Version 4: September 2024

ICL minicomputers.

Historical background.

Established in 1968, ICL was an amalgam of ICT and the mainframe computer interests of English Electric. ICT had previously acquired the mainframe interests of EMI and Ferranti. In turn, English Electric had, by 1967, acquired the mainframe interests of Leo, Marconi and Elliott Automation. Thus, by a complex process of mergers and take-overs, in 1968 ICL became the *only* major UK manufacturer of mainframe computers. The ICL 1900 range, launched in 1964, was the company's first major initiative. This was followed ten years later by the 2900 range, which itself was superseded by the Series 39 in the mid-1980s.

ICL started to have links with Fujitsu in 1981. Eventually Fujitsu acquired ICL and, in June 2001, Fujitsu decided to dispense with the name ICL. At that point, ICL employed 19,200 people in Europe, the Middle East and Africa, over 10,000 of whom were in the UK. In 2002 the residue of the ICL company was re-branded as Fujitsu's European Services arm.

Back in the 1970s, ICL was actively interested in a broad range of commercially-oriented applications involving both large and small computers – some of the latter coming within the definition of minicomputer. Three particular ICL products are considered as minicomputers and are described later in this section. These are the ICL DRS/20, the ICL System Ten and the ICL System 25 minicomputers. The sub-section on the DRS/20 begins by reviewing the underlying world-wide technological innovations that were driving the whole of the minicomputer market area.

Finally, it is worth observing that ICL did not really interest itself in smaller computers for real-time industrial process control or on-line defence-related applications. From 1968 onwards these specialist fields were left to the small systems divisions of Ferranti and Elliott-Automation, the latter becoming part of GEC in 1968. Post-1968 minicomputers designed under the GEC and Ferranti labels are in separate sections of the *Our Computer Heritage* website.

The ICL DRS/20 description starts on the next page.

Descriptions for the ICL System 10 and System 25 will follow but have not yet been uploaded at the time of writing.

ICL's DRS 20 Series – Distributed Resource Systems

Product Overview

Contents.

1. Introduction

The **DRS20 Series** of desktop **Intelligent Workstations**, and pedestal-cabinet packaged **File, Network, and Communications Servers** were the first members of a new ICL family of Distributed Processing System products, announced in September 1981. They were aimed at the (then) emerging, and subsequently burgeoning, markets for Departmental Computing, Distributed Processing, Networked Word Processing and Office Systems, interlinked with larger centralized mainframe Corporate computer systems via a variety of (again emerging, but later industry-standardized) Local- and Wide Area Networks communications technologies, standards and protocols.

During the 1970's microcomputer technology was fast developing, together with associated software and application development tools, to the point where single- user, desktop intelligent workstations and prototype "personal computers", with screen/keyboard and "floppy disk" storage, were becoming a practical proposition at an affordable price *("... purchasable for about one quarter of a programmer's annual salary. Quite simply -by mid 1970's- it was no longer necessary to share computing resources." - Dr. Gary A. Kildall - Digital Research Inc. – pub. Byte Magazine. June 1981).*

The DRS20 series derived from development projects and products acquired by ICL following its take- over of Singer Business Machines (SBM) in 1976, and in particular, the plant and development labs. in Utica, New York, home of the Singer 1500 (formerly Cogar C4) Intelligent Terminal /Data Capture product ranges. These products were already spearheading the trend towards the distribution of computing resources away from a centralized "Data Processing Centre" and into end user departments, and remote locations in large multi- location Corporations or Public Services organisations, and into the smaller businesses and offices of multifarious mid –sized organisations worldwide.

The generic product branding terminology for the new ICL family of products – "**Distributed Resource Systems"** (**DRS)** – was chosen to reflect not only the market and user segments the products were targeting, but also the system's architectural design and hardware/software structures. As described below, multiple microprocessor subsystems themselves were "distributed" internally within a system "node" or unit to provide the sort of end-user application performance that could only previously have been delivered by a much faster, complex and hence more costly, shared minicomputer single central processors.

2. The Distributed Resource Architecture - DRA

2.1 Early Microprocessors.

To appreciate the hardware and software architecture of DRS20, one must first consider the state of development and sophistication of microcomputers, and their related software development tools, at that period i.e. during the 1970's. Intel had introduced its first "commercial" 4-bit microprocessor family- the MCS-4 with the 4004 CPU - in 1971. This was followed in 1972 by the **8-bit "8000" family**, with its 8008 CPU, and, subsequently, the higher performance **8080** (*1974)* and **8085** *(1976*) CPUs, together with the MCS-85 family of support chips for memory, peripheral I/O controllers etc. These latter CPUs could address 64Kb of memory (compared to just 16Kb of the 8008) with a Bus width of 8-bits (data) / 16-bits (addressing) structure – enough to become the basis for early microcomputer systems. (eg 8080 was used in the Altair 8800 System – generally regarded as one of the first practical, if somewhat limited, desktop microcomputers.)

Other comparable microprocessors were being introduced at the time, such as Zilog Z80, TI's TMS1000 and Motorola 68000, but Intel was emerging as the market leader and computer systems developers' supplier of choice – especially in USA. But compared to contemporary minicomputers (eg DEC VAX's), and even small mainframe processors, the performance of these micros was still relatively modest. For example: **8080:** Clock rate - 2 MHz, delivering 0.29 MIPS. For the **8085:** Clock rate – 3MHz and 0.37 MIPS. Enough ,

perhaps, for a single –user, single- processing , simple application on a DIY home- build micro., but hardly enough to support multi-user, multi-processing , “serious” transaction processing systems in the corporate Data Processing/ Information Processing world?

Note also that **16-bit microprocessors**, with faster Clock rates, and larger addressable memories, did not start appearing until the late 1970s. Intel’s **MCS-86** Family, with the **8086** CPU (up to 10 MHz with 0.75 MIPS; Bus width- 16 bits data, 20 bits address; 1 Mb memory), and the **8088*** CPU (8MHz with 0.66 MIPS; Bus-width – 8 bits data, 20bits address; 1 Mb memory) were not introduced until 1978 and 1979 respectively. (*The 8088 was used in IBM’s first PC, launched in August 1981).

8088 also provided forward compatibility from Intel’s earlier 8-bit family, using the common 8 -bit data bus width. This latter facility subsequently proved valuable for the evolutionary development and enhancement of the initial DRS20 design, which, in its first manifestations, used the Intel 8-bit family microprocessors and support chips, but later moved to 16 –bit processors.

2.2 Microprocessor Software Development Tools.

Thus, the choice for new product hardware developments at Singer’s (later, ICL’s) Utica facility in the mid 1970s was, not surprisingly, the Intel 8-bit microprocessor family – and particularly **8085 CPU.** In addition and in parallel, a whole set of software development tools and products were emerging to enable the more effective implementation of “proper” DP /IT systems on these Intel microprocessors; most notably from **DRI (Digital Research Inc.)** with its pioneering **CP/M** operating systems software. Developed during 1973/74, the original 8-bit CP/M provided three main components: BIOS (Basic Input /Output); BDOS (Basic Disc Operating System); and CCP (Console Command Processor), designed to run on a minimum hardware configuration comprising an ASCII terminal (eg.Teletype or Video/Keyboard); an 8080 or 8085 microprocessor CPU with min. 16k RAM; at least one Floppy Disk drive (originally 8”). Not very sophisticated, but enough for system developers to start building viable single-user application systems.

Later versions of the CP/M family, particularly for 16-bit micros such as 8086 /8088, evolved to support other disc storage subsystems (eg 5.25 in. Floppies, and 8” and 5 ¼” hard disc drives – “Winchester” technology – of varying capacities). Multi- programming (MP/M), and Concurrent Application execution **(CCP/M)** versions followed, but not until early 1980’s. **CP/NET**, which distributed operating system functions throughout a network of microprocessors, first appeared in late 1980. And, of course, in mid 1970’s, Microsoft was only just established (incorporated in 1976) and MS-DOS did not yet exist!

So, the above combination of hardware and software products and components then most commonly available in the marketplace, together with their known limitations, largely determined the design characteristics of the initial DRS20 Series during its development in the mid 1970's. The other determining factors were the incorporation into the DRS design of evolutions of the **SIO (Serial Input/Output)** and peripheral device interfaces from the **Singer 1500 Intelligent Workstation** family, and the early form of **Local Area Network** interconnect for workstations and servers over low-cost, television aerial-style co-axial cable. And since there was a large and growing customer base of several thousand Singer (and later ICL) 1500 Systems installed with users, especially in UK and W. Europe, a "1500 compatible" forward transition route for those users' applications was also seen as essential.

2.3 DRA - the basic concept

2.3.1 Hardware Architecture

The basic design concept for what became the DRS20 Series was to exploit the advantages of parallel running of systems and applications tasks across several collaborating microprocessor sub-systems, linked by a common message- passing bus backplane (in the "server" configurations), or interacting over local- or wide-area network links between workstations and servers. DRA defined a way of splitting up total systems tasks and multiple user applications into a series of individual tasks, or "functions", and dedicating a complete single-board microprocessor, with its own memory and a common bus interface, to each main function. These micro sub systems were known as **"Function Processors"** each with its own memory (typically up to 64kb). The main Function Processors were:-

File Processor(s) – with a back- end interface (* in fact, via an associated **Disc Formatter** processor using a Signetics 8X300 micro) to appropriate floppy disk or hard disc storage devices.

Workstation Processor - which interfaced to screen and keyboard, and an RS232 workstation printer;

Network Processor(s) – which linked either to the SIO Local Area Network (branded **Microlan** for subsequent DRS product marketing purposes), or to various common Wide Area Networks communication links, standards and protocols.

The **Applications Processor(s)** could therefore be dedicated to executing the main applications code, whilst other system tasks and calls, such as file accessing and management, communications message handling, read/write from /to video terminal screen, keyboard and printer etc. could be proceeding in parallel in the other FP's.

So, in summary, the hardware architecture of DRS20 was one of the earliest examples of a **Multiple-Microprocessor Parallel Processing** system**.**

(It is perhaps worth commenting that this type of multi-micro architecture, although superseded in the later 1980s by the availability of much faster micros with extended memory addressing and storage capacity - eg. Intel's 32- bit range of 80386, 80486 and later P5 Pentium etc. - re-appeared in the late 1990's/ early 2000s, when these much faster microprocessors (and the emerging SPARC and RISC processor technologies) were arrayed together in significant numbers to provide supercomputing systems power and performance. ICL's later DRS 3000 and DRS 6000 UNIX Server systems deployed a similar multi-microprocessor architecture.)

The various Function Processors (FP's) were combined and packaged into a variety of Intelligent **Workstation** desktop units and cabinet- housed **Controller (or Server)** Units, which are detailed later. Within any of these units, or **Nodes,** the appropriate Function Processor PCBs *(PWA cards in US parlance)* were plugged in to an "intelligent" backplane bus *(described in early product literature as the **"FP Link**")* which provided both power and data paths for the intercommunication between co-operating processors. In the Server unit configurations, the Bus was known as the RP8 bus, *(so called, if memory serves, to relate to its 8-bit data paths, and the ability to interconnect up to 8 FP's. "RP" may have been abbreviated from "Real Processors"; or "Retail Processor").* The RP8 bus was in fact a 10-slot backplane, with one PCB (card) slot occupied by the bus arbitration/management processor; other function processor cards could be placed in any order in the other spare slots *(with one exception, concerning the RMM processor and memory – see below)*

In the video Workstation configurations, a sub-set of the RP8 bus allowed the interconnection of three FP's. Each type of FP had a common Bus-interface "front end", and where appropriate, a device specific (eg disk, video/keyboard, network link etc) "back end" interface. The various FP's and their associated devices could be packaged in different combinations into various Workstation and Server product model units, thereby offering a variety of performance, capacity and enhanceability options. In particular new, or higher performance, FPs could be later introduced into the system configurations to provide new, superior performance models.

2.3.2 Software Architecture

To enable all these hardware components - FPs, nodes, networks and devices - to operate together in an effective way, the system had to be under the control of a software "operating system" – in the case of DRS20 this was **DRX –** the **Distributed Resource EXecutive**. As it name implies this was in itself a set of software components *(or "sub routines", in earlier software parlance?)* located, according to the particular task or function, in their appropriate FPs.

DRX was comprised of two main elements:

(a) **Message Manager (MM) -** which handled **Process** management, **Memor**y management, **FP Link** management and **Inter-service Message Passing**.

(b) Function Managers (FMs) - , which are distributed across the various FPs, and control the particular tasks and services of their respective FPs.

Each FP contains its own specific FM code (eg **DBM -Data Base Manager-** in the File Processor) appropriate to its task. Each FP also contains its version of the **DRX Message Manager** front end, which is the software interface through which each FP and its task software intercommunicates with others, passing messages and data in the common format. (*Although this was not realised at the time, it might be said that DRX and the Microlan connected workstations and servers were an early manifestation of an "Intranet" environment; possibly, with the communication also over wide area networks, it also exhibit some aspects of early "Internet" processes?)*

A feature of DRX was that the "chat" (i.e. message passing) between FPs and their software components was not restricted to those FPs within the same node or server; they could also intercommunicate and interwork, across local, and /or wide area, networks. For example, the Application running in an Intelligent Workstation (AP) could access files held in another File Processor (FP) in another node, across the **Microlan** - a truly **Networked Operating System**. In effect, the usual elements of a typical software Operating System in a single Central Processor were, in the case of DRX, "distributed" throughout the network according to the needs of the system and the end user application processing.

(DRX and CP/NET? It is relevant to note that DRI announced, in late 1980, a "series of network –oriented operating systems - CP/NET- that distributes operating systems functions throughout a network of non-homogeneous microprocessors"! Chicken or Egg? Given that ICL Utica must have been using (some parts of?) the DRI CP/M and Intel 8080/85 software development systems at that time in developing their ("1500R") systems, it will be interesting to establish how much of DRX is owed to the DRI CP/NET developments- OR VICE-VERSA?!)

The DRA/DRX systems architecture was also constructed in a way such that different microprocessors, either 8-bit, 16-bit, or even greater, could be used in different Function Processors, and could interwork, provided the DRX Message Manager front ends were the same and passed/received the same message types. This gave DRS20 Series a potential performance enhancement and model upgrade that was exploited in later phases of the development and marketing programmes.

There were, of course, some limitations in the early system and software releases; up to 16 interworking nodes only were permitted on the early versions of Microlan. Additionally, the initial phases of the hardware and software product release were constrained by the need to deliver in a timely manner, the "1500 Replacement " – or **DRS20- Retained Mode systems**. These were systems with an "R-Mode" Application Processor, emulating the Singer 1500 code, that could execute the majority of the existing 1500 Series applications and network communications software; of significant importance as a forward transition path for the over 4000 user- installed 1500 Series systems.

3. Early Hardware Products

The initial product models announced in 1981, and brought to market in early 1982, were based on the Intel 8-bit microprocessor product family – mainly 8085 and associated microcontrollers. They were a Desktop Intelligent Workstation product, the **DRS20 Model 10,** and two desk –pedestal packaged **File Processors Systems** (today we would call them Servers), the **DRS 20 Model 40,** which had two (2) **8" Diskette file units**, and the **DRS 20 Model 50** which housed a **single 8" Diskette** together with an **8" Winchester technology Hard Disc Drive, of either 16Mb or 27 Mb capacity.**

3.1 Model 10 Video Processor Workstation, which was offered with either the **"R-Mode"**

Processor *("Retained Mode"– an AMD2900 bit-slice emulation of the 1500 order code, with its own separate memory card),* or the **"N- Mode"** processor *(i.e. "Native Mode" - using Intel 8085 code and instruction set)*, comprised a 12" 2000ch.(25 x80) monochrome Screen and Keyboard (full ASCII) with three Function Processors (Application, Workstation and Local Net/Microlan) housed in the tilt-and-swivel VDU head . *(N- Mode Apps. Processor had 64Kb store; R-Mode had 32k with optional 32k upgrade)***.** The other two processors each had 48K for the systems control /DRX software. An RS232 port to the Workstation FP enabled the attachment of a local printer. Power supply module, and Microlan and RS232 external connector sockets, were housed in the VDU base unit.

3.2 Model 40 Diskette System, again could be offered with either "R-Mode" or "N-Mode" Application processors. The basic, desk pedestal- sized system cabinet housed the RP8 "smart bus" 10- slot back plane and PCB cage, together with racking for two 8" diskette drives, and a power supply package. A VDU workstation and keyboard (externally similar to the Model 10) could be used atop the systems cabinet, or on the optional extra desk table top, but in this case the Application processor(s), Workstation and (optional) Local net Processors were housed in the system cabinet RP8 cage, together with a File Processor + Formatter, software configured to run Floppy Disks. Wide area network communications could be linked via (optional) Communications FPs in the cabinet bus.

Two extra 8” floppy Disk drives could be added, housed in an additional extension unit pedestal cabinet. A Model 40 “Server” could support an additional 3 Model 10 Workstations (or other Desktop Workstations - see below for Models 20 and 25) on a Microlan Local Network link.

3.3 Model 50, was configured and similarly packaged to the Model 40, with the same options and combinations of Applications processor(s) – R or N-mode ; Workstation , Local Net and Communications processors, but this time packaged with a File Processor/Formatter supporting one (1) 8” Diskette drive , and an 8” Winchester technology Hard Disc Drive of either 16Mb or 27Mb capacity. Two additional Hard Disc Drives could be added in a pedestal-sized extension cabinet, to provide a total system disc capacity of up to 81 Mb - (3 x 27Mb).

As with Model 40, the model 50 could act as a stand -alone small computer system with appropriate programming and application software; or as a Node in a local area network (Microlan) configuration (Model 50 could host up to 15 other Nodes on Microlan); or as an RJE or Interactive terminal system linked to other mainframe computers via wide area networks with relevant protocols.

Fig. 1 A DRS20 model 40 Function Processor system, showing the two 8” floppy disk systems in one cabinet, also the extension cabinet housing two further 8” disk systems (note: this is the maximum disk system capacity for the original model 40).

3.4 Peripheral System Options.

Various **Printer** options could be configured into a DRS20 series network;

- Matrix Printers – RS232 – 80, 100 or 180cps versions.
- Correspondence - Quality Printer – 55cps

- Line Printers(PBS) – 360 or 720 lpm – (Microlan connected*)
- ½" Reel-to-Reel Magnetic Tape Drives - 800 or 1600 bpi -- (Microlan connected.*)

(* *These were carry-over products from the 1500 Series, and connected to Microlan rather than the earlier 1500 SIO - Serial Input Output- link.)*

3.5 Additional Models (announced 1982).

Two other significant hardware models were announced in Spring 1982 (and delivered late 1982) , using the same 8-bit Intel 8085 technology and (most of the) existing Function Processor modules, but in this case deploying the recently-released 5¼" Diskette and Hard Disc Drive technologies *(dubbed "mini-disks/diskettes" at the time).* This enabled the disk file units now to be packaged into the Desktop Workstation, with the disk drive modules slotted into a laterally- expanded Video head housing, alongside the display screen.

3.5.1. Model 20 – packaged as a "laterally-stretched" Model 10 desktop Workstation unit, with the same N-mode* Applications, Workstation and Microlan FP's , and a new File Processor capable of driving two (2) mini –diskette . These drives, each of 650Kb capacity, were located in the Video Display head casing to the right hand side of the screen.

3.5.2. Model 25 – similar packaging to Model 20, with same FP options, but this time with a File Processing sub system comprising 1 x Diskette (650kb) plus one 5 ¼" Hard Disc Drive - capacity 11.3 Mb; both drives located in the Video head casing as per Model 20.

(* R-Mode versions of Models 20 & 25 were not offered)

The printers and other peripheral options as per Models 10, 40 and 50 were available with Models 20 and 25.

Fig. 2 A DRS20 model 20 Function Processor system of 1982: The photo shows the distinctive keyboard design and the double 5¼” mini-diskette drive within the display cabinet.

Fig. 3 A DRS20 model 25 Function Processor system, showing the single 5¼” diskette drive and the 5¼” hard drive housed in the display head.

3.6 Product Packaging.

Styling and cabinet colour schemes. The original casework, cabinets and cladding panels for early Models 10, 40 & 50 were initially introduced and shipped with a black/light grey colour

livery. At the time of Models 20 and 25 introduction, all products were then subsequently shipped in a revised colour scheme livery of beige/dark brown, which aligned with ICL's corporately- defined colour schemes and packaging specifications devised for the "Networked Product Line" families of Office System and Distributed Processing products)

3.7 Microlan

The Microlan Local Area Network connection was a derivative of the SI/O (Serial Input/Output) interconnection technology developed earlier for the 1500 Series; itself having been a development of a simple co-axial (TV type) cable for linking video/keyboards terminals to a minicomputer first developed for the pioneering MDS 2400 Direct Data Entry system.

Transmission was bit-serial p/e at a nominal 1.25 Megabits /second; electrically, the cabling was to RG62 A/U definition; 92 ohm impedance; 47.6 picofarad/meter capacitance; attenuation 20.7 db/100m @ 400 MHz. Initially a network node/device was restricted to being max. 300 meters from the host; but later improvements, including signal boosters, extended this to over a kilometre distance.

System nodes were "T-piece" connected to Microlan; no "branches" were permitted on the Lan.

4. Software Products

The early software releases for DRS20 *(Dec.1981)* were determined largely by marketing and key customer early shipment priorities. Commitments had been made to some large, important and strategically influential 1500 Series customers (specifically, New York State Services – NYSS) to provide the full "R-Mode" processing and systems software to facilitate forward porting of a number of their State- wide deployed existing 1500 applications suites and software tools, packages, diagnostics and utilities.

4.1 R-Mode. Hence the first release of **DRX (DRX 5.0)** supported a **RMM (Retained Mode Manager)** module, together with an initial **DBM 0 (Data Base Manager)** which handled 1500 type data file stores, but only on Model 10 Workstations and Model 40 Floppy Disc configurations initially. Together with a first release of **Local Net Manager** (for Microlan connected nodes and peripherals), this enabled the majority of the 1500 Series application packages, programming languages (eg **1500 Assembler and Extended Business BASIC- interpreter**), data capture and entry products **(CDE, BTL, later ADE**) and remote communications links **(esp. IBM 2780 RJE** emulation) to be executed on the Phase 1 DRS 20s.

Software support, in the form of an enhanced File Manager and utilities (DBM 0+), for the Hard Disc Model 50 systems soon followed *(Spring 1982),* thus enabling the majority of the 1500 program products set to execute on the three initial models, in local and wide area networks (now including **IBM 3780 terminal emulation**, and **ICL's CO3 {batch} terminal protocols**). A version of **C.I.S. COBOL** (used elsewhere on ICL products) was released for "R-Mode" systems.

4.2 N- Mode – the real DRS20! DRX 5.1 was initially written to run on **Native Mode** (Intel 8080, 8085, 8088) processors, as were its set of utilities, diagnostics, Local Net Manager, Data Base Managers, and the run time environments for language compilers : **C.I.S. COBOL; PASCAL: Microsoft BASIC**. **DRX 5.1**, released in Spring 1982, included the full-facility **DBM 1.0** (revised ISAM**;** shared file access; 3-byte addressing etc.) for improved performance, large (>16Mb) file addressing and disc /tape back-up filing and archiving.

4.3 The other key software product released at this time was **Distributed Text Manager (DTM),** an in-house developed Word Processing package, with dictionary, calculator/maths pack and good editing facilities. *(DTM was eventually superseded in mid-1980's by other ICL W.P developments and acquired products - eg Officepower which were more sophisticated and powerful- by which time DRS 20 Series had also been supplanted by later product designs, but which were still marketed under the DRS brand identity. e.g.* ***DRS 300,*** *later* ***DRS 400, DRS 3000 and DRS 6000).***

4.4 Further **Communications and Networking** products for all models were released at the time of the Model 20 and Model 25 introduction *(Summer 1982).* These included ICL IPA (**Information Processing Architecture**) conformant products, including **FTF (File Transfer Facility); DAF (Distributed Application Facility); ADI (Applications Data Interchange) ; RSA (Remote Session Access)** and interactive terminal links with **ICL (CO3 -7561 mode)** and **IBM (3270/3278 mode**) mainframe systems, over **SNA, X25, or SDLC or HDLC networks**.

(Open Systems networks were still in their definition stages at this time but ICL eventually co-defined and standardized on the X-Open definitions, with its own Ethernet, later OSLAN Local Area network products. DRS20 systems were later able to link into OSLAN networks)

4.5 CP/M. A revised version of DRX (DRX 2.1) was released specific to the Model 20 and 25 product specifications, and the **CP/M 2.2** operating system was made available on individual workstation Models 10, 20 and 25. (A later release enabled CP/M- based applications to interwork between all models and nodes across DRS networks). Thus, the increasing catalogue of applications packages and tools written by third party software

houses for the expanding microprocessor marketplace became available to DRS20 users. *(The BIOS variant portion of CP/M linked with DRX function and message manager elements; BDOS had its own file areas on disc separate from DRX/DBM files).*

5. Derived Products and later DRS 20 Series Models .

5.1 As well as providing products for the Distributed Computing and Networked Office Systems markets, the basic DRA designs and hardware products, based around the RP8 Bus / multiple -microprocessor FP hardware and DRX software, were adopted as the basis of several other new /replacement products in the ICL portfolio, including the family of **9500 Retail POS Terminal network Controllers.** These superseded the earlier small retail POS controller systems based on 1500 Series – another reason for the early "R-Mode" DRS products!

5.2 ICL's own in-house developed **Interactive Terminal VDU workstations** (7561) and **Terminal Cluster Controllers (7501/2/3)** had been in market for some time, and were in need of enhancement or upgrade/replacement products. Following various corporately defined future product strategy mandates from ICL's Product Planning Division (a key and influential corporate function), and particularly a 1978/9 documented plan to produce a **"Unified Product Set" (UPS) for Small Systems,** the DRS/RP8/DRX structure was also being used to produce new single- user communicating terminal workstations, and cluster controllers for "dumb" interactive workstations, collectively known internally as the "7500R" products, with compatible DRS family styling and packaging.

This produced, from mid 1982 onwards, three new DRS 20 family models – the **Model 6 Interactive Terminal** - a single user "dumb" workstation; the **Model 16 Interactive Terminal -** again single user, but with some inbuilt processing power**;** and the **Model 30 Terminal Cluster Controller**, capable of supporting up to 24 connected Model 6 workstations. All these models were designed to link into ICL mainframe networks, and as such were marketed as the **"Distributed Access"** members of the DRS20 Series.

5.3 DRS20 – 100 Series - the second phase of DRS20 series developments, introducing 16-bit Intel 8086 and 8088 Application (and other) Function Processors, and enhanced performance software and expansibility, were released in the 1984/5 time- frame. **Models**

110 and **150** supplanted the earlier M10 and M50; 5 ¼" Disc and diskette technology became the standard; revised versions of the Model 20 and 25 were produced, resulting in the **Models 120** and **125,** and a desktop packaged Disc processor **Model 128.** (There were no "R-Mode" variants of the 100 Series models).

New versions of the Function processors used in 100 Series were:

- **AP2** - which used the later Intel 8085 AH/2 microprocessor, capable of addressing 128k of memory in two banks of 64k.
- **FP2** - utilised full 8085 64k memory.
- **WP2** - again utilising full 64k memory
- **AP16** - 8086 CPU addressing up to 256kb memory
- **CP16*** - 8088 **CPU** addressing 128kb memory *(* CP = Communications Processor)*

(Further models of DRS20 were released in the 1985 timescales – in particular a **200 Series –** these are not included in this Product Overview document)

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5.4 Other Software and Application Program Products.

Following the early product release phases, a series of ICL- derived and supported Application Package products were introduced and marketed. Some examples of these were:

BUSINESS 20; PAY 20; PERSONNEL 20; PLANNER 20; SOURCEWRITER 20.

(The nature of these applications are indicated by the titles)

The marketing strategy for the provision of other industry/commercial segment- specific Application Packages was to encourage and incentivise Third Party Software Houses to port their products to DRS, and to develop new packages. The introduction of the CP/M and CCP/M environments on DRS systems from 1982 onwards also enabled and facilitated access to the many software applications already developed , and being developed, for the microprocessor and emerging personal computer markets

6. Pricing, Commercial and Market Positioning

In the early marketing phases of DRS20, the hardware products were offered on outright sales terms only (as opposed to the hire or leasing arrangements that prevailed for larger "mainframe" systems) but with the software products "unbundled" (which again was common industry commercial practice at that time). Software was usually licensed on a "one –time" payment basis, with both Primary licences for eg DRX running on a (*Master)* Server system, and Secondary Licences for the DRX version running in each Intelligent Workstation node.

A Multiple Units Discount scheme was operated, to encourage orders for larger numbers of hardware systems. A variety of Maintenance Service contracts were offered by CSD (Customer Services Division) with various T & Cs and pricing to suit different customer preferences.

6.1 Price Positioning.

The examples below are based on the UK market prices and terms at 1981 launch time. Similar equivalent local pricing and terms were implemented in other European and International territories, priced in local currency. DRS20 Series was released for sale in all ICL's major world-wide country markets. Where required, local language variants (eg Display character sets and keyboard layouts) were provided. (By late 1982 this also included Arabic and Cyrillic characters!).

6.1.1 System Product pricing examples:-

Model 10 Workstation: (64K App. Processor;Video/Keyboard FP ; Local Net processor) - **£2250***

Model 40 Diskette System: (2x8"diskette;Video/Keyboard /64K.Apps. processor.) - **£4200 Model 50 Disc System:** (1x8"diskette;Video/Kbd;16Mb Disc; 64KApp.Proc. /Wkstn.proc.) - **£7500**

(For comparison, the first IBM PC model, launched in Aug. 1981, with only 16K RAM, VDU/keyboard (mono) and No diskettes or network connection, was priced in US at $1565)*

- R-Mode models were priced **+£200** higher than above. Model 10R had only 32k memory.

  Memory upgrade (32k) for Model 10R = **£500**

- 27Mb Disc Model 50 **= £8200**

- Additional Local Net Processor = **£650** (for Model 40 or 50)

- Comms. Processor = **£850**

Example Peripheral prices:

- 80pp Matrix Printer = **£600**; Correspondence Printer = **£2500**; 180cps132pp Matrix = **£2755**

- 360 lpm PBS Printer = **£7715**; 1600bpi 9-track Magnetic Tape Drive = **£8825**

6.1.2 Software pricing examples. All DRS Program Products were charged on a One-Time Licence (to use) basis. A Primary Licence was charged for the first copy/ use on a host node/ “master”system; Secondary licences were charged for use of product on each subsequent node.

- DRX 5 (Primary**) - £656**
- DRX 5 (Secondary M40/50) **- £558**
- DRX 5 (Secondary M10) **- £112**
- Retained Mode Manager (RMM Primary) - **£250**
- RMM (Secondary) - **£213**
- CIS COBOL(compiler) **- £656;** BASIC (Interpreter) - **£250**; Distributed Text Manager - **£250**
- IBM 2780 Comms. (Primary) **- £100;** ICL Full XBM Comms. (Primary) **- £100**

6.2 Market Positioning.

DRS20 Series was first launched at SICOB trade fair (Paris, France) in September 1981, as a key element of a new overall ICL product and marketing strategy initiative, conceived by the then recently-appointed managing director Robb Wilmot, and promulgated as the **Networked Product Line (NPL).** DRS20 was positioned as the product vehicle to exploit the expanding and merging markets for distributed processing, distributed access, office systems, local and wide area networking, and personal computing technologies, interworking with corporate data centre systems, all conforming to the emerging industry standards for Open Systems.

The initial models were competitively-positioned against the then current mini-computer and small business computer products from IBM (System/23), Hewlett Packard (HP125 & 250 ranges), Data General (CS/10) and comparable products from Wang, Xerox and Datapoint. With the introduction of the Models 20 and 25 (and later the 100 series performance enhanced models) a more aggressive positioning against the IBM PC and other "personal computer" suppliers was also established. As part of NPL, DRS20 was trumpeted at launch time as being a key element in the Wilmot business strategy of ICL becoming **"Big In Small Systems".**

6.3 Business Achievement

At time of launch an aggressive 5-year Business Plan to ship some 150,000 Workstations and 75,000 "Servers", worth approaching £1billion in revenues, was set. A significant proportion of those resultant sales were to be to large public and private sector (corporate) organisations, predominantly in ICL's existing UK, European and (ex Commonwealth) International territories, and, not surprisingly, to ICL's captive mainframe user customer base. Nevertheless, the perceived technical advantages and value of DRS also resulted in a significant number of sales into organisations with other (non ICL) central DP/mainframes.

Sales into large Retailing groups (especially Supermarkets) were one of the key market segment targets with the DRS - derived Retail POS Controller systems products (9500 series).The majority of orders and contracts were for multiple-unit sales, often amounting to several hundred units^ per customer. *(^ in this case, "units" refers to both "Server" and "Workstation" products).*

In retrospect, the Business Plan targets and objectives were essentially achieved, albeit over a longer period (about 7 years), and with the inclusion of the additional products models (eg DRS20 100 and 200 Series, and the early DRS 300) included in the portfolio. In September 1984, internal ICL marketing documents were announcing:- *"60,000 units already sold to over 5000 customer organisations in 40 countries world–wide".* By 1987, internal ICL documents were reporting **Total Sales Revenues**, from all DRS products and services worldwide, of almost **£900 million** for the period 1981 – 1987. Of this, the DRS20 Series had contributed almost £600 million between 1981 and 1985.

Manufacturing and Supply of the early DRS20 products was based in the Utica (NY, USA) facility, despite the majority of the sales and marketing opportunities being in UK, W. Europe

and other non-North American territories. (The “Distributed Access” models were sourced from UK based manufacturing facilities). During the period 1981 – 85 significant changes to dollar/sterling exchange rates, and the need to rationalise large portions of ICLs Product Development and Manufacturing facilities in UK and elsewhere, resulted in the manufacture and (some) product development activity for DRS20 being transferred from Utica to UK locations in Bracknell, Letchworth and Kidsgrove.

(A reduced facility was retained in Utica, and transferred organisationally to North America Sales operations, in order to continue support for their few large customers – notably NYSS - New York State Services. The development and manufacturing facilities in Utica NY were finally closed in mid-1987.)

http://sw.ccs.bcs.org/iclarch/

7. Reference sources

A significant amount of printed material relating to the DRS products, in the form of internal and external Sales , Marketing and Promotional documents, brochures and media, and Product Technical manuals, Service manuals and Engineering materials etc. exists in the **ICL Archive** held by the **Science Museum** at its Wroughton (Wilts) Library. (The relevant **Index Pages** from the ICL Archive can be viewed on-line at: *http://sw.ccs.bcs.org/iclarch/* The archive was created and indexed by CCS members. It is not currently possible to view the individual archive documents on-line. A number of the document Item Folders and content have been reviewed and examined by the author in preparing this overview document. This involved personal visits to Wroughton, where the staff were most helpful in providing requested-in-advance documents for examination. It is recommended that those seeking more detail and technical information on DRS20 Series, and successor DRS products *(or indeed, many other early ICL computer systems)* should make arrangements to visit the SM Wroughton librtary and archives. Details can be found at: *www.sciencemuseum.org.uk/wroughton*

Of particular value and interest are the items in the following “Boxes” in the ICL Archive:

Box 10 –ICL Printed Brochures -1965 -1987

Folder Items: **10/1/11** Distributed Resource Systems; 10/10 Miscellaneous

Box 39 – Distributed and Personal Systems – DRS, 8801, PC, PERQ, OPD

Folder Items: (most of) **39/1** thro’ **39/24** and **39/51 and 39/52**

Other material used in the compilation of this paper is from the personal archive of ICL publications and materials held by the author.

Pictorial Material; The majority of this is in the form of (product) photo shots reproduced in sales brochures and documents held in Wroughton, or on 35mm transparency slides, or overhead projector foils, used in various ICL sales/marketing presentations. Some of these (but incomplete sets) are held by the author.

Note on the images in Document V3: these photos, shown in the section "Early Hardware Products" are from the collection at Wroughton, as described above. Fujitsu, as the successor to ICL, retains the copyright for these images.

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