

EUROMECH

EUROPEAN MECHANICS SOCIETY

Final Report

Date: 8 Feb 1996

Please send this report to the Secretary-General of EUROMECH, Professor Bengt Lundberg, School of Engineering, Uppsala University, Box 534, S-751 21 Uppsala, Sweden, within one month after the Colloquium.

General

EUROMECH Colloquium No: 342

Dates: 26-29 Sept 1995

Title: Aerothermodynamics

Co-Chairman: Dr. H. Legge, Prof. R. Brun

Place and country: Göttingen, Germany

Is there need of another colloquium on the same subject? Which year? 1998 (modified subject)

Finance

Conference fee: 230,-- DM, waived for students and some East European participants. The fee included: 80,-- DM (Euromech)

Funding: Fees + Donations

Accommodation (type and cost): Hotels and Hostels, private arrangements

Meals: at the DLR cantine, covered by the Colloquium

Participation

Number of participants from each country:

Austria	_____	Germany	<u>14</u>	Rumania	_____
Belgium	_____	Great Britain	<u>4</u>	Russia	<u>11</u>
Bielorussia	_____	Greece	_____	Slovakia	_____
Bosnia	_____	Hungary	_____	Slovenia	_____
Bulgaria	_____	Ireland	_____	Spain	_____
Croatia	_____	Italy	<u>2</u>	Sweden	_____
Czech Republic	_____	Latvia	_____	Switzerland	<u>2</u>
Denmark	_____	Lithuania	_____	Ukraine	<u>1</u>
Estonia	_____	Netherlands	<u>1</u>	Yugoslavia	_____
Finland	_____	Norway	_____	Others	<u>8</u>
France	<u>12</u>	Poland	_____	Total	<u>55</u>
Georgia	_____	Portugal	_____		

Please turn

Deutsche
Forschungsanstalt
für Luft-
und Raumfahrt e.V.



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Abt.: Aerothermodynamik
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Göttingen, 06.02.96

Dear Professor Lundberg,

unfortunately, we could not recover the final report for that you mention from amongst our paper work. We did, however, produce a report which was sent to Prof. Crighton. This report is attached to the current fax.

Should you still require the questionnaire, I would appreciate a fax copy of it.

I apologize for the confusion in the communication.

With best regards,

Dr. Georg Eitelberg

Encl. 3 pages

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Aerothermodynamics

I. Scientific developments

The topic "Aerothermodynamics" has its applications mostly in spacecraft flow, especially in reentry flow. The conference joined therefore researchers from the rarefied flow community and the continuum high enthalpy flow community. To study these flows, where the state or composition of the gas changes in the course of the flow, including reactions and relaxation phenomena of internal and external degrees of freedom, several highly sophisticated facilities have been built up during the last five to ten years in Europe. These facilities and the experience gained with each of them were presented at the colloquium.

The facilities are:

The hypersonic free piston driven shock tunnels TCM2 of the University of Marseille and the HEG of the DLR in Göttingen, the hot shot high enthalpy wind tunnel F4 of the ONERA in La Fauga-Mauzac, the renewed Plasma Wind Tunnel facilities at the "Institut für Raumfahrtssysteme" (IRS) of the University Stuttgart, a Laser-sustained Plasma Free Jet at the Laboratoire des Jets Moléculaires, CEA, DRECAM-SCM at the "Centre d'Etudes de Saclay" and the high vacuum plume test facility (STG) of the DLR in Göttingen.

A main concern in the high enthalpy facilities is still the flow quality including the influences of contamination, e.g. on the gas surface interaction and relaxation phenomena.

The gas surface interaction was treated theoretically and experimentally from the translational degrees of freedom over the internal degrees of freedom to the chemical catalysis, but the uncertainties concerning the experimental and theoretical results are still very large.

Concerning plume flow and impingement (especially from small satellite control thrusters) several models were presented but there is still a lack in experimental data concerning the nozzle boundary layer expansion, which the plume testing facility (STG) should deliver.

To study the flow, optical methods especially laser techniques (e.g. LIF or LIPF) are often used. These methods are partly still under development. The electron beam fluorescence method is now extended to several gases.

Theoretical work was partly directly connected with the high enthalpy facilities, e.g. with the nozzle flow behaviour, but was also connected with bodies in tests and in flight (blunted and sharp cones, sharp flat plates, a hyperboloid flare) tested in these facilities. In the rarefied flow regime, the Direct Simulation Monte Carlo Technique is now a standard tool, where especially at smaller Knudsen numbers the chemical reactions and the gas surface interaction is of major concern.

2. Participants

A list of participants (about 60) - not all are Europeans - is included. Most of the participants were coming from France (15), Germany (15), where the new testing facilities are located, and from eastern European countries. The latter contributed especially theoretical work.

3. Financial arrangements

The registration fee was 150 DM + 40 ECU (80 DM) for non-members of Euromech. The registration fee covered lunches, a dinner, snacks at the coffee breaks, a book of abstracts and other personnel and material costs. For a number of participants, scientist from Russia and students, no conference fee was charged. Our contribution to EUROMECH will reflect this.

Four well known invited Russian scientists were sustained by paying travel and hotel costs. Help and additional money was obtained from companies and institutions (University of Marseille, Lambda Physik GmbH Göttingen, La Vision Göttingen, Sparkasse Göttingen, Sun Microsystems GmbH Unterföhring, TSI GmbH Aachen, Mercedes-Benz AG Stuttgart).

The balance between the costs of the colloquium and the fees obtained was covered by funding of the DLR.

4. Opinions

The combination of rarefied flow with high enthalpy flow seemed fruitful for both sides. The physical models for relaxation phenomena, chemical reactions, gas surface interaction etc. are usually similar or the same in both research fields. The combination of numerical codes for continuum flow in technical applications employing Navier Stokes equations or boundary layer theory and codes for rarefied flow employing mostly the DSMC technique is still a pending task, though the gap in Reynolds number is closed at least for two dimensional flows.

In spite of the considerable reduction in funding of aerospace activities, the colloquium was a success and well attended and to our opinion with about 60 participants and over 50 contributions at the upper limit.

5. Suggestion

It would be helpful, if an explicit reason for the 40 ECU contribution toward the EUROMECH could be provided. Without such a statement it is hard to justify an almost 55 % surcharge to the conference fees.

Göttingen, 23 Oct. 1995

Harber & Legge
Dr. H. Legge

Georg Eitelberg
Dr. G. Eitelberg