Continuing the Manchester Connection

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bjp slide 1

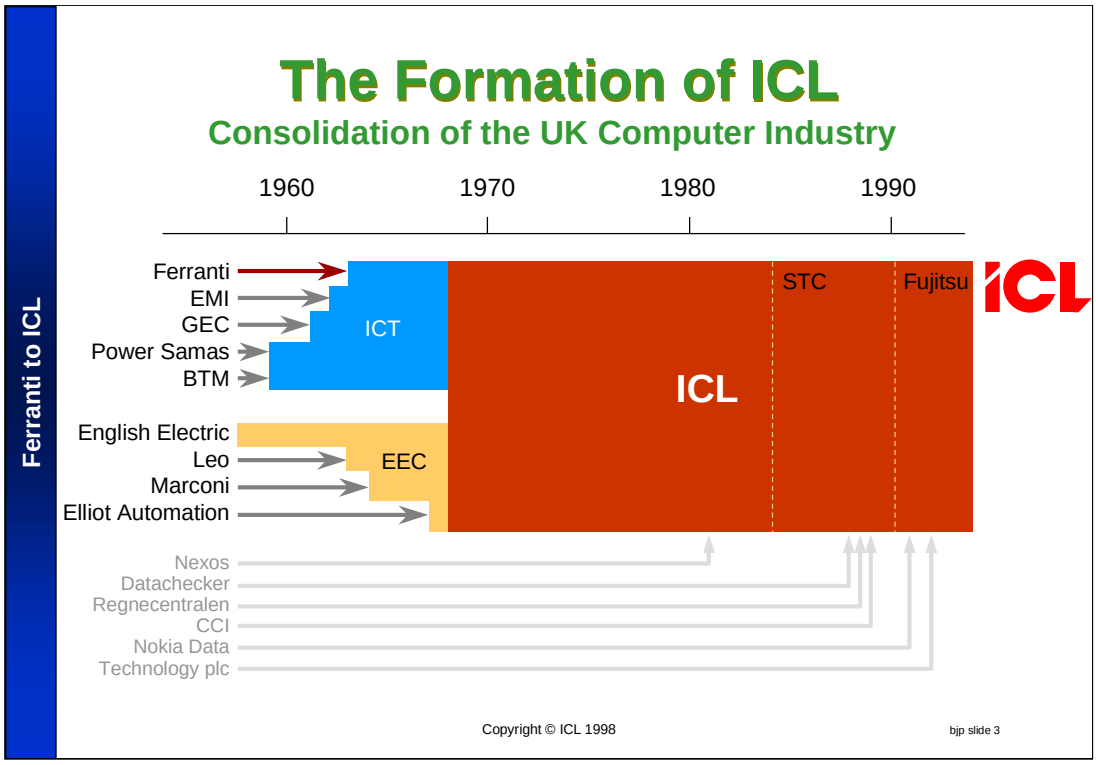
- This talk follows on from the talk given by Keith Lonsdale this morning in which he described how the Ferranti Company worked with the University to produce commercial versions of the Baby/Mk1 and its successors.
- The co-operation between the University and industry has been continued with the successors of Ferranti - firstly ICT and then ICL.
- The emphasis on “Manchester” in the title arises because the successor companies have continued to operate development facilities on the (now modernised) site occupied by Ferranti and situated a few minutes away from the University. The site is now the home of ICL High Performance Systems - the modern counterpart of the Ferranti Computer Department.

Overview

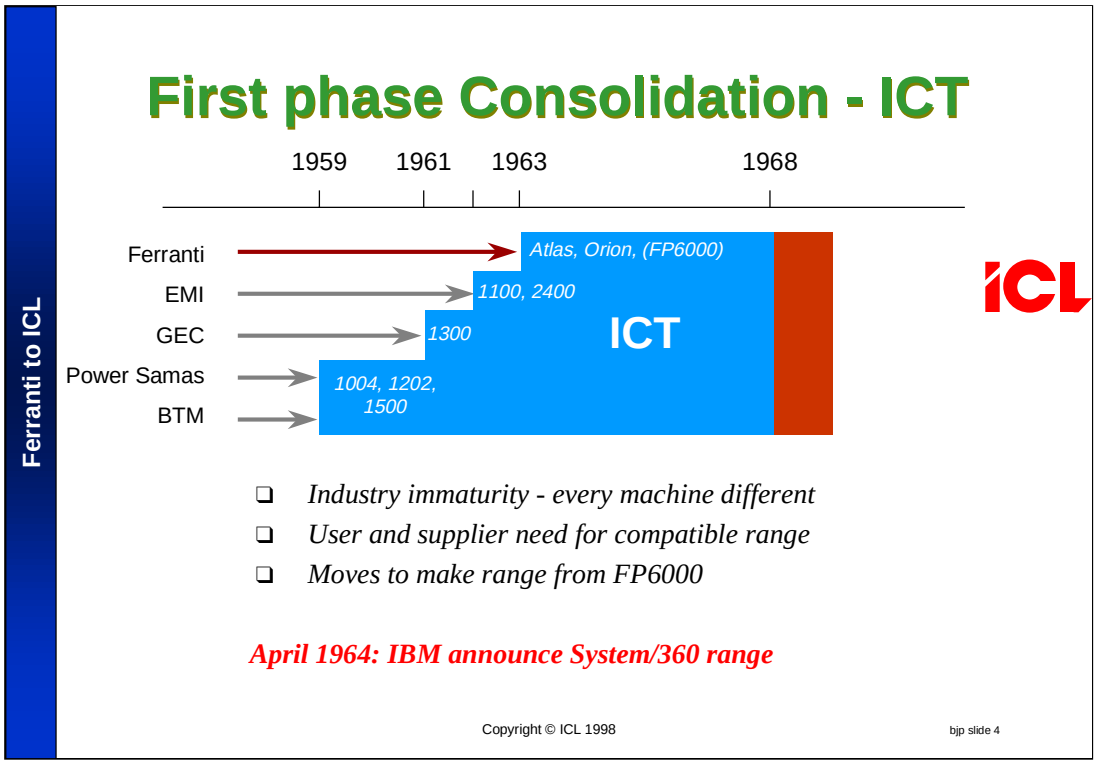
- *From Ferranti to ICL*
- *ICL's 1974 New Range - VME2900 Series*
  - Planning the 2900
  - The University influence
  - The architecture lives on!
- *Parallel Processing*
- *The Wider Relationship*
- *Conclusions*

bjp slide 2

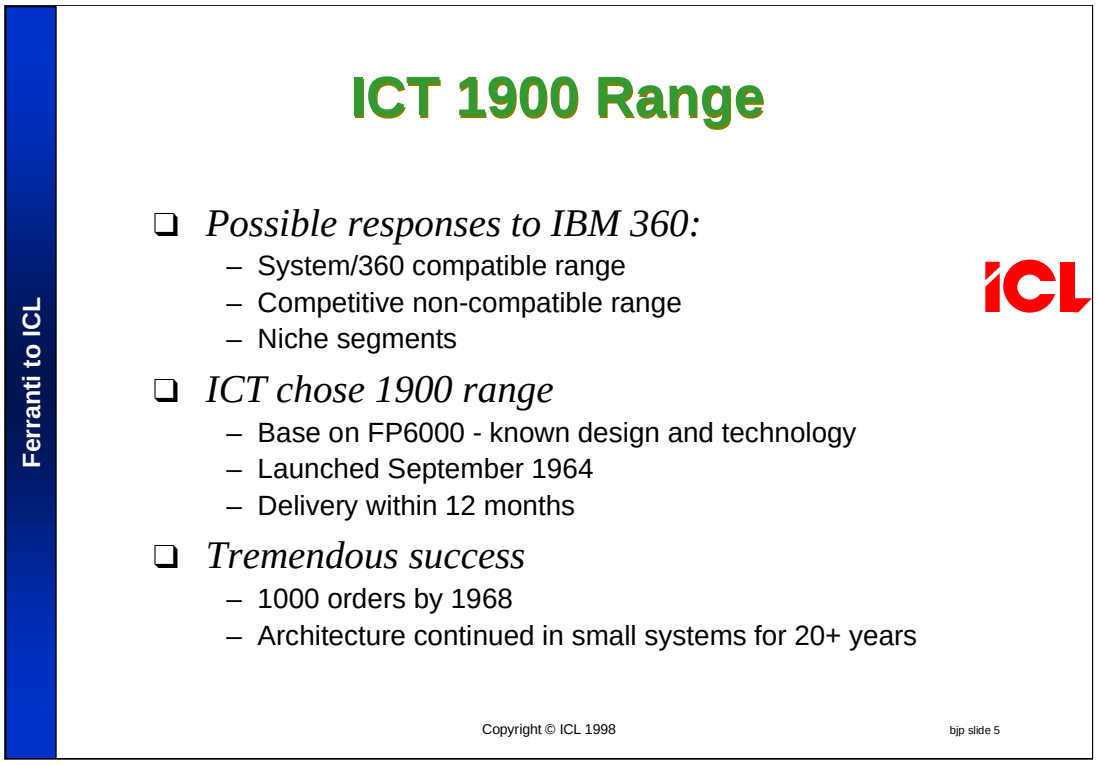
- The first part of the presentation traces the history of the formation of ICL and identifies some experiences which were to influence subsequent decisions.
- The main part of the presentation is devoted to a look at ICL's VME2900 Series and its successors, and the influence the work in the University had on it.
- Jumping forward a decade there is a short summary of the activities on Parallel Processing described earlier by Professor Ian Watson.
- Before the conclusions, there is a brief reminder of the broader relationship between the University and ICL.



- In the 1950s, many UK companies felt it necessary to enter the computer business. Segmentation of the market into process control, commercial processing (known then as Electronic Data Processing or EDP), and scientific computing was taking place. However, within each of these segments companies were essentially all competing over the same turf. The specialisation of companies into suppliers of hardware, middleware, applications, outsourcers, integrators etc was still a long way in the future. Furthermore, the market for computers was still very small - total European sales of computers over the decade of the 1950s were put at 550.
- By the end of the fifties it was becoming clear to companies and government that this was not a viable EDP industry. Consolidation was essential.
- The consolidation took nearly ten years to complete and happened in three phases:-
  - a group of companies merged progressively into International Computers and Tabulators (ICT) during the late ’50s and early ’60s;
  - during the middle sixties another group merged into what was eventually called English Electric Computers (EEC);
  - finally, towards the end of the sixties these two groups came together to form International Computers Ltd (ICL).
- For completeness, subsequent acquisition by ICL are shown. The dotted lines across the ICL group denote the merging of ICL into Standard Telephones and Cables (STC), and the subsequent de-merging of ICL and the acquisition of a majority holding by Fujitsu.



- The slide focuses on the first phase of consolidation - into ICT. The original founders were in the punched card business and needed to get into computers quickly. Accordingly deals were struck with Univac and RCA to provide the emergent ICT with computers it could sell. Unsurprisingly there was no compatibility between the machines from the different companies.
- The subsequent incorporation of computer interests from GEC, EMI and Ferranti brought another 6 machines. Additionally Ferranti were in process of bringing another machine to market - the FP6000 developed by the Canadian associate company. All of these machines were incompatible, even where they came from the same company!
- Given the immaturity of computing (technology and market), it is no surprise that each machine was so different. However, it was becoming a problem for both suppliers and their customers. Applications had to be re-written. Suppliers were struggling with the economics of systems achieving total sales of tens (or less!)
- During 1963, ICT were wrestling with this problem. The answer seemed to be a compatible range. Various alternatives were explored. The new machine from Ferranti was found to be capable of extending upwards and downwards to create a compatible range. The existence of hardware and software for one member in the range was a big advantage. A product could be in the market quickly. Building in a standard peripheral interface, already in existence in ICT, provided a range of peripherals.
- Then in April 1964, without warning, IBM made an announcement that stunned the computer world. The System/360 range. "FC's" words of 16 years earlier were again appropriate: "Nothing was ever the same again"



- Across the world, suppliers had to decide how to respond to the IBM announcement. One possibility, followed by RCA and English Electric, was to develop ranges compatible with IBM's. A full-range supplier alternative was to differentiate from IBM, offering an internally compatible range. Burroughs and Bull were among the manufacturers who followed this strategy. Finally a manufacturer could choose a niche and promote their own architecture. CDC went this way.
- ICT rejected the360 compatible option because they did not believe it possible to beat IBM at their own game. The niche approach was not an option because it did not fit ICT's market. The middle option of the competitive range was already well advanced.
- And so the 1900 range was launched at the Business Efficiency Exhibition in London in September 1964. Two machines from the range were demonstrated. Deliveries within 12 months were available - ahead of System/360 in the UK.
- The 1900 range was an immediate and sustained success, transforming ICT's business. ICT had taken over 1000 orders by the time of the formation of ICL in 1968. The 1900 architecture continued to be used in small products into the mid eighties.

Ferranti to ICL

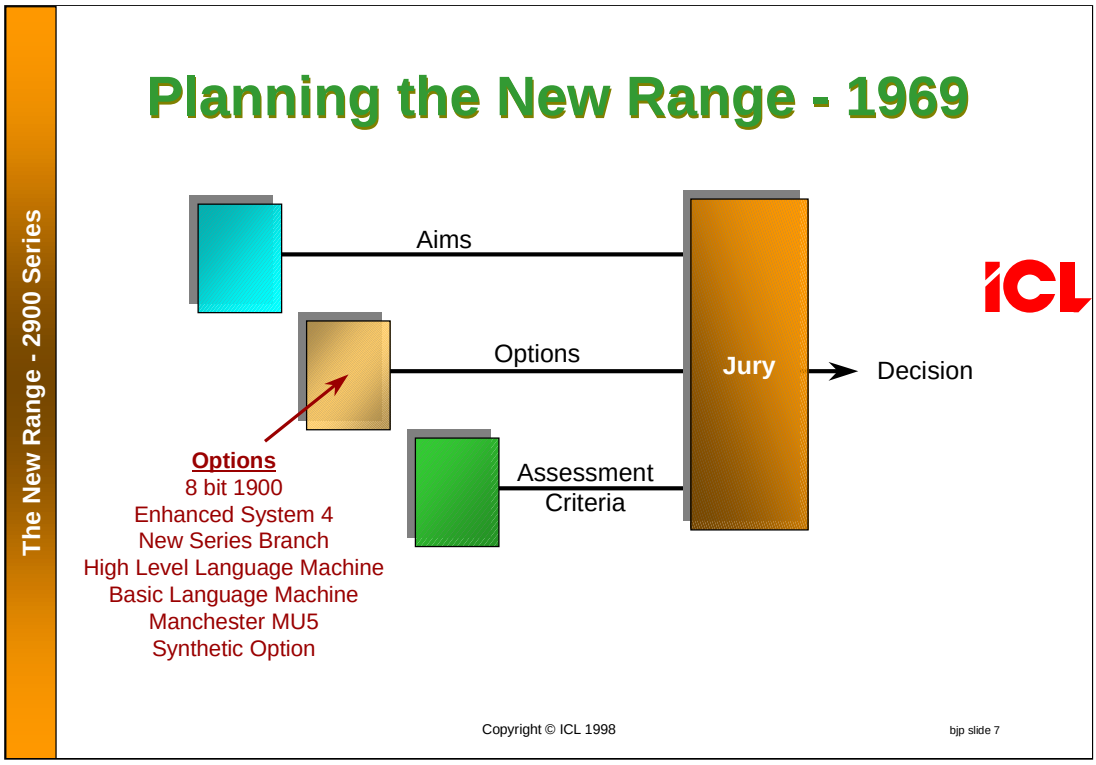
Final phases of Consolidation

ICT + EEC ⇨ ICL

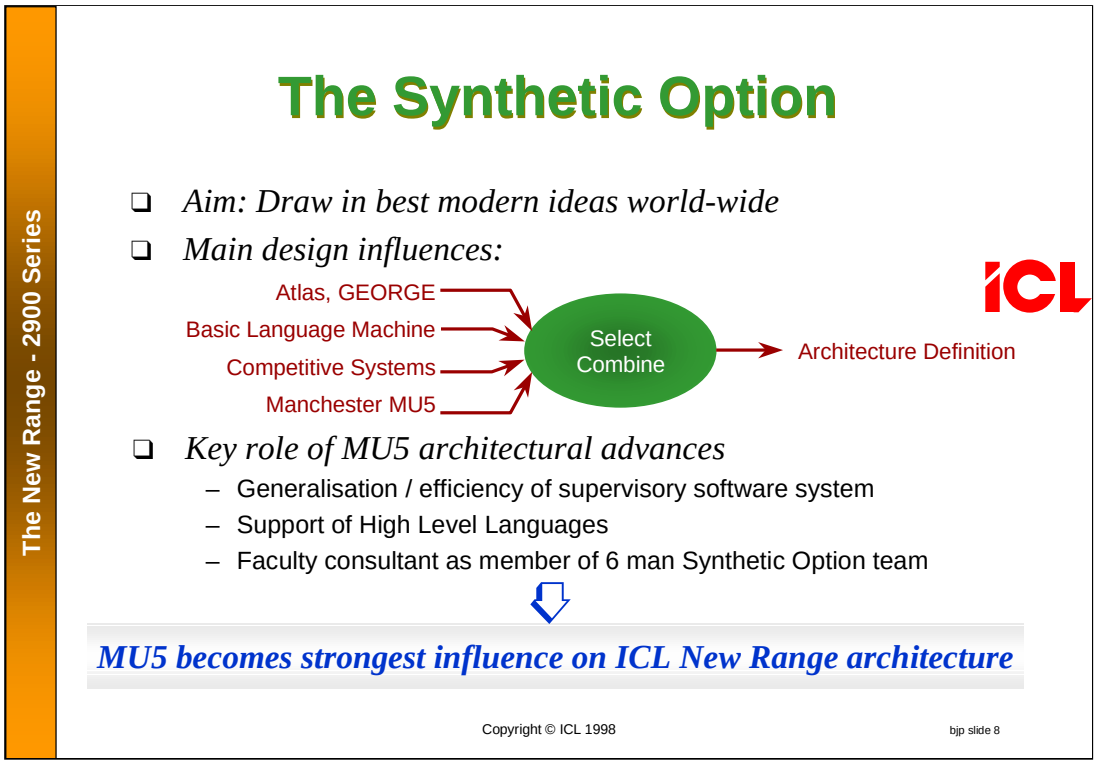
- *Government intent on consolidation of UK industry*
  - Prepared to offer grant
- *Need for new range:*
  - ICT 1900
  - EELM System/4
  - Elliot Automation 4100
- *Worsening financial situation*
  - ICT/EEC merger in 1968

bjp slide 6

- During the mid ’60s the pioneering computer business of Lyons Electronic Office (LEO) merged with English Electric Computers to form English Electric Leo. A year later the computer interests of Marconi joined to create EELM. In 1967, Elliot Automation merged and the name was changed to English Electric Computers (EEC).
- In the second half of the ’60s, there were therefore two main UK businesses, ICT and the EE-based group. The Ministry of Technology of the Wilson Labour Government were keen to see these merge into a strong and viable UK industry. It was recognised that rationalising the businesses and their disparate ranges would be costly and the Government were prepared to put up some money to start the company on a sound footing.
- Discussions between the various parties continued over a number of years, towards the end of which financial problems, nationally and within the industry, worsened. Eventually the situation was brought to a head by an unexpected bid for ICT by Plessey. ICL was eventually formed through a merger of ICT and EEC in 1968, but on financial terms which placed it in a weak situation for the expensive period ahead.
- Following the merger, it was clear that rationalisation of the ranges was again required. Although the 1900 was still very successful and there were comprehensive enhancements already in development, the 1900 range was weak at the high end and in the emerging transaction processing market. It would need major changes to be competitive beyond the mid ’70s. The EEC System/4 was an IBM compatible range. However EEC were having real difficulties with hardware and software. The first big issue for the new ICL was its future range.



- Facing the problem of choosing the future range in the latter half of 1968, the new ICL tried first to repeat the experience of ICT. Was there an available, proven system which would meet there needs? By the end of 1968 it was decided this did not exist, and a "New Range" would be needed.
- At the beginning of 1969 a concentrated activity was begun. A number of teams, each of just a few people, were set up. Individual teams focussed on identifying the broad aims, fleshing out options, and developing sets of detailed assessment criteria. The teams operated in parallel and interactively during the first quarter of 1969 and presented their findings to a "jury" drawn from a wide range of skills across the company. Altogether, seven options were investigated by seven teams.
- Some of the more significant options were:-
  - The first two, developments of 1900 and System/4, had obvious attractions. However, the Jury were not convinced of the long-term viability of the 1900 architecture nor of the business wisdom of head-on competition with IBM.
  - The Basic Language Machine (BLM) was an elegant, fundamental r-think of computer architecture developed by a team in ICL's labs under the direction of John Iliffe. Although the Jury were sceptical that BLM could satisfy all of the needs, Iliffe's ideas were to have a considerable influence on the outcome.
  - At this time, the University of Manchester were some three years into their MU5 system. One team looked at the wholesale adoption of the MU5 architecture and its expansion into a range. The Jury found much to admire in the architecture but saw practical difficulties with the option. However, as we see next, this particular option was by no means the only input from MU5.
  - The final option was named the "Synthetic Option". With some caveats, it was eventually selected by the Jury. It is examined in more detail next.



- The brief of the Synthetic Option team was to draw on the best modern ideas from anywhere, and to synthesise them into a coherent and flexible architecture. The team responded to this brief with some style.
- The main design influences came from the four sources indicated:-
  - From Atlas and the GEORGE operating system on 1900 came lessons learnt in creating large, efficient operating systems;
  - The innovative work done by John Iliffe and his co-workers on the Basic Language Machine influenced many aspects of the architecture;
  - Competitive influence came mainly from the large Burroughs machines (similarities in HLL handling) and MULTICS (protection);
  - However, the remarkable architectural advances made by the University of Manchester in the MU5 almost certainly constituted the single most important influence on New Range architecture.
- The influence of the University work on the Synthetic Option continued the tradition started with Ferranti. The six members of the SO team were familiar with the work on MU5 and included a member of faculty working as a consultant.

  The SO team shared the University view on a number of important aims and the resultant MU5 architectural decisions were well received by the SO team. Two such areas were the ideas of generalising the OS whilst improving its efficiency; and the recognition of the growing importance of High Level Languages with their need for a “compiler friendly” architecture. Although the MU5 and New Range architectures are not the same, there is a clear family resemblance. Many of the fundamental approaches to storage management and process structure in New Range are directly derived from MU5.

The New Range - 2900 Series

The MU5 Relationship

- *Continuing in the Ferranti tradition*
- *ICT/ICL*
  - Support for MU5 SRC application
    - Specially modified 1905E
    - Construction facilities provided at cost
  - Use of ICT 1906A technology and DA
  - ICL staff seconded to University
- *Computer Science Department*
  - Faculty consultants to ICL
  - Potential use of MU5 as early 2900
    - Convergence activity

bjp slide 9

- There was a quite complex web of relationships between the University and ICT/ICL during the MU5 and New Range period:-
- The work at the University on MU5 had started at least two years before the ICL New Range architecture activities just discussed. In 1966 the University approached ICT to enlist support for the MU5 project. In 1967 the University applied to the Science Research Council for a grant. In support of the application, ICT agreed to construct a specially modified version of one of their 1900 series machines which would be used as a multi-processor with the new machine. ICT would provide construction facilities for the new machine at cost and would make available the technology and Design Automation tools used in its recently released top-of-the-range 1906A. ICL staff were seconded to the University to work on the project (5 out of a team of 20 in 1968).
- The earlier description of the ICL Synthetic Option team mentioned the inclusion in the team of a faculty member of the Computer Science Department, working as a consultant. He was not alone. Records indicate that five members of faculty were retained by ICL at different times and in different roles during the New Range activity.

  During the development period of the first 2900 systems, serious consideration was given to the idea of ICL manufacturing the MU5 design as an early 2900 product. Some aspects of the two architectures were sufficiently different to cause user incompatibility so, in 1971, a convergence exercise was mounted and changes introduced to bring them closer. In the end, the idea of using MU5 in this way was not taken up.

The New Range - 2900 Series

The VME2900 Story

- *The birth (pangs!) - 1974 launch*
  - Five years hardware and software effort
  - Financial problems ⇨ new, American, management
- *1985 - Series 39 Nodal Architecture*
  - Fujitsu technology agreement
- *1997 - Trimetra, the "Millennium" strategy*
- *The promise has been fulfilled*
  - Robust, efficient architecture
  - Used and trusted by wide range of organisations
    - Government, Financial Services, Utilities...

bjp slide 10

- Five years of implementation effort followed the Jury decision to adopt the Synthetic Option. Populating the New Range was an enormous undertaking. ICL had to develop everything: processing and IO systems, operating systems, database, TP monitor, compilers, applications and bridges from previous ranges.

  Meanwhile the financial situation was deteriorating. National economies were in bad shape and the computer industry plunged into world-wide recession. The situation for ICL was becoming critical. Without help it would not be able to deliver the New Range. Eventually Government agreed to provide a repayable loan - on condition top management was changed. The new management were largely American and introduced a tough, abrasive culture.

  Eventually, in April 1974, the New Range was launched as the 2900 Series. The launch was a slick marketing affair. Regrettably, as a matter of historical fact, it must be recorded that no credit was given at the launch to the contribution made by the University.

  The 2900 Series (later VME2900) was introduced "top-down" and the range gradually filled out. The software matured and new models were introduced. The 2900 Series continued for more than a decade.

…continued overleaf

The New Range - 2900 Series

The VME2900 Story (continued)

- *The birth (pangs!) - 1974 launch*
  - Five years hardware and software effort
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- By the early eighties, hardware technology trends indicated the need for a new approach to multi-processors. Aided by an agreement giving access to Fujitsu's world-class technology, a new "Nodal Architecture" was developed. The nodes of a multi-processor were interconnected by fibre optics and could be physically dispersed for "disaster tolerance". This radical approach was enabled by the strongly object-oriented design of the VME operating system developed by ICL and the process model embodied in the original 2900 architecture. The 2900 architectural model was preserved, providing applications and data compatibility with earlier 2900s - a testament to the quality of the original architecture. The new systems were named Series 39 and launched in 1985. They continued until 1997.
- The latest manifestation is the Trimetra range launched in 1997. Trimetras feature a combination of a VME system and a Unix or NT system. Customers can consolidate applications running on different platforms into a Trimetra - for example allowing them to front an established VME based sales application with a customer service desk application running on Microsoft® Windows NT. Bringing the story up to date, May 1998 saw the first delivery of a VME system in which the entire architecture is emulated on an industry-standard Intel-based multi-processor. Full application and data compatibility with previous VME systems is preserved. Over the next few years this technology will be extended upwards to cover the entire range, guaranteeing the future availability of VME systems well into the next millennium.
- The early promises have been richly fulfilled. The original 2900 architecture has stood the test of time, fierce competition, and dramatic changes of underlying technology. Now, thirty years from its original conception, it remains the most modern and most efficient mainframe architecture. Large and medium organisations depend on their VME systems to keep their businesses running. We look forward to it being alive and well on its 50th birthday!

Parallel Processing

Parallel Processing

- *Flagship 1983-7*
  - UK Alvey programme
  - Parallel declarative system
  - Cluster of projects involving:
    - ICST, UM, UEA
    - ICL, Plessey
- *EDS 1987-91*
  - European Esprit programme
  - Parallel system and its exploitation
  - 16 partners at peak
  - Industrial Lead: Bull, ICL, Siemens
  - Research incl: ECRC, ICSTM, UM, UEA
- *ICL Products*
  - *Goldrush Mega***SERVER** launched 1993
  - *Pim***SERVER** - video server derivative

32 node
*Goldrush Mega***SERVER**

- During the early 1980s concerns about the future scalability of the traditional multi-processor model raised the level of interest in parallel processing.
- Over the period c1983 to c1987, ICL partnered with a group of Universities in a cluster of projects under the UK national "Alvey" programme. The focus of these projects was the combination of declarative paradigms and parallel processing, hiding the messy detail of parallelism from the programmer. The contributions of each of the Universities and industrial partners were nicely complementary. As Professor Ian Watson described previously, the University of Manchester were primarily concerned with computational models, building on their previous pioneering work in Dataflow architecture.

  The largest project, "Flagship", was led by ICL. By the end of this project the scalability of a 16 processor system was demonstrated using an operating system and database written in a declarative language.
- The successful outcome of the Flagship project enabled ICL to assemble a consortium of industrial and academic partners which won a European Esprit research contract - European Declarative Systems (EDS). EDS was a complex consortium. The central theme was the industrial exploitation of parallel declarative systems. However this was a broad church within which the partners pursued related but personalised ends determined by their business priorities. ICL were interested in a parallel database machine and used the results of the EDS project in the "Goldrush" system.
- After three years work productising the EDS results, ICL launched the ***Goldrush Mega*SERVER** in 1993. It was used to run large data-warehouse applications and benchmarked very favourably against traditional architectures. Over the next couple of years there was a spurt of interest in large-scale interactive multimedia delivery (initially "Video-on-Demand"). A "***Pim*SERVER**" variant of Goldrush was produced and has been used in a number of regional development projects, for example to deliver training material.

The Wider Relationship

The Wider Relationship

- *Education*
  - PEVE
  - ICL's Core Technical Training Programme from 1985
  - University and ICL received National Training Award
  - Modular Masters Degree
- *Faculty*
  - ICL Professor of Computer Engineering (~30 years)
  - Professor of Software Engineering and ICL Senior Fellow
- *Ongoing projects*
  - Wide range of software topics and a hardware project
  - Likely style for future

bjp slide 13

- The preceding discussion has focussed on product-related relationships between the University and ICL. This slide takes a brief look at some broader aspects of the relationship.
- In the mid 1980s ICL had the need to broaden the skills base of its engineering workforce. Working with the University and its nascent PEVE unit, a training programme was put together and rolled out over the next few years. All of this happened prior to the more recent national schemes encouraging industry/academic co-operation in training. The University and the Company won a National Training Award for this scheme.
- Mention has already been made of the services provided by faculty members acting as consultants to ICL and its predecessors.

  For some 30 years, there has been an ICL Professor of Computer Engineering, occupied for many years by Professor Dai Edwards and recently by Professor Steve Furber.

  The current Head of Department and Professor of Software Engineering, Professor Brian Warboys, spent most of his career in ICL. Brian's influence on the 2900 architecture is immense and he was the chief architect of the VME operating system mentioned earlier. For some ten years prior to his present appointment he split his time between Senior ICL Fellow and his role at the University.
- Today there are a range of project activities between ICL and the University. The nature of the computer industry has changed, and ICL has changed. As a result, the projects today span a wider set of disciplines and the ICL groups involved range beyond the traditional Manchester-based group. This will probably be the pattern for the next few years until another shift occurs in the industry.

Conclusions

- *Congratulations on 50th Anniversary*
- *ICL is proud of its long association with the University of Manchester*
- *We know your work and people are world-class*
- *We look forward to a continuing, productive relationship in the future*

Material in this presentation drawn from:
"The ICL 2900 Series" Author: J.K.Buckle in Macmillan Computer Science Series 1978
""The Origins of the 2900 Series" Author: J.K.Buckle in ICL Technical Journal First Issue 1978
"The MU5 Computer System" Authors: Derrick Morris & Roland N. Ibbett in Macmillan Computer Science Series 1979
"ICL A Business and Technical History" Author: Martin Campbell Kelly Clarendon Press 1989
… and discussions with some of the people involved at the time

- We offer our warmest congratulations to the University of Manchester and the Department of Computer Science on the proud occasion of the 50th Anniversary of the Baby.
- ICL, and particularly the Manchester-based division, High Performance Systems, is proud of its long association with the University. We trace the connection back through the predecessor companies to the pioneering days of the University and Ferranti described by earlier speakers.
- We are pleased to honour not only the team and the event of 50 years ago, but the people and the stream of work which has continued to emerge from the University. We *know* that your work and your people are world-class. We *know* it because you have helped us to produce products which have stood the test of time and have held their own on the world stage against competition from the best.
- ICL operates in an industry which changes continually. The products of this industry are enabling fundamental changes in the society in which we all live and do business. We cannot and will not stand still. The University/ICL connection will continue to change. Whatever its future shape we look forward to a continuing relationship from which both sides derive benefit.