Visions of the Future in Aeronautics and Space

NIAC

NASA Institute for Advanced Concepts

3rd Annual Meeting

June 5-6, 2001

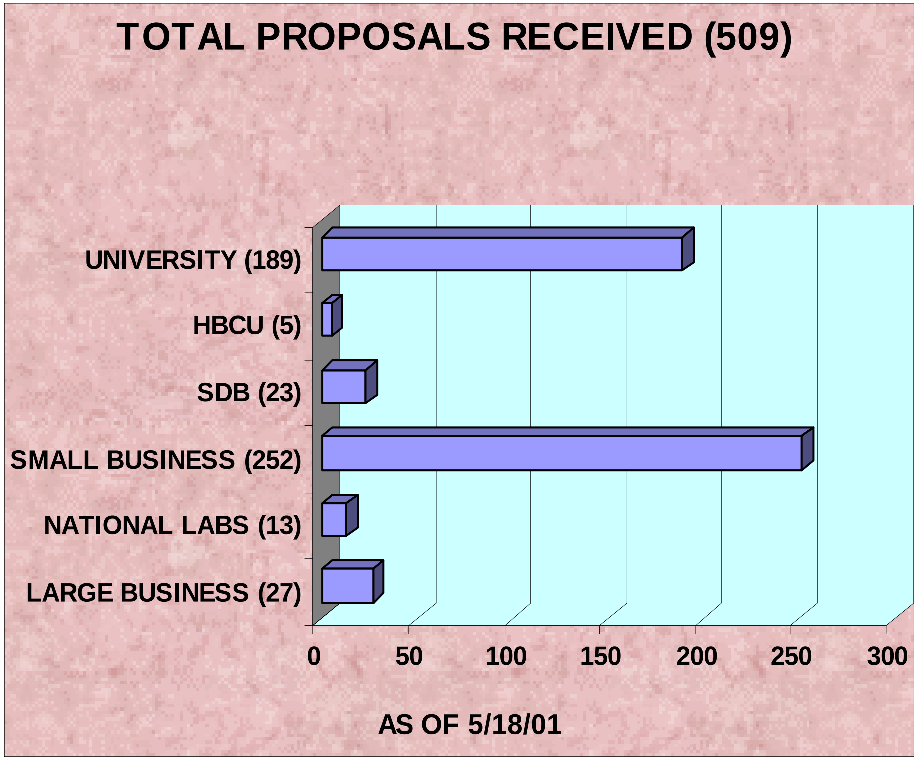
NASA-Ames

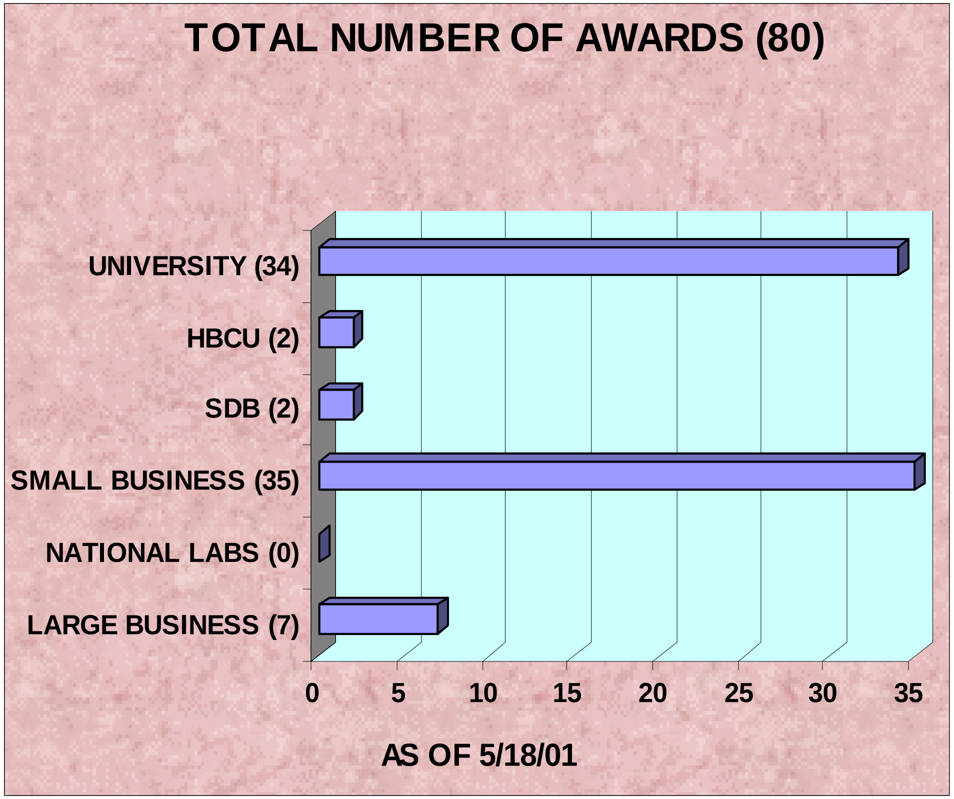
USRA

ANSER

Proposals Received and Awards

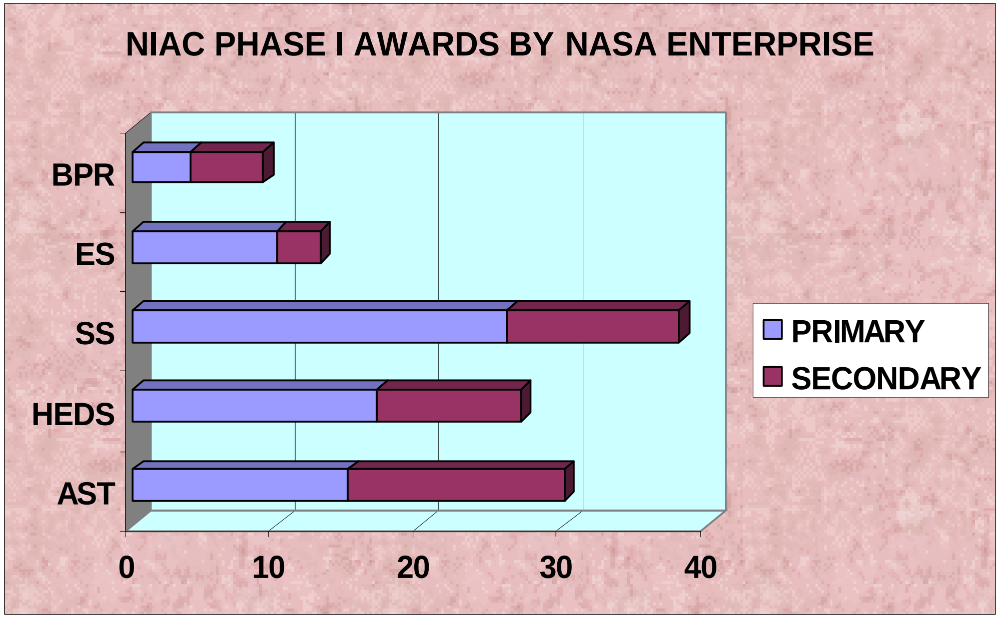
(through May 18, 2001)

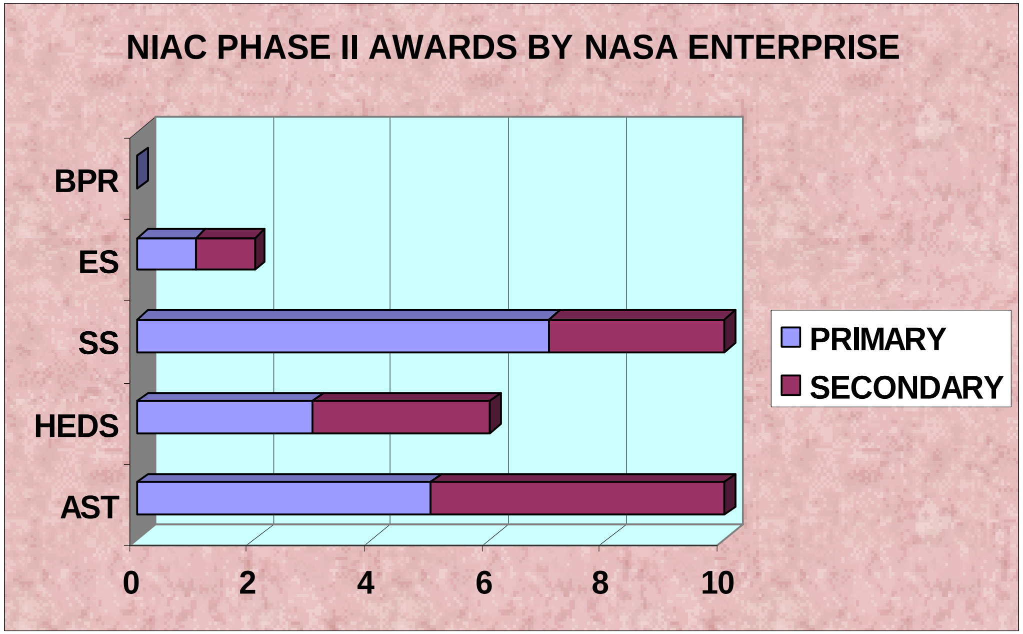




NIAC Awards

(through May 18, 2001)





Future Events

Late Summer or Early Fall 2001

Release of Next Phase I Call for Proposals with a due date of early CY 2002

November 2001

NIAC Phase I Fellows Meeting and Workshop

June 2002

NIAC 4th Annual Meeting
Location - TBD

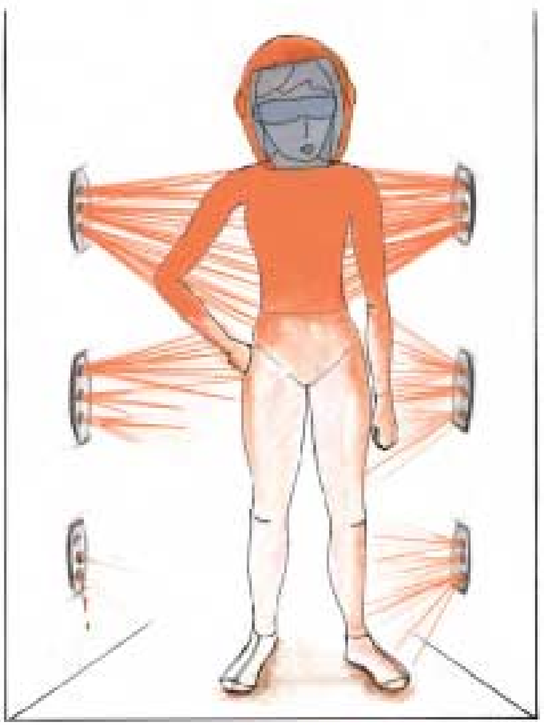
Phase I Awards

Call for Proposals: CP 00-02

Performance Period: June 1 – November 30, 2001

Astronaut Bio-Suit System for Exploration Class Missions

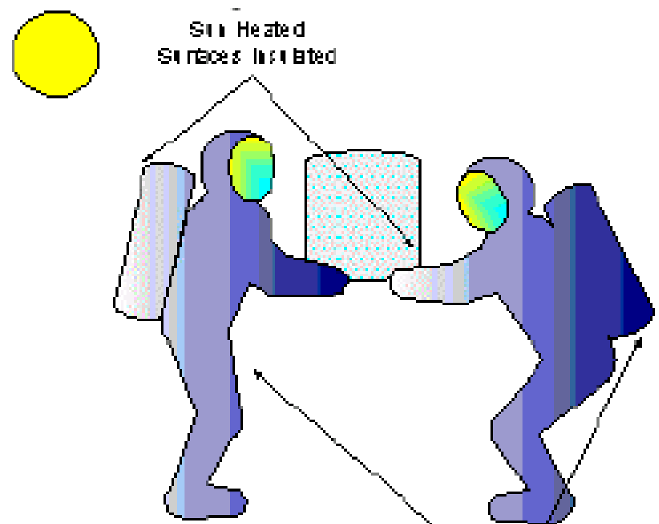
Dava Newman
Massachusetts Institute of Technology

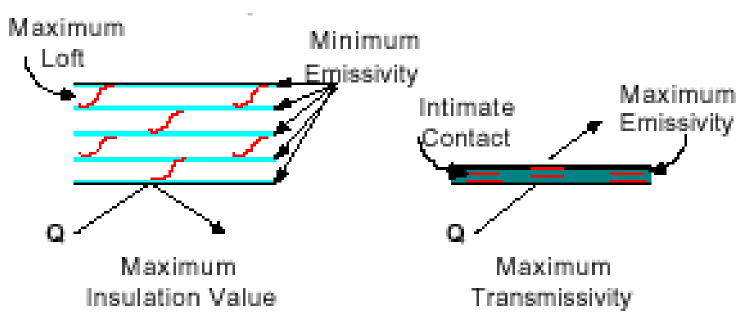



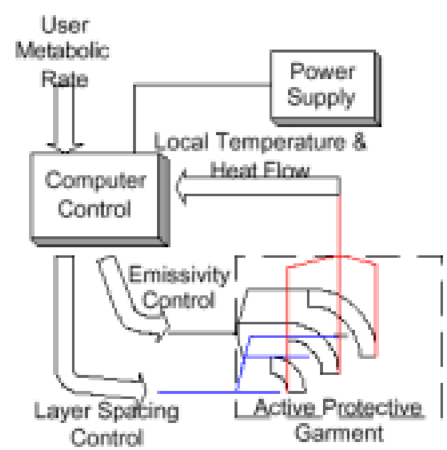
A Chameleon Suit to Liberate Human Exploration of Space Environments

Edward Hodgson

Hamilton Sundstrand Space Systems International

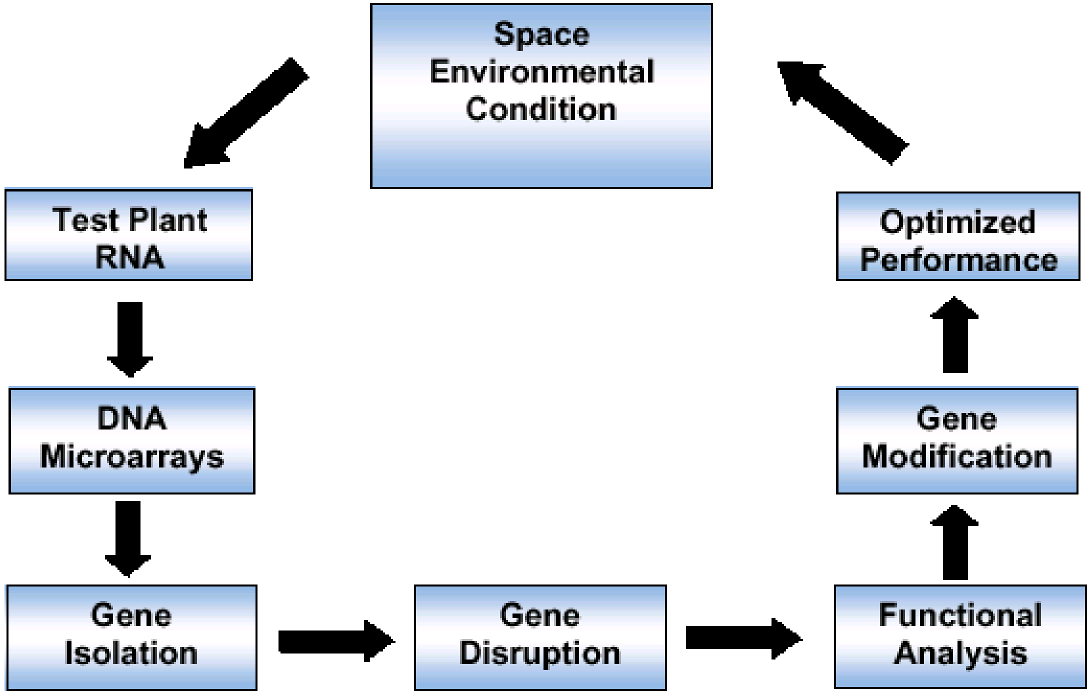






A Flexible Architecture for Plant Functional Genomics in Space Environments

Terri Lomax
Oregon State University



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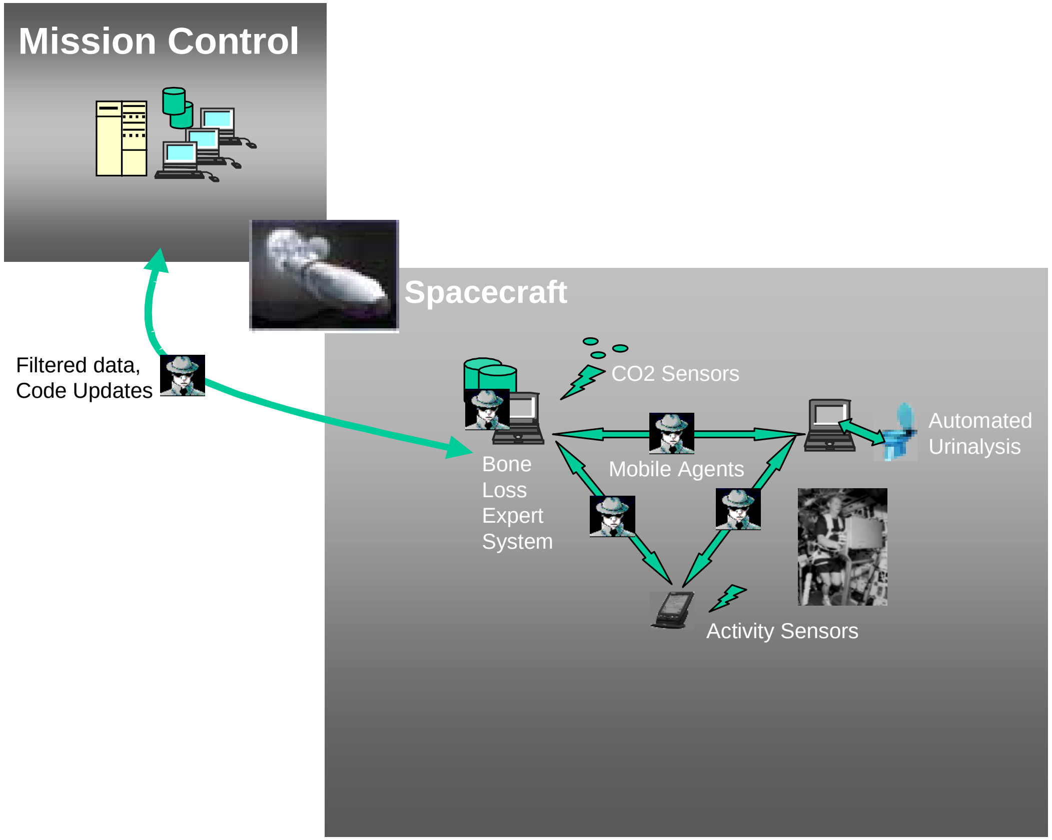
A Novel Information Management Architecture for Maintaining Long Duration Space Crews

George Cybenko
Dartmouth College



- *Agents transmit information to and from Mission Control.*
- *Agents ability to analyze information prior to moving saves bandwidth.*
- *Code and data can be updated throughout the mission, enabling increased performance and adaptation to mission conditions.*

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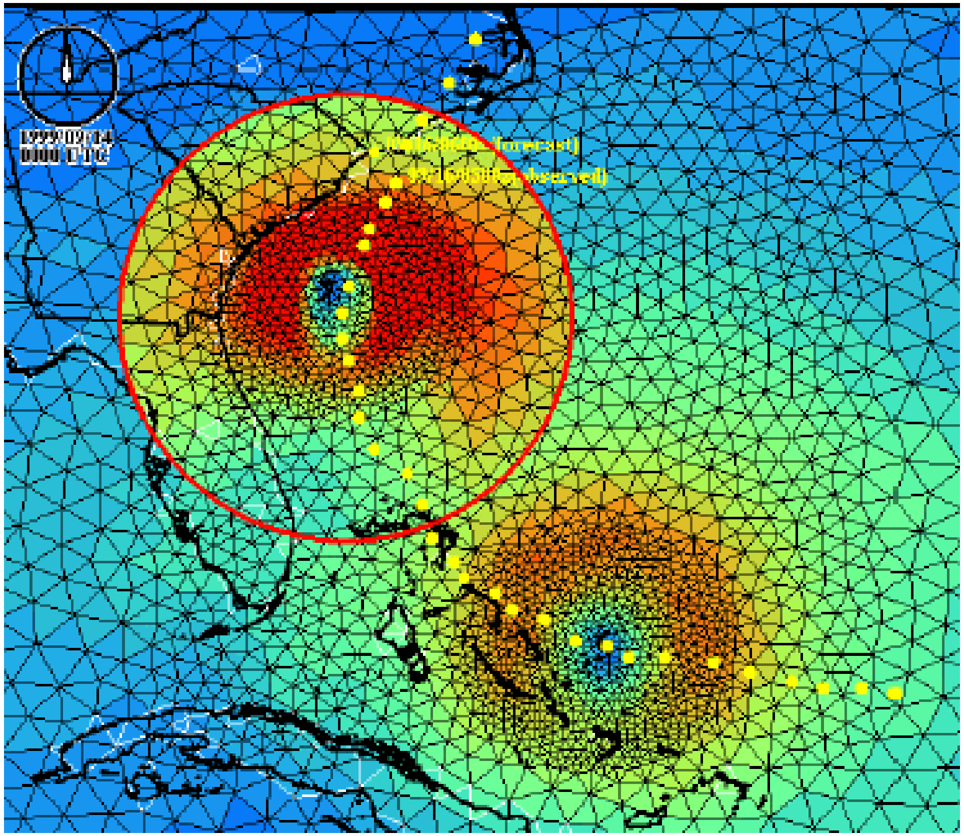
Adaptive Observation Strategies for Advanced Weather Prediction

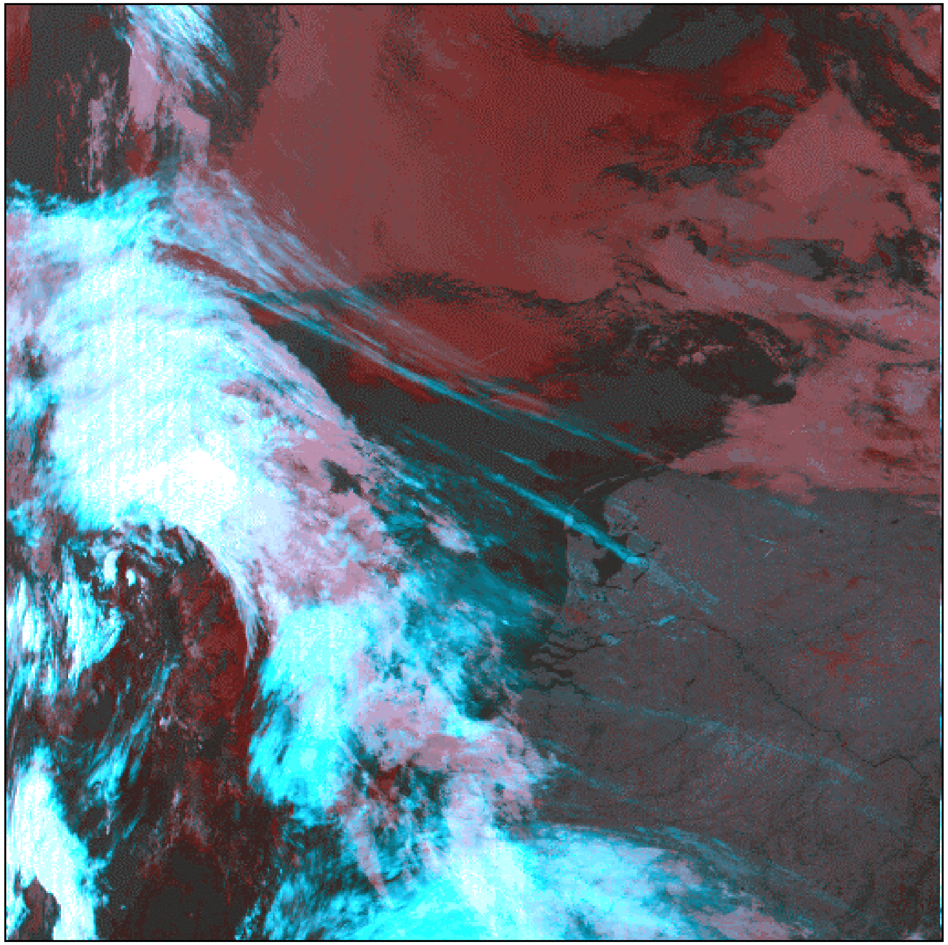
David Bacon
SAIC, Center for Atmospheric Physics

Michael Kaplan
North Carolina State University



Controlling the Global Weather

Ross Hoffman
Atmospheric and Environmental Research, Inc.



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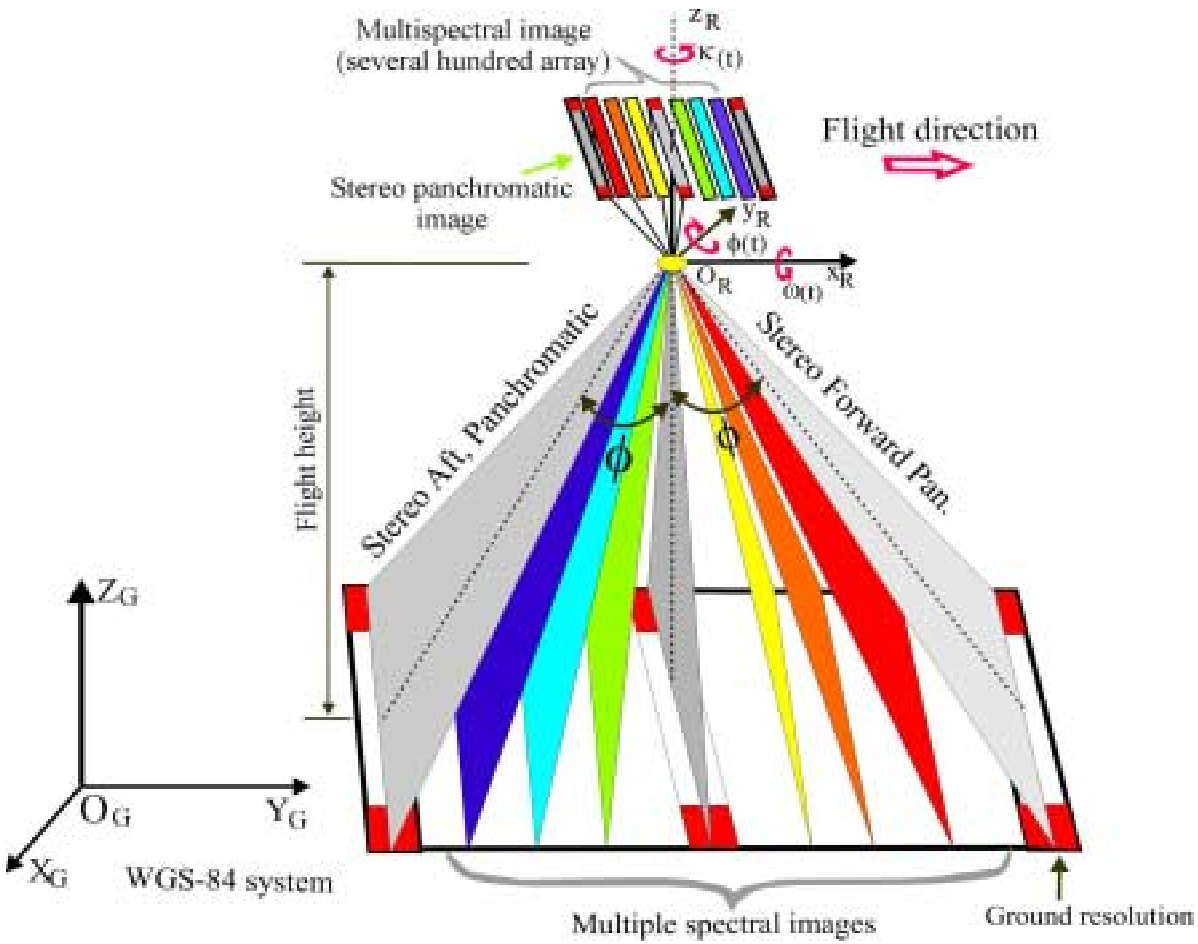
Architecture of "Intelligent" Earth Observation Satellite for Common Users in 2010-2050

Guoqing Zhou
Old Dominion University



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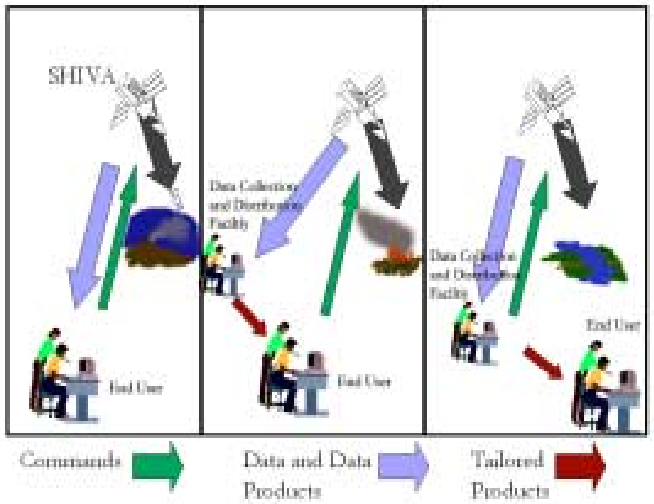
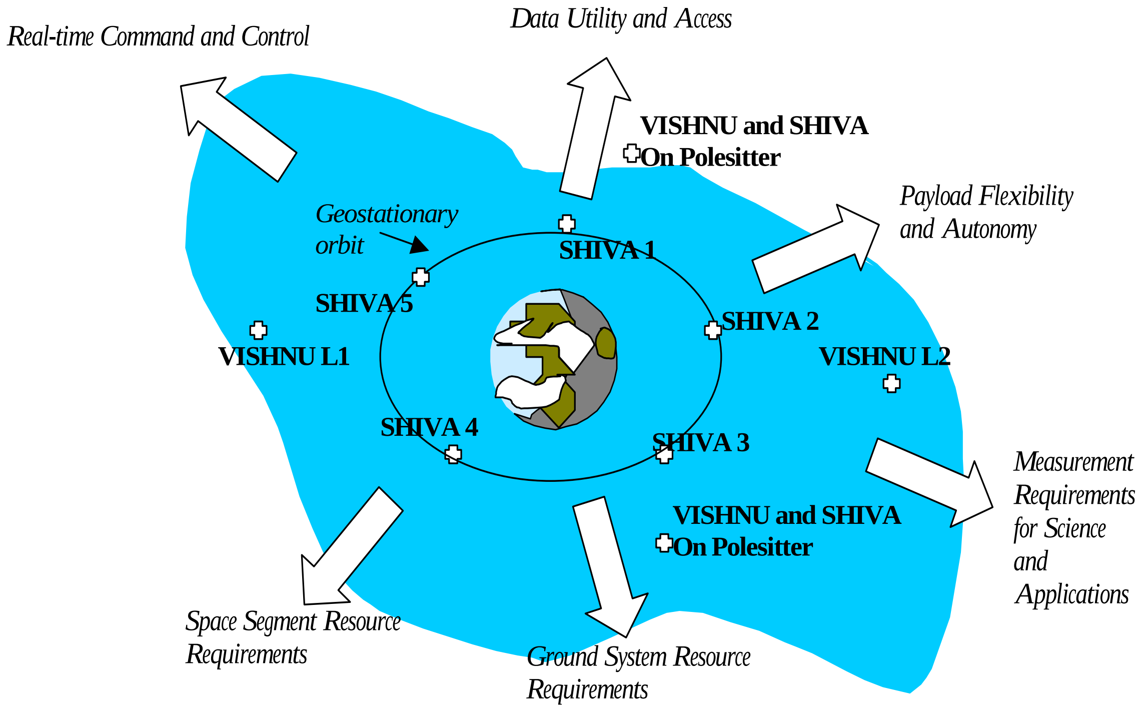
Global Observations and Alerts from Lagrange-Point, Pole-Sitter, and Geosynchronous Orbits (GOAL&GO)

Larry Paxton
Johns Hopkins University
Applied Physics Laboratory



The SHIVA system uses multiple, selectable bands as commanded by remotely located users to search for, identify, and report geophysical events. A pointed telemetry system reduces the ground system requirements.



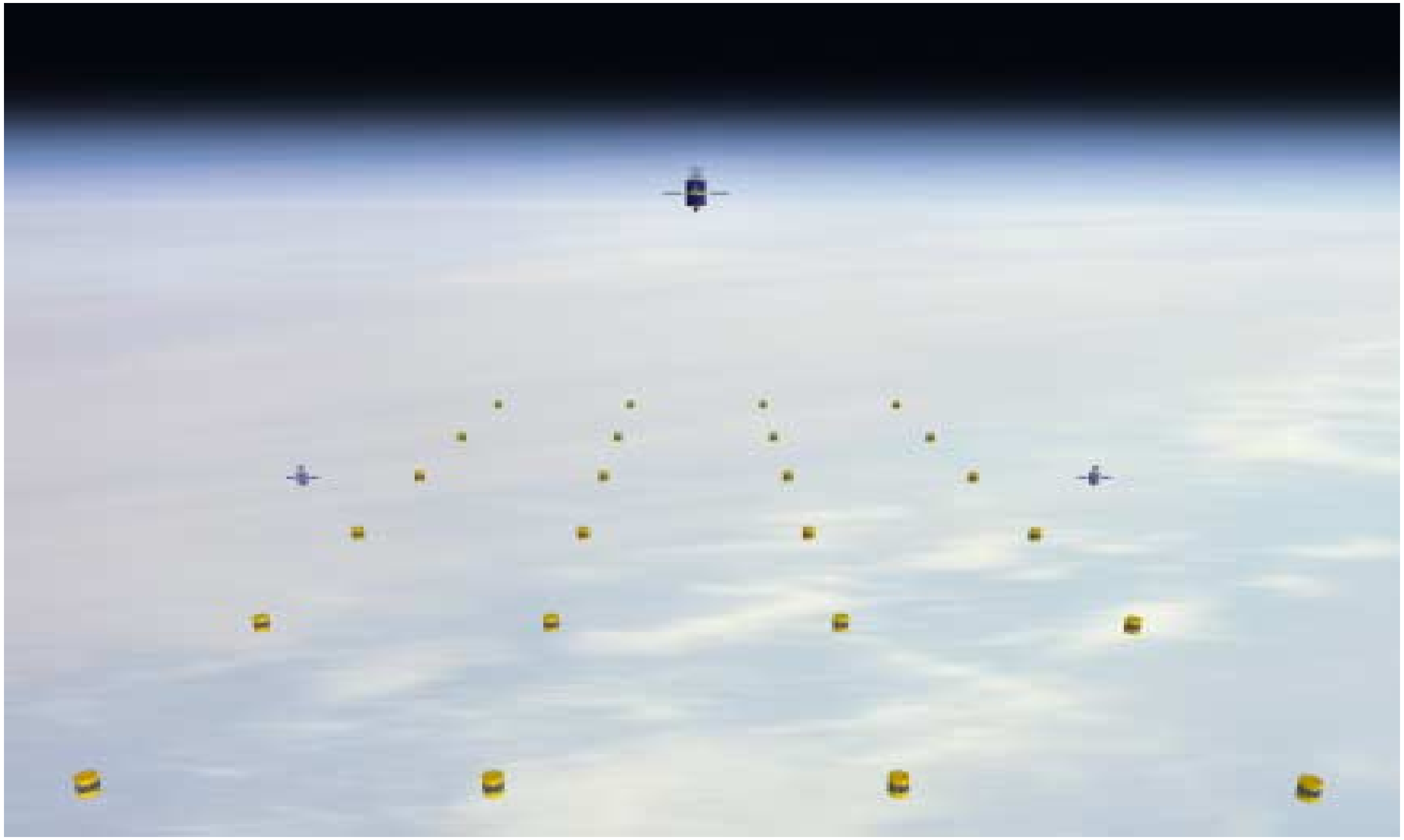
3D Viewing of Images on the Basis of 2D Images

H. John Caulfield
Fisk University

- Analogous to how nature allows you to see a 3D image using only one eye at a hyperfocal distance from your eye
- Connected set of computer programs that start with any digitized 2D image and convert it into a pair of images for 3D visualization
- Will be tested on telescopic and microscopic images in Phase I
- Feasibility established for simple objects in the near field
- Will record simulated scenes of interest for NASA and blur them by various amounts digitally to simulate telescopic images
- Attempt 3D visualization of local regions
- Design software for a hardware system to be built in Phase II

Formation Flying with Shepherd Satellites

Michael LaPointe
Ohio Aerospace Institute



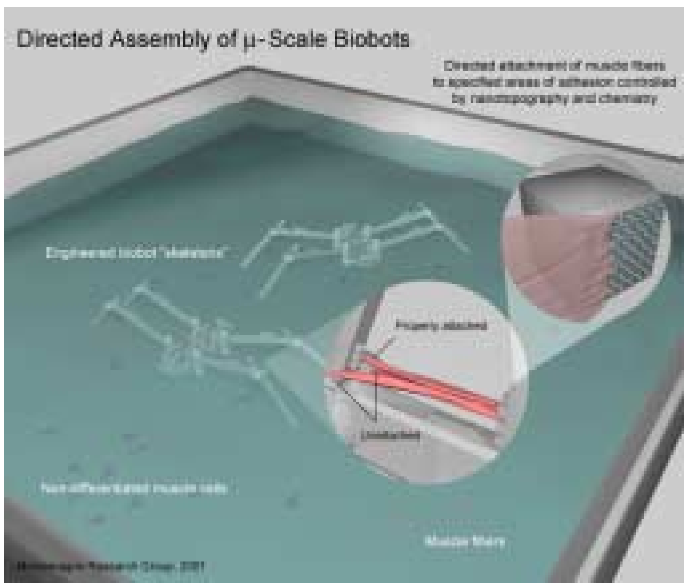
Propellantless Control of Spacecraft Swarms using Coulomb Forces

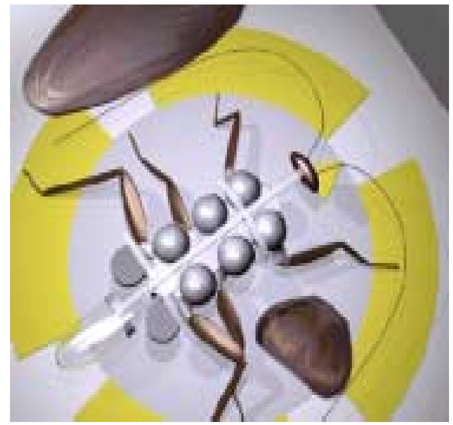
Brad King
Michigan Technology University

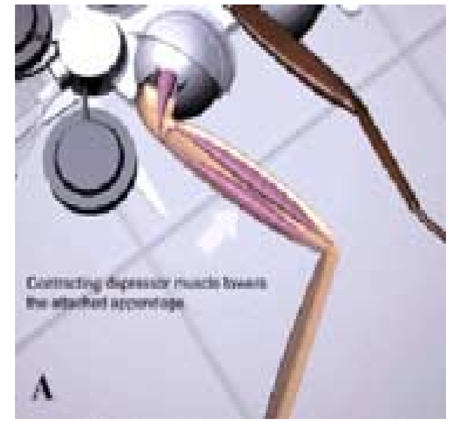
- Potentially feasible to generate tens of micro-Newtons of attraction and repulsion between spacecraft separated by tens of meters.
- Net spacecraft charge can be controlled by harvesting ambient space-plasma electrons or actively emitting electrons.
- Mutually interacting Coulomb spacecraft will be oriented in stable minimum energy arrays that can be configured using active control.
- Advantages
  - Circumvent need for micro-thrusters in satellite swarms
  - Increase formation mission lifetimes by harvesting in-space resources
  - Greatly improve fine position-keeping through active feedback
  - Facilitate wider range of satellite formation
  - Increase swarm robustness through fault-detection and reconfiguration

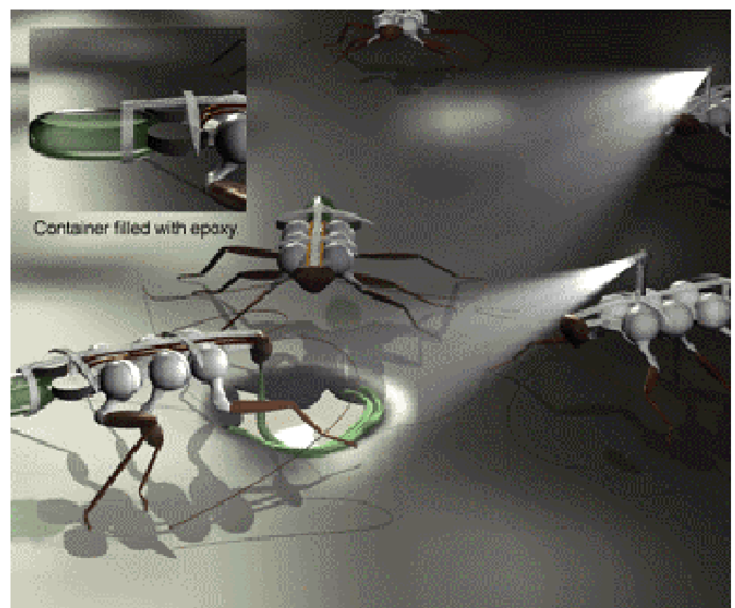
Directed Application of Nanobiotechnology for the Development of Autonomous Biobots

Carlo Montemango
Cornell University









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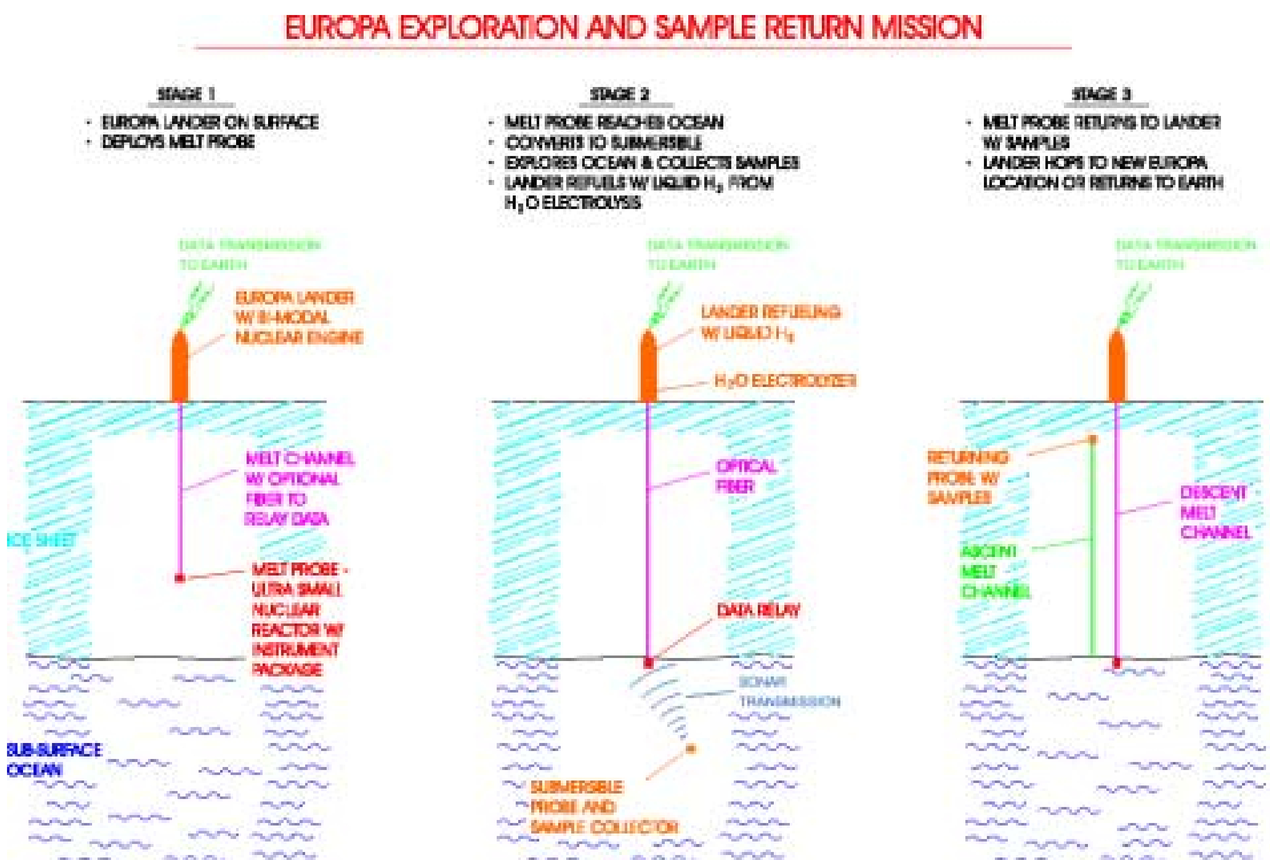
Europa Sample Return Mission utilizing High Specific Impulse Propulsion Refueled with Indigenous Resources

John Paniagua
Plus Ultra Technologies, Inc.



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Analytic Services Inc.

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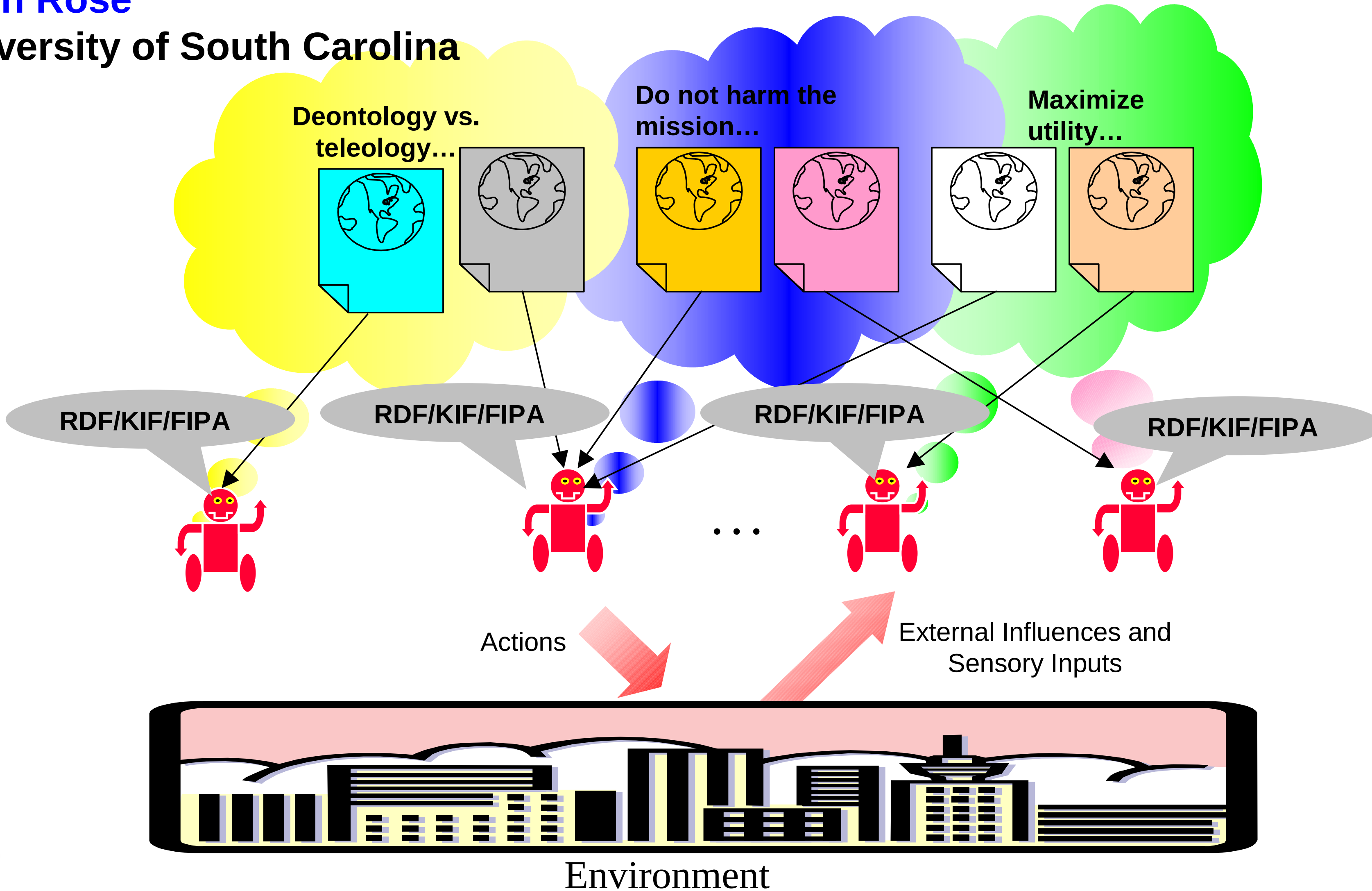
Achieving Comprehensive Mission Robustness

John Rose
University of South Carolina



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Ultra-High Resolution X-ray Astronomy using Steerable Occulting Satellites

Glenn Starkman
Case Western Reserve University

- Occultation of an X-ray telescope by a steerable satellite may allow binary point source resolution better than milli-arcsecond with little or no re-design of X-ray telescopes.
- Model reconstructive capabilities of the technique and adjust satellite shape so as to maximize those capabilities.
- Evaluate possible scientific payback from implementing this approach in conjunction with planned facilities, such as Constellation-X.
- Occulter design considerations to be investigated.
  - Thickness
  - Size
  - Steerability
  - Binary point source resolution
  - Compound source resolution
  - Target sources

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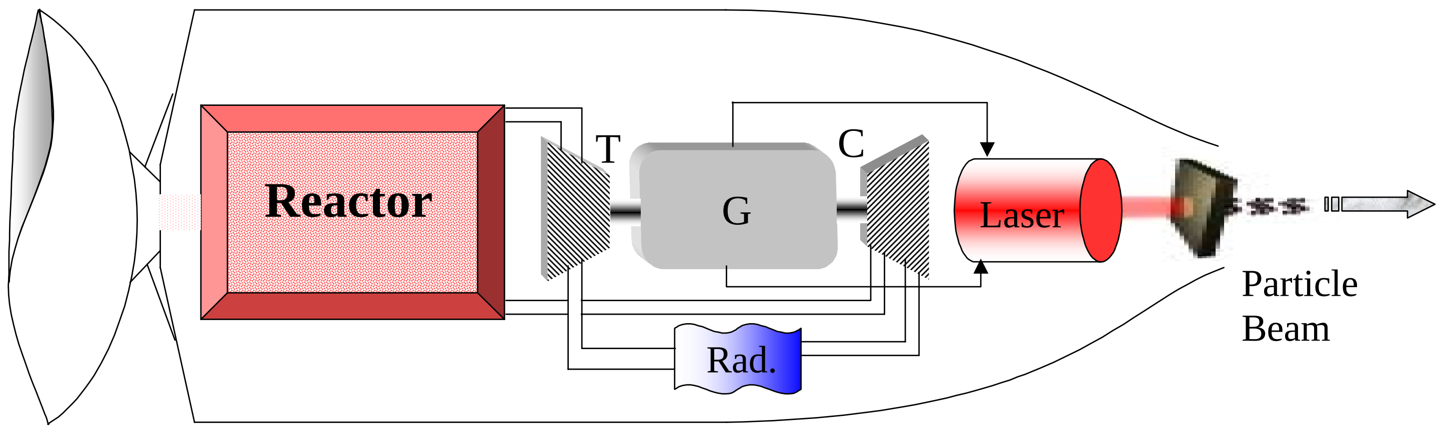
Ultra-Fast Laser-Driven Plasma for Space Propulsion

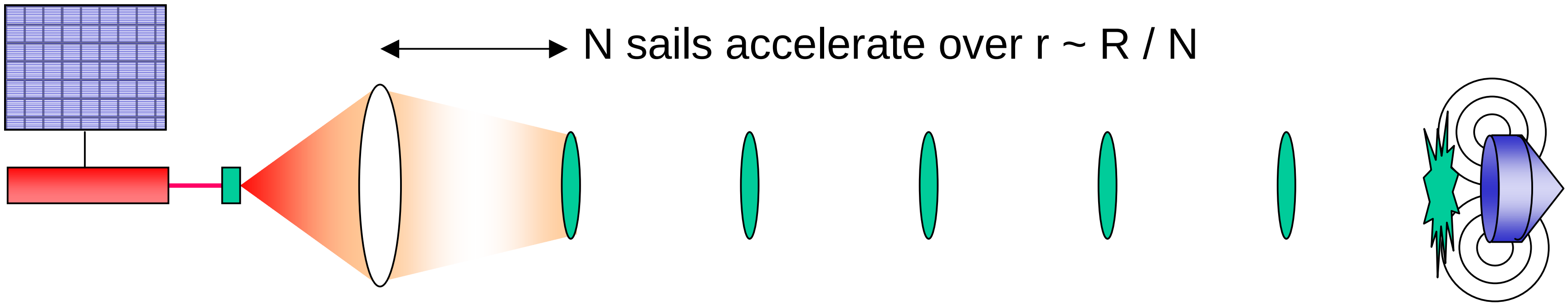
Terry Kammash
University of Michigan



Laser-Accelerated Plasma Propulsion System
(LAPPS)

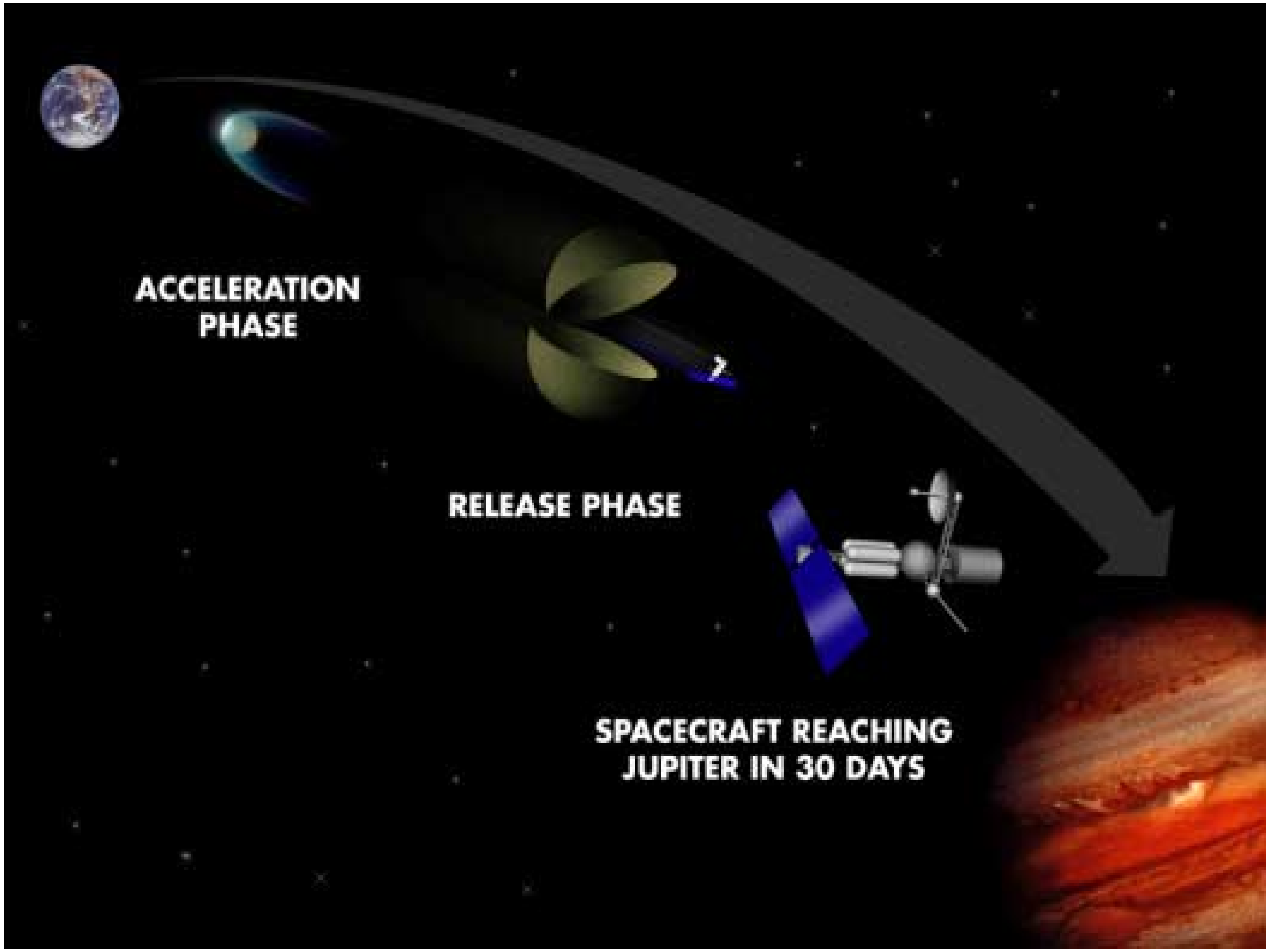
High Acceleration Micro-Scale Laser Sails for Interstellar Propulsion

Jordin Kare
Kare Technical Consulting



High Speed Interplanetary Tug / Cocoon Vehicles (HITVs)

Nick Omidi
Scibernet, Inc.



June 5, 2001 - Morning Agenda

9:00am – 10:00am **Keynote Speaker**

Dr. Bruce Jakosky, University of Colorado

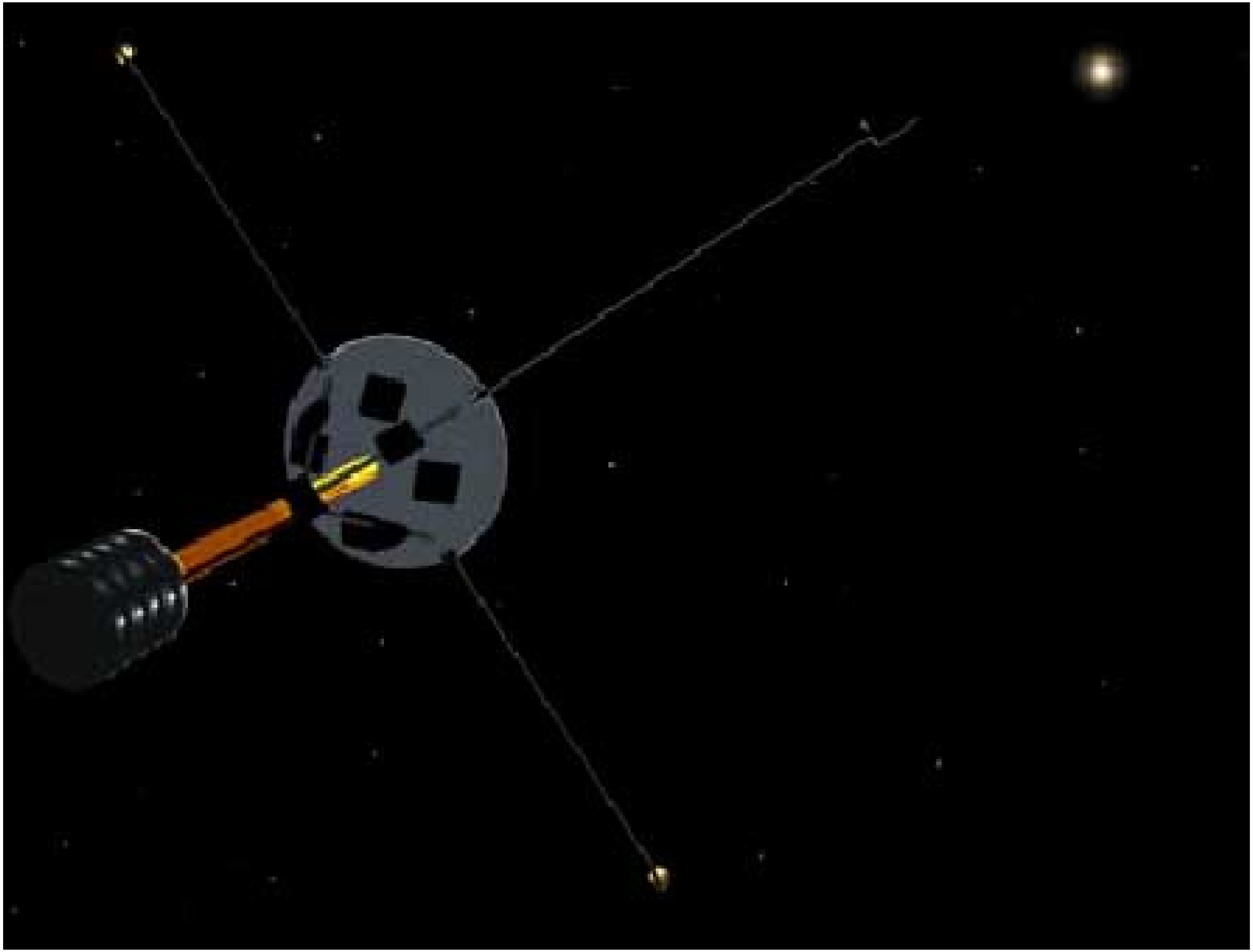
10:00am – 10:30am **Break**

10:30am – 11:50am **NIAC Status Reports**

Dr. Ralph L. McNutt, Jr., Johns Hopkins Applied Physics
"A Realistic Interstellar Explorer"

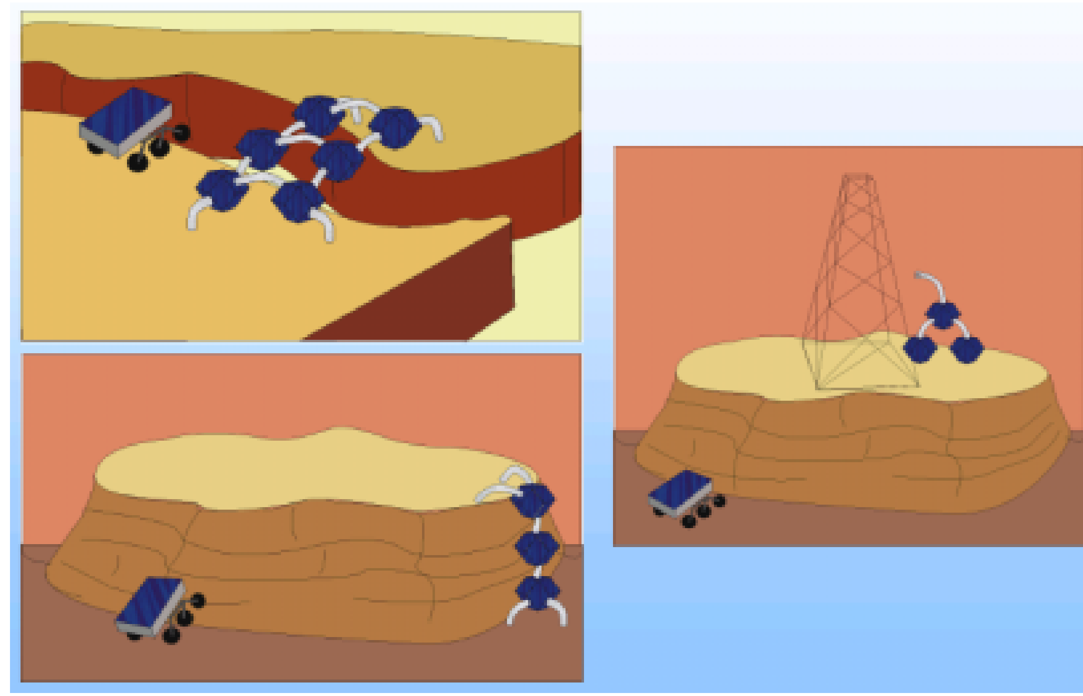
Dr. Steven Dubowsky, Massachusetts Institute of Technology
"Self-Transforming Robotic Planetary Explorers"

11:50am - 1:00pm **Lunch** *(on your own)*



Self-Transforming Robotic Planetary Explorers

Steven Dubowsky, Massachusetts Institute of Technology



The STX c.2010

June 5, 2001 - Afternoon Agenda

1:00pm - 3:00pm **NIAC Status Reports**

Dr. Neville J. Woolf, Steward Observatory, University of Arizona
"Very Large Optics for the Study of Extrasolar Terrestrial Planets"

Dr. Paul Gorenstein, Smithsonian Institution, Astrophysical Lab
"An Ultra-High Throughput X-Ray Astronomy Observatory with a New Mission Architecture"

Dr. Webster Cash, University of Colorado
"X-Ray Interferometry"

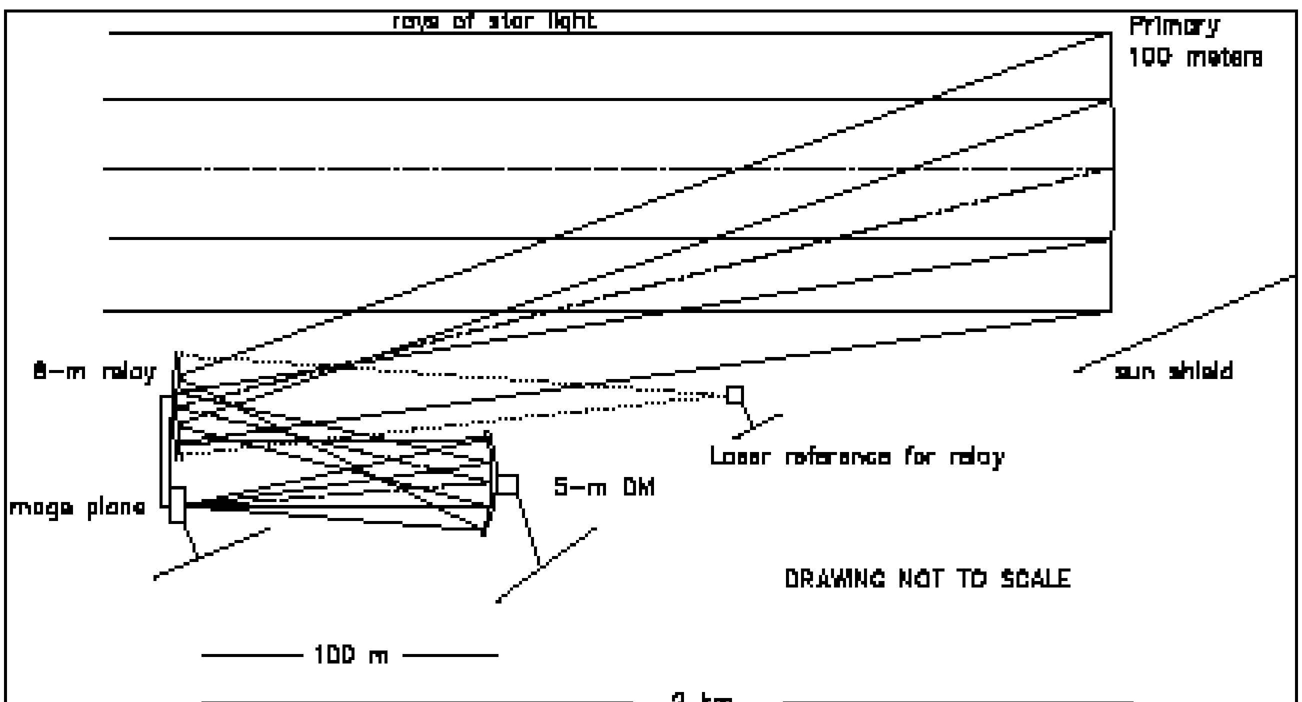
3:00pm - 3:15pm **Break**

Hubble Space Telescope (operational)

Next Generation Space Telescope (technology development)

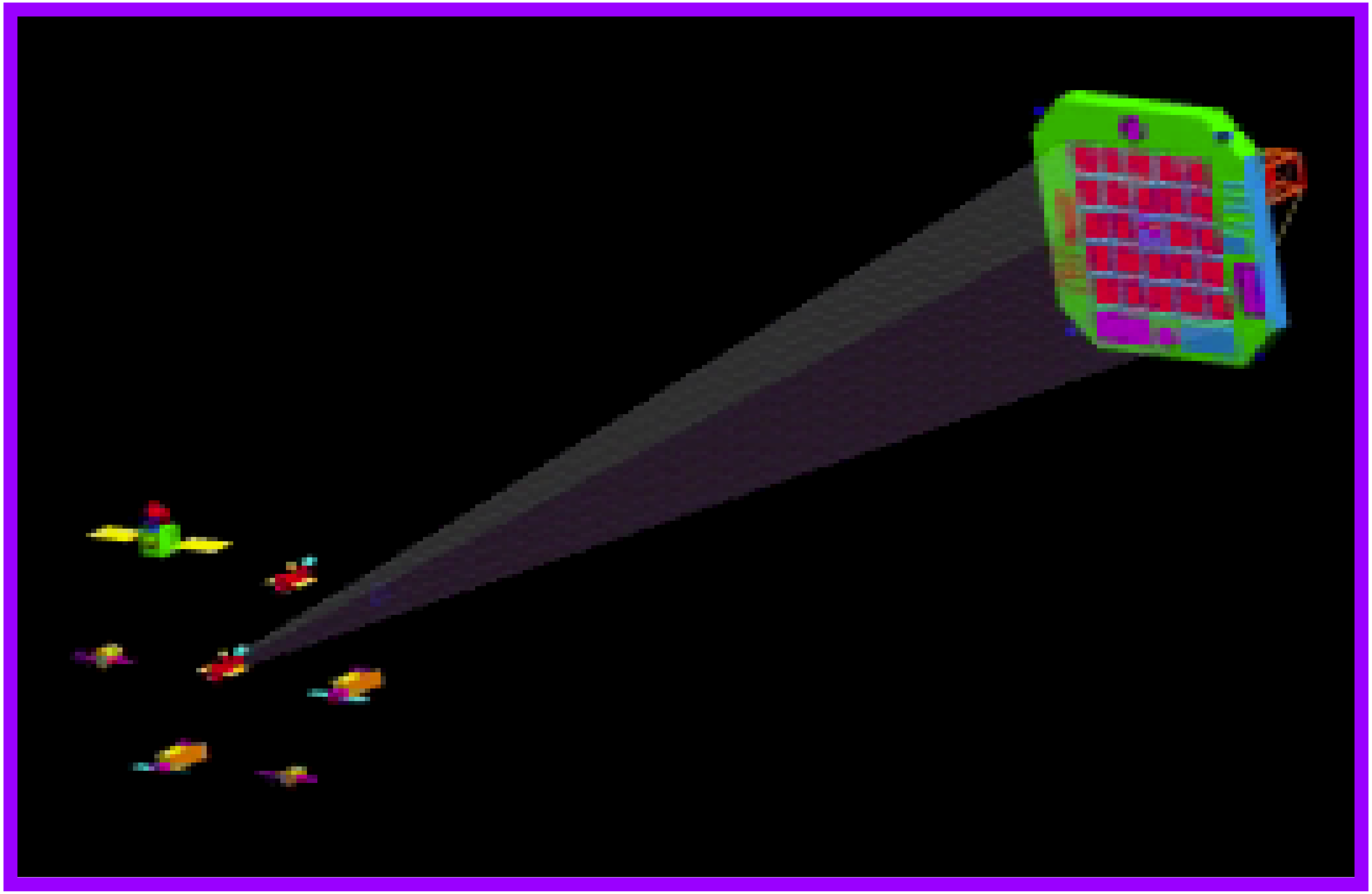
Terrestrial Planet Finder (concept development)

Life Finder



An Ultra-High Throughput X-Ray Astronomy Observatory with A New Mission Architecture

Paul Gorenstein, Smithsonian Institute, Astrophysical Observatory



June 5, 2001 - Afternoon Agenda

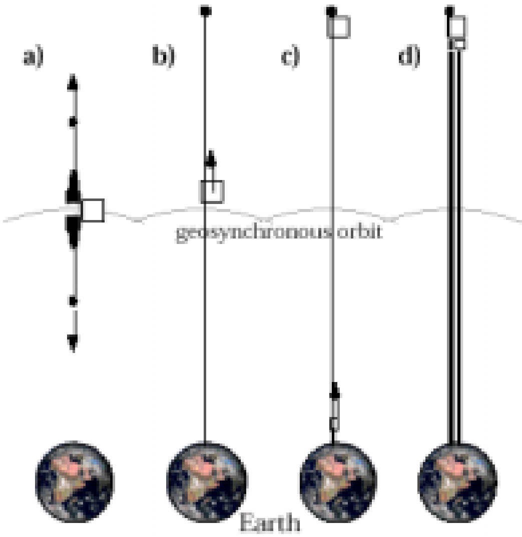
3:15pm - 5:15pm **NIAC Status Reports**

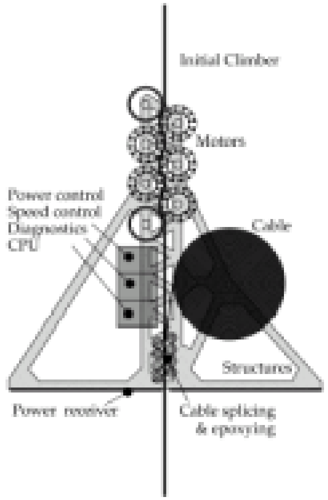
Bradley Edwards, Eureka Scientific
"The Space Elevator"

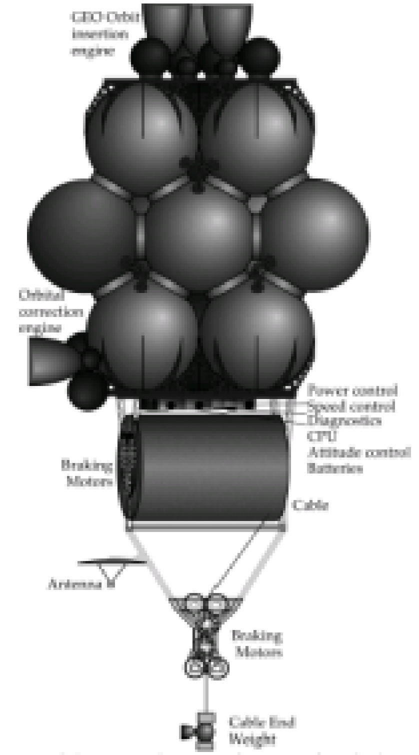
Dr. George Maise, Plus Ultra Technologies
"Exploration of Jovian Atmosphere using Nuclear Ramjet Flyer"

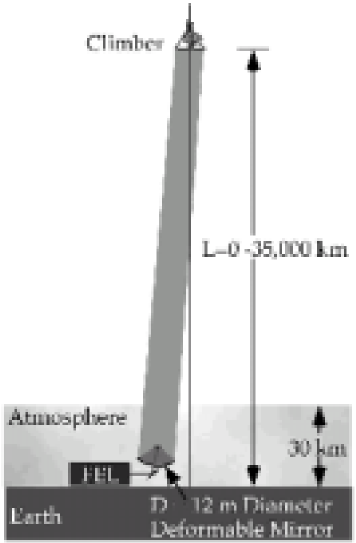
Dr. Kerry T. Nock, Global Aerospace
"Cyclical Visits to Mars via Astronaut Hotels"

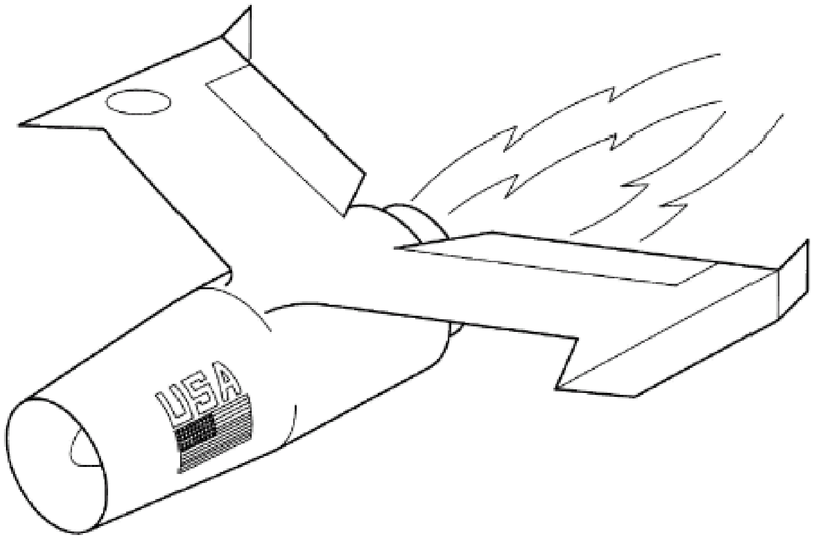
5:30pm - 7:00pm **Reception, Ames Cafe**


a)
b)
c)
d)
geosynchronous orbit
Earth

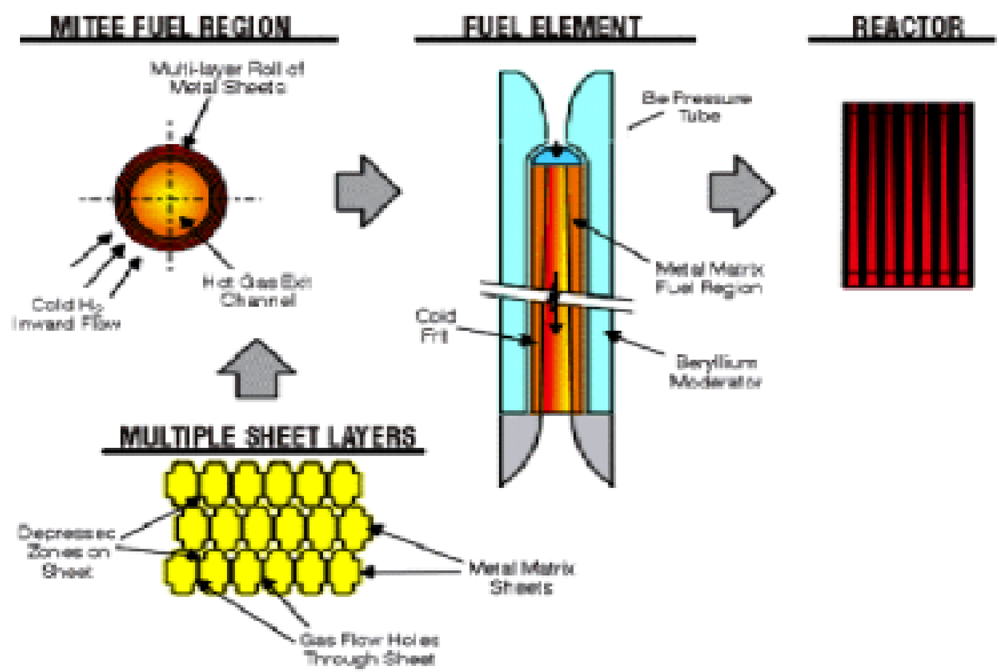

Initial Climber
Motors
Power control
Speed control
Diagnostics
CPU
Cable
Structures
Power receiver
Cable splicing
& epoxying


GEO Orbit
insertion
engine
Orbital
correction
engine
Power control
Speed control
Diagnostics
CPU
Attitude control
Batteries
Braking
Motors
Cable
Antenna
Braking
Motors
Cable End
Weight


Climber
L=0 -35,000 km
Atmosphere
30 km
FEL
Earth
D 12 m Diameter
Deformable Mirror

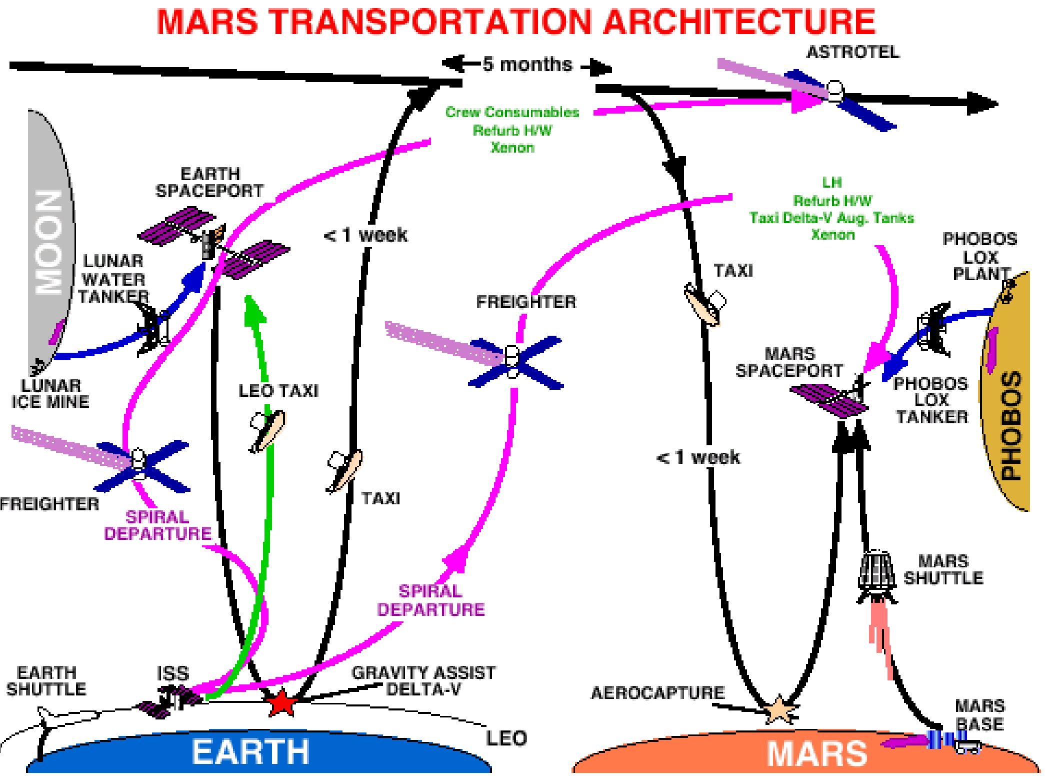


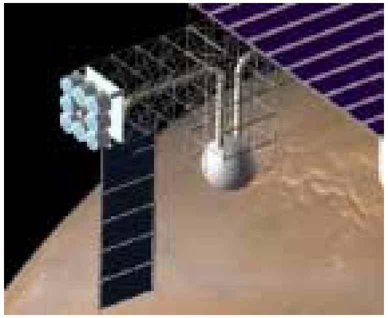
MITEE Nuclear Engine



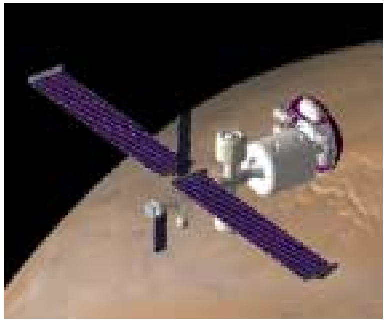
Cyclical Visits to Mars via Astronaut Hotels

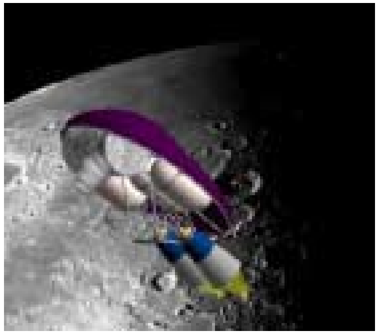
Kerry Nock, Global Aerospace Corporation





Astrotel IPS





Taxi departing

Taxi during Mars Aerocapture

June 6, 2001 - Morning Agenda

8:30am - 8:40am **Welcome and Introduction of Keynote Speaker**
Dr. Robert A. Cassanova, NIAC Director

8:40am - 9:40am **Keynote Speaker**
Dr. Eric Barron, Pennsylvania State University

9:40am – 10:20am **NIAC Status Report**
Dr. Robert M. Winglee, University of Washington
"The Mini-Magnetospheric Plasma Propulsion, $M^2 P^2$"

10:20am – 10:40am **Break**

10:40am – 12:00pm **NIAC Status Reports**
Dr. Ilan Kroo, Stanford University
"Mesicopter: A Meso-Scale Flight Vehicle"

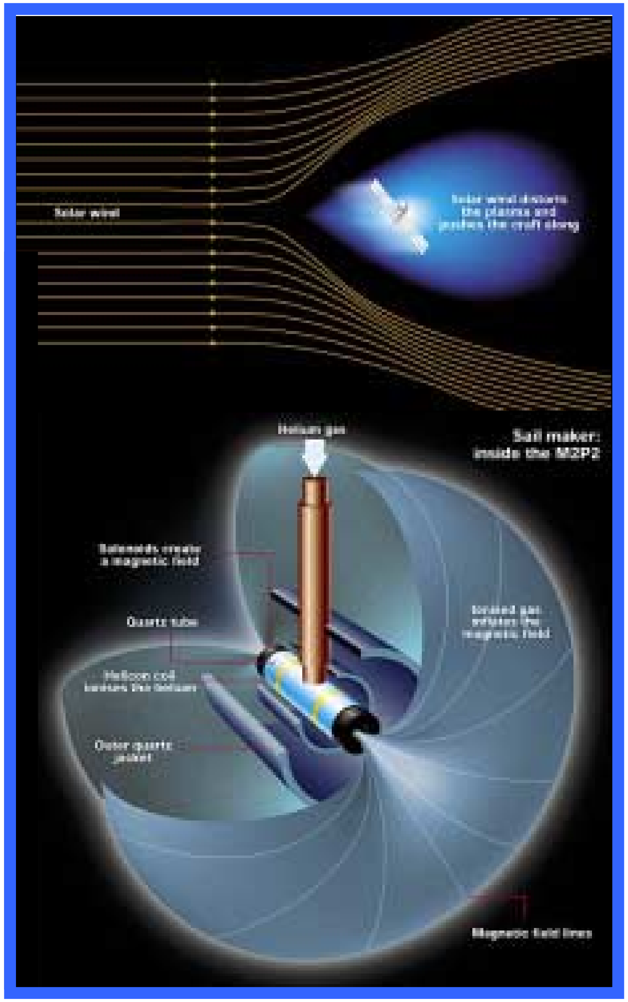
Dr. Kerry T. Nock, Global Aerospace Corporation
"Global Constellation of Stratospheric Scientific Platforms"

12:00pm - 1:00pm **Lunch** *(on your own)*

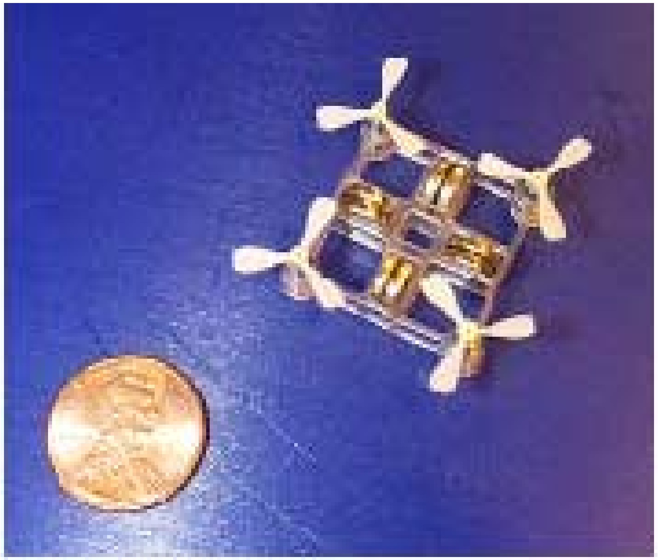
The Mini-Magnetospheric Plasma Propulsion System, M^2P^2

Robert M. Winglee, University of Washington

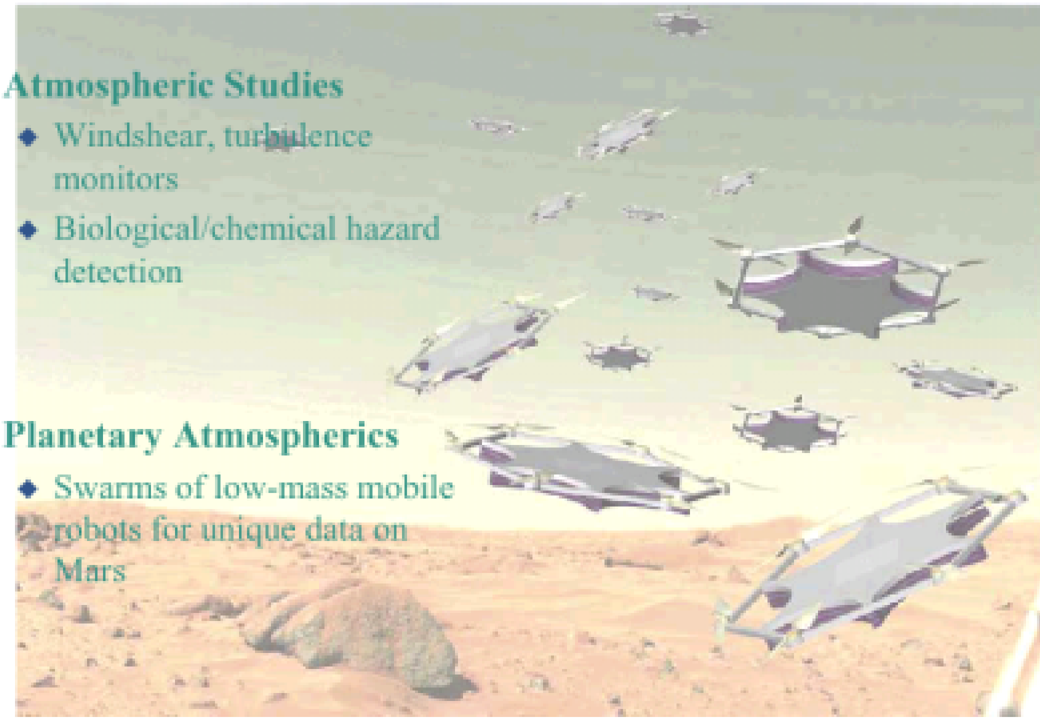
Concept for interstellar propulsion and radiation shielding



Graphics by permission of *New Scientist*



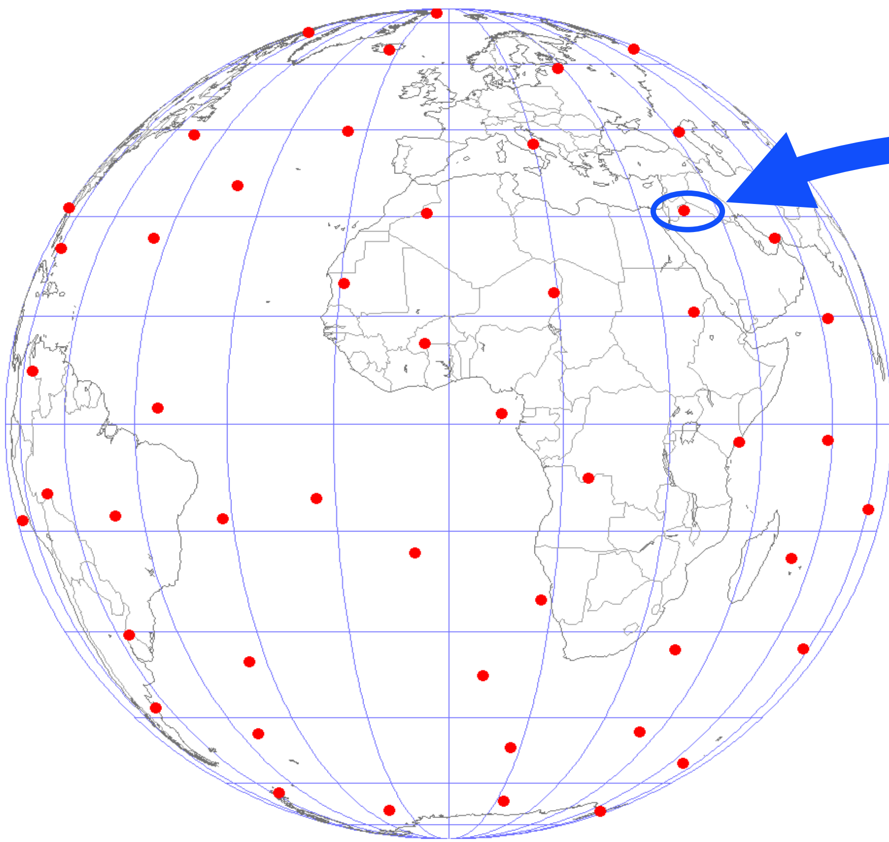
The Concept: Applications

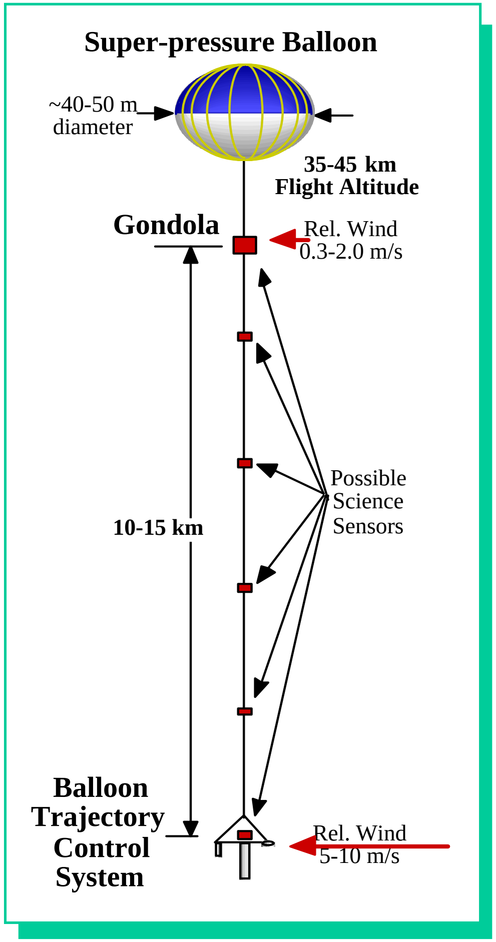


- **Atmospheric Studies**
  - Windshear, turbulence monitors
  - Biological/chemical hazard detection
- **Planetary Atmospherics**
  - Swarms of low-mass mobile robots for unique data on Mars

Global Constellation of Stratospheric Scientific Platforms

Kerry Nock, Global Aerospace Corporation





June 6, 2001 - Afternoon Agenda

1:00pm - 3:00pm **NIAC Status Reports**

Dr. Robert P. Hoyt, Tethers Unlimited, Inc.
"Moon & Mars Orbiting Spinning Tether Transport (MMOSTT)"

Mr. John Grant, Boeing
"Hypersonic Airplane Space Tether Orbital Launch Study"

Dr. Eric E. Rice, Orbital Technologies Corporation
"Advanced System Concept for Total ISRU Based Propulsion and Power Systems for Unmanned and Manned Mars Exploration"

3:00pm - 3:15pm **Break**

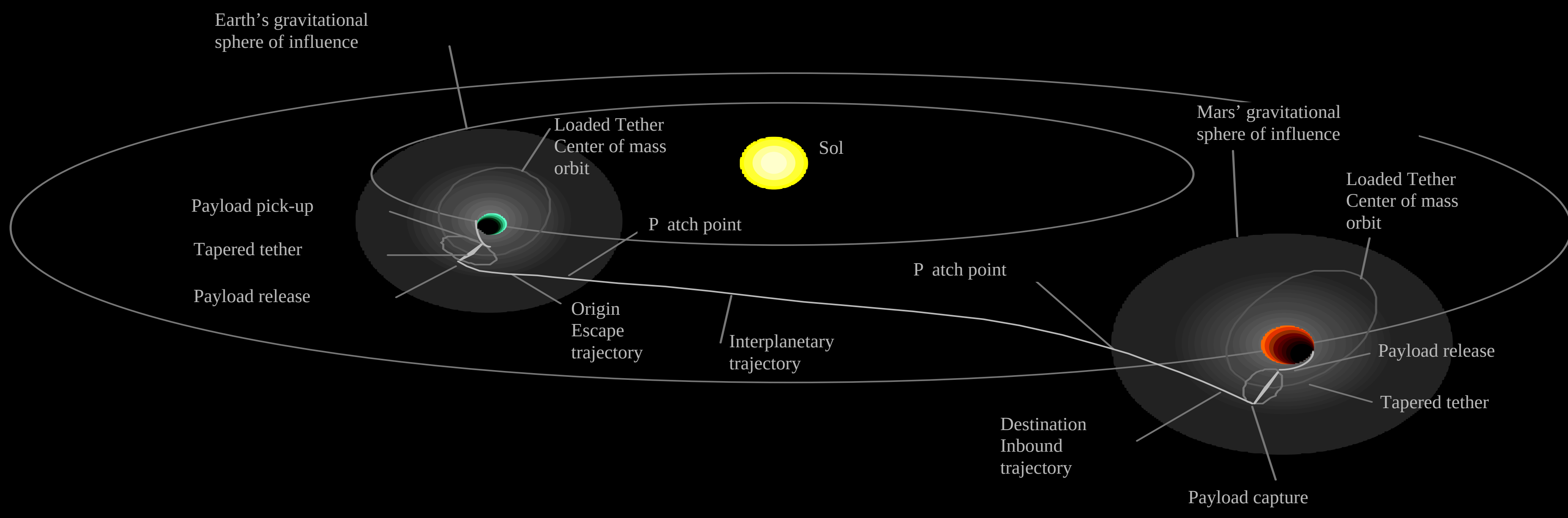
3:15pm - 4:35pm **NIAC Status Reports**

Anthony Colozza, Ohio Aerospace Institute
"Planetary Exploration using Biomimetics"

Mr. Andrew Keith, Sikorsky Aircraft Corporation
"Autonomous VTOL Scalable Logistics (AVSLA)"

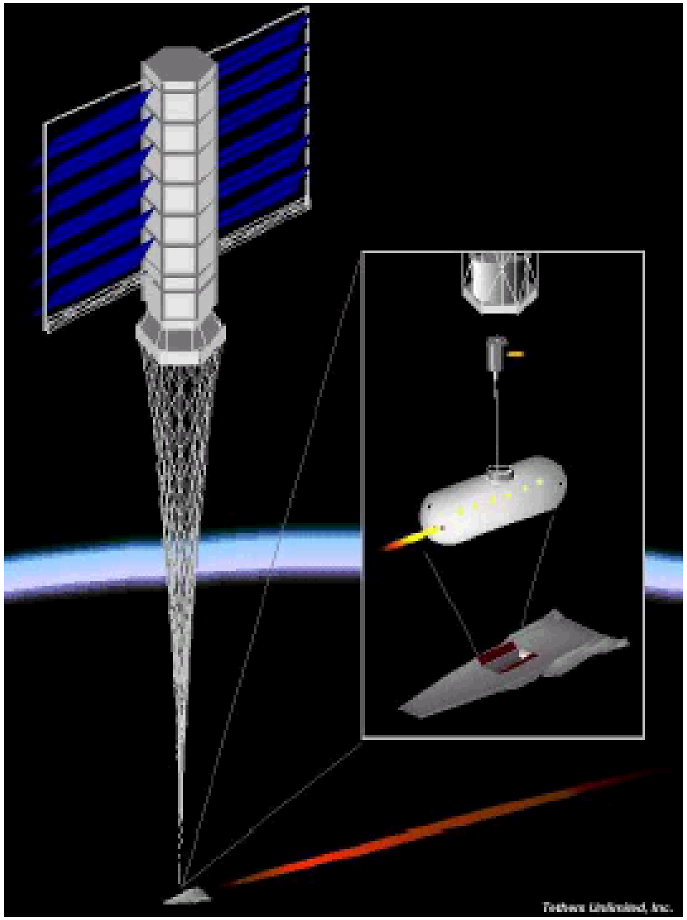
4:35pm **Adjourn**

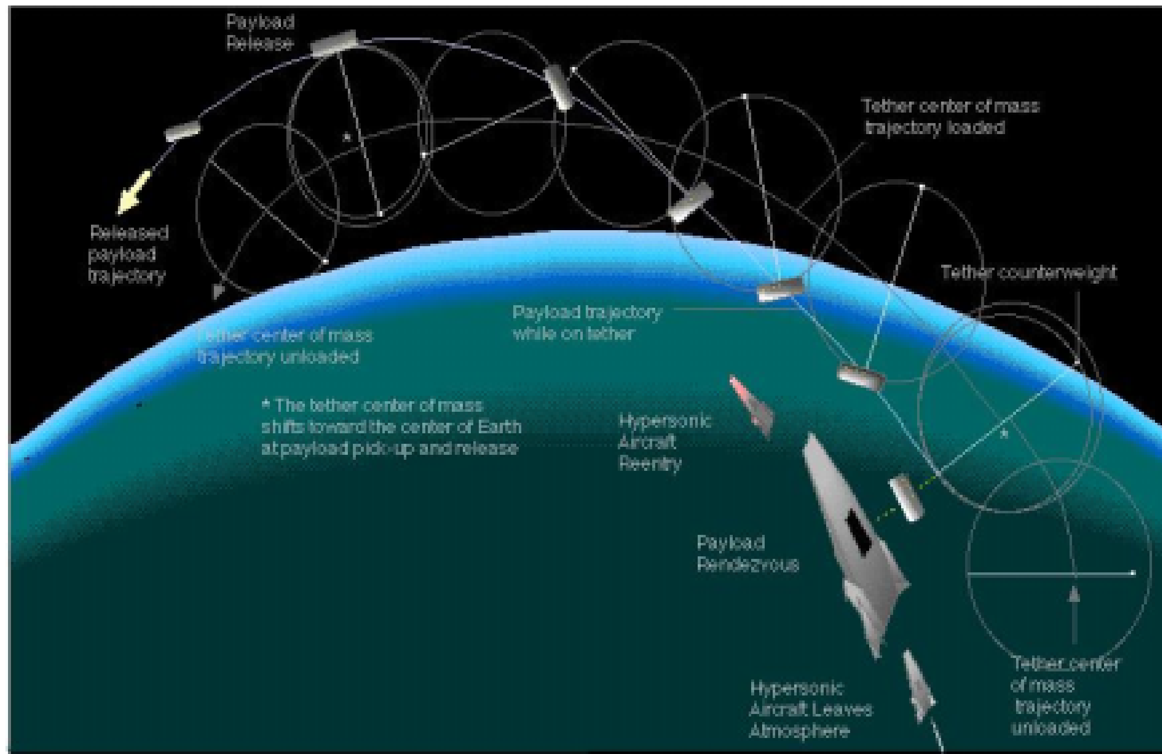
INTERPLANETARY TRANSPORT USING ROTATING TETHERS

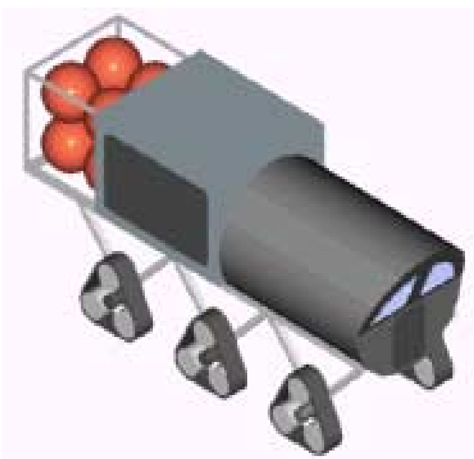


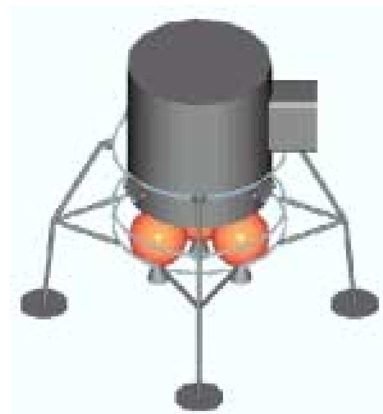
Hypersonic Airplane Space Tether Orbital Launch – HASTOL

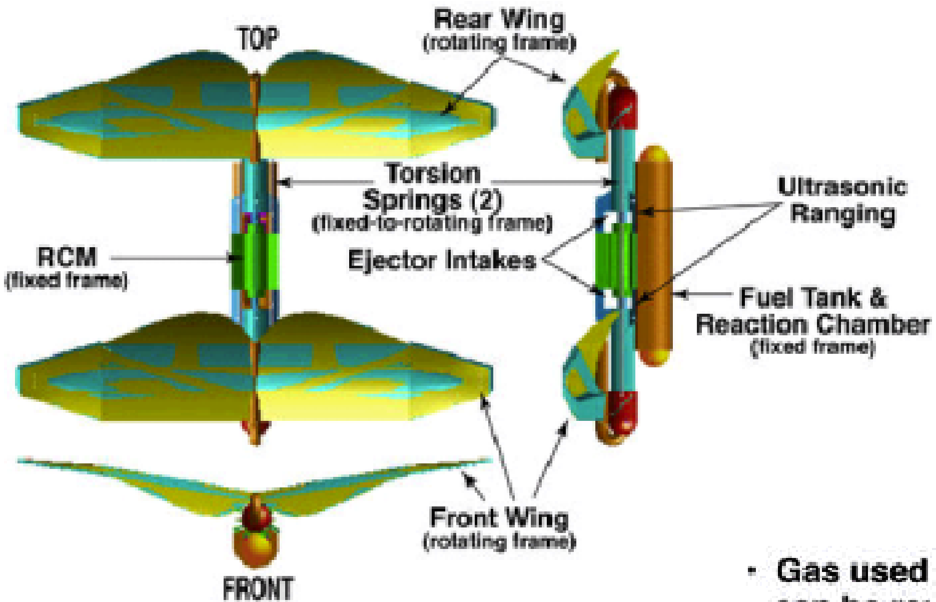
John Grant, The Boeing Company



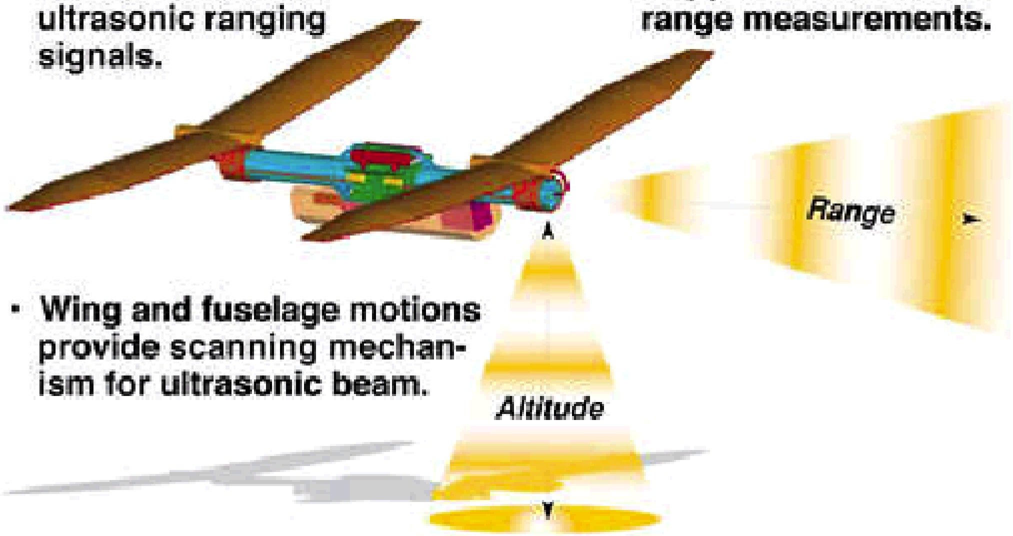








- Gas used to drive wings can be reused to create ultrasonic ranging signals.
- FMCW waveform allows Doppler insensitive range measurements.
- Wing and fuselage motions provide scanning mechanism for ultrasonic beam.



Methodology for Study of Autonomous VTOL Scalable Logistics Architecture

Andrew Keith, Sikorsky Aircraft Corporation