



## Professor Brian E. Launder on his 60th birthday

Brian E. Launder, Professor of the University of Manchester Institute of Science and Technology (UMIST), was 60 on 20 July 1999. His name has been closely associated with the development of engineering turbulence models that have been used worldwide both in research and in industrial computations. Launder was a pioneer in this field and has been one of the most influential contributors. But Launder's achievements go much beyond this topic. As a distinguished scientist and educator, Brian Launder is well known beyond the fluid dynamics and heat transfer community and much respected among learned societies for his contributions to the archival literature, his admirable lecturing and for his administrative leadership.

Brian Launder graduated in 1961 from Imperial College with a B.Sc. in Mechanical Engineering. He continued his education as a graduate student at Massachusetts Institute of Technology, where in 1963, he received a S.M. and in 1965 a Sc.D. degree. He began his academic career in 1964 as lecturer in the Department of Mechanical Engineering at Imperial College, where he became a Reader in 1971. In 1976 he moved to the University of California at Davis as Professor in the Department of Mechanical Engineering. In 1980 he returned to England accepting the post of Professor of Mechanical Engineering at UMIST, where he has stayed to the present time. Brian Launder could not have chosen a more appropriate city to settle than the place where Osborne Reynolds laid the foundation of the mechanics of turbulent flows and derived his famous averaged equations about a century earlier. At UMIST Brian Launder found an inspiring environment where he could continue his research in the best tradition of the Manchester mechanics school. There he served twice as head of the Thermo-Fluids Division, twice as Head of Department of Mechanical Engineering, and Professor in charge of Aerospace undergraduate courses. Since 1998 he has been a UMIST Research Professor and Chairman of UMIST's Environmental Strategy Group.

The research career of B.E. Launder began in the field of turbulent flow laminarisation related to flows in gas-turbine blade passages. This topic, on which he defended his doctoral thesis at MIT, remained one of his lasting challenges to which he would return later on several occasions. However, shortly after joining Imperial College as a young lecturer, he shifted his focus to the more general problem of mathematical modelling of turbulence. This move coincided with, and was much inspired by the breakthroughs in the development of computational methods for fluid dynamics and the pioneering work on turbulence modelling by a research team at the Imperial College led at that time by Professor D.B. Spalding, FRS. Realising that the coming age of computers would open new frontiers in solving turbulent flow problems, Launder, together with a group of his first graduate students and assistants, revived the early pre-computer ideas of Chou, Rotta and Davidov and adapted them into a form that was directly implementable into the first Computational Fluid Dynamics (CFD) codes. The success was immediate and overwhelming: the  $k-\epsilon$  model that emerged from these pioneering efforts in the late sixties became, and still is, the most widely used engineering turbulence model.

implemented in practically every commercial CFD code and used daily in various branches of engineering. But, that was only the beginning. In the years to come Brian Launder devoted a great part of his creative talent and energy to expanding the topic, which emerged into a scientific discipline of its own. His original contributions include the formulation of second-moment (Reynolds stress) closure models for high-Reynolds number flows and its subsequent extension to account for viscosity and near wall effects, the development of second-moment closures for scalar transport, new wall functions and one of the first multi-scale models. More recent contributions include the development of non-linear eddy-viscosity models and formulation of non-linear models of the fluctuating pressure-strain process. In pursuit of models of increasing sophistication, sounder theoretical rationale and more general performance, Launder discovered new challenges and expanded his studies to a broad range of turbulence and flow phenomena, that include laminar-to-turbulent and reverse transition, separation and recirculation, flow impingement, effects of rotation, buoyancy and variable fluid properties. The probing analysis and characterisation of the large range of flows studied by him and his co-workers in the course of model development and validation is a valuable scientific contribution in itself: studies of many flow cases and their numerical solutions will serve long as a rich source of knowledge. His publications on experimental research of turbulent flow and convective heat transfer, particularly in impinging fluid jets, curved channels and spirally fluted tubes, made also a significant impact. With these contributions over more than three and half decades, Brian Launder has been providing the fluid mechanics and heat transfer community with fresh ideas, original analysis and novel solutions, leaving a lasting imprint as one of the primary authorities in the field. His many publications in renowned journals and monographs, recognisable by his lucid writing style and their intellectual content, have been widely cited in the scientific literature, some of them at a record level.

His service to education includes many years of excellent teaching as an inspiring classroom lecturer and project supervisor in a broad area of thermodynamics, fluid mechanics and turbulence. Over the years till now he guided exactly forty doctoral students, many of who are now distinguished scientists and professors, engineers and leaders in industries and societies. His name and reputation has attracted many visitors who were keen to interact with Brian and to learn from him, as best seen by numerous joint publications with over thirty postdoctoral researchers and academic visitors.

Launder's contribution to the promotion of fluid mechanics, heat transfer and turbulence research among a broader community deserves also to be mentioned. In addition to his innovative input to engineering education at UMIST, he has served in numerous national and international promotional and policy-making bodies. These include Chairman of the Nusselt/Reynolds Prize Board, Co-chairman of the Scientific Committee of the Research Programme on Turbulence at the Isaac Newton Institute of Mathematical Sciences in Cambridge, member of the UK National Committee on Heat Transfer, Chairman of the Engineering Foundation Committee on Turbulent Heat Transfer (1998) and various committees of the Royal Society and Royal Academy of Engineering. In addition, Launder has participated as a lecturer in a large number of specialist courses held all over the globe and organised variously by academia, industry and research institutions. His theoretical skill, broad knowledge and a keen sense for real-life engineering have been much in demand by various industries. He has consulted and participated in industrial research and development projects, particularly in aerospace and energy engineering, in his native UK and abroad.

Since 1987 he has been Editor-in-Chief of the International Journal of Heat and Fluid Flow, was a founding Member of the Turbulent Shear Flow Symposia and served in the Organising Committee of all eleven symposia and as co-editor of Springer proceedings of all nine volumes. He is also member of the Scientific Advisory Committees of several research institutions abroad, included amongst which are the Institute de Mécanique des Fluides in Toulouse, LIMSI in Paris and the Stanford/NASA Ames Center for Turbulence Research. He is also a fellow of the Institution of Mechanical Engineers, the Royal Aeronautical Society and ASME.

For his outstanding scientific and educational achievements Brian Launder has received numerous recognitions and awards. In 1994 he was elected a Fellow of the Royal Society (FRS), and, in the same year, a Fellow of the Royal Academy of Engineering (FEng). Other recognitions include higher doctorates, a D.Sc. (Eng) from the University of London (1976), a D.Sc. from the University of Manchester (1985) and a D.Eng. from UMIST (1996), an Honorary Professorship from Nanjing Institute of Aeronautics and Astronautics (1993), the Best Paper Award (Busk Prize) of the Royal Aeronautical Society (1995), the Computational Mechanics Award of the Japanese Society of Mechanical Engineers (1996) and the title of Doctor Honoris Causa from INP Toulouse (1999).

Brian's amicable personality, professional authority and a keen interest in many spheres outside his work have created a large circle of close friends all over the globe. At sixty Brian Launder is still as active as ever, enthusiastic equally about new research topics and educational challenges as with classical music, English and French etchings, French landscape, cuisine and wines. His friends, colleagues and students are proud of their association with Brian Launder and keep in pleasurable memory numerous occasions of informative and inspiring discussions on professional themes, but also social gatherings with him and his family – wife Dagny, daughter Katya and son Jasper – in their home in Didsbury and elsewhere. They are also pleased to commemorate his outstanding achievements on the occasion of his 60th birthday, wishing him many happy returns, good health and every success in his future endeavours.

K. Hanjalić  
W.P. Jones  
W. Rodi