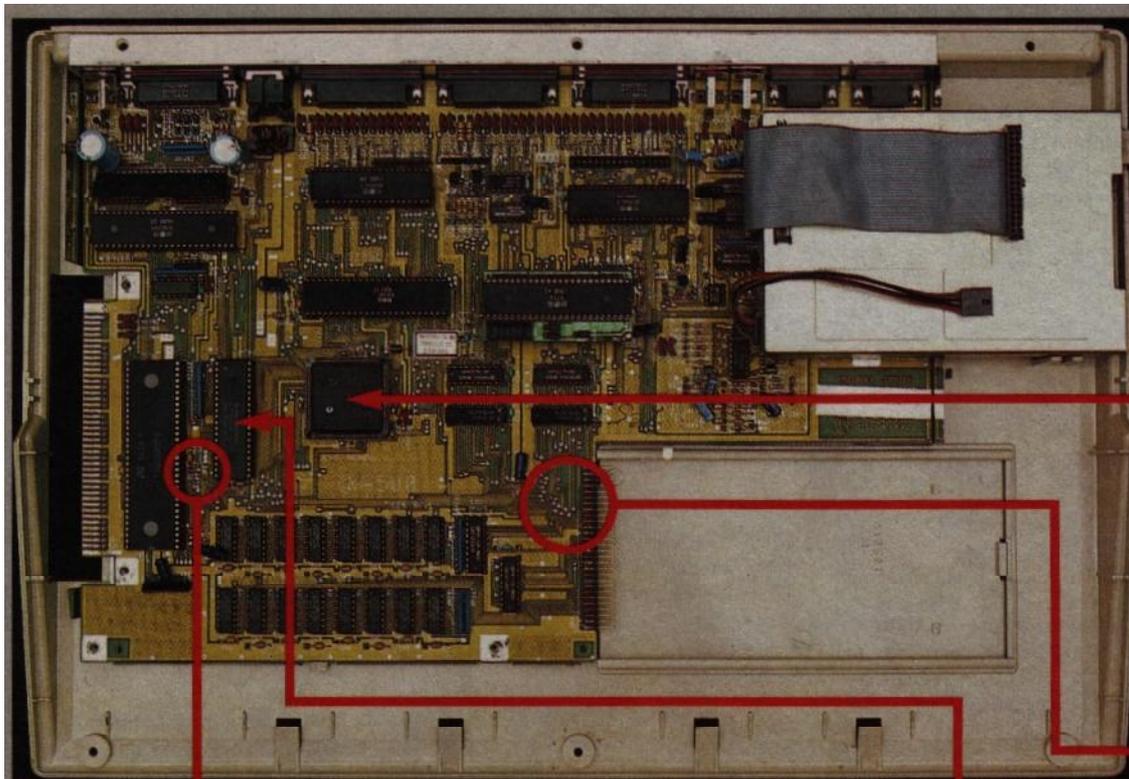


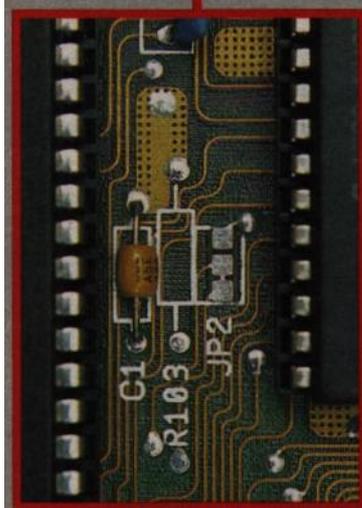
A CLOSE-UP OF THE A500 REVISION 5 MOTHERBOARD



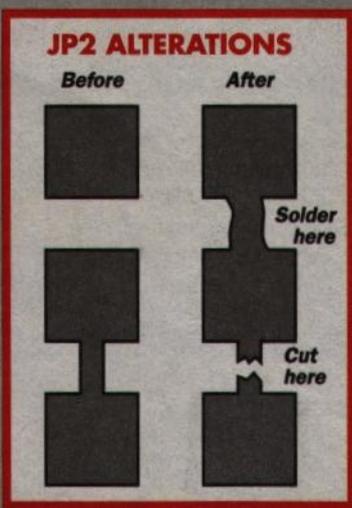
Here are the Kickstart ROM and the modifications to gain 1Mb of Chip RAM on a revision 5 machine. Read the main text before you begin! For info on the Denise chip, see the revision 6 diagram on page 24.



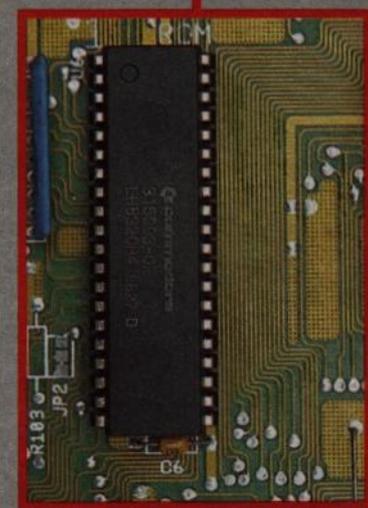
The Agnus chip. If the one on your board is numbered 8370 or 8371 it needs to be replaced with the newer 8372A chip so that you can access up to 1Mb of Chip RAM.



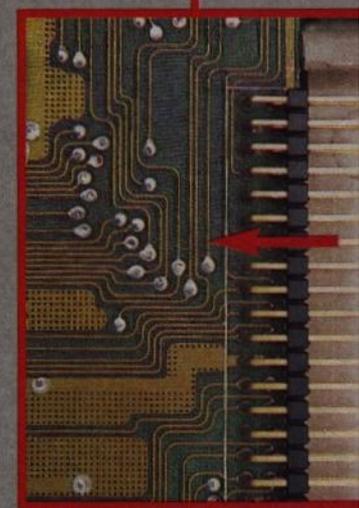
The three solder pads here make up JP2. To complete the 1Mb Chip RAM conversion, first carefully cut the track between the middle and the lower with a sharp craft knife (see the diagram above right).



Next heat up a soldering iron and add a small blob of molten solder to the top pad. With the hot Iron gently spread this over to connect the top to the middle pad.



The Kickstart ROM, in the same position for all revisions. On one end of the chip is a semi-circular indent which must point up the board - i.e., towards the back. It should be next to a white "1" printed on the board.



There are four small solder pads just across from the eighth pin down on the edge connector. Cut the track leading to the pad nearest to the edge connector (arrowed above). Be careful not to cut the wrong track.

programs, especially serious applications, now only work under Kickstart 2.04 or higher. You may even find with programs you already use that future updates will not work without the new Kickstart. If you're buying new software, make sure it features the green "Release 2.0 compatible" sticker.

Workbench 2.04 (supplied with the Kickstart 2 upgrade kit) is a vast improvement over the earlier Workbench efforts. Many people gave up using the original Workbench 1.2/1.3 and use the Shell or CLI

instead. Workbench 2.04 was rewritten to be much easier to use, particularly for the new user - you can now do directly from Workbench almost anything that previously needed the Shell.

What's more, Workbench 2 and above look a lot nicer than 1.3. You can have custom backgrounds, custom fonts and your own error sounds.

Installing Kickstart 2.04 in an A500 is easy, as long as you make sure you buy the full Commodore upgrade kit. The upgrade kits now

come in three flavours:

- **Kickstart/Workbench 2.04.** This contains the 2.04 Kickstart ROM and Workbench 2.04. This is now out of date, so you may be able to get one of these packs at a knock-down price, and you can always buy the Workbench 2.1 upgrade later.
- **Workbench 2.1 with Kickstart.** This contains the 2.04 Kickstart ROM and the new Workbench 2.1. There are a few differences between 2.1 and 2.04 that make the newer version worth getting, although at the time of writing the pack has not yet

been officially launched and the price of import packs is very high.

· **Workbench 2.1 only.** If you already have a 2.04 Kickstart ROM (for example if you're an A500 Plus owner) you may want to upgrade to the latest Workbench version, which is available separately.

FITTING A NEW KICKSTART

The Kickstart ROM has a wire soldered over the top. Beware buying cheap ROMs - some sources do not

supply the official parts, only ROMs without a wire over the top, which may require some soldering to install in early A500s. You will need to cut the wire if you have a newer Revision 6a Amiga. On older Amigas, keep the wire intact. Extracting a rectangular chip from the motherboard is very simple. Use a flat-bladed screwdriver to gently ease **both** ends of the chip up from the socket. Do not try and pull the chip out from one end only,

because this will bend some of the legs. If you do bend some of the legs then **gently** bend them back into shape with a pair of pliers. **ANOTHER WARNING:** Observe antistatic precautions when handling any electronic components. Static electricity can kill, or seriously damage, the sensitive integrated circuits in your Amiga. Earth yourself by wearing a commercially-available anti-static wrist strap or else by touching an earthed conductor such as a radiator while handling chips, and don't touch the components any

more than necessary. Always handle chips by the black plastic case - try to avoid unnecessary contact with the metal legs.

By now you should have safely removed your old Kickstart ROM from your A500. You could keep this to fit into a Kickstart switcher, but most people never want to go back to Kickstart 1.3 after using 2.0.

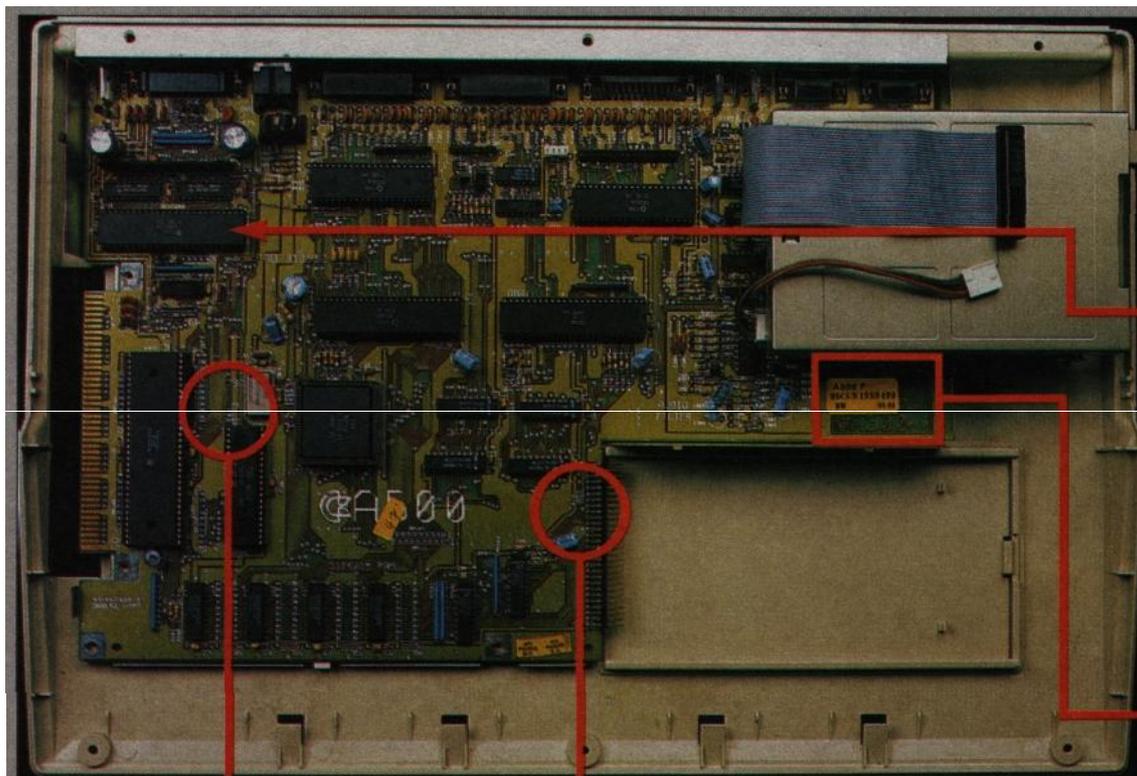
See the diagram on the previous page for information on how to insert the new chip the right way round. Gently press the chip into the socket, making sure you don't bend any of

the pins too far.

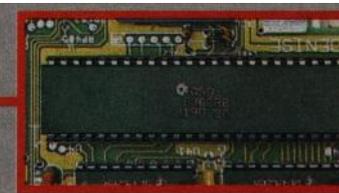
If you do not have a hard drive, then installation is now finished. You can put your Amiga back together (unless you plan to make other modifications) and boot your new Workbench 2 disks.

With a hard drive all you need to do, after reassembling your Amiga, is connect your hard drive and run the **Install** program on your 2.0/2.1 Install disk. This will copy over the necessary Workbench 2 files to your hard drive. After this, reset and you have Workbench 2.

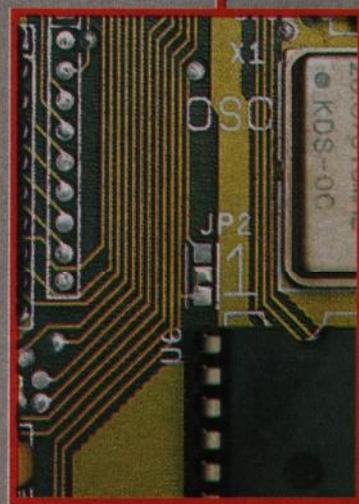
A CLOSE-UP OF THE A500 REVISION 6A MOTHERBOARD



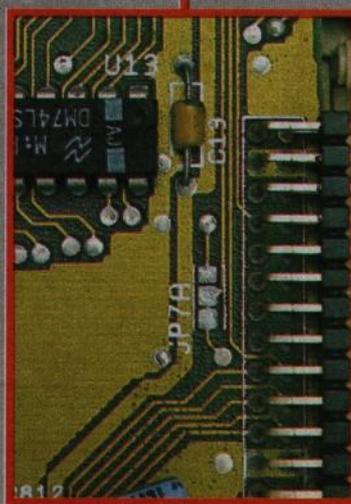
Here's how to locate the parts of the circuit board that need to be altered for 1Mb Chip RAM on revision 6a boards. Also shown is the location of the Denise chip, which is the same for all boards.



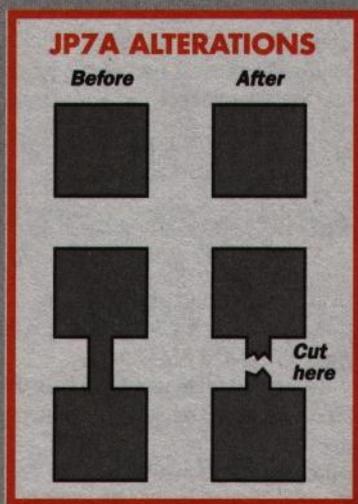
The Denise chip can be replaced by the Super Denise (number 8373) to give several new display modes including Productivity, with a resolution of 640x480 displayable on a multisync monitor.



JP2 is in a slightly different place on revision 6a machines, but the modifications to be made to it are exactly the same as for a revision 5 machine. See the bottom left of the diagram on page 21 for details.



The difference is in JP7A, which is not present on revision 5 boards. The existence of this group of pads makes the conversion much easier for revision 6a owners. Above right is a diagrammatic representation.



JP7A is located next to the trapdoor RAM connector. Using a sharp craft knife, cut the connection between the two lower pads. Be careful, because repairing incorrectly-cut tracks can be difficult.



Later revision boards have their revision number printed on this area, below the disk drive. Make a note of this number, because some of the modifications are dependent on which revision Amiga you have.

A CHIP OFF THE OLD

RAM There are several different kinds of Random-Access Memory that your Amiga can use. There are two main types, called Chip RAM and Fast RAM. Chip RAM is used for programs, graphics and sound, while Fast RAM **can only be used** for programs, but programs in Fast RAM run faster.

Because graphics and sound can only be used in Chip RAM, however much Fast RAM you add you will not be able to use programs that require a lot of graphics or sound memory - for example, using Deluxe Paint 4 in Hi-res Interlace 16-colour mode.

Newer Amigas, like the A1200, can use up to 2Mb of Chip RAM, allowing far better use of graphic-intensive programs. However, you can upgrade your old A500 to take advantage of more Chip RAM. If you have an A500 Plus you already have 1Mb of Chip RAM fitted to your machine. To upgrade to 2Mb of Chip RAM, all you need to do is buy an A500 Plus 1Mb RAM upgrade (the Commodore A501+ for example). Any other RAM you add to your system (RAM added to an external hard drive interface, for example the GVP HC8+) is Fast RAM.

If you have an A500 with a half Mb expansion fitted (totalling 1Mb of RAM), you probably have the most common set-up, a half Mb Chip RAM machine with a half Mb of expansion (or "slow") RAM. Slow (expansion) RAM is the least useful of all memory types. It has the major disadvantages of both Chip RAM (programs operate slowly in it), and Fast RAM (it cannot be used for storing graphics or sound). All Amiga 500s can be upgraded to convert this less-useful slow RAM into far more useful Chip RAM, essential if you want to use Deluxe Paint 4 or any other graphics-intensive program to the full.

FITTING NEW CHIP RAM

This is an operation that involves handling static-sensitive components and a very simple soldering job that anyone with a soldering iron should feel competent to attempt. First, check **which revision motherboard and Agnus chip** you have. If you've got a revision 3 board, read this fully before deciding whether to proceed or not - it's not as easy as on revision 5 or 6a machines.

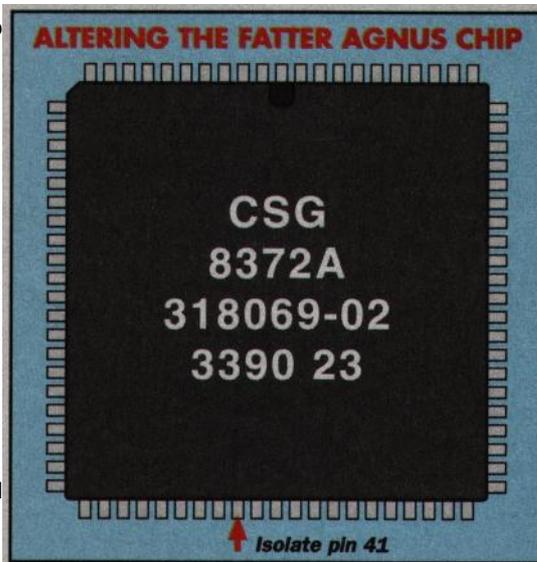
You will need an 8372A Agnus chip. If you bought your A500 with a half Mb expansion fitted by Commodore, it's highly likely you have this chip already, in which case skip the next stage.

If you do not have this chip, it is available for around £50 from most Amiga dealers, although you may prefer to ask your dealer to fit the

chip for you. The removal of the old Agnus chip from your motherboard is by far the most difficult part of this operation. Without the right tool (a PLCC chip extractor) it's very easy to damage the chip socket when removing the chip.

If you do feel lucky, use two very small flat-bladed screwdrivers at opposite corners of the socket to lever the chip out.

Next, you need to mask pin 41 on the 8372A Agnus chip before insertion (unless you live in North America or anywhere else that uses the NTSC video standard, in which case ignore this paragraph). See the diagram below for details. Once the older Agnus is removed, insert your new 8372A chip. Remember to align the chip in the same direction as the original. On one side of the square socket you will see the number 1 printed on the motherboard. Align the top of the



The semi-circular mark at the top of Agnus' plastic case denotes *pin* 1. Count anti-clockwise to locate *pin* 41. Isolate it with a silver of Sellotape or a *dab* of Tippex, or bend it up or even remove it altogether.

chip with this when inserting it. When everything is connected up again, test your Amiga with the new chip. It should work as before (still with half a Mb Chip RAM and half a Mb Fast). If it does not work, check you have the chip installed correctly. • If you get a solid green or yellow screen, you probably either have a faulty chip or you have installed it incorrectly. • If you get something that looks like a normal screen but either stretched out (so you lose some of your Workbench screen) or with a very fast rolling display, you have not insulated pin 41 correctly - remove the chip and insulate the pin.

Now you have to make two small modifications on your motherboard. These depend on the revision of your motherboard.

• Revision 6a

First find JP2 on the motherboard.

This is made of three small squares of solder, the bottom two connected by a small thin track. See the diagram on page 24 for details of what to do here. Next find JP7A - next to the trapdoor RAM connector - and carry out the modifications also described in the diagram on page 24.

• Revision 5

This modification is very similar to the Revision 6 procedure described above, but there is no JP7A to change, so you will have to find and cut a track on the motherboard. See the diagram on page 21 for the full details.

• Revision 3

Oh dear. This is a tricky one. Most people regard it as impossible to upgrade the revision 3. It isn't, but it's certainly not for the inexperienced. The following modifications are needed:

On the board there is a connection between pin 59 on the

Fat Agnus and pin 52 on the 68000. (The top left pin on the 68000 is pin 1. Count downwards from there, and then from the bottom right to the top right for the highest numbered pin.) This must be cut, and a small piece of wire added to connect pin 59 on the Fat Agnus to pin 47 on the 68000.

Tricky? Yes, it is. If you feel uneasy about doing this, then perhaps it's time to retire your old A500 and buy a new machine.

When you've successfully completed all this,

put your Amiga back together and power up. Type AVAIL from the Shell and you should have one million bytes of graphics (Chip) memory available. If you still only have half a Mb of Chip RAM, then double-check all your connections.

If, after you have made the alterations, your Amiga seems more unreliable than before, then check the RAM chips in your expansion. Commodore A501 boards are usually fine, but some third-party boards (particularly older 16-chip boards) may be too slow to use as Chip RAM. If your system is unreliable try a new, four-chip, RAM expansion. This should solve the problem.

If you use a lot of graphics-based programs, especially for video, desktop publishing or multimedia work, 1Mb of Chip RAM may not be enough. You can expand up to 2Mb

the procedure listed for the modification to 1Mb, except do not fit a 8372A Agnus chip. Buy the Meg-AChip board (reviewed on page 86 of this issue) and plug this into the Agnus socket. (Beware though, this will prevent you adding other boards inside your Amiga, such as accelerators.)

SPEED TO THE HEART OF THE MATTER

The A500 is a slow machine by today's standards. The Amiga 1200 is between two and five times faster than the original Amiga, and even that is not as fast as it might be. The Amiga uses the Motorola 68000 family of CPU (Central Processor Unit). The CPU is the chip that does most of the work in your computer. Faster CPUs enable you to use your computer more productively. Tasks that may take hours on slower machines can take minutes, and tedious tasks on slower machines (such as printing from a graphics word processor) are no longer irritating, and in some cases almost instantaneous.

Processor clock speeds are measured in MegaHertz (MHz). This is the frequency of a clock signal that drives the chip. Although the faster the clock frequency the faster the chip operates, higher-spec chips generally run at higher speeds because of design differences, so for example a 14MHz 68020 outperforms a 16MHz 68000 quite considerably in some cases.

There are several versions of the Motorola chip used in Amigas: • **68000**. This is fitted to the A1000, A500, A500 Plus, A600, A1500, A2000 and CDTV. Running at a rather slow 7MHz, this processor has been the standard fitted to almost every Amiga model since 1985.

• **68020**. This is currently fitted into the Amiga A1200. Running at a more respectable 14MHz, it gives a significant performance benefit over the older generation of Amigas.

• **68030**. This is a faster model of the 68020 chip. Currently a 25MHz '030 chip is fitted to the Amiga 3000 and the Amiga 4000/030

• **68040**. Currently the fastest processor fitted to Amigas, the 25MHz '040 chip may run at the same speed as the 68030 fitted to the Amiga 3000 and 4000/030 but outperforms it considerably by virtue of its better design. The top-of-the-range Amiga 4000/040 and Amiga 4000T are fitted with this processor.

To further complicate matters, there are several models of each processor. The 68020 and above are available in two models, the standard (for example the 68030 in the Amiga 3000) and the EC (68ECO30 in the 4000/030). The EC stands for both "Economy" (the EC

versions are cheaper) and "Embedded Controller" - these processors were initially designed for cheap mass-market non-computer use in, for example, industrial control equipment, washing machines and video recorders.

The EC version of the 68020 is limited in the maximum memory it can address - an A1200 with the 68ECO20 **can only use** a maximum of 2Mb Chip RAM and 8Mb Fast RAM. The 68020, non-EC, chip can theoretically address up to

4 GigaBytes, or 4,096 Mb, of RAM. The EC version of the 68030 does not contain the MMU (Memory Management Unit) present in the full 68030 chip. This is a complex part of the chip that enables the computer to block the processor from accessing areas of memory, or remap a block to point at another area. If this sounds exactly the sort of thing you could do with, then the 4000/030 isn't the machine for you. Luckily for most people there are only a handful of programs that require the presence of an MMU (the developer tool **Enforcer** and the virtual memory program **GigaMem** being the two most important), so unless you need these the EC030 will be as good as the full '030 for you, and will save a few pounds too..

The EC version of the 68040 leaves out both the MMU and the maths coprocessor present in the full '040 chip. Currently Commodore are not using the 68ECO40 chip in any of their machines.

Maths coprocessor? What's that? Maths coprocessors are chips which specialise in handling all the complex mathematical functions that slow down normal processors, especially calculations involving not just whole numbers (integers) but fractions. Because these fractions can be accurate to varying numbers of decimal places, maths coprocessors are also referred to as Floating Point Units or FPUs.)

can only be used by programs that have been specially written to take advantage of them, but many packages now support them and run much faster if you have such a chip fitted. These programs include Art Department

Professional, VistaPro, Imagine, Real 3D, Scenery Animator, Morph Plus, and Sculpt

software you use can benefit from a maths coprocessor before you buy one - otherwise it's wasted money. A maths coprocessor cannot speed up most programs on its own.

The two models of FPU currently available are the 68881 and the 68882, both also made by Motorola. The latter is considerably faster in some functions, but not much faster in others. Choice of maths coprocessor is usually down to budget. If you can afford the 68882 then go for that; if not, the 68881 is quite a bit cheaper. The 68040 chip has a built-in maths coprocessor to take the load off the CPU, so lucky people with Amiga 4000/040s or 68040 accelerator boards do not need to add one.

So, you want a faster processor. How do you fit one? Unfortunately it's not a simple matter of unplugging one chip and adding another. Each chip is different and requires different circuitry to control it. Upgrading processors in the Amiga range requires the installation of an accelerator board. These vary in cost from around £170 to over £2,000, and they're so important an area that we've put together a separate roundup of them starting on page 28.

The final area where the A1200 represents an advance over the older Amigas, and by far the most important, is in the graphics display. The Amiga has been limited to a maximum of 32 independent colours chosen from a palette of 4,096 for over seven years. Compared with the PC graphics at the time (CGA, with four colours using one of two fixed palettes, or EGA, with 16 colours from a



DCTV is another solution to the problem of Insufficient colour resolution. It plugs in externally to give a composite video signal with thousands of colours.

palette of 64), and the Macintosh (then only black and white), the Amiga was amazing. Unfortunately for Commodore, the competition have caught up. IBM launched VGA in the late 1980s with 256 colours displayable from a palette of 262,112. Macintosh went slightly better with their Mac II colour computers - 256 colours from a palette of 16 million.

Commodore have caught up with the introduction of the AGA graphics chipset. The Amiga 1200 is now capable of displaying 256 colours from a palette of 16 million, and the HAM-8 mode allows photo-realistic images, almost indistinguishable from expensive 24-bit displays, on a standard, £399 Amiga.

Where does this leave the Amiga 500 owner? Can the new AGA chips be fitted to the A500? Unfortunately, no. The AGA chips are far more advanced than the original graphics chips and require a totally different board layout. It's technically next to impossible to produce an add-on to use the AGA **chips on an A500 - and if it could** be done, it is doubtful that the price would be less than double that of a new A1200.

Now, this doesn't mean you should just go out and sell your A500 right away. There are alternatives.

HiQ Limited supply the A-Video 24 card (£499), an internal-fitting card that gives the A500 12-bit (4,096-colour) and 24-bit (16-million-colour) displays. The best part of the package they supply is the excellent TV-Paint graphics package - what Deluxe Paint should be, it's probably the best paint package on the Amiga. The **A-Video** card won't enable you to run AGA software (like Deluxe Paint AGA), but if you're using your Amiga for graphics (for example, raytracing), the A-Video will perform more than adequately as a display device.

The **DCTV** A570 (now £149) is another box that provides the A500 with better-than-normal graphics., Plugging in externally, so it is terribly simple to set up, it gives the A500 a composite video display in over four million colours. The box is ideal for

simple video work, because the composite output needs no encoding to connect straight to standard video recorders. Also provided as part of the **DCTV** hardware is a frame grabber, which can digitise a colour video image. You can import this straight into the excellent **DCTV** paint program supplied, mess around with it and display it back as video. Again, DCTV won't run new AGA software and you can't have fancy Workbench backgrounds, but for a practical solution for a common use of the Amiga, DCTV is a solid performer.

If all you're after is a flicker-free high-resolution display, then there are two ways you can reduce the flicker, although both require an expensive multisync monitor (like the Commodore 1960) to work.

First, the A500 Plus introduced a new chip, the Super Denise (8373) to replace the original Denise video chip. This gives your machine several new display modes, including "Productivity", which can give a flicker-free 640 x 480 resolution display on an Amiga connected to a multisync. This chip will work on any Amiga that has the Fatter 8372A or 8375 Agnus fitted, and adding it in is easy - simply remove the old Denise chip and insert the new chip.

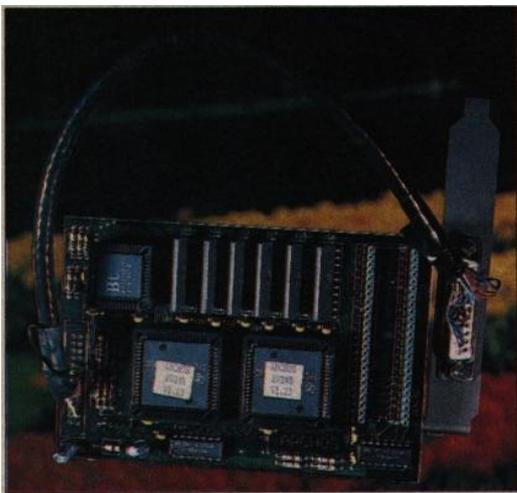
Only software written to take advantage of different screen modes, or programs that run on the Workbench screen, will run flicker-free, but it's sure better than nothing.

If you want to fix the flicker permanently, you need the ICD *Flicker Free* Video 2 card. This plugs into the Denise socket and contains extra circuitry and RAM to remove the interlace flicker from any screen mode, although again this requires a multisync monitor to work.

Or, for £399 or less, you can buy a hardware frame buffer that will enable you to display all the new AGA modes (including HAMS), flicker free on a multisync. It will run Deluxe Paint AGA, and even has its own floppy drive, 68020 processor and mouse. Yes, it's an Amiga 1200 - a bargain in anyone's language. Whether you buy one or upgrade your A500 will depend largely on whether or not you have many A500 peripherals you want to keep. But at least now you know how to upgrade should you choose to.

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The A-Video card provides both 4,096-colour and 16.7million-colour modes, and has some special animation features too. The latest version will fit externally.