THE COMBUSTION INSTITUTE

(British Section)

NEWSLETTER

VOLUME 2002-2 **AUTUMN 2002**

EDITOR:
Professor A R Burgess **E-mail: a.burgess@ucl.ac.uk**

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EDITORIAL

I hope that your post box took the strain of this *Newsletter*! It is certainly a bumper edition and, hopefully, will contain something of interest to everyone. I seem to have spent most of my supposedly quiet and relaxed retirement days for many weeks making it grow.

The Sapporo Symposium has perhaps dominated this year for many members and, rightly, takes up a lot of space in this issue. I am grateful to the authors of the reports on "their Symposium".

Also included this time is a report on the Autumn Research meeting of the Section at Cranfield, the format of which was slightly different from usual. At that meeting was held the AGM of the section; the minutes are reproduced here.

An important part of the minutes of the AGM is the review of membership numbers. Despite the efforts of the committee, especially Valerie Dupont, our membership secretary, the number of members has been falling over the last year or so. It is very important to keep up the size of our membership particularly to allow us to support and fight for combustion interests in Britain. Please make an effort to recruit colleagues, your boss, research students, friends and anyone interested in the health of British combustion research and development. The membership fee is very small and the benefits can be large; see the size of the grants to be given to participants in the last Symposium.

The committee is discussing ways to raise the profile of combustion in Britain. Anyone with suggestions should contact Chris Lawn and/or write a note to me. It is important that the subject is made known to school children as well as politicians and the general public.

I am always rather disappointed by the response of readers to the *Newslette*r. I receive praise for each issue, but few offers of articles, letters to the editor or even suggestions for improvements. There are a number of points in this edition where members are asked to send their thoughts and comments. Please do so. I don't know what I would do without such stalwarts as Ken Palmer who has responded to my "Spontaneous Cacti Combustion" competition, and who tells me he is already working on an article for the Spring 2003 edition!

I was delighted to receive an entry in the competition from a very faithful reader in the USA; Elaine Oran has some surprising facts in her submission! I shall ask the committee to award some kind of prize for both Elaine and Ken, preferably something that would not prevent the instant ignition of gunpowder if tested, as "proof" of our gratitude for their support for the *Newsletter*.

An innovation in the last *Newsletter* was the inclusion of a list of papers published by members. I have now compiled what, I hope, is a definitive list of members' publications during 2001 and the start of a 2002 edition which will be published in full (dependent upon the response of members by mid-March next year) in the spring 2003 *Newsletter*. I have produced this as a sixteen-page supplement because of the length of this edition. The completeness of these lists depends on members sending me their publication lists, hopefully in a format similar to that used in *Combustion and Flam*e.

I wish everyone a happy and peaceful Christmas and a successful 2003.

Tony Burgess

COMBUSTION PEOPLE

Colin Peter Quinn, 1934-2002

Colin Quinn died in mid-October after getting a chest infection on a family Continental holiday. *Derek Bradley writes* "I admired Colin very much and he was a splendid Treasurer and supporter of the British Section".

He was the Treasurer from 1975 to 1981, an important period which included the Leeds Symposium. This was the first time the national organising section kept the profits. In this case they were considerable and gave the British Section a financial base which allowed them to use the interest on the capital to give generous travel grants for all of the following Symposia. He also oversaw the conversion of the Section to a Charity, again enhancing the funds by reducing tax liability on income. In these ways he had a major influence on the development and success of the Section over the last 25 years.

Derek continued "He was on our Leeds Organising Committee and handled the acquisition of the huge funds for the British Section in masterly fashion. He was a very astute treasurer not only in getting the funds but also in hanging on to them! I also recall drafting a memorandum on SERC and Combustion Research with him when we were both on the BS Committee and us both petitioning with the appropriate SERC officials for a better deal for combustion research (nothing changes!)".

Colin was born in Ripon and brought up in the West Riding, where his father was in the police. He attended Barnsley Grammar School at the same time as Michael Parkinson who featured Colin as the form swot in one of his *Sunday Times* reminiscences; Colin did not let this pass without a firm rebuke. He moved to Ermystead's Grammar School in Skipton from where he won a place at Christ's College, Cambridge. His National Service in the RAF allowed him to acquire the electronics skills stood him in good stead in the pre-digital experimental era.

After graduating in Natural Sciences, Colin worked for his PhD with Howard Purnell where his studies of pyrolysis generated his interest in free radical chemistry, hydrocarbon oxidation and combustion. He became a fellow of Caius College and a University Demonstrator before being persuaded by Morris Sugden to move to the Thornton Research Centre, Shell Research, Chester, where he was to spend the bulk of his career.

There, as head of the Combustion Division he led a vibrant group who enjoyed the freedom to develop science as well as supporting the business technologically. Colin made a major experimental and modelling contribution to the development of cool flames and engine knock with Mike Halstead, Andy Prothero and Leslie Kirsch. He also led significant programmes on soot formation, turbulent combustion and free radical kinetic measurements in gas, liquid and solid phases with Steve Graham, Jean Rosenfeld, David Parkes and John Bennett. Of particular benefit to the business was the work together with John Eyre and David Bull on explosions and detonations that underpinned the safe handling of LNG and LPG. At the same time he encouraged strong links with Academia through publication, shared research, and participation in the Research Councils and learned societies.

After an assignment in London in the Marketing Distribution Business, Colin returned to Thornton as a Director of the laboratory. There, as well as championing longer term

research, he built up a broad technological programme to support the growing gas and coal businesses, activities in the North Sea, and to develop alternative sources of energy; rather too soon in hindsight.

In the 1980s Shell began to focus more on its traditional core and many of the diverse activities were pruned. Colin returned to his core expertise too and spent the last couple of years at Thornton managing the Engine Fuels programme strengthening the breadth and depth of the Company's fuel technology.

When he retired in 1992 he and his wife, Jo, returned to their roots to live near Ripon. They participated strongly in the community; Colin was an active Churchwarden as indeed he had been in Cheshire.

Throughout his life Colin was vigorous in argument as many of us have experienced. When he overstepped the mark he apologised gracefully by a reference to an appropriate verse in the Bible. He expected high standards and scientific rigour from all, himself included. His face was a picture when a potential recruit (unsuccessful!), asked about the second law, told him the laws of thermodynamics were the sort of thing one could always look up if one needed them. Colin's conversation was never dull and he was an amusing raconteur; an honest and straightforward Yorkshire man who is missed by many.

Our sympathies go to Jo, Michael and Kate.

David Parkes
Brian Tyler
Derek Bradley

P G (Sandy) Ashmore

After reading Brian Tyler's tribute to Sandy Ashmore in the last Newsletter (Vol. 2002-1) Ken Palmer has written with "a couple of anecdotes to emphasise Sandy's equanimity in the face of the unexpected".

Ken says "He reminded me that at the beginning of World War 2 the British used barrage balloons as a form of air protection. The balloons were filled with hydrogen and were being shot down with incendiary bullets by hostile aircraft. Sandy was sent to Cardington, a balloon centre where the necessary hydrogen was manufactured by the electrolysis of water, and was told to make the hydrogen non-inflammable but without losing its buoyancy. He expressed doubts but was told *it is a matter of Chemistry and you are a Chemist*. However he soon managed to transfer to more agreeable work.

Many years later Sandy and I were External Examiners for a Doctorate viva in Norway. As a courtesy to the examiners all printed and spoken technical contributions were in English. After the thesis had been cleared we attended the day in Norway, at which the Candidate gave a public lecture on his thesis, with spoken comments from the Examiners and the audience. The Candidate was then required to give a lecture on a subject chosen by the Examiners, not necessarily related to that of the thesis, and for which the Candidate had been given a fortnight's notice to prepare. After more discussion the proceedings adjourned to a social evening. Sandy told me afterwards that it was the first time in a long series of viva examinations that he had been serenaded by a candidate on the trombone, accompanied by his wife at the piano. Sandy was much impressed by the social aspects of

the day, which suited him perfectly since he was just as interested in the scientist as in the science. Sandy was a good friend to many people, and he will be much missed.

Arthur Lefebvre was recently awarded the George Westinghouse Gold Medal which was established by the American Society of Mechanical Engineers (ASME) to "recognize eminent achievement or distinguished service in the power field of mechanical engineering". Arthur's citation reads "for teaching excellence and research contributions for fuel atomizers in gas turbine combustion". Congratulations, this joins many other awards for his work in gas turbine combustion.

Fred Lockwood and other Gold Medallists

Congratulations to Fred on the award, at the Sapporo Symposium, of the Bernard Lewis Gold medal "for brilliant research in the field of combustion, particularly on combustion in furnaces". He joins a distinguished list of British Section members who have received this award in the past, including A G Gaydon, R G W Norrish, P Gray, F J Weinberg, D B Spalding and K N C Bray.

The other two Gold Medals awarded at the 29th Symposium were the Alfred C Egerton medal for distinguished, continuing and encouraging contributions to the field of combustion to Ben Zinn and the Ya B Zeldovich medal for outstanding contribution to the theory of combustion or detonation to Norbert Peters. Congratulations to them both.

If you have an interest in any combustion-related topic you should join

THE BRITISH SECTION
OF THE COMBUSTION INSTITUTE

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- **the Section's *Newsletter***
- **and a chance to meet like-minded people**

Ask the Membership Secretary, Valerie Dupont, for details.
E-mail: v.dupont@leeds.ac.uk

All members are urged to try to recruit their colleagues, students, friends and even their bosses! We need a large membership to ensure that the voice of combustion is heard in Britain.

COMMITTEE OF THE BRITISH SECTION 2002

Chairman: Professor C J Lawn
Engineering Department
Queen Mary and
Westfield College
Mile End Road
London E1 4NS
Tel: 020 7882 5279
Fax: 020 8983 1007
E-mail:
c.j.lawn@qmw.ac.uk

Secretary: Dr A S Tomlin
Department of Fuel and Energy
Houldsworth Building
University of Leeds
Leeds LS2 9JT
Tel: 0113 233 2500
Fax: 0113 244 0572
E-mail: A.S.Tomlin@leeds.ac.uk

Membership Secretary: Dr V Dupont
Department of Fuel and Energy
Houldsworth Building
University of Leeds
Leeds, LS2 9JT
Tel: 0113 233 2503
Fax: 0113 233 0572
E-mail:
V.Dupont@leeds.ac.uk

Treasurer: Professor G.T. Kalghatgi
Shell Global Solutions
Shell Research and Technology Centre
Thornton, P O Box 1
Chester CH1 3SH
Tel: 0151 373 5703
Fax: 0151 373 5052
E-mail:
Gautam.T.Kalghatgi@OPC.shell.com

Committee:

Professor A R Burgess
Dept of Chemical Engineering
University College London
Torrington Place
London WC1E 7JE
a.burgess@ucl.ac.u

Dr M Brown
Energy and the Environment Division
Advantica Technologies Ltd
Ashby Road
Loughborough LE11 3GR
martin.brown@advanticatech.com

Dr R S Cant
Engineering Department
Cambridge University
Trumpington Street
Cambridge CB2 1PZ
rsc10@eng.cam.ac.uk

Dr M Fairweather
Dept of Chemical Engineering
Houldsworth Building
University of Leeds
m.fairweather@leeds.ac.uk

Professor P Gray, FRS
Gonville and Caius College
Cambridge
CB2 1TA
pg263@pop.hermes.cam.ac.uk

Professor A N Hayhurst
Chemical Engineering Department
Cambridge University
Pembroke Street
Cambridge CB2 3RA
allanh@cheng.cam.ac.uk

Professor W P Jones
Dept of Mechanical Engineering

Dr C H Priddin
Rolls-Royce Ltd
P O Box 31

Dr Ian A B Reid
BP Chemicals
Building B, Chertsey

Imperial College of Science, Technology and Medicine
Prince Consort Road
London SW7 2BY
w.jones@ic.ac.uk

Derby DE24 8B J
christopher.priddin@rolls-royce.com

Road
Sunbury-on-Thames
Middlesex TW16 7LL
reidia@bp.com

Dr D B Smith
29 Enfield Street
Beeston
Nottingham NG9 1DN
david_b_smith@talk21.com

Dr Jose Luis Torero
Institute of Infrastructure and Environment
Crew Building
The King's Buildings
School of Engineering & Electronics
The University of Edinburgh
Edinburgh, EH9 3JN
j.torero@ed.ac.uk

Dr Yajue Wu
Department of Chemical and Process Engineering
Sheffield University
Mappin Street
Sheffield S1 3JD
y.wu@sheffield.ac.uk

BRITISH SECTION NEWS

AUTOIGNITION

Notice of a meeting of the Combustion Institute (British Section) to be held on Wednesday 16 April 2003 at the University of Oxford

The Spring meeting of the Section will be held in the Department of Engineering, University of Oxford on Wednesday 16 April 2003. It will be a one-day meeting on "Autoignition" and it is planned to have invited lectures covering the fundamental chemistry of autoignition and its relevance to internal combustion engines, gas turbines and fire and explosion hazards. There will also be talks covering Homogeneous Charge Compression Ignition (HCCI) engines - a topic which is of great current interest. Please mark this date in your diary if you are interested in any of these topics and tell your friends and colleagues!

For more information contact one of the organisers:-

Gautam Kalghatgi *(Gautam.T.Kalghatgi@opc.shell.com)*
Richard Stone *(richard.stone@eng.ox.ac.uk)*

MEMBERSHIP STATISTICS

In September 2002, the Combustion Institute membership was of 171 members. Of these, 56% were academics (including students), and 46 % were from industry and various organisations. This balance between academics and industrial members has not altered significantly over the last three years. The student membership represented 12% of the total, while 16% were retired members, again unchanged numbers for the last three years. The total membership is on a downward trend, with 219 and 194 members at the close of 2000 and 2001 respectively. The members who did not renew their membership (47 in September 2002) were academics in a majority of two thirds, of which typically 25% were students. Our new members (22 in September 2002) are also mainly academics, of which the majority (13) are students. These numbers are perhaps representative of the fact that established academics are significantly moving away from the subject of combustion to work in other areas of research, while industry is decreasing the number of its combustion-related staff. (*For more details on the statistics of the membership for the last three years, see the AGM minutes*).

Valerie Dupont
Honorary Membership Secretary

BRITISH SECTION PRIZES (2002)

For each year since 1986 the Section has awarded the **Sugden** prize for the best paper published anywhere in that year. While the judging panel always does its best to consider all relevant papers, wherever they are published, it may be that some possibilities are missed. The Committee therefore wishes to remind members that they are encouraged to nominate papers published in any journal during 2002 for consideration. At least one author must have been a member of the Section at the time of publication.

Since the **Gaydon** prize, which has recently been instituted, is for the best paper with at least one British Section author at the last International Symposium (Sapporo 2002), there is less likelihood that any will be missed. Nevertheless, the views of the membership on worthy recipients will be welcomed.

Chris Lawn

A EUROPEAN COMBUSTION SYMPOSIUM 2003?

In Sapporo this summer representatives of the European Sections finally managed to get together to agree a format for a European meeting which was proposed in 2000 and is now planned for 2003. Tentative proposals are for it to be over a period of three days in a conference centre in Orleans during the Autumn. (Regretfully, we agreed that it had to be in UK term-time, but will be confined to just two week-days, with travel and the opening over a week-end.) There will be an open call for papers and little selection, with final publication on a CD, and just two or three full-scale topical lectures. Presentation of the submitted papers will be limited to a very short period (5 minutes?), with Rapporteurs to sum up, possibly on an 'applications' basis. Your views on these proposals are invited. Would you support such a meeting, as a reasonable interim gathering between Sapporo and Chicago?

Chris Lawn

COMBUSTION AND FLAME

Our journal receives a thorough examination during a Symposium. In particular, there are meetings of the editorial board, with new appointments to the Board and formal reports from the editors and publishers. In spite of the world being a difficult one, Combustion and Flame is doing well. Most notably its citation index rose from 1.560 at the last count in 2000 to 1.839 most recently for 2001. This is significantly better than the ratings of other related journals (Combustion Theory and Modelling is 1.118; Combustion Science and Technology is 0.606); the exception is Progress in Energy and Combustion Science (2.886), where the large number of citations derives from it only publishing reviews. Mercifully, it is still cheap ($52) to buy a year's subscription to Combustion and Flame and have hard copies arriving in the post monthly.

The main business item has been to select a publisher for the next few years. After a lot of running around the market square, it was agreed to stay with Elsevier, who offered the most attractive package to the Institute. One aspect of this is that members of The Combustion Institute will receive free electronic services in relation to Combustion and Flame; the information is on its way to members (*see below*).

Other matters which should be mentioned are that you are encouraged to submit papers electronically to Combustion and Flame; this will speed up the handling of papers. Most people assume that Combustion and Flame does not publish review articles; on the contrary we welcome them, just as we are happy to publish "Brief Communications". In fact, these short notes can now be published much more quickly than ordinary papers. The journal exists to serve the combustion community by publishing papers on any aspect of combustion. Because Combustion and Flame is so cheap to buy, its readership is large, so do send us your next paper, because it will be read by many.

A.N.Hayhurst

A MESSAGE FROM PITTSBURGH TO ALL C I MEMBERS

Combustion and Flame is now available online free of charge

On behalf of Elsevier Science I am pleased to announce that Combustion and Flame is now available online free of charge to ALL Combustion Institute Members, via either:

- ChemWeb (http://fuel.chemweb.com)
- ScienceDirect

Both access options allow access to the full text of an archive back to at least 1998 (ScienceDirect currently has an archive back to 1995 with plans to extend this to Volume 1/Issue 1).

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Sue Terpack: office@combustioninstitute.org

SYMPOSIUM NEWS

Although strictly not British Section News, members may like to know that the 2006 Symposium will be held in Heidelberg; most people will know that Chicago is the venue for the 2004 meeting. Start writing now!

The Program Co-Chairs for the Chicago Symposium are Peter Lindstedt and Ron Hanson.

Perhaps this is the place to remind non-members of the special advantages of membership in a Symposium year. Members who have papers accepted for a Symposium are eligible to apply for grants to attend, subject to a continuing membership from the year before the meeting. These grants can be substantial; see the reports from members attending the Sapporo Symposium later in the *Newsletter*. Grants are sometimes available for travel to other conferences. Ask the Section's Secretary. Members should remind their non-member colleagues of this great benefit.

COMBUSTION INSTITUTE (BRITISH SECTION)

AUTUMN RESEARCH MEETING 2002

Report on the Autumn Meeting of the Section organised in collaboration with the the BFRC and the Combustion Physics Group of the I of P, held in the School of Engineering, Cranfield University on Monday 16 September 2002

Programme

LES of Gas Turbine Combustor Flows,
K Menzies, Rolls Royce plc

Three-dimensional DNS of Turbulent Autoignition,
AJ Lowe, RS Cant and E Mastorakos, Cambridge University

Measurements of the Acoustic Instability of Flames Formed by Small Premixing Burners,
CM Coats, Z Chang, PD Williams, University of Leicester

The Response of Fuel Injectors to Acoustic Perturbation and their Role in Combustion Instability,
MC Jermy, WG Doherty and DA Greenhalgh, Cranfield University

Ignition Phenomena in a Reactive Solid Containing a Hot-spot,
A Shah, A McIntosh, J Brindley, J Griffiths and M Pourkashanian, University of Leeds

Combustion and Emissions Modelling for Practical Fuels in a Homogeneous Charge Compression Ignition Engine,
A Bhave, M Kraft, F Mauss and L Montorssi, Universities of Cambridge, Lund and Modena

Poster Session

Large Eddy Simulation of Premixed Turbulent Propagating Flames,
MS Ali and SS Ibrahim, Loughborough University

DNS for Premixed Flames in the Numerical Wind Tunnel Configuration,
N Chakraborty and RS Cant, Cambridge University

LES for Gas Turbine Combustors,
F Di Mare and WP Jones, Imperial College

Integration of CFD and Linearised Theory for LPP Combustion Dynamics,
CA Armitage, RS Cant, AP Dowling and TP Hines, Cambridge University

The Thermo-Acoustic Response of a Premixed Swirl Burner to Forced Excitation,
CJ Lawn, Queen Mary London

Three-dimensional Visualisation of Diffusion Flame Shapes under Acoustic Excitation,
WB Ng, AF Salem, and Y Zhang, UMIST

A Fast Correlated-k Gas Model for Fires and Combustion Applications,
S Dembele, and JX Wen, Kingston University

Flame Acceleration of Pressure Induced Premixed Flames,
OJ Teerling, AC McIntosh, VHY Tam and J Brindley, University of Leeds

*Radiation Heat Transfer in a Gas Turbine Combusto*r,
CD Stewart and JB Moss, Cranfield University

An Investigation of Size Distribution Functions of Soot Particles in Laminar Premixed Flames,
B Zhao, Z Yang, MV Johnston, H Wang, AS Wexler, M Balthasar and M Kraft,
Universities of Cambridge, Delaware and California (Davis)

The Autumn Research Meeting was held in the King's Norton Library at Cranfield University on 16th September 2002. It was organised and introduced by Professor Barrie Moss of Cranfield University. The meeting was broadly themed around the topic of combustion instability, an area of increasing practical importance and theoretical interest in the effort to develop combustion devices with lower emissions. A majority of the papers and posters (10 from a total of 16) were directly concerned with experimental or computational studies relating to combustion instability with a further two papers examining ignition, another important unsteady combustion phenomenon. The other presentations considered soot, radiation and internal combustion engine emissions prediction.

The meeting was split into two sessions, with three oral presentations in the morning by the present author, Nondas Mastorakos (Cambridge) and Chris Coats (Leicester). The poster presentations were then made before and during lunch, giving everyone the opportunity to examine the posters at length and to discuss the material with the aid of refreshment. Following the British Section AGM the afternoon session consisted of a further three oral presentations by Mark Jermy (Cranfield), Akeel Shah (Leeds) and Amit Bhave (Cambridge).

A number of common threads emerged from the presentations and posters. It was clear how central the burner geometry is to the understanding of combustion instability and how understanding the response of the burner is a fundamental step towards understanding the instability mechanisms. The work presented by Coats, Chang and Williams (Leicester), by Lawn (Queen Mary) and by Jermy, Doherty and Greenhalgh (Cranfield) all presented aspects of fundamental experimental investigations of burner response to acoustic excitation. All of these experiments employed a means of acoustic forcing to perturb the inlet flow in a known manner and measuring the response. The work of Ng, Salem and Yang (UMIST) presented a novel method of interpreting stereoscopic images of flames under acoustic excitation to reconstruct three-dimensional images, which should make interpretation of the flame dynamics from experimental observation easier.

Another common thread was the increasing importance of sophisticated unsteady CFD techniques in investigating unsteady combustion phenomena. In particular Large Eddy Simulation (LES) is finding increasing use as a tool to provide insight into unsteady effects in combustion with the ultimate aim of direct calculation of combustion-acoustic interaction in many cases. It was also clear how suitably chosen Direct Numerical Simulation (DNS) experiments can aid LES modelling. Examples of LES and DNS applications to premixed flames were presented by Ali and Ibrahim (Loughborough) and by Chakraborty and Cant (Cambridge), while application of LES to non-premixed combustion chamber configurations were presented by di Mare and Jones (Imperial) and the present author. Alternative computational approaches were shown by Armitage, Cant, Dowling and Hines (Cambridge) who combined a linearised method with an unsteady CFD description of the flame response to predict the unsteady response of a lean premixed prevaporised combustor, and by Teerling, McIntosh, Tam and Brindley (Leeds) who predicted the response of a premixed flame to a pressure wave using a two dimensional unsteady calculation with a Flux-Corrected Transport method. In another approach Bhave, Kraft, Mauss and Montorssi (Cambridge, Lund and Modena) showed the application of a method combining an unsteady 1-D description of the fluid dynamics with detailed chemistry to calculate emissions from a HCCI engine.

Two different theoretical approaches to ignition problems were presented by Lowe, Cant and Mastorakos (Cambridge) and by Shah, McIntosh, Brindley, Griffiths and Pourkashanian (Leeds). The former presented three-dimensional Direct Numerical Simulations of autoignition in non-premixed flows showing how the autoignition locations were at a well-defined 'most reactive' mixture fraction with low scalar dissipation. The effect of turbulence on the autoignition delay time was also investigated. The latter presentation considered ignition from a heat source in a reactive solid analytically and through one-dimensional calculations.

The work presented on the related topics of soot and radiation considered both modelling and measurements. An efficient computational method applicable to scattering gas and particle mixtures was presented by Dembele and Wen (Kingston), which is sufficiently economical for inclusion into multidimensional CFD calculations. Radiation modelling is complicated by the difficulty of obtaining accurate measurements in complex configurations at relevant conditions. Moss, Stewart, Devaud and Rubini (Cranfield) presented a technique for obtaining spectrally resolved thermal radiation measurements in a can-type non-premixed gas turbine combustion chamber. Data have been obtained at 11 bar pressure with this method which offers a novel means of obtaining useful data for model validation. Predictions of radiation are obviously critically dependent on knowledge of the local soot properties. One key requirement is the distribution of soot particle sizes in the flame, which has been investigated by Zhao, Yang, Johnston, Wang, Wexler, Balthasar and Kraft (Delaware, UC Davis and Cambridge). The particle size distribution function was measured and predicted for a laminar premixed flame showing a bimodal distribution in some circumstances.

The use of a 'themed' meeting with an emphasis on work in progress was new to the British Section and appeared to work quite well. Certainly the strong emphasis on unsteady combustion and acoustic interactions ensured that the audience generally had similar interests allowing for plenty of discussions particularly during the poster sessions. However

it has the disadvantage that it does not necessarily expose the audience to areas of combustion activity that they are not involved with. The representation from so many of the University combustion groups within the UK was extremely encouraging. The main disappointment for the author was the small attendance from the industrial community, especially disappointing with so much good and relevant applied research on show. However this may be a reflection on the state of combustion research within many British industries generally rather than a failing of the meeting!

Kevin Menzies

MINUTES OF THE AGM OF THE CI(BS)

held at Cranfield University on Monday 16 September 2002 at 1.30PM

Present:

I.S. Al-Rahbi	C. Lawn (Chairman)
A.M.Ali	M. Lewis
K. Bray	A.C. McIntosh
R.S. Cant	C. Mohamed
G. Carroll	B.Moss
C. Coats	K. Palmer
G. Cox	C.S. Panoutsos
S. Duranti	R. Perez
S. Farhat	D.B. Smith
D. Greenhalgh	K.Syed
S. Hajim	A.S. Tomlin (secretary)
A. Jasuja	Y. Wu
M. Kraft	Y. Zhang

1. **Apologies for Absence**

   Apologies for absence were received from M. Brown, A.R. Burgess, V. Dupont (Membership Secretary), A.N. Hayhurst, and G.T. Kalghatgi (Treasurer).

2. **Minutes of the AGM, 13th SEPTEMBER 2001**

   The Minutes were signed as a correct record.

3. **Matters arising**

   The treasurer Gautam Kalghatgi had reported that the British Section is able to qualify for charitable status despite having substantial financial reserves but that we are not able to qualify for covenant claims. There were no matters arising other than items on the Agenda.

4. **Chairman's report**

The Chairman Professor Lawn reported that the funding application to the EU for a joint European Sections' meeting in Spring 2002 had been turned down. Following a meeting of the Chairs of the European Sections in Sapporo in July, the meeting is now scheduled to take place in Orleans in 19th - 21st October 2003. The format of the meeting is to be less restrictive than the original proposal, which focused mainly on future technologies. The subject areas covered will be open, with the format of the meeting being largely based on posters and round-table discussions, and with extended abstracts to be published on CD. It is proposed to invite representation from EU policy makers for at least part of the meeting. Views from the membership on the proposed format of the meeting are welcome.

The Chairman commented that one of the functions of the British Section should be to raise the profile of combustion in the UK. The distribution of new advertising fliers was noted but he commented that membership of the British Section had still fallen this year. He described the British Gas Flame Road-Show which had become available since it was no longer in use by Advantica. Although it was not possible for the British Section to house the road-show due to its space and man-power requirements, it is being housed by the University of Loughborough. This may allow the possibility for the British Section to sponsor profile-raising events using the equipment. It was thought that such events would be aimed at the sixth-former and undergraduate market. Professor Lawn had explored the possibility of nominating a speaker for the Royal Institution Christmas lectures but, since it would occupy up to a year of the nominees time, it was thought not to be feasible to even bid for it. The Chairman also reported that an updated web-site for the British Section was under development. Dr. K. Palmer suggested that a video may be a good way to distribute promotional and education material to Schools and Colleges. The Chairman agreed to pursue this idea further through the Committee. Any other ideas from the membership about possible profile raising activities are welcome.

5. **Secretary's Report**

Membership 2001:

Dr. Dupont had provided a summary of recent membership statistics. The British Section currently has 171 members compared to 187 at the same time last year. (note that membership runs from January to December).

	absolute numbers			% of total membership		
	Dec 2000	Dec 2001	Sept 2002	Dec 2000	Dec 2001	Sept 2002
Number of members for year	219	194	171	100	100	100
of whom are academics	124	92	95	56.6	47.4	55.6
number of students included in	30	15	21	13.7	7.7	12.2

"academics"						
number of retired members included in "academics"	7	9	9	3.2	4.6	5.3
number of non-academics in total	95	102	76	43.4	52.6	44.4
number of retired members included in "non-academics"	20	21	18	9.1	10.8	10.6

Non-renewal of membership

	Dec 2000	**Dec 2001**	**Sept 2002**
Total of non-renewals	**41**	**63**	**47**
Of whom were academics	21	40	28
number of students included in "academics"	5	19	7
number of retired members included in "academics"	0	2	1
Number of non-academics in total	20	23	19
Number of retired members included in "non-academics"	1	1	2

New members each year

Total number of new members	19	32	22
Of whom were academics	17	20	18
number of students included in "academics"	14	9	13
number of retired members included in "academics"	0	0	0
number of non-academics in total	2	12	4
number of retired members included in "non-academics"	0	0	0

NB: figures of 2000 members minus non-renewed in 2001 plus new members in 2001 do not match exactly figures for 2001 members because some members may have let their membership lapse for over a year when they might have been counted as new members when they rejoined.

Meetings

Following discussion with the membership an attempt to vary the format of British Section meetings was made this year. The Federation of European Sections meeting did not take place in the Spring of 2002. The British Section Spring meeting was

therefore held on April 17th 2002 at Queen Mary, University of London in the Octagon Theatre. 17 posters were presented on the topics of Non-laser diagnostics, Two-phase reacting flows, and Syngas and biomass combustion, with 32 attendees. Three afternoon raporteurs sessions took place where the main poster points were presented and discussed. John Smart judged the posters and the poster prize was awarded to R.M. Carter and Y. Yan for their poster, "On-Line Measurement of Pulverized Fuel Fineness using Digital Imaging Techniques". A report on the meeting appeared in the Spring *Newsletter*.

The Autumn meeting was held at Cranfield University on September 16th 2002. The meeting included both poster and oral presentations with papers being selected from submitted abstracts from the suggested topics: Combustion Instability, LES / DNS of Turbulent Flames, Advanced Measurement Techniques for Flames, Combustion and Emissions Modelling for Practical Fuels, Combustion Processes in Furnaces and Fires, Nano-particles in Flames.

Prizes.

The committee recently agreed to fund a separate prize for the best UK paper in the International Symposium of £300, to be termed the Gaydon Prize. The award for the 28th International Symposium on Combustion, 2000, had been made at the Spring meeting to X.Jiang and K.H.Luo for their paper "Combustion-Induced Buoyancy Effects of an Axisymmetric Reactive Plume".

The Sugden Prize for 2001 has been awarded to K. N. C. Bray, M. Champion and P. A. Libby, for their paper "Pre-mixed flames in stagnation turbulence. Part V - Evaluation of Models for the chemical source term" in *Combustion and Flame*, **127**, 2023.

Travel Grants.

This year the British section made 17 travel awards of £1,000 to members as a contribution towards the cost of presenting their papers at the 29th International Symposium on Combustion in Japan. In addition two awards of £750 were made to student members to attend the Symposium. The Section also agreed to make travel grants available to students presenting papers or posters at combustion-related meetings other than the International Symposium. Two such grants have been awarded so far this year.

6. **Honorary Treasurer's report**

The Secretary presented a statement of accounts for 2000/1 on behalf of the Treasurer.

Current total assets are £78,322 - £2,895 in the current account and £75,427 in the COIF Deposit Fund. Our funds were boosted by the return of money owed by the

Edinburgh Symposium and our final share of the profit from this, which was around £13,500. Members were given the option to renew their membership by standing order - at last count 31 people, around 15% were making use of the facility. Membership income is on a downward trend - see below. The figure for 2002 is projected from what we have collected so far, £2328. A new Prize, the Gaydon Prize worth £300 for the best paper by a British section member at the International Symposium was awarded. Also two prizes of £50 each were awarded to the best Student Poster at the April meeting. Travel grants worth £16,500 (15 @£1000 and 2 @ £750) were made for the 29th Symposium. Three further travel grants, two of £250 and one of £500, to enable students to present their work at international conferences have also been made. So the grants made in 2002 represent the largest such sum given out by the British Section. Normal expenses (committee, secretarial, newsletter, Prizes) average around £3,200 per year. Normal sources of income are COIF investment interest (~£3400), membership income and profits from colloquia (~£500) and the total is around £6400. So we still generate a surplus which is mainly used to award Travel grants.

7. **Election of Committee members**

Stewart Cant, John Smart and Alison Tomlin had reached the end of their terms. The Chairman thanked them for their efforts as members of the Committee. Martin Brown, Gautam Kalghatgi and Chris Priddin were all re-elected for a second term. Chris Priddin is elected for a further 2 years having already served for 4 years. The Chairman welcomed the newly-elected members, Drs Ian Reid, Jose Torero and Yajue Wu to the Committee.

8. **Any other business**

Dr. David Smith presented a short report on the Combustion Institute Board Meeting that took place in Sapporo in July 2002. The Venues for the 2004 and 2006 International Symposia will be Chicago and Heidelberg respectively. A short debate took place on appropriate citation procedures for the Symposium Volumes. The Board Meeting had agreed that the correct citation should be that which is presented on the spine of the volume and that the new citation format should not be used on issues before the 28th Volume. Professor Moss raised the issue of the standing of the Symposium Volume for RAE submissions when compared to standard refereed journals such as Combustion and Flame. Professor Lawn commented that some debate had taken place with regards to a second round of refereeing for the Symposium volume separate from that for accepting a paper for presentation, but it was not expected that this procedure would be adopted in the near future.

The meeting closed at 2.15 p.m.

Alison Tomlin (26/9/02)

ILASS EUROPE 2002

A report on the 18th Annual Conference on Liquid Atomization and Spray Systems held at the University of Zaragoza, Spain on 9-11 September 2002

The 18th Annual Conference on Liquid Atomization and Spray Systems - ***ilass Europe 2002*** - was organized by the Laboratory for Research in Combustion Technology (LITEC), a research center supported by the Spanish Council of Scientific Research (CSIC), Universidad de Zaragoza, and the Regional Government of Aragon. This prestigious event was held in a new building at the ACTUR campus of the Universidad de Zaragoza in the north of the city, about 15 minutes by car or bus from the city centre.

Zaragoza is a beautiful and historical city, 2000 years old, where you can find ancient and modern monuments and buildings, most of which are illuminated at night producing an attractive scenery for visitors; without doubt the perfect place to hold important events, especially this one.

It was obvious that the committee had worked very hard before and also during the conference because everything seemed to run smoothly and on time. The organizers were friendly and open people that helped as much as they could, and made everyone feel at home. The fact that the number of attendants was not that big (around 120 people) probably helped to make a more friendly atmosphere.

The conference was run simultaneously in three rooms (one of them an auditorium). I was surprised about the variety of topics covered, among others: Fundamentals of atomization, Spray modeling, Spray impact on walls and liquid films, Injection in internal combustion engines, Cryogenic sprays, Gas turbine applications, Agricultural applications, Spray combustion, Electro-sprays and ultrasonic atomization. Although much of the work presented and the studies that I am doing in my PhD had some points in common, on many occasions the information provided was completely new to me.

The spray combustion session was held during the whole morning of the last day; there was also a substantial variety of subjects, which made it very interesting. The engine sprays session and the one about impact on walls were probably the more directly related to practical applications that I had opportunity to witness.

The speakers invited to give the plenary lectures were: Prof. Gerard M. Faeth, current Editor-in-Chief of the Journal of the American Institute of Aeronautics and Astronautics. I had the opportunity to meet him during lunch and I found him a very interesting and cordial person. Prof. Antonio Barrero, from Universidad de Sevilla, talked about controlled generation of micro and nanodroplets including the generation of hollow droplets and droplets filled by another liquid. Prof. Stephane Zaleski from Pierre et Marie Curie University (Paris VI) gave a vivid speech about numerical simulation of fluid interfaces, showing excellent animations and representations from computational work. Also among other attendants I had the opportunity to sit with were well-recognized people in the field such as Dr C Tropea and Dr N Chigier, who were also chairs at some sessions.

This has been my first experience of an international conference, and I am very grateful to all people and institutions that contributed in one way or other to make it possible. It was really fulfilling and enlightening. Although I felt very excited and nervous I think that I delivered an understandable talk, and I am actually proud of it.

Numa Marquez

THE TWENTY-NINTH INTERNATIONAL SYMPOSIUM ON COMBUSTION, 21-26 JULY 2002, SAPPORO, JAPAN

Members receiving travel grants from the Section to help them attend the Symposium were asked to contribute a short article to the Newsletter about their experiences. Most did! The result, somewhat edited, appears here. I have taken out parts which duplicate information and I have omitted most references to how grateful members were to the organisers and to the Section for the grants.

Tony Burgess

These Symposia have a momentum all of their own. Beforehand I wondered if any would be deterred from travelling to Japan by 11 September and all that. The answer was not many, but who could fail to notice the absence of such regulars as John Beer, Heinz Wagner, Peter Gray, Ken Bray, Felix Weinberg, Graham Dixon-Lewis, John Griffiths, Chris Morley, Tony Burgess, Jack Howard, Adel Sarofim, Nikolai Kidin and many others. Of course, later you realise that on average more than 50% of the papers submitted are rejected. In that case, it is remarkable that such an organisation can survive when it regularly annoys half of its members by rejecting their work. I am sure the above grandees were not in that category, but were deterred by the effort and expense of travelling so far. Nevertheless, The Combustion Institute will have to address the problem of how future symposia might be organised to be more inclusive.

It was indeed quite a trek travelling to Sapporo and I for one saw it all in a different light by spending two nights on the way there in Moscow. I expect the organisational details of life in Moscow to be less than perfect, but certainly I was quite surprised by the number of registrants (including me) having to sort out such things as payments for the social evening before they could be presented with their conference bag of goodies at the registration desk in Sapporo. I thought I had organised all those trivial details months before leaving England. That was the only organisational lapse and everything proceeded as smoothly as I had previously assumed.

Scientifically there were no shocks, huge developments or really notable new ideas. My impression was of steady development. I was disappointed by a few of the plenary lectures because they were for the specialist: I had naively expected to learn something about areas quite distant from my own. The notable exception here was Sebastian Candel. The sessions always present an identity crisis when there are often three possibilities for the next paper I might go and sit in on. I attended many of the papers on coal and found that people are arguing more fiercely about how carbon burns in oxygen than when I first encountered the problem thirty years ago. Here is just one area where computational chemistry is making an impact. We shall hear more of it. I attended interesting sessions on the synthesis of fine particles where I thought the modellers were surprisingly uninhibited by a lack of knowledge of the chemical details of the flames producing particles. Progess in NO_X and SO_X, as well as in soot and reaction kinetics, again seemed steady and without any great leaps forward.

The social side was well organised and successful. However, with everyone dispersed in lots of tiny hotels (with rooms small enough for a sub-mariner) and having to lunch in bars around town, there were limited opportunities for meeting new or young people. Even so, the British contingent performed well. We were delighted by Fred Lockwood's gold medal and also by our rendition of a Beetles' song at the party on the Wednesday evening. It is clear that the number of papers from the British Section was not huge, but I am sure we were "punching above our weight". None of it would have been possible but for the very generous travel grants from the committee of the British Section. We are extremely grateful. Years ago a friend informed me that going to a conference is just like the Russian aristocracy before the revolution: they would trot off every summer to St Petersburg solely to remind each other that they were still alive in spite of all the problems of managing their decrepit estates. That grand old lady, The British Section, although depleted in numbers, is evidently still very much alive.

A.N. Hayhurst

Proceedings began with a fine Hottel Lecture from Sébastien Candel on "Combustion Dynamics and Control." This charted the studies of combustion instabilities since 1945. Instabilities in lean-burn gas turbines have led to active control procedures and the determination of transfer functions. Problems arise in developing suitable sensors and integrating activators into injectors. Description of the perturbed velocity field incident on the flame front is crucial in determining the flame transfer function, and it is necessary to account for the flame cusping when more than one wavelength wrinkles the front. Integration of the *G*-equation has enabled computation of the transfer function over a range of frequencies. The modelled phase lag between combustion and flow perturbations increases with frequency, as is observed in practice.

Large eddy simulations are highly relevant to instability studies and were featured in a number of presentations. One by Pitsch, involving unsteady flamelets, was applied to the piloted CH_4-air turbulent jet Sandia flame D, with some local extinction, and gave improved predictions of mass fractions of CO and H_2. It was interesting to note how perceptions of lifted turbulent jet diffusion flames through the years have returned, via dissipation in diffusion flames, to the Vanquickenborne-Kalghatgi concept of them as arrays of premixed flamelets, albeit with a greater understanding of the detailed flame structure. Driscoll reported a new Particle Image Velocimetry technique capable of 8000 images/s. This was used to obtain histories of gas and flame propagation velocities, conditionally measured at the flame leading edge, outside the main turbulent region. Values of the latter velocity were close to the laminar burning velocity. Individual vortices rolled-up the flame base and moved it inwards, subjecting it to larger velocities that carried it downstream. Direct Numerical Simulations (DNS) of such flames presented by Takeno also suggested they are composed of a stable, leading edge, laminar flame, an inner vigorous turbulent premixed flame and a number of floating diffusion flame islands. The stable laminar leading edge flame is stabilised outside the turbulent jet and has a triple flame-like structure. The Leeds-Daresbury offering I presented modelled the piloted jet Sandia flames, D, E and F, the last with pronounced local extinctions. A library of stretched premixed laminar flamelets was employed, with extinctions and changes of volumetric heat release rate due to flame stretch. Second order moment closure was used for the reaction progress

variable, conditioned upon the different values of mixture fraction. The roles of negative flame stretch rate and flame curvature are important. With regard to the latter, experimental pdfs of curvature of high resolution were presented by Shepherd and DNS data by Jenkins.

An experimental study of premixed spherical imploding laminar flames was presented by Baillot. These were created at the top of "pagoda" flames, formed by acoustic oscillations from a loudspeaker. Implosions are subject only to negative curvature stretch. She found that the corresponding curvature Markstein numbers depended upon the choice of isotherm, whilst confirming they were different from those due to strain rate. Similar implosion flames, falling from a drop tower, were studied by Driscoll, who found the Markstein numbers for an implosion to be significantly larger than for an explosion.

The Plenary Lecture by Sivashinsky on "Premixed Combustion Modelling" was a fine demonstration of his creative mathematical approach. It covered instabilities and accelerations of spherical flames, accelerations and extinctions of turbulent flames and the role of hydraulic resistance, including boundary layers, in deflagration to detonation transitions. In the following session Law presented experimental data, for pressures up to 2 MPa, on cellular instabilities and flame accelerations in an explosion bomb. Matalon updated the earlier seminal Bechtold-Matalon theoretical paper on the developing instabilities in spherical expanding flames, to cover variable transport properties over a wide range of equivalence ratios. The style of this paper makes it more accessible for practising engineers and covers the developing flame speed. Karlin also traced the development of instabilities mathematically. He found that the rates of linear growth of perturbations of steady pole solutions of the Sivashinsky equation demonstrate that cellular flames must be highly sensitive to external noise. Patel from the Loughborough group presented further computational and experimental studies of turbulent flames over multiple obstacles.

A special Fire Research session was dedicated to the memory of the victims of the attacks on the twin towers of the World Trade Center. A Plenary Lecture by Hirano gave an overview of "Combustion Science for Safety." Invited reviews followed, with Quintiere discussing the internal problem of "Fire Behaviour in Building Compartments" and Makhviladze the external problem of "Large-Scale Unconfined Fires and Explosions." Quintiere presented approximate mathematical formulations of fire evolution for both crib-like and pool-like fires, with Semenov diagrams to explain the development of fires through flash-over. Maximum temperatures in the region of 1350 &#0176C were suggested and these formulations were applied to the towers. Their failure was not due to impact, but the weakening of the steel by fire. The thickness of the insulating cladding of the steel was different in the two towers and his expressions approximately explained why the towers collapsed at different times after impact. Only recently has NIST been funded to conduct an investigation. Makhviladze classified fuel releases into different categories. The structure of any subsequently burning cloud then could be obtained for both single and two phase releases. The rate of fireball burning could be derived, along with the radiative flux. These findings were applied first to the terrorist bomb explosion on the Warrington gas-holder and the subsequent fire. A second application was to the release of hydrocarbons following the fracture of the large pipeline at Ufa. In both cases it was possible to estimate the masses

of fuel involved. At Ufa it was massive (probably the largest ever) and a sequence of events was traced that led to a devastating fire-storm.

There were a number of both 2D and 3D DNS studies of the autoignition of non-premixed, turbulent, gaseous, reactants. For engine fuels the underlying, exceedingly complex, chemistry is probably still the dominant factor. Relevant to this, a paper describing new reaction mechanisms for the autoignition of heptane isomers was presented by Westbrook. Hydroperoxy alkyl radicals were assigned new reaction sequences involving additional internal H atom abstractions. This accelerates autoignition in fuels with tertiary C-H bonds in the parent fuel. The isomers considered provide an unusually wide range of computed autoignition delay times. These were compared with those measured on the rapid compression machines of co-authors Griffiths and Mohamed at Leeds and Ribaucour at Lille. For the nine isomers considered these times are roughly related to the corresponding Research Octane Numbers.

A number of presentations featured laser ignition. Phuoc and White drew up an energy balance for a laser-induced spark. The shock wave accounted for 51-70% and radiation for 22-34% of the energy. With a remaining hot gas energy of 7-8%, this mode of ignition did not differ greatly from that of an electric spark. Chung presented a numerical simulation which showed how the initial shock wave from the high temperature and high pressure region generated the torus-like flame kernel that propagated radially and generated the front lobe, which propagated back toward the laser source. The front lobe was separated from the torus for lean mixtures, but was connected for a stoichiometric mixture.

I was surprised at the extent of the effort in USA devoted to micro-power (mW to W) generation using combustion. This was admirably surveyed by Fernadez-Pello in an invited review. Despite their low efficiencies, such micro devices might have higher specific energies than batteries. Heat transfers must be carefully controlled and catalytic surface reaction is necessary if flame thicknesses are excessive. Current studies cover Wankel engines (no valves), free piston engines, micro-rockets, reformers, fuel cells, thermo-electrics and liquid film combustors. Whittle's problems in developing rotary devices of sufficiently high efficiency and combustors of sufficient intensity are re-lived, with Lilliputian silicon rotaries running at over 10^6 rpm and a catalytic combustion chamber, at MIT. It is entertaining to predict the variety of problems that might be created to utilise these solutions.

The Symposium was excellently organised and for this we thank profusely our Japanese hosts for their untiring efforts and Japanese industry for its generous financial support. On a matter quite outside their control however, there were concerns amongst several of us about both the low proportion of submitted manuscripts that were accepted and the number of multi-submitting authors who felt that it was their better paper(s) that were rejected. The sometimes embarrassing failure to fill the allocated discussion time at the end of a presentation also might suggest that our procedures (no doubt contrary to our intent) are encouraging the safe dotting of "*i*"s and crossing of "*t*"s, while discouraging more contentious new ideas that would stimulate discussion.

Derek Bradley

Previous to the Symposium we had spent a couple of nights in Tokyo, and were pleased to find that the courteousness and efficiency of the Japanese were the same in all parts of Japan. The sumptuous opening reception held something for everyone, though it helped if you liked raw fish! The local brews were fabulous, and a good time was had by us all.

Bright and early (well, early - some of us not feeling too bright after the events of the night before) next morning we attended the plenary lecture by Sèbastien Candel, which gave an interesting overview and insight into combustion control and dynamics. The talk was very informative, especially if dynamics and control was not really your field. It managed to convey a little of the difficulties of this subject, without overburdening us with too much technical information. I very much enjoyed the session on combustion of solid fuels. I found the two papers presented on the day on char structure and evolution of porosity to be particularly useful and interesting. The authors of the papers were Külaots, Aarna, Callejo, Hurt and Suuberg and Yu, Strezov, Lucas, Liu and Wall.

The next day, I again tended to attend the session on solid fuels, being particularly interested in a paper presented by Paul Campbell on work which he, Reginald Mitchell and Liqiang Ma had done concerning characterisation of coal-char and biomass-char reactivities towards oxygen. The experimental setup was most ingenious. Throughout the day I occasionally popped next door to the session on stationary combustion, where I found paper presented by P Salatino on catalytic combustion of methane in a fluidised bed to be most informative.

I found the Toshisuke Hirano's plenary lecture, combustion science for safety, to be fascinating, especially the results on flame propagation and explosions. Sometimes it did make me wonder exactly how much of his drive to set fire to things came from academic interest, and how much from pyromaniac tendencies (especially when it came to setting fire to huge vats of kerosene). Though I guess this is true for many members of the combustion community. I decided to follow the thread through the morning by attending the sessions on fire behaviour in building compartments and large-scale unconfined fires and explosions. Both of these sessions were well thought out and enjoyable, even if you were attending for the sake of interest, with no prior knowledge of the subject. They both explained the subjects clearly and gave us a clear grounding in them. One slight annoyance was that the prepared question and answer session at the end seemed, to many people, to be an excuse to stand up and try and sell their latest piece of equipment, or to promote their company. I felt that this detracted from the session.

Wednesday afternoon was a chance to go and see the horses at the northern horse park, and a great time we had too. I only hope that there is never a cause for the combustion community as a whole to have to hunt its dinner with a bow and arrow, nor to have to sing for their supper.

On Thursday, after the plenary lecture, I attended the session on pollutant formation (NO_X) followed by the combustion synthesis session. The evening's entertainment was the banquet, which was lavish, and had a great deal of sake. In fact, we had previously been to the Sapporo brewery, and were astonished to find that the Symposium had taken such a large percentage of the annual production of saké. A back of the envelope calculation

amazed us with the actual amount of sake set aside for each person at the banquet (around a bottle each).

On Friday, I skipped the plenary lecture as I was giving my talk, and was far too nervous to stay still for the required hour in any case. I enjoyed giving the talk, though finished a bit early, leaving lots of time for the rigorous questioning which is a strength of the Symposium. This was my first talk, and I am very grateful to the session chairs for their support. In the afternoon I went to the lively session on soot before the leaving party, which was again very good.

My wife also attended the Symposium, and enjoyed the accompanying persons' programme greatly. There was always something for her to do; the Kinki-Nippon tourist board, together with the Symposium organisers, had arranged a really interesting and fun set of events. After the Symposium we went on the post-Symposium tour of Tokyo and the environs. This was very good, but seemed to inexplicably cross backwards and forwards across rush hour Tokyo a lot. We all had a great time though.

Paul Fennell

I think the 29th Combustion Symposium held in Sapporo was excellent and well attended. The local arrangements were great with very interesting picnic and banquet which reflected the Japanese culture.

The technical program consisted of seven parallel technical sessions on each day for oral presentations with a Hottel plenary lecture on the first day and four plenary lectures on the following four days. In addition there was a series of work-in-progress sessions during the week.

In general, most of the papers presented were of high standard and well presented. However, there wasn't, in my opinion, a breakthrough in combustion science as that observed in the 28th Symposium, Edinburgh. In Edinburgh, there was a breakthrough on the development of laser diagnostics techniques and advanced numerical techniques, such as the large eddy simulation (LES) and direct numerical simulation (DNS), as useful tools for combustion studies in practical industrial applications. Most of the research work presented in the 29th Combustion Symposium can be seen as a "refinement" of the advanced techniques proposed in the Edinburgh Symposium.

Another observation, I noted during the 29th Symposium, was that the gap between academic and industrial research is still quite wide especially in the field of internal combustion engines. I wasn't, really, impressed by the quality of papers presented on either experimental and/or numerical studies of flow and combustion in realistic IC engines. There is a need for greater interactions between academics and design engineers /scientists to narrow this gap, a task which is not always easy to do.

Salah S. Ibrahim

During my career I have attended many Combustion Symposia. This event adhered closely to the standard format in terms of the technical and social programmes. The Japanese are famous for their organisational abilities and hospitality and the arrangements of this event bore abundant proof of that. And when the odd hiccup inevitably occurred, such were rectified quickly, efficiently and with the utmost courtesy. While not wishing to show preference, many were those who said that this was the best organised symposium ever. My congratulations and thanks to the Japanese for a very enjoyable event. A highlight for me was the splendid Japanese style banquet; of course it was bound to be as I was presented with an award I had never dreamed of receiving.

I attended as many technical sessions as I had the energy for and would have like to have attended many more. I was present at all of the invited lectures and particularly enjoyed the one of Candel whose talk was, as a plenary should be, scintillating and accessible to whole of a generalised audience. The poster sessions continue to be well attended and to exceed expectations. I have to say that on this occasion I noticed that quite a few authors who had oral presentations were also presenting something rather similar in the poster sessions to achieve a 'double whammy' effect.

In my experience each Symposium has a flavour which is indicative of the culture of the day. It was a little difficult to discern that this time. My overall feeling was that we 'combustioneers' are becoming somewhat closeted and insular. Dare I say it, our good old Combustion Institute is becoming a bit too much of a 'gentlemen's club'? For better or for worse, I believe we need to integrate more with other disciplines, modern control theory and microbiology for example. Initiative from the top is required to achieve this. How to do it, I do not know, the Symposia are already rather large, but the modern world is corporate and applied and integrated technologies are required. There have been several attempts to introduce more practicality into the Symposia, to some extent successful, but there is still some way to go if our subject is to capture the current day respect it deserves.

I am always interested in the developments the theory of turbulent combustion, even though I have long since departed from this area. I attended a few sessions and the presentations and discussion were as 'cosy' and erudite as ever. But we still need better and more readily usable methods. I was very much taken by the paper Mizobuchi et al on the lifted turbulent flame. They had made some rather incredible DNS calculations, and for a Reynolds number reasonable magnitude, which went someway towards explaining the physics of this fascinating phenomenon.

Lastly, I should mention that, in spite of the UK's apparent commitment to Kyoto and the environment, the lack of new blood and combustion research monies in our country was all too evident. Is this the nature of spin?

And I ought also to mention that my wife and I passed a wonderful and adventuresome four days touring Hokkaido after the Symposium, exquisitely organised for us by the official travel agents-four days without seeing a single 'European', I would never have believed that such was possible in Japan.

F C Lockwood

The Sapporo Symposium was well balanced across all areas of research in combustion. The programme was well organised, maintaining a generally high standard of papers accepted for presentation, a credit to the hard work of many people who worked on the programme committee and who refereed submissions. Local arrangements were excellent in a very attractive part of Japan.

It is hard to single out any particular area of scientific interest when the most anybody could do was attend about one sixth of the presentations. But I was pleased to see a greater degree of recognition of the importance of flame-instability in determining the behaviour of turbulent premixed flames. The link between intrinsic instability, caused by hydrodynamic and also sometimes thermo-diffusive effects, and the subsequent dynamics of a flame, is far from trivial and needs a great deal of research to be fully uncovered, but I have for a long time felt uncomfortable with the paradigm that flames simply respond passively to fluid-dynamical turbulence. Theoretical considerations dating back some 20 years have clearly indicated that this can't be the case except, possibly, when there is very intense fluid-dynamical turbulence (but even this is doubtful).

My overall impression is one of an improving degree of synergy between experiment, modelling and theory. Each of these areas, aided by tools such as numerics, PIV, asymptotics, LIF, laminar sub-models, etc., is vital if we are to tackle important challenges like turbulent combustion.

John Dold

The 29th International Combustion Symposium took place during late July 2002 in the pretty city of Sapporo on the island of Hokkaido in northern Japan. The eleven-hour flight from the UK to Japan was fairly tiring, although I was entertained for a time by a well intentioned elderly Japanese lady sitting alongside me who produced for my enjoyment a number of dinky origami items. After a fast, clean train from Sapporo airport I emerged from the subterranean station into the balmy evening air of the city itself, only stopping briefly to take in the sight of the spacious square in front of the station before I headed for my hotel and rapidly succumbed to jet lag.

The conference was held in two, almost adjacent, hotels allowing quick and easy movement between the many presentations. Over the course of the week presentations and poster sessions were given on a wide variety of combustion research topics, and it was interesting to observe many established researchers from a number of areas of expertise presenting the fruits of their work. Presentations that stand out in my mind include those of Professor Bill Linak on the subject of ash particle size distributions from a pulverised fuel combustor, an area of interest to my own research, and the plenary lecture by Klaus Hein on challenges for research in a changing energy market. A particularly interesting presentation was given by James Quintiere regarding the behaviour of fires in building compartments, touching on the subject of the fires that took hold in the World Trade Centre. It was refreshing also to notice a large number of younger Symposium delegates from many countries, with whom I took great pleasure in meeting and discussing various subjects relating to combustion research.

The large social programme offered plenty of relaxation for everyone, although there were many alternative distractions in Sapporo to entertain the short-stay visitor. With a population of almost two million Sapporo is one of Japan's largest cities and yet it seemed a compact, peaceful and generally pleasant place to be. The layout of Sapporo's streets are based on the American-style grid system. This is handy for newcomers and tourists but ultimately robs Sapporo of a lot of character, which on closer inspection it appears to have in abundance. Since my Japanese extends to a handful of words and phrases I met with little success in making myself understood, but the helpfulness and friendliness of the Sapporeans smoothed out most misunderstandings and made for a very enjoyable stay.

Kevin Clark

The travel contribution made by the Combustion institute was particularly welcome this time given the expense associated with travel to Japan. The trip was well worth it and I certainly enjoyed "the beautiful island of Hokkaido" to the extent possible. The banquet was super and the cultural (and culinary) diversity was much appreciated. The local organiser for the next meeting was at our table and I look forward with interest to 2004. Some clearly found the sake very good indeed and the manner of dealing with social embarrassment would probably be too much even for the most ardent UK supporter of "name and shame". It might, however, suit the prohibition lobby in Sweden so there may be a new export opportunity here.

The scientific program for the meeting was generally good with some quite healthy exchanges in different areas. In this context it is perhaps appropriate to outline the importance of the Symposium as a focal point for "fringe" meeting such as the TNF workshops. The latter have been an excellent forum for vigorous debate and scientific discussions of work in progress. The latter aspect was also (again) superbly organized by Volker Sick for the Symposium. The use of the Symposium to exchange ideas informally is important and the presence of students an important aspect. The expense of travelling to Japan had the consequence that not as many as usual could make the trip and I hope that this situation will change.

Splitting of sessions between adjacent locations again proved to be less than ideal with some excellent contributions not given sufficient attention as a result. These are all lessons for Chicago and I am pleased to report that preparations for the technical programme are on schedule and well underway. It is my hope that it stays that way.

Peter Lindstedt

After spending almost a year commuting between London and Sendai in Japan, the prospect of visiting Sapporo was probably not as exciting a one for me as it would be for others. Nonetheless the thought of a cold crisp beer after a long hot soak in a Japanese bath (Onsen) was attractive enough to conjure up the required few thousand words.

I must also confess some scepticism about the Combustion Institute meeting itself. My last attendance nearly a decade or so ago was memorable for the lack of opportunity to track people down, a consequence of the large numbers of participants. In reality, the Sapporo

meeting proved to be much better and the coffee area made it possible to arrange times to meet old friends and to drum up valuable new contacts. It was also heartening to see that so many UK scientists were in attendance.

As someone whose primary interest was in gas phase detonation and explosion, the number of talks in the relevant sessions was disappointing but the upside was plenty of opportunity to listen to and read papers of more peripheral interest, valuable reading and thinking time that these days is lost supporting the continuous generation of the element administratum. The reading room is a valuable asset but often seemed to be under-utilised. There was never a queue, unlike the internet room.

Despite the fact that it was a multi-site multi-session meeting, the proximity of the two venues did not prevent movement between sessions and this all went well for me and, most importantly, I missed the start of only one presentation because the chair started a talk early. What was a little disappointing was the standard of the occasional paper. Although not an expert in the field, it would be obvious even to me that something was in error and this occasionally led other delegates to make some pretty forthright comments from the floor. Recently there has been some discussion about increasing the number of papers presented at the Symposium. Personally, although sympathetic to giving everyone a voice, it would be a pity to see the hard won accreditation of the standing of the proceedings undermined by increasing volume at the expense of quality.

And finally to the social side. There can be no doubt that organising the meeting to coincide with the local beer festival was a stroke of genius. Not only did this allow one to unwind at the end of the day but it provided the ideal opportunity to strike up conversations with students and locals alike and many an early evening ended to the clatter of glasses and combined cries of Kampai, Cheers and Iechyd Da. Given the numbers attending, the official events (I did not attend the banquet) went smoothly and as an experienced attendee at such functions in Japan, I made sure that I was amongst the first to the sushi. The Wednesday trip was also most enjoyable despite the light rain and we are still discussing the origin of the static at barbecue time that lifted many peoples' hair on end. All in all a valuable and worthwhile visit.

Geraint Thomas

I was one of the few - that is one of the few Brits that were present in the Sessions on 'The Combustion of Solid Fuels' and 'Stationary Combustion'. I also went to papers given in other sessions on NO_x and soot where there were impressive demonstrations of advancing instrumental and computational techniques, but as far as I could see the increase in knowledge was incremental.

Of course the Solid Fuel and Stationary Combustion papers were given in another hotel away from the main conference hotel - and the two sets of traffic light controlled crossing did prevent easy role swapping. I thought some of the solid fuels papers were extremely interesting and innovative. The main developments were from the US and Australia - seemingly not bothered by carbon dioxide emissions - and from Japan where there were some interesting papers on both coal and on the reactions of carbon.

In the set of coal papers presented, the emphasis was on a better understanding of the combustion process in a quantitative sense and the development of accurate combustion models. Significant advances are being made there with predictions getting nearly accurate enough for plant design usage. The other main development was in the use of these models being modified for biomass applications. The papers on the devolatilisation of biomass being of great interest particularly as they show that much of biomass devolatilistion takes place before the flame front in pf flames.

The papers on stationary combustion were diverse and interesting. In related sessions were the papers on catalytic combustion work and on micro-combustors. The latter lectures resulted in packed lecture theatres with people standing outside the door. Clearly everyone has identified this area as a cost-effective method of combustion not needing many square metres of costly floor space.

I thought that the Plenary Lectures were all very interesting and the lecture on 'New Challenges for Research in a Changing Energy Market' by Klaus Hein was particularly challenging for the delegates from a high carbon dioxide producing country. An interesting debate ensued.

Alan Williams

I will carry this experience forever with me. It was an academically enlightening symposium, which actually made me realise the potential and future of research area I was working on. I became and felt part of the ever-growing combustion community, which was so forthcoming and motivating for the youngsters and their ideas. They were supportive of the research, yet, critical to give the right direction and channelize the mind-set of students.

The conference was organized in the right environment. The organizing committee was highly efficient, a trademark of Combustion Institute and the Japanese culture. The country is highly technical and had enormous research going in area of combustion, thus making it a suitable place to host such a prestigious conference. The climate was good and there was a well mix of academic and personal interactions catalysed by trips to the countryside and discussion forums.

The authorities in their respective fields gave the Plenary lectures and the selection of topics were very apposite for the audience. I had special liking for the Plenary given by Candel and other plenary lectures by Wagner and Hein.

I learnt a lot from the papers being presented there specially related to my area of research. As I was particularly interested in laminar flames and soot, the sessions provided me with new information and updated me to the new concepts being involved in this area. I was presenting a poster on day one and had lots of people taking interest in the work. There was some critical feedback with some motivating pats.

On the whole it was an enriching experience for me, more so because it was my first international conference.

Jasdeep Singh

As usual the refereeing process was very nerve-wracking, though in the end, we did get one of our submissions through. It wasn't necessarily the one that I though it would be, but I cannot suggest a better system to select papers and I guess one has to accept this process. Travelling to Sapporo was a real experience. After eleven hours in a plane I found myself standing outside at 7.00 am in the morning at 30° heat and 90% humidity; an experience I will not easily forget.

The plenary lecture given by Sebastian Candel was really impressive and made me realise how far this branch of combustion science had developed. >From the invited presentations I was mainly interested in internal combustion engines, the soot session, and the combustion synthesis lectures. Among the many good papers and topics I saw I would single out a few. I was very impressed by the diagnostic work that enables one to observe the morphology and size distribution of particles in Diesel engines. Predicting these peoples observation is certainly one of the future challenges for modellers. The soot sessions were also very interesting. The two talks by Schuetz and Frenklach as well as by Violi et al. made me realise that Molecular Dynamics software has reached a level that even quite complicated problems can be examined. Of course, this is very good news for modellers as it means that there will be an alternative than to just fit some model constants to experimental data. I am convinced we are going to see more of this sort of work in Chicago. Another important paper for me was the work by Qing Tang and Stephen Pope. The rate constrained equilibrium approach seems to be an alternative to techniques reducing the complexity of detailed chemical mechanisms. The work that was presented was still at an early stage and it certainly will be very interesting to see how useful that promising method will turn out to be.

Talking about chemistry leads me to commenting on people's effort to automate the creation of detailed chemical mechanisms, which I think is a very important task. Starting from an automatic mechanism generator coupled with ab-initio and semi-empirical codes to get the rate data as well as using modern optimisation techniques to solve the inverse problem when fitting it to a whole set of experimental data seems to make detailed mechanisms more and more reliable even for complex fuels. These mechanisms were then combined with intelligent strategies for reduction by lifetime analysis and the daptive chemistry approach. Among other people the groups of Mauss (Lund), Green (MIT), and Wang (Delaware) attracted my attention.

I think these are the main impressions I took from the Symposium scientifically. Again it has to be said that the Work-In-Progress Poster sessions are extremely interesting, the place to get in touch and kick off good discussions. Maybe one should try to make these WIPs even more prominent by devoting more time to them in the program.

Marcus Kraft

The Symposium was held in the nice Japanese city of Sapporo surrounded by hot springs and volcanoes. It gathered large number of leading combustion scientists from around the world. The variety and quality of topics offered for discussion was so impressive that

making a decision on which papers to attend was a common problem. Besides traditionally attractive sessions on Turbulent Combustion and Laminar Flames, interesting talks were delivered in sessions on Detonations, Internal Combustion Engines, Microgravity, Fire Research, and Micro Combustors.

The Hottel plenary lecture was presented by S. Candel, who provided a broad survey of combustion dynamics and control. The Hottel lecturer outlined directions of the research important for the design of efficient gas turbines. In his opinion, these involve deeper understanding of interaction between flame fronts and perturbations of different nature. Also, this aspect of the combustion dynamics was stressed in the topical review of the turbulence in combustion processes given by A.R. Kerstin. In his talk recent progress in the researches on the modelling of the interaction between the flame front and flow turbulence was discussed. Eventually, G. Sivashinsky in his plenary lecture on the developments in premixed combustion modelling reviewed the current state of studies of flame front dynamics based on asymptotic mathematical models. In particular, recent achievements in understanding of physics of self-acceleration of outward propagating wrinkled flames sustained by the intrinsic flame instability were of considerable interest.

A possible approach to the explanation of the latter phenomenon was outlined in the talk "Cellular flames may exhibit a non-modal transient instability" by V. Karlin. In that work effect of perturbations on hydrodynamically unstable flame fronts was studied within the framework of the Sivashinsky equation.

Among other interesting talks closely relevant to the effect of the perturbations on evolving flame fronts I should like to mention:

1. G. Rozenchan, D.L. Zhu, C.K. Law, S.D. Tse, Outward propagation, burning velocities, and chemical effects of methane flames up to 60 atmosphere.
2. G.R.A. Groot, L.P.H. de Goey, A computational study on propagating spherical and cylindrical premixed flame.
3. K.W. Jenkins, R.S. Cant, Curvature effects on flame kernels in a turbulent environment.
4. T. Lieuwen, Analysis of acoustic wave interactions with turbulent premixed flames.
5. A. Lipatnikov, J. Chomiak, Turbulent burning velocity and speed of developing, curved and strained flames.
6. I.G. Shepherd, R.K. Cheng, T. Pleasing, C. Kortschik, N. Peters, Premixed flame front structure in intense turbulence.
7. O.C. Kwon, G. Rozenchan, C.K. Law, Cellular instabilities and self-acceleration of outwardly propagating spherical flames.
8. R. Addabbo, J.K. Bechtold, M. Matalon, Wrinkling of spherically expanding flames.
9. D. Bradley, D.R. Emerson, P.H. Gaskell, X.J. Gu, Mathematical modelling of turbulent non-premixed piloted jet flames with local extinctions.

Vladimir Karlin

I shall leave to others the description of the wealth of interesting Technical Sessions, all run with Shinkansen-like precision and efficiency by our hosts. Nor shall I dwell on the revelations of the karaoke at the Barbecue, except to admit that, while not disgracing ourselves completely, we were out-sung by the Swedish group. Instead, it is my lot to report briefly on the three 'business meetings', which I dutifully attended while others were well into their Sapporo beer.

Interesting snippets from the Committee and Members' meetings included reports from the other Sections, in which we learnt that the membership in Japan is 658, Korea 416, Sweden 227 (no wonder we were out-sung), Russia 203, Taiwan 200, the Nordic Countries 160, Germany 148 and France 120. These are to be compared with our 195, although the basis of membership in the various countries may be different from ours, which of course is 'paid up for the year'. Most Sections hold similar meetings to ours: I emphasised the additional 'promotional' role we feel we need to fulfill. The French publish PhD abstracts in their newsletter, and the Canadians survey their combustion labs. We might consider these ideas ourselves*.

Brian Haynes (Vice-President) reported on a deal which has been struck with Elsevier for publication of the Proceedings which involves an excellent pricing structure, royalties to the Institute, and the electronic archiving of the Proceedings back to the 1st Symposium. This is linked to a 6-year contract cycle for *Combustion and Flame*, which will also be electronically archived.

There was discussion about the future shape of the Symposia. Currently acceptance rates for papers are at about 45%. The concensus was for keeping it at about this level, but that may make it difficult to accommodate all the papers when the venue is back in the U.S, particularly as it is felt that the W-I-P posters should be allocated core time in future. The next Symposium coincides with the 50th Anniversary of the Combustion Institute. Ideas on how to celebrate are invited: should we look to the future or review the history?*

Chris Lawn

Report of Sapporo Board Meeting (mostly)

For me, the Symposium almost started disastrously. My flight left Heathrow at 10am, meaning check-in around 8am. I had a choice: either the 5:30am train from home (Nottingham), or stop over in London the evening before. Given the state of our railways ("Owing to driver shortage, we apologise ..."), the latter option seemed preferable. I was just settling down to an early night in a cheap hotel near St Pancras station (somehow this sounds rather better than a hotel near Kings Cross) when it suddenly dawned on me that I had forgotten my passport. Panic stations! I threw everything back into my case and ran (almost literally) back to St Pancras, just in time to catch the last train to Nottingham - they were closing the barrier as I 'dashed' up. Finally arrived back home around 1:30am and had to wake the family to get in. I collected the passport and had a couple of hours sleep before a 5am taxi back to Nottingham station in time for the 5:30 train. The train ran like clock-work and I made the airport in nice time. But, what if ....?

Now down to the Symposium. Rather than report on the technical programme, as others are doing, I thought I would try to capture the flavour of the Board Meeting, presence at which was one of my particular reasons for attending the Symposium. The Board meeting is probably not unusual for an academic body: it considers important matters but not always in the most efficient, and certainly not the speediest, fashion. Following established practice, we met for about 5 hours on Sunday afternoon before the Symposium started and then convened on Wednesday afternoon to complete business (and miss half the fun of the Wednesday outing). One of the Board's more important functions is to decide venues of future Symposia - this time, for 2006. We started this on Sunday by hearing two presentations, from Heidelberg and Beijing, and were then invited to ponder the choice until the reconvened Wednesday meeting. Preceding the Symposium, there had been rumours that the Polish Section wanted to propose Warsaw but Charlie Westbrook, Chair of the Site Selection Committee, had received no firm proposal. But, in this ensuing period, it transpired that Warsaw did indeed wish to host the meeting. So on Wednesday, we heard a third proposal, before discussion of all three. It was clear that we had three interesting but very different venues from which to select. The Board, I think by a significant margin, opted for Heidelberg. We had a beautiful presentation from Juergen Warnatz and felt confident that Germany would host an extremely attractive meeting, but the other two offer tantalizing options for a future Symposium.

A particular difficulty in deciding the venue arises because the different proposals on the table seldom have the same foundations. This year, Charlie was asked to try to smooth this out and he strove hard to ensure that, in particular, the draft budgets covered the same items and generally had a more consistent basis. He now wants to extend this to produce clear guidelines for proposers of future symposia. A real difficulty arises in trying to think of the myriad of often small but necessary items at the proposal stage; these fully emerge only during the detailed organisation. This obviously creates a mechanism for upward budget creep; we saw it, to some extent, at Edinburgh. This new move should help to alleviate this and should also greatly assist detailed planning of symposia.

What else? Juergen Troe and Forman Williams, co-chairs of the Technical Program Committee, reported on their arrangements for technical sessions at Sapporo; likewise Volker Sick on preparations for the Work-in-Progress sessions. All three plus others on the Technical Program Committee, had performed a huge task very efficiently. Because of the tight time constraints imposed on the technical program, there is constant jockeying with the format. This went a little further year, with Forman proposing serious examination of more radical recipes for the future, to squeeze more papers in: 7, 8, even 10 parallel sessions; or shortening paper presentation time to 5 or 10 minutes. This prompted considerable discussion, although the majority opinion was that the current pattern is probably the optimum*.

The final item I will mention is Tony Dean's report as Chair of the deliberations of the Publications Committee. The most significant item here was the question of how to refer to the proceedings of past symposia. Most of you already know that, while books of past symposia are generally called Twentieth Symposium (International) on Combustion, etc., the Edinburgh and all future ones will be entitled Proceedings of the Combustion Institute, Vol 28, and so on. As a result, a groundswell of opinion had built up in the Institute,

advocating that *all* past issues also be known as Proceedings ... Vol (whatever number). While this seems a somewhat arcane matter, it has considerable importance, as it affects referencing of all past symposium papers. As a member of the Publications Committee, I know that it created considerable controversy within the committee. I expected similar at the Board meeting but, in the event, Tony's recommendation, that we refer to past Symposia according to the title on the cover, was accepted without very little debate. (In case this prompts debate in our Section, I will say that I was firmly on the side arguing for the recommendation that emerged)*.

Dave Smith

**** Members are invited to comment on any of the points in these reports, especially those marked with an asterisk. Comments to the authors or editor please.***

Members may like to know that a selection of photos taken in Sapporo are available on the web: sue-me.eng.hokudai.ac.jp/29symp. I accessed this via the Pittsburg website.

In the list of Symposium papers with British Section authors (Newsletter 2002-1) at least one publication was omitted. Apologies to the authors:-

C.K. Westbrook, W.J. Pitz, J.E. Boercker, H.J. Curran, J.F. Griffiths, C. Mohamed and M. Ribaucour. Detailed chemical kinetic reaction mechanisms for autoignition of heptane under rapid compression.

SPONTANEOUS CACTI COMBUSTION COMPETITION

I had only two responses to my invitation in the last Newsletter to apply for funds to research this important topic. One was from our regular contributor, Ken Palmer, and the second was from a very faithful and enthusiastic reader from across the Atlantic, Elaine Oran. Her e-mail suggested a related topic and she then produced a paper and proposal; These are reproduced below. Both proposals are reviewed by a distinguished FRS, our former "Northern Correspondent".

"I just received the Spring Newsletter! It came to NRL nicely fried (irradiated) to ensure that it did not contain any stray anthrax spores. We have been dealing with this funny kind of mail for quite a while now ... since anthrax was detected in our mailroom.
Anyway, I wonder if it is too late to mention this. Some time ago I became interested in spontaneous human combustion (SHC). It seems that this is a much more crucial (and maybe more common?) issue than spontaneous cacti combustion.
And there are many cases of SHC that have been documented. Somewhere, in the archives of papers I've saved, I have a summary and description of a number of these 'events.' Now it seems to me that we could easily get funded, in this age of biothreats, if we proposed studying them and determining what, when added to what water sources, would cause this ...??? Do you know the field?"

REVIEW AND PROPOSAL FOR FUTURE RESEARCH

Recently there has been considerable concern about a number of recurring combustion hazards, including planes being hurled at skyscrappers (ref Washington Post), spontaneously igniting cacti (ref Anthony Burgess), and nuclear explosion threats initated by terrorists (ref Dan Oran, novel Z-Wars).

There has also been the diverting use of weapons of mass distraction, such as anthrax spores loosed on our mailrooms which leads to all of our mail being irradiated and terribly delayed, and the snipers (snippers?) that have made us fearful of even leaving our homes to buy fire extinguishers at the Home Depot Shoppe.

There is one issue, however, that has not received proper attention, and this is the imminent, every-more-likely possibility of spontaneous igntion of our fellow human beings. This is a documented phenomenon. It is interesting that the two classic works on this topic were published in 1763. One is by Jonas Dupont, who presented a series of case studies entitled *De Incendiis Corporis Humani Spontaneis*. (I have not been able to obtain this classic work, so reporting it here is questionable.) The other, better-documented and classic exposition is *Incendiis Corporis Humani Spontaneis*, which is the doctoral thesis of the illuminary D. Davidis van Royen.

These rather incendiary works sparked considerable studies of the phenomenon. All of these works attempted to ascertain the source of ignition. Because of the rather unsophisticated techniques used for analyses in those bygone days, the source remained rather illusive, even undetermined. Folklore has it that such combustion may be attributed

to imbibition of alcohol combined with fuming opiates, or overly enthusiastic overindulgence in beans, without or without the accompaniment of tobacco. It must be noted, however, that all of these combustion events start from inside the body and consume all or most of the organism.

Let me review a few cases:

The apocrophal death of Polonus Vorstius, in Milan, sometime between 1468-1503. Drank too much wine, spewed flames, and burned up.

Earlier than 1654, the Academic Senate of Copenhagen was sent a deposition about a person who died after belching flames, and then being consumed from the inside. (*Historiarum Anatomicarum Rariorum* by Thomas H. Bartholini)

In 1725, in Rheims, Nicole Millet was found burned to death in an unburned chair (*De Incendiis Corporis Humani Spontaneis*).

In 1731, an account was published about the remains of the Countess Cornelia di Bandi of Cesena, Italy, which were found on the floor of her bedroom. Her body was ashes but her stockinged legs survived, as did a large portion of her head.

In approximately 1853, a German liquor-shop owner in Colombus, Ohio, mysteriously burst into flames and was consumed. (Charles Dickens preface to the second edition of *Bleak House*).

And even recently

In 1938, Ms Andrews was dancing in a nightclub when flames issued abruptly from her back, chest and shoulders. Her significant other was badly burned trying to put the flames out. He commented that there were no flames in the room, that they had come from Ms Andrews herself. She died on route to the hospital.

In 1980, an adult male body was discovered in an room armchair in Wales. It was almost totally consumed by a fire that had hardly damaged the armchair. Nearby plastic objects were undamaged. The fire that had killed the man had been of a sufficient intensity to leave a coating of vaporized flesh on the ceiling.

And there are many many other similarly documented cases.

To date, the work in this area has been neither scientific nor logical, though there have been certain undeniable elements of futile creativity. There is a noted unwillingness (an inability?) of most researchers to look at the problem systematically and with modern experimental, computational, and theoretical tools.

Thus we propose to take this to a higher plane of creative study by solving the full set of time-dependent reactive Navier-Stokes equations for this problem. We will include models

for multiphase compressible gas dynamics, exothermic chemical reactions, heat conduction, and molecular diffusion.

We will cleverly account for boundary layers by using the very latest in adaptive mesh refinement. By necessity, a program of this magnitude will require an enormous amount of computational time and computer memory, and so qualifies as a Grand Challenge Problem.

Referees report

The applicant displays splendid innovative blue skies thinking outside the box. The integration tools proposed to leverage outcomes are well conceived to carry the project forward, although stakeholders will require a more formal mission statement to be put in place. The core values the applicant reveals are at the very centre of our project. I have spoken to the minister and we would advise that the restrictive practice of peer review be dispensed with and that we should go straight into a Private Finance initiative with Sainsburys as the retail outlet. University staff must no be involved in any way. Warm personal greetings to you from the bottom of the Think Tank.

SPONTANEOUS IGNITION OF CACTUS

A Research Proposal by Professor Ken Palmer

A spontaneously igniting cactus has been reported in a reputable publication [1]. Whilst the phenomenon cannot be regarded as impossible it raises questions that require formal scientific reasoning to answer. Clearly a cactus, in air, is thermodynamically unstable since heat would be generated when the cactus is converted to carbon dioxide and water. On the other hand there may be a high activation energy requirement which presents an unscalable barrier to spontaneous reaction in practice. Some mechanism must be operating to prevent all cacti from spontaneously igniting or heating even in the Arizona desert; it must be admitted that the phenomenon, if it exists, is so far of rare occurrence.

A similar situation arose about 35 years ago, and was widely reported on British national radio, by Milligan [2]. In this case the phenomenon was of exploding batter puddings, the cause of which was never seriously explained. There appear to have been few, if any, further cases reported. But this should not lead to complacency, because Chaos Theory predicts a large number of incidents may be triggered by subtle changes in the environment such as global warming arising from excessive combustion. Prevention of injury or financial loss by such explosions is therefore an urgent requirement.

A common factor for both sets of data is that they appear to follow a Poisson distribution. (In the case of the batter puddings possibly *saumon* en *croûte*). But there is insufficient data for a purely theoretical analysis, and computer modelling is likely to generate ambiguous results because of lack of input from which to optimise the usual variable constants. An experimental programme is therefore proposed.

Summary of Programme

A very large number of agave cactus plants would be grown indoors, under stringently controlled conditions, and observation made over a period of years of any spontaneous heating or ignition in the plants. Concurrently, the juices from the plants would be collected continuously by a small number of skilled staff. The juices would be fermented and distilled and the product, tequila, manufactured and bottled on a commercial scale. Income from the sale of the product in the locality, a university town, would undoubtedly be sufficient to finance the programme.

In the event of spontaneous ignition leading to a serious fire, arrangements will be put in place to prevent the fire brigade from attempting to extinguish it. Explosion hazards from alcohol vapours would make it unwise to enter buildings. Instead the premises would be heavily over-insured against fire. After lavish rebuilding of the facility the product would be re-branded as 'Phoenix'; commercial co-operation with Arizona may then be possible. If no spontaneous ignition is obtained over a statistically significant period of years the programme would be terminated, and a successor implemented. See "Future Work".

Procedure

In order to obtain premises an offer would be made to take over a university in a large town having at least two universities. Preference would be given to a modern university with buildings having many large plate glass windows. The offer would stress that the university was a serious cost to public funds, and that its transfer would be without charge, thereby eliminating the cost at a stroke (The 2nd university would act as a customer base).

The university staff would be released from their contracts, and the associated chores of teaching and research, enabling them to find more profitable employment in journalism, consultancy, TV chat shows, lecturing on luxury cruises, writing paperback novels, etc.

The students would be able to find immediate employment, with income, instead of accumulating debts that had to be repaid after graduation. Their quality of life would be greatly improved. A small number would be employed to operate the tequila process.

Those buildings that were essentially large greenhouses would be utilised to grow the cactus plants from seed. Some lecture rooms with raked floors would be used to store the collected juices from the cacti; with storage tanks at the back of the rooms the juices would flow under gravity to the laboratories. Here the juices would be fermented, filtered, distilled and bottled. The bottled product, and new empty bottles, would be stored in the Great Hall which would act as a distribution centre. Seminar rooms would become intermediate transit facilities; a few rooms would be set aside for the use of staff who may wish, occasionally, to lie down and sober up. The main Administration building would be converted into a multi-storey car park, an attraction to the municipality, the income from which would be applied to maintenance of the buildings and grounds.

Cost

As currently there are many claims on limited public funding the proposed programme would require provision of a minimal sum in the first year (ie a packet of cactus seed at £5)

and nothing further in the future. Thereafter the programme should be self-financing. In the event of cash flow problems, local bank managers would be called to a meeting during which the product would play a prominent role. The solution should soon be negotiable!

Future Work

When the programme has been terminated, the same organisational methodology could be applied to another product. For example instead of cactus the facility could easily be adapted to the growing of cannabis. The potential market is very large, especially after the use of cannabis by all persons over the age of 15 years becomes compulsory. It is foreseen that the tough new laws will be stringently enforced to eliminate any possibility of discrimination against those permanently addicted to the drug. Indeed it may be necessary to take over additional universities in order to meet the demand.

Organisational Consequences

If the commercial activities develop as planned the demand for public funding of research would diminish, so that the existing Research Council functions would need to be re-thought. The way ahead could be to set up a successor body more commercially orientated, entitled Corporation Overseeing Research: Physical Sciences/Engineering, ie CORPSE. We anticipate the website: www.corpse.ac.uk; No flowers, by request.

References

1.Newsletter. Combustion Institute (British Section). 2002-1. Spring 2002. Page 4.
2. Milligan, Spike et al. The Goon Show.

Referee's Report

This is a very nice review of the sea of troubles consequent upon the invention of fire. The review of spontaneous ignition, however, omits Felix Weinberg's seminal letter to the "Times" (of London), the experiment of that nice man from California I met at a conference who wrapped a pig in a blanket soaked in paraffin, lit it and found roast pork after 20 hours, not to mention the article I helped write for the high lifers and clubbers magazine "DVinfinity" published in Brighton or the "Lancet" article on bowel explosions consequent upon the removal of polyps by electrically heated resistance wires. These omissions are not, however, my reason for rejecting the proposal. The reason is that every five years or so the media recycle stories of human spontaneous combustion which are great fun and enable a few of us to receive a little recognition and even an honest penny. There is real danger that the proposed mathematical model will reveal the truth - that spontaneous combustion of people cannot occur. Furthermore, this truth will not be revealed in a fun way, but as coloured contours derived from tweaked numerical "constants". .....But if these could be tweaked to show it was possible, well, ... I might reconsider.