

**00-5 IUTAM Symposium on Free Surface Flows
Birmingham, United Kingdom, 10-14 July, 2000**

a) Scientific Committee

J. R. Blake (UK), J. B. Keller (USA), A. C. King (UK, Chairman), W. Lauterborn (Germany), D. H. Peregrine (UK), A. Prosperetti (USA), E. O. Tuck (Australia), L. van Wijngaarden (Netherlands).

b) Short summary of scientific progress achieved

This symposium was convened to bring together those working in the area of free surface flows. It attracted a wide and high quality set of participants from around the world who were generally working on problems concerned with Bubble dynamics, Dynamic wetting, Moving contact lines, Axisymmetric flows and non-linear waves. There were five days of invited presentations on these topics with excellent interaction between the participants in the allotted discussion time and also in the refreshment or lunch breaks. In the area of Bubble dynamics there were theoretical and experimental papers on laser induced and acoustic bubbles and their applications e.g. sonoluminescence and sonochemistry. Work was also presented, and discussed, on toroidal bubbles, underwater explosions and Lagrange's equations for describing bubble dynamics. The appearance of a stress singularity at the moving contact line of a wetting fluid, or when an axisymmetric thread of fluid snaps, brought about a great deal of discussion on how to modify the Navier-Stokes equations and boundary conditions in order to resolve this non-physical effect. The use of lubrication theory and its regularisation gave some insight into this and there was substantial interaction between participants on the question of whether contact line effects were global or local in various different flows. The extreme features of Non-Linear waves were described and discussed using both numerical methods and analytic techniques. Some non-classical flows with non-linear waves such as muddy bed topographies, free surface shear layers and hydraulic jumps of mixed type illustrated the scope of modern applied mechanics and indicated areas in which further work need to be carried out. The general view of

the participants was that there were strong overlaps in the apparently different areas of the symposiums' scope, which made interaction between the delegates very fruitful. It would be reasonable to view this symposium as having contributed towards new research collaborations in a very positive way.

c) Countries represented and Number of Participants

Australia 3, China 1, France 6, Germany 4, Ireland 1, Italy 1, Japan 2, Netherlands 2, New Zealand 1, Norway 1, Romania 1, Russia 1, Singapore 1, South Africa 1, United Kingdom 48, United States 16.
Total 89

d) Proceedings of the Symposium

The Proceedings comprising reviewed Symposium papers will be published by Kluwer Academic Publishers by the end of 2001 (Editors: A. C. King and Y. Shikhmurzaev)

e) Financial Support

Financial support for the Symposium was generously provided by the following organizations: IUTAM, Schlumberger Cambridge Research and The University of Birmingham.

f) Scientific Program

Session 1: Bubbles and Acoustic fields

Chair: J. R. Blake

A. Prosperetti, *Vapour bubbles in flow and acoustic fields*

D. Lohse, *How snapping shrimp snap: through cavitating bubbles*

T. Matula, M. R. Bailey, P. R. Hilmo, D. L. Sokolov and L. A. Crum, *Simultaneous detection of acoustic and light emissions from cavitation bubbles in shock-wave lithotripsy.*

Session 2: Spiral flows

Chair: J. Billingham

Y. M. Stokes, *Flow in spiral channels.*

I. Wallwork, S. P. Decent and A. C. King, *The stability and trajectory of a spiraling liquid jet.*

Session 3: Vortices and free surfaces

Chair: M. J. Cooker

R. M. Moreira and D. H. Peregrine, *Interaction of water waves and vortices*.

M. Sterling and D. W. Knight, *Boundary shear stress and velocity distributions in open channel flow*.

J. M. Vanden-Broeck, *Large gravity-capillary waves with constant vorticity*.

Session 4: Discontinuities in wave motion

Chair: E. O. Tuck

M. J. Cooker, *Violently erupting jets from sea wave impacts*.

M. S. Longuet-Higgins, *Vertical jets from standing waves: the bazooka effect*.

D. P. Lathrop, *Surface singularities and jet eruption*.

Session 5: Unsteady liquid-solid interactions

Chair: D. J. Needham

J. R. A. Pearson, *The approach of liquid-liquid interfaces to smooth probes: some thought on rupture by asperities and edges*.

D. H. Peregrine and M. Brocchini, *An instantaneous measure of the strength of a spilling breaker?*

J. Billingham and E. O. Tuck, *Zero gravity sloshing*.

Session 6: Laser-generated bubbles

Chair: T. Matula

W. Lauterborn, T. Kurz, O. Schenke, O. Lindau and B. Wolfrum, *Laser-induced bubbles in cavitation research*.

A. Vogel, E. Brujan, P. Schmidt and K. Nahen, *Interaction of laser-produced cavitation bubbles with elastic boundaries*.

J. R. Blake, *Single cavitation bubble luminescence*.

Session 7: Nonlinear water waves

Chair: A. D. D. Craik

D. Astruc and S. Fauve, *Parametrically amplified 2-dimensional solitary waves*.

H. -C. Chang and E. A. Demekhin, *Wave texture coarsening and selection on a falling film*.

I. Barashenkov, *Travelling solutions, solitonic complexes and the effect of impurity in Faraday resonance*.

G. A. El and R. H. J. Grimshaw, *An integrable model for undular bores in shallow water.*

Session 8: Before and after breakup of liquid volumes

Chair: J. R. A. Pearson

P. L. Marston, M. J. Marr-Lyon and D. B. Thiessen, *New methods for controlling the capillary instability of liquid bridges.*

S. P. Decent and A. C. King, *Surface tension driven flow in a slender cone.*

L. de Luca, *Mechanisms of break-up of plane vertical jets.*

Session 9: Coalescence and breakup

Chair: A. C. King

J. Eggers, *Coalescence of liquid drops.*

J. R. Lister, D. Vaynblat and T. R. Witelski, *Singularity, similarity and symmetry in pinchoff and rupture.*

Y. D. Shikhmurzaev, *Coalescence and breakup: solutions without singularities.*

S. T. Thoroddsen, *The cascade of coalescing drop.*

Session 10: Waves caused by moving bodies

Chair: J. M. Vanden-Broeck

E. O. Truck, D. C. Scullen and L. Lazauskas, *Ship-wave patterns in the spirit of Michell*

L. LI, D. T Papadopoulos, F. T. Smith and G. X. Wu, *Water flow from rapid partially submerged body movement.*

E. Parau and F. Dias, *Ice waves generated by a moving load.*

Session 11: Bubbly liquids

Chair: W. Lauterborn

G. Tryggvason and B. Bunner, *Direct numerical simulations of bubbly flows.*

K. Sugiyama, S. Takagi and Y. Matsumoto, *Pseudo turbulence modelling in dispersed flow.*

Session 12: Wetting, coating, cusping

Chair: J. R. Lister

S. Garoff and E. Ramé, *Experimental studies of the hydrodynamics near moving contact lines.*

S. B. G. O'Brien, M. Hayes and J. H. Lammers *Coating of substrates with small imperfections.*

D. Jacqmin, *Flow of air into a free surface cusp or 180° moving contact line.*

M. Siegel *Cusp formation and tipstreaming instabilities for time-evolving interfaces in Stokes flow.*

Session 13: Modelling moving contact lines

Chair: Y. D. Shikhmurzaev

L. M Hocking, *Contact angles and van der Waals forces*

C. Duquennoy, O. Lebaigue and J. Magnaudet, *A Numerical model of a gas-liquid-solid contact line*

M. C. T. Wilson, J. L Summers, P. H. Gaskell and Y. D. Shikhmurzaev, *Numerical modelling of the moving contact-line problem.*

E. Ramé, *Modelling dynamic wetting in the presence of surfactants.*

Session 14: Thin films and flows over curved surfaces

Chair: L. M. Hocking

J. R. King, *Degenerate fourth order parabolic equations and thin film flows*

J. Rosenzweig and O. E. Jensen, *Long-time draining of thin films in nonuniform geometrics.*

M. Heil, *Finite Reynolds number effects in Bretherton-type flow in channels with rigid and elastic walls.*

S. K. Wilson and B. R. Duffy, *Thin-film flows on large horizontal cylinders.*

Session 15: Modelling of bubbles

Chair: G. Tryggvason

J. R. Ockendon and S. Howison, *Free surfaces in negative squeeze films.*

J. F. Harper, *Lagrange's equations for rising bubbles.*

H. Wong, *The motion of an expanding or contracting bubble pinned at a submerged tube tip: theory and experiment.*

R. Palaparthi, C. Mandarelli and D. T. Papageorgiou, *Controlling the mobility of bubbles using surfactants – an experimental and theoretical study.*

Session 16: Free surfaces in natural processes

Chair: D. H. Peregrine

J. E. Zhang and T. Y. Wu, *Run-up of ocean waves on beaches.*

D. J. Needham, *Alluvial dynamics: ripples, dunes and roll waves*.

N. J. Balmforth, A. S. Burbridge and R. V. Craster, *Radial extrusion of isothermal, viscoplastic materials – evolving lava domes*.

Session 17: Instability

Chair: S. P. Decent

A. D. D. Craik, *Instability of two-dimensional standing Faraday waves*.

L. Kondic and J. Diez, *Instabilities in the flow of thin liquid films*.

L. Cummings and M. Benamar, *Fingering instabilities in thin films of nematic liquid crystals*.

Session 18: Bubbles near walls

Chair: J. Harper

Y. L. Zhang, K. S. Yeo, B. C. Khoo and W. K. Chong, *3D toroidal bubbles near a rigid wall*.

A. Verma, P. J. Harris and R. Chakrabarti, *Dynamics of an explosion bubble close to a deformable structure*.

S. Popinet, *Bubble collapse near a solid boundary: A numerical study of the influence of viscosity*.

Report composed by A.C. King