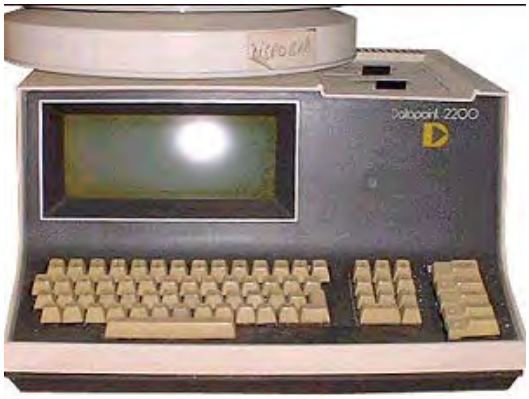
The Hardware and its History

The Card Reader

The history of punched cards goes back as far as the early 18th century with the automatic loom. The cards used for TOPS trace their origins back to Herman Hollerith who patented a system for tabulating statistics in 1889. The firm Hollerith founded became International Business Machines, IBM,in the 1920s. The cards used in TOPS are a smaller format than the original IBM 80 column card but carry 96-columns with smaller, round holes. They were introduced by IBM in the mid 1970s, contemporary with the introduction of TOPS. Early TOPS installations used the older, larger IBM 80-column cards, but were retro-fitted with the 96-column cards.

The Ventek Terminal



The terminal supplied from 1974 by Ventek was a Datapoint 2200, a very early desktop computer – it even came with its own desk and dates from about 1970. The desk housed the interfaces to peripherals. The processor was constructed from logic chips and thereby predated all single-chip microprocessors as used in today's computers. The operating system was loaded from the tape deck at the top by pressing the 'RESTART' button, top right on the keyboard, and this is shown in the film. The tapes could hold up to 150 kilobytes of data. The system memory of 12 kilobytes seems puny by today's standards, but this was state of the art at the time. The screen was 80 characters wide – standard for teleprinters – and 12 lines high with a green on black display. Again early TOPS installations used an IBM terminal which were replaced by the Datapoint.

The FAX Machine

The facsimile machine shown is the Mufax Courier from Muirhead. FAX traces its origins back to 1843 and Scottish inventor, Alexander Bain. His principle of scanning a document line-by-line remains to this day. Alexander Muirhead demonstrated his first FAX machine in 1947. The scanning technique used a rotating drum. However the Mufax shown owes some gratitude for its scanning to the Nipkow disc used in Baird's mechanical television system. Today's FAXes have the benefit of a complete line of sensors, removing the need for moving parts other than the paper transport. Printing in the Mufax used electrically sensitive paper operated by a helical roller, similar to a lawn mower blade. Current FAX machines use electrostatic printing and there are many combined instruments performing scanning, printing and FAXing into one box.

The Silent 700 Printer

Following the FAX machine we see the Texas Instruments Silent 700 thermal printer. Again this was state of the art for the 1970s. Commercial electrostatic copying and printing, xerography, was only in its infancy at the time. Thermal printers are still to be found today, especially for printing till receipts.

The Telephone Transmission System

The telephone transmission system shown is housed in cabinets designed to a British Post Office standard, known as Type 62. The analogue system allowed hundreds of telephone calls to be carried over one coaxial cable, which is not unlike a television aerial cable. The system shown was the culmination of development from systems in the 1930s with as few as six channels. Not long afterwards telephone transmission moved into the digital era.

The Lenkurt Modem

The GTE-Lenkurt 25C modem followed principles, also dating from the 1930s, whereby multiple telex connections could be carried on a single telephone circuit. [picture] The modest data speed needed for TOPS allowed this economy of combining the signals in the Combiner shown, which works rather like the sound mixing desk in a recording studio. Modern modems use similar means of transmission but work at much higher speeds and require an entire telephone circuit to themselves.

Background to the NRN

The earlier systems, and also emergency services and utilities, used the Midband, or Band 2, radio frequencies of 104 to 108 MHz; The railways using 105 MHz channels. The radio spectrum regulatory authorities were planning to turn these radio frequencies over to the broadcasters, and provide PMR channels in the 174 to 205 MHz Band 3 range. As these proposals were not finalised, some of the Band 2 systems were extended with automatic systems filling the gap from Rugby to Gretna, with the manual systems then being converted to automatic systems.

Later systems were to be introduced on the new Band 3 channels, and eventually the Band 2 systems were replaced by Band 3 systems. Whereas the Midband systems had a single radio channel used throughout an area, meaning when a call was in progress adjacent transmitters could not be used, the new Band 3 systems were distributed trunked systems with a common signalling channel throughout an area, but different speech channels, allowing more simultaneous conversations.

Later the system was enhanced by the ORN (the Overlay Radio Network) giving enhanced coverage to complement the introduction of radios into locomotive cabs. These radios had a single emergency button to call the (regional) TCO (Train Control Office). The TCO in turn had facilities to make broadcast calls to all Locos, or all radios in the area of an incoming TCO call, or in the area of a selected radio transmitter.

In more remote areas simpler, but compatible systems linked trains to the controlling signalbox, giving the ability to pass signalling information allowing train movements to be authorised. This is the RETB (Radio Electronic Token Block) system.