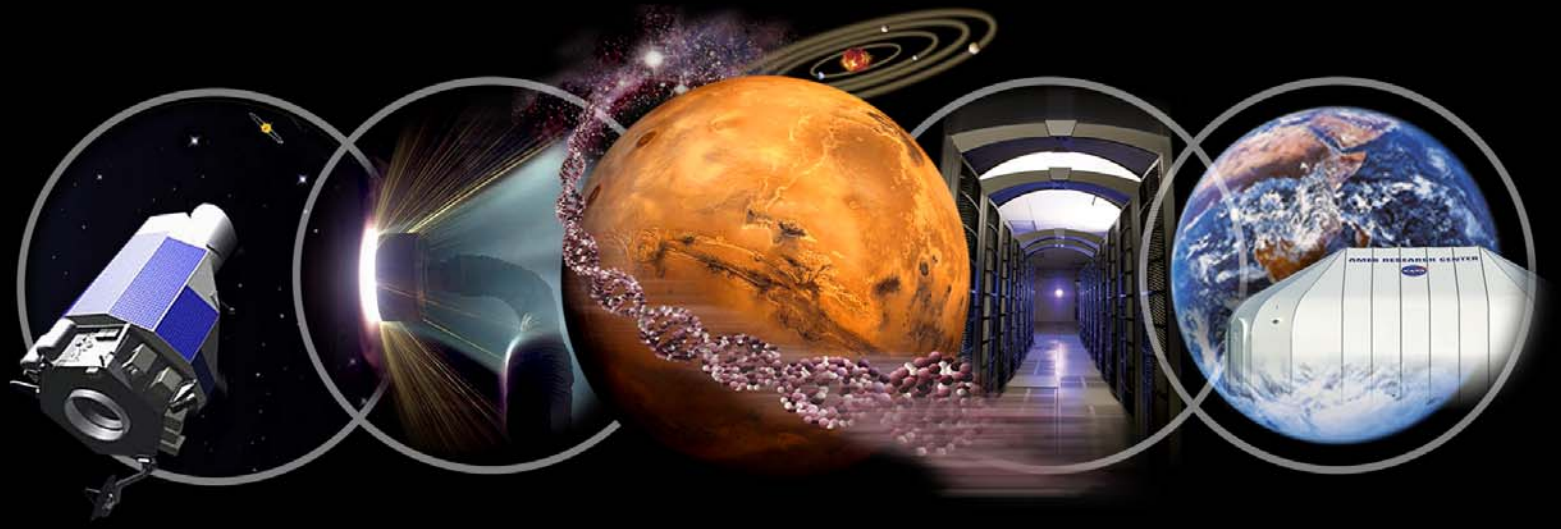
Discovery ➲ Innovation ➲ Solutions



Entry Probe Workshop

G. Scott Hubbard
NASA Ames Center Director

August 23 , 2004

Visibility ➲ Excellence ➲ Impact

Ames Research Center


The NASA Vision
To extend life to there,
To find life beyond.
The NASA Mission
To understand and protect our home planet
To explore the universe and search for life
To inspire the next generation of explorers
...as only NASA can

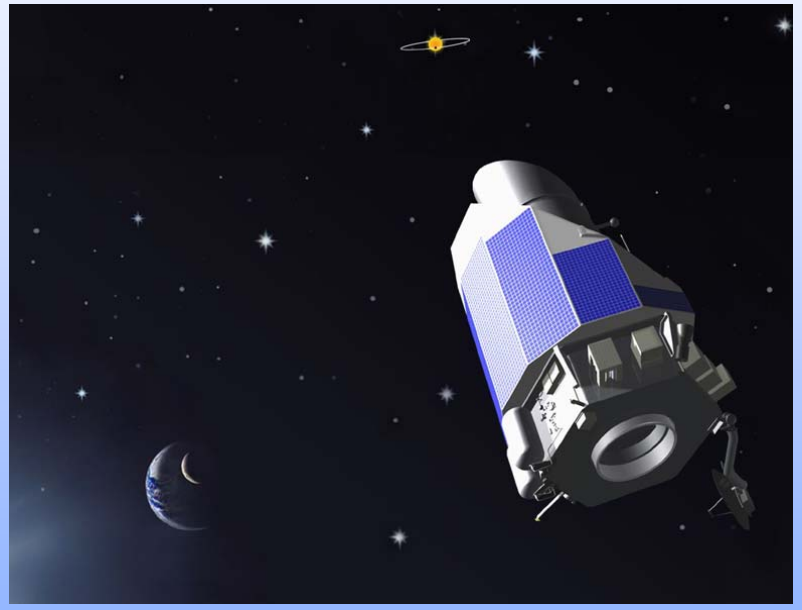
The Vision for Space Exploration

- ***Implement*** **sustained & affordable human/robotic program to explore the solar system and beyond**
- ***Extend*** **human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations**
- ***Develop*** **the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration**
- ***Promote*** **international and commercial participation in exploration to further U.S. scientific, security, and economic interests.**

To explore the universe and search for life: Probes in Context

To fully understand the potential for life elsewhere in the universe, we must first understand the origins and evolution of our own solar system planets.

Probes are needed for full the comparative planetology that will help us understand the data from extra solar planet studies.



Kepler: The Search for Habitable Planets

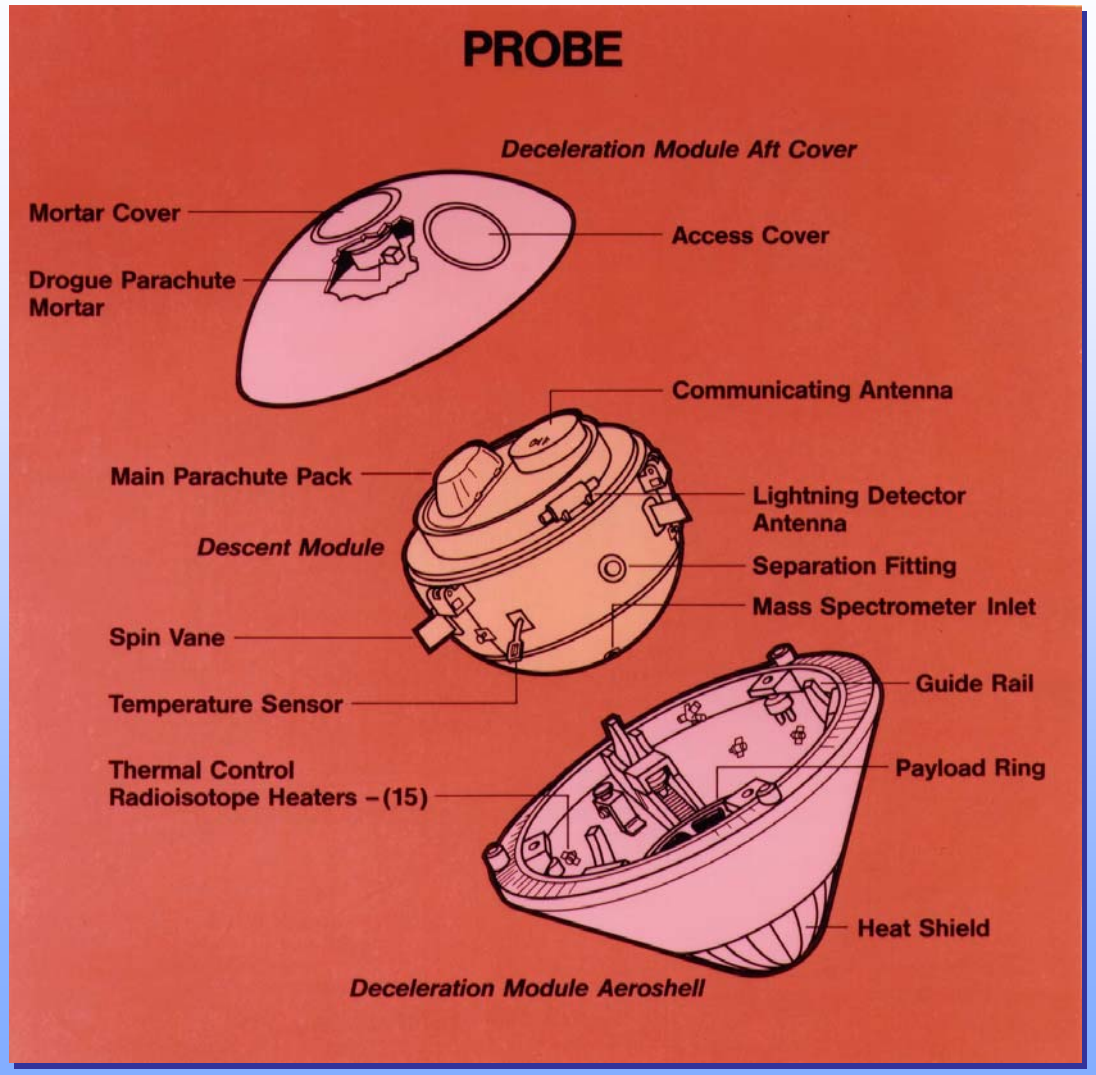
A Discovery class mission on track to launch in '07. Kepler will survey ~ 100,000 stars to detect planets, including terrestrial planets, and determine if they are in the habitable zone

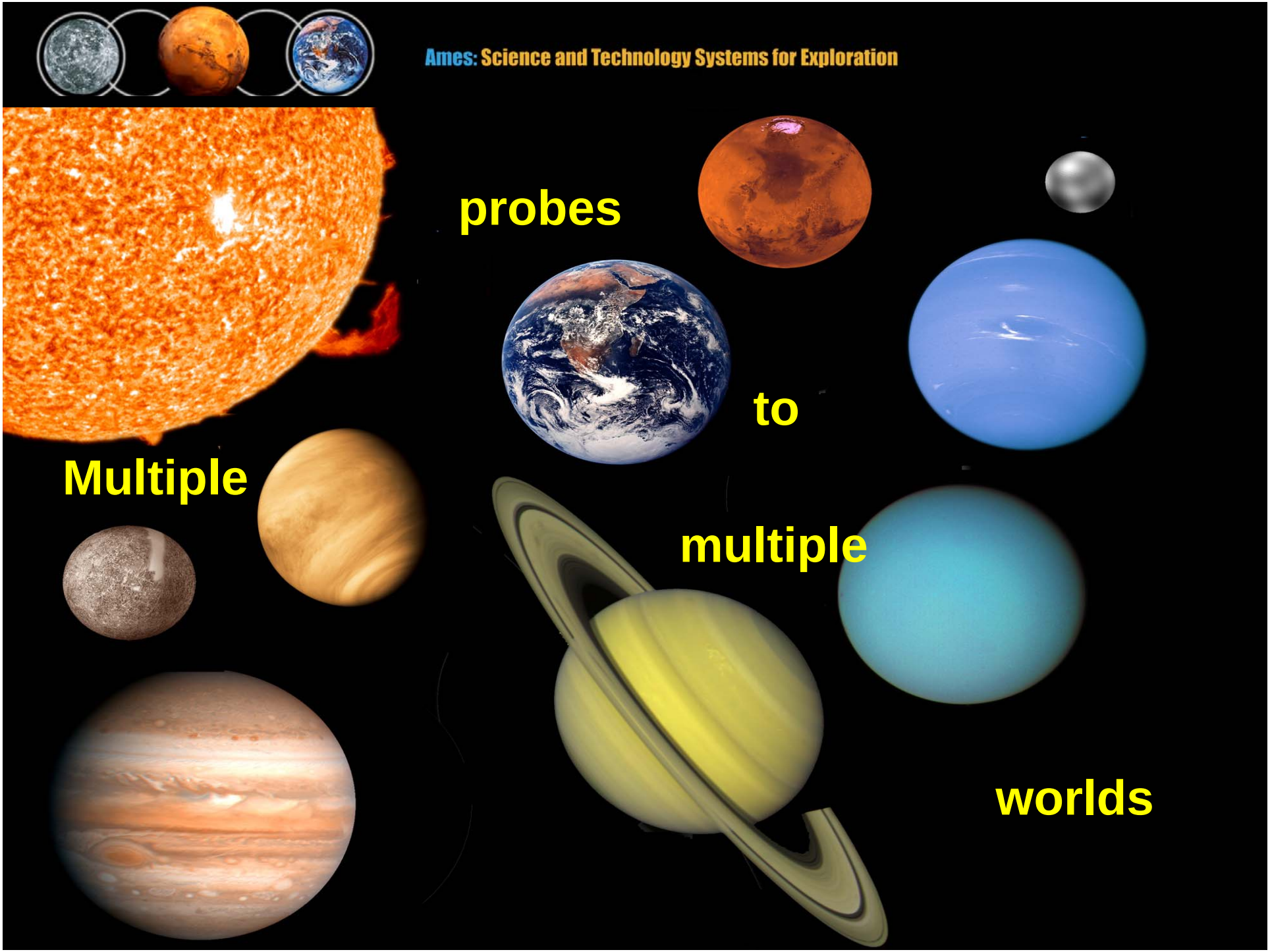
Terrestrial Planet Finder

Two missions planned to launch within the next 10 to 15 years. Observing extra-solar planets in both visible and infrared light will greatly enhance understanding of whether a planet ever could or actually does harbor life.

What is a probe?

Galileo Probe




Ames: Science and Technology Systems for Exploration
probes
to
Multiple
multiple
worlds

NASA Ames Research Center-founded 1939

Basic Science (Earth-Life-Space): Astrobiology- the study of life in the universe

Major Projects

- Stratospheric Observatory For Infrared Astronomy
- Kepler Mission-Search for Habitable Planets
- Space Station Biological Research Project

Technology for Science and Exploration

- Information Technology (Autonomy, Human Factors, High-End Computing)
- Nanotechnology
- Bio-Info-Nano Fusion
- Thermal Protection Systems

Aviation and Aeronautics

- Air Traffic Management and Control

Education

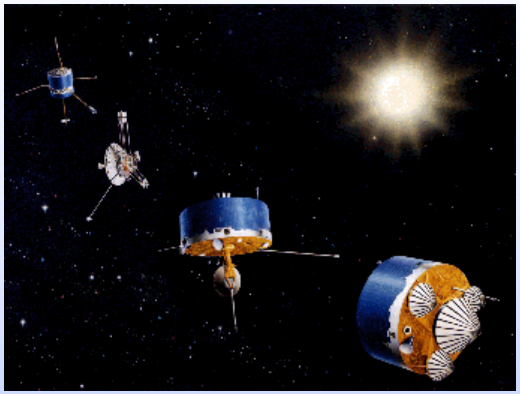
3919 Employees

- (1471 Civil Service/2448 Contractor and Other)

$775+ M Annual Budget

Discovery ➲ Innovation ➲ Solutions

Past & Present: Successful Probes and Fly-by's



The Pioneer 6-11 and Pioneer Venus Program 1965-2003 :

A series of projects considered models of science driven, cost effective missions.

Pioneer Venus multi-probe

Galileo Probe 1995 (entry):

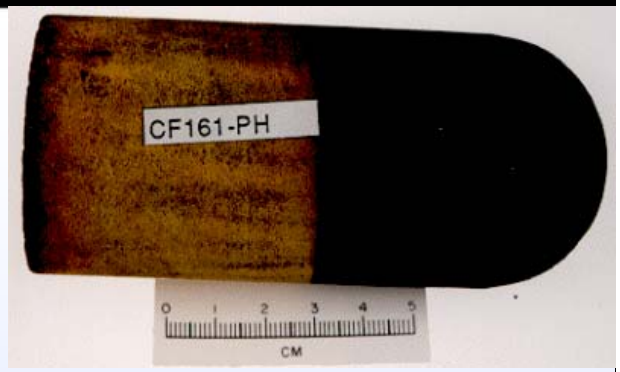
Entered Jovian atmosphere to return first data ever of the interior of Jupiter

Huygens probe

Will descend through the atmosphere of Saturn's largest moon, Titan on January 15, 2005.

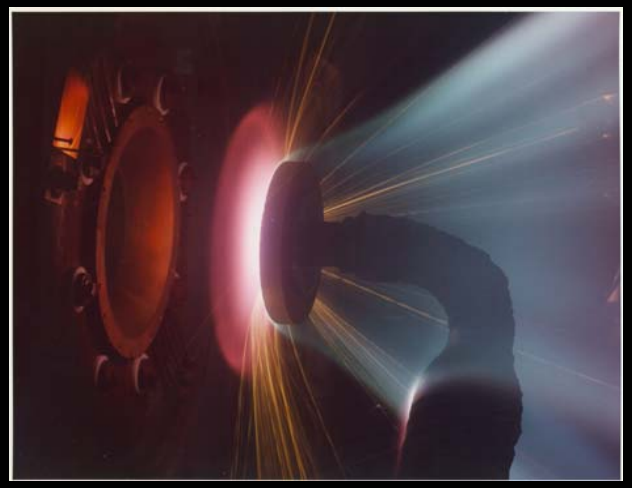
The result of effective international collaboration

Thermal Protection Materials and Arc-Jet Facility



PICA: A posttest sample of Phenolic Impregnated Carbon Ablator or PICA, used in the thermal protection system of the Stardust mission

Testing and materials for Mars Pathfinder and Mars Exploration Rovers
Support for Shuttle, and future human vehicles



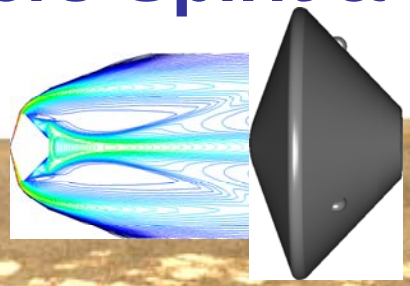
Ablative TPS Testing

Panel Test in the AHF

Lost tile test for Shuttle Orbiter

Mars Exploration Rovers-Spirit & Opportunity

Ames' Contributions



TPS system validation

Science discovery
3 Co-Investigators from Ames

- David Des Marais
- Natalie Cabrol
- Michael Sims

Technology & Major Facilities Enabled the Mission

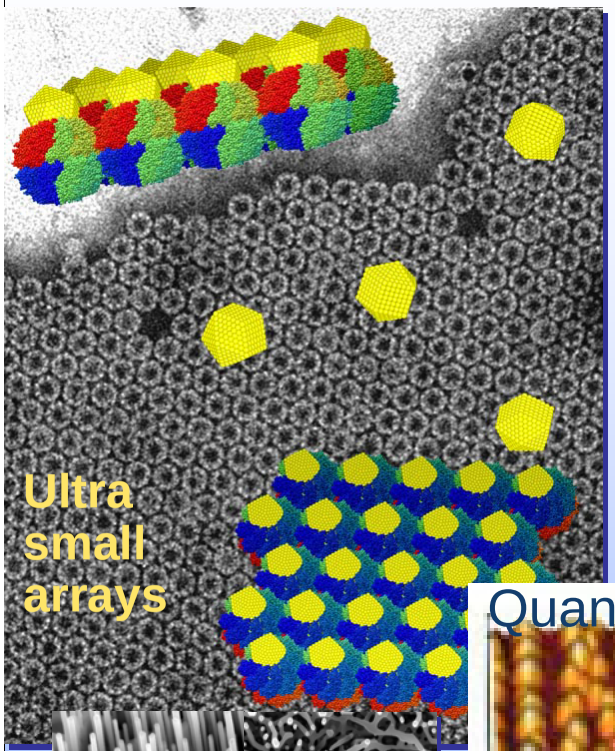
- Thermal Protection Systems and Arc Jet Testing
- Wind tunnel parachute testing
- Mission systems software tools
- Human Factors/Mars Time

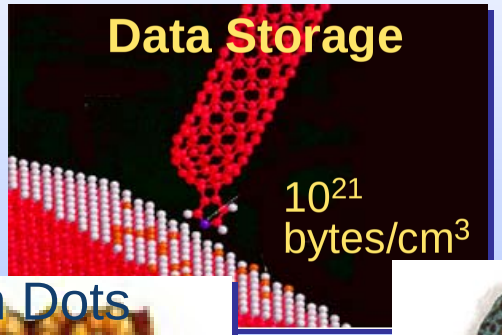
MER Parachute Testing in 80 by 120 foot Wind Tunnel

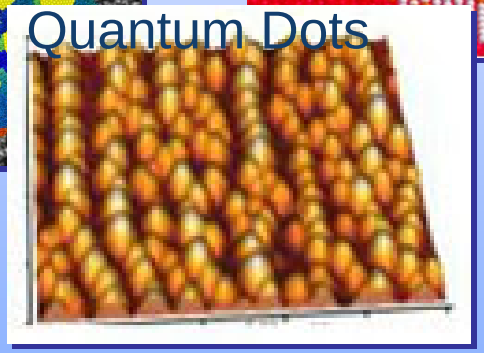
Science & Engineering Collaboration Tools

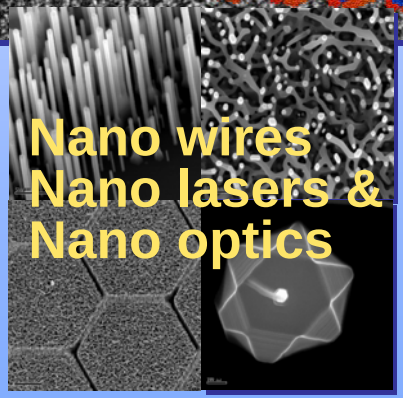
Bio/Info/Nanotechnology

"*NASA Ames* - One of the largest single nanotechnology research centers in the world."*









Gecko Feet Adhesive

* January 20, 2004 "Nanoscience and Nanotechnology: Opportunities and Challenges in California" report prepared by the California Council on Science and Technology for the state legislature.

Technology for Exploration

Applications in nanotechnology

Established World Class base for future revolutionary capabilities

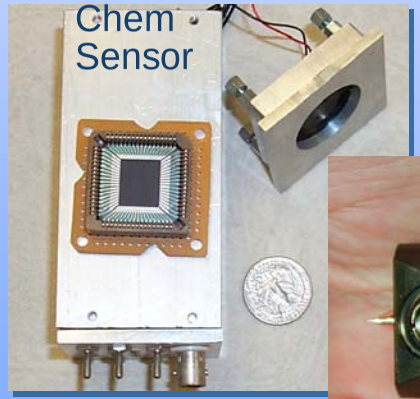
-Next Generation thermal, radiation, & impact protective systems

-Highly efficient life support systems

-Extremely sensitive & selective life detection sensors

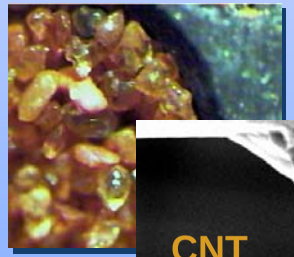
Developed:

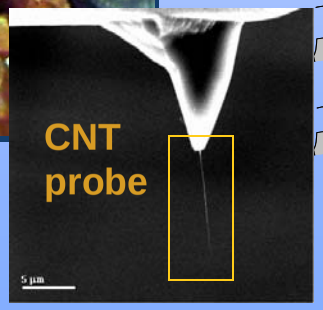
- Carbon nanotube (CNT) based Chemical sensor
- X-ray tube for soil analysis instrument to fly on Mars-09 mission
- Probe for atomic force microscope to analyze Martian dust
- Nanotube-copper composite for advanced thermal control in space



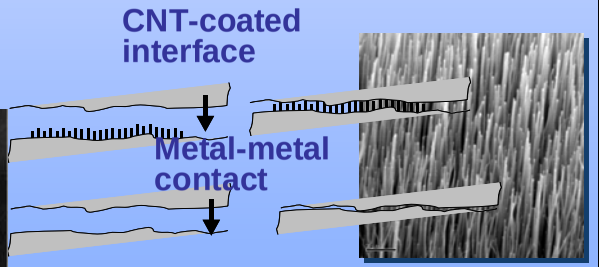
X-ray tube

CNT tips on Atomic Force Microscopes…





…may go to Mars



Thermal interface

Award Winning* NASA Research Park

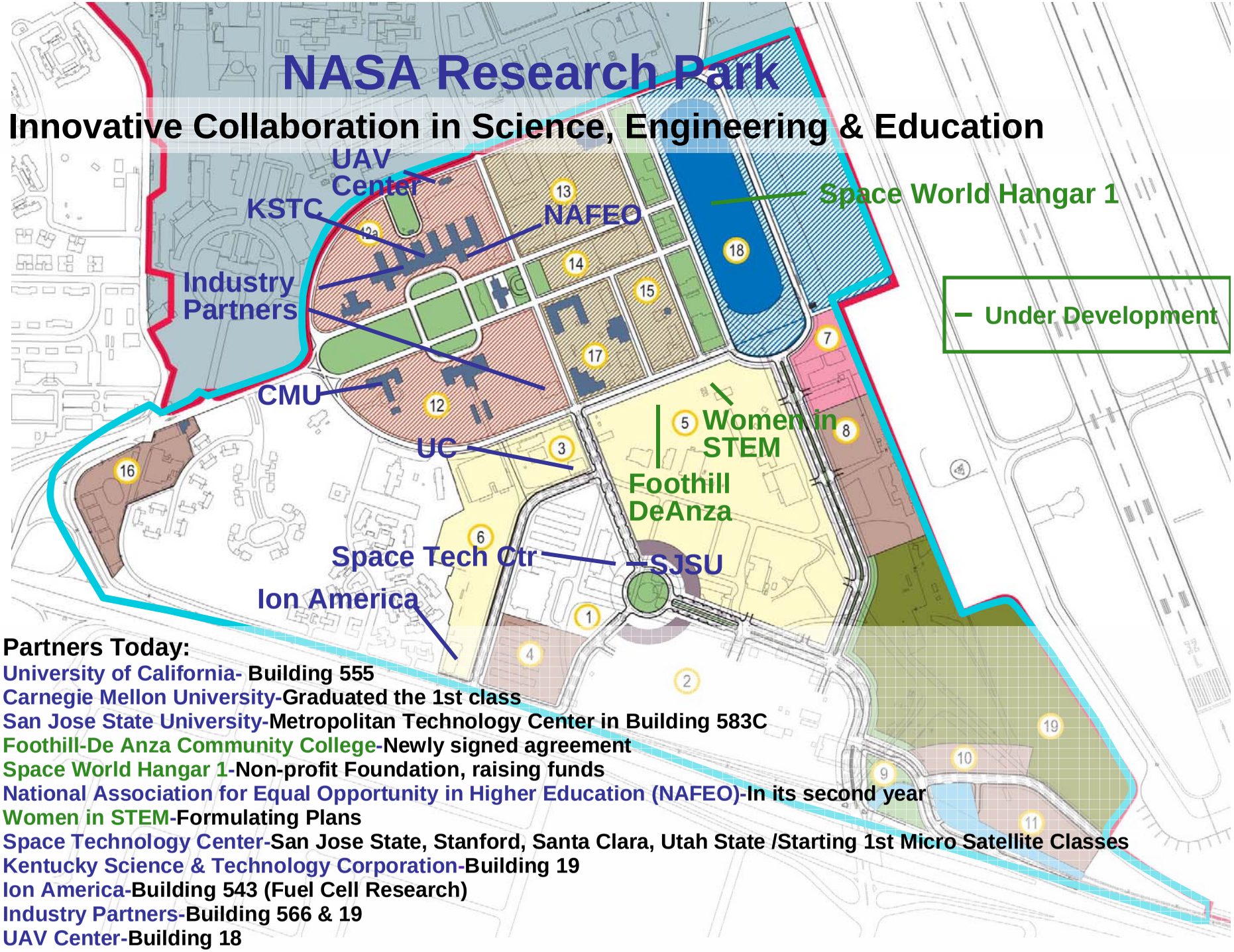
"NASA Research Park partnerships permit NASA to achieve a high return on its investment dollar"

-National Research Council review of NRP

***2003 GSA Award for Best Use of Federal Property**

NASA Research Park

Innovative Collaboration in Science, Engineering & Education



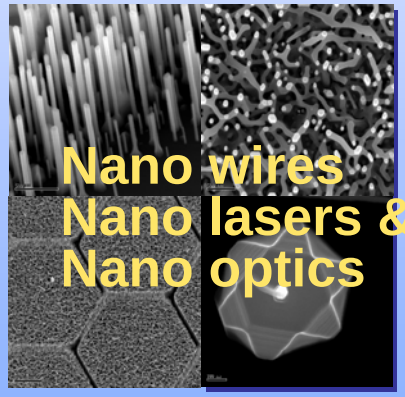
Partners Today:

University of California- Building 555
Carnegie Mellon University-Graduated the 1st class
San Jose State University-Metropolitan Technology Center in Building 583C
Foothill-De Anza Community College-Newly signed agreement
Space World Hangar 1-Non-profit Foundation, raising funds
National Association for Equal Opportunity in Higher Education (NAFEO)-In its second year
Women in STEM-Formulating Plans
Space Technology Center-San Jose State, Stanford, Santa Clara, Utah State /Starting 1st Micro Satellite Classes
Kentucky Science & Technology Corporation-Building 19
Ion America-Building 543 (Fuel Cell Research)
Industry Partners-Building 566 & 19
UAV Center-Building 18

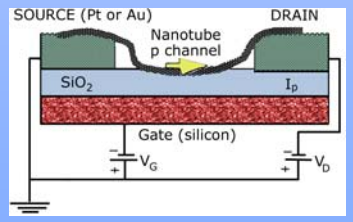
Where we need to go

- Broader Collaborations
- Growing infrastructure
- Multiple micro/nano probes
- Longer lived surface probes
- Integrated new technologies

Pascal: a multi micro probe concept for Martian weather stations

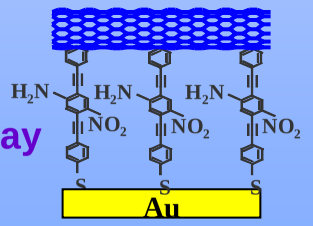


Nano materials: advanced nano materials my offer solutions to surviving high pressure, high temperature environments



Carbon Nanotube Transistors

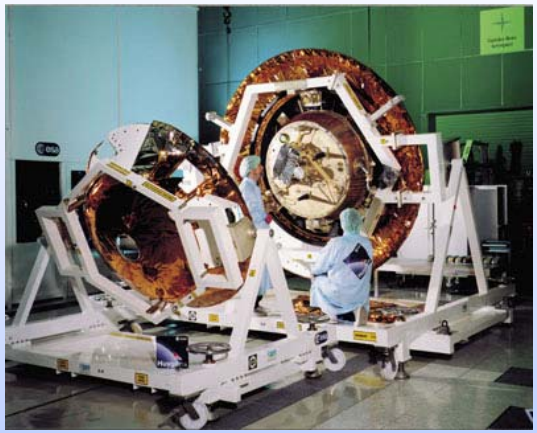
Molecular Electronic Memory Array



Nano instruments: ultra small, ultra light instruments will make it all possible

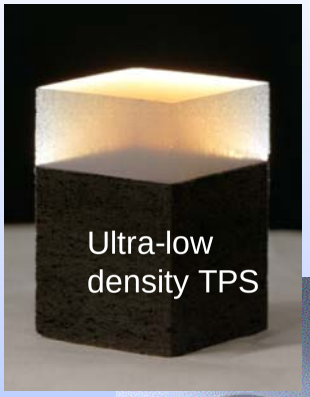
The Future: Pico Probes

new materials,
&
nanotechnologies

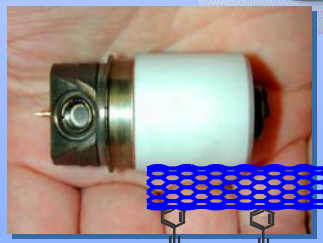


Today: Huygens probe:
> 318 kg

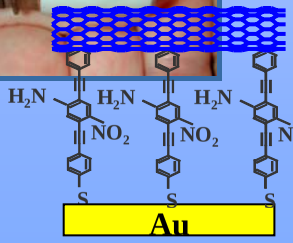
\+



Next Generation of Light Weight Ceramic Ablators (LCA)



Ultra-small instruments



Nano-electronics

=

Scale of future "pico" probes

<1kg