Review of early LEO Milestone Proposal

Dr Andrew Herbert OBE FREng
Chairman of Trustees, The National Museum of Computing

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Is suggested wording of the Plaque Citation accurate?

"J. Lyons, UK's largest catering company of 20th century, built the first business computer to reduce extensive clerical work. Lyons engineers developed LEO (Lyons Electronic Office) at Cadby Hall in Hammersmith, London, following the success of an experimental computer at Cambridge University. Computers had previously only been used for military or scientific purposes. Lyons realised the potential demand from government and commerce for business computing and formed LEO Computers Ltd."

The wording is accurate in general terms but has two problems.

First, in the early days of the modern computing, i.e., late 1940s-mid 1950s, the term "computer" did not necessarily carry all the associations with contemporary usage. Many early machines were electromechanical rather than electronic, or a hybrid of the two, some were general purpose, others dedicated to a single task. Some had a stored program memory, others were programmed by external media or wiring. Not all were digital, for example the U.K. Treasury had a hydraulic analogue computer (the MONIAC) for modelling the U.K. economy.

The citation needs to be more precise about what kind of computer LEO was (electronic, digital, stored program, for example). This however presents a word count challenge.

The second is the description of the Cambridge EDSAC as "experimental". EDSAC was only "experimental" in the sense it was the first electronic digital stored program computer built by Cambridge and the second in the world after Manchester and their Small-Scale Experimental Machine ("Baby"). However, the EDSAC was built with a purpose in mind and successfully provided a scientific computing service across the university from 1949-1956. A better word might be "pioneering".

A suggested rewording for the citation:

"J. Lyons, UK's largest catering company of 20th century, built the first electronic digital stored program business computer to automate clerical work. Lyons engineers developed LEO (Lyons Electronic Office) at Cadby Hall in Hammersmith, London, following the success of a pioneering scientific computer at Cambridge University. Computers had previously only been used for military or scientific purposes. Lyons realised the potential demand for business computing and formed LEO Computers Ltd."

Is evidence presented in the proposal of sufficient substance and accuracy to support the Plaque Citation?

Bluntly, no. The proposal is quite weak on detail and lacks reference to documentary sources. It contains a lot of irrelevant detail about the LEO Society and its activities, a worthy body dedicated to protecting the memory of LEO Computers Ltd and the people who worked there. I am certain the required detail is available, including in the resources held by the LEO Society, but this needs to feature in the proposal.

The format is very uneven and the structure chaotic. The proposal appears to be a cut and paste from multiple sources, some detailed, some in bullet form, and it jumps from topic to topic. It needs to be rewritten as a coherent narrative.

Comments by section.

Key Outcomes.

How does this relate to the citation? It is about the achievements of the LEO Society.

Historical significance.

While this section broadly tells the LEO story it is riddled with inaccuracies and lacks references to supporting evidence.

Where is there supporting evidence that "office management as practised by Lyons' J.R.M. Simmons and T.R. Thompson ... was far ahead of that practised in most other British and foreign businesses?"

What about the use of punched card equipment for automated information processing pre- and during WWII by national government (e.g., census records and analysis), local government (e.g., property records), large financial firms (e.g., in insurance), and intelligence fusion (e.g., the Bletchley Park "intelligence factory")? Punch card technology was well-established prior to WWII.

Did Lyons use any kind of automated information processing before LEO? If so, what? If not, what made them "far ahead" of others?

In 1947 there was very little information about electronic computers beyond ENIAC and Von Neuman's draft report on the EDVAC. How did Lyons management make the link between these electronic computers, which in 1947 were dedicated to scientific and military tasks, to the potential to use them for business applications? This intellectual leap is the key to LEO and the creation of business computers. Was it a result of deep analysis or a leap into the dark?

While it is true Lyons made a substantial donation to help with the construction of EDSAC, what is the evidence to back up: "EDSAC was short of funds". Wilkes in his memoirs does not present the relationship in this way.

LEO Computer Origins

It is incorrect to say early computing devices "converged on ENIAC". The immediate post war machines converged on Von Neumann's conceptual design for the EDVAC, which introduced the stored program concept (and indeed, subsequently ENIAC had an elementary form of program memory added, but later in its life).

The paragraph "From ENIAC, Eckert and Mauchley (EDSAC) ..." is confused. Eckert and Mauchley had nothing to do with EDSAC. Can you show where in his description of mercury delay lines, Eckert describes them being used to hold "both program and data"? The insight that a memory could hold both is usually attributed to Von Neumann and the Draft Report on the EDVAC, dated 1945.

The EDSAC was the first modern electronic computer to "go into service". The Manchester Small Scale Experimental Machine ("Baby") was demonstrated the year before EDSAC first ran a program, but Baby was only conceived of as a testbed for the Williams Tube memory technology and was never put to useful work – it became the basis for the Manchester/Ferranti Mk 1, which first worked in 1950, by which time the EDSAC was providing a computing service to Cambridge University.

The concept of "intellectual property rights" did not really exist in the 1940s outside of patent and copyright. Cambridge did not patent EDSAC and freely shared their ideas with all who were interested. It is wrong to say Lyons "received the intellectual property rights" for EDSAC.

It seems strange to put a photograph of LEO II alongside the description of LEO I. There are plenty of photographs of LEO I available.

It would be helpful to have more detail about the changes made from EDSAC to produce LEO. How was the order code extended to meet the needs of business computing? What was done to build a more reliable machine to provide business continuity (EDSAC was notoriously unreliable...)? What peripherals were added to meet the needs of business computing (EDSAC had only a paper tape reader for input and a teleprinter for output, I believe LEO added multiple paper tape readers, punches and printers. What can you say about these? Why paper tape and not punch card?)

What evidence did Eric Schmidt give to support his claim that LEO was the "world's first office computer", and where did he say this?

It would be helpful to have dates for first delivery/operation of other business computers from contemporary US vendors (IBM, Univac etc) and British vendors (Elliott/NCR, English Electric, Ferranti) to establish the precedence of LEO I.

Obstacles...

It would be helpful to have more detail about the changes made from EDSAC to produce LEO. There needs to be an explanation about what was missing from ENIAC, EDVAC, EDSAC that made them unsuitable for business computing.

How was the order code changed to support business computing needs?

There was more to reliability than just leaving LEO on 24*7 – Pinkerton and his team made significant improvements to the EDSAC circuits and construction: these should be outlined. Also say more about the modularity of LEO – EDSAC was monolithic in design and almost every chassis unique.

What is "egg boxing"? This is not a term known outside of LEO I.

The more significant reliability problem with mercury delay lines than vibration is changes in temperature – this changes the speed of sound in mercury and hence the storage capacity of the delay line. Cambridge ended up with their delay lines in thermostatically controlled ovens. What did LEO do about this?

What features set this apart ...

ENIAC, Manchester Baby, EDSAC were all make by single organizations. (Cambridge used a subcontractor to assemble electronics to their design). LEO is not unique in this respect.

If not under “Obstacles” the differences from ENIAC, EDVAC, EDSAC should be discussed here.

A LEO applications process example for Payroll

This heading isn’t followed by any related text!

The design included…

This section appears to be a paste of bullet points and somewhat incoherent across a range of hardware, software and operational matters.

Who was Caminer and what was his role?

The Cambridge EDSAC had a programming system based on an extensive library of subroutines for mathematical functions, input and output, debugging aids including postmortem reports and program tracing, so the concept of “debugging” was not unique to LEO I and indeed EDSAC users were encouraged to desk check programs and start with small runs to avoid wasting the scarce resource of machine time.

Did LEO I have form input? (References to published sources would really help with fact-checking).

Cambridge would claim microprogramming was invented by Wilkes for EDSAC 2. Did it feature in LEO 1?

Did LEO I support multiprogramming and interrupts, or did this come later in LEO II/III?

As I read this section it sems to be more about LEO as an organization and the totality of the LEO range. The scope of the citation is the first LEO (i.e., LEO I).

Lenaert’s notebooks

Lenaert’s notebooks are an important and useful resources, as much for his experience of working on the EDSAC team (something that could have been mentioned), for his subsequent work on LEO and an understanding of late 1940’s electronics. But as the digitization is incomplete it is premature to claim this as part of the Milestone, and a Milestone proposal is not the place to post a plea for help.

Humanitarian and Educational Contributions

Coombs was not the first female programmer – consider Grace Hopper and Harvard Mk. 1, "application programmer" is ill-defined, I would assume Hopper though she was writing "applications"?

LEO was unique in giving careers in programming and engineering – Ferranti, Elliott, English Electric also did this to name but three. And we can be sure they managed the training of their staff.

Was the Braille technology part of LEO 1, the scope of the citation, or later?

The remainder of this section is about the activities of the LEO Society and outside the scope of the citation.

The films and videos should be consolidated with the References section.

The comment about presentations should give a reference to where these can be found, together with an explanation of how/where they support the citation.

Why was the achievement successful and impactful?

This section needs expanding. How did LEO contribute to the Lyons business – what efficiencies, cost savings or new lines or business did it enable?

Ongoing Developments of LEO I

The information about users of LEO I is pertinent and that LEO went on to build subsequent machines, but the use of later machines, the customers for them and the collapse of the company is outside the scope of the citation. And for completeness it should be added EELM was merged with ICT to become ICL, now Fujitsu.

References

A URL for LEOPEDIA should be here. What long term guarantee is there that this online resource will be available a long time into the future?

Journals and Books

The main text should reference these works, with page locations, for the claims made in the proposal.

Acknowledgement

While well-motivated, this is not a normal element of a Milestone proposal.

Appendix

Some of this section could be folded into the main body of the text, as it helps answer many of the questions raised above.

By starting with ENIAC, you have skipped over the Harvard Mk 1, the Atanasoff-Berry Computer, the wartime Colossus at Bletchley Park and others in the timeline of the modern digital electronic stored program computer.

Academic computing historians enjoy quibbling over definitions and precedence of early computers: it would be wise to stay out of this and just talk about business computers, where it is pretty clear LEO takes precedence.

Comment about "Harvard architecture" is irrelevant.

"LEO was more than a United Kingdom achievement." This could be put more strongly: "LEO was the first business computer in the world."

IBM has "business computers" before the System/360. For example, the System 650, described on IBM's history web site as "the workhorse of commercial computing", but as it was only announced in 1953, it post-dates LEO.

For a milestone proposal you need to be entirely confident in your claims: "This appears to confirm that in the field of applying digital computing to business processes for a large commercial company, LEO was ahead of the progress in commercial and business application in the U.S., and elsewhere." is diffident, you need to be authoritative, and with supporting evidence.

CSIRAC and Zuze's machines contemporary to LEO are not relevant as oriented toward scientific computing.

Does proposed milestone represent a significant technical achievement?

It is widely accepted by computer historians that LEO I was the first business computer, and that it was a significant technical achievement embodying new technologies beyond those in the contemporary scientific machines such as EDSAC, Manchester/Ferrant Mk 1, Pilot ACE to deal with the specific requirements of business-critical commercial information processing and calculation. It is also widely

accepted that the LEO organization led the way in developing software and operating procedures for computerising business processes in the interests of improved business efficiency and profitability.

1.
2.

Were there similar or competing achievements? If so, have the proposers adequately described these and their relationship to the achievement being proposed?

LEO I was the first business computer. But it was quickly joined by competitors within a few years, perhaps just one or two at most. The proposal could have made a better job of how LEO differed from the scientific computers that preceded it, and the announcement dates or first delivery dates of machines for commercial processing from other manufacturers.

Have proposers shown a clear benefit to humanity?

The proposers could have done a much better analysis and explanation of the benefits LEO bought to Lyons, in terms of business efficiency and profitability, i.e., that the machine created an economic benefit, that was recognized and copied by others and indeed throughout the 1950s, 60s, 70s and 80s "business computers" were the most common type.

To the best of your knowledge, would you say that LEO was really the first application of a stored-program computer to a business?

Yes! And even more so if we pin it down to electronic, digital, stored-program computer. (To rule contemporary punched card technologies for example.)

But there is some slipperiness in the term "to a business". For example, the EDSAC at Cambridge was for scientific computing, but then "science" was part of the "business" of the university; the Colossus at Bletchley Park was for codebreaking, but that was the "business" of Bletchley.

The proposal needs to draw out that by business computer, they mean a computer designed to support commercial functions, such as stock control, payroll, work planning and scheduling, accounting etc.

A more detailed analysis of when others introduced business computers would be helpful.