PowerBook 500 series

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The **PowerBook 500 series** (codenamed *Blackbird*) was a range of Apple Macintosh PowerBook portable computers first introduced by Apple Computer with the 540c model on 16 May 1994. The 500 series was the first laptop computer to use a trackpad instead of a trackball as a built-in pointing device and the first to have Ethernet networking built-in.

It was the first PowerBook series to use a Motorola 68LC040 CPU (simultaneous with Duo 280) and be upgradeable to the PowerPC architecture via a swap out CPU daughter card (with the PowerPC and 68040 upgrades for sale), use 9.5" Dual Scan passive color/B&W displays, 16bit stereo sound with stereo speakers, have an expansion bay, PC Card capability, two battery bays (and a ten minute sleep/clock battery), full size keyboard with F1-F12 function keys, be able to sleep while connected to an external monitor and have a battery contact cover included on the actual batteries. It included a single serial port which could be to connect to a serial printer or a network via Apple's LocalTalk. In another first, it also included a AAUI port for connecting to non-LocalTalk (usually Ethernet) networks.

The 500 series was discontinued completely with the introduction of the ill-fated PowerBook 5300. The PowerBook 190 was the de facto successor to the 500 and continued the only 68LC040 processor offering as the low-end of the PPC-based PowerBook family.

The 540c is rated #2 of the all time best PowerBook models made according to Insanely Great Macintosh (http://web.archive.org/web/20060324140419/http://www.insanely-great.com/features/112900.html) (survey taken Nov, 2000).
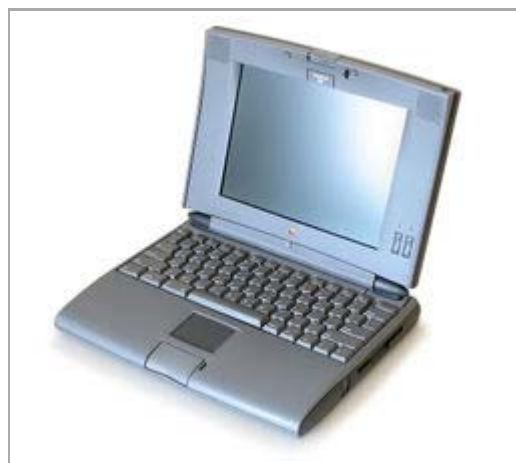
PowerBook 500 series	
Manufacturer	Apple Computer
Type	Portable computer
Pointing device	Built-in Trackpad
Introduced	16 May 1994

The door on the 550c is removed, and some trim on the 520c is removed showing the internal components. Ports from left to right are: Power in, Printer/Modem, sound in, sound out, ADB, AAUI, monitor out, SCSI (HDI-30 connector), modem port, and Kensington key-lock. Yes, the 550c hinge cover is darker. Note the labels on the door needed to identify the internal modem (FCC info on the "PowerPort" label, Canadian on other two). The 100-240v power supply is on top.

Contents

History

It was introduced on 16 May 1994 with the expensive active matrix LCD PowerBook 540c and 540, with the passive matrix 520c and 520 soon after. One of its marketing highlights was the promise of a PowerPC upgrade to its CPU and PC Card (PCMCIA) expansion. The introduction of this model came at the time of Apple's change over to the new PowerPC Chip from the 68k line of CPU's, and Apples advertising and promise of the PowerPC was the cause of headaches to the company. The resulting strong demand for its ground breaking design and wrong market prediction of waiting for the fully PowerPC PowerBook resulted in shortages early on.

In due course the 540 was dropped from the line, 8 mb of additional memory and the modem was offered installed from the factory, hard drive capacity was increased (from 160 and 240 to 320 and 500 mb), and the installed system upped from System 7.1.1 to 7.5. The PC Card Cage also started to sell on the market.

In 1995 Apple gave permission for Apple Japan to introduce an updated version, called the 550c, with a bigger display (10.4"), CPU with FPU (68040), bigger hard drive, and Japanese keyboard. It was only sold in Japan, and never received FCC certification.

With delays in the new PowerPC book (5300), demand for the PPC upgrade mounted, and Newer Technology began to market the upgrade before Apple did, although they had produced the upgrade modules for Apple first. What's more, the offered 117 MHz versions over Apples 100 (actually, 99) MHz offering. Soon there after Newer introduced a 167 MHz model that outperformed the fastest PowerBook 5300, the $6800 5300ce, at a time when problems with that line became a real issue to Apple.

About the time Apple introduced the PowerBook 1400, Newer introduced a 183 MHz upgrade with 128 Kb of L2 Cache that kept it ahead of the power curve performance wise. Newer Technologies stated they could not produce more of the 183 MHz upgrades because the supply of connectors was exhausted.

Impact on the Industry

This laptop was the first in the industry to include:

- Track pad (instead of track balls, pointer (IBM), or mouse), offered on most laptops today
- 16bit stereo sound @ 44.1kHz (Typical was 8bit mono @ 22kHz)
- Stereo speakers (located in upper corners of screen)
- Ethernet via AAUI (A transceiver was used to connect to either UTP or Coaxial type wiring)
- Non specialized internal expansion bay for connecting many types of devices (PDS connector in left battery bay).

- "Intelligent" NiMH batteries (that is, had on-board circuitry to monitor health of battery)
- CPU on a daughter card, unique for a notebook.

And among Apple's PowerBook line the first to have:

- 68LC040 (with Duo 280), or 68040 (in Japanese model) CPU standard.
- PowerPC 603e CPU as an upgrade
- 9.5" displays
- 10.4" display (550c in Japan)
- Dual Scan passive color and B+W screens
- CPU on daughtercard (first in any Mac) (PowerPC and 68040 upgrades)
- Expansion bay (PDS connector in left battery bay)
- PC Card capability (PCMCIA) via module
- 2 battery bays (and a 10 minute sleep/clock battery)
- Full size keyboard with function keys (F1-F12)
- Sleep while connected to external monitor
- Battery contact cover included on the batteries

Engineering

Variations across the range

Although the 500 "Blackbird" prototypes were black, only one of the five production models was completely black; that was the 550c, sold only in Japan. The 550c differed from the four two-tone grey models in a few other key respects as well, including a larger active-matrix color screen, a combined Roman/Kanji keyboard, and a full 68040 processor. The other models were all charcoal grey with darker grey trim, came with a variety of displays (active/passive matrix; color/greyscale), and used the 68LC040 processor (a low-cost variant without a math co-processor). The full-sized keyboard with 12 function keys, and used a 640x480 resolution display was consistent across the family.

Optional Internal Modem

The modem was developed with Global Village, and is a unique 2 part design. The transceiver with the modem connector is installed in the back, and the modem itself is located next to the CPU daughter card. It was a V.32 Terbo, and had a top rate of 19.2 kbit/s, but only with the same modem as it was not an official standard. Otherwise it would drop down to 14.4 kbit/s. Due to a bug with the new combined printer/modem port, the driver had to be upgraded to 2.5.5, and the Chooser was replaced in the GV install.

Expansion bay

The 500 series of PowerBooks included the ability to use two batteries at the same time, allowing for 4 hours of battery life from two installed charged batteries. However the left batter also had an internal PDS slot that allowed for custom modules to be installed. Despite protypes being made, only 2 devices reached the market.

PCMCIA "card cage"

One is the PCMCIA module. There were three versions; RevA, RevB and RevC. The RevC is the most useful as it can take 16bit WiFi cards, allowing the possibility to get a Powerbook 5xx connected online or in the home network using a technology that was developed after the Powerbook 5xx's were discontinued by Apple. The

different revisions of the PCMCIA module were released by Apple to accommodate the developing PCMCIA standard. These modules are difficult to find, and the RevC module is in particular demand because it alone works with 16-bit WiFi cards.

PC Card (PCMCIA) cage, 16bit, 2 Type I/II or 1 Type III cards, using a 68000 CPU to convert the PC Card protocol to PDS.

FPU co-processor

The other is the FPU co-processor, to make up for the lack of one in the PowerBook's 68LC040 CPU. The FPU module uses a 68882 FPU co-processor made by Sonnet.

Production

In total, almost 600,000 PowerBook 500 series units were produced, compared to only 300,000 PowerBook 5300 units.

Models

PowerBook 520c and 550c

An Apple PowerBook 520c

	520	520c	540	540c	550c
Apple Part #	M3981LL	M3984LL	?	M2809LL/B	?
Processor	68LC040	68LC040	68LC040	68LC040	68040
CPU Speed	25 MHz	25 MHz	33 MHz	33 MHz	33 MHz

Built-in RAM (MiB)	4	4	4	4	4
Maximum RAM (MiB)	36	36	36	36	36
Hard drive (MB)	160 or 240	160, 240, or 320	240-320	240-320, later 500	750
Display	9.5" B&W, Dual scan passive	9.5" Color, Dual scan passive	9.5" B&W, Active Matrix	9.5" Color, Active Matrix	10.4" Color, Active Matrix
LCD Resolution/Color	640x480x16	640x480x256	640x480x64*	640x400x32K**	640x400x32K**
# the family part number is M4880, but individual models have different #'s not on printed the case					
* 64 grays, though can be set to 256 grays.					
K** 32,000 colors at 640x400, or 256 colors at regular 640x480					

Video display support

Resolution*	Frequency	Monitor Type	LCD Bitdepth	External Bitdepth
512x384	60 Hz	MultiSync	n/a	8bit (256 color/gray)
640x400		built in LCD	16bit (64K color/gray)	n/a
640x480	67 Hz	VGA	8bit (256 color/gray)	8bit (256 color/gray)
800x600	56 Hz	SVGA	n/a	8bit (256 color/gray)
832x624	75 Hz	MultiSync	n/a	8bit (256 color/gray)
1024x768	60 Hz	XVGA/VESA	n/a	4bit (16 gray)
This a listing of all the resolutions and colors supported.				
*To access the resolutions in the PowerBook, look in the "Monitors and Sound" control panel and list resolutions, or for older "Monitors control" 'Option-click Option' for listing.				

CPU upgrades

model	Sonnet	Apple	NUpowr 117	NUpowr 167	NUpowr 183	NUpowr G3
Maker	Sonnet	Apple	Newer Technology	Newer Technology	Newer Technology	Newer Technology
Processor	68040	PowerPC 603e	PowerPC 603e	PowerPC 603e	PowerPC 603e	PowerPC 740*
CPU Speed	66/33 MHz	99 MHz	117 MHz	167 MHz	183 MHz	223 MHz?

L2 cache	none	none	none	none	128kb	512kb?
Included RAM (MiB)	4 MB	8 MB	0,4, or 8 MB	0 or 8 MB	0 or 24MB#	24 MB?#
Produced	unknown	6000	"excess of 15,000" of all types of NUpowr versions			(prototypes only)
Notes		M3081LL/A		most numerous version		

To fit the additional RAM in, removal of the modem daughter card is required, a small price considering the 19.2 kbit/s limit.

* The PowerPC 740 "G3" is fully pin compatible with the 603e and Newer Technology acknowledged making a prototype, but never produced it. Another 500 was upgraded in Japan by removing the 603e and installing a G3.

? Newer Technology never divulged the specifications for the G3 upgrade, estimate based on current technology.

Legacy

At a time when most laptops had Grayscale displays, mono speakers with only 8 bit audio out, insufficient battery life, and some even had side mounted snap on track balls, the 500 series became the model for all laptops to this day. With the built in Ethernet (via a versatile AAUI transceiver), SCSI port (forerunner of today's FireWire) and ADB (similar to USB), it had all the features of desktops at that time, making them the first viable desktop replacement laptops.

See also

- PowerBook

External links

- O'Grady's PowerPage - PowerBook 500 (http://ourworld.compuserve.com/homepages/tenchi/500.html)
- How to use a Powerbook 540c as a WiFi Web Server (http://www.haddockdot.co.uk/)
- MacOpinion Retrospective: the Powerbook 500 Series (latest Archive .org version) (http://web.archive.org/web/20060216051222/http://www.macopinion.com/columns/roadwarrior/00/09/13/index.html)
- Item 102633215 in the Computer History Museum (http://archive.computerhistory.org/resources/physical-object/apple/102633215.sm.jpg)
- Apple Technical Specifications: PowerBook (http://www.info.apple.com/support/applespec.legacy/powerbook.html)
    - 520 Specifications (http://docs.info.apple.com/article.html?artnum=112264)
    - 520c Specifications (http://docs.info.apple.com/article.html?artnum=112265)
    - 540 Specifications (http://docs.info.apple.com/article.html?artnum=112266)
    - 540c Specifications (http://docs.info.apple.com/article.html?artnum=112267)
    - 550c Specifications (http://docs.info.apple.com/article.html?artnum=112313)

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