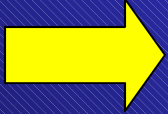
**Andrew Bingham, Clarkson University**

**Deployment of an Interstellar Electromagnetic Acceleration System**

# NSVFP Poster Session

**Andrew Bingham, Clarkson University**

**Deployment of an Interstellar Electromagnetic Acceleration System**



**Xiadong Liu, Yu Liang, QiChang Liang, Michigan State University**

**Propulsion by the Recoil of the Field Momentum**

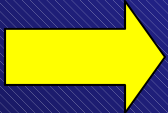
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**Chris Malow, University of Virginia and Danielle Adams, MIT**

**Humanitarian Systems Enabled by Space Solar Power**

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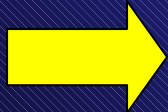
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**Hunter Marks, Louisiana State University**

**Towards a Decision Support System for Selecting a Landing Site**

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**Tommy Sebastian, North Carolina State University**

**Lunar Scout Vehicle - A Novel Long-Range Lunar Rover**

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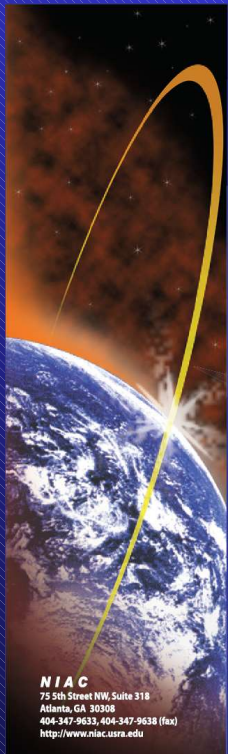
**Tommy Sebastian, North Carolina State University**

**Lunar Scout Vehicle - A Novel Long-Range Lunar Rover**



**Neil Toronto, Brigham Young University**

**Creative Autonomous Vehicles**



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**6th NIAC Annual Meeting**  
 Wednesday, October 20 2004

**8:00am - 8:45 am**

Light Breakfast

**8:45am - 9:00am**

Welcome: **Robert Cassanova, NIAC Director**

**9:00am - 10:00am**

Keynote Speaker: **Robert Hoyt, Tethers Unlimited**  
 Space Tethers: Lessons for Developing "Revolutionary" Technologies

**10:00am - 10:30am**

Break

**10:30am - 12:00pm**

NIAC Status Reports:  
 (45 minutes) **Steven Howe, Hbar Technologies, LLC**  
 Antimatter Driven Sail for Deep Space Missions  
 (45 minutes) **John Slough, University of Washington**  
 The Plasma Magnet

**12:00pm - 1:00pm**

Buffet Lunch

**1:00pm - 3:00 pm**

NIAC Status Reports:  
 (45 minutes) **Raymond Sedwick, Massachusetts Institute of Technology**  
 Electromagnetic Formation Flight  
 (45 minutes) **Constantinos Mavroidis, Northeastern University**  
 Bio-Nano-Machines for Space Applications  
 (30 Minutes) **Florin Mingireanu, Louisiana State University**  
 Ramjet Statoractor

**3:00pm - 3:30pm**

Break

**3:30pm - 4:45pm**

NIAC Status Reports:  
 (45 minutes) **Parviz Saroussian, Technova Corporation**  
 Inherently Adaptive Structural Systems  
 (30 Minutes) **Darin Ragazzine, California Institute of Technology**  
 and **Frank White, Harvard University**  
 Collectible Projectosats

**4:45pm - 5:15pm**

Open Discussion and Adjournment



**6th NIAC Annual Meeting**  
 Tuesday, October 19, 2004

**8:00am - 8:30am**

Registration and Light Breakfast

**8:30am - 9:00am**

Welcome: **Robert Cassanova, NIAC Director**  
 NIAC Overview  
 Introduction of New NIAC Phase I Fellows and NIAC Student Fellows

**9:00am - 10:00am**

Keynote Speaker: **Paul Spudis, Johns Hopkins Applied Physics Lab**  
 The New Presidential Space Vision

**10:00am - 10:30am**

Break

**10:30am - 12:00pm**

NIAC Status Reports:  
 (45 minutes) **Dave Newman, Massachusetts Institute of Technology**  
 Astronaut Bio-Suit System for Exploration Class Missions  
 (45 minutes) **Paul Todd, Space Hardware Optimization Technology, Inc.**  
 Robotic Lunar Ecopoiesis Test Bed

**12:00pm - 1:00pm**

Buffet Lunch

**1:00pm - 3:00 pm**

NIAC Status Reports:  
 (45 minutes) **John Maniobianco, ENSCO, Incorporated**  
 Global Environmental MEMS Sensors (GEMS):  
 A Revolutionary Observing System for the 21st Century  
 (45 minutes) **Alexey Pankine, Global Aerospace Corporation**  
 Sailing the Planets: Science from Directed Aerial Robot Explorers  
 (30 Minutes) **Calvin College Team**  
 Global System for Monitoring Earth Radiation Balance

**3:00pm - 3:30pm**

Break

**3:30pm - 5:30pm**

NIAC Status Reports:  
 (45 minutes) **Anthony Colozza, Ohio Aerospace Corporation**  
 Solid State Aircraft  
 (45 minutes) **Narayanan Komerath, Georgia Institute of Technology**  
 Tailored Force Fields  
 (30 Minutes) **Zach Adam, University of Washington**  
 The Origin of Life and Spaceflight Biospherics

**5:30pm - 7:00pm**

Reception, Viewing of NIAC Phase I and Student Award Posters