

TOP MARKS FOR RASPBERRY PI

Russell Barnes speaks to the founder of the Raspberry Pi Foundation to find out why he thinks the Model A+ is their most exciting release yet...

A+

Eben Upton came up with the idea of an affordable credit card-sized Linux PC while working as the Director of Studies in Computer Science at St John's College, Cambridge. Part of his role was to manage and monitor undergraduate admissions, something Cambridge appeared to be fast running out of.

"It wasn't a case of me waking up one day wanting to make a credit card-sized computer, but waking up one day and realising we've got no computer science students and wondering why," explains Upton. "Ultimately we came to the conclusion that there was a distinct lack of programmable

computers for kids and we started putting some thought into what we could do about it."

As he talks Eben brandishes the latest offering in the Raspberry Pi line-up, the Model A+. It looks rather

different to its predecessors, almost as if someone's taken a hacksaw to a Raspberry Pi and lopped an end clean off. As it turns out, that's almost exactly

what happened, but there's a bit more to the story than that...

For a start, this isn't the first time the Raspberry Pi's winning formula has been tweaked. Earlier this year the Foundation launched the B+, an improved version

"The model A+ looks as if someone's taken a hacksaw to a Pi and lopped an end off."

Eben Upton: Quickfire Q&A

Q What's your favourite thing about the model A+?

A It's amazing what ergonomics can do for the popularity of a product. One of the things people love about the B+ is the fact it looks nice. It's got the rounded corners, the mounting holes and the connectors are all lined up with the edge of the board – it's just nicer.

I'm really obsessed with the rounded corners [laughs]. It's a little thing and it's really easy, but it makes such a difference on the A+.

Q Does the \$20 make the Pi more of an Arduino competitor?

A We're just about in the range of official Arduinos in terms of price. Of course we're not an Arduino competitor. I don't think there's a great deal of overlap between what the Raspberry Pi is the right product for and what the Arduino is the right product for. The Arduino still consumes less than power than an A+ and it has analog inputs. The Raspberry Pi on the other hand drives a display and has more processing power. There's still a

massive gulf between the two products.

Q Will the Raspberry Pi Compute Module ever take off with industrial partners?

A We don't want to push people to the Compute Module until they're ready. I think the Compute Module is well suited to industrial solutions, so if someone needs 10k of something it's definitely worth doing a small amount of R&D so you can go for a Compute Module, but it takes time to make that transition.

of its 3.5 million-selling Model B. It's the board Upton refers to as the 'deluxe model', because while the Model A is the Foundation's affordable flagship Pi priced at \$25, the B comes with the added convenience of extra USB ports and Ethernet networking for an extra \$10. The dream was to produce a \$25 computer powered by open source software, but it seems the vast majority of geeks and educators were more than happy to pay an extra ten bucks for the privilege.

Thanks to the massive success of the Model B, the team employed by the charity has positively ballooned over the last 12 months (even so the entire workforce can be counted on two hands and one foot). One of those new employees was Director of Hardware, James Adams, who was tasked to taking over from founding member Pete Lomas to create the Raspberry Pi Plus line.

With a combination of user feedback and raw common sense, Adams utilised the new economies of scale and reputation the Foundation had achieved to really go to town with the Model B+ improving the board layout, adding more General Purpose Inputs & Output (GPIO) pins, doubling the number of USB ports and massively improving power consumption among other things. And all this happened at the same retail price as the original Model B.

It was just the ticket too. The B+ became the fastest selling credit card-sized PC in the world almost

overnight. "Even though it was only a couple of weeks from when the B+ came out, we sold more Raspberry Pi's in that half of July than we've ever sold in any single month before," enthused Upton. Today the Raspberry Pi is selling over 100 thousand per month and the Foundation is on the brink of selling its four millionth Linux-powered PC.

Do we need a Model A?

With the Model A selling less in its entire lifetime than the Model B sells in a month, it wouldn't be outside the realm of reason to wonder if the Model A line is worth

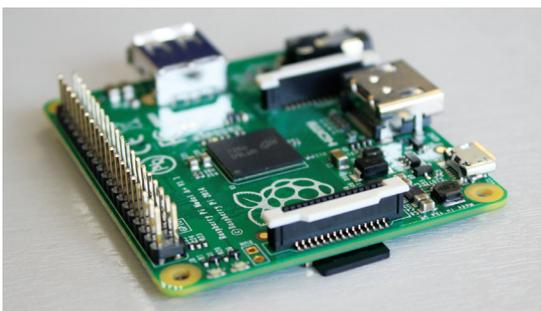
Original Model B goes back into production

The old Model B is once again rolling off the production line at Sony's facilities in Wales.

"Obviously when we started the Model B+ we wanted to make sure our channel partners weren't stuck with lots of Model B," says Upton. "We've got a lot of small businesses that started around the Pi and if you leave them with lots of old inventory it could cause them lots of problems. We told them all about the B+ and made sure they could move their old stock before we put the B+ on sale.

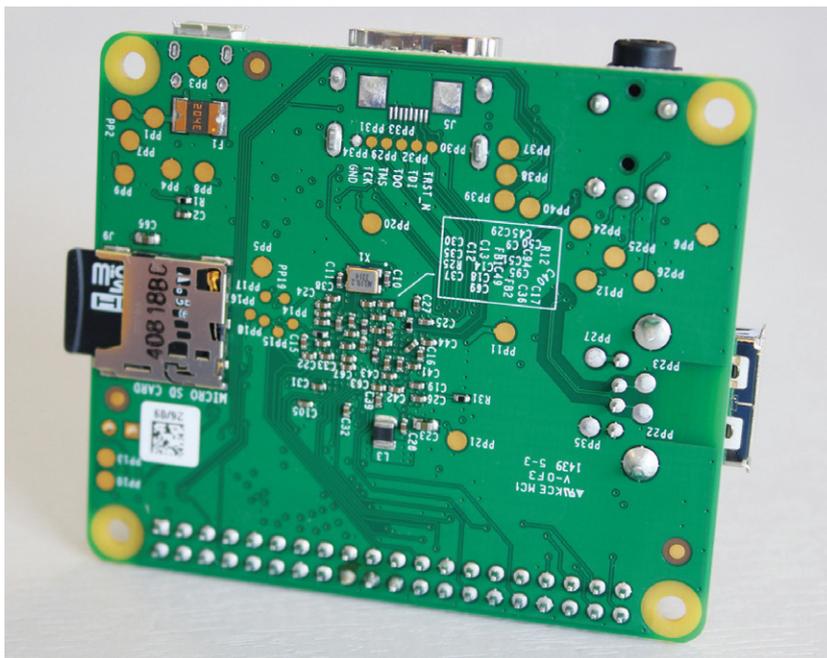
"After putting the B+ out there what we found was that a lot of people who were putting the model B into their products were saying, 'actually we're pretty happy with the Model B, can we keep buying it?'. It's great that we've got industrial customers that turn around and ask for 10,000 more Model Bs."

But what about the original Model As? "We're definitely not going to make any more As. Industrial demand for As hasn't been anywhere near as strong, so I really don't want to restart the A line."



The key benefit of the Model A+ isn't just the low price – it's the low, low power consumption.





Check out those corners – see how round they are.

continuing at all. Indeed, the \$25 credit card-sized PC for schools is barely in any schools, despite there being a good number of more expensive Model Bs to be found in the education sector.

As it turns out, it's only really hardcore hackers that make any real use of the Model A. People like Dave Akerman (www.daveakerman.com). Dave regularly attaches Model A Pis to weather balloons so he can take pictures with the Camera Board from an altitude of around 35km – right on the edge of space. With projects of this magnitude every milligram and milliwatt really count and the Model A's lighter load in terms of weight and power consumption makes it the ideal candidate.

Eben is the first to admit the Foundation failed to communicate the benefits of the Model A beyond its cheaper price, and it's something the team are determined to rectify with the new Model A+.

"It's easy for people to look at the Model A and think it's just a cheaper variant of the B. When they look at it like that they might as well just go for the deluxe

model since it's only an extra \$10," explains Upton. "I feel like some people missed out on why the lower-power model like the Model A can make sense. If you're building something with robotics, or essentially any project that doesn't need Ethernet networking, it's a great fit."

Eben also thinks it would make a mockery of the original \$25 computer promise if they didn't continue with the Model A: "It's also really important to us because it's our flagship product. It was our original stake in the ground and where it all started."

Chopping the end off the B+

While some tech firms would be nervous to have another try at a less successful model, the Foundation is very excited about the release of the A+. A look over the specs shows it's a big improvement over the flagship Raspberry Pi, but the groundwork for the A+ started when the B+ was still the drawing board.

Upton says: "James Adams came over to see me [with a Model B+] and said 'you know we can chop the end of this board off, right?'"

It transpired that Adams actually designed the Model B+ with the Model A+ in mind, making it a trivial board design tweak to shave quite a large amount off one end of the board for the A+.

"Where the original Pi had *ad hoc* mounting hole positions, the B+ has these nicely positioned square mounting holes on the body of the board, then an extension on the right that contains the Ethernet and USB ports, which are 'outboard' of these mounting holes," continues Upton. "James basically explained that we can chop the board off at the mounting holes and find room on the board for a single USB connector, meaning we could make an A+ board that was markedly smaller than the B+."

It certainly feels impressive in your hands. The mounting holes are in the same place as the B+, but with the shorter board they're located in all four corners, making it a shade off being totally square.

Since it has the same improved GPIO as the B+, it's also still compatible with the new Hardware Attached on Top (HAT) standard for Raspberry Pi add-on boards. In fact, the outline of a Model A+ and a HAT board is identical, making an A+ with HAT a very compact and mobile combination.

"We set about making a mock-up of the design and we all agreed that it made a really quite attractive product," continues Upton. "It really adds something to the mix and it adds something to its uniqueness too. It's cheaper than the B+, it consumes less power, but now it's quite a bit smaller too."

Not just smaller in the X dimension either – it's almost half the height too. Until it was replaced in the Model B+ by a dual-purpose 3.5mm audio and composite jack, the Raspberry Pi's board height was dictated by the massive (not to mention bright yellow) composite video port. Now the limiting factor on the height of the board is the low-profile USB port, bringing the Z dimension down from 21mm to 12mm.

Model A+ essentials

With only one USB port, getting by with a Model A with anything more than an SSH connection over Wi-Fi can be tricky. Here are a few add-ons designed to help...

■ **Broadcom WiFi adapter & 2 port USB hub** – £9.99 (www.pi-supply.com)

The fact that the drivers for Broadcom's range of Wi-Fi adapters have only just appeared in the Raspberry Pi's official distro, Raspbian, is a minor embarrassment, but perhaps by way of making up for the oversight you can now buy this two-port USB hub with built-in Wi-Fi. OK, it's not going to win any awards for design, but you can use it turn your Model A+ into B+ at a whim.

■ **Riii Miniature Wireless USB Keyboard with**

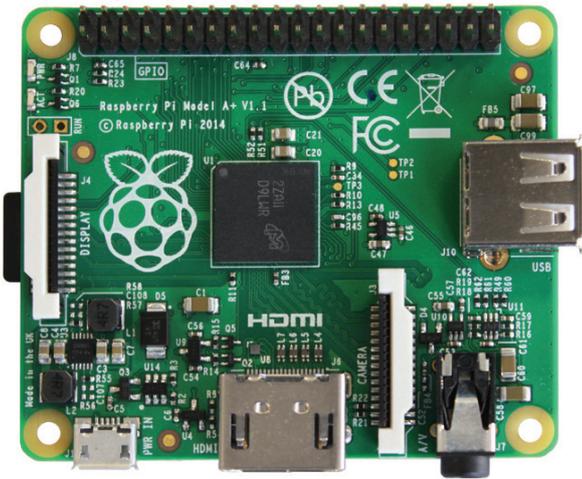
Touchpad – £26 (www.thepihut.com)

This tiny wireless keyboard with touchpad will give you decent control over your Model A+ with a full qwerty keyboard, a built-in touchpad, backlit keys, multimedia controls and even an integrated laser pointer.

■ **USB sound adaptor for Raspberry Pi** – £3.99 (www.modmypi.com)

Want to use your Model A+ as a decent audio player or a voice recorder? Although the A+ and B+ have improved audio support, there's no microphone input and the audio it outputs is still low-definition. The only way around either of these problems is to use a USB audio card, like this affordable little fellow from ModMyPi.com.

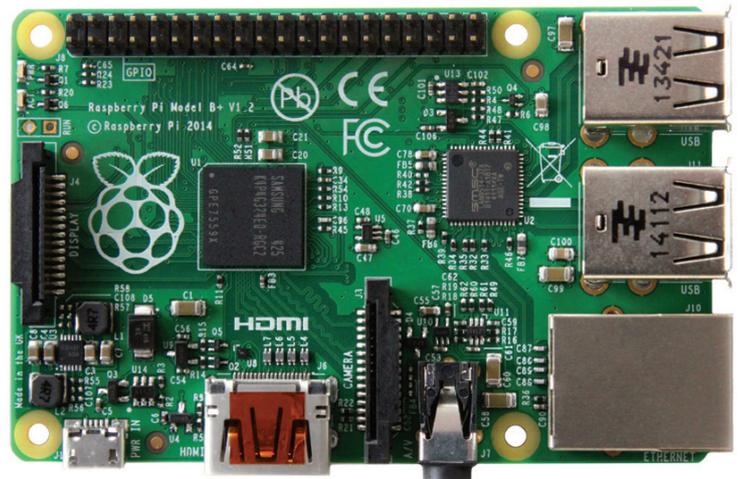
Side by side How the Model A+ and B+ stack up

**Model A+ specs**

Price: ~£15/\$20
 Dimensions: 65 x 56 x 12mm
 SOC: Broadcom BCM2835 (700MHz)
 Memory: 256MB RAM
 Networking: None

Expansion:

1 x Micro SD card slot
 40 GPIO pins
 1 x USB port
 Power consumption:
 200mA under load

**Model B+ specs**

Price: ~£27/\$35
 Dimensions: 85.6 x 56 x 21mm
 SOC: Broadcom BCM2835 (700MHz)
 Memory: 512MB RAM
 Networking: Ethernet 10/100

Expansion:

1 x Micro SD card slot
 40 GPIO Pins
 4 x USB ports
 Power consumption:
 370mA under load

(left, Model A+; right: Model B+)

Like the Model A, the A+ features just one USB port, 256MB RAM and no Ethernet port. Besides this (and the size of the board) Eben says it's 'electrically identical' to the Model B+. This means the A+ now benefits from the B+'s improved power chain, meaning you don't need the mother of all micro USB power adaptors to keep your Pi running or a powered USB hub to enable the use of USB storage. On top of that, if you're looking to run a project from batteries you're in for a massive boost in longevity.

We've yet to put the Model A+ through the wringer on a benchmarking test bed, but we know it draws about 200mA from the 5V power with a keyboard plugged in, running 'hello_teapot' over a HDMI monitor. Compared to the already impressive 370mA from the Model B+ it's head-turning stuff.

The \$20 credit card-sized PC

The Raspberry Pi Foundation has always been ambitious when it comes to price, and the A+ already just about the cheapest single-board computer it's



HDMI out, and the potential it brings for displaying video to your television, is a strong factor in favour of the Pi.

possible to make. That said, the Foundation hasn't rested on its laurels with the A+. In fact, they ripped up their own '\$25 computer' rule book.

"I had a great conversation with [Google boss] Eric Schmidt last year when Google gave us a large donation to help us distribute Raspberry Pis to school children," says Upton. "We had a really good conversation and we were talking about price and performance among other things and he said to me 'try and be as cheap as possible... try and get as close to free as you can.'

"I found it really inspirational to have someone like Eric not just say 'well done; you've got a great product', but 'why aren't you asking yourself how to be cheaper?'"

It wasn't long until the Foundation ran off the prototypes of the board and he and the team really took to the new design. "It's just a great product," exclaims Upton. "I almost don't care how many of these we sell. The A+ went from something we knew we had to do to something that we're actually really enthusiastic about.

"It gives people a really low-cost way to come and play with Linux and it gives people a low-cost way to get a Raspberry Pi. We still think most people are still going to buy B+s, but it gives people a way to come and join in for the cost of 4 Starbucks coffees."

According to Upton they're really bumping up against the limits of how much you can build a significantly high-tech product for and not have people lose money in the process.

"It's already about the cheapest thing you can get that does this kind of thing by some margin, but we'll never be complacent about that," he concludes. ■