J. Fluid Mech. (2010), *vol.* 663, *pp.* 18–21. © Cambridge University Press 2010
doi:10.1017/S0022112010004179

Batchelor and Crighton Commemorative Talks

David Crighton FRS

J. E. FFOWCS WILLIAMS†

Apart from being extremely clever, David Crighton was a very nice person. He must have been well brought up and made his family very proud of him (see figures 1 and 2).

I was at Imperial College in the 1960s, in the Mathematics Department there, where we all knew that Imperial was better than Cambridge. I had been to Cambridge once. I was taken there by Peter Davies to meet Dr Batchelor, a very memorable occasion on two counts. The first was the car journey, POAL driving and relying on my skill as look out and navigator. I was then just starting research at Southampton University and had been given a project involving turbulence. Little was known about this at Southampton, but very much at Cambridge, where POAL had recently been educated and where he had made friends with the world's leading authorities, to whom he would personally introduce me. One was George Batchelor who, on answering the knock on his door, was informed 'I am Dr POAL Davies and I have found a mistake in your book'. We were invited in and George asked what the mistake was. He was informed that 'it was only a small one and that Shon Williams who knew all about it would explain'. But I knew very little of his book and almost nothing about turbulence, certainly nothing about a mistake in the most important new book on the subject. George Batchelor was very kind to us.

Why David Crighton sought supervision for research at Imperial having been a successful undergraduate in the Department of Applied Mathematics and Theoretical Physics (DAMTP) is not clear to me, but I have heard that he wanted to get away from the place quickly. It may have had something to do with bad memories caused by the fact that he saw a close friend (the son of Ralph Lapwood, one of his teachers) run over and killed by a bus. On the other hand, it may have been his desire to benefit from what he had learnt by earning some money and paying his way in life. University jobs were quite easy to get in those days but they were not paid very much, certainly nothing like the salaries paid at polytechnic colleges, where university-type material was taught to part-time students in an intense programme allowing no time for research. The lecturers were very highly paid for this professionally thankless task of teaching exhausted students. David became a lecturer of mathematics at the Woolwich Polytechnic. He was a brilliant teacher and enjoyed it. He even enjoyed teaching gangland youths and keeping a resemblance of order in night classes. Few people did and it was not easy to staff the place with mathematicians capable of lecturing on the most advanced material offered by British universities, to which politicians tended to equate polytechnic colleges. David thrived there, quickly rising to the top and quickly becoming bored stiff. He had developed a hankering for research.

So it was that he found me at Imperial, where I was housed temporarily with mathematical colleagues in splendid rooms in the Victoria and Albert Museum I

† Email address for correspondence: jef1000@cam.ac.uk

https://doi.org/10.1017/S0022112010004179 Published online by Cambridge University Press



David and his mother in 1986. She was very proud of him.

was busy, mainly researching problems that had arisen in the industrial and defence sectors, with which I enjoyed collaborating. David had been fascinated with what he had heard from Batchelor and Ian Proudman at Cambridge and was clearly interested in why I was so sceptical about turbulence. He listened vary carefully and from what he said and the way he said it, I was left in no doubt that he knew a great deal and knew things I had never heard of. I liked him and we quickly arrived at an agreement to collaborate in research. I immediately set about finding support for him to research full time, initially at Woolwich where he wanted to honour the commitments he had made, but eventually at Imperial College where he registered for a PhD and became my research assistant.

From the start David was enthusiastic and seemed to know at least as much as me about everything. I was not shy and regarded anything mysterious as fair game. I knew David was like-minded so I involved him in most things I came across, regardless of what formal discipline they were in. His research projects included a series of diverse things having in common only their interest to me. That was actually the case with all of my most able students. David was exceptional in that he thought more clearly than most before telling me that some of my interests were daft, and even then he would suggest how they might be changed to conform better to real life.

His first research project concerned what influence gas bubbles in water might have on the sound generated by turbulent flow. He taught me the fascinating things bubbles can do to modify the transmission of sound and together we applied Lighthill's exact analogy to the nonlinear problem. We discovered some fascinating things that occurred in particular regions of parametric space. We were not the only ones to find them interesting, but we probably found them more interesting than most. About a year later, the opening lecture at the International Congress of Acoustics was given in Budapest by the foremost Russian authority on sound interacting with flow. David and I were there and amazed to hear an apology about the paper, and to witness a

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David and his sister Frances in 1986.

complete unfamiliarity with English when I asked 'what paper?' The paper in question was one that Crighton and I had published in *JFM*, and it greatly amused us to see it so comprehensively plagiarized in this important lecture. The paper had got me into trouble before because we had published it without seeking the permission of our American sponsor – the US Navy.

In those days, the Aeronautical Research Council (ARC) considered every important aeronautical advance, some of them carrying a security classification. Membership of its subsidiary on noise enabled one to know what noise questions were nationally significant, very important because noise had both an aeronautical and naval significance. Academics had to have access to ARC committees to be properly abreast of the field. David Crighton quickly became one of the noise committee's

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most active members with serious noise issues rarely escaping his attention. I was directing research to control the take-off noise of Concorde, part of a desperate national programme to do something the industry knew it could not do, and David was appointed to the panel as my technical assistant. He was therefore in the thick of things, had access to all the known information on the subject and he could see what problems needed doing. In addition to all this, it was natural that David should join the group I led to teach to the Admiralty the advanced theoretical methods believed to give the Americans advantage in the use of modern SONAR. Of course, like me, David was a full-time employee of Imperial College, a college unusual at that time in its commitment to work with and help industry. He was a very busy man, and he thrived on it.

At the College we enjoyed great freedom, our research being just as important as teaching. Several people of like mind collaborated and many enjoyed the research seminars run in the Mathematics Department. A group, which included David, travelled elsewhere to attend seminars, and in that group grew up a preference for attending Friday seminars at DAMTP.

Those seminars were most interesting and most enjoyable. We had enormous fun on those occasions. We, who knew our superiority over Cambridge, loved to observe the solemn wait till George Batchelor and Brooke Benjamin joined the front row and the seminar could start. They rarely spoke but seemed to us to be there as guardians of the truth, with Ed Frankiel being the chief theoretician and Michael McIntyre the agent provocateur. Keith Moffatt and Phillip Saffman were the straight guys. As might be guessed, we eventually had to agree that there was real meat in these Friday gatherings and we adapted things at Imperial College so as more and more to mimic them.

In 1972 I accepted a chair in the Engineering Department at Cambridge and came here still carrying on with my several external commitments, especially the Concorde group in which David was still my research assistant. He wished to remain so and also to remain at Imperial College, where he was enjoying such success. Everyone thought he was doing a splendid job and so that is exactly what happened. David came here about once a week but Imperial remained his base.

During his time with me, the subject of aero-acoustics, in which he had become a world authority, changed enormously, very largely due to David's efforts. He was a champion of matched expansions, deterministic models and asymptotic methods, and our view of where jet noise comes from was largely transformed by his work. David always seemed to be at the forefront of new developments, collaborating with and expounding the results of researchers across the globe. David was the first to appreciate what effect flight has on noise and he was quick to appreciate the difference between flight simulated in a wind tunnel and the real thing. His summary produced for the ARC's noise committee, of which he was then chairman, of the reasons for jet noise, which usually scales on the eighth power of jet velocity, scaling instead on the fifth power is most instructive. And the work, he did with colleagues on applications to the aerodynamic noise problem of the Wiener–Hopf method, showed rare analytical mastery. It was no surprise to me, nor to several others, that his first real job was that of heading the Mathematics Department at Leeds University, and it was no surprise at all that he should bring new life and sparkle to that post.

I know that towards the end of his life David really appreciated Cambridge and all it stood for and that, despite his heavy workload, he did some of his best work here. I think though that his experience before settling where he really belonged, enlivened his life enormously. It was always a pleasure to see him and a privilege to know him so well.

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