International Planetary Probe Workshop

Presentation to OPAG

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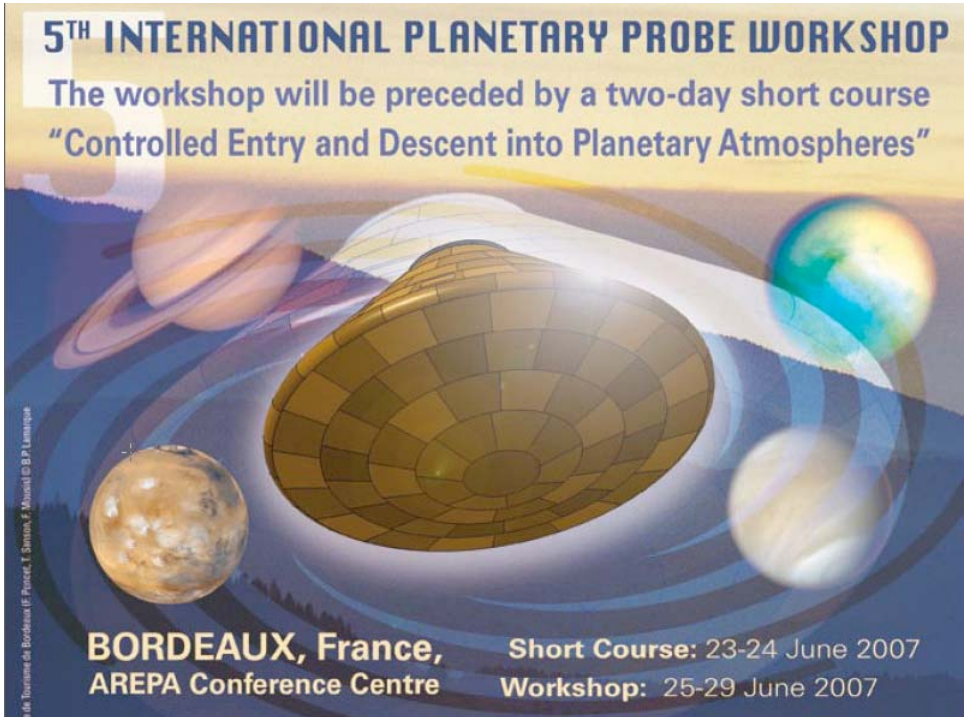
Topics

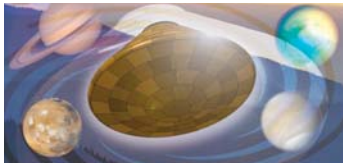
- **International Planetary Probe Workshop - Goals**
- **Fifth International Planetary Probe Workshop (IPPW-5)**
  - Held in Bordeaux, France, June 23-29, 2007
- **Sixth International Planetary Probe Workshop (IPPW-6)**
  - Will be held in Atlanta, Georgia, June 21-27, 2008

International Planetary Probe Workshop - Goals

- ***To Review*** **the state-of-the-art in science, mission design, engineering implementation and technology for the *in situ* robotic exploration of planets and satellites with atmospheres**
- ***To Share*** **ideas, mission opportunities, and emerging technologies to enable future mission success**
- ***To Serve*** **as a forum for discussions on innovative methodologies and techniques for future probe missions**
- ***To Involve*** **young scientists and engineers in the field of entry, descent and flight in planetary atmospheres in an opportunity to learn from experienced researchers and practitioners**
- ***To Foster*** **international collaboration among the communities of scientists, engineers, and mission designers interested in planetary probes.**

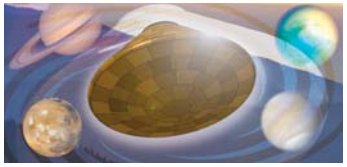


IPPW-5 Overview



- **Held in Bordeaux, France**
  - 23 June – 29 June 2007
    - 23-24 June: Short Course
      Controlled Entry And Descent Into Planetary Atmospheres
    - 25-29 June: Workshop
- **9 sessions and posters**
- **Attended by 200 scientists, engineers, students and policy makers**
  - NASA centers and US industries
  - ESA and European industries
  - Research facilities throughout the world
  - Educators and students from
    - 8 US universities
    - 9 universities in Europe and Asia

Short Course: Controlled Entry And Descent Into Planetary Atmospheres



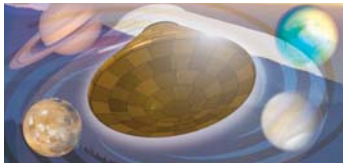
Day One - Lectures

1 Introduction
2 Separation and Arrival
3 Reference Atmospheres and Their Use
4 The Entry Phase
5 Impact of Atmospheric Composition on Science and Engineering
6 Impact of Atmospheric Electricity on Probes
7 Descent
8 Communications and Tracking

Day One – Four Parallal Case Studies

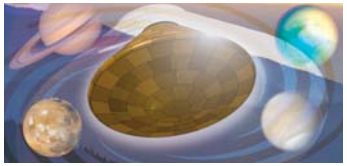
1 Venus Lead: Tibor Balint (JPL) and Colin Wilson (Oxford)
2. Mars Lead: Kim Reh (JPL) and Craig Peterson (JPL)
3. Titan Lead: Ralph Lorenz (JHU APL)
4. Saturn Lead: Tom Spilker (JPL)

IPPW-5 Sessions



No	Topic
I	Current Outlook
II	Mission Concept Studies, and Science Drivers of Technology and Sample Return - Venus and Mars
III	Entry, Descent and Landing Concepts for Current and Future Missions Beyond Earth
IV	Technology Systems, Electronics, Instruments and Sensors, Communications and Batteries
V	Mission Concept Studies and Science Drivers ff Technology - Giant Planets and Titan
VI	Entry, Descent, and Landing Technologies for Planetary Missions
VII	Emerging, Enabling, and Extreme Environment Technologies; Cross-Cutting Technologies
VIII	Earth Entry, Descent and Landing for Sample Return and Crewed Missions
IX	Future Outlook

IPPW-5 Highlights

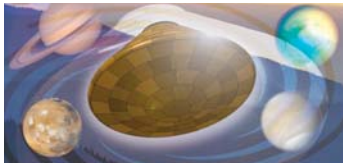


International Collaboration

- **NASA's planetary science program**
  - Overview ……Jim Green
  - Mars Program……Doug McCuistion
- **ESA Cosmic Vision program**
  - Overview ……Michel Blanc
  - TANDEM (Titan and Enceladus)……..Athena Coustenis
  - KRONOS (Saturn)……B. Marty/A.Coustenis
  - EVE (European Venus Explorer……Eric Chassefiere
- **Prospects for international cooperation**
  - Panel Discussion……Scott Hubbard, Chair

Timing of IPPW-5 coincided with the submittal date of the Cosmic Vision proposals which limited participation of Cosmic Vision proposal leads

IPPW-5 Highlights (cont)

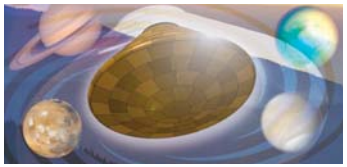


Entry, Descent Landing

- **Mars EDL Capability and Technology Needs**
  - Overview…….....Mark Adler/Rob Manning
  - MSL Entry Descent and landing……..A.D. Stelzner et al
  - MSL EDL Instrumentation (MEDLI)……...M.J. Gazarik
  - ExoMars – entry descent landing……V. Giorgio
  - Mars Phoenix EDL System……M.R.Grover et al
  - Mars Sample Return EDL-European View……R. Fisackerly et al

- **Earth EDL– sample return and human missions**
  - Stardust Sample Return capsule entry……D. Kontinos/M.Stackpoole
  - Sample Return from the Moon…….....Bernard Foing
  - Orion Heat Shield technology……Raj Venkatapathy
  - Orion Landing system……B. Bryant and J Corliss
  - TORCH TPS flight test program……..George Chen

IPPW-5 Highlights (cont)



Outer Planet Probes

- **Saturn probes**
  - Entry probes into Saturn and Beyond…… Sushil Atreya
  - Kronos – Saturn exploration with probes……Bernard Marty
  - NASA studies of missions to Saturn with probes……Tibor Balint

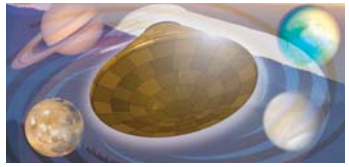
Extreme Environment Technologies

- **Radiation Hardened Electronics**
  - Radiation Hardened Electronics for Space Environments (RHESE) program……Andrew Keys
  - Silicon Germanium technology……Leora Peltz
  - Simulation of radiation effects ……Michael Alles

- **Packaging for extreme high temperature environments**
  - Electronics packaging for extreme environments…….Wayne Johnson
  - High Temperature Electronics or Venus Missions……Gary Hunter

- **Architecture**
  - Mission architecture & Venus probe surface lifetime… Craig Peterson

IPPW-5 Highlights (cont)



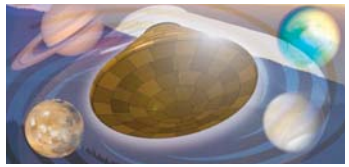
Flight in Planetary Atmospheres

- **Hypervelocity Flight**
  - Hypersonic Aeroshell shape optimization…….. John Theisinger et al.
  - Mars entry - Reaction control interference…….. Artem Dyankuno et al.

- **Guided Subsonic Flight**
  - Guided parachute guidance system……..J. McKinney et al
  - Parrotators for planetary atmosphere exploration.. V Nadal Mora et al

- **Lighter-than-atmosphere (LTA)**
  - Historical Overview of Balloon missions…….Jacques Blamont
  - Recent developments- Mars, Venus Titan…….Jim Cutts
  - Practical balloon designs for Titan……Ralph Lorenz
  - Autonomy technologies for Titan Aerobots…….Alberto Elfes
  - Exploring Venus with Balloons……K. Baines
  - Balloon deployed probes for Venus……Colin Wilson

IPPW-5 Highlights of particular interest to OPAG



Outer Planet Probes

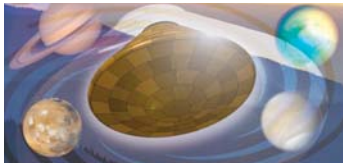
- **General**
  - Rotational spectroscopy on planetary probes……..B.J. Drouin
  - Ultrahigh resolution spectroscopy for planetary probes….D.T.Young

- **Saturn probes**
  - Entry probes into Saturn and beyond…… ……..Sushil Atreya
  - Kronos – Saturn exploration with probes……Bernard Marty
  - NASA studies of missions to Saturn with probes……Tibor Balint

- **Jupiter probes**
  - Mission design consequences of Jupiter probe……Mark Ayre
  - Extreme environments technology for Jupiter probes……Tibor Balint

- **Titan Exploration**
  - Mission concepts for Titan Exploration……..T. Spilker/A.Coustenis
  - Practical balloon designs for Titan……..Ralph Lorenz
  - Autonomy technologies for Titan Aerobots……Alberto Elfes

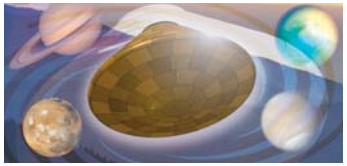
IPPW-5 Highlights (cont.)



Awards

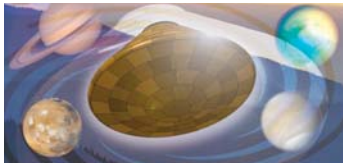
- **Al Seiff Memorial Award - Hasso Niemann**
  - **In recognition of contributions to the advancement of mass spectrometry technologies; and for the development and use of the techniques of gas chromatography and mass spectrometry applied to solar system exploration spanning missions from the Planetary Atmospheric Experiments Test to Huygens.**
- **Student Best Paper Awards:**
  - **Ian Clark (GT)**
  - **John Theisinger (GT)**
  - **Prabhakar Subrahmanyam (SJSU)**
- **Student Poster Paper Awards**
  - **Three US students and one European student**

What is unique about IPPW-6



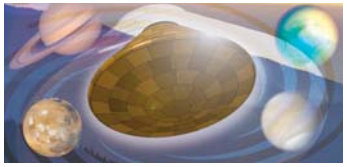
- **Programmatic context**
  - Phoenix will have landed a month prior to the workshop
  - NASA plans for the next Outer Planet Flagship mission clarified
  - NASA will be on the verge of releasing the New Frontiers AO
  - Venus Flagship Architecture study near completion
- **Other features of IPPW-6**
  - Further progress towards a permanent home and international presence for IPPW.
  - Student attendance projected to be significantly larger than previous years
  - Strong focus on technologies for extreme environments benefiting from the short course and the strong program at Georgia Tech

Backup Charts



- **Highlights of particular interest to VEXAG**
- **Highlights of particular interest to OPAG**

IPPW-5 Highlights of particular interest to VEXAG



- **Missions**
  - Exploring Venus with Balloons……K. Baines
  - Balloon deployed probes for Venus……Colin Wilson
  - Historical Overview of Balloon missions…….Jacques Blamont

- **Technology**
  - Mission architecture & Venus surface lifetime… Craig Peterson

- **Packaging for extreme high temperature environments**
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