

National Aeronautics and Space Administration



OFFICE OF THE CHIEF TECHNOLOGIST

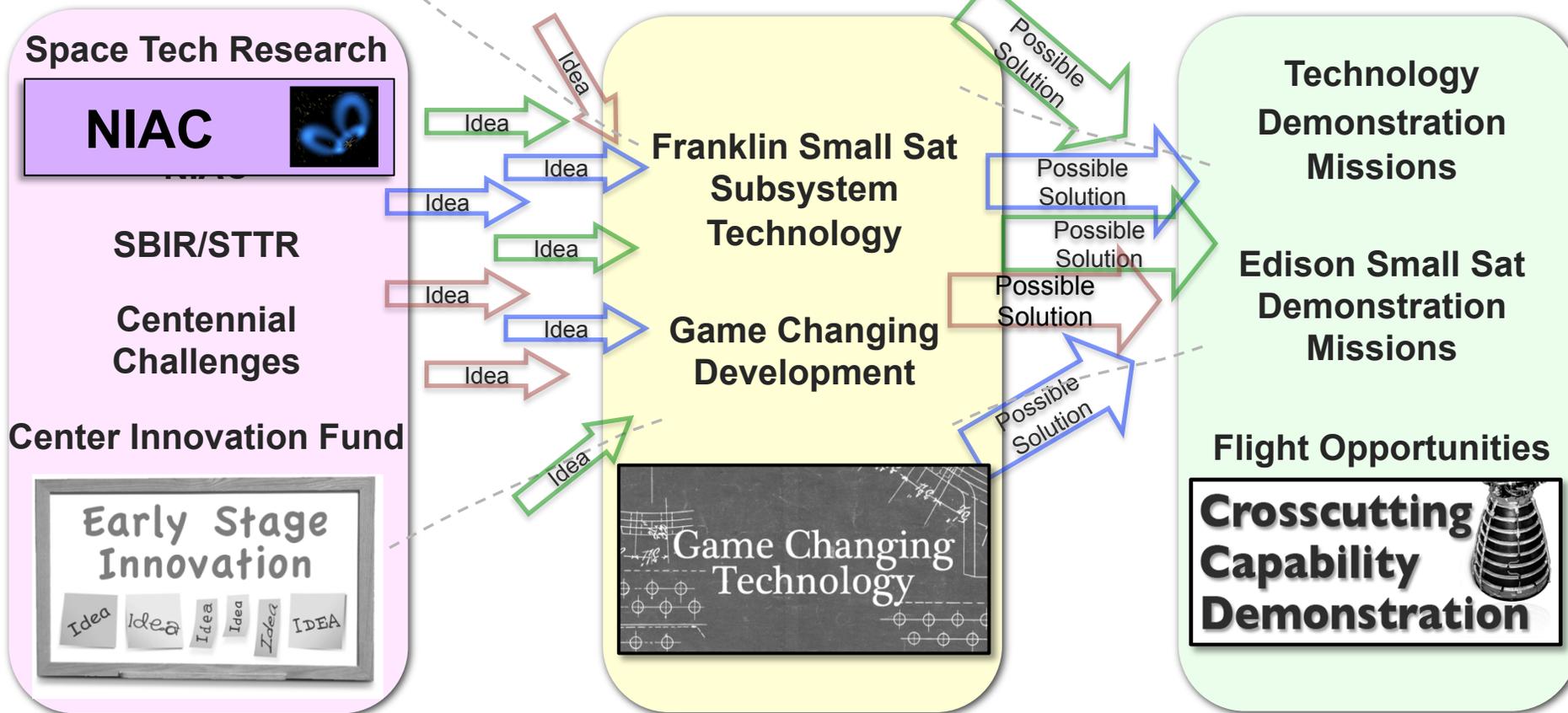
SPACE TECHNOLOGY  
**INDUSTRY FORUM**

A woman in a dark jacket and pants stands on the right side of a yellow-toned, futuristic industrial or technological environment. The background is filled with complex machinery, pipes, and structural elements, creating a sense of depth and scale.

## **NASA Innovative Advanced Concepts (NIAC)**

**Dr. Jay Falker**  
Program Manager (Acting)  
July 13, 2010

# OCT Program Overview



Technology Readiness Level (TRL)

# What is NIAC and why does it matter?



A program to give visionary ideas a chance  
– one of them (maybe yours) just might change the world!

**Objective: Early studies of visionary, long-term concepts**

- There was an original NIAC from 1998-2007



***is back!***

***“Don’t let your preoccupation with reality stifle your imagination”***

-- Dr. Robert Cassanova and Sharon Garrison,  
original NIAC Director and NASA Coordinator

- OCT is re-establishing this with a slightly updated name:  
***NASA Innovative Advanced Concepts*** Program
  - Still called “NIAC” to restore the original intent/spirit, and build on its success
  - Now run from HQ rather than an external institute, to allow both external and NASA participation
- Focus: aerospace architectures, systems, or mission concepts (TRL 1-2 or early 3; 10+ years out)

# NIAC Program Overview



## Two Phases of Funded Studies

*Increased time and funding compared to original NIAC awards!*

### PHASE I

**Funding: up to 1 year, \$100K**

Purpose: To examine the overall viability of an innovative system or concept

Open Competition: Proposals welcome from all sources, including academia, industry, all US government agencies (including NASA and JPL), and partnerships

Awards: 15-20 per year

### PHASE II

**Funding: up to 2 years, \$500K**

Purpose: To further develop the concept and assess key issues such as cost, performance, development time, infusion path, and business case

Downselect Competition: Proposals eligible based on successful Phase I awards

Awards: Will ramp up to 3-8 per year

- Both competitions will be based on independent peer review of all qualified proposals
- There is no fixed internal/external distribution; intent is to reward the best ideas

# NIAC Proposal Evaluation Criteria

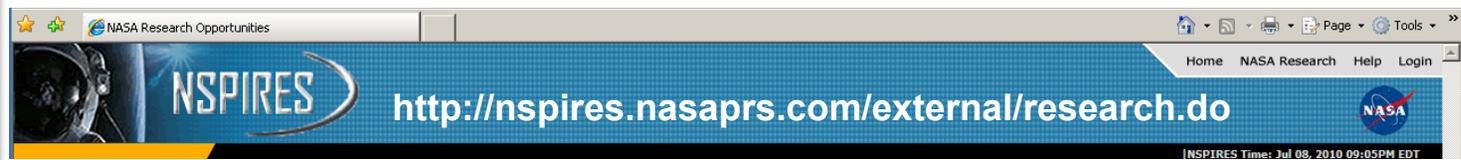


## For consideration, proposals must be...

- **Aerospace Architecture, System, or Mission Concepts**
  - *Not narrowly focused*
- **Innovative & Visionary**
  - *Not incremental*
- **Technically Substantiated** (with scientific principles)
  - *Not science fiction*
- **Very early development** (TRL 1-2 or early 3, 10+ years from application)

## For selection, proposals are compared in terms of...

- **Potential Impact (Value)**
  - Innovation
  - Comparative benefit
  - Maturation (Planned outcome & development path)
- **Technical Merit & Work Plan**
  - Description of the underlying scientific principles
  - Technical approach
  - Feasibility, planning, and schedule
- **Suitability of Team & Cost Estimate**



# Example NIAC Visionary Challenges & Concepts

Meant to be illustrative, not exhaustive or targeted



- Expanding human presence throughout the solar system
- Responsive, adaptive architectures for timely access to targets of interest
- Revolutionary methods for understanding and exploring the cosmos
- Novel searches for life – including evidence of Earth's origins
- Truly autonomous robotic operations (self-assembling, evolvable systems)
- Advanced information processing to dramatically facilitate science and exploration
- Breakthrough concepts for much faster, more efficient transportation



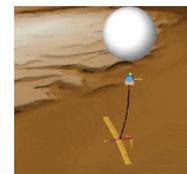
**Bio-Suit**  
Dava Newman  
MIT



**Biomimetic Entomopter**  
Anthony Colozza  
Ohio Aerospace Inst.



**Redesigning Life to Survive Mars**  
Wendy Boss  
N. Carolina State Univ.



**Aerial Robotic Explorers**  
Alexey Pankine  
Global Aerospace Corp.



**Space Elevator**  
Bradley Edwards  
Carbon Designs, Inc.

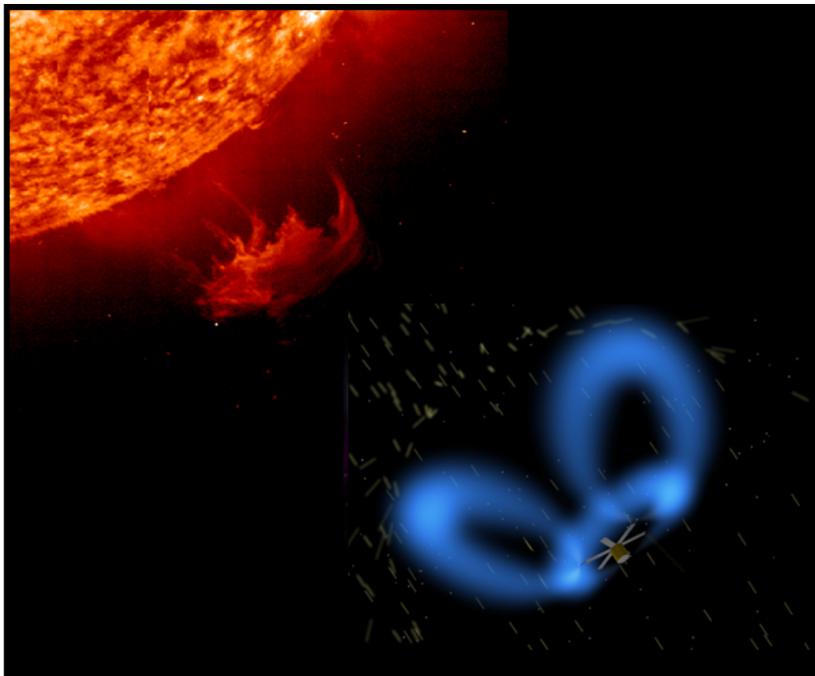
# Previous NIAC Highlight: Plasma Sail



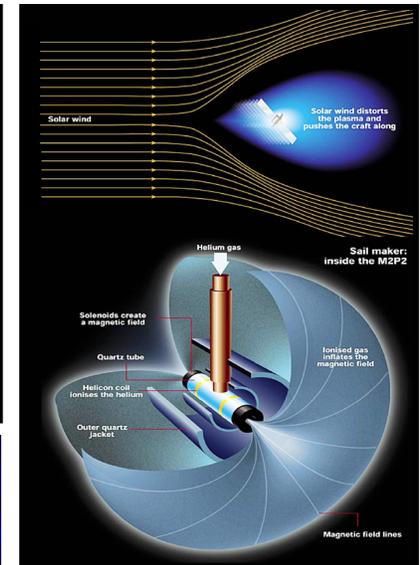
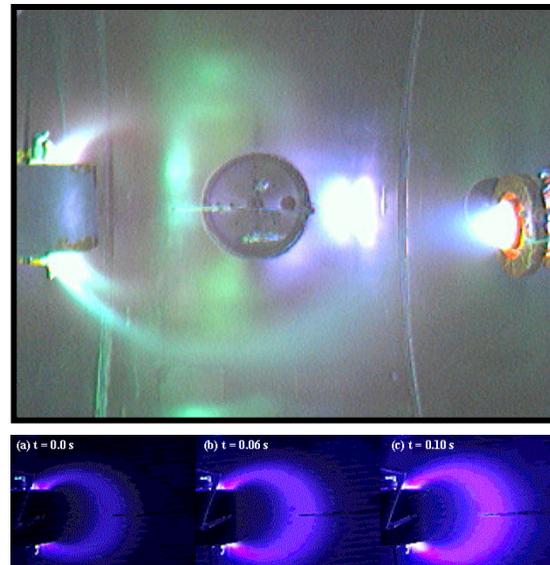
## Mini-Magnetospheric Plasma Propulsion (M2P2)

PI: Prof. Robert Winglee  
University of Washington, Seattle

**M2P2:** The Mini-Magnetospheric Plasma Propulsion (M2P2) Prototype seeks the creation of a magnetic wall or bubble (i.e. a magnetosphere) attached to a spacecraft that will intercept the solar wind and thereby provide a high-speed propulsion system with high propellant efficiency and high specific impulse. In order to get a sufficiently large interaction region, plasma is injected onto the magnetic field lines and the plasma pressure causes both the plasma and the magnetic field that is frozen into the plasma to expand to several tens of kilometers without the need for deploying any large mechanical structures.



Mini-Magnetospheric Plasma Propulsion (M2P2) is an advanced plasma propulsion system that will enable spacecraft to attain unprecedented speeds for minimal energy and mass requirements.



Images: Robert Winglee

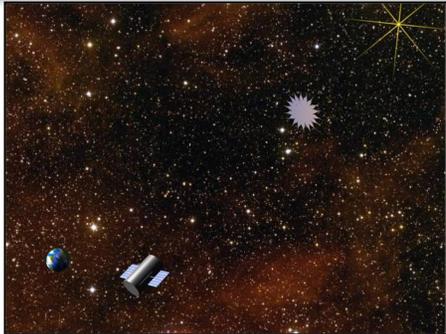
- NIAC Phase I Study completed in 1998
- NIAC Phase II Study completed in 2000
- Received NASA funding for testing at MSFC vacuum chamber
- 2001-2002 consideration by NASA Decadal Planning Team and NASA Exploration Team
- Further development with JSC VASIMIR until 2002

# Previous NIAC Highlight: New Worlds Observer

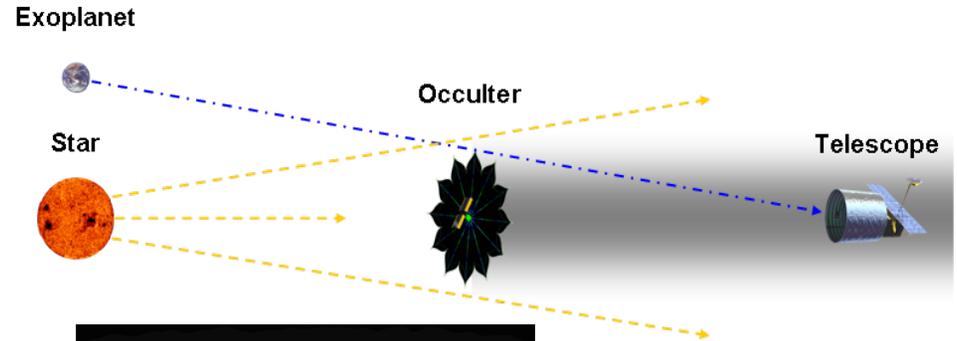


## New Worlds Observer (NWO)

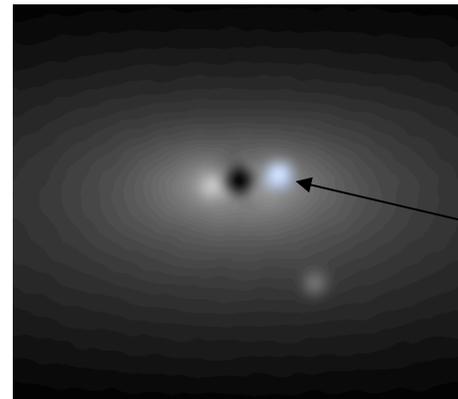
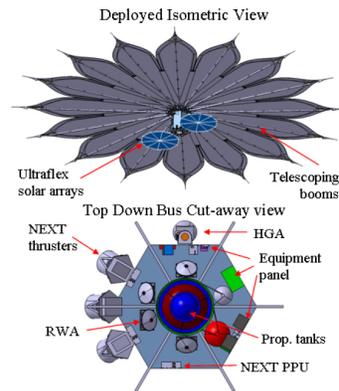
PI: Prof. Webster Cash  
University of Colorado, Boulder



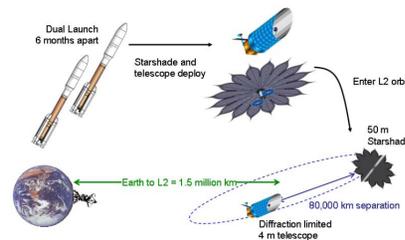
**NWO:** A large occulter in space designed to block the light of nearby stars in order to observe their orbiting planets. The observations could be taken with an existing space telescope, possibly the James Webb Space Telescope when it launches, or a dedicated visible light telescope optimally designed for the task of finding exoplanets.



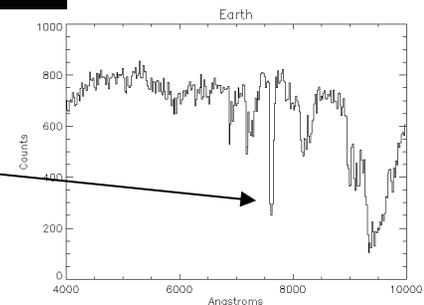
- NIAC Phase I Study completed in 2005
- July 6 2006 *Nature* cover story
- NIAC Phase II Study completed in 2007
- Received NASA follow-on funding for Terrestrial Planet Finder development
- Northrop Grumman and Ball Aerospace added external investments
- Over 40 papers published 2004-2008
- Feb 2008 \$1M for NASA Astrophysics Strategic Mission Concepts Study
- Informing NRC Astronomy and Astrophysics Decadal Survey



**Map Neighboring Planetary Systems  
Find Earth-like worlds!**



**Spectra will show water & oxygen  
→ LIFE!**



Images: Webster Cash

# Estimated Timing for First NIAC Phase I Awards



**“T”**  
(Authorization)



**Release NASA Research Announcement (NRA or “Call”)**

**T + 1 month**



**Notice Of Intent Due** (Optional)

**T + 2 months**



**Proposals Due**

**T + 4 months**



**Selections Ready**

**T + 5 months**



**Grants Awarded & Studies Underway**

# Learning from the Past



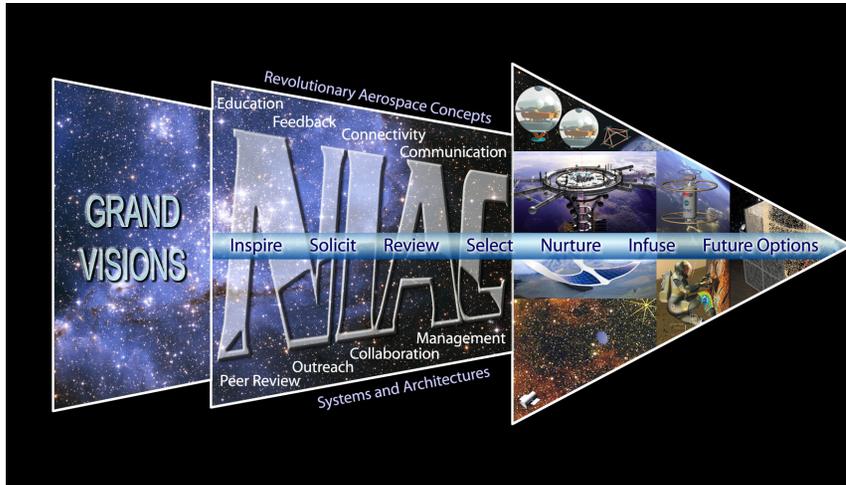
## Preserve the Recognized Strengths:

- **Scope/Vision** – revolutionary, creative, controversial, yet credible

*“Imagination, not imitation!” “Don’t let the rules become millstones...” “Inspire giant leaps forward”*

-Dr. Robert Cassanova, original NIAC Director

- **Process**



Images: Katherine M. Reilly

- **Outreach/Publicity**



## Mitigate the Perceived Weaknesses:

- **External only** → Allow NASA participation and improve infusion
- **40 years out is too remote** → New focus is 10+ years out
- **No support beyond Phase II** → Path to Game-Changing Technology

# Conclusion



## NIAC: The Future Possibilities Depend on You

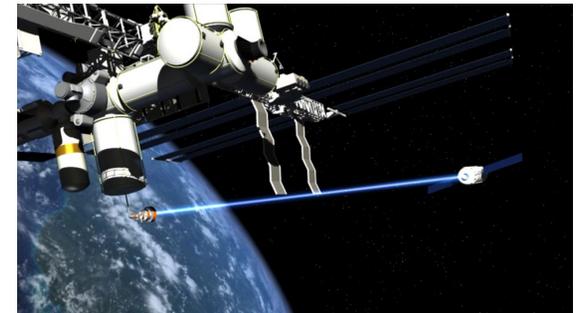
- NIAC is the most open-ended and far-reaching of NASA's new technology programs
- This exciting program is open to anyone
- Your participation is essential. Please speak up tomorrow at the NIAC break-out session, or follow up anytime:

**John (Jay) Falker, PhD**  
**Office of the Chief Technologist**  
**NASA Headquarters**  
**[jfalker@nasa.gov](mailto:jfalker@nasa.gov)**  
**202-358-4545**

For more information,  
Please visit the OCT website:  
[www.nasa.gov/oct](http://www.nasa.gov/oct)



Images: Robert Winglee



# Questions?



## Three Stages of Reaction to Revolutionary Ideas

- 1 – It's completely impossible
- 2 – It's possible, but it's not worth doing
- 3 – I said it was a good idea all along

– *Arthur C. Clarke*



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