NIAC

NASA Institute for Advanced Concepts

2005 NIAC Annual Meeting

USRA

The Universities Space Research Association

ANSER

Analytic Services Inc.

Image Courtesy of the Hubble Space Telescope Science Institute, 'Kepler's Supernova Remnant'

NIAC Charter

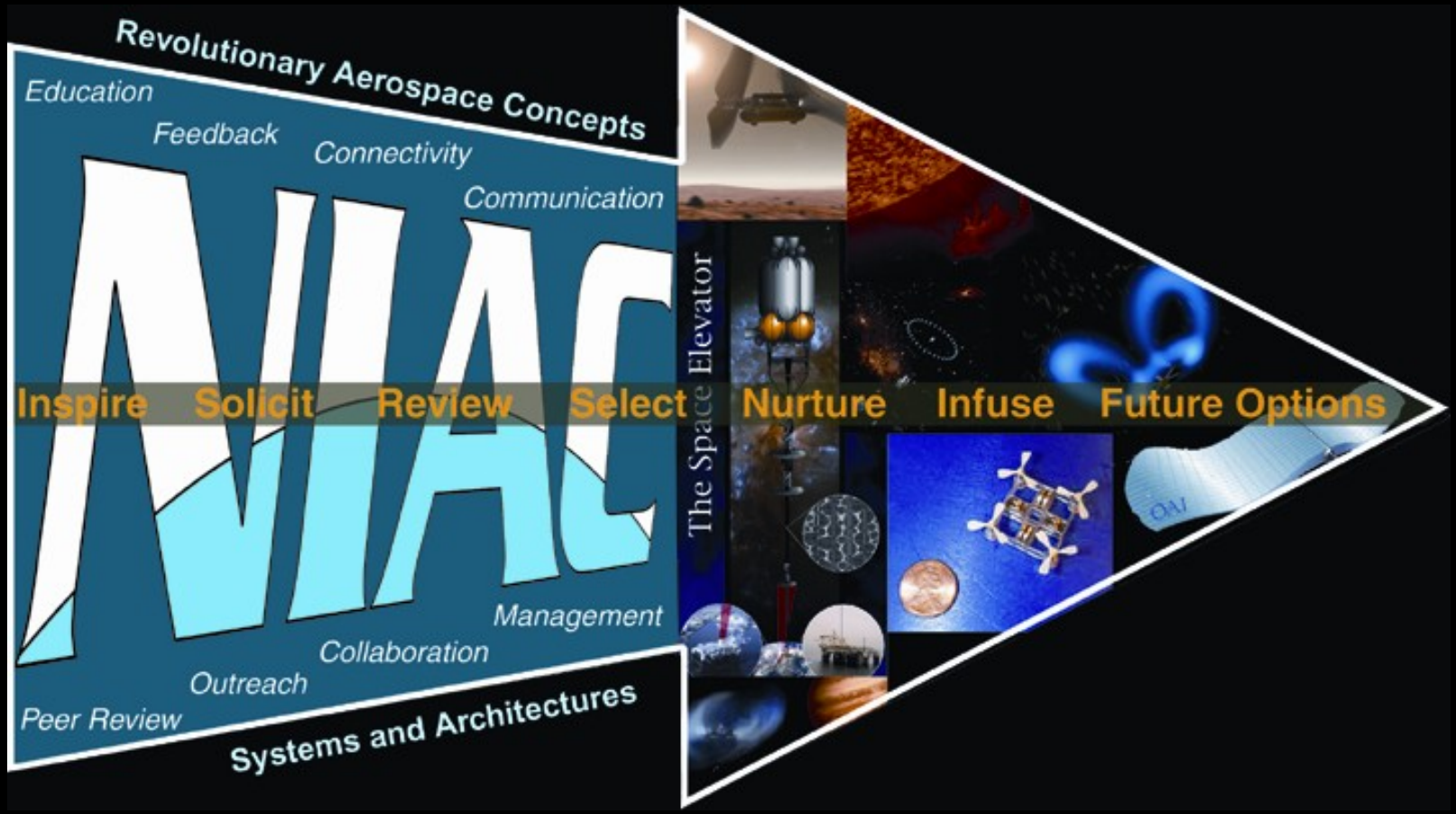
Focus on Revolutionary Advanced Concepts for Architectures & Systems

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

Provide a pathway for innovators with the ability for non-linear creativity to explore revolutionary visions for future aerospace endeavors.

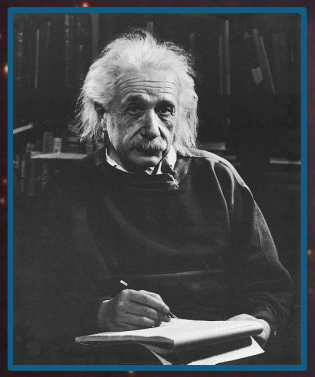


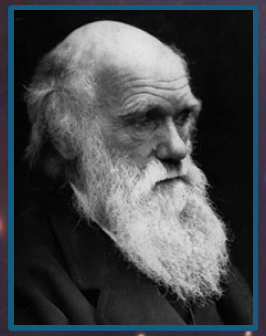
NIAC
NASA Institute for Advanced Concepts

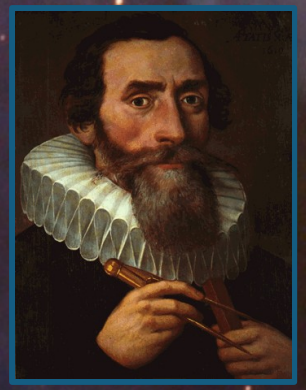
where creativity and imagination, inspired by curiosity and the eternal quest for knowledge, are necessities, not luxuries.

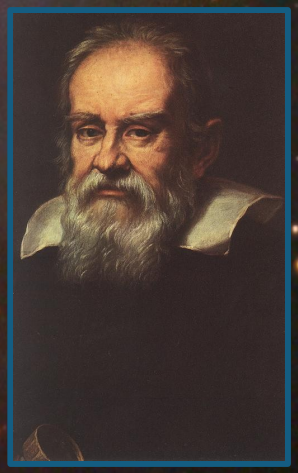

Revolutionary Aerospace Concepts
Education
Feedback
Connectivity
Communication
NIAC
Inspire
Solicit
Review
Select
Nurture
Infuse
Future Options
Management
Collaboration
Outreach
Peer Review
Systems and Architectures
INSPIRATION
DISCOVERY
KNOWLEDGE
ENABLING TECHNOLOGIES & INFUSION INTO NASA

The true visionary delights in an unfettered, creative imagination, exploring the possibilities of understanding the mysterious.









Visionaries and geniuses share a common trait:

The ability to transcend life's experiences
and leap vast intellectual distances
to set a new course for others to follow.

What is *Revolutionary*?

- The genius is in the generalities, and not the details
- The new idea illuminates a pathway towards a significant expansion of knowledge
- It inspires others to produce useful science and further elaboration of the fundamental idea
- It triggers a transformation of intuition
- Revolutionary paradigm shifts are often simple, elegant, majestic, beautiful and are characterized by order and symmetry

What is *Revolutiona*

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

Robert A. Cassanova, Sharon M. Garrison

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

Robert Cassanova, Ron Turner, Pat Russell


rays or star light

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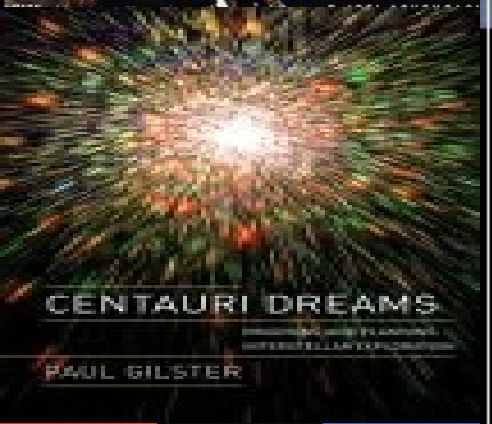
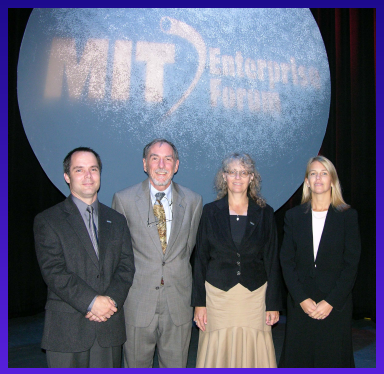
Publicity



MIT Forum



Washington Post

Space.com

Huntsville Times

Georgia Trend Magazine

Christian Science Monitor

"Centauri Dreams"
by Paul Gilstar

Popular Science

Galafilm Productions, Inc.

IEEE Spectrum Online

Discovery Channel

NASA

NewScientist.com

Sensors Magazine

Space.Ref

Slashdot.com

Universe Today.com

Worldchanging.com

NPR affiliate WVXU

XStar Radio Network

Planetary Society Radio

NPR "Talk of the Nation"

Michigan's Daily Mining Gazette

National Geographic

USA Today

CP 05-02
Phase II Awards

Redesigning Living Organisms to Survive on Mars

Wendy F. Boss & Amy Grunden
N. C. State University

New Worlds Imager

Webster Cash, University of Colorado

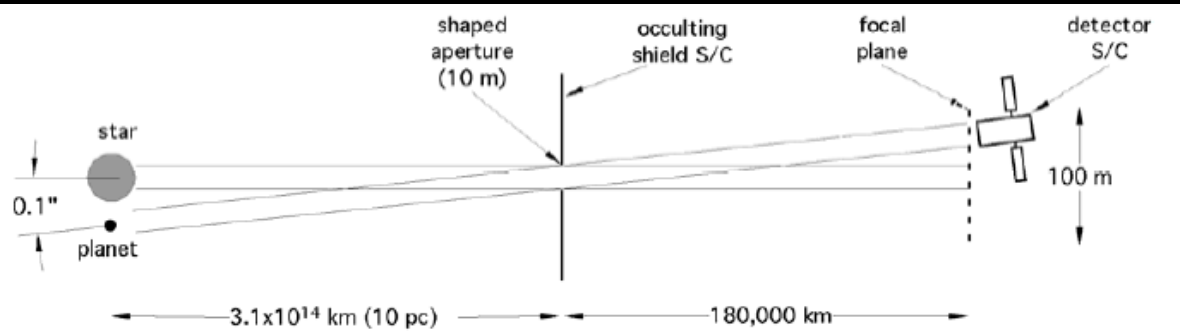
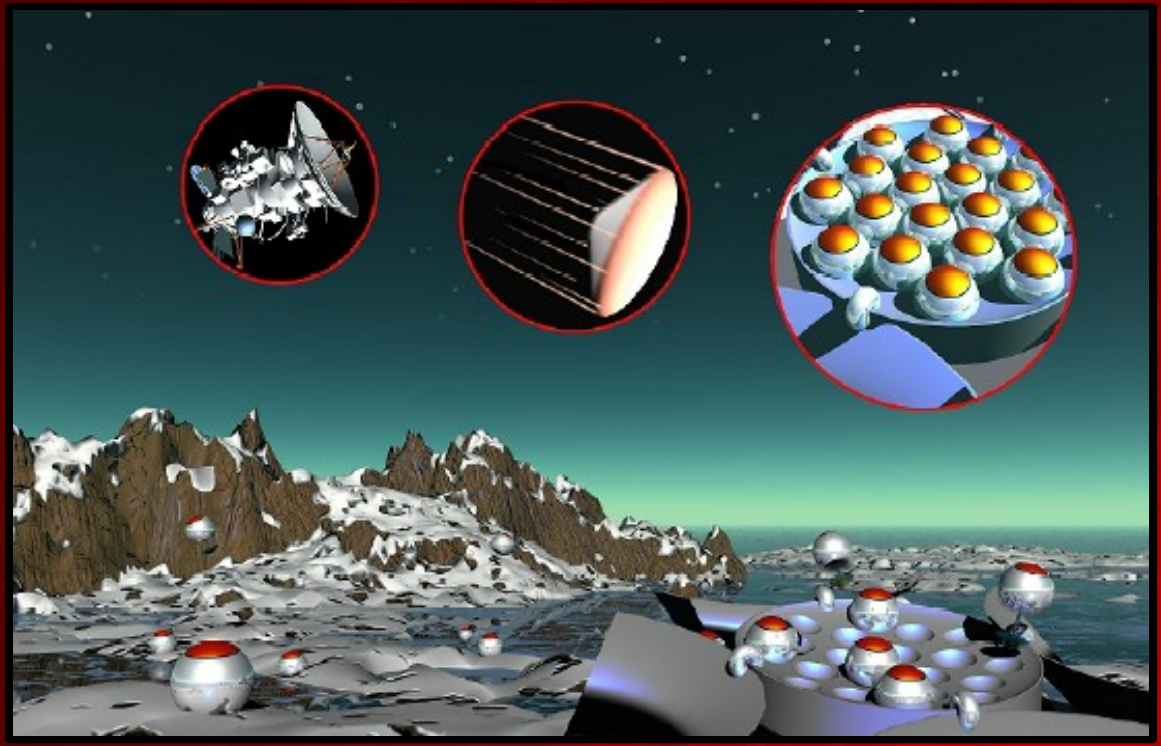


Figure 4: A properly shaped aperture makes an ideal lens. This pinhole camera creates a large focal plane where the light from a planet is separated from its parent star *before* it reaches the telescope which then concentrates and analyzes the signal.

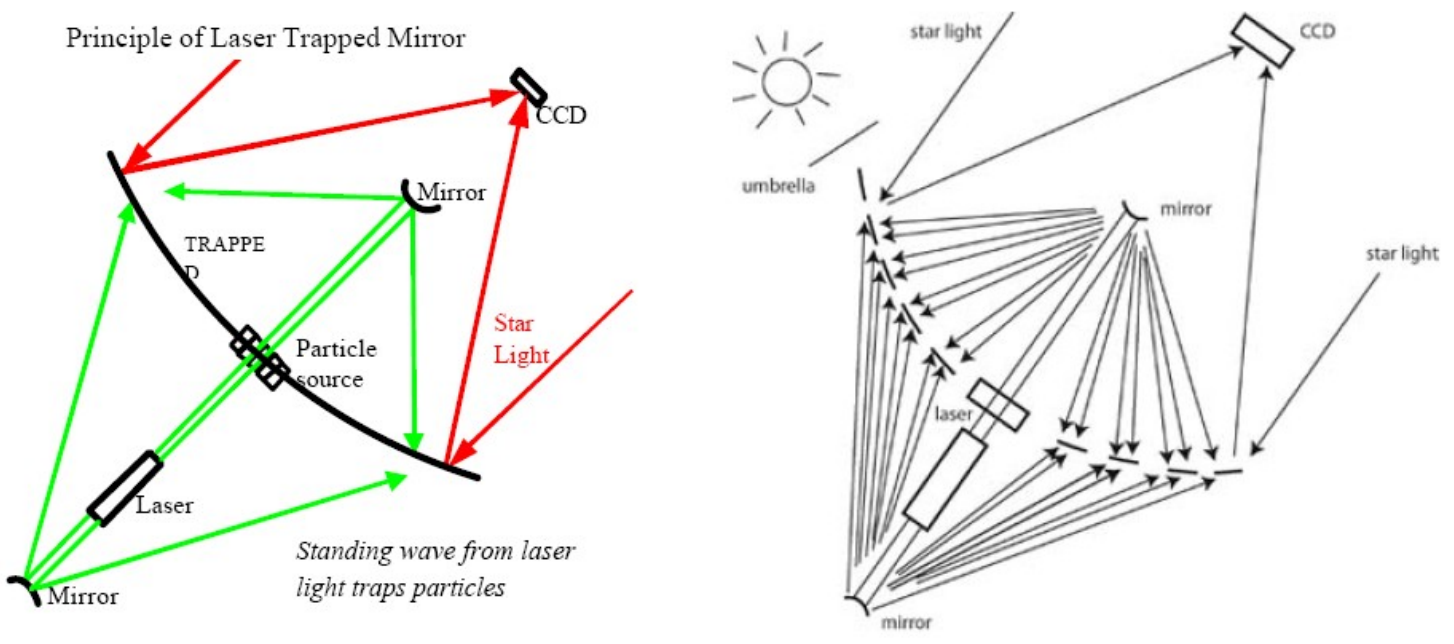
Microbots for Large-Scale Planetary Surface and Subsurface Exploration

Steven Dubowsky, MIT



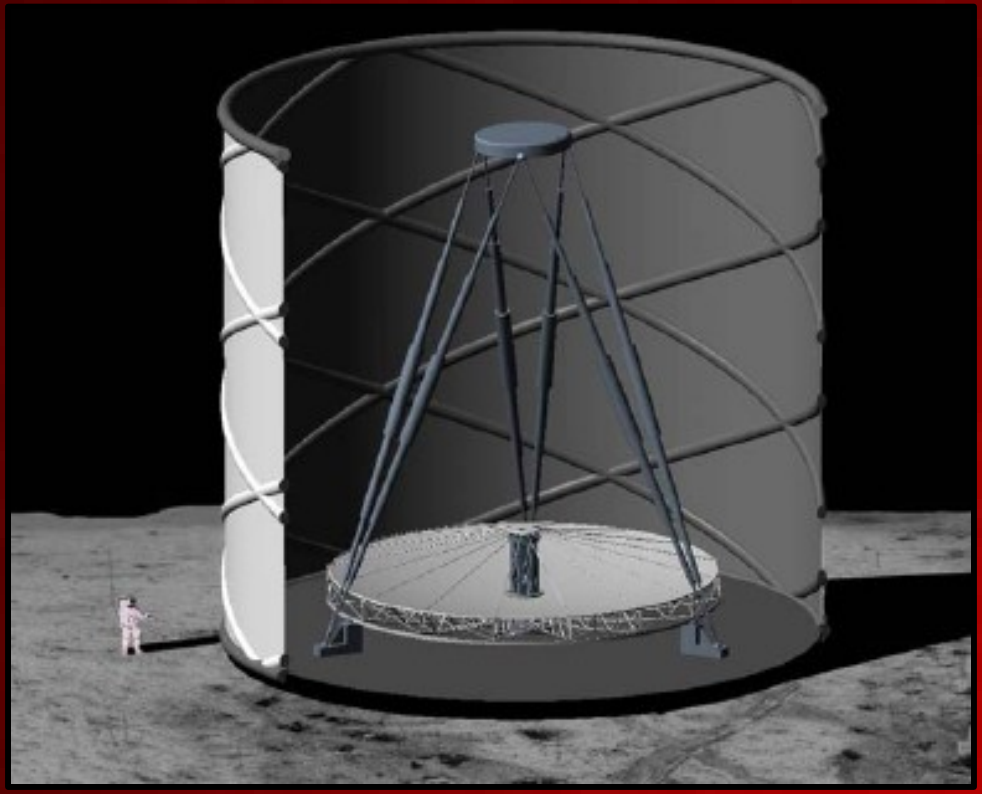
Laser Trapped Mirrors in Space

Elizabeth McCormack, Bryn Mawr College



A Deep Field Infrared Observatory Near the Lunar Pole

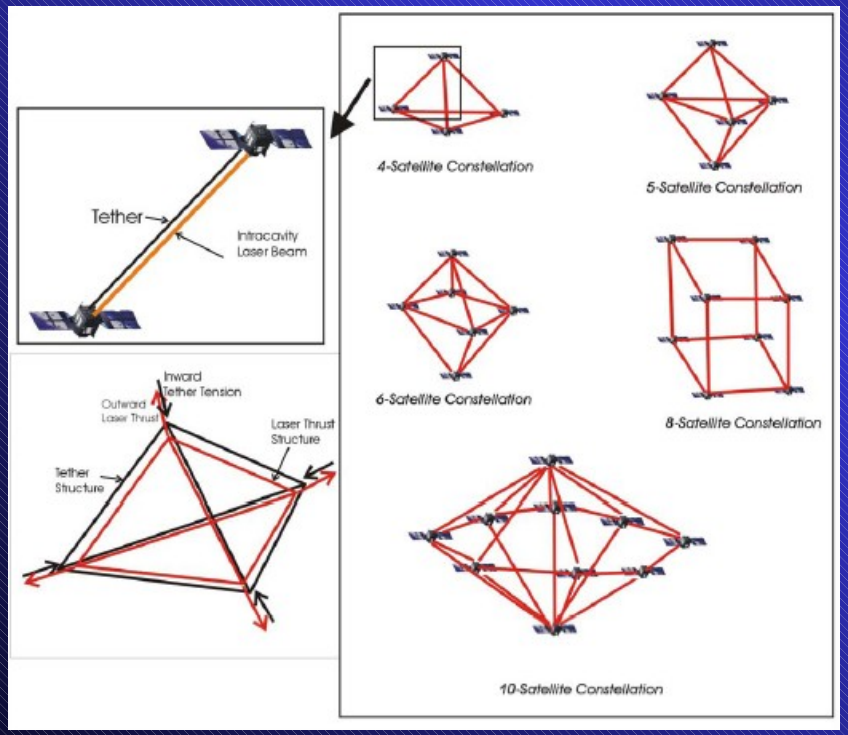
Simon “Pete” Worden, University of Arizona

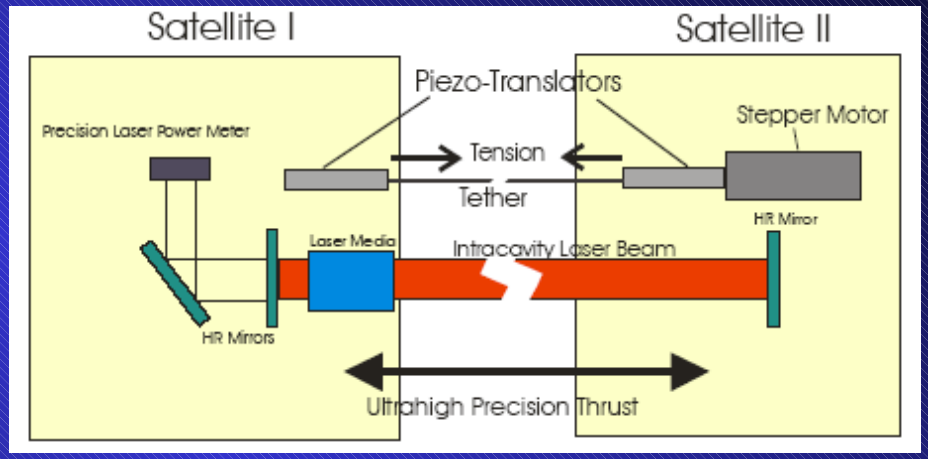


CP 05-01
Phase I Awards

A Contamination-Free Ultrahigh Precision Formation Flight Method Based on Intracavity Photon Thrusters and Tethers

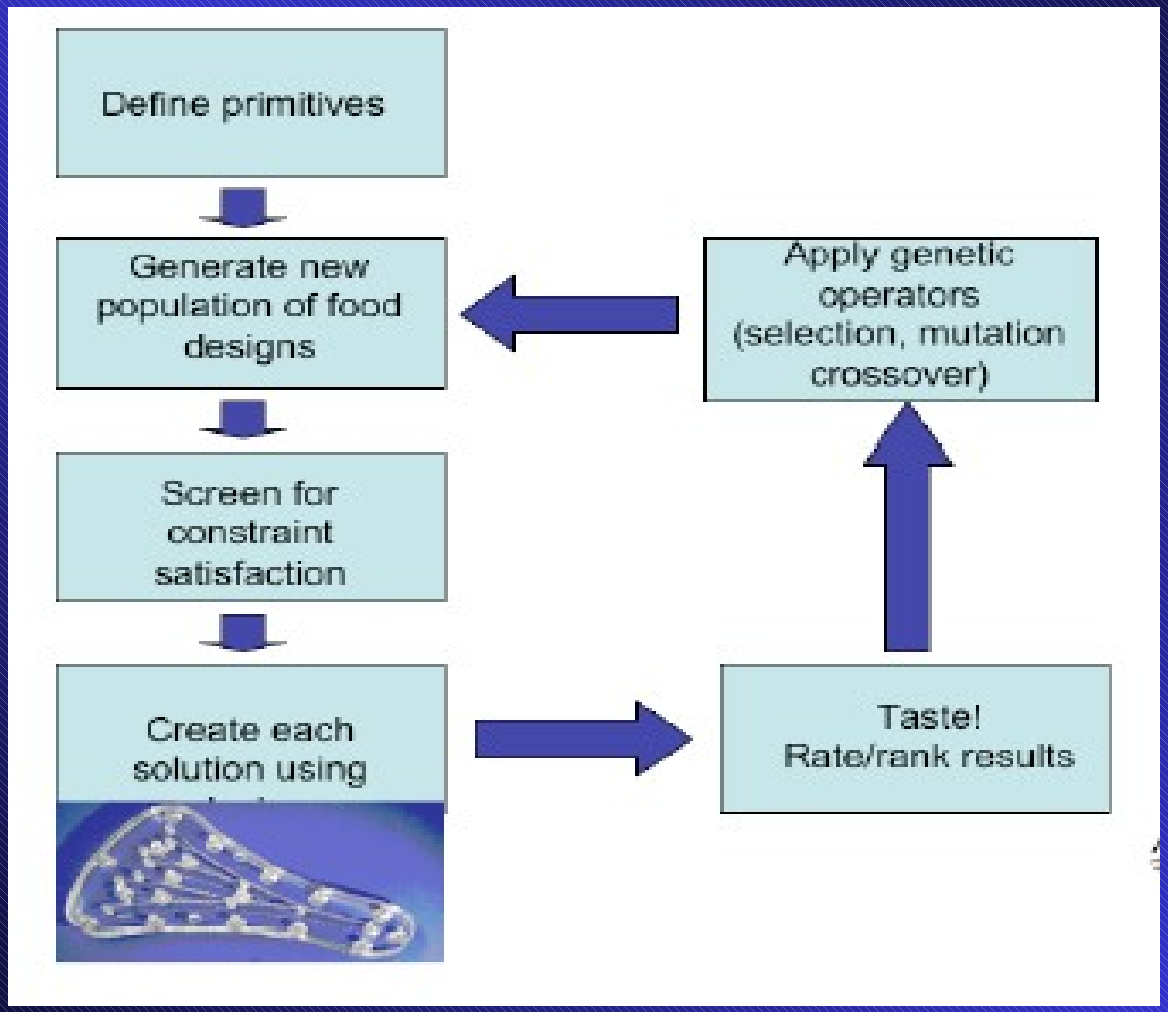
Young Bae
Bae Institute





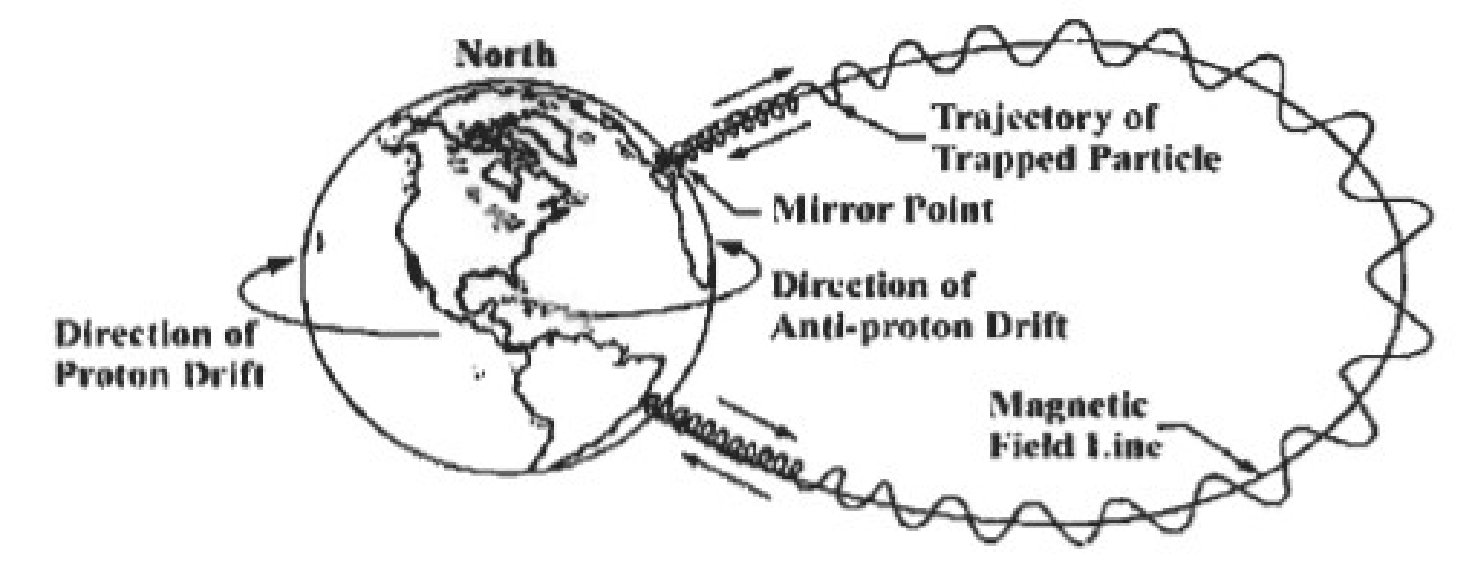
Customizable, Reprogrammable, Food Preparation, Production and Invention System

Eric Bonabeau, Icosystem Corporation



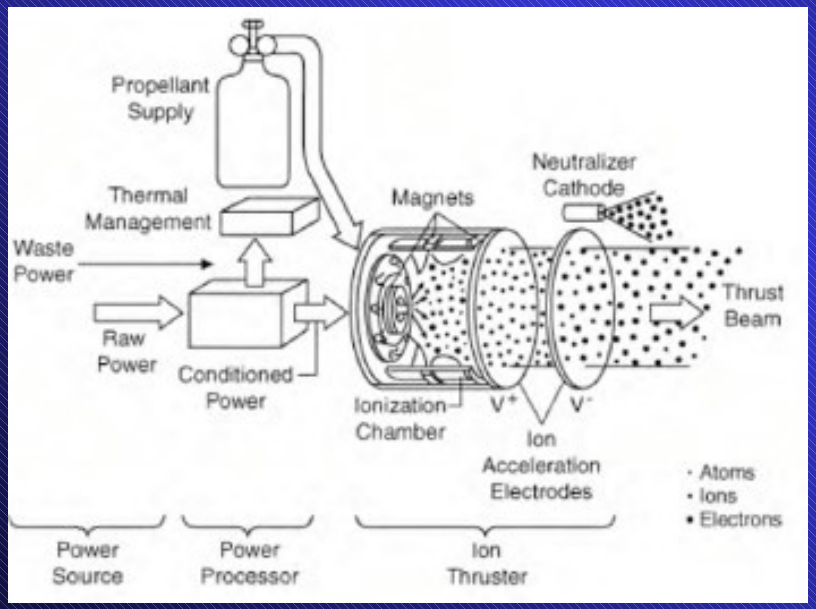
Extraction of Antiparticles Concentrated in Planetary Magnetic Fields

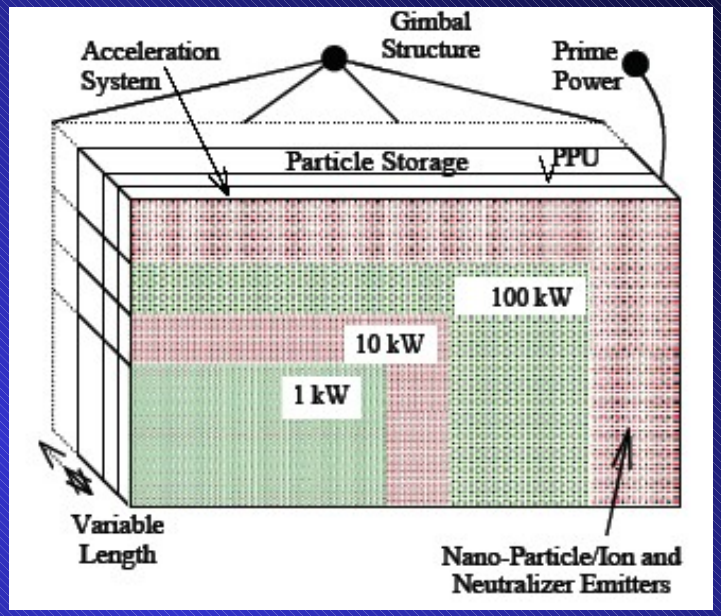
Jim Bickford **Draper Laboratory**



Scalable Flat-Panel Nano-Particle MEMS/NEMS Propulsion Technology for Space Exploration in the 21st Century

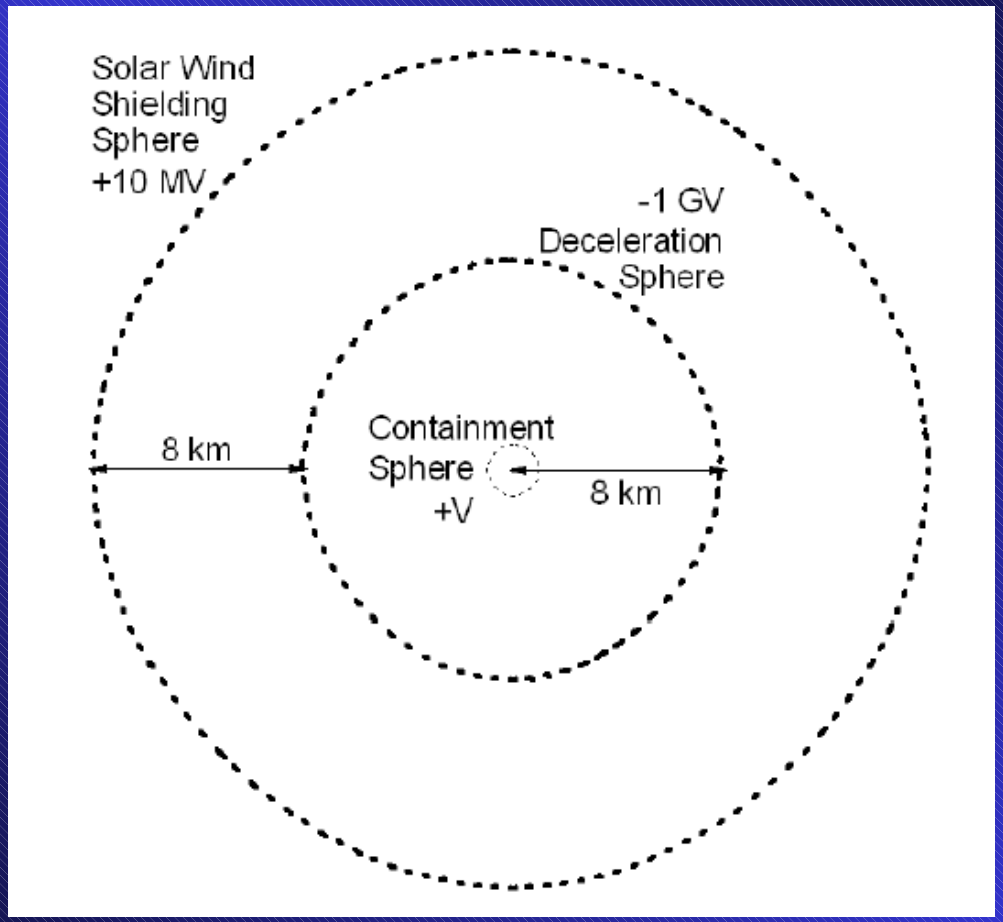
Brian Gilchrist University of Michigan





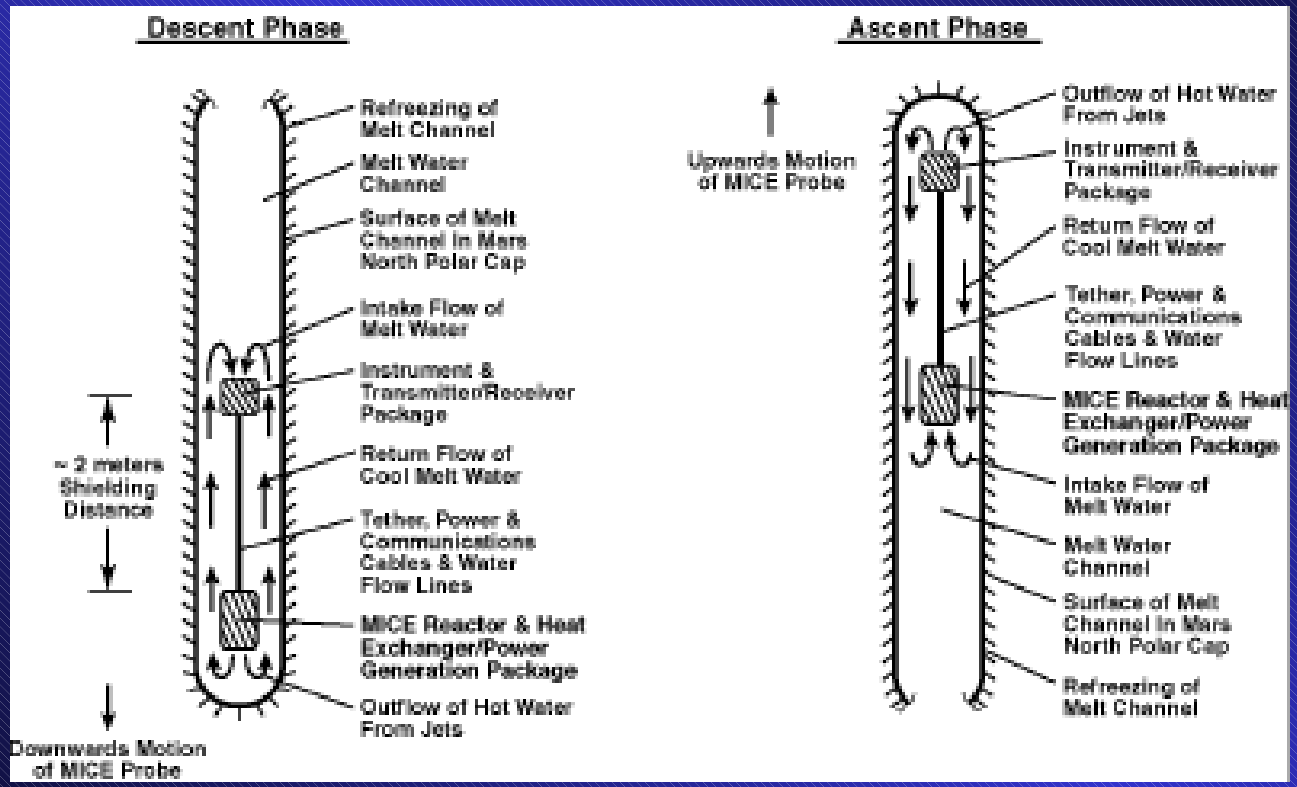
Anti-Matter Harvesting in Space

Gerald Jackson Hbar Technologies, LLC



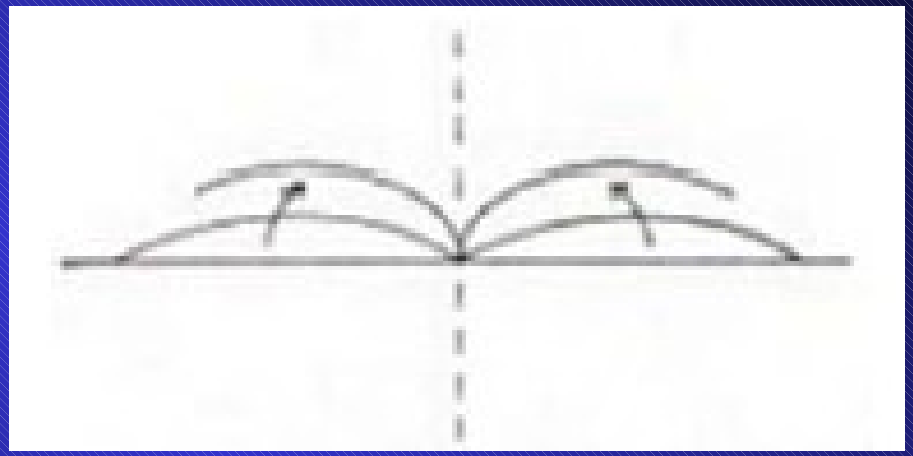
Multi-MICE: A Network of Interactive Nuclear Cryoprobes to Explore Ice Sheets on Mars and Europa

George Maise
Plus Ultra Technologies, Inc.



Artificial Neural Membrane Flapping Wing

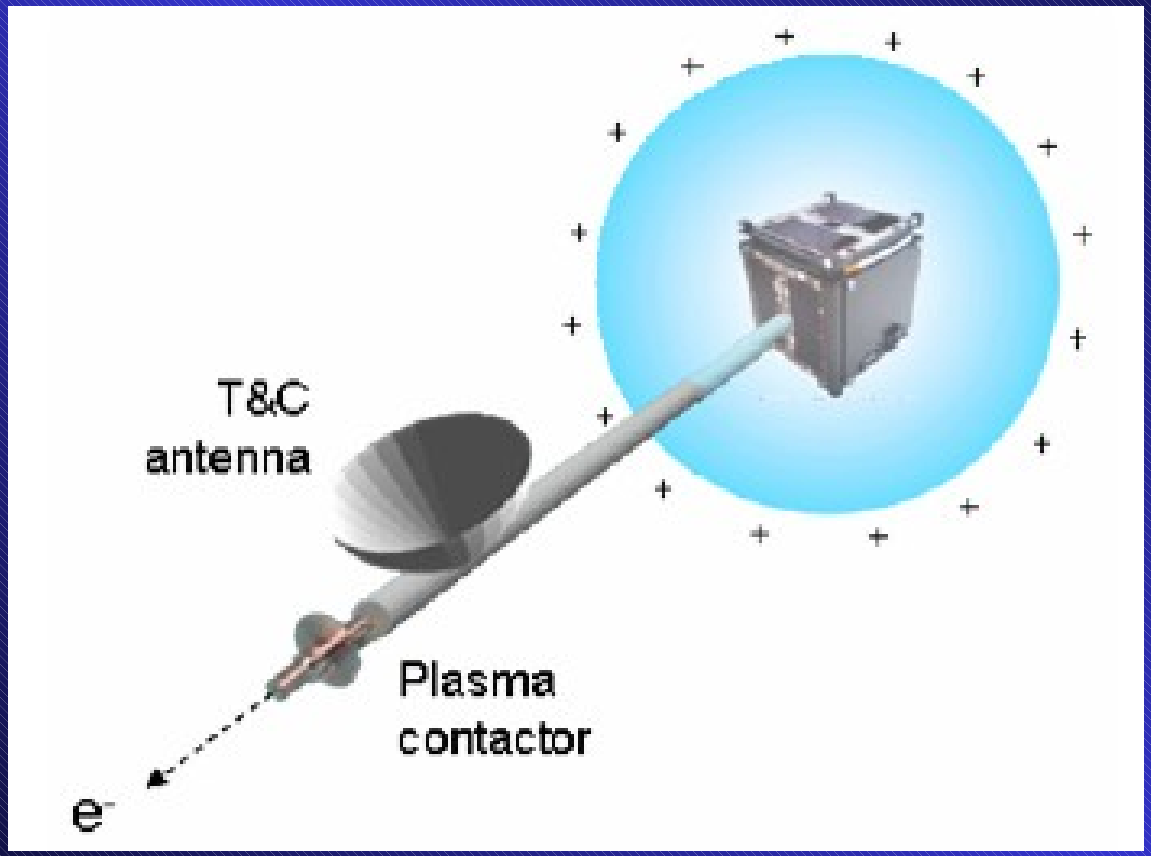
Pamela Menges Aerospace Research Systems, Inc.



Lorentz-Actuated Orbits: Electrodynamic Propulsion without a Tether

Mason Peck

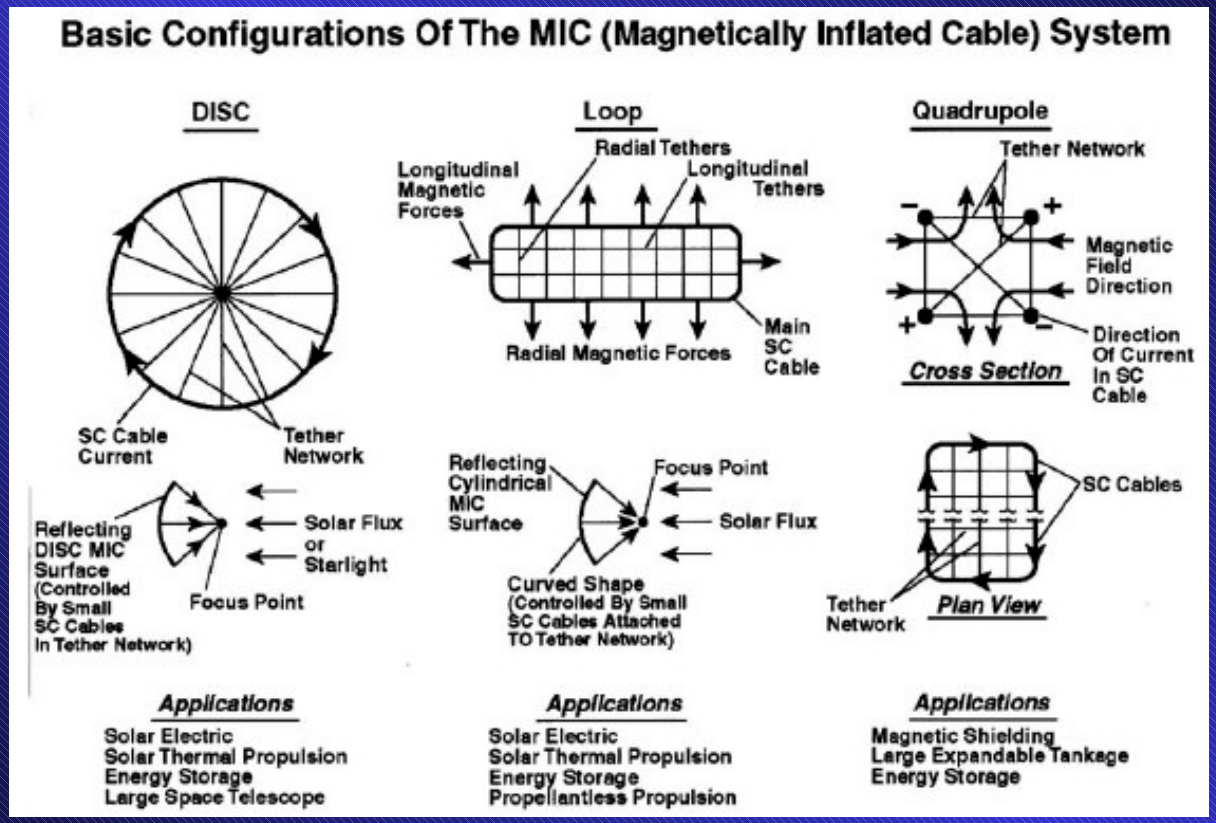
Cornell University



Magnetically Inflated Cable (MIC) System for Space Applications

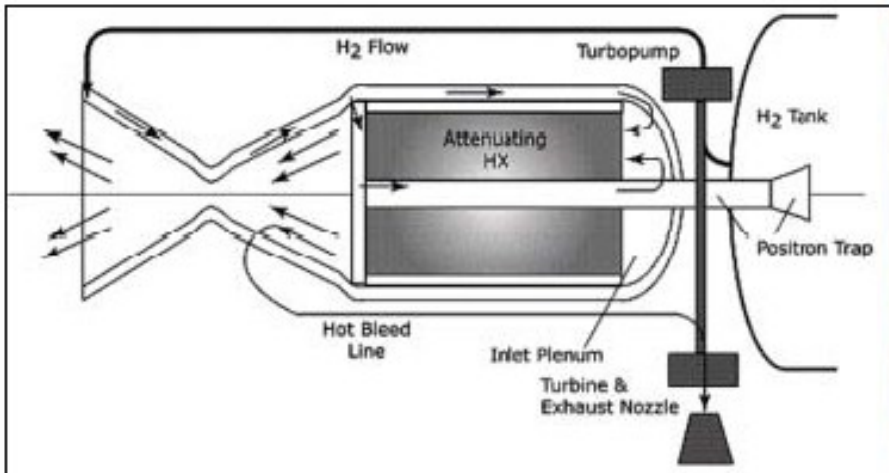
James Powell

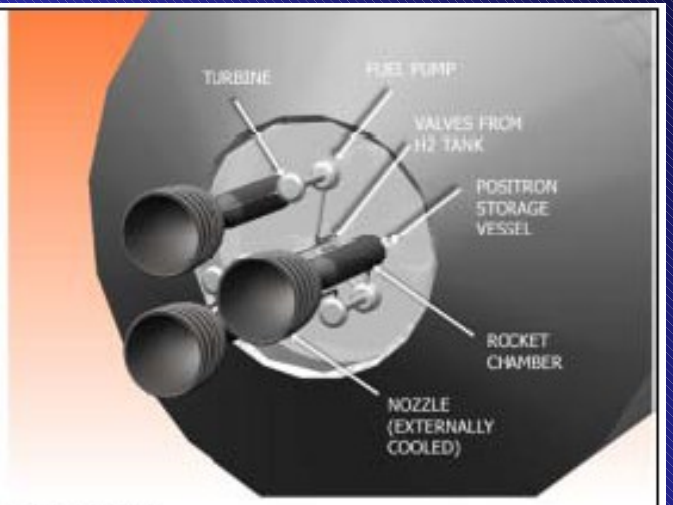
Plus Ultra Technologies, Inc.



Positron Propelled and Powered Space Transport Vehicle for Planetary Missions

Gerald Smith Positronics Research LLC

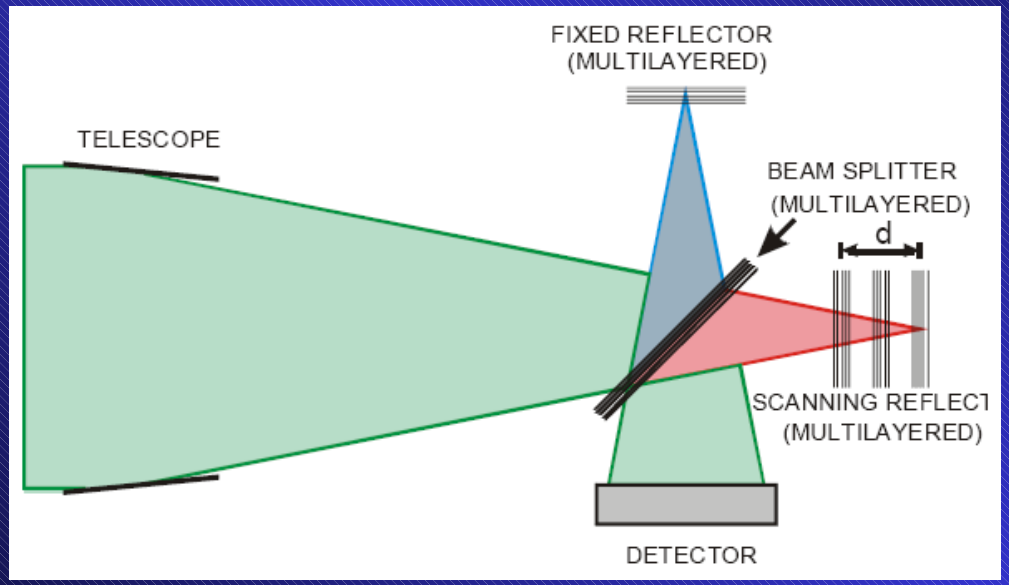


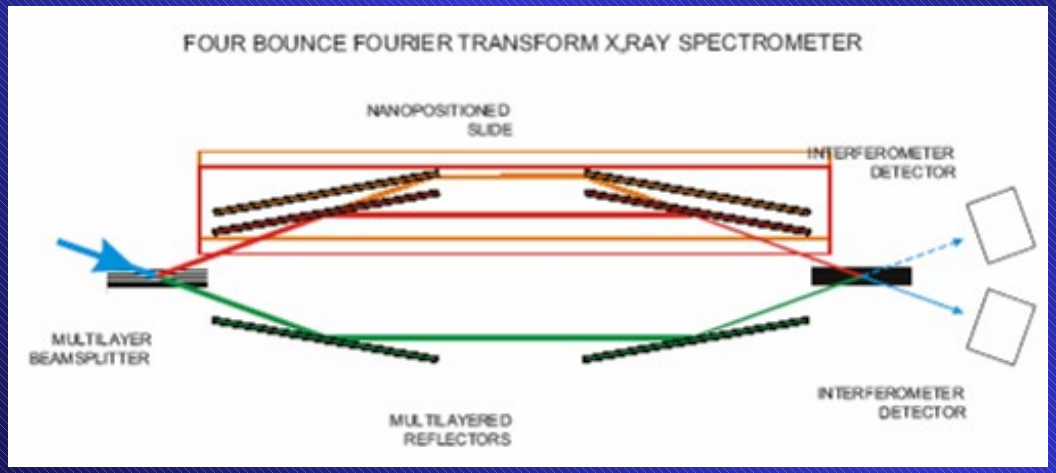


1. Positrons enter through trap conduit on-axis with matrix of tungsten and composite.
2. Annihilations produce gamma rays which attenuate in matrix.
3. Heat energy is transferred to hydrogen to temperatures up to material limits.

Ultra-High Resolution Fourier Transform X-Ray Interferometer

Herbert Schnopper Smithsonian Astrophysical Observatory





Modular Spacecraft with Integrated Structural Electrodynamic Propulsion

Nestor Voronka Tethers Unlimited

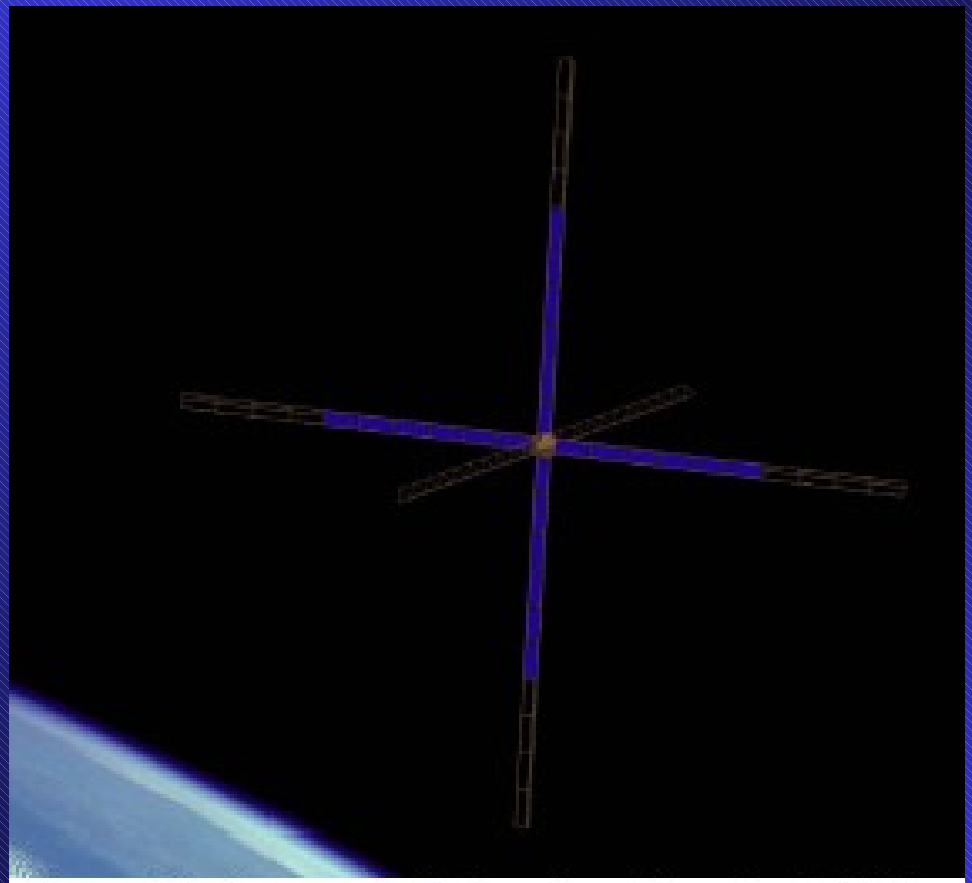


Figure 1. Conceptual drawing of a single Modular Spacecraft with Integrated Structural Electrodynamic Propulsive Elements.

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USRA

Dr. Diana Jennings

Associate Director

NASA Institute for Advanced Concepts

NIAC Student Fellows Prize (Funded by USRA)

CALL FOR PROPOSALS

NIAC

NIAC
Student Fellows Prize

The NASA Institute for Advanced Concepts (NIAC) seeks to identify creative and innovative students who possess an extraordinary potential for developing advanced concepts in the fields of aeronautics, space and the sciences.

Each Student Fellow will receive a total of $9,000 for the Academic year 2005-2006.

NIAC intends for these awards to benefit talented individuals who have shown extraordinary originality and dedication in their academic pursuits and a marked capacity for self-direction. We seek exceptional creativity, and the promise for important future advances based on a track record of significant accomplishment, and potential for the fellowship to facilitate subsequent creative work.

- Applicant must be in a U.S. institute of higher education
- Applicant must be a U.S. Person
- Applicant must apply no later than their junior year of college

For more details on the NIAC Student Fellows Prize and how to apply, go to WWW.NIAC.USRA.EDU

Due Date: April 15, 2005

Photo Courtesy of the Solar Data Analysis Center - NASA Goddard Space Flight Center

Minority, female and disadvantaged students are encouraged to respond to this Call For Proposals.

NIAC seeks to identify creative and innovative students who possess an extraordinary potential for developing advanced concepts in the fields of aeronautics, space and the sciences.

- Each Student Fellow will receive a total of $9,000 for the Academic year 2005-2006.
- Funds will be directly disbursed to the Student Fellow in three equal increments: September 2005, December 2005, and March 2006.

NIAC Student Fellows Prize Winners

Andrew Bingham, Clarkson University - "Interstellar Exploration by Repeated External Acceleration“ Mentor: Ken Visser

Nicholas Boechler, Georgia Institute of Technology - "Direct Conversion for Solar Space Power“ Mentor: Narayanan Komerath

Aimee Covert, University of Michigan - "Advanced Concept for the Detection of Weather Hazards on Mars: Non-Thermal Microwave Emissions by Colliding Dust/Sand Particles“ Mentor: Nilton Renno

Joseph Fronczek, New Mexico State University - "Bio-Inspired Sensor Swarms to Detect Leaks in Pressurized Systems“ Mentor: Ram Prasad

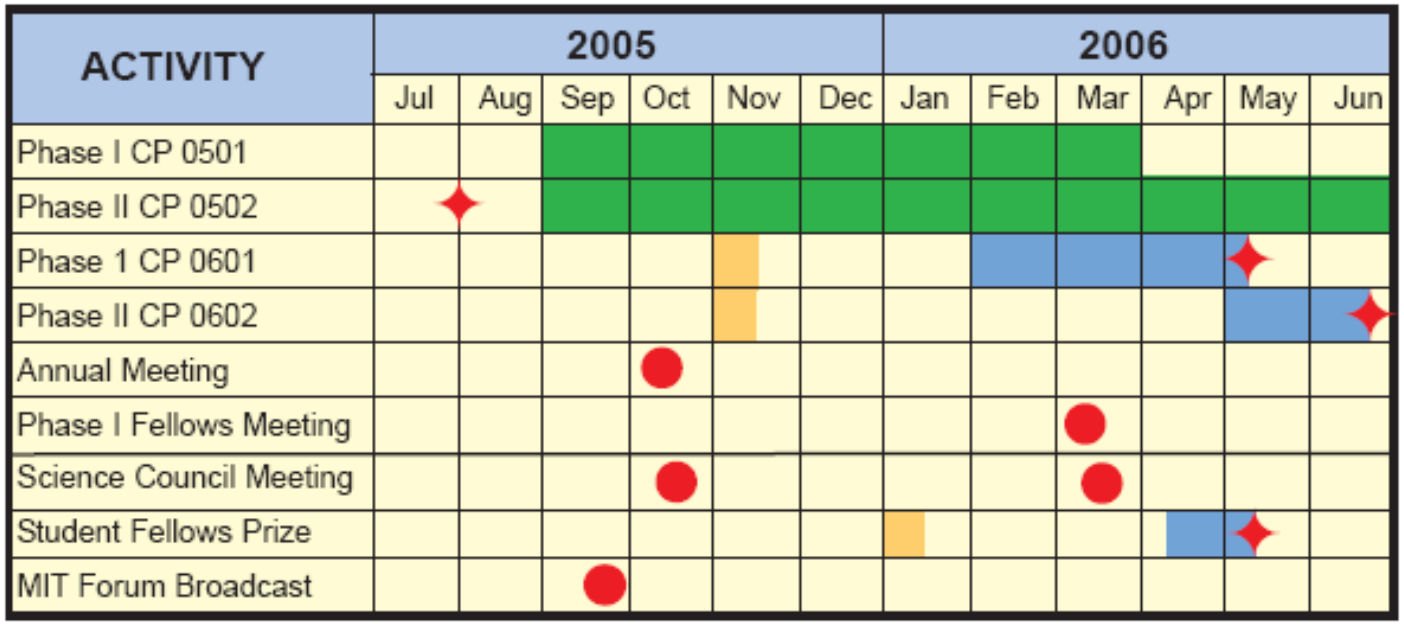
Brian Sikkema, Michigan Technological University - "Wind-Driven Power Generation on Titan” Mentor: Brad King

Dr. John L. McLucas Award for the Study of Space Safety

Joseph Fronczek, New Mexico State University - "Bio-Inspired Sensor Swarms to Detect Leaks in Pressurized Systems“ Mentor: Ram Prasad

Joe was nominated by USRA; this award is sponsored by the Arthur C. Clarke Foundation of the United States

Major Activities for the 8th Contract Year



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NIAC 7th Annual Meeting
Monday, October 10, 2005

8:00 - 8:30AM	Registration and Light Breakfast
8:30 - 9:00 AM	Welcome: **David Black, President of the Universities Space Research Association** **Robert Cassanova, NIAC Director** NIAC Overview, Introduction of New NIAC Phase I Fellows **Diana Jennings, NIAC Associate Director** Introduction of NIAC Student Fellows
9:00 - 10:00 AM	Keynote Speaker: **Courtney Stadd,Capitol Alliance** "Beyond LEO: Political Issues and Challenges Facing NASA"
10:00 - 10:30 AM	*BREAK*
10:30 - 12:00 PM	*NIAC STATUS REPORTS:* **Steven Dubowsky, Massachusetts Institute of Technology** "Microbots for Large-Scale Planetary Surface and Subsurface Exploration" **Alexey Pankine, Global Aerospace Corporation** "Sailing the Planets: Science from Directed Aerial Robot Explorers"
12:00 - 1:00 PM	*LUNCH*
1:00 - 2:00 PM	Keynote Speaker: **Dr. Fred Adams, University of Michigan** "Cosmic Genesis and Eschatology: The Origin and Fate of the Universe"
2:00 - 3:30 PM	*NIAC STATUS REPORTS:* **Narayanan Komerath, Georgia Institute of Technology** "Tailored Force Fields for Space-Based Construction" **John Slough, University of Washington** "The Plasma Magnet"
3:30 - 4:00 PM	*BREAK*
4:00 - 4:45 PM	*NIAC STATUS REPORTS:* **Dava Newman, Massachusetts Institute of Technology** "Astronaut Bio-Suit System for Exploration Class Missions"
4:45 - 5:45 PM	Grand Visions Discussion
5:45 - 7:30 PM	*RECEPTION:* Viewing of Phase I and Student Fellow Presentations

Grand Challenges

- Problem solving
- Inspire creative application of known scientific phenomena and technologies

Grand Visions

- Inspire giant leaps forward
- Provide an environment for creativity, imagination and innovation
- Visions illuminate the order of all things in the darkness of chaos

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NIAC 7th Annual Meeting
Tuesday, October 11, 2005

8:00 - 8:45 AM	Registration and Light Breakfast
8:45 - 9:00 AM	**Dr. Robert A. Cassanova, NIAC Director** Welcome
9:00 - 10:00 AM	Keynote Speaker: **Dr. Paul MacCready, AeroVironment** "Far Out Aeronautics and Motions"
10:00 - 10:30 AM	*BREAK*
10:30 AM - 12:00 PM	*NIAC STATUS REPORTS:* **Webster Cash, University of Colorado Boulder** "New Worlds Imager" **Simon P. Worden, Steward Observatory, University of Arizona** "A Deep Field Infrared Observatory near the Lunar Pole"
12:00 - 1:00 PM	*LUNCH*
1:00 - 2:30 PM	*NIAC STATUS REPORTS:* **Constantinos Mavroidis, Northeastern University** "Bio-Nano-Machines for Space Applications" **Elizabeth McCormack, Bryn Mawr College** "Investigation of the Feasibility of Laser Trapped Mirrors"
2:30 - 3:00 PM	*BREAK*
3:00 - 4:30 PM	*NIAC STATUS REPORTS:* **Wendy Boss, North Carolina State University** "Redesigning Living Organisms for Mars" **Paul Todd, SHOT, Inc.** "Robotic Lunar Ecopoiesis Test Bed"
4:30 - 5:00 PM	*WRAP-UP*
5:00 PM	*ADJOURN*

Keynote Speakers

Courtney Stadd
Capitol Solutions

"Beyond LEO: Political Issues and Challenges Facing NASA"

Dr. Fred Adams
University of Michigan

"Cosmic Genesis and Eschatology: The Origin and Fate of the Universe"

Dr. Paul MacCready
Aerovironment Incorporated

"Far Out Aeronautics and Motions"