

An opinion on the inclusion of Tom Kilburn's name in a revised citation for the IEEE Milestone proposal: **Atlas Computer and the Invention of Virtual Memory 1957-1962.**

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18th February 2022. lavis@essex.ac.uk

The purpose of this note is to provide expert comment on the proposal to include the words “led by Tom Kilburn” in the citation.

1. Personal experience.

I joined Tom Kilburn's Atlas team in September 1962 and remained on Kilburn's team at Manchester until well after the Atlas installation at Manchester had been decommissioned in September 1971. My Atlas task, along with one other researcher, was to design the hardware and software for an on-line A-D-A Converter and to use this peripheral for experiments in automatic speech recognition and speech synthesis on Atlas. See for example [ref. 1]. During this time I developed close working relations with relevant employees of Ferranti Ltd. as well as with the academics on the Atlas team.

As an aside to my main computer architecture research, I began to record the history of Manchester computers, publishing a book on the subject in 1975. In retirement I have widened my interest in computer history, publishing a total of six books and six journal papers in the area.

2. Kilburn as leading Atlas designer.

The IEEE Milestone application as submitted already gives ample evidence for Kilburn as the leader of the University of Manchester's computer design group and, through the inclusion of his name on relevant Atlas patents and publications, as the inspiration behind all the novel features of the Atlas project. As an academic myself, I fully endorse Kilburn as the prime inspiration for, and the on-the-spot leader of, the Atlas project.

3. Kilburn's leadership of the collaborative project.

The Atlas project was a collaboration between the University of Manchester and Ferranti Ltd. The purpose of this note is to verify that Kilburn was indeed the leader of the entire Atlas design team, including those team members employed by Ferranti Ltd. I know from personal experience that Tom Kilburn was usually to be seen sitting in the Atlas machine room, surrounded by Ferranti personnel and university staff, observing and commenting. His presence was everywhere. No action was taken without Tom's approval. Tom had a close working relationship with Peter Hall (the CEO at Ferranti's West Gorton factory) and they remained friends long after Atlas was done and dusted. The cooperation between academia and industry was exceptional. The chronology of the formal links between Kilburn's group at Manchester University and Ferranti Ltd. is given in detail in [ref. 2].

4. Testimonies from three former Ferranti employees.

In order to give practical meaning to Tom Kilburn's leadership from Ferranti's perspective, we give below the views of three Ferranti Ltd. employees who played key roles in the Atlas design. Their comments address the direct question: "What was the role of Tom Kilburn in the joint academic/industrial Atlas project?" These comments, and the full transcripts of audio interviews from which the quotations are taken, appear in two published reports [refs. 3, 4]. Photographs and full CVs of the three speakers are also included in [refs. 3, 4].

4.1. Statements from D J (Dave) Howarth and M T (Mike) Wyld.

Dave Howarth joined Ferranti Ltd. in 1960. He was the first Ferranti programmer to work on the Atlas Supervisor (Operating System). He became the leader of the Supervisor team and remained the principal Atlas Supervisor expert well into the late-1960s.

Mike Wyld joined Ferranti Ltd. in 1960. In early 1961 Mike began to work with Dave Howarth on Atlas software. Mike became the resident Atlas system software specialist in Manchester from mid-1963 until 1966 when he left Ferranti. Some relevant Atlas publications contributed to by Howarth and Wyld are given in [refs 5a, 5b, 5c].

Here are relevant extracts from the December 2012 interview of these two former Ferranti employees.

Interviewer: Now, although you didn't formally report to Tom, Tom Kilburn, I guess his presence was overpowering in the sense that he was ... would it be right in saying, his was the main driving force of the whole [Atlas] project?

MW: Absolutely, yes.

DH: I think that's fair comment. One was always conscious of the fact that Kilburn was in charge. He was the one who knew everything that was going on.

MW: He knew everything ... what you were doing ... why are you doing that? Or that sort of thing. Totally, I mean. In fact, I don't know where he actually did any work but he sat in the computer room, is my memory. Almost every time you went in, Tom would be in the corner with somebody or other – with David, Dai, or whatever. But I'm sure he had an office somewhere - I've no idea where it was!

DH: He was always there, and you could rely on him being there, if reliance was useful, or you could ignore him being there. It was really quite encouraging to know that a man of his intellectual prowess, as it were, was sat there in the [Atlas computer] room puffing away at his pipe, keeping an eye on us hard workers, as it were.

MW: And I think everybody deferred to him.

4.2. Statement from E C Y (Yao) Chen.

Yao Chen joined Ferranti Ltd. in 1959 as an Atlas hardware designer but had worked on prototype Atlas circuits since September 1957 as Kilburn's research student at the University. In 1963 Yao became Ferranti's principal support engineer for three Atlas installations (at Manchester, London and Chilton/Harwell). In October 1964 he joined the Department of Computer Science at the University of Manchester as lecturer. A relevant Yao Chen Atlas publication is given in [ref. 6] and a relevant Atlas follow-on patent in [ref. 7].

Interviewer: Right. What I'd like to start with is your comments on Tom Kilburn. Of all the people associated with Atlas, in terms of publications, etc., one constantly comes across the name Tom Kilburn – and quite rightly so. But what I don't know, and our listeners will not know, is: What was it like working for Tom? How did you find Tom as, if I may say, a group leader? Yao: would you like to comment on Tom?

Yao: I have no words ... how to describe how I feel about Tom. And, I mean, he just, to me, was the greatest man ever. And, either as a project leader, as a professor, everything and, er, we worked under him. We never felt, or I never felt, any real pressure he put on me or to any other colleagues. But everybody worked as they, you know, according to their own true feelings – not as a piece of work but just as a way of life, if you like. So, to me, Tom was everything.

5. Conclusion.

My expert opinion is that the words “led by Tom Kilburn” should be included in the Atlas Milestone citation.

References.

1. *Some Facilities for Speech Processing by Computer*. S H Lavington, L E Rosenthal. Computer Journal, Vol.9, No. 4, February 1967, pages 330-339.
2. *Timeline of the MUSE/Atlas project at Manchester University, 1955 – 1971*. Simon Lavington, November 2012.
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3. *Atlas archival interview number 1: Supervisor software*. S H Lavington. Recorded as part of the 50th Anniversary of Atlas, Manchester University, 6th December 2012.
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- 5 (a). *The Atlas Supervisor*. T. Kilburn, R.B. Payne, D.J. Howarth, AFIPS Proc. Eastern Joint Computer Conference, vol. 20, December 1961, pp. 279-294.

5 (b). *The Manchester University Atlas operating system: Part 1, internal organisation.* Kilburn, T, Howarth, D J, Payne, R B and Sumner, F H, Computer Journal, Vol. 4, No. 3, 1961, pages 222 – 225. *Part 2, Users' description.* Computer Journal, Vol. 4, No. 3, 1961, pages 226 – 229.

5 (c). *The Atlas Scheduling System.* D J Howarth, P D Jones, M T Wyld. Computer Journal, Vol. 5 No. 3, November 1962, pages 238 – 244.

6. *The central control unit of the Atlas computer.* F H Sumner, G Haley, E C Y Chen. Proc. IFIP Congress, 1962, pages 657 – 663.

7. UK patent application 47964/65 leading to UK patent 1160116. *One level store system: data storage and addressing arrangements.* Inventors: T Kilburn. F H Sumner, E C Y Chen.