

I.A.A. Commission III

GLASGOW MEETING MINUTE

meeting date: September 28 th , 2008 <i>date de la reunion</i>	rep./ <i>rep.</i>	page/ <i>page</i> 1
meeting place <i>Lieu de la reunion</i>	GLASGOW, SCOTLAND	chairman T.YASAKA / J. MANKINS <i>président</i>

I.A.A Commission III

GLASGOW MEETING MINUTE

meeting date <i>date de la reunion</i>	Sept. 28th, 2008	rep./rep.	page/ pag <i>e</i>	2 14
---	------------------	-----------	-----------------------	---------

minute's date <i>dates de compte rendu de reunion</i>	October 6th, 2008	participant <i>participants</i>	P. BAINUM Y. BEKEY C. BONNAL C. BRUNO M. CALABRO G. GENTA H. HOFFMANN P. JUKOLA J. KAWAGUCHI R. LENARD E. MACCONE J. MANKINS G. MATLOFF W. MENDELL A. MISRA J. ONODA J. PEARSON MR. PERINO G. POLISHCHUK K. PICHKHADZE V. PRISNIAKOV H. RAUCK G. REIBALDI W. SIEGPRIED P. TRIVAILO E. VALLERANI K. WAKKER T. YASAKA
--	-------------------	------------------------------------	--

SUBJECT/ <i>objet</i>	Progress meeting, according to the proposed agenda.	COPY/ <i>copie</i>
-----------------------	---	--------------------

agenda:

I.A.A Commission III

GLASGOW MEETING MINUTE

meeting date <i>date de la reunion</i>	Sept. 28th, 2008	rep./ <i>rep.</i>	page/ <i>pag</i> <i>e</i>	3 14
---	------------------	-------------------	------------------------------	---------

1. Review of previous minutes of meeting
2. SG 3.5: Peer review results
3. SG 3.6: Decision on the publication
4. Study Groups Status
 - SG3.1
 - SG 3.8
 - SG 3.9
 - SG 3.10
 - SG 3.11
5. Symposia status
 - IAC 2008
 - IAC 2009
6. Proposal for next IAA conferences
7. Actions
8. AOB
9. Conclusions

description/ <i>description</i>	action/ <i>action</i>	due date <i>/ date butoir</i>
---------------------------------	-----------------------	--------------------------------------

The Chairman welcomes the members present at the meeting.

1. Review of previous minutes of meeting

No outstanding action

2. SG 3.5: Peer review results

Ivan Bekey presented the implementation of the comments in SG report, see Annex 1

There is an urgency to publish the report by February 2009 because of the UN COPUOUS Meeting, and Ivan Bekey has been invited to make a presentation, it will be important to distribute the study on this occasion.

The Commission unanimously approved the report and recommended to request SAC approval for publication of the study as soon as possible.

A copy of the report has been handed over to the Secretary and to the Chairman.

GR to distribute the report to the members of the Commission III

3. SG 3.6: decision on the publication

The Commission has recommended to send the paper to Acta Astronautica for publication.

J. Mankins shall forward the paper to Acta Astronautica

4. Study Groups Status

Overall status is shown in Annex 2

SG3.1

The SG has produced 3 papers at this IAC. These papers are C4.2 01, 02 and 03.

The draft of the final report shall be ready for presentation to the Commission at the IAC 2009.

SG 3.2:

The report has been published by AIAA and is also available on the IAA website.

SG 3.6:

This study has been cancelled in March, however the Commission feels that a new study group about exploration should be established at the latest by March 2009.

SG 3.8:

The report has been stopped in view of the lack of support.

SG 3.9:

The study status was presented, see Annex 3.

The Symposium on Private Human Access to Space was held in May 2008. A selection of papers of the Symposium should be published by June 2009 in Acta Astronautica. A CD with 68 papers of the Symposium has been provided to the Chairman

Main features of the Symposium were discussed, among others: Propulsion is a problem, motivation is fuzzy and the business case has not been convincing for 100 – 120 Km suborbital flight.

Final Draft of the Study Group Report should be ready by March 2010. Finalization of the study for IAC 2010

A second conference sponsored by IAA on Private Access to Space is considered for 2010, however this requires to be confirmed

SG 3.10

G. Matloff and C. Bruno indicated the main elements of this study, see Annex 4. The main rationale of the study is the possibility that Alpha Centauri has planets, and therefore it is important for IAA to make a study.

meeting date Sept. 28th, 2008

REP./PPP

page/PPP 5

14

*date de la
reunion*

Commission I should be involved in this study and Mr Maccone could be a good liaison with this Commission.

In July 2009, a conference on "Mission To The Outer Solar System And Beyond" will take place in Aosta, Italy.

SG 3.11

J. Mankins presented the status of the study, see Annex 5.

IAC 2009 is very much interested by the energy production issue and J Mankins shall approach LOC to make them aware of this study.

The plan of the study is to complete the Draft final report by March 2010.

Discussions took place about the carbon in-print of existing energy production system as well as about the time scale for implementation of the solar power.

The first deployment could be at 2 \$/KWatt, for a 5MWatt military application, by 2020, using existing launcher system; this could be a demonstrator for security and natural disaster applications

5. Symposia status

The status is shown in Annex 6

IAC 2008

All the sessions were reviewed and found complete with Chairman / Rapporteur.

IAC 2009

The Chairman stressed the importance of checking the available call for papers in order to correct mistakes.

6. Proposal for next IAA conferences

April 2009, AIAA/IAA Planetary Defence Conference

Mid 2009, Solar Power Satellite

July 2009, Aosta conference on "Mission To The Outer Solar System And Beyond"

2010, Private Human Access to Space

7. Actions

- Acta Astronautica to publish the major paper on Private Human Access to Space, T. Yasaka to solicit the IAA secretary
- Bring the SG 3.5 report to the approval of the SAC
- Review the IAC 09 Call for Papers for consistency

8. AOB

Overlapping between IAA and IAF has been mentioned as a problem for this congress.

A new study paper about Sustainable Human Exploration shall be defined in March 2009 in coordination with Commission I

9. Conclusions

The next meeting will take place in Paris on March 17th, 2009.

I.A.A Commission III

G L A S G O W M E E T I N G M I N U T E

meeting date Sept. 28th, 2008

ref./réf.

page/ *pag* 6
e

14

***date de la
réunion***

meeting date Sept. 28th, 2008
date de la
reunion

REP./REP.

page/ pag 7
E

14

Final Report of Study Group 3.5 **Dealing with the threat to Earth from asteroids and comets**

The following editing was accomplished to comply with most of the comments by the 10 Peer Reviewers. S.G. 3.5 feels that the report is now fully ready for final approval by the SAC and the BOT.

1. Created an abstract
2. Created an Executive Summary
3. Created a Glossary
4. Identified a clear role for the IAA
5. Identified the sources of the figures
6. Number of recommendations was drastically reduced:
 - a. at higher level
 - b. with concrete implementation steps where appropriate
7. Addition of a number of figures and text to clarify important points
8. Unified the format in all the chapters
9. Moved the Russian contribution to a stand-alone Appendix
10. Corrected errors and inconsistencies as possible in time allowed
11. Unified some terminology between chapters as time allowed

An IAA presentation summarizing the report has been requested by Richard Crowther to be given to UN COPUOUS in February, 2009. Distribution of the report to the UN COPUOUS delegates at the same time was also requested, if possible.

[illegible]

International Academy of Astronautics - IAA Commission 3

Solar Energy from Space: the First International Assessment of Opportunities, Issues
and Potential Pathways Forward

STATUS REPORT

John C. Mankins, Chair
Nobuyuki Kaya, Co-Chair

27 September 2008





AGENDA

- Introduction
- Overview of the IAA Solar Energy from Space SG
- Status Review for the SG
- Working Discussion
- Conclusion



INTRODUCTION

- A new study group addressing energy from space has been started
- Title of Study:
 - Solar Energy from Space: the First International Assessment of Opportunities, Issues and Potential Pathways Forward
- Chairs of the Study:
 - [J. Mankins](#)
 - [N. Kaya](#)
- Members:
 - See next page



MEMBERSHIP

as of 27 September 2008

- James Armor (US)
- Ivan Bekey (US)
- Henry Brandhorst, Ph.D.
- A.C. Charania (SEI)
- Ron Clark (Lockheed Martin)
- Lt. Col. Paul Damphousse (USMC/NSSO)
- Paul Eckert (Boeing)
- Peter Glaser (US; ex officio)
- Jerry Grey (AIAA)
- Raghavan Gopalaswami (India)
- Joe T. Howell (US)
- Koichi Ijichi (USEF)
- Frank Little (TAMU)
- Gregg Maryniak (US)
- Shoichiro Mihara (USEF)
- Neville I. Marzwell, Ph.D.
- Guy Pignolet (Science Sainte Rose)
- Joseph Rouge (NSSO)
- Susumu Sasaki, Ph.D. (JAXA)
- Col. Michael Smith (USAF)
- Leopold Summerer (ESA)
- Didier Vasseaux (CNES)
- Robert Wegeng (US/PNNL)
- Prof. Dr. Kai-Uwe Schrogl (representing IAA Commission V)
- Peter Swan (representing IAA Commission VI)
- Janet Verro (Space Power Assoc.)
- *Additional members, to be identified...*

CONFIRMED AT THIS TIME



GOALS

- The overall goals of this study is to determine what role solar energy from space might play in meeting the rapidly growing need for abundant and sustainable energy during the coming decades, to assess the technological readiness and risks associated with the SSPS concept, and (if appropriate) to frame a notional international roadmap that might lead the realization of this visionary concept.
- Because significant advances in space solar power systems could have a profound and positive impact on human and robotic space exploration capabilities as well as a range of space applications, the study will also identify such opportunities and evaluate the potential for synergies (if any) between these benefits for space missions and SSPS for terrestrial markets.
- Finally, there have long been discussions of the potential role that extraterrestrial resources might play in SSPS architectures; the study will also attempt to identify these opportunities and assess potential connections between international lunar exploration programs now being undertaken and SSPS.



OBJECTIVES (1)

- Identification of relevant markets and applications for new energy sources—including both ultimate applications in terrestrial markets, as well as interim applications in space programs.
- Identification and evaluation of the technical options that may exist for solar energy from space to contribute to meeting global energy needs.
- Identification and evaluation of the technical options that may exist for space solar power to contribute to ambitious government and commercial space mission concepts and markets
- Identification and evaluation of options for the utilization of extraterrestrial resources, in particular lunar resources in future space solar power systems
- Preliminary determination of appropriate SSPS architecture level figures-of-merit, and values of these that must be achieved in order for solar energy from space is to become economically viable for a range of terrestrial market opportunities and space applications.



OBJECTIVES (2)

- Preliminary identification of other issues and policy questions that would require resolution for SSPS to become a reality (e.g., spectrum allocation).
- Assessment of the technical feasibility, technological maturity and degree of difficulty in the above space solar power options.
- Formulation of a strategic approach to realizing the potential of energy from space—and one or more technical / programmatic roadmaps implementing this strategy.
- Development of a summary report, documenting the results of the study and articulating the prospects for Energy from Space to make a substantial contribution to satisfying future global needs.
- These initial intermediate goals will be updated during the course of the study.



STATUS

- The new Energy Study Group has been formed
 - Various additional members have agreed to participate since the status report to the IAA in March 2008
- A web-based group has been formed and many of the study group members have been registered
- Three working meetings were planned for 2008
 - Japan - at or near the ISTS Conference at Hamamatsu in June 2008 (not a formal IAA workshop...)
 - US - at or near the AIAA / IECEC Conference in Cleveland, Ohio USA in July 2008 (not a formal IAA workshop)
 - A meeting of the overall study group at the Glasgow Congress in September 2008 — THIS WEEK

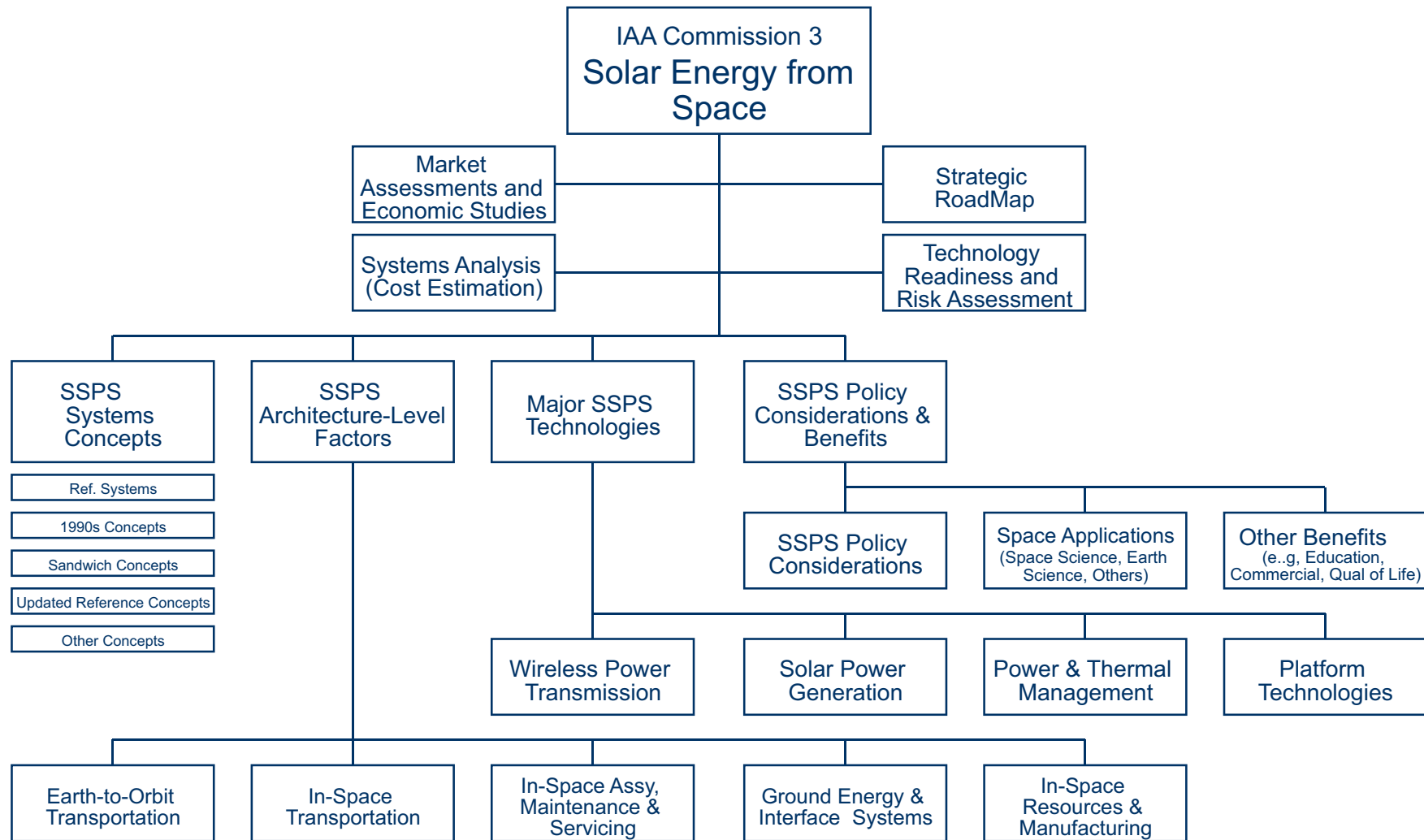


STATUS (2)

- Meeting held at the 2008 USRI Conference in Chicago, IL USA (August 2008)
 - “Robust” technical discussion on this subject
 - Invited identification of Study Group Members
- Work Breakdown Structure for the study group has been composed, and draft final report outline developed...
 - SEE NEXT PAGE...
- Joint Session with the IAF organized for the 2008 IAC Congress in Glasgow
 - Preliminary discussion held with 2009 LOC/IAF Co-Chair for Korea IAC (Energy is a focus area for this IAC/LOC)
- Discussion of the organization of working groups will be started at this meeting



IAA Solar Energy from Space WBS





Schedule of Major Milestones (DRAFT)

- SG Initially Proposed – March 2007
- SG started – March 2008
- Working Meetings – 2008-2009
- Sessions at IAC
 - 2008 (Glasgow)
 - 2009 (Korea)
 - 2010 (Prague)
- Relevant Sessions @ AIAA IECEC 2009
- Focused Conference “SPS 2009” – Summer / Fall 2009
- Project Final Report for Peer Review – March 2010

meeting date Sept. 28th, 2008
*date de la
réunion*

PEP./PPF

page/ *page* 8
8

14



IAA Commission III meeting
Glasgow, September 28th, 2008
Christophe Bonnal

Progress report on IAA Study Group 3.9 “Private Human Access to Space”

Proposer(s): H. Rauck – G. Brachet **Chair:** Ch. Bonnal
Primary IAA Commission Preference: Commission 3
Secondary IAA Commission Interests: Commission 5

Overall Goal:

Identify and quantify the key topics associated to Manned Private Access to Space for both Orbital and Sub-orbital missions.

Key words:

- Technical aspects
- Legal and regulatory aspects, safety aspects
- Financial aspects, market analyses, associated business plans
- Motivations of potential customers
- Physiological and Psychological requirements, ergonomic constraints

Expected outcome of the study:

IAA Position Paper giving the keys to the topic and potentially including recommendations.
Subdivision of the study into key chapters, with one “book captain” per chapter ; 7 or 8 members per chapter covering a wide range of origins (countries, agencies, industrials, searchers, operators...)

Time line:

3 years following the initial proposal (March 2007)

Revised timeline:

IAA symposium	⇒	28-30 May 2008
Publication of the full CD with all the papers⇒ (2 months delay due to holidays and editorial problems)		End of September 2008
Report during IAC Glasgow	⇒	October 2008
Publication in Acta Astronautica of the 15-20 best papers		
Not yet started, due to lack of understanding of the editing constraints (Q sent to IAA SG, but no answer so far)		
Tentative date was March 2009,	⇒	Revised to July 2009
Drafting of the Position Paper	⇒	Daejeon, October 2009
Re-work within the SG3.9 working group	⇒	IPC, Paris March 2010
Draft release for Peer Review within IAA	⇒	IPC, Paris March 2010
Final publication	⇒	IAC, October 2010.

1st IAA symposium on Private Human Access to Space

meeting date Sept. 28th, 2008
date de la
réunion

REP./REP.

page/ page 9
/

14

Arcachon, 28-30 May 2008

Short summary:

68 presentations organized into 16 sessions + 2 round tables
139 delegates from 16 countries
15 IAA members but only 1 non-chairman or non presenter
Good local organization by Avantage-Aquitaine
Nice place, nice banquet, very positive feedback from participants
Proceedings CD finally issued, currently under mailing to participants

Co-sponsorship from AIAA, ACE, 3AF, IISL, Eucass, Astech, ARA, IAF and RAES



Content in the frame of the Study-group:

⇒ Uneven depending on topics:

- very rich symposium on legal, certification & insurance aspects

good session on technical aspects, medics, ground

technological aspects

reliability, safety and risk

⇒ As a consequence, the resulting study is not well balanced and requires more effort on some topics

- fair on

- poor on

Program Committee members = Study-group book captains:

I.A.A Commission III

G L A S G O W M E E T I N G M I N U T E

meeting date Sept. 28th, 2008

REP./PPF

page/PPF 10

date de la
réunion

P

14

Dr. Melchor J. ANTUÑANO, Director, Civil Aerospace Medical Institute, FAA

Max CALABRO The Inner Arch, former head of propulsion department
in Astrium Space Transportation, IAA

Pr. Mireille COUSTON University of Lyon 3, Head of Space Laws Center

Pr. Richard CROWTHER Rutherford Appleton Laboratory

Philippe DRONEAU, Deputy Director, Toulouse Cité de l'Espace

Patrick EYMAR, N4E, former head of future projects at Astrium ST

Prof. Dr. Med. Rupert GERZER, Head, Institute of Aerospace Medicine
German Aerospace Center DLR

Walter PEETERS, Dean of ISU, International Space University

Manola ROMERO, ONERA, IAA

Dave SALT, Vega Group, European Space Agency

Garrett SMITH, Airbus, Chairman of the 3AF Space Tourism Commission

Derek WEBBER, Spaceport Associates

Francis WINISDOERFER, Airbus, Professor at Strate College

Synthesis required to all Program Committee members following their sessions

↳ It is proposed to hold the

2nd Symposium on Private Human Access to Space in July 2010

→ Location and local organizer to be discussed,
but same as 2008 seems a good idea.

meeting date Sept. 28th, 2008
date de la
reunion

REP./REP.

page/ page 11
/

14

Technologies to Enable Near-Term Interstellar Precursor Missions

IAA Commission 3.10 Study
September 28, 2008
Room SECC Ness

Study Outline:

1. Why Interstellar Precursor Missions

- i. What is a precursor mission. Scientific objectives: The solar wind bow shock and heliopause. The Oort Cloud. Gravitational waves. Interstellar plasma. The “Pioneer anomaly”. The Sun gravitational lens effect, and others. Some cosmological implications of these objectives and their impact on understanding of how the universe was formed and evolved. Impact of conceptual planning of such missions on youngsters’ scientific education and career choice.
- ii. Missions planning. Why they need to be near-term (e.g., within 20 or 30 years, the working lifetime of young scientists starting their careers now). Context: first step out of the Solar System.
- iii. Emphasis of Study: primarily enabling technologies. Missions classified according to feasibility. TRL challenges and required development.

2. Typical Missions

2.1 Mission Constraints and Assumptions

- i. Discuss ‘game rules’: general constraints and assumptions bounding the study.
- ii. Primary constraint: maximum payload mass. In-orbit assembly or not (cost, practicality). Launcher choice (Ariane 5 ECA, others).
- iii. Constraint: mission timescale. Data mass vs. nominal mission time. Mission extension criteria and their tradeoffs.
- iv. Constraint: target minimum distance from Earth. Choice/selection of flight timescale. Challenges and technologies.
- v. Assumption: justify exclusion of chemical propulsion ($SI < 470$ s). Analyze nuclear thermal propulsion ($SI < 1000$ s) options.

meeting date Sept. 28th, 2008
date de la
réunion

REP./PPF

page/PPF 12
8

14

vi. Assumption: scientific instruments suite provided by space agencies and universities. Estimate masses and power consumption from existing designs.

2.2 Conceptual Analysis of Trajectory

Outline theoretical treatment to compare missions (see also below).

Optimize the SI of each propulsion system proposed to accomplish mission. Effect of specific mass (kg/kW) of the complete power generator and conditioning system. Criteria to compare on an equal basis different propulsion systems (e.g., solar arrays, nuclear propulsion and solar sails. Effect of propulsion system mass.

2.3 Mission Scenarios

Analyze scenarios, e.g.:

- i. Direct launch into an Earth-escape heliocentric trajectory with $C_3 > 0$, followed by appropriate thrusting from an electric propulsion system (EPS).
- ii. Spiral orbit-raising manoeuvre around the Earth. This will very considerably enhance the payload available, at the cost of increased mission duration (tradeoffs).
- iii. Solar sails: trajectories. Analyze options based on mass, and time limitations (e.g., this class of trajectory may start with an initially inward trajectory, to exploit solar radiation pressure to achieve significantly 'large' acceleration).
- iv. Power. Nuclear power source vs. solar arrays. Dependence on trajectory.
- v. Hybrid mission trajectories (e.g., EPS + solar array to reach close to the sun, followed by large solar sail.

3. Enabling Technologies

A major issue of study. Analyze developments required within the defined 'near-term' to enable missions identified, e.g.:

- i. Solar sails. Reducing mass/unit area. Increasing tolerance to high temperatures and space environment. to permit operation close to the Sun. Forming thin film surfaces in space.
- ii. Solar arrays. Mass, power, per unit area and specific mass (kg/kW). Increasing tolerance to high temperatures and space environment.

I.A.A Commission III

GLASGOW MEETING MINUTE

meeting date Sept. 28th, 2008

REP./PPF

page/PPG 13

date de la
réunion

P

14

- iii. Nuclear power. Conversion technologies, radiation shields, and radiators. Reducing specific mass. Increasing power conversion efficiency. Matching reactor to EPS (“direct drive” concepts).
- iv. Hi SI, high efficiency advanced propulsion systems. Variable SI vs. thrust concepts and impact on mission. Thrusters, power conditioning, control, thrust vectoring, propellant feed and storage options.
- v. Thermal control.
- vi. Deep space communications systems. Effect of data rates.
- vii. Spacecraft automated health monitoring and control.
- viii. Reliability, redundancy and lifetime considerations. Critical issues (e.g., qualification). Conventional life-testing of components and technologies no longer an option.

4. The Longer Term View

Reading the crystal ball: indications of what enhancements might be possible in the longer term, on the basis of current progress (but: ignore unpredictable “breakthroughs”).

5. Conclusions

Review of findings and predict roadmap in terms of technologies covered. Selection of mission most likely to achieve a significant scientific return.

Tentative Timetable

First draft: by the Korea 2009 IAC
Issuing by IAA: by 2010

Team Members

In alphabetical order:

Claudio Bruno

Mike Gruntman

Anders Hansson

Les Johnson

Roger Lenard

Claudio Maccone

Greg Matloff

Ralph McNutt

Tibor Pacher

Paul Czysz

Dana Andrews

*red:absent*** accepted and not withdrawn*

Symposium Title/ Session Title symp.	Coordinator (Symposium) Chairman (session)	Number of Papers*	Status
A.5. Human Exploration of the Moon and Mars Symposium	W. Mendell, C. Sallaberger		
A.5.1 Strategies to establish Lunar and Mars Colonies	U.Apel, WH Siegfried, G Morgenthaler (R)	6	papers uploaded (n°6 withdrawn)
A.5.2 Human and Robotic partnerships to realize space exploration goals	B.C.Clarck, C Sallenberger M Reichert (R)	8	paper 5 missing (n°1, 7 withdrawn)
A.5.3 The next steps for Human Space Exploration: What are the alternatives ?	R.W. Farquhar, E. Messerschmid, G.Schwehm (R)	8	papers uploaded
A.5.I Interactive session on Human Exploration of the moon and Mars	G Morgenthaler, C Sallenberger		
C.3.1 Space Power Symposium	J. C. Mankins		
C.3.1 Joint Session with Space Systems Symposium on IAA Study " Solar Energy from Space"	N Kaya, L Summerer, HJ Wilenberg (R)	10	paper 7, 10 missing
D.3 Symposium on Stepping Stones for the Future: Strategies, Architectures, Concepts and Technologies	J. C. Mankins, A. Pradier		
D.3.1: Strategies, Architectures to Establish a "Stepping Stone" Approach to our Future in Space	J.C.Mankins, V. Prisniakov, W. H. Siegfried (R)	9	papers 2,10 missing (n°7 withdrawn)
D.3.2: Novel Concepts and Technologies for the Exploration and Utilization of Space	J T. Howell*, H.Yamakawa M.A.Perino (R) N.Suzuki, (R)	9	papers 3,11 missing (n°2, 5 withdrawn) * J Howell to be replaced by J.SANDERS
D.3.3 Infrastructures and Systems to Enable Ambitious Future Exploration and Utilization of Space	W. H. Siegfried, S Hovland, S Hovland (R) , G Woodcock (R)	11	papers 10,11 missing (n°2 withdrawn)
D.3.4 / E.5.4 Joint session on Space Technology and System Management Practices and tools part 1	P. Jukola, P. A. Swan, C. Moore (R)	8	papers uploaded
D3.5/ E5.5 Joint session on Space Technology and System Management Practices and tools part 2	J.C.Mankins, P. A. Swan, + C. Moore (R)	7	papers 1,4,6 missing (n°7 withdrawn)
D4 Symposium on Far Futures: Renewed Visions	Hans E.W. Hoffmann, G.Reibaldi		
D.4.1 Space Elevator System Infrastructures	D.Raitt, P. A. Swan, L. Thompson (R)	9	paper 6 missing

IAC 2009 IAA Symposia

ref	Symposium Title / Session Title	Coordinator (Symp.) /Chairman (session)	Status
A.5.	Human Exploration of the Moon and Mars Symposium	W. Mendell, C. Sallaberger	
	A.5.1 Strategies to establish Lunar and Mars Colonies	U.Apel, W.H. Siegfried, G <i>Morgenthaler (R)</i>	
	A.5.2 Human and Robotic partnerships to realize space exploration goals	B.C. Clarck, C Sallenberger <i>M Reichert (R)</i>	
	A.5.3 The next steps for Human Space Exploration: What are the alternatives ?	R.W. Farquhar, E. Messerschmid, G.Schwehm (R)	
C.3.1	Space Power Symposium	J. C. Mankins	
	Joint Session with IAA Commission 3 (Space Technology & System Development) on "Solar Energy From Space"	N. Kaya, J. Mankins, J.T. <i>Howell (R), L. Summerer (R)</i>	
D.3	Symposium on Stepping Stones for the Future: Strategies, Architectures, Concepts and Technologies	J. C. Mankins, A.Pradier	
	D.3.1: Strategies, Architectures to Establish a "Stepping Stone" Approach to our Future in Space	J.C.Mankins, A.PradierW. H. <i>Siegfried(R)</i>	
	D.3.2: Novel Concepts and Technologies for the Exploration and Utilization of Space	J T. Howell, L. Suchet, M.A. <i>Perino (R) N.Suzuki, (R)</i>	
	D.3.3 Infrastructures and Systems to Enable Ambitious Future Exploration and Utilization of Space	W. H. Siegfried, Y.Takizawa, <i>S Hovland (R), G. Woodcock (R)</i>	
	D.3.4 / E.5.4 Joint session on Space Technology and System Management Practices and tools part 1	J.C.Mankins, P.A. Swan, C. <i>Moore (R) ,P. Jukola (R)</i>	
	D3.5/ E5.5 Joint session on Space Technology and System Management Practices and tools part 2	J.C.Mankins, P.A. Swan, C. <i>Moore (R), P. Jukola (R)</i>	
D4	Symposium on Far Futures	Hans E.W. Hoffmann, G.Reibaldi	
	D.4.1 Human exploration beyond Mars	H. Rauck, P. Jukola, O. de <i>Weck(R)</i>	
	D.4.2 Space Elevator and Tethers	D. Raitt, P. A. Swan, R. E <i>Penny (R)</i>	
	D.4.3 Interstellar Precursor Missions	R. X. Lenard, C. Bruno, D. <i>Andrews (R)</i>	

>12 session

IAA Commission III meeting minutes, Annex 6