

The case for a Space Science and Technology Initiative

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E&AS Visiting Committee

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Space Initiative
M Ortiz 02/03/04

The case for a Space Initiative...

- Space remains a rich source of fundamental problems in science and technology
- NASA's mission statement (1998 Strategic Plan):
 - *To explore, use, and enable the development of space for human enterprise*
 - *To advance and communicate scientific knowledge and understanding of the Earth, the solar system, and the universe*
 - *Research, develop, verify and transfer advanced aeronautics, space, and related technologies*
- However, space technology and the space program are presently undergoing rapid and profound changes

Space research faces its future...

- Space shuttles grounded, manned program in disarray, presently under review

.COM



Shuttle Might Not Launch Until March 2005

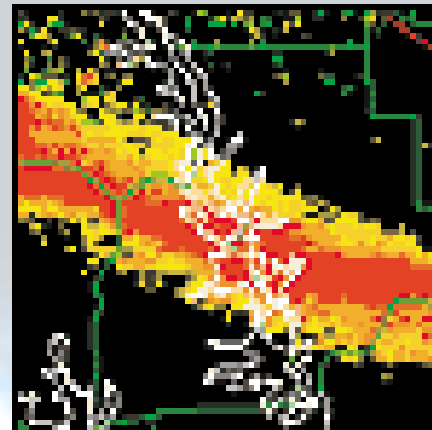
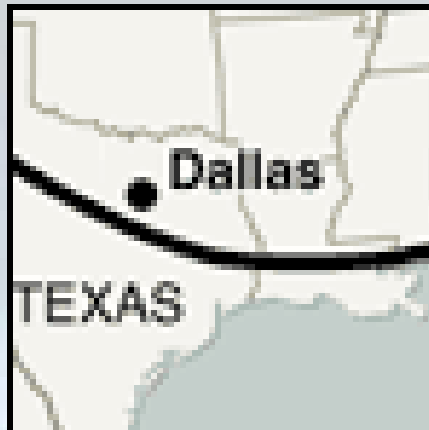
By [Tariq Malik](#)

Staff Writer

posted: 11:00 am ET

18 February 2004

Columbia's
final
descent
trajectory



Doppler weather
radar images show the
aftermath of the breakup
of the shuttle Columbia

Space research faces is future...



The White House

PRESIDENT GEORGE W. BUSH

President * News * Vice Pres

YOUR GOVERNMENT KIDS

President Bush Announces New Vision for Space Exploration Program

Remarks by the President on U.S. Space Policy
NASA Headquarters
Washington, D.C.



January 14, 2004



Space research faces its future...

- US space program faces new competition from China in addition to traditional pressure from European and Russian space program

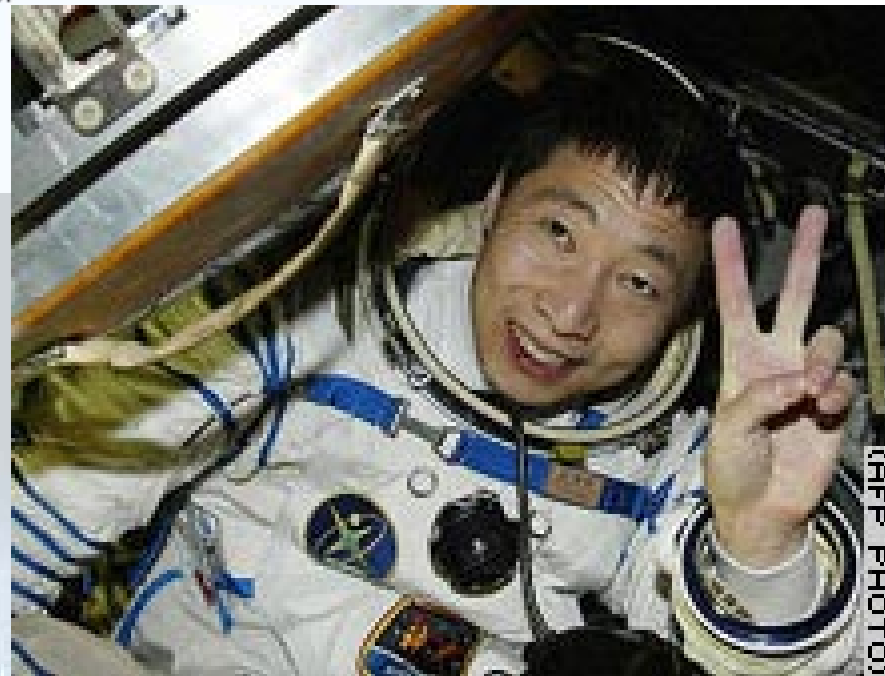


What Next for China? Friendly Competition or New Cold War?

By [Leonard David](#)

Senior Space Writer
posted: 07:00 am ET
17 October 2003

China's latest national hero, Yang Liwei – the country's first man in space.



(AFP PHOTO)

Space research faces its future...

- "Space is not on the margins of fighting wars anymore," Maj. Gen. Robert Dickman, Air Force deputy secretary for space



Pentagon Using Weather Satellites in Iraq War

By [Jeremy Singer](#)

Space News Staff Writer

posted: 06:25 pm ET

09 April 2003

The Iraq war proved how essential weather, communications and targeting satellites are to the U.S. military

- The Iraq war was "the most integrated and precise military engagement in history," (largely due to a greater use of space-based equipment) Peter Teets, Air Force Undersecretary

Space research faces its future...

- Space research is in transition
- DARPA-NRO workshop, March 16-17, 2003: Space community has become too conservative, must recover ability to think 'out-of-the-box', generate 'blue-sky' concepts
- Some of the new challenges include:
 - *Very large space structures, large-aperture optics*
 - *On-orbit manufacturing, materials synthesis*
 - *Virtual design and testing, modeling & simulation*
- Opportune time for E&AS to throw in hat, contribute to setting directions, developing enabling technologies

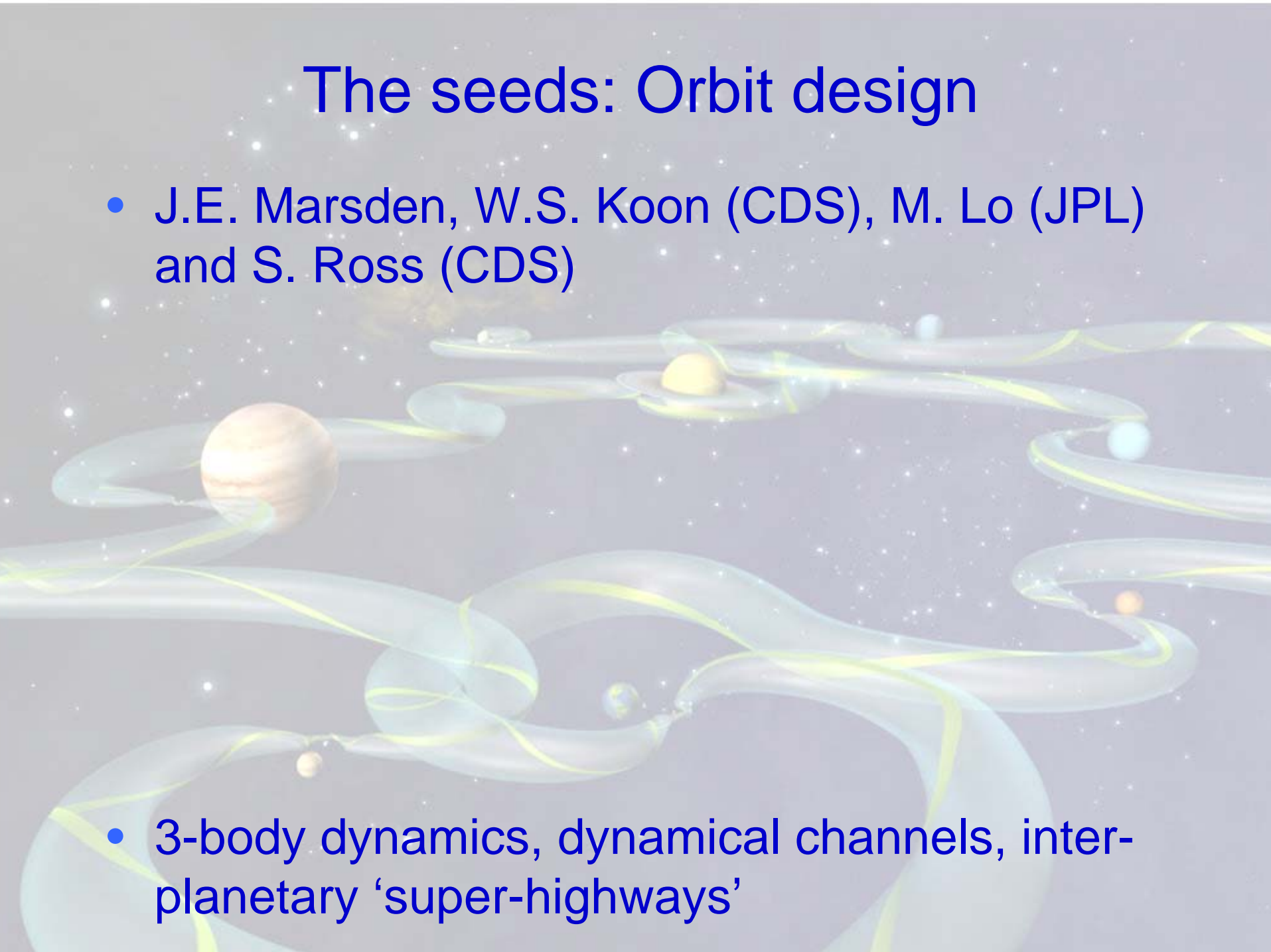
The seeds of a Space Initiative...

- Caltech/JPL synergistic partnership provides a unique foundation for a Space Initiative
- Research seeds: Uncoordinated 'islands' of space research already within E&AS
- Teaching seeds: Some relevant courses already in the catalog
- Outreach seeds: Extensive local aerospace industry base, contacts presently underway

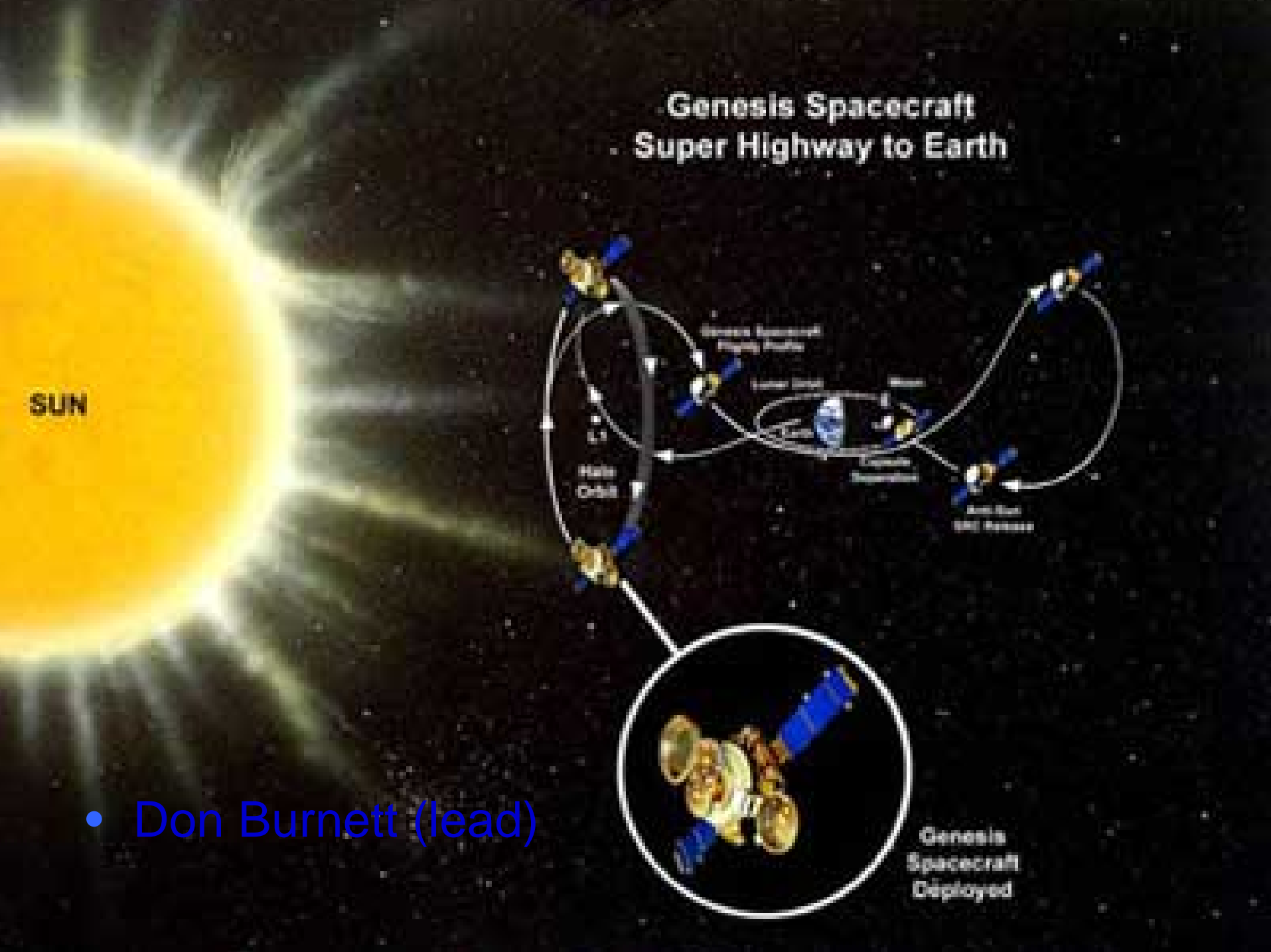
The seeds: Orbit design

- J.E. Marsden, W.S. Koon (CDS), M. Lo (JPL) and S. Ross (CDS)

- 3-body dynamics, dynamical channels, interplanetary 'super-highways'



Genesis Spacecraft Super Highway to Earth



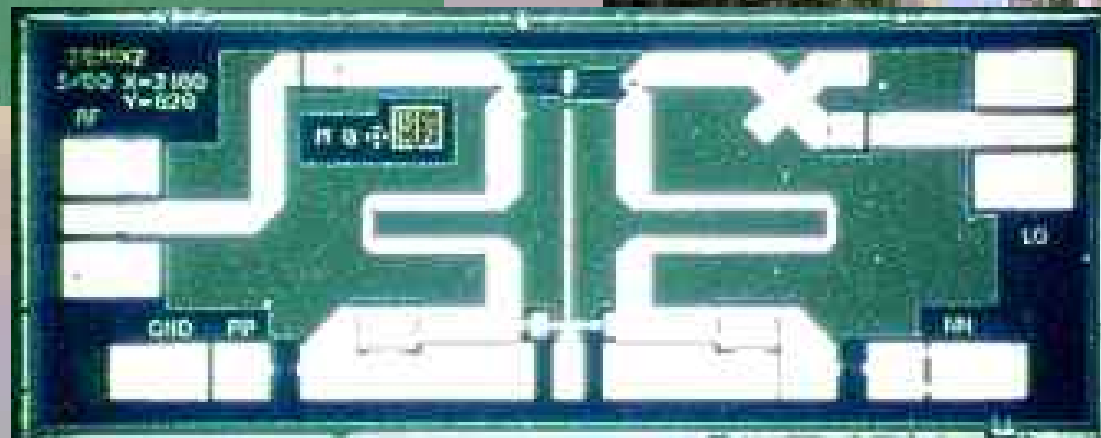
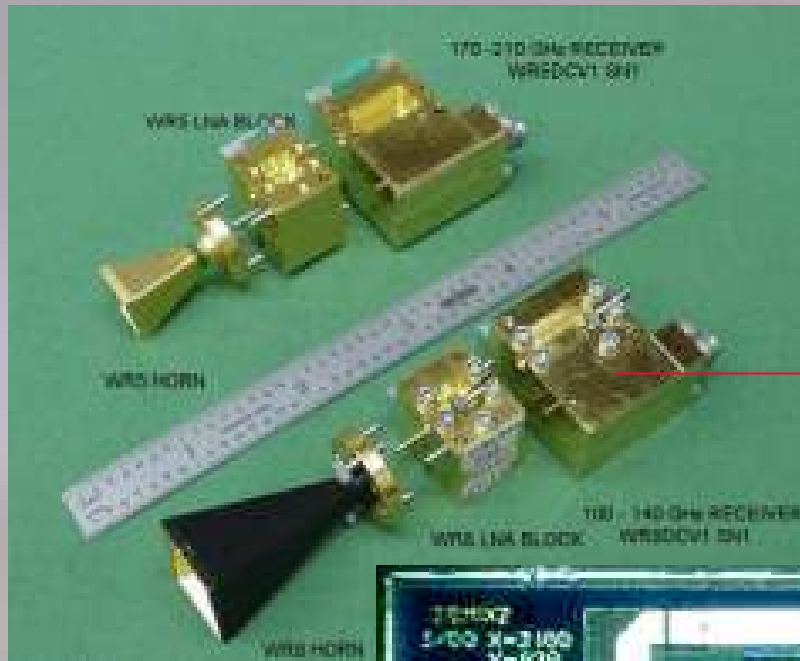
- Don Burnett (lead)

Jupiter Icy Moons Orbiter



The seeds: mm-wave sensors

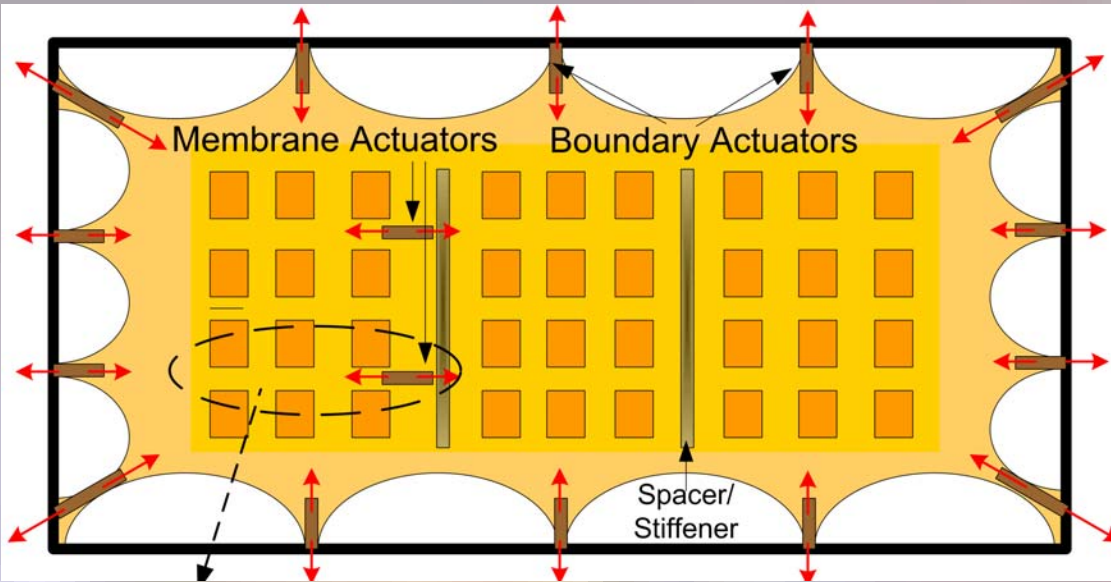
- D.B. Rutledge + S. Weinreb (JPL)
- Monolithic Millimeter-Wave Integrated Circuits



Interior of
100-140-
Receiver

The seeds: Large-aperture systems

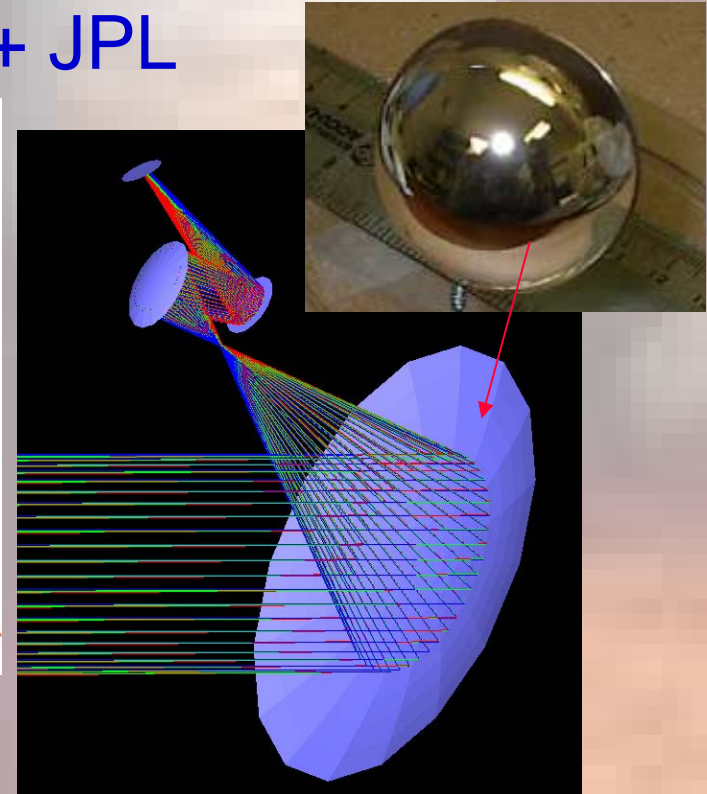
- M. Ortiz, F. Cirak (CACR) + JPL



Adaptive control of phased array using:
1- Mechanical control
2- Electrical control



Inflatable antenna experiment



Rigidized membrane telescope system

The seeds: Ae/CDS 125abc

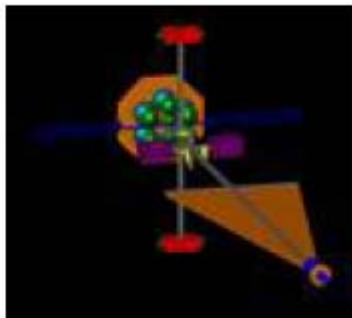
- Ae/CDS 125. Space Missions and Systems Engineering



LABORATORY FOR SPACECRAFT AND MISSION DESIGN

- C. Peterson (director), J. Sercel (JPL)

Ae 125 Final Projects



ODYSSEY (2003)

The class of 2002-2003 proposed a new Age of Exploration enabled by a fleet of reusable, piloted spaceships. Their study includes a program outline and a design concept for the first two spaceships in the fleet. Their presentation can be viewed **as an MS PowerPoint file.**

The seeds: Ae 107

- **Ae 107. Colonization and Industrialization of Space**



LABORATORY FOR SPACECRAFT AND MISSION DESIGN

- C. Peterson (director), J. Sercel (JPL)

Ae 107 Final Projects

Heliopolis (2002)

The first Ae 107 class re-investigated the O'Neill colony concept, and proposed a multi-faceted program to develop the lunar surface, harness asteroids, and construct a colony in near-Earth space to begin a space-faring civilization. Their final presentation can be viewed **as a PDF file**, or view the executive summary **as a PDF file**.

The Space Initiative: Model I

- CIMMS: Center for Integrative Multiscale Modeling and Simulation
- ~ 14 faculty + students
- Founded on seed money from division to foster synergistic interaction between faculty interested in complex phenomena across multiple time and length scales
- Led to a successful NSF/ITR proposal, founding of new SIAM Journal
- The center has been a focal point of intellectual activity through seminars, workshops and collaborative research

The Space Initiative: Model II

- Institute-wide intellectual, educational and outreach initiative (e.g., IST Initiative)
- Interdisciplinary Research Centers (~4) + JPL
- Development/campaign funding: Brick & mortar, facilities, fellowships, endowed professorships...
- New faculty recruited in the broad area of space science and technology, homes in all divisions
- Programs: Workshops, symposia, short courses, winter and summer schools, industry conferences
- Coordinated academic programs related to space

...The case for a space initiative

“Our job is to move the frontier”

“We are going to pick the missions which are really difficult to do, almost at the edge of impossible”

Charles Elachi, JPL Director, in: “Mission Impossible: Charles Elachi’s Vision”,
Space.com, 08 August 2001