



## International Advisory Board for the International Microgravity Plasma Facility

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1 May 2000

### **Minutes of the Meeting of the International Advisory Board 25 April 2000 Santa Fe, USA**

Present at the meeting were:

Prof. John E. Allen, Dr. Laifa Boufendi (representing Prof. André Bouchoule), Prof. John Goree, Prof. G.M.W. Kroesen, Prof. A. Mendis, Prof. Fortov, Prof. G. Morfill, Prof. N. Sato, Dr. Hubertus Thomas, Prof. Y. Watanabe.

Also present were three representatives of Kayser-Threde and an engineer from MPE.

The meeting lasted 7 hours, beginning 09.00 April 25 and ending 17.10 April 25.

#### The agenda included the following:

- Introductory statements by Prof. Morfill, and by Prof. Goree.
- A presentation by Kayser-Threde of work done since December 1999.
  1. Telescience Requirements
  2. RF chamber design
  3. DC chamber design
- Scientific discussion
- Upcoming AO for international microgravity experiments
- Discussion of the participation of national agencies
- Preparation of the Advisory Board recommendations.

**Meeting of the International Advisory Board**  
**25 April 2000**  
**Santa Fe, USA**

The advisory board unanimously approved the following consensus report:

1. The Advisory Board notes with satisfaction that the DLR has followed the recommendation made in the Board's third meeting to fund a preliminary Phase B program.
2. The Board is also pleased that the DLR has indicated that it intends to contact other national agencies to seek their international participation. Noting its previous recommendation to its own members to contact the national agencies in coordination with the DLR, the Board recognizes that it will need contact names and addresses for the various agencies.
3. The Board notes that Kayser-Threde has fulfilled expectations to date. It has focused its recent efforts on the needs identified in the third report. Specifically, Kayser-Threde has begun developing drawings for vacuum chambers and for the rf electrode configurations within them. The Board believes that testing and simulations of multiple electrode configurations should be carried out before freezing the design of the chamber. We expect that a successful design and testing process will include manufacturing an electrode configuration and operating it under laboratory conditions, determining where the glow is, and then redesigning the electrode configuration to improve it. This process may require several iterations. There is little doubt that this process will succeed, but it will require a significant number of months of effort. The process can be speeded by incorporating plasma glow simulations, as recommended below. After the laboratory design and testing sequence is completed, it is expected that there will be more than one promising design, although the designs might differ from one another only by minor mechanical dimensions, for example electrode diameter or cleaning hole size. Selecting the best design will require parabolic flights. Parabolic flights will also be required to test particle injection and cleaning methods.
4. The Board recommends that a consultant be hired to carry out numerical simulations of the rf plasma glow in the proposed rf chamber, and that the consultant should cooperate with MPE and Kayser-Threde in testing several configurations before they are manufactured. The intent of these simulations is to speed the design of the mechanical dimensions and configurations of electrodes so that the plasma glow (burn) will be distributed as desired, with a gentle peak in the center of the inter-electrode gap. Simulation results are needed during the next few months.
5. The Board believes that two possible dc plasma configurations are worthy of consideration. Before selecting one of these configurations, the Board believes that further work is required at two locations: HEDRC and Tohoku University, to test particle cleaning and injection. It will also help if HEDRC can determine whether

particles can be trapped in a useful way using a larger diameter glass cylinder, with a diameter large enough to accommodate a metal gridded sphere as used by the Tohoku group. The latter possibility would allow essentially a compromise between the other two concepts. Until the Board is able to recommend which configuration is most promising, Kayser Threde should produce only a non-detailed design of the DC chamber. Considering the status of the DC chamber, the Board anticipates that parabolic flight testing of the DC chamber should be planned for 2001 or later.

6. The two critical items for the rf chamber that were identified in the third report, particle injection and cleaning, continue to have the same status as earlier. Both items require design of a specific apparatus configuration for the flight chamber, and laboratory testing followed by parabolic flight testing. The Board is as optimistic as before that solutions for these two items are likely sometime in the future to undergo a successful test, and the Board will monitor these two items until that happens.
  
7. The Board recommends that Kayser Threde should:
  - Establish the initial vacuum chamber mechanical drawings and release these drawings to Board members, who may wish to manufacture copies for their own tests.
  - Design and oversee the manufacturing of the first trial configuration of electrodes, particle cleaning and particle injection.
  - Assess camera sensitivity requirements, accounting for filter wheel throughput, to meet user needs for imaging several spectral lines from the plasma glow.
  - Communicate frequently with laboratories that are to develop diagnostics and manipulation concepts, including multiple-layer 2D imaging, non-imaging spectrometer, laser scanner mirrors for Ar laser pointing. Kayser Threde should collect information on the intended uses of the Ar laser for ellipsometry and manipulation to determine if the Ar laser can be replaced by an infrared laser, which would be more energetically efficient.
  
8. The Board recommends to its own members that:
  - They should submit proposals as users of IMPF, in response to the AO (Announcement of Opportunity) expected in the Fall of 2000. The AO will be released by a working group consisting of ESA countries, NASA, and NASDA. Board members should also encourage other scientists in their country to respond to this AO with proposals of their own.
  - They may request letters of support from the Chairman, to include with their own proposals or correspondence to their national agencies.
  
9. The Board notes that Kayser-Threde has produced a flyer publicizing IMPF. Kayser-Threde has followed the Board's recommendation from its third meeting to produce an electronic version of its feasibility study. This report, and the flyer, are now posted on the Kayser-Threde website. The existing IMPF website at [www.microgravity.net](http://www.microgravity.net) has now been linked to the new Kayser-Threde site.

The meeting was adjourned by Prof. Goree.

During the three days after the meeting, the 8<sup>th</sup> Dusty Plasma Workshop was held at the same location. Among the 85 scientists attending the meeting, there was considerable interest in IMPF and the forthcoming AO. Prof. Morfill gave a talk describing IMPF; both he and Prof. Goree encouraged attendees to submit proposals to their national agencies in response to the forthcoming AO.

The chairman believes that scheduling the Advisory Board meeting in conjunction with the scientific workshop was helpful in generating attendance at the Board meeting, and in promoting IMPF to its future users.

We anticipate that talks on IMPF will be given at microgravity conferences in Vancouver Canada in May 2000, Sorrento in September 2000, and possibly at the NASA Microgravity Fluid Physics Conference in Cleveland in August 2000, by Dr. Thomas, Dr. Stuffer (Kayser-Threde), and Prof. Goree, respectively. These speakers intend to cooperate in the preparation of their presentations.

The next meeting of the International Advisory Board is scheduled for Munich, either late September 2000, or 2-3 Nov. 2000, depending on the availability of hotel rooms.

Sincerely,

John Goree

Professor of Physics, The University of Iowa  
and  
Chairman, International Advisory Board of IMPF