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Computer Technology Ltd. and the Modular One.

Contents.

1. Introduction and CTL company history.

Computer Technology (later Information Technology) was started in 1965 by Iann Barron together with a group of computer engineers from Elliott Automation. The immediate reason for the company's foundation was the announcement of the Digital Equipment PDP11. Iann Barron, recounting the story many years later, believed that this was an ideal computer for Elliotts to manufacture and said that he had 'secured the offer of the European licence'; however the management of Elliotts were not interested. While it might have been sensible for Elliotts as an established company to market the PDP11, this was not a practicable proposition for a startup and so, once he had left Elliott Automation, Iann Barron's aim was to create a more powerful computer which would address the same market as the PDP11 – this was to become known as the minicomputer market.

Financing was secured remarkably quickly, the two initial backers being Arnaud de Vitry, who had been the principal backer of Digital Equipment, and Robert Maxwell, who had a vision of computers as the future of publishing. Unfortunately, Maxwell proved a very uncertain source of funds, which led to many difficulties for Computer Technology Ltd.

The concept of the Modular One was created around a number of ideas:

- The use of integrated circuits to build a computer. In particular the use of fast emitter coupled logic to gain a performance advantage. Modular One was one of the first computers to use integrated circuits and possibly the first to use emitter coupled logic integrated circuits.
- The use of a high performance core store with a 1 microsecond cycle time.
- A 16 bit word – at that time the fashion was for 12 or 24 bits, which was strongly preferred by the British establishment (for example, at Elliotts).
- A standardised interface to connect all the modules of the computer, enabling multiple processors, modular storage and flexible peripheral configurations.
- Multiprogramming, with relocatable program and data spaces and some degree of memory protection.
- Program and peripheral priority systems, with fast program switching.
- Multiprogramming operating system.

Work on the design was started in August 1965 in a terraced house in Luton. The first computer was delivered on schedule about three years later, to a company in Fenchurch Street, London. By this time Computer Technology Ltd. was operating from a Norman

Foster designed factory in Hemel Hempstead. The Modular One met all Iann Barron's initial design objectives.

The main application areas were universities for research projects, the National Health Service, the MRC, CERN, instrumentation automation such as NMRs and a variety of advanced research applications, particularly multiple processors. More information on deliveries and dates is given in Section 2 below.

When he started the company, Iann Barron was helped by Tom Margerison (the founder of the *New Scientist*) who subsequently became Chairman of Computer Technology Ltd. Margerison changed the name to Information Technology. Iann Barron recalls that the company never had the money to develop a successor to the Modular One, so the computers gradually became non competitive and the company declined. Iann Barron left the company in 1973. It was eventually bought by ACT (Apricot) in January 1990 which was then acquired by Mitsubishi.

At the time of writing (2018) two Modular One computers are still known to exist, though neither is in regular working order. One system is in storage at the Museum of Science and Industry in Manchester. The other, an ex-NPL system used on the NPL packet switching network and the Scrapbook project (see video links here http://www.npl.co.uk/mathematics-scientific-computing/history-of-computing/), was bought in 1980 by Patrick Sugrue together with two teletypes and a high speed paper tape reader. It was used as a home computer up to 1982. The current plan is to restore this machine – see: http://redhawksys.com/index.htm

2. CTL Modular One deliveries and anecdotes about the sites.

This delivery list has mainly been compiled by Mike Gibbons evandmike@hotmail.com . After working at Elliott Brothers at Borehamwood from 1962 to 1968, Mike Gibbons joined Computer Technology Ltd. at Hemel Hempstead in 1968. He was an Installation and Commissioning Engineer until 1971, when he moved to the Systems Test Department. In 1974 he set up a new group called TEAM (Test Engineering And Methods) to introduce new products from design into manufacturing. Mike left CTL in 1992.

The list is only approximate, since the official company records have not yet come to light. The entries in the Table are all for Modular One computers, of which well over a thousand are believed to have been delivered. The CTL Satellite One computer is not included in the list. This machine was a basic standard Modular One but with more or less a set configuration which included a tape reader and tape punch and Data Products line printer and minimum of one VDU. The Satellite One was very popular and sold in large numbers throughout the UK after 1972.

Background notes on some of the installations are given after the Table.

(Table begins overleaf)

Delivery date	***No. of Systems***	***Customer/location***	***Comments***
July 1968	1	International Data Highways (IDH), Clerkenwell Rd. and Finsbury Square, London EC2	See Note 1. More IDH installations followed.
Oct 1968	1	Cambridge University Language Research Unit	Margaret Masterman
Nov 1968	1	Manchester University Dept of Psychology	Arthur Reader
1968/69	1	Oxford University Department of Mathematics	
1969	1	Oxford University, Science Labs (?)	
1969	1 + ?	Warwick University Dept of Computer Science	Colin Whitby-Strevens. See Note 2a.
1969	2	Cambridge University Mathematical Laboratory	Roger Needham. See Note 2b.
1969	1	Leeds University	
1969	1	Essex University	
1969	1	Sussex University Department of Mathematics	
1969	1	Autonomics Ltd.	
1969	1	Dundee Royal Infirmary	See Note 3.
1969?	1	MRC Laboratory, New Addenbrookes' Hospital, Cambridge.	
1969	1	Bristol University Medical School	See Note 4.
1969	1	Durham University School of Engineering Science	See Note 5.
1969	1	Dental practice in London	See Note 6.
1969	1 (later moved)	Medical Research Council, London	See Note 7.
1969	1 (later moved)	Medical Research Council, Manchester	See Note 7.
1969	1	Atomic Weapons Research Establishment, Aldermaston	
1969	1	UK Atomic Energy Authority, Culham	
1969 & 1970	2 + ?	International Data Highways, Finsbury Square	See Note 1.
1969/70	1	Oxford University Dept of English Language	
1970	1 + ?	National Physical Laboratory, Teddington	See Note 8.
1970	1 (later moved)	Medical Research Council, London	See Note 7.
1970	1 (later moved)	Medical Research Council, Manchester	See Note 7.
1970	1	John Radcliffe Hospital, Oxford	
1970	1	Aberystwyth University	
1970	1	Royal Victoria Hospital Belfast	
Before 1971	1 + ?	RAF Marham, Norfolk	See Notes 9.
Before 1971	1 + ?	RAF Special Projects (Nimrods).	See Notes 10.
Before 1971	1	MOD Royal Military Police, Euston Rd., London.	See Note 11.
1971	1 (later moved)	Medical Research Council, London	See Note 7.
1971	1	Sheffield Hallam University	

Oct 1971	1	Computing Science, Glasgow University	
Post 1971	1	Royal Navy submarine	See Notes 12.
Post 1971	1	European Space Agency, Holland	
May 1972	1	Edinburgh Royal Infirmary	See Note 7.
Post 1972	1	University College Hospital, London	
Post 1972	1	Aberdeen Hospital	
?	1	Dept. of Health & Social Security (DHSS) Blackpool	See Note 13.
?	1	DHSS Long Benton, North Tyneside	See Note 13.
?	440	DHSS offices throughout the UK	See Note 13
?	1	Supreme Headquarters Allied Powers Europe (SHAPE) Headquarters, Stanmore, Middlesex	
1971 - 74	several	The European Space Research and Technology Centre (ESTEC), Noordwijk, the Netherlands.	See Note 14.
Post 1974	many	Metropolitan Police Project 880	See Note 15
1972 onwards	many	ICL Kidsgrove	See Note 16
1970 – 75	Many	CERN, Geneva	See Note 17
1970 – 75	1	Computer Aided Design Centre, Cambridge.	See Note 20
1975	1	METEOSAT	See Note 18
1976	1	GEOSTAT	See Note 19

Notes.

1. The first system, delivered to Clerkenwell Road, was considered to be a CTL Beta site. Installed in dedicated air conditioned computer room in the basement of the building, followed by at least two more Modular Ones in subsequent years. The initial system was small with around four modules but then later expanded with more memory. The main system was eventually very large and was fitted with the new Burroughs B5500 1Mbyte fast disc, approximately 36" diameter spinning on the vertical plane with one head per track.

2(a). One of the first systems to have a Universal Interface which allowed users to design and implement their own interface. This Warwick system was connected to an NCR-Elliott 4120 in the Computer Room on the floor immediately above the Modular One. The fact that Mike Gibbons had worked on 4120 and 4130 computers at Elliotts was of some help in getting the connection working correctly. Mike remembers that Warwick was of the friendliest sites to visit.
Andrew Herbert adds: When I saw at least one Modular One system at Warwick University systems in late 1974 they were used by Colin Whitby-Strevens to support operating systems, distributed systems and computer network research. As I recall his group mostly programmed in BCPL and wrote their own operating system for the Modular One.

2(b). Andrew Herbert describes the Cambridge activity as follows. In 1975 there were two Modular Ones in use. The larger was principally used to support a student FORTRAN Teaching System on behalf of the University Computing Service; the smaller was used as a front-end processor for the CAP research computer. (The CAP project on memory protection ran from 1970 to 1977; see https://en.wikipedia.org/wiki/CAP_computer).

The FORTRAN Teaching System machine had a fixed disc used for swapping, an exchangeable disc for the user file system, a line printer, paper tape reader and punch and

operator's console (an ASR33 teleprinter). In a separate building there was a classroom room with a number (20?) of KSR33 teletypes connected to the Modular One….This machine also acted as a line printer and paper tape punch outstation for the IBM 370/165 serving the academic side of the Computer Laboratory.

The CAP front-end processor was a smaller machine physically but also with fixed disc, exchangeable disc, line printer, paper tape reader and punch, operator's console and a multiplexor for up to four KSR33 teletypes. It also had a custom hardware interface to the CAP in the form of a bi-directional parallel channel.

On both machines the fixed disc was a rebadged Burroughs device, 500K (or 1Mbyte?) 32 bit words capacity, and used for virtual memory swapping. The disc had one vane and 200 heads. The exchangeable disc, was a rebadged CDC device, capacity 7,000K 32 bit words, and held a user file system. The discs had 11 vanes with 20 heads. Each vane contained 200 cylinders, each comprised of 20 tracks. Each track was divided into 14 pages of 256 16 bit words. The heads were operated hydraulically.

The CAP Modular One had 16K of 16 bit word store. The FORTRAN system had a larger memory and occupied more cabinets than the CAP Modular One. The CAP Modular One ran the E2 Executive. The FORTRAN Teaching System ran the more powerful E4 Executive, a multi-tasking operating system…. Once or twice a year we would back up both systems by taking their exchangeable discs from the Computer Laboratory to another Modular One installation at the MRC Laboratory on the New Addenbrookes' Hospital site about 2 miles away.

The CAP front-end Modular One was decommissioned around 1978 when CAP was converted to use the then newly invented Cambridge Ring Local Area Network to access file, print and terminal servers. If I remember correctly the FORTRAN Teaching System was still in service when I left the Cambridge Computer Lab in 1985.

3. This system was housed in the Medical Research Laboratory, which contained numerous jars with various body parts immersed in fluid. The computer was actually first delivered and installed at Edinburgh University for a day's demonstration to potential Northern and Scottish customers. It was then stripped down and re-packed for delivery and installation in Dundee. The whole process spanned five days, involving departure from Hemel Hempstead early on a Monday morning in a hired Transit van, Tuesday's Sales Demonstration, Wednesday's transport and re-installation at Dundee, Thursday's Acceptance Trials and Friday's confirmation meeting with satisfied users and return to Hemel Hempstead. Mike Gibbons and Chris Purkis were responsible for this demanding sequence.

4. This site was involved with medical training and research. The research, under Tom Williams, included the investigation of the brains of live cats.

5. This site was the first Modular One installation to have Analogue-to-Digital/Digital-to-Analogue converters attached.

6. This large private Dental Practice was close to Harley Street. The Modular One system was installed in the front window, in plain view from the street. It was one of the first CTL

systems to be delivered with a paper tape punch unit manufactured by the Tally Corporation.

7. This system was housed in a new Computer Building attached to the Hospital. It was the largest and most complex system ever installed by CTL. It re-used all the MRC Modular Ones previously installed in MRC sites in London and Manchester plus some new systems from the factory at Hemel Hempstead. The final MRC Edinburgh site included at least eight processor modules (type 1.11) interconnected, multiple storage consisting of type 1.21 core store and type 1.22 semiconductor memory. The peripheral equipment included type 1.32 GNT Tape Readers, type 1.33 Tally Punches, type 1.52 Disk Controllers with multiple 80 Mbyte, 300Mbyte single and double stacked disk drives (both hydraulic and voice coil actuated), Data Products Line Printers, CAD / ADC Controllers and type 1.09 9-Track Magnetic Tape Drives.

The main purpose of the MRC's Edinburgh Modular One system was to carry out testing of amniotic fluid taken from wombs of pregnant women throughout UK. The intention was to replace a manual process involving a number of women in a laboratory testing samples under a microscope and looking for errors/faults/defects in chromosomes. Sadly the computer system never worked satisfactorily and it was later used for Medical Research, Accounts and Patient Records. On a more positive note, more NHS installations were to come. Indeed, the Modular One became for a time the standard NHS laboratory computer.

The huge MRC Edinburgh complex was installed by Mike Gibbons (Lead Engineer) and Alfie Best. They remember that the CTL lorry driver Alec did a daily round trip from Hemel Hempstead to Edinburgh for several days, delivering equipment; on each journey northwards the 7 ton Ford lorry was loaded to the roof.

Mike and Alfie remember that the Edinburgh computer room was brand new and equipped with smoke and gas sensors. "One day while working under the false floor installing cabling, a serious smell became evident which set off the fire alarms. We left the room and sat outside, whilst several Fire Engines appeared from all over Edinburgh. The firemen soon identified the Computer Room as the location of the alarm, so we were promptly accused of smoking in the Computer Room! Having pointed out that we were not smoking and that there was still a serious smell in the room, the firemen made a further check and declared that the drain cover for the main sewer had lifted due to several bits of building debris becoming lodged in the pipe".

8. The Modular One at NPL was primarily used for used for software research, particularly for the *Scrapbook* project on information storage, retrieval and sharing – see https://www.youtube.com/watch?v=QqB0w1FkR3o *Scrapbook* involved a messaging system which, in due course, used NPL's pioneering 1.5 Mbps Packet Switching network – see: https://www.youtube.com/watch?v=tT4AaelwvV4

After NPL had finished with its Modular One, the computer was acquired in 1980 by Patrick Sugrue of Redhawk Systems, Dorchester, Dorset. Patrick has been restoring the machine to working order – see: http://redhawksys.com/index_files/Page627.htm

9. Mike Gibbons remembers that systems for Marham were modified by RAF Engineers so that all contacts and the complete core of the core store were coated in oil supplied and

used by RAF. Any equipment sent to this site was not re-usable by CTL so, if returned to Hemel Hempstead, any spares were scrapped.

10. The system was installed in special racking as specified by the RAF and delivered to an RAF site for installation in NIMROD aircraft. The computer(s) were maintained by RAF personnel by bulk part exchanges, but later serviced by CTL engineers due to the cost of repairs and high failure rates under service conditions.

11. This site was situated in Euston Road, London, protected by armed Military Police. The Modular One was used at the time of Irish (IRA) crisis. It was one of the first CTL installations to have 9 track reel to reel tape drives installed. Mike Gibbons remembers that he was subjected to a full security check of all his equipment and tools whenever he entered the building, due to the high security situation. “The door of the computer room was 4-inch solid oak. You were escorted everywhere. If you wanted to go to the lavatory you had to leave the toilet door open with the guard standing near you”.

12. The Modular One system was modified to fit into special racking for installation in a Royal Navy submarine.

13. An initial system was delivered to both the Blackpool and Long Benton sites, for an assessment of central records for DHSS. These were followed by a few more systems at both sites. Based on this experience, a special DHSS Modular One computer was designed around TTL 2901 bit- sliced processors. Mike Gibbons was the project leader. He remembers that, during manufacture, bar codes were used for the first time for part/serial numbers. An IBM PC with custom-built control box was used as a central station, enabling a senior wireman (Chris Silver) to assemble the system and use the PC to control the tests and issue instructions. This led to lower labour costs at CTL and improved fault finding. Once manufactured, one of these special Modular One systems went to each of the 440 DHSS offices throughout the UK.

14. A number of Modular One systems were delivered to ESTEC in Holland, who then shipped them to the Guiana Space Centre at Kourou in French Guiana on the north Atlantic coast of South America. At Kourou, satellites were launched using the French Ariane Rocket as the launch vehicle.

15. Mike Gibbons remembers that this was an £880K project which involved the delivery of a large number of systems to the Metropolitan Police. One substantial Modular One system was installed at Scotland Yard, housed in a lead lined room on the same floor as the Flying Squad, sometimes called the Central Robbery Squad or *The Sweeney*.

16. Numerous Modular One systems were delivered to ICL Kidsgrove over a period, at the rate of at least five systems every fortnight. They were specially configured for ICL, painted in ICL colours and used as Front-End Processors to both 1900 and 2900 mainframes. They were initially badged as ICL 7905s. At some point in the late 1970s, a revised version of the hardware was released by CTL (this may or may not have been a cover story to disguise a price change) and assumed the 7906 designation. At the same time another version allowing much less user flexibility was announced at the 7904. This was intended to cover the same ground as the (ICL-designed) 7903 aka PF56 which was by then at the end of its sales life. As front-end communications processors, the Modular Ones in some

cases allowed in excess of 100 terminals to be connected to an ICL mainframe system. Delivery to end-users and maintenance was carried out by ICL personnel.

17. At least 15 Modular One systems were delivered to CERN as part of their Scientific Programme, between 1970 and 1975. All systems were of the same configuration and included Data Products 600 LPM Line printers. Many (all?) of the CTL computers were used as Remote Input Output stations for CERN's CDC 7600 computer.

18. A Modular One system in custom racking was delivered to UMETSAT (European Organisation for the Exploitation of Meteorological Satellites) in Darmstadt. EUMETSAT operates the Meteosat series of geostationary weather satellites.

19. GEOSAT (GEOdetic SATellite) was a US Navy programme for oceanographic observations. The first GEOSAT satellite was launched in 1985. It is not known what part a Modular One system played in the oceanographic programme, or where the computer was sited – though it was first delivered to Holland (ESTEC).

20. Other installations for which details are sparse.
(a). A CTL Modular One computer with a half-inch magnetic tape system was connected to the CAD Centre's Atlas 2 computer at Madingley Road Cambridge in the early 1970s.

(b). The Department of Engineering Mathematics at Queens University, Belfast, had a Modular One running an interactive system with dumb terminals.

(c). There may have been a Modular One in Dublin at the government's Central Data Processing Services (CDPS).

Information believed to be correct as of March 2019.

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3. Modular One technical details.

(to come).