Funding Opportunities for *In Situ* Instruments

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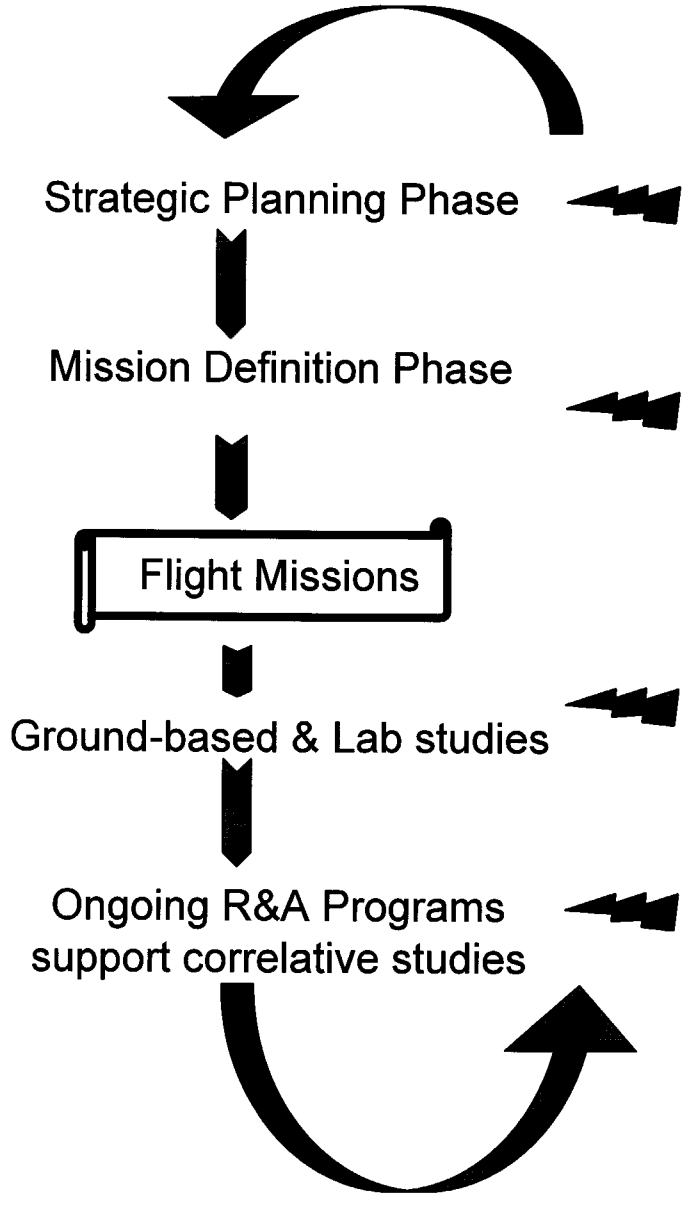
Topics

- Strategic value of instrument Supporting Research and Technology (SR&T) programs
- NASA's Technology Readiness Levels
- Instrument development programs
  - PIDDP
  - MIDP
  - ASTID
  - ASTEP
- Mission opportunities
  - Discovery, Mars Scout, Smart Lander
- If you want to work with JPL…

SR&T Role in Exploration of the Solar System



R&A contributions

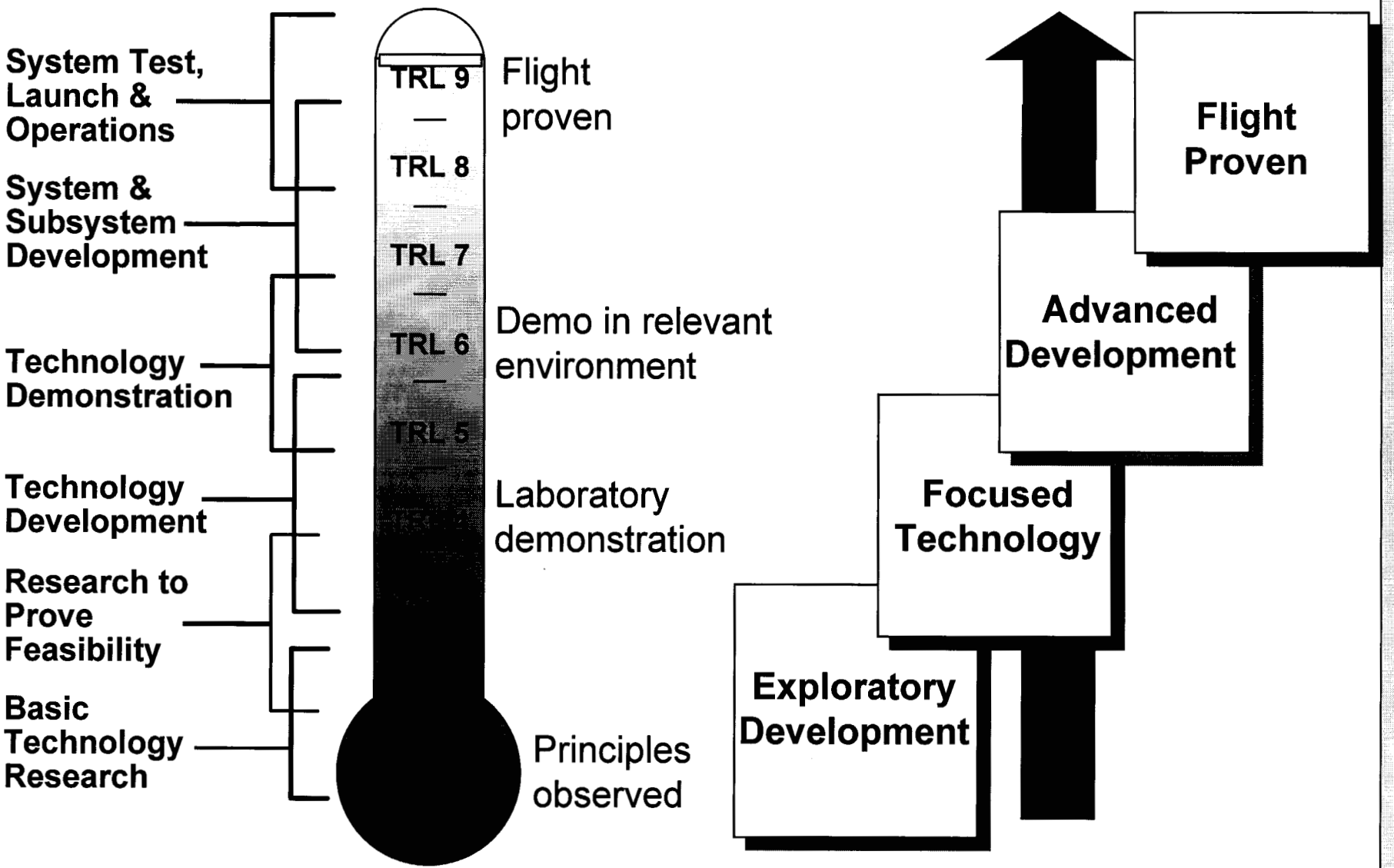
Theoretical modeling, identifies new knowledge needed, defines program gaps

Modeling and correlative studies of prior mission data to help define detailed mission requirements and constraints

Ground-based observations provide vital space and time context. Lab studies provide fundamental data.

Detailed studies of mission data support next cycle and justify missions that further knowledge in Solar System science. Instrument development programs enable new capabilities. Space Science Data System archives data and provides documented data to investigators.

NASA's Technology Readiness Levels



Solar System Exploration

NASA NRAs for In Situ Instrument Technology Development

The following solicitations exist to fund proposals for the development of in situ instruments

- Code S
  - Planetary Instrument Definition and Development Program (PIDDP)
  - Mars Instrument Development Program (MIDP)
  - Mars Fundamental Instrument Research Program (FY03 new)
  - Astrobiology Science & Technology Instrument Development (ASTID)
  - Astrobiology Science & Technology for Exploring the Planets (ASTEP)
- Code U
  - Advanced Human Support Technology
  - Biomolecular Systems Research Program
- Code R
  - Advanced Measurement and Detection

Strategic Importance of the SR&T Programs in Code S

ORIGIN AND EVOLUTION OF SOLAR SYSTEM BODIES

Cosmochemistry

- Study the chemical building blocks of small bodies, planets, and life through laboratory research on extraterrestrial materials

Planetary Geology and Geophysics

- Understand surfaces, interiors, satellites and rings
- Determine and constrain the processes of planet formation and evolution

Origins of Solar Systems

Mars Data Analysis

PLANETARY SYSTEMS SCIENCE

Planetary Astronomy

- Inventory and assay the physical building blocks of planetary systems
- Observe and model large-scale planetary processes

Planetary Atmospheres

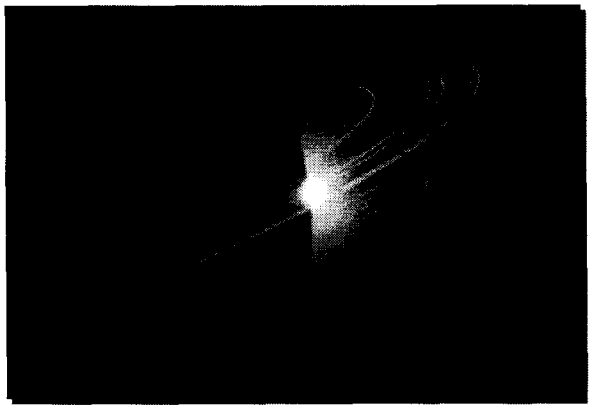
- Understand atmospheric chemistry and dynamics and the implications for life
- Model and study planetary climate evolution

Near Earth Objects (NEO's)

- Inventory and characterize Near Earth Objects larger than one km

Mars Fundamental Research

- XXXX



ASTROBIOLOGY AND PLANETARY INSTRUMENTATION

Exobiology

- Seeks to understand the origin, evolution, & distribution of life in the universe

Planetary Major Equipment

- Upgrading analytical, computational, telescopic, and other instrumentation required by investigations

Planetary Instruments Definition and Development Program (PIDDP)

- Develop new space-based instrument technology

Mars Instrument Development Program (MIDP)

- XXX

Astrobiology Science & Technology Instrument Development (ASTID)

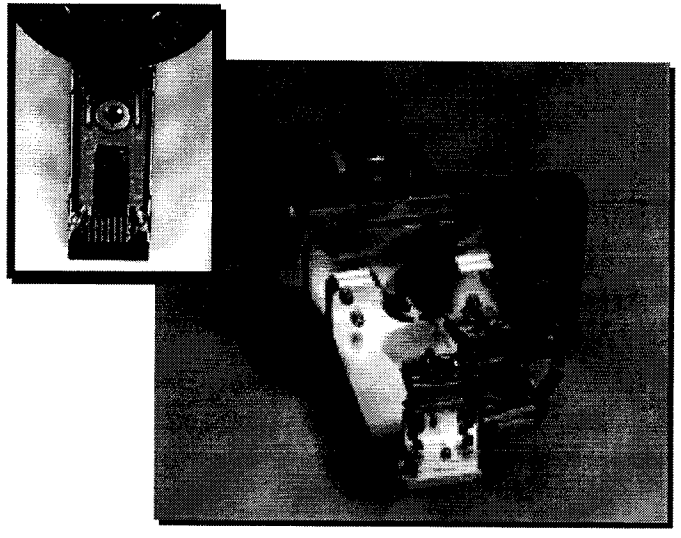
- XXX

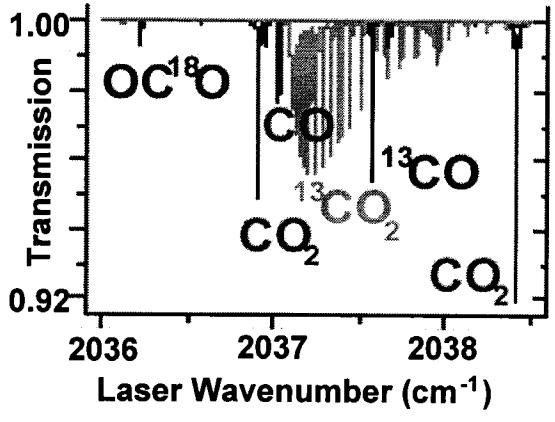
Astrobiology Science & Technology for Exploring the Planets (ASTEP)

Planetary Instrument Definition and Development Program

PIDDP supports the advancement of spacecraft instrument technology to breadboard stage (TRL 4)

- Goal: Develop promising planetary instrumentation candidates through breadboard validation in a laboratory setting
- Targets: Discovery, Mars Surveyor >2007, Mars Scout missions, Outer Planets
- Areas of focus (excludes astrobiology):
  - Optics and imaging systems for remote
  - Geophysics, radio, particles and fields
  - In situ instruments
    - age dating
    - soil/rock mineralogy & chemistry
    - water/ice detection & characterization
    - drilling/coring
    - atmospheric chemistry



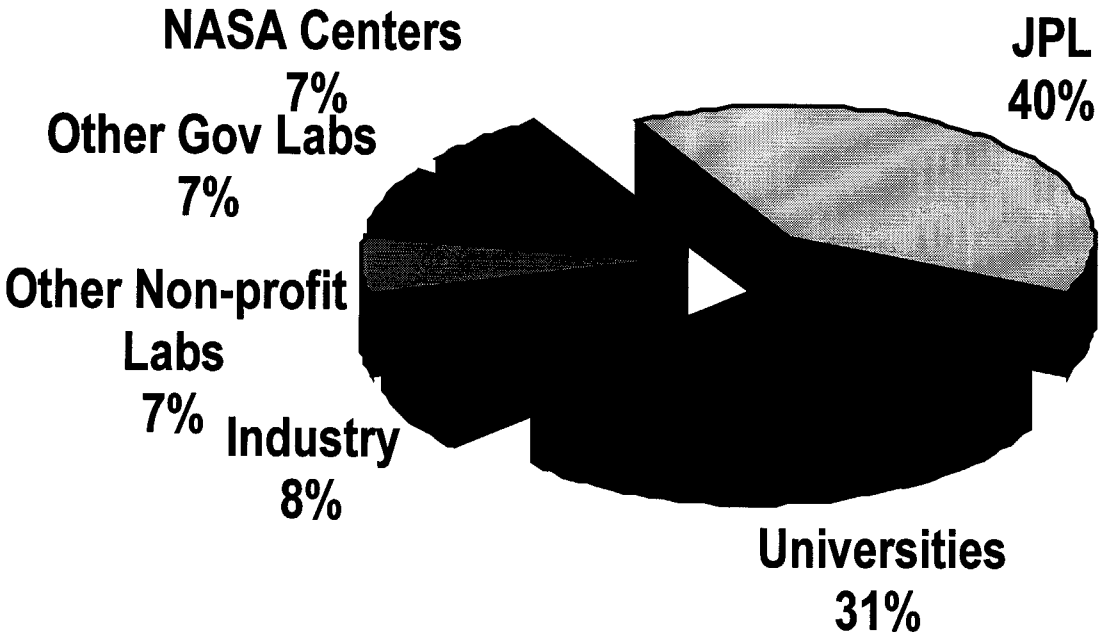


~$6M/yr, ~$200K per investigation

Solar System Exploration

PIDDP Community

NASA engages the outside community in instrument technology development and evaluation.



- In 2001—
  - 53% of the PIDDP awards went to non-NASA investigators
  - the PIDDP review panel consisted of 25% academics, 20% industry, 35% NASA, 20% non-NASA government

PIDDP's Impact on Flight Hardware

Most instruments flown on planetary missions over the last 20 years have some PIDDP heritage.

- Example missions with PIDDP-derived instruments
  - Cassini Orbiter
  - Cassini-Huygens probe
  - Comet Nucleus Tour (CONTOUR)
  - Deep Space I
  - Deep Space 2 microprobes
  - Hubble Space Telescope
  - Mars '96 (Russian, ill-fated)
  - Mars Climate Orbiter
  - Mars Exploration Rovers
  - Mars Global Surveyor
  - Mars Odyssey
  - Mars Observer
  - Mars Pathfinder
  - Mars Polar Lander
  - Mars Reconnaissance Orbiter
  - MESSENGER
  - NEAR
  - Netlander
  - Rosetta (ESA)

Mars Instrument Development Program

MIDP supports the advancement of spacecraft instrument technology to systems-level simulations (TRL 6)

- Goal: Develop instruments to the point of systems-level simulated rover or lander operations under realistic conditions.
- Targets: Mars Scout, Mars Smart Lander, >2007 Mars missions
- Areas of focus (excludes astrobiology):

  - sample acquisition (grabbing, coring, chipping, caching)

  - In situ analysis

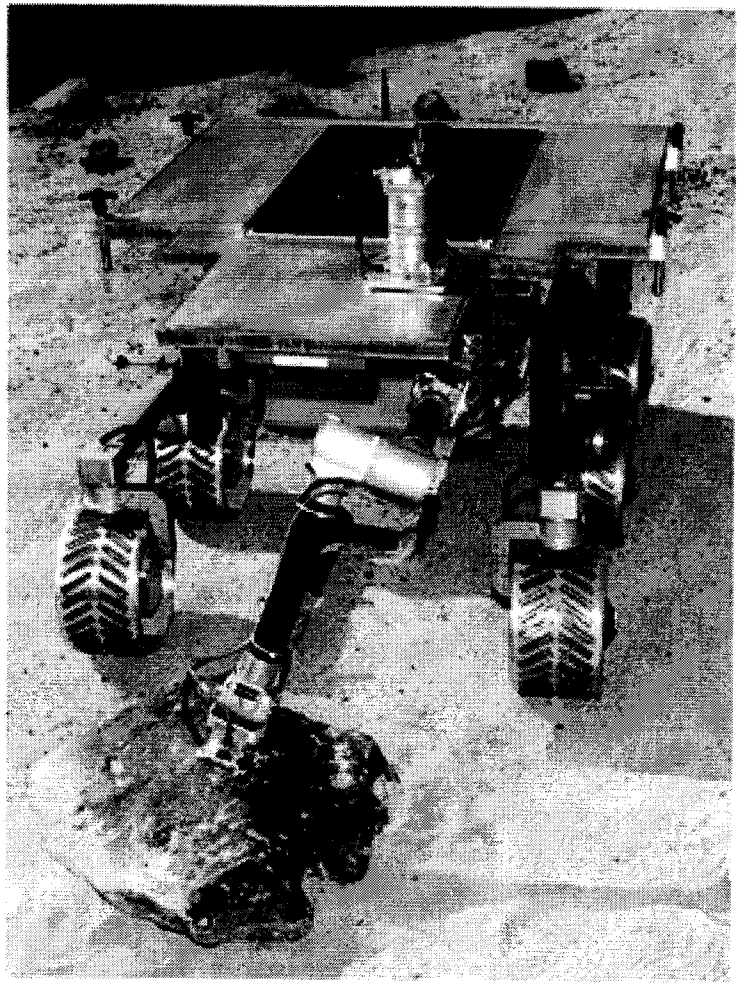
  Environmental (T, P, wind velocity, dust loading, water vapor flux, atm isotopes

  Subsurface ice/water

  High resolution imaging, microscopy

  Soil/rock compositon & mineralogy

  Oxidants, organics, heat flow, seismic.....



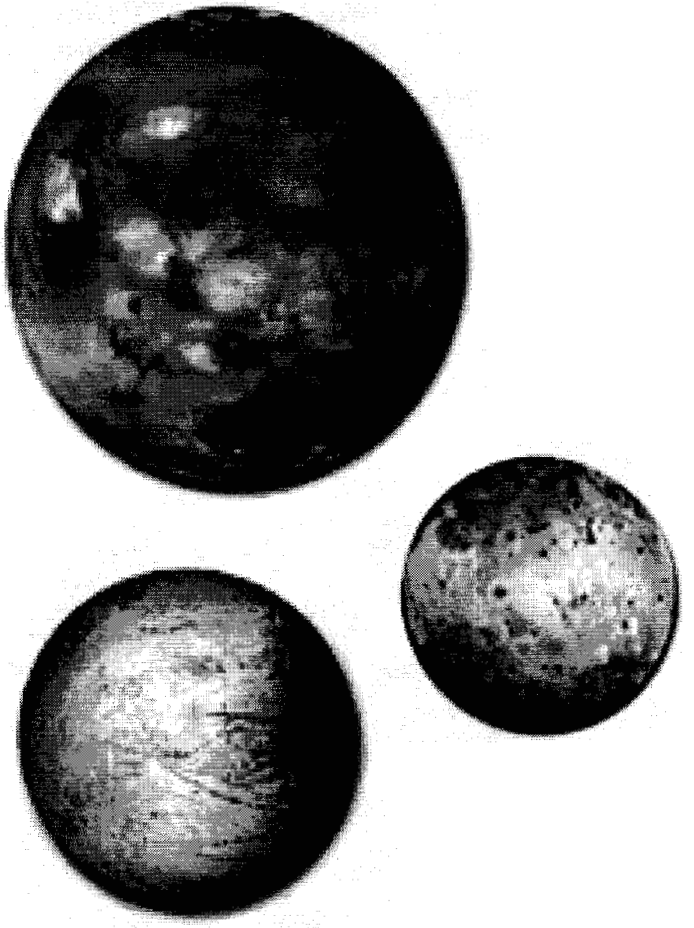
~$6M/yr, ~$350K per investigation

Astrobiology Science & Technology Instrument Development

ASTID supports the development of instruments that will help meet astrobiology goals for space missions (TRL 1–6) and Earth-based studies.

- Goal: Feasibility through brass-board level support for new instrument concepts for astrobiology
- Targets: Mars, comets, Europa, Titan, Io
- Areas of focus:

- detection of biomarkers; isotopic/organics
- novel access technologies; aseptic drilling
- physical/chemical factors that might indicate life
- Non-flight instruments for Earth-based research to understand the limits and constraints of life in extreme environments



~$5M/yr, $200–300K per investigation

Astrobiology Science & Technology for Exploring the Planets

ASTEP supports systems-level field campaigns to demonstrate and validate astrobiology science & technology in extreme environments.

- Goal: Conduct exciting astrobiology research in extreme environments as planetary analogs. Validate systems in high-fidelity field tests.
- Examples:

  Mars—deserts, hot springs, volcanoes

  Europa—Lake Vostok, Chernobyl, black smokers

- Areas of focus:

- detection of biomarkers; isotopic/organics
- novel access technologies; aseptic drilling
- physical/chemical factors that might indicate life
- Non-flight instruments for Earth-based research to understand the limits and constraints of life in extreme environments

~$5M / 12M / 18M for FY02/03/04 (steady thereafter)
$1M per year awards for field work

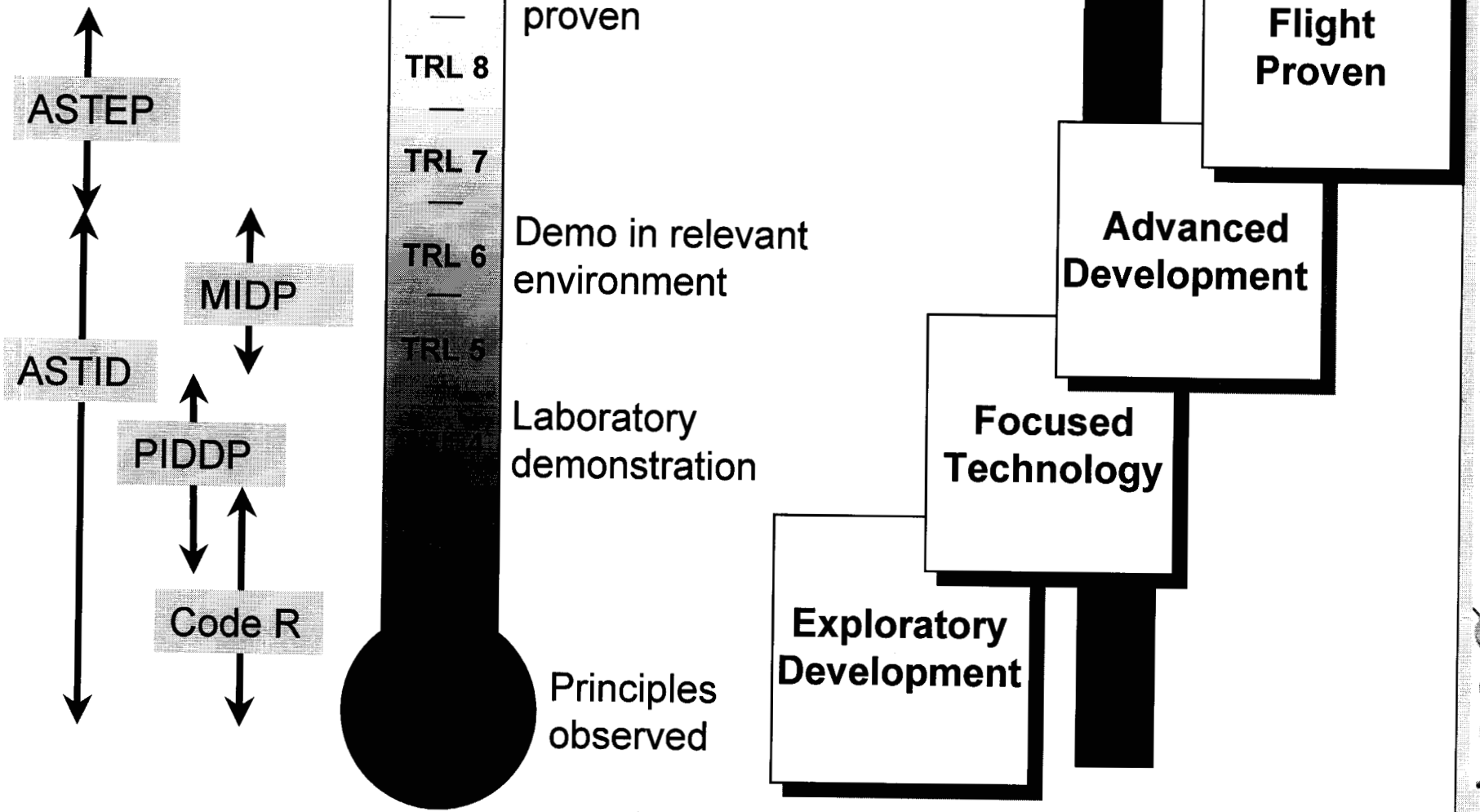
Solar System Exploration

Other NASA Funding

ASTEP supports systems-level field campaigns to demonstrate and validate astrobiology science & technology in extreme environments.

- Code R (Office of Aerospace Technology)
  - Advanced Measurement and Detection
  - BioNano Technology for Sensors
  - Focus on component technologies
  - Low TRLs 1–3 (through proof-of-concept)
  - Typically $100–200K awards
  - Programs being reorganized; stay tuned to NASA site
- Code U (Office of Biological and Physical Research)
  - Advanced Environmental Monitoring and Control
  - In situ instruments that might be used as part of the human support infrastructure on Space Station
  - $3M/yr program; typically $100–200K/yr awards

Code S Funding Opportunities as f(TRL)



Solar System Exploration

Working with JPL

- JPL can help:
  - Identify a planetary scientist who might be interested In collaborating with you
    - Extent to which it addresses a priority science goal of a mission on the NASA SSE roadmap
    - Applicability to multiple missions
  - Identify a technologist who might be interested in collaborating with you
- JPL internal funds for outside collaborations
- Contacts
  - CISSR director, Pat Beachamp
  - CISSR technologist, Greg Bearman
  - JPL's "In Situ Experiments & Technology" Section, Paula Grunthaner
  - Firstname.lastname@jpl.nasa.gov

JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

To: Document Review

Subject: Author Certification for Oral Presentation/Poster Session Paper

Title of Abstract for Presentation/Poster Session Paper:

Funding Opportunities for In Situ Instruments

Conference/Meeting:

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Date(s)/Location:

June 11-13, 2001; Pasadena, CA

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