



## **IAA / ESA Workshop**

# **The Next Steps in Exploring Deep Space**

**22-23 September 2003**

**ESTEC, Noordwijk, The Netherlands**

Organised by:

International Academy of Astronautics (IAA)

European Space Agency (ESA)

### **Background**

This workshop will build up on an ongoing IAA cosmic study "Next Steps in Exploring Deep Space", in order to provide a vision for the scientific exploration of space by humans in the first half of the 21st Century. The purpose is to provide a roadmap for a systematic, logical, and science-driven plan for exploration of the Solar System and unlocking the mysteries of the Universe - a program that builds gradually and systematically to establish a permanent presence at each outpost along the way and that builds the communications, transportation and other logistical infrastructure as it proceeds. The workshop will elaborate a set of long-term scientific goals for space exploration that provide the context for carrying out scientific investigations at specific destinations in space. The workshop will also consider the scientific priorities established by various communities and space agencies over the world. Possible architectures will be discussed for the space flight infrastructure required to pursue these science goals at the specified destinations, including examination of the relevant policy, international aspects and public engagement in this enterprise.

### **Main Organisers**

Bernard H. Foing, (ESA), Chief Scientist, ESA Research and Scientific Support Dept., ESTEC/SCI-S  
Wesley T. Huntress, Jr., (IAA), Geophysical Laboratory, Carnegie Institution of Washington

## Agenda

### Day 1: Monday 22 Sept, plenary session in ESCAPE Copernicus

08:30 Registration

09:00 Welcome and Introduction B.Foing/W.Huntress

09:15 **Session I: The Future of Astronomy & Fundamental Physics from Space**

|  |                   |
|--|-------------------|
| Origin and Evolution of the Universe             | J.L. Puget        |
| Frontiers in High Energy and Fundamental Physics | E. van den Heuvel |
| Search for Earth-Like and Living Exo-Planets     | A. Labeyrie       |
| Astrobiology and conditions for life             | P. Ehrenfreund    |

10:45 Break

11:00 **Session II: The Future of Solar System Exploration Science**

|                                     |             |
|-------------------------------------|-------------|
| The Moon                            | B. Foing    |
| Near Earth Objects and Small Bodies | P. Michel   |
| Mars                                | R. Pellinen |
| The Space Environment               | M. Blanc    |

13:00 Lunch

14:00 **Session III: Technology and Human Aspects**

|   |              |
|---|--------------|
| Future Space Telescope System Concepts                          | H. Thronson  |
| Advanced robotics and artificial intelligence                   | J. Mankins   |
| Planetary resource utilization                                  | I. Casanova  |
| Life sciences in space and living on another planet             | G. Horneck   |
| Human space flight activities supporting deep space exploration | C. Nicollier |

15:45 Break

16:00 **Session IV: Contributed Talks and Discussions in Splinter Groups**

(Charge to the groups: Based on science, develop an exploration strategy for both robots & humans; where do humans provide significant benefit)

|                           |                               |
|---------------------------|-------------------------------|
| Group 1: Moon             | Chair: O. Korablev            |
| Group 2: NEOs             | Chair: A.C. Levasseur Regourd |
| Group 3: Mars             | Chair: R. Pellinen            |
| Group 4: Space Telescopes | Chair: J.P. Swings            |

18:00 Informal drink and reception in Copernicus, ESCAPE

## Day 2: Tuesday 23 Sept, ESCAPE Copernicus

- 09:00 **Session V: Rationale for exploration, models for the future**  
Policy and International Cooperation Considerations G. Naja  
Space exploration & Society: How can we make the next steps? R.M. Bonnet  
Reenergizing Relevance: Building the Psychological Highway to Space M. Craig & R. Rogers  
Exploration drivers R. Heidmann
- 10:30 **Session VI: Architectures for the Next Steps in Deep Space**  
ESA Cosmic Vision towards the next decade B. Foing  
Aurora F. Ongaro
- 11:15 Break
- 16:00 **Session IV (splinter groups continued)**  
(Charge to the groups: Based on science, develop an exploration strategy for both robots & humans; where do humans provide significant benefit: preparation of group report and recommendations)  
Group 1: Moon Chair: O. Korablev  
Group 2: NEOs Chair: A.C. Levasseur Regourd  
Group 3: Mars Chair: R. Pellinen  
Group 4: Space Telescopes Chair: J.P. Swings
- 13:00 Lunch
- 14:00 **Session VI: Architectures for the Next Steps in Deep Space (continued)**  
Human space flight to Earth orbit and beyond J. Feustel-Buechl  
Russia O. Korablev  
France R. Bonneville  
Italy S. di Pippo  
Canada A. Berinstain  
NASA NEXT G. Martin  
Japan T. Mukai  
China  
India
- 16:00 IAA Cosmic study on "Next Steps in Exploring Deep Space" Huntress/Stetson/Farqhar
- 16:20 Break
- 16:40 **Session VII:**  
Splinter Groups' Reports, Wrap-up Discussion & Closing remarks: (incl. Scientific Research Priorities, Robotic and Human aspects, Spacecraft Transportation Systems, Near-Term and Long-Term Roadmap, Design of Habitats & Resource Utilisation, Commercial Activities, Management and Legal Aspects, Implementation)  
Sessions and Panels Chairs, W. Huntress, B.H.Foing
- 18:00 End of Workshop

## Contributed talks for splinter sessions, and posters

### Group 1: Moon

Enabling technologies for future human and robotic exploration  
Autonomous and Intelligent Systems  
Lunar geochemistry  
The scientific case for renewed human exploration of the Moon  
Moon-Mars forum and workshop: a young perspective  
Lunar initiatives for small partners  
From the ISS to the Moon: ISU summer study

### Chair: O. Korablev

N. Frischauf  
J.C. Piedboeuf/A. Berinstain  
M. Grande  
I. Crawford  
F. Mikl, R. Drummond et al  
J.D. Burke  
ISU summer students

### Group 2: NEOs

"EUNEOS: a space survey dedicated to the detection of small Potentially Hazardous Asteroids"  
The Gulliver Mission: Sample Return from Deimos

### exploration and hazards Chair: A.C. Levasseur-Regourd

P. Michel  
Dan Britt

### Group 3 : Mars

Network science on Mars for the next decade  
Mars US perspective on next decade and beyond  
Sorption water in the upper Martian surface  
A European perspective for next decade of Mars exploration  
Aurora posters short presentations  
"The Mars Waystation -- What, Why, Where"  
The ambiguous relation between astrobiology/Mars human exploration

### Chair: R. Pellinen

V. Dehant & Netlander team  
J. Garvin  
D. Möhlmann  
A. Chicarro  
Aurora team  
C. Benton  
G. Kminek

### Group 4: Space Telescopes

### Chair: J.P. Swings

### Poster session:

*J.P. Barriot, V. Dehant, and NEIGE team:* Radio-science experiment on landers: NEIGE, Netlander Ionosphere and Geodesy Experiment

*M. Hamelin, J.J. Berthelier, S. Bonaimé, V. Ciarletti, F. Dolon, G. Leturgez, B. Martinat, R. Ney:* Use of long antennas to measure the permittivity of the upper martian subsurface: the Netlander GPR example

*P. Lognonne et al:* A Seismic Ultra Broad Band Experiment for Future Martian European Network

*A. Rivoldini et al:* A joint inversion method of electromagnetic, geodetic and seismological data for the study of planetary interiors

*I. ten Kate, J. Garry, R. Ruiterkamp, B. Lehmann, P. Ehrenfreund, N. Boudin, B.H. Foing:* Simulation chamber experiments in support to Mars Express and future space missions

*S. Conway Morris:* Constraints of life

*J.C. Piedboeuf & A. Berinstain:* Autonomous and Intelligent Systems

*B.H. Foing & ILEWG: International Lunar Exploration Working Group: the Next Steps*

*B.H. Foing et al : Education and Public Support, Lunar Explorers Society goals and activities*

*M. Race, M. Criswell, J. Rummel: Planetary Protection Issues & Human Exploration of Mars*

*Aurora team: 1) Space Exploration and Utilisation; 2) Aurora Framework for exploration & Roadmap, 3) - Human mission to Mars design - step by step: Industrial support & Concurrent Design Facility (CDF) Studies*

## **Logistics, registration and hotel reservation**

ESTEC Conference Bureau (confburo@esa.int).

## **Local organizing committee:**

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