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TECH ADVISOR

DECEMBER 2022

MICROSOFT'S LATEST SURFACE LINE-UP
EVERYTHING YOU NEED TO KNOW

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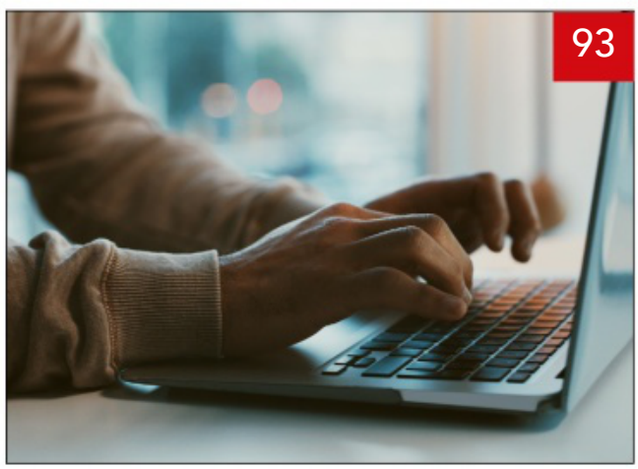
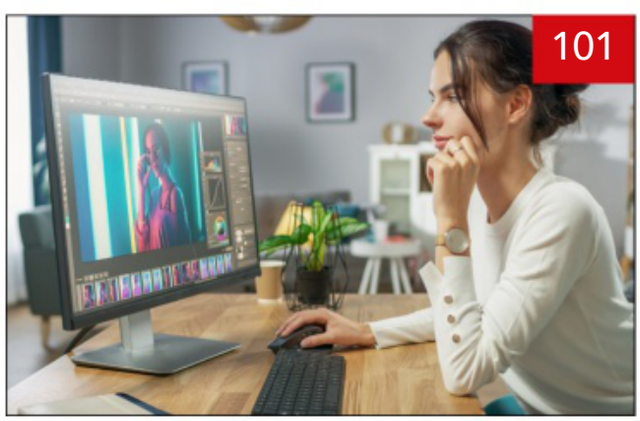


Credit: Getty Images/Delmaine Donson



Credit: Getty Images/gorodenkoff

Credit: Getty Images/jpkirakun

Windows 11 2022 Update bug can slow file downloading by 40%

Local file copies can slow down, too, due to the same 22H2 bug. MARK HACHMAN reports

Downloading and even copying local files may be as much as 40 percent slower using Windows 11's 2022 Update, a Microsoft program manager has confirmed.

Ned Pyle, a principal program manager at Microsoft, wrote that there is a performance regression in Windows 11's 2022 Update (22H2) when copying files from a remote computer using the Server Message Block (SMB) protocol (fave.co/3CoDAkh).

It's not entirely clear whether copying files will slow down when downloading

them from a remote server, or merely accessing them from a remote PC. Microsoft doesn't appear to know quite yet, either. "The issue is not actually in SMB code, so I can't give you an ETA for a permanent fix yet; SMB is just the most likely scenario to be noticed," Pyle wrote. "You could see this behaviour even with local file copies not using SMB. We're working with another team to understand this and get to a permanent solution."

The slowdown appears to manifest when copying down or downloading 'large' (multi-gigabyte) files from a remote machine onto a PC running Windows 11 2022 Update. Files that are copied to another PC not running the Windows 11 2022 Update won't see the slowdown, Pyle wrote.

There is a workaround, though. "[U]se robocopy or xcopy with the /J (unbuffered IO) parameter," Pyle added, which will return performance to the expected levels. Pyle provided an example of the code:

robocopy \\someserver\someshare c:\somefolder somefile.ned /J

In September, Microsoft reported a printer bug (see page 6) that manifested when printers were unable to communicate their advanced features to a host PC, which prevented those features from working. Microsoft blocked users with the issue from upgrading to 22H2.

Windows 11 printer bug blocks 22H2 upgrade, advanced features

Sit and hope Microsoft discovers a fix soon. MARK HACHMAN reports

If you're a Windows 11 user whose been having problems with your printer's more advanced features, Microsoft has some bad news: You may have to wait – on both your printer problems and the upgrade to the Windows 11 2022 Update (22H2).

Microsoft has placed a compatibility hold on certain PCs trying to update to Windows 11 22H2. This is meant to prevent them from receiving the upgrade before the issue resolved, Microsoft says (fave.co/3TbHbc8).

The scenario is a catch-22 of

sorts: certain printers may have issues wirelessly communicating to their host PCs, and informing them of certain advanced features. In this case, Windows controls the printer with the Microsoft IPP Class Driver or Universal Print Class Driver, essentially a generic interface to allow the printer to print. The connectivity issues prevent the host PC from identifying the more advanced features, such as colour printing, dual-sided/duplex printing, and more, and thus those features don't work.

Unfortunately, the inability to print using advanced features can carry over to Windows 11 22H2, hence the hold. The problem is that Microsoft is taking a shotgun approach at the moment: if your PC's printer uses an IPP Class Driver or Universal Print Class Driver, it wont be able to upgrade until Microsoft resolves the issue. Microsoft is trying to narrow down the solution to isolate the printers that fit within the constraints of the problem – generic drivers, inability to communicate, advanced features – but isn't there yet.

If you're desperate to upgrade, you can remove the printer via the Windows Settings menu (Bluetooth & devices > Printers & scanners) and then try to upgrade to Windows 11 22H2.

The caveat: that may not happen right away. Windows 11 22H2 may only appear in Windows Update after 48 hours, which means you'll be left without the ability to print for up to two days. And no, downloading the update manually won't help: "We recommend that you do not attempt to manually upgrade using the Update now button or the Media Creation Tool until this issue has been resolved and the safeguard removed," Microsoft said.

Upgrades always introduce new bugs, but this is an annoying one.

Windows 10 will continue until 2025, Microsoft confirms again

Windows 10, Windows 11 – as long as you're paying Microsoft for subscriptions, it's all the same. MARK HACHMAN reports

Though Microsoft recently released the new Windows 11 2022 Update, there's no obligation to upgrade. It will continue to support Windows 10 through October 2025, company executives said.

"We remain committed to Windows 10 and will continue to service Windows 10 through October of 2025," said John Cable, vice president of program management for Microsoft's Windows Servicing and Delivery, in a briefing with reporters.

Microsoft's Windows 11 2022 Update (previously code-named 'Windows 11 2H22') is a collection of

new features that address many things that many people don't use regularly, including accessibility features, as our Windows 11 2022 Update (22H2) review concludes (see *Tech Advisor*, October 2022). PCs running Windows 10 and Windows 11 are eligible to upgrade to Microsoft's new feature update for free.

If you don't want to upgrade, don't worry. Windows 11 is improving, but Windows 10 is an excellent operating system, which makes it difficult to recommend a move. Microsoft also hasn't set an end date for when the free Windows 11 upgrade will expire, Aaron Woodman, Microsoft's vice president in charge of Windows, said during the briefing.

Technically, the fact that Microsoft will continue to support Windows 10 until 2025 isn't anything new, as Microsoft has been saying this since June 2021. Still, Microsoft then said that Windows 10 would be retired on 14 October, 2025 – even though the original lifespan called for it to end support in 2017. What we've learned is that Microsoft is holding fast to that 2025 deadline.

All this means is that is while Microsoft is encouraging you to move to Windows 11, there's no obligation to right now. Microsoft isn't pulling the rug out from anyone – though it's going to be releasing new Windows 11 features on an accelerated time frame.

Why? Because in April, Microsoft chief executive Satya Nadella told analysts that Windows was the "socket" for subscriptions: to Microsoft 365, Windows 365, Azure, Game Pass Ultimate and the like. As long as you're allocating a portion of your pay check to a recurring subscription, Microsoft's happy.

RIP, Stadia: Google gives up its game streaming ghost

Stadia will shut down in January, giving hardware and software refunds to players. MICHAEL CRIDER reports

Google Stadia, the company's first foray into the gaming market and a potentially earth-shattering approach to high-end game streaming, is dead. Or at least it will be, once 2023 rolls around. In a sombre blog post (fave.co/3RUM7Ry), Stadia's general manager Phil Harrison said that the service will be shutting down on January 18 of next year. Most users will have their hardware and software purchases refunded.

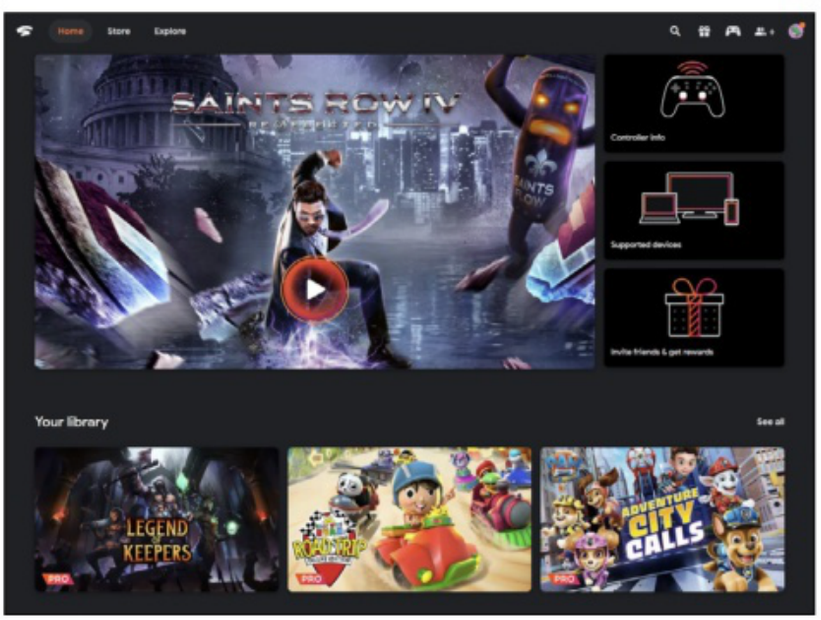
Stadia was formally announced at the Game Developers Conference in 2019, just three and a half years ago, after a few months of testing

the as-yet-unnamed game streaming service. Stadia was introduced with great expectations: PC-game level performance, utilizing the latest in hardware to both enhance graphics and create brand-new kinds of game experiences, all streamed near-instantly to players around the world via Google's massive cloud presence. In a star-studded presentation, the company affirmed a commitment to a new type of platform, utilizing tools like YouTube and Android to make an always-on, always-shareable gaming world.

The reality was a lot more humble. Though Google invested in development and even created its own publishing division, the service launched with only a few major titles, all of which had been available on PC and consoles for some time. Stadia's high-definition, lag-free streaming technology was impressive – it was cited as the best way to play Cyberpunk 2077 due to the game's rocky technical launch. But the service's requirement that users both buy individual games at full price and pay a subscription fee for full performance was a downer even at launch. Combine that with a relatively small game selection and hiccups like limited geographical availability and no iOS support, and it's easy to see why gamers stuck with conventional PC and console systems.

It doesn't help that even Google was soon facing stiff competition. Microsoft's Xbox Game Pass introduced streaming titles for Android and PC shortly after, complete with a Netflix-style all-you-can-play library. Nvidia followed with the final version of GeForce Now, allowing PC gamers to stream the huge Steam and Epic game collections they already owned at no extra cost.

Even before more consumer-friendly options appeared, the stigma of the 'Google Graveyard' – Google's reputation for abandoning its projects, even those popular with millions of



Stadia homepage layout.

users – made tech press wary and consumers hesitant to buy games and streaming hardware. Despite an advertising blitz and support from major publishers like EA, Rockstar and Ubisoft, it seemed almost inevitable that Stadia would make its way to the graveyard too. The writing was on the wall when Google shut down its internal publisher, Stadia Games and Entertainment, without releasing a single exclusive title.

At the very least, Google isn't leaving the players it did manage to attract on the hook for its ambitions. According to Harrison, the company will be refunding "all hardware purchases made through the Google Store, and all game and add-on content purchases made through the Stadia store". Even with a small player base, that will amount to hundreds of millions of dollars. Refunds are planned to be completed by mid-January, just as the service is shutting down.

And what will Google do with all the technology it created for Stadia? Who knows. It's already branched out in offering at least some of it to partners like AT&T. And there's certainly a market for high-end game streaming, if not in Google selling it directly to consumers. Microsoft and Nvidia are still going strong (though Amazon's similar Luna isn't looking too hot), and game developers such as Square Enix and Capcom are using cloud gaming tech to deliver high-end games to the limited mobile hardware of the Nintendo Switch. Google says that it sees "clear opportunities" to apply Stadia tech to YouTube, Google Play, and augmented reality, and to share it with industrial partners.

Google unveils a wave of cloud-powered gaming Chromebooks

Acer, Asus and Lenovo will ship gaming Chromebooks backed by free trials of Amazon Luna+ and GeForce Now. MARK HACHMAN reports

Google is challenging the notion that you can't game on a Chromebook with… cloud gaming Chromebooks.

We've known how to game on a Chromebook for months now, and Google and its partners (Acer, Asus, and Lenovo) have adopted the same approach for Chromebooks: adopt cloud gaming from major providers like Microsoft's Xbox cloud gaming service, Amazon's Luna, and the GeForce Now

service from Nvidia. What Google is doing, though, is taking modern gaming-class hardware – Core i7 chips from Intel, plus 144Hz+ 1440p displays – and combining them together in premium cloud gaming Chromebooks. On a PC, this approach might cost well over £1,000. In a Chromebook, Google executives say they're targeting £700 or so as the maximum – in part because they can exclude a pricey GPU and let the cloud do all the work.

And, boy, is it. The natural question one would ask is why build in such high-end displays if the games being streamed to them are only 1080p. In Nvidia's case that won't be the case: Andrew Fear, director of product management for GeForce Now, said that the service will deliver 1600p game streaming at 120Hz with RTX effects on – and you'll get three months of this service tier, with an Nvidia RTX 3080 backing it up, for free with purchase of a new gaming Chromebook.

Interestingly, Google directly addressed the key weakness of cloud gaming: latency, or the delay during which your inputs need to travel up to the server and be processed. Google says that its platform has been tested with Gamebench to deliver a smooth experience, with measured frame rates of 120fps and a console-class input latency of under 85 milliseconds. According to Fear, Nvidia recently tested Destiny 2, Apex Legends and Fortnite on a GeForce Now data centre with an 8ms ping time and about 60ms of total latency, he said.

Lenovo IdeaPad Gaming Chromebook.

In essence, what Google hopes to offer is a relatively inexpensive Chromebook without the need to manage drivers, OS updates, or game installs – another point of differentiation between a laptop and a Chromebook. "I'm sure many of you hear this: I want a gaming computer, but it's a lot of time and money," said John Maletis, vice president of product management for Google's Chrome OS.

The Acer Chromebook 516GE.

"It's going to feel like you're playing on a local device," Maletis added.

HERE ARE THE THREE NEW GAMING CHROMEBOOKS

Google and its partners promise three new gaming Chromebooks: the $649 (around £585) Acer Chromebook 516GE, the Asus Chromebook Vibe CX55 Flip, and the $599 (around £540) Lenovo IdeaPad Gaming Chromebook.

The Acer Chromebook 516GE's 16-inch display has a resolution of 2,560x1,600, a 16:10 aspect ratio, and a game-ready 120Hz refresh rate. Inside is an Intel Core i7-1260P processor. According to Acer, the 65 watt-hour battery can last for up to nine hours. Hopefully, that number holds true in real world use, as Chromebooks are renowned for their battery life. The 1080p webcam is a nice addition as well, especially if you plan on using this device for video conferencing.

We don't know the price of the Asus Chromebook Vibe CX55 Flip, though we know that it will ship in October too. The Vibe CX55 Flip includes a 15.6-inch full HD (1080p) display with a 144Hz refresh rate, and a choice between a Core i3-1115G4, a Core i5-1135G7, and a Core i7-1165G7 processor inside, along with an option of 8GB to 16GB of LPDDR4X memory and either 128GB, 256GB, or 512GB of SSD storage along with Wi-Fi 6 (802.11ax) connectivity. Asus says that the Vibe CX55 Flip will ship with orange WASD keys to make it easier for (right-handed) game play; there is a narrow number pad on the right of the keyboard for lefty gamers, too.

Lenovo, meanwhile, says that its $599 (around £540) IdeaPad Gaming Chromebook will include a 16-inch, 120Hz 2,560x1,600 display generating 350 nits, with the choice of either a Core i3-1215U or a Core i5-1235U inside. Lenovo will ship the Chromebook with a standard 8GB of LPDDR4X memory, and with a choice of 128GB (eMMC) or either 256GB or 512GB of SSD storage. Key travel

will be 1.5mm, which is unusually comfortable. The Chromebook will ship with Wi-Fi 6E and a variety of USB-C and USB-A ports, with a 71Wh battery that should be good for up to 11 hours, Lenovo says.

Acer, Asus, and Lenovo say that they're shipping a three-month trial of Amazon's Luna+ cloud gaming service, and the Nvidia GeForce Now premium tier. An Xbox Game Pass Ultimate trial (which supports cloud gaming) has not been included, though gamers can add the service via Microsoft's Chromebook-compatible progressive web app (PWA). (Lenovo will ship a three-month trial of Xbox Cloud Gaming, a representative said via email.) Buyers can also receive a complimentary SteelSeries Rival 3 gaming mouse subject to availability, Google says.

The Asus Chromebook Vibe and its highlighted WASD keys.

Naturally, Google won't be providing a customary trial of its own Stadia cloud gaming service. Google has said it will discontinue Stadia (see page 10).

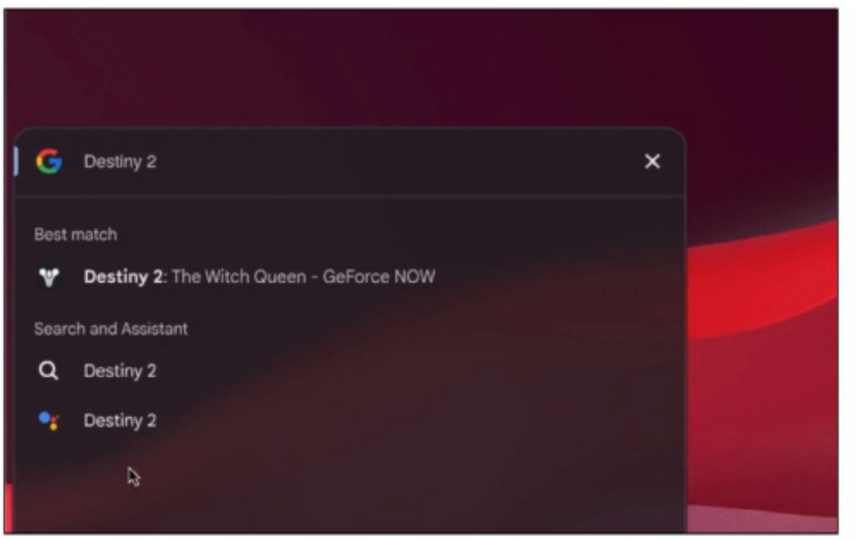
THE DETAILS OF GOOGLE'S CLOUD GAMING PLAN

We've known of Google's plans to build gaming Chromebooks since January, when a special flag was discovered within Chrome OS to support the RGB keyboards that will be included in these gaming Chromebooks. Google's Maletis said that Chrome OS has been tweaked to allow you to search for a game via the Everything search button, and then for the OS to unearth what service you can connect to play it. Eventually, in-progress games will be saved to the taskbar to swap between work and play, he said.

Google also worked with Acer, Corsair, HyperX, Lenovo and SteelSeries to accommodate peripherals like mice, game controllers, and headsets – both to make sure they're compatible with Chromebooks, as well as to make any accessory settings apps compatible with Chrome OS. It doesn't appear that any joysticks

or other flight controllers are supported, however, excluding Microsoft's Flight Simulator from the mix.

While cloud gaming will work on older Chromebooks, or Chromebooks with slower Core i3 chips inside, "the experience is just much, much better on these devices," Maletis said.



Searching for games is being built into Chrome OS.

One important question – how much bandwidth will 1600p/120Hz game streaming require? – doesn't appear to be that much of a concern. According to Fear, that tier will consume about 35Mbits/s, enough for most broadband services. But beware if you have a data cap: at that data rate, that tier would consume 126,000Mbits or 15.75 gigabytes per hour. At Comcast Xfinity's standard capped broadband plan of 1,229GB per month, that equates to a little more than 78 hours of gaming per month.

First look: Microsoft Surface Pro 9

Microsoft's new flagship 2-in-1 is official, and there are some notable changes. ANYRON COPEMAN reports

In 2021, Microsoft released the biggest update to the Surface Pro in many years. The Surface Pro 8 was undoubtedly a success, helping Microsoft to re-establish itself as the 2-in-1 maker to beat.

A year later, you could be forgiven for expecting a very minor update: there's no need to change a winning formula so soon after it was introduced. But while that may look like the case, the new Surface Pro 9 includes several interesting updates that make it worth considering – for the right kind of person.

That includes the option for an ARM-based Qualcomm chip for the first time, bringing 5G to the Surface Pro for the first time and likely replacing the Surface Pro X. But there are also new Intel CPUs

if you'd prefer. Here's everything you need to know.

AVAILABILITY

The Surface Pro 9 is available to preorder now and will be released on 8 November.

PRICE

Core i5, 8GB RAM, 128GB SSD: £1,099
Core i5, 8GB RAM, 256GB SSD: £1,399
Core i7, 16GB RAM, 256GB SSD: £1,599
Core i7, 16GB RAM, 512GB SSD: £1,899
Core i7, 16GB RAM, 1TB SSD: £2,199
Core i7, 32GB RAM, 1TB SSD: £2,599
SQ3, 8GB RAM, 128GB SSD: £1,299
SQ3, 16GB RAM, 256GB SSD: £1,599

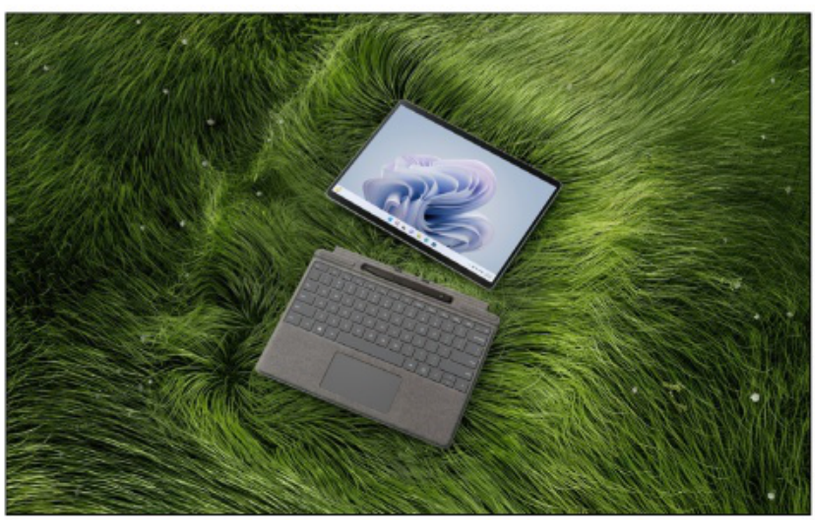
Remember, any price you pay doesn't include the Type Cover once again. This will set you back at least £129, but you can pay as much as £259 for a Signature model with the Slim Pen 2 stylus.

FEATURES

On the face of it, the Surface Pro 9 looks like an iterative update. There are none of the big design changes we saw last year, with most of the focus on improving internals. However, to think of it like that would do a disservice to the updates Microsoft has introduced here, some of which are significant.

Undoubtedly the key differences are under the hood, where you now have a choice of chipset type. The traditional Intel CPU upgrade is here, with a choice of two 12th-gen processors: Core i5-1245U or Core i7-1265U. This should deliver a nice boost to performance, especially when combined with 16- or 32GB of DDR5 RAM rather than the entry-level 8GB.

However, for the first time on the main Surface Pro line, you have the option for an ARM-based processor. This is a Microsoft-branded 'SQ3' chip, but it's based on Qualcomm's Snapdragon 8cx Gen 3. ARM's only previous appearance on Microsoft hardware was the Surface Pro X, so it



For the first time on the main Surface Pro line, you have the option for an ARM-based processor.

looks like this will now be merged with the Pro 9. The two devices now look extremely similar, anyway.

Microsoft describes the SQ3 chip as 'blazing fast', but it remains to be seen how performance will compare to the Intel models – you still get options for 8- or 16GB of RAM here, albeit of the slightly slower DDR4x standard. Most of the early software compatibility issues with ARM devices have been ironed out, and they devices generally deliver impressive battery life.

The Surface Pro 9 is available in a range of colours.

According to Microsoft, you can expect up to 19 hours of "typical device usage" if you opt for an ARM model. That's up from 16 hours on the Surface Pro 8, although 15.5 hours is the claim for the Intel models. As usual, a specific battery capacity hasn't been revealed, but it looks like charging has been downgraded from 65- to 60 watts for some reason.

It's also worth noting that the ARM models are described as the 'Surface Pro with 5G'. Qualcomm's chips have the technology built in, so this is the first time we've seen 5G come to the Surface Pro. Both versions of the Pro 9 have the option for 128GB, 256GB or 1TB SSDs, although there's also an Intel model with 512GB of storage. As before, these are easily removable.

The only other upgrade of note arrives on the built-in webcam. It could already support 1080p video, but moving from a 5Mp to a 10Mp sensor should improve image quality. The 10Mp rear camera is unchanged, as is the rest of the device.

However, the rest of the device is unchanged. That means you still get a 13in 'PixelSense Flow' display – that's LCD rather than OLED. A 2,880x1,920 resolution gives it Microsoft's customary 3:2 aspect ratio. The 120Hz refresh rate is also retained, and this can now automatically adjust to improve power

efficiency. That's thanks to the Dynamic Refresh Rate (DRR) feature now being available within Windows 11.

You also get the same 10Mp rear camera and 5Mp webcam, although these were already among the best you'll find on any tablet.

Ports remain frustratingly limited, with just 2x USB-C (both Thunderbolt 4) alongside the Surface Connect for charging. As you might expect, there is a nano SIM slot on the ARM models.

As you can see from the image above, the Surface Pro Signature Keyboard is also now available in two new colours: Sapphire and Forest.

Despite the high price tag, the Surface Pro 9 could replace the Pro 8 as the best 2-in-1 you can buy. But there's a distinct lack of upgrades on the Surface Laptop 5 that launched alongside it.

First look: Microsoft Surface Laptop 5

Microsoft's latest laptop squeezes new silicon into the same old design. DOMINIC PRESTON reports

Since making its debut a little over five years ago, the Surface Laptop has consistently ranked among the best thin and light laptops you can buy, and Microsoft is no doubt hoping that the new Surface Laptop 5 will be worthy of the same praise.

Announced alongside the Surface Pro 9 and the Studio 2+ all-in-one, it's fair to say that the Laptop 5 is a conservative upgrade, with upgraded Intel processors and Thunderbolt 4 support embedded into a laptop with the same design and displays as last year's model – and indeed as the year before.

Still, even if not much is new, the Surface Laptop 4 was great, and an upgraded take on it sounds like no bad thing. Here's what you need to know.

AVAILABILITY

The Surface Laptop 5 is available to buy now.

PRICE

The Surface Laptop 5 starts from £999, but since it's available in two sizes with different specs, pricing is a little more varied than that.

The £999 start price is for the smaller 13.5-inch model, which goes up to £1,699 when fully specified with an i7 processor, 16GB RAM, and 512GB storage. If you prefer a larger laptop, the 15-inch model starts from £1,299, but goes up to a whopping £2,399 if you opt for an i7, 32GB RAM, and full 1TB of storage.

The start prices are a little higher than last year's, but that's in part because Microsoft is no longer offering cheaper entry-level AMD models. Look further back, and the pricing is roughly in line with the Laptop 2 and Laptop 3:

Surface Laptop: From £649
Surface Laptop 2: From £979
Surface Laptop 3: From £999 (13.5-inch); £1,199 (15-inch)
Surface Laptop 4: From £799 (13.5-inch); £1,299 (15-inch)
Surface Laptop 5: From £999 (13.5-inch); £1,299 (15-inch)

FEATURES

As mentioned above, the Laptop 5 is a pretty cautious upgrade from Microsoft. At a glance, it looks pretty identical to the Surface Laptop 3 and 4, and comes in the same pair of display sizes: 13.5- and 15-inch. The overall design is the same, for both good and bad. It's slim and lightweight, but still includes a surprisingly thick bezel around the display on either model.

The biggest design change is the introduction of a new colour: Sage green. The larger 15-inch model is available in familiar Platinum or Matt

The Surface Laptop 5 is available in two sizes: 13.5- and 15 inches.

Black, while the smaller 13.5 variant adds Sandstone and the new Sage colour options. It's also worth noting that the Platinum 13.5in comes with Microsoft's familiar 'Alcantara' fabric lining on the inside of the laptop, but this isn't included on other colours – or on the larger laptop.

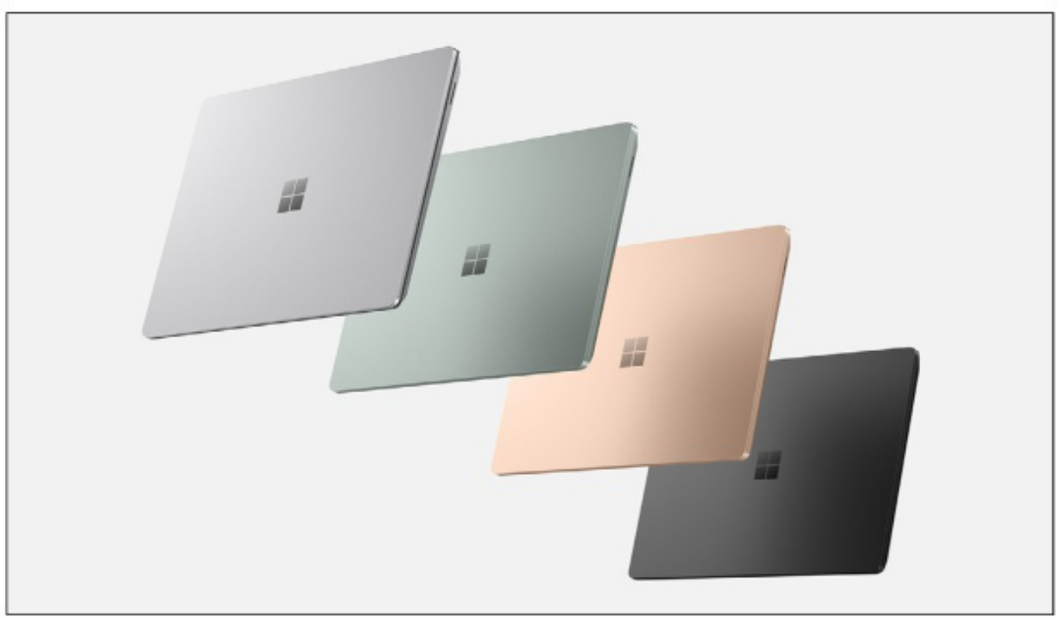
Despite early rumours of a bump to a 120Hz refresh rate, Microsoft has also kept its display tech essentially the same. Both laptops use Microsoft's LCD 'PixelSense' touchscreens, with a resolution of 2,256x1,504 in the smaller model, and 2,496x1,664 in the larger – with a matching pixel density of 201ppi in either case. Refresh rate hasn't increased, but the company has added in support for Dolby Vision IQ tech, which was previously exclusive to the high-end Surface Laptop Studio. The screen supports the Surface Pen stylus, but this is sold separately.

There has at least been a bump in chipsets, with support this year for Intel's 12th-gen U-series processors. The 13.5in model gives you a choice of i5 or i7 chips (the i5-1235U or i7-1255U, to be precise), while the 15-inch is i7-only (the same i7-1255U).

There are two quick anomalies to clarify here. The first is that while last year Microsoft offered a choice between Intel and AMD Ryzen chips, this year it seems to be Intel-only so far at least.

The second thing to note is that those chip numbers are for the consumer models. If you buy a commercial/enterprise model it will come with the very slightly faster i5-1245U or i7-1265U chips.

As before there are no discrete graphics card options, but the integrated Intel Xe graphics should be



The biggest design change is the introduction of a new colour: Sage green.

Both laptops use Microsoft's LCD 'PixelSense' touchscreens.

sufficient for most use cases. LPDDR5x RAM is available in 8GB, 16GB, or 32GB configurations, while the removable SSD storage is either 256GB, 512GB, or 1TB – though as always, the exact configurations available will vary between countries.

Microsoft's unpopular Surface Connect port is still here for charging – though at least this guarantees compatibility with any old accessories you have around. It's joined by a 3.5mm headphone jack, a USB-A 3.1 port, and a single USB-C port – though this now supports USB 4.0 and Thunderbolt 4, giving you the latest connectivity at least. Wireless connectivity comes from Wi-Fi 6 and Bluetooth 5.1.

The same 720p webcam also returns, driving Windows Hello facial recognition. Dual far-field mics should help with audio on video calls, while Dolby Atmos support is included with the speakers.

Battery life has been slightly improved, but not by much, with a promise of up to 18 hours of 'typical device usage' on the 13.5-inch model and up to 17 hours on the larger one. That's similar to last year's model, so no big change, but since battery life was already great we can't complain much.

Charging is faster too – Microsoft says that the included 60-watt charger can deliver up to 50 percent of battery back in just half an hour plugged in.

Of course, it's no surprise that the Laptop 5 arrives with Windows 11 running out of the box.

First look: Microsoft Surface Studio 2+

No, there's no standalone display option for the Microsoft Surface Studio 2+, but Thunderbolt is included instead. MARK HACHMAN reports

Microsoft's Surface Studio 2+ represents the rebirth of Microsoft's iconic, massive touchscreen all-in-one PC – with an Nvidia GeForce RTX 3060 under the hood alongside an 11th-gen Core chip.

Otherwise, little has changed from its predecessor. The focal point of the Surface Studio 2+ remains its massive 28-inch (4,500x3,000) touch display, which absolutely commands attention as it rises majestically from its undersized base via a 'zero gravity hinge'. Nevertheless, enthusiasts are likely to be disappointed by two key facts of this launch: No, there's no standalone Studio monitor yet, and Microsoft has continued to use mobile components inside the Surface Studio 2+.

So what's changed? Microsoft has made the leap to a semi-modern mobile Core processor, though the 11th-gen

Core (as opposed to the modern, shipping 12th-gen 'Alder Lake' chip) is a bit of a head-scratcher. Nvidia's RTX 3060 GPU, however, makes more sense.

Essentially, the Surface Studio 2+ is a small step up from the Surface Laptop Studio Microsoft debuted in 2021, which also emphasized its unique pull-forward display. Is it worth the starting price of £4,699.99?

FEATURES

Display: 28 inches (4,500x3,000; 192ppi) sRGB/Vivid colour profiles with Dolby Vision; 10-point multi-touch PixelSense, Gorilla Glass 3
Processor: Core i7-11370H
Graphics: Nvidia RTX 3060 with 6GB GDDR6 VRAM
Memory: 32GB DDR4
Storage: 1TB SSD
Ports: 3 USB-C (Thunderbolt 4) w/ support for three external 4K60 displays, 3 USB-A (5Gbps), 1 gigabit Ethernet port, 3.5mm headphone jack
Cameras: Front: 1080p, Windows Hello-compatible
Audio: Dual far-field mics, dual stereo speakers with Dolby Atmos
Wireless: Wi-Fi 6 (802.11ax), Bluetooth 5.1
Operating system: Windows 11 Pro
Dimensions: 637.35x 438.90x 12.5mm; 9.56kg
Accessories: Surface Pen, Surface Keyboard, Surface Mouse (all in box); Surface Dial (optional)
Price: From £4,699.99

Some of the upgrades to the Surface Studio 2+ are in line with Microsoft's other Surface devices. For example, though there's no hint of a standalone Surface Studio display, the inclusion of Thunderbolt 4 means that a Surface Studio 2+ buyer will have the option of adding an additional three displays – though at a 'paltry' 4K (3,840x2,160) resolution, is it even worth it?

However, Microsoft's Surface Studio 2+ does not ship with a 120Hz-capable display, perhaps an odd choice when Microsoft originally intended 120Hz to smooth and improve the digital inking experience, which is part and parcel of the Surface Studio line-up.

Microsoft is also making the Surface Studio 2+ far more manageable, in that virtually everything from the display to the PSU, thermals, motherboard, and hinge cover are now replaceable through a Surface Commercial Authorized Device Reseller. It's doubtful that the Studio could be updated in this way, but we can dream.

First look: Pixel 7 and 7 Pro

Google's latest flagships are finally here. CHRIS MARTIN reports

The Pixel 7 range arrives at a time when smartphone innovation leaves a lot to be desired and many question the relevance of the Pixel's existence. Still, these are the benchmark for third-party Android phone makers and has plenty of fans around the world – including me.

At the same prices as their predecessors, the Pixel 7 phones come with advancements such as Google's new Tensor G2 processor, more eco-friendly designs, better cameras, and more.

RELEASE DATE

Both phones are available to order now from fave.co/3RJtzno.

PRICE

Google has kept the pricing the same as last year's Pixel 6 range meaning prices start at £599. Here's the full pricing:

Pixel 7
128GB: £599
256GB: £699

Pixel 7 Pro
128GB: £849
256GB: £949
512GB: $1,099 (US only)

NEW FEATURES
As mentioned at the top, the phones this year aren't a huge jump from the Pixel 6 series. The same is true of the iPhone 14 range, but there are new features and developments to talk about here so let's look at the main ones.

Design
Although the Pixel 7 phones look similar to last year, there are a few tweaks worth noting. Starting with the most obvious: different colours.

Both come in Obsidian (black) and Snow (white), then the third option is different, so the Pixel 7 comes in Lemongrass and the 7 Pro has a less garish Hazel.

Google has also gone a bit more eco-friendly as both devices have an aluminium enclosure 'made of 100 percent recycled content'.

The Pixel 7 is also easier to handle than the 6.4in Pixel 6 thanks to a slightly smaller 6.3in display and smaller bezels. It's a deliberate effort to make the phone more compact and also results in it being lighter than the Pixel 6 by 10g.

Google has also put Gorilla Glass Victus on the back as well as the front, whereas the Pixel 6 had Gorilla Glass 6 as the rear cover.

Tensor G2
As expected, the Pixel 7 phones come with the new generation of Google's own Tensor processor which arrived with the Pixel 6.

Google told us: "We've improved almost every major subsystem in the chip, and we've designed them to work really well together to handle the nuanced and complex nature of our

The Pixel 7 is available in a range of colours

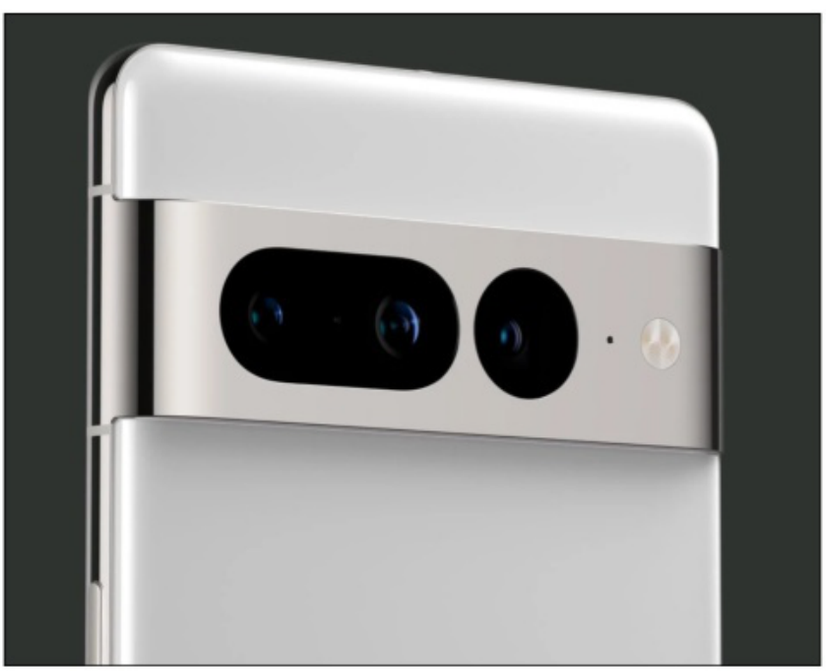
software and machine learning."

As well as improved performance – albeit small since the main upgrade here is from Cortex-A76 to A78 so uses the older Armv8 architecture – there are some practical results of the new chip including suggested emojis for Assistant voice typing which, for text, is now available in French, Italian and Spanish.

You can also transcribe audio messages on Google's Messages app and later in 2022 Clear Calling will use Google's machine learning to do things such as minimize wind and traffic noise and enhance the caller's voice.

These are largely thanks to a new on-board TPU (Tensor Processing Unit), but there are also security improvements thanks to the coupled Titan M2 security chip (the same as the Pixel 6), which allows for Face Unlock 'thanks to advanced machine learning models for face recognition'.

Furthermore, Pixel 7 owners will get VPN by Google One at no extra cost later this year.



The Pixel 7 Pro's cameras have been improved.

Photography

The other main area of development that Google wants to highlight in the Pixel 7 phones is better cameras.

First up is Super Res Zoom, which now offers up to 8x on the Pixel 7, and Pixel Pro Zoom up to 30x on the Pixel 7 Pro (previously Super Res Zoom 7x and 20x respectively). Google adds that: "We've also achieved optical quality similar to a dedicated 2x telephoto lens for Pixel 7 and a 10x telephoto lens for Pixel 7 Pro."

The 7 Pro also exclusively gets Macro Focus, which Google says delivers Pixel HDR+ photo quality from as close as 3m away from the subject.

Another new feature is Guided Frame, which helps blind or low-vision users capture selfies with a combination of audio guidance, high-contrast

visual animations and haptic feedback. Videos can also be shot in 10-bit HDR while Cinematic Blur gives footage a shallow depth of field.

Photo Unblur is a Google Photos feature coming to Pixel 7 phones first. And Google has also updated the Real Tone algorithm having trained it with more than 10,000 portraits to ensure skin tone is as accurate as possible.

Finally, Night Sight now needs only half the amount of exposure time it previously did to capture detailed images in low-light situations.

Most of this is on the software side as the Pixel 7 and 7 Pro have the same cameras as last year. So they share a 50Mp Octa PD Quad Bayer wide camera as the main camera along with a 12Mp wide-angle option, then the Pro additionally has a 48Mp telephoto camera.

However, the selfie camera on both phones has been bumped from 8- to 10.8Mp with a wider field of view.

SPECIFICATIONS

Pixel 7

- 6.3in (2,400x1,080; 416ppi) AMOLED, 90Hz, HDR10+ display
- Android 13
- Google Tensor G2 (4nm) processor
- Octa-core (2x 2.85GHz Cortex-X1, 2x 2.35GHz Cortex-A78, 4x 1.8GHz Cortex-A55) CPU
- Mali-G710 MC10 GPU
- 8GB RAM
- 128GB/256GB storage
- Dual rear-facing cameras: 50Mp, f/1.9, 25mm (wide), 1/1.31in, 1.2µm, multi-directional PDAF, Laser AF, OIS; 12Mp, f/2.2, 114-degree (ultra-wide), 1/2.9in, 1.25µm
- Selfie camera: 10.8Mp, f/2.2, 21mm (ultra-wide), 1/3.1in, 1.22µm
- Wi-Fi 802.11 a/b/g/n/ac/6e, tri-band, Wi-Fi Direct, hotspot
- Bluetooth 5.2, A2DP, LE, aptX HD
- GPS with dual-band A-GPS, GLONASS, GALILEO, QZSS, BDS
- NFC
- USB Type-C 3.2
- Fingerprint scanner (under display, optical)`
- Non-removable 4,355mAh lithium-polymer battery
- 155.6x73.2x8.7mm
- 197g

Pixel 7 Pro

- 6.7in (3,120x1,440; 512ppi) LTPO AMOLED, 120Hz, HDR10+ display
- Android 13
- Google Tensor G2 (4nm) processor
- Octa-core (2x 2.85GHz Cortex-X1, 2x 2.35GHz Cortex-A78, 4x 1.8GHz Cortex-A55) CPU
- Mali-G710 MC10 GPU

- 12GB RAM
- 128GB/256GB/512GB storage
- Three rear-facing cameras: 50Mp, f/1.9, 25mm (wide), 1/1.31in, 1.2µm, multi-directional PDAF, Laser AF, OIS; 48Mp, f/3.5, 120mm (telephoto), 1/2.55in, 0.7µm, multi-directional PDAF, OIS, 5x optical zoom; 12Mp, f/2.2, 126-degree (ultra-wide), 1/2.9in, 1.25µm, AF
- Selfie camera: 10.8Mp, f/2.2, 21mm (ultra-wide), 1/3.1in, 1.22µm
- Wi-Fi 802.11 a/b/g/n/ac/6e, tri-band, Wi-Fi Direct, hotspot
- Bluetooth 5.2, A2DP, LE, aptX HD
- GPS with dual-band A-GPS, GLONASS, GALILEO, QZSS, BDS
- NFC
- USB Type-C 3.2
- Fingerprint scanner (under display, optical)
- Non-removable 5,000mAh lithium-polymer battery
- 162.9x76.6x8.9mm
- 212g

Opinion: The Pixel 7 shows yearly updates are unsustainable

New smartphones are good, but new smartphones are not new. HENRY BURRELL reports

The thing that struck me most watching Google's launch of the Pixel 7 was just how much the phone is a repackaged Pixel 6.

Sure, the design has been tweaked slightly, and the display is a smidge smaller at 6.3in rather than 6.4in, but otherwise this is an identical device to last year's.

The Pixel 7 has Android 13 software, the same 128GB storage, same 8GB of RAM, and same camera hardware as the Pixel 6 down to the very last spec.

The Pixel 7 Pro is a similar story, with

the same screen size and core specs as the Pixel 6 Pro. A new macro mode is nice, but unremarkable.

Google might tell you the Tensor G2 processor is a big upgrade, but it won't be for most people.

The same applies to the iPhone 14 I recently reviewed. It is physically indistinguishable from the iPhone 13 and in day-to-day use has the same performance and features.

Reviewing the phone in isolation, you'd have to conclude that it's one of the best phones you can buy. But it is the tiniest annual update I've ever seen – Apple's addition of things like Photonic Engine and Action Mode are not reasons to upgrade from an iPhone 13.

These two tech giants – along with rivals like Samsung, Xiaomi, and Oppo – could be leading the smartphone industry in a different way, though.

What if they broke the repetitive yearly flagship update cycle?

Long gone are the glory days of yearly changes in smartphone form factor such as LG's move from curved back G4 to modular G5 or when Google itself embraced design diversity by letting different manufacturers create its Nexus phones annually.

Today, not only do the new Pixels look like last year's phones, but they are also pretty much the same on the inside too.

WHAT NEEDS TO CHANGE?

Despite the smartphone stasis we're experiencing this year, I'm sure our upcoming reviews of the Pixel 7 and 7 Pro will be positive. We have to consider the merits of the product in hand, rather than focus entirely on how it compares to its predecessor. Not everyone reading those reviews already owns last year's device.

They may be coming from a phone several years old. Most people – rightly – no longer update their phone every year, or even every two years. Research house Strategy Analytics forecasts the global smartphone replacement cycle will shorten to 39 months by 2026.

At the end of 2021, it was at a record high of 43 months. That's nearly four years between upgrades for most people.

This begs the question: is it time phone manufacturers consider breaking their yearly release cycles?

If you're using a four-year-old Pixel 3 right now, the Pixel 7 will be a huge update giving you better display, cameras, and battery life.

If you're using a one-year-old Pixel 6, don't even think about it. Save your money.

If you own a Pixel 6 there's very little reason to upgrade.

Phone manufacturers say they are being greener by not putting a charger in the box with their most expensive phones anymore. It's one thing to do that or ship the phones in smaller boxes made from recycled materials.

What about not shipping a new phone at all? That is the most sustainable approach.

MORE NEEDS TO BE DONE

The biggest phone companies are a long way off sustainably sourcing the materials for the actual phones themselves. Only start-up Fairphone claims to have an ethically fair supply chain.

Google and Apple have the power to affect change. If they wanted to have a more sustainable and ethically sound supply chain, they could.

They could both decide to release new Pixels and iPhones every two years. Apple in particular has the power to lead the industry in this way – other brands started taking the charger out the box after Apple did it first.

The reality is that both companies want more profit. And when it comes to phones, new models every year is the best way to make money, even if they're not really new at all.

If you want to do something about this, the best thing to do, dear reader, is to hold onto your phone for a bit longer than you might have done in the past.

And, of course, you could consider buying a refurbished phone rather than a new one. There should be some sweet deals on the Pixel 6 pretty soon, too.

Lenovo IdeaPad 5 Pro (2022)

Price: £999 from fave.co/3yuFDBZ ★★★★☆

The Lenovo IdeaPad 5 Pro proves that gaming and entertainment laptops don't have to be expensive – this rig costs £999, with cheaper models available. You get a decent amount of machine for your money. It has a 16in, high-resolution screen, Nvidia GeForce RTX graphics and a decent AMD Ryzen processor.

Lenovo's laptop isn't the only affordable entertainment machine on the market, though. Laptops from Asus, MSI and Dell all offer comparable specifications at similar prices, and two of those occupy long-term positions on our best cheap gaming laptop chart – so the Lenovo IdeaPad has strong competition.

DESIGN

The IdeaPad is designed for everyday use alongside gaming, so its aesthetic is more restrained than many rivals – and for many buyers, that's a good thing. The IdeaPad has a sleek gunmetal exterior with slim bezels and no RGB LEDs, so it'll fit into any situation.

The IdeaPad is designed for everyday use alongside gaming, so its aesthetic is more restrained than many rivals.

Build quality is consistently good, which isn't always a given at this price. That's all the more impressive when you consider the Lenovo's modest 1.9kg weight and slim 18mm body.

On the right-hand edge, you'll find two USB-C 3.2 Gen 1 ports and an SD card reader, and the left-hand side deploys a Type-C connection with charging and an HDMI 1.4b output. There's also a 720p webcam with Windows Hello for face log-in. On the inside, there's dual-band Wi-Fi 6 and Bluetooth 5.1, but no Gigabit Ethernet. That's good connectivity, although bear in mind that the Lenovo has no Thunderbolt support and no fingerprint reader.

Despite those omissions, the Lenovo IdeaPad 5 Pro competes well against its rivals. It's slimmer and sturdier than the MSI GF63, and that laptop has no card reader – but it does have wired Internet and newer HDMI if those are important to you.

The Asus TUF Gaming A15 and Dell G5 15 Gaming are both larger than the Lenovo, and both have wired Internet – but the former suffers with mediocre build quality, and the latter has slower USB ports.

KEYBOARD

The keyboard is sensible rather than spectacular. The layout is good; it's got a number pad, separated cursor buttons and large keys, which make up for the lack of RGB LEDs.

The buttons have reasonable speed, so they're fine for gaming and typing, but they don't have the crisp action that you'll find on the best gaming laptops.

The keyboard is sensible rather than spectacular.

If that's of interest, the Asus and MSI rigs are both better.

The trackpad, meanwhile, feels hollow and shallow, so it's not satisfying but fine for everyday basic use but nothing more. And because the pad sits on the left-hand side of the wrist rest, it's too easy to trigger its surface during gameplay. A USB mouse will be far better for games and for efficient working.

DISPLAY

The Lenovo's display is more immersive than the screens of rivals – and not just because of its 16in size, either. This panel has a 16:10 aspect ratio for extra height, and its 2,560x1,600 resolution outstrips the competition, too.

The contrast ratio of 1,293:1 beats every rival and provides lashings of punch and depth, and the display's delta E of 1.49 and sRGB coverage level of 97.7 percent are similarly impressive. They mean that every colour needed by games will be rendered accurately so games look excellent on the IdeaPad.

The colour temperature of 7165K is slightly cool, which means the display misses a little vibrancy but it's not a dealbreaker. And while the brightness level of 362 nits isn't quite high enough for decent outdoor use, that's not a big issue either.

The 120Hz refresh rate isn't brilliant. It's fine for single-player gaming, but lower than the rates on rivals and not high enough to satisfy anyone interested in eSports.

If refresh rate does concern you, then the Asus TUF Gaming A15 is your best alternative. Its 2,560x1,440 resolution is marginally lower than the Lenovo's figure, but it has good quality and it runs at 165Hz.

The speakers underwhelm here; they combine tinny high-end noises with clunky, overbearing bass. A headset

or external speakers are recommended to enjoy media and, of course, for a better gaming experience.

The Lenovo's display is more immersive than the screens of rivals.

PERFORMANCE

The IdeaPad 5 Pro pairs an Nvidia GeForce RTX 3050 graphics core with an AMD Ryzen 7 5800H processor. The GPU is a modest chip with 4GB of memory, while the processor is a reasonable octa-core part with a 4.4GHz top speed. Elsewhere there's 16GB of dual-channel memory and a rapid 1TB SSD.

This mid-range specification delivered middling benchmark results. The AMD chip delivered a Geekbench multi-core score of 7,149. That's easily ahead of the i5-11400H inside the MSI GF63, and it's enough power to tackle everyday computing, loads of browser tabs and mainstream creative work like photo-editing.

That's great, but more processing power is easy to find: the TUF Gaming A15 includes AMD's newer Ryzen 7 6800H and the Dell is now available with that AMD chip and Intel 12th-Gen silicon. They're all much faster and better for creative workloads.

You might encounter some gaming issues on this laptop, too. In Cyberpunk 2077, for instance, it only achieved a just-playable frame rate of 30fps at 2,560x1,600 when I used the game's 'Low' graphics settings. At 1080p and 'Medium' settings, the game hit a reasonable 39fps pace, but you lose out on sharpness by dropping the resolution.

Happily, the situation was better in less-demanding titles. The laptop hit 36fps in Far Cry New Dawn's Ultra settings at native resolution, and it played Tom Clancy's Rainbow Six Siege at 93fps.

Geekbench 5 (multi-core)

Lenovo IdeaPad 5 Pro (2022): 7,149
MSI GF63 Thin (2022): 5,366
Asus TUF A15 (2022): 9,946

Acer Nitro 5 (2021): 8,065
Dell G5 15 Gaming (2020): 6,377

Battery life

Lenovo IdeaPad 5 Pro (2022): 9 hours
MSI GF63 Thin (2022): 3 hours, 7 minutes
Asus TUF A15 (2022): 10 hours, 53 minutes
Acer Nitro 5 (2021): 4 hours, 55 minutes
Dell G5 15 Gaming (2020): 8 hours, 13 minutes

It's a mixed bag when it comes to gaming. If you want to play mainstream titles and eSports games – and if you're happy to reduce resolution and graphics settings – then you'll be fine. But if you'd like a laptop that can tackle top titles at 60fps and without compromise then you'll have to look elsewhere, like to the Asus and Dell machines with their RTX 3060 GPUs.

The IdeaPad 5 Pro was a bit inconsistent in thermal tests, too, although it is a pretty quiet notebook. No matter the task, the IdeaPad was quieter than most gaming laptops and in many situations you just won't notice it.

Negatively, though, a good gaming session makes the metal above the keyboard incredibly hot and the underside isn't far behind. That's not a dealbreaker because this is the kind of laptop you'll usually use at a desk, but it's an unfortunate side-affect of a slim design.

If there's one area where the Lenovo impresses it's battery life. During a work test, it lasted for five hours and seven minutes, and it ran for more than nine hours in a video test – so if you're using this laptop for everyday work tasks you'll easily see lunchtime. That's a far better result than the MSI and Asus machines and on par with the Dell.

The IdeaPad only handled ninety minutes of gaming, but that's no surprise and no worse than any other entertainment laptop.

The IdeaPad has decent connectivity, and its large display delivers superb quality.

VERDICT

It's tricky to pick the best-value option: while some of Lenovo's rivals serve up faster CPUs and the RTX 3060 graphics core at similar prices, they're often heavier, thicker and weaker than the IdeaPad. Indeed, the IdeaPad takes a different approach by delivering a chassis that's slimmer, lighter and more mature than most of its contemporaries. It's robust, it has decent connectivity, and its large display delivers superb quality. It's quiet, too, and has decent battery life outside of games.

It's not all good news, though. The processor offers mid-range pace, but nothing more, and the graphics core can't run top games at top settings. The keyboard is soft and the speakers aren't great.

Don't write off the Lenovo IdeaPad 5 Pro, though, it's skills just lie in different areas than others and makes a better choice for those that want a more portable device that's also nicely suited to work as well as play. Mike Jennings

SPECIFICATIONS

- 16in (2,560x1600) IPS LCD
- Windows 11 Home
- AMD Ryzen 7 5800H processor
- Nvidia GeForce RTX 3050 GPU
- 16GB RAM
- 512GB SSD
- 1x USB Type-C
- 2x USB 3.2
- 1x HDMI 2.0
- Full HD 1080p IR and ToF webcam (Windows Hello compatible)
- Wi-Fi 6 802.11ax
- Bluetooth 5.2
- 4-cell Lithium-polymer battery
- 356x251x16.9mm
- 1.9kg

Asus ZenBook S 13 OLED (2022)

Price: £1,299 from fave.co/3rUOQQl ★★★★½

It's easy enough to find a small laptop, but the Asus ZenBook S 13 OLED tries to go beyond the norm with a sensational OLED display and a lightweight design.

Beyond the eye-searing screen and svelte body, there's plenty to like. The ZenBook deploys a factory-fresh AMD Ryzen processor and has long battery life, too. And, at a starting price of £1,299 in the UK, the price is not outrageous either.

That sounds great, but the ZenBook S will have to perform if it wants to outpace the competition: there's the dominant Apple MacBook Air and its updated M2 processor, and Dell's XPS 13 and XPS 13 Plus are both impressive.

DESIGN

The ZenBook S 13 OLED is physically impressive. On the scales, this laptop only weighs 1.09kg, so it undercuts all of its rivals – even if the MacBook Air and standard XPS 13 are a bit slimmer.

Asus's notebook has good build quality, too, with pleasing strength throughout the magnesium-aluminium alloy casing. Combine that with its MIL-STD 810H certification and you've got a laptop that'll easily withstand daily commuter life. It looks good, too, with a matte metal chassis and a bright chrome hinge.

I've reviewed the Aqua Celadon model, which has a slight tinge of green, and it's also sold in shades of blue, white and beige. In this respect, its four colour options outstrip both competitors.

The ZenBook's right-hand edge has two USB-C ports with power delivery, and there's another on the left. One of those powers the laptop, and Asus includes a full-size USB adapter. The AMD internals means no Thunderbolt 4 support, which you will find on the Apple and Dell laptops.

The ZenBook has a 1080p webcam without Windows Hello sign-in, but you get biometrics from the fingerprint reader in the power button.

KEYBOARD

Cleverly, Asus has made the power button shorter and more resistant than the rest of the other keys, so it's harder to accidentally hit while typing. Elsewhere the layout is conventional, and the keyboard has a three-stage white backlight.

Asus hasn't made any big changes on this generation of ZenBook keyboard, but that's no bad thing – the buttons still have solid travel and an action that provides fast, consistent typing. This keyboard easily matches any rival.

The trackpad is solid, too: large, smooth and with a responsive, shallow clicking motion. It's usable

The keyboard has a conventional layout.

for most tasks, although you'll want the USB-A adapter and a proper mouse for precise work.

The display has a stellar specification.

DISPLAY

The display has a stellar specification. It's a 13.3in OLED display with a 16:10 aspect ratio and a resolution of 2880 x 1800. That's more pixels than the MacBook Air and a higher resolution than the XPS 13 unless you pay for its pricey 4K option. The ZenBook's panel is a touchscreen, and a stylus is included in the box to boot – handy for creative work.

Unsurprisingly, the Asus exhibits sensational contrast: the OLED technology means that dark areas have incredible depth, and colours pop from the panel with impressive vibrancy.

There's plenty to like about those colours, too. The screen renders 100 percent of the sRGB gamut at a monster 161.7 percent volume, and it produces 92.8 percent of the Adobe RGB gamut and 97.9 percent of the DCI-P3 space with volumes beyond 100 percent. Wow.

They're huge figures and mean that this screen produces almost every shade needed by creative tasks, including those that need the Adobe RGB and HDR spaces. And while the Delta E of 3.12 could be a bit better – and you'll need it to be more accurate if you're a really serious creative – it's still good enough to ensure accuracy in most workloads.

The only notable issue comes in the brightness department. While this display can reach 550 nits in HDR mode, in SDR mode it tops out at 357 nits – fine for indoor use, but not quite bright enough for consistent outdoor usage. Still, that's the only complaint I've got about a superb screen. The OLED panel provides a broad, accurate colour gamut, incredible vibrancy and a high resolution. Only the Dell XPS 13 Plus and its optional OLED display can compete.

While this display is undoubtedly

bolder than the IPS panels in the Apple and the standard XPS 13, you may still want to stick with those – they provide more muted, realistic colours. For lots of work situations, that remains an advantage so it depends on your personal usage and taste.

The speakers, meanwhile, offer decent volume and reasonable mid-range clarity, but there's a severe lack of bass so they're only suitable for background media use.

PERFORMANCE

AMD's new Ryzen 7 6800U takes centre stage in the ZenBook S 13 OLED. It uses an updated version of the Zen 3 architecture that's been around since 2021, and this low-power processor has eight multi-threaded cores and a solid top speed of 4.7GHz.

Alongside the processing cores, you'll find AMD Radeon integrated graphics, 16GB of dual-channel LPDDR5 memory and a fast 512GB SSD. That's great, and on the inside users can reach the SSD – but memory upgrades aren't possible because the RAM is soldered to the motherboard. Connectivity comes from dual-band Wi-Fi 6E and Bluetooth 5.2, but there's no Ethernet for wired Internet as per most modern laptops.

AMD's updated processor helps the Asus slot between its rivals. In Geekbench's multi-core test the ZenBook returned a result of 7,714. That's a solid score, and twice as good as the Intel Core i7-1250U that you'll find inside the Dell XPS 13 – but it's still around 1,000 points behind the Apple M2 processor inside the latest MacBook Air.

There's another consideration from Dell's line-up, too: the XPS 13 Plus. If you configure that rig with a Core i7-1260P processor, that chip will outpace the AMD Ryzen 7 6800U inside the ZenBook. In real-world terms, there's enough grunt here to handle multi-tasking, any office app and mainstream content creation. It's certainly a better productivity portable than the Dell XPS 13, even if it's a little slower than the XPS 13 Plus and the MacBook Air.

There's some evidence that the Ryzen chip doesn't run at its peak capacity, which is no shock from a slim laptop. The CPU rarely exceeded speeds of 2.7GHz in tough work tests, and the metal above the keyboard and on the underside became extremely warm after long-term work benchmarks.

Geekbench 5 (multi-core)

Asus ZenBook S 13 OLED (2022): 7,714
Huawei MateBook X Pro (2022): 5,834
Microsoft Surface Laptop 4 (2021): 5,569

Dell XPS 13 (late 2020): 5,411
Apple MacBook Air M2 (2022): 8,959

PCMark 10

Asus ZenBook S 13 OLED (2022): 5,738
Huawei MateBook X Pro (2022): 5,345
Microsoft Surface Laptop 4 (2021): 4,735
Dell XPS 13 (late 2020): 4,752

The Asus has a great screen, solid internals and lengthy battery life.

3DMark (Night Raid)

Asus ZenBook S 13 OLED (2022): 20,532
Huawei MateBook X Pro (2022): 16,946
Microsoft Surface Laptop 4 (2021): 16,377

Battery life

Asus ZenBook S 13 OLED (2022): 17 hours, 55 minutes
Huawei MateBook X Pro (2022): 9 hours, 9 minutes
Microsoft Surface Laptop 4 (2021): 16 hours
Dell XPS 13 (late 2020): 10 hours, 4 minutes
Apple MacBook Air M2 (2022): 17 hours, 30 minutes

Charge in 30 minutes

Asus ZenBook S 13 OLED (2022): 37%
Huawei MateBook X Pro (2022): 59%
Microsoft Surface Laptop 4 (2021): 31%
Apple MacBook Air M2 (2022): 30%

That's not a deal-breaking flaw, especially if you need a laptop for short bursts of activity. I'd also recommend the Balanced operating mode, which does a great job of cutting back on temperatures while only slightly reducing performance levels so you're still left with enough ability for multi-tasking and photo-editing.

The ZenBook fights back in battery life tests. It lasted a monster 17 hours 55 minutes in our usual video playback test, which is a couple of hours beyond

the Dell and Apple notebooks. If you want to use everyday work applications, you'll still get ten hours from this rig. It's an excellent choice if you want a laptop for all-day working – and if you're careful with your applications and screen brightness, it'll handle the evening too.

VERDICT

The Asus ZenBook S 13 OLED lives up to its name – its OLED display is stunning, with huge quality and clarity. Beyond that, this laptop is slim, light and has a great keyboard. Its battery life impresses, and it's got the power for multi-tasking and mainstream creative work. Its price even undercuts most rivals. That's not to say the MacBook Air M2, Dell XPS 13 and other rivals are without their charms. Apple's machine is faster. The Dell XPS 13 is slimmer than the Asus and it has Thunderbolt, and the XPS 13 Plus is available with faster processors and OLED panels.

There's no doubt that the ZenBook is a great competitor, though – easily able to stand alongside those other laptops. Its great screen, solid internals and lengthy battery life make this an excellent ultraportable. Mike Jennings

SPECIFICATIONS

- 13in (2,880x1,800) OLED
- Windows 11 Home
- AMD Ryzen 7 6800U processor
- AMD Radeon integrated GPU
- 16GB RAM
- 512GB SSD
- 3.5mm headphone jack
- 720p HD camera
- Wi-Fi 6E 802.11ax
- Bluetooth 5.2
- 4-cell Lithium-ion battery
- 296.7x210.5x14.9-14.9mm
- 1.09kg

Asus ROG Phone 6D Ultimate

Price: £1,199 from fave.co/3ymch8Q ★★★★☆

Asus is on a mission in 2022. Just weeks after the company announced its flagship ROG Phone 6 and 6 Pro, two new high-end handsets were revealed.

The ROG Phone 6D and 6D Ultimate aren't being pitched as direct successors – just alternatives. That's because they both use MediaTek's Dimensity 9000+ chipset, rather than the Snapdragon 8+ Gen 1 found on the 6 and 6 Pro.

How much of a difference does that actually make? And do the cooling upgrades on the 6D Ultimate justify the extra cost? I spent a few weeks with the most expensive gaming phone you can buy to find out.

DESIGN

From a quick glance at the ROG Phone 6D Ultimate, you could be forgiven for thinking that Asus has re-released the 6

Pro. While the dark grey finish (your only colour option) is more muted, the two phones look almost identical.

I say almost, because there's one key design difference on the 6D Ultimate. Instead of the small RGB 'Dare to Play' logo, you get what Asus is calling the 'AeroActive Portal'. That's a fancy name for what is essentially a small flap which can open while gaming to improve heat dissipation.

It won't work unless you have the AeroActive Cooler 6 connected. Despite it being compatible with all ROG Phone 6 handsets, it's only included in the box with the 6D Ultimate. A small piece of plastic on a glass-backed phone isn't the prettiest look, but its inclusion here is certainly justified.

On the opposite side, you'll still find the secondary 'ROG Vision' display, but its usefulness remains limited. It can be used to display the likes of battery percentage, incoming calls and connection status, but it still can't show notifications.

Given it's facing away from you while gaming, its primary purpose seems to be looking cool to other people. There's nothing wrong with that, but it's not a reason to buy this phone over the regular ROG Phone 6D or 6.

The rest of the design is unchanged, meaning you still get an imposing triple rear camera module at the top. There is a slight camera bump, something which could surely have been avoided considering the phone's thickness – 10.4mm. However, it doesn't get in the way while gaming, and still doesn't wobble when used face up on a table.

Despite having a glass back, the 6D Ultimate does a good job of resisting fingerprints. It's highly reflective and shimmers in the light, but there are no noticeable smudge marks.

Flipping the phone over reveals the same 6.78in OLED display that you'll find on all the other ROG Phone 6 handsets. In a world where notches and cut-outs are the norm, it's refreshing to see Asus stick with slim bezels. This gives the phone an attractive symmetry, and I'm certainly not complaining about an 82.2 per cent screen-to-body ratio.

Asus has put the space to good use, with a selfie camera which can also be used for face unlock. It's not as secure as something like Apple's Face ID, so I'd recommend the under-display fingerprint scanner instead. This is easy to set up and reliable, but also much faster than most sensors of this kind.

The sides of the phone are also unchanged, but there's a lot more going on compared to regular phones. On the right (or top, when used in landscape mode), you'll find shoulder triggers

either side of the volume and power controls. This is the perfect position for use while gaming.

On the other side, you'll find one of the key design features of ROG Phones in general – a second USB-C port. This lets you comfortably charge your phone while gaming, and it's a game changer compared to awkwardly using the one at the bottom.

Asus has also retained the 3.5mm headphone jack, meaning you can easily connect wired headphones if you'd rather not rely on Bluetooth or the built-in speakers. Given how important audio is for gaming, it's great to have all three options.

However, the 6D Ultimate takes things to another level when it comes to weight. At 247g, it's heavier than the other ROG Phone 6 handsets and one of the heaviest phones you can buy.

Asus has also retained the 3.5mm headphone jack.

That's before you factor in the AeroActive Cooler 6, which adds another 117g. It's not a dealbreaker, but something to be aware of if you're considering this phone.

DISPLAY

While the display on the 6D Ultimate is identical to the other three ROG Phone 6 phones, it certainly wasn't in need of an upgrade.

The 6.78in, 2,448x1,080 OLED screen is a joy to behold, delivering the rich, vibrant viewing experience that mobile gamers crave. Some people might have been hoping for a 1440p resolution, but I have no complaints about the level of detail on offer.

Of course, the key feature that sets it apart from most other phones is that high refresh rate. At 165Hz, it can only be matched by the other ROG Phone 6 handsets and recent Red Magic phones. This delivers a stunning smoothness and fluidity to the user experience, although you may not notice a difference compared to 144Hz or even 120Hz.

With that in mind, I'd recommend sticking with 'Auto' mode

The 6.78in, 2,448x1,080 OLED screen is a joy to behold.

most of the time. This allows the 6D Ultimate to dynamically switch between 165Hz, 144Hz, 120Hz, 90Hz and 60Hz depending on what you're doing, helping to prolong battery life.

It works in tandem with the 720Hz touch sampling rate, meaning the display can register touch input up to 720 times every second. That makes the 6D Ultimate extremely responsive, even if some of Android 12's slow animations don't always show it.

Asus says the 6D Ultimate can hit an incredible maximum brightness of 1,200 nits, but I didn't get anywhere near that in testing. Still, 553 nits means it's still fine to use in most outdoor environments.

Audio is more important on gaming phones than regular handsets, and Asus has clearly prioritised it here. Like other ROG Phone 6 devices, those bezels mean there's room for dual front-facing stereo speakers on the 6D Ultimate.

Designed in collaboration with audio company Dirac, the sound they produce is excellent. With detailed music playback and punchy sound effects, they help take gaming without headphones to the next level. There's also more bass than you'd expect from a smartphone, and it avoids distortion at high volumes.

PERFORMANCE

The Snapdragon 8+ Gen 1 chip is one of the key strengths of the ROG Phone 6 and 6 Pro, but Asus has decided to switch things up with its new phones. Both the 6D and 6D Ultimate are powered by the Dimensity 9000+, MediaTek's flagship smartphone silicon.

It's the first time we've seen Asus move away from Qualcomm on its gaming phones, with the company indicating it's about offering gamers more choice. This means there's also new graphics, with a Mali-G710 GPU rather than the Adreno 730.

So, how much of a difference does it make to performance on the 6D Ultimate? In short, very little. There's no noticeable drop-off or boost in performance. It was superb on the 6 Pro, and that remains the case here.

Geekbench 5 (multi-core)

Asus ROG Phone 6D: 3,554
Asus ROG Phone 6: 4,162
Asus ROG Phone 5s Pro: 3,626
Red Magic 7S Pro: 4,192
Black Shark 5 Pro: 3,699
Samsung Galaxy S22 Ultra: 3,628

GFX Manhattan 3.1

Asus ROG Phone 6D: 91fps
Asus ROG Phone 6: 100fps
Asus ROG Phone 5s Pro: 100fps
Red Magic 7S Pro: 120fps
Black Shark 5 Pro: 118fps
Samsung Galaxy S22 Ultra: 110fps

Battery life

Asus ROG Phone 6D: 12 hours, 31 minutes
Asus ROG Phone 6: 11 hours, 51 minutes
Asus ROG Phone 5s Pro: 13 hours, 1 minute
Red Magic 7S Pro: 10 hours, 37 minutes
Black Shark 5 Pro: 9 hours, 6 minutes
Samsung Galaxy S22 Ultra: 10 hours, 55 minutes

Charge in 30 minutes

Asus ROG Phone 6D: 71%
Asus ROG Phone 6: 88%
Asus ROG Phone 5s Pro: 25%
Red Magic 7S Pro: 100%
Black Shark 5 Pro: 100%

Interestingly, there's only 16GB of RAM here, compared to 18GB on the 6 Pro. But there's a simple explanation for this: the 6D Ultimate uses the faster DDR5X standard, which doesn't currently go higher than 16GB.

I tested the same range of games as the 6 Pro and couldn't tell the difference between the two. Demanding games such as Asphalt 9, Call of Duty: Mobile and PUBG Mobile all run without any stuttering or hesitation, making them a joy to play.

On those FPS titles, the shoulder triggers are an effective alternative to tapping on the screen. But for the full experience, you'll want to connect the dedicated Kunai 3 Gamepad that's sold separately. None of the games mentioned above can output at 165Hz, but Asus highlights a small selection within its 'Armoury Crate' launcher. Real Racing 3 is the big name here, and there's a noticeable improvement in fluidity and responsiveness compared to other titles, especially when combined with the 720Hz touch sampling.

Demanding games such as Asphalt 9 run without any stuttering.

But after only a few minutes of gaming, I noticed the back of the phone getting quite warm. With no built-in fan, you'll need to connect the AeroActive Cooler 6 that's included in the box for longer sessions. This is highly effective at cooling the device without sacrificing performance, and it adds four customizable buttons that can used while playing.

As mentioned above, this is supplemented by the 'AeroActive Portal', a small flap which opens when the cooler is connected to improve airflow and, as a result, heat dissipation.

The company says it improves thermal efficiency by up to 20 percent, but this is impossible to verify. I certainly didn't notice any build-up of heat while the portal was open, but the same could be said for just the cooler with the 6 Pro.

But it's worth reiterating that performance is among the absolute best you'll find on any smartphone. The move to MediaTek hasn't changed that, although there is some slight variation in the benchmarks.

There's just one configuration of the 6D Ultimate, and it offers 512GB of internal storage. That'll be plenty for most people, but it'd still be nice to see the option for microSD expansion.

With no built-in fan, you'll need to connect the AeroActive Cooler 6 that's included in the box for longer sessions.

PHOTOGRAPHY

The ROG Phones aren't known for their camera prowess, which explains why the sensors haven't been upgraded on the 'Ultimate' branded phone. It means you'll get the same triple rear module, with a 50Mp main lens joined by 13Mp ultra-wide and 5Mp macro.

There have been a few software updates since the 6 Pro launched, but none have had a noticeable effect on image quality. That's not a bad thing in well-lit environments, where the 6D Ultimate produces vivid shots that are full of detail. It tends to over-saturate, but that means most people won't have to edit their photos later.

I particularly enjoyed the way the main sensor handled landscapes, avoiding the common tendency to overexpose the sky. But it's a good option for street photography and buildings, too, with strong dynamic range standing out. In short, this is a much better lens than you'd expect on a gaming phone.

Sadly, things aren't quite as impressive when it comes to the other two sensors. It's great to have the option of an ultra-wide camera, but there's a noticeable drop-off in quality and exposure does become an issue here. Elsewhere, low-quality macro lens takes decent close-up shots but adds little to the camera experience.

I'd have preferred a telephoto camera, which would've helped reduce the rapid decline in image quality when you zoom beyond 2x.

On the rear of the phone you'll find a 50Mp main lens joined by 13Mp ultra-wide and 5Mp macro.

There's also no depth sensor, but you still get a software-based portrait mode. Being able to adjust the level of background blur before and after the shot is taken is a great feature, but it struggles a lot with edge detection.

Using software for the night mode is much more impressive. It

We'll start off with a low-light shot…

…and one taken using the phone's night mode.

Next up, we have the same scene taken with the main lens…

…the 2x zoom…

…and the 8x zoom.

Here's an example of a macro shot.

We'll finish off with a selfie…

…and a photo taken using the phones portrait mode.

does a good job of brightening low-light images without losing key details.

Asus had plenty of space on the front of the phone to include a good selfie camera, and the company has delivered just that. The 12Mp sensor delivers clear and crisp selfies, even in some challenging lighting conditions. However, you'll want to turn the beauty mode off for the best experience.

The 6D Ultimate can technically record video up to 8K at 24fps, but 1080p at 30fps is enabled by default. EIS (electronic image stabilization) on the main lens keeps footage steady most of the time, but it's probably only suitable for casual use.

BATTERY LIFE

Asus hasn't changed the size of the batteries in its ROG Phones for a few years now, meaning you still get dual 3,000mAh cells which combine for a total capacity of 6,000mAh.

However, from using the phone it's easy to see why it hasn't been upgraded. Battery life is a key strength of the 6D Ultimate, with the phone comfortably lasting a full day of moderate usage. You can stretch this to two days if you drop the refresh rate to 60Hz, but you miss out on a key feature.

I mainly used the phone in 'Auto', which automatically adjusts at various intervals between 60Hz and 165Hz depending on what you're doing.

That's also the mode I used for PC Mark's battery benchmark, which aims to simulate real-world usage at 200 nits of brightness. The 12 hours and 31 minutes I recorded is even better than the 6 Pro (11 hours, 51 minutes), and one of the best scores we've recorded.

However, charging via USB-C was slightly slower. Using the 65-watt adapter included in the box, I reached 34 percent in 15 minutes from off, then 71 percent by the half-hour mark. It took around one hour for a full charge.

This is perfectly respectable, but it'd be nice to see Asus embrace even faster charging on future models. It's disappointing that the phone still doesn't support wireless charging, with the company claiming the space required is being prioritized for other things.

SOFTWARE

The 6D Ultimate received several software updates during my testing time, but the phone still runs Android 12. Specifically, it's a combination of Asus's Zen UI and ROG UI skins over Google's OS, but the core experience remains relatively similar to what you'll find on Pixel phones.

But just like previous ROG Phones,

the gaming software experience really begins once you launch X Mode. In this mode, the phone is optimized to deliver the best possible gaming experience. It also gives the home screen and app icons a gamer aesthetic. As a result, turning this off makes the 6D Ultimate very easy to use as a regular smartphone.

You can launch games from anywhere, but Asus would prefer you to use the Armoury Crate companion app. Here, you can fine-tune performance, customize features and accessories and connect with other players. If you're an avid gamer, there's a lot of functionality here.

Once you're in the game, quick settings can be accessed via the Game Genie toolbar. A wide range of options are available, including those which specifically target the CPU and GPU.

Asus says the ROG Phone 6D Ultimate and all its other handsets will get at least two major versions of Android. That means Android 13 and 14, then only security updates until 2024.

Google now recommends this as the minimum, but Asus could be more generous with a phone that's so expensive. Many gamers will choose to upgrade their phones after two years, but they shouldn't be forced to.

VERDICT

The ROG Phone 6D Ultimate justifies its name with an array of top specifications and features.

The Dimensity 9000+ is every bit as good as the Snapdragon 8+ Gen 1 that powers the 6 Pro. That applies to both performance and power efficiency, with battery life another real highlight.

When combined with the large, 165Hz display, the gaming experience is among the best you'll find on any mobile device – provided you're happy with Android

The Asus runs a combination of Asus's Zen UI and ROG UI skins over Android 12.

apps. When the phone inevitably starts getting warm, you can connect the included fan and make use of the 6D Ultimate's new cooling portal. However, the latter will only be beneficial for long gaming sessions. It's also a big, bulky phone, and that only gets worse when you connect the cooler.

But despite the high price tag, it may still tempt avid mobile gamers looking for the absolute best experience.

Anyron Copeman

SPECIFICATIONS

- 6.78in (2,448x1,080; 395ppi) AMOLED, 1B colours, 165Hz, HDR10+ display
- Android 12
- MediaTek Dimensity 9000+ (4nm) processor
- Octa-core (1x 3.35GHz Cortex-X2, 3x 3.2GHz Cortex-A710, 4x 1.8GHz Cortex-A510) CPU
- Mali-G710 MC10 GPU
- 12GB/16GB RAM
- 256GB storage
- Three rear-facing cameras: 50Mp, f/1.9, 24mm (wide), 1/1.56in, 1.0µm, PDAF; 13Mp, f/2.2, 13mm (ultra-wide); 5Mp, (macro)
- Selfie camera: 12Mp, f/28mm (wide)
- Wi-Fi 802.11 a/b/g/n/ac/6e, tri-band, Wi-Fi Direct, hotspot
- Bluetooth 5.3, A2DP, LE, aptX HD, aptX Adaptive
- GPS with A-GPS. Up to tri-band: GLONASS (1), BDS (3), GALILEO (2), QZSS (1), NavIC
- NFC
- USB Type-C 3.1 (side), USB Type-C 2.0 (bottom), accessory connector, USB On-The-Go
- Fingerprint scanner (under display, optical)
- Non-removable 6,000mAh lithium-polymer battery
- 173x77x10.4mm
- 239g

Sony Xperia 5 IV

Price: £949 from fave.co/3fP6By3 ★★★★½

Sony has nailed it with the Xperia 5 IV (mark four), even if that is a terribly confusing name for a phone. The company has decided its smartphones aren't going to be crowd pleasers anymore. It's got PlayStation for that. Instead, the Xperia phones are now extensions of the company's Alpha camera products, with bits of its Bravia TV and Walkman heritage thrown in for good measure. To some, that is very enticing.

This direction won't appeal to everyone, and that's okay with Sony. It's not here to compete with Samsung or Apple, or even Oppo or Xiaomi. It's just here doing what it, and its hardcore fans, love.

If you want a phone with a superb display, a headphone jack that supports hi-res audio, solid battery life, wireless charging, a notification LED, and cameras that don't rely on software processing, this is the phone for you.

DESIGN

The Xperia 5 IV is a premium product as soon as you take it out the box, even if the box is made from recycled paper and there's no charger or even USB-C cable included. This is a good thing for the environment but isn't a luxurious reveal for what is a very high-end device.

Our review unit was a utilitarian) black, though there are white and green version too.

My review unit was a utilitarian (boring) black, though there are white and green version too. The rear matte glass is the best feeling I've used on any phone – the right mix of soft but also grippy. This is a no fingerprint zone.

Aluminium rails add to this lovely feel. They are broken up with antennae bands, a USB-C port, a volume rocker, and a physical power button with a fingerprint sensor built in, the latter still a hugely underrated and underused way of doing biometrics on a phone. I found it very consistently responsive, and better than on the Xperia 1 IV.

Along with this is a two-stage shutter button for the camera. It's so welcome on a phone like this designed around the cameras, and I miss it when using other phones.

There's also a headphone jack, a rarity on premium phones these days. The triple camera module on the back is understated in the top left corner, with a textured Sony logo and very faint NFC, Xperia, and other EU regulatory branding on the back.

The phone is slim and tall to the benefit of landscape use more than portrait. My small hands mean I can type (just about) with one hand, but my thumb reaches nowhere near the top of the display. When typing, the haptics are strong and sharp with good feedback.

DISPLAY

The display is a smidge too tall, but the payoff is full screen video in 21:9. Sony is sticking with its decision to differentiate in this way, but it's great when watching movies, many of which

are now shot in 21:9. Watching Guy Richie film *The Gentlemen* on the Xperia 5 IV was a treat, with the full landscape screen used with no letterboxing or any content cut off.

Many series and older films will still letterbox, but the 6.1in OLED is pin sharp. It's only 1080p, though the 4K resolution on the larger Xperia 1 IV is overkill. Hardly any apps stream video in 4K.

The 6.1in OLED is pin sharp.

You can set the display to 120Hz for smoother scrolling, which along with the tallness benefits scrolling through social media apps, fitting lots of fluid moving images and texts onto what is still quite a compact display.

This setting is turned off by default, suggesting Sony thinks you can enjoy this phone at 60Hz, and you can. The display is not LTPO, a technology that can conserve power and switch between refresh rates, so if you turn on 120Hz it hits the battery somewhat. It looks lush though, and it's protected by top-of-the-line Gorilla Glass Victus, as is the back glass, so it should resist scratches well.

Add to that IP68 water and dust resistance and a microSD card slot in a SIM tray you can remove with your fingernail rather than a fiddly pin, and you've got one heck of a fully featured phone. This includes front facing dual stereo speakers, which sound full and rich and only distort at the highest volumes and aren't obstructed when holding the phone landscape to watch video.

The headphone jack is also capable of outputting hi-res audio, which I gladly took advantage of with hi-res files downloaded onto the phone. It also supported hi-res wireless audio though it's trickier to take advantage of this without compatible headphones or streaming services.

PERFORMANCE

As of the Xperia's September 2022 release, the best mobile chip from Qualcomm is the Snapdragon 8+

Gen 1, but the Sony is stuck with the slightly older 8 Gen 1. This isn't a bad thing as it's still a supremely powerful chip that can handle everything I threw at it while testing.

One issue is the 8 Gen 1 doesn't manage thermals all that well, and several phones we've tested with it get hot while charging, including the Xperia 5 IV. The 8+ Gen 1 has much better thermal management, but this phone must have been finalised at the same time as the Xperia 1 IV, which also has the older chipset.

I didn't find it an issue, and all phones get warm if you fast charge them or use the camera for an extended period. If you've heard elsewhere that Sony phones run dangerously hot, that is an overstatement. The 5 IV gets hot under load, but not to dangerous levels. My iPhone 13 mini gets hot when it charges via a cable with the screen off. It's physics.

In benchmarks, the Xperia 5 IV outperformed the Xperia 1 IV on most test using the CPU Geekbench test and the GFXBench graphics tests.

Geekbench 5 (multi-core)

Sony Xperia 5 IV: 3,401
Sony Xperia 1 IV: 3,265
Xiaomi 12 Pro: 3,438
Oppo Find X5 Pro: 3,361
Samsung Galaxy S22 Ultra: 3,628
Google Pixel 6 Pro: 2,875
OnePlus 10 Pro: 3,429

GFX Manhattan 3.1

Sony Xperia 5 IV: 60fps
Sony Xperia 1 IV: 60fps
Xiaomi 12 Pro: 68fps
Oppo Find X5 Pro: 59fps
Samsung Galaxy S22 Ultra: 52fps
Google Pixel 6 Pro: 45fps
OnePlus 10 Pro: 60fps

Battery life

Sony Xperia 5 IV: 13 hours, 11 minutes
Sony Xperia 1 IV: 8 hours, 23 minutes
Xiaomi 12 Pro: 7 hours, 29 minutes
Oppo Find X5 Pro: 10 hours, 33 minutes
Samsung Galaxy S22 Ultra: 9 hours, 28 minutes
Google Pixel 6 Pro: 9 hours, 15 minutes
OnePlus 10 Pro: 11 hours, 20 minutes

Charge in 30 minutes

Sony Xperia 5 IV: 47%
Sony Xperia 1 IV: 46%
Xiaomi 12 Pro: 100%
Oppo Find X5 Pro: 94%
Samsung Galaxy S22 Ultra: 62%
Google Pixel 6 Pro: 39%
OnePlus 10 Pro: 94%

In (more important) real world use, I had no issues with the 5 IV. It

felt very fluid, apps stayed in memory allowing me to switch between them effectively, and AAA games such as Call of Duty Mobile and Asphalt 9 ran without a hitch.

The only version available has 8GB RAM and 128GB storage, though the latter is expandable. There's only a single SIM slot, but you can add a second line via eSIM.

BATTERY LIFE

Sony has somehow stuffed a large 5,000mAh battery in this phone, and it has superb battery life. I always got through a heavy day's use, and never hit 20 percent before bed. That's despite shooting tons of photos and video, texting, video calls, and watching videos. Lots of video.

The phone scored an impressive 13 hours and 11 minutes in PC Mark's controlled battery test. That's one of the best scores ever for a flagship-grade device we've tested, beaten recently only by the similarly priced Asus Zenfone 9. That's also a smaller than average phone – good work, Sony and Asus.

There's also wireless Qi charging here for the first time on an Xperia 5 series phone. Rejoice.

Unfortunately, charging is slow at 30W watts compared to other Android phones in this price range that can top up to 100 percent in about half an hour. I charged the Xperia 5 IV to 47 percent in that time.

PHOTOGRAPHY

To get the most out of the Xperia 5 IV's very good cameras, you will need to know – or learn – how to use manual controls.

Sony has three different camera apps on the Xperia 5 IV, one of which is called Photography Pro. This is the go-to point and shoot camera app that, like every other phone on the market, uses a 'basic' mode to capture pictures and then process them with software.

This is called computational photography and phone makers use it in their cameras to make up for the deficiencies of necessarily small sensors in phone cameras. Modern phones pair hardware and software to produce the best image possible.

Sony's computational photography has improved markedly over the last three years and the Xperia 5 IV is a solid point-and-shoot in auto mode. Aside from the basic mode, the Photo Pro app also has an auto mode and several manual modes. This is where it gets very manual indeed, and Sony ditches the reliance on software to hand full manual controls to you as the photographer

We were impressed with the Sony's cameras.

as you would have with a Sony Alpha DSLR camera.

If you aren't familiar with how to use manual controls on a camera, then you will find the modes baffling and frustrating. I have a Nikon DSLR, but I found a steep learning curve with the deep menus of options and changing ISO, shutter speed, and aperture was daunting. I took tons of awful photos before getting into the groove.

But when I did, I found the phone one of the most rewarding to shoot on. 'Mainstream' camera phones like the Galaxy S22 Ultra give you a certain amount of manual control, but they also do most of the work for you. Having control over ISO on the Xperia is great fun and allowed me to change the mood of a scene by changing how much light to let into the lens.

If you know what you're doing, this could be the most versatile smartphone camera going, along with the Xperia 1 IV. You don't get that phone's physically moving optical lens on the 5 IV though, but it's no big loss. Shots have awesome dynamic range, and the level of detail is the best it's ever been on a Sony phone, with a very natural look to images that I like. You can also shoot in RAW format if you want to edit photos later.

A rapid shooting mode on the main lens can take 20 shots per second. Other phones cannot do this! It's another great point of differentiation to capture fast moving subjects. This sensor is also very good at rack focus, which can focus on subjects in foreground or background, and keep the other plane blurred. Apple does this on the iPhone 13 and 14 and calls it Cinematic Mode, but the Xperia 5 IV can do it too.

Sony has used three 12Mp sensors for its main, ultra-wide, and telephoto lenses to successfully keep colours consistent across all three and

Here's a selection of photos taken with the Sony's excellent cameras.


Give way to
oncoming
vehicles


DESIGN GEN


Touch here if this
bicycle is damaged


MINI
Marmite

zooming between lenses when shooting video is smooth.

In keeping with the real camera vibe, Sony labels the lenses 16mm, 24mm, and 60mm in the camera apps. The 60mm telephoto gives great natural bokeh for portrait images using just hardware, but you can add more blur with a software portrait mode too, as you can on the capable front facing 12Mp camera.

All three main lenses support real-time object tracking to keep a subject locked in focus, as well as eye autofocus for keeping people and animals looking sharp. All three lenses can also record 4K video at 60fps in slow motion, which is very impressive.

Videography Pro allows for more granular video controls and you can even live stream to YouTube right from the app. I recorded over 30 minutes of 4K video in the app and the phone got a little warm, but it did not overheat or stop working.

There's also a Cinema Pro that gives you cinematic video filters and bunch more light controls and readouts. This is a very nerdy camera phone but if you are into it, there should be no other choice (bar the Xperia 1 IV) for the versatility and function on offer. You can even hook up the phone to an Alpha camera and use the phone as a monitor.

SOFTWARE

My main grievance with the Xperia 5 IV is that Sony is only offering two years of Android platform and security software updates. This is far too low for a phone that costs near to a grand – it should be more like four years. It stops me wholeheartedly recommending the phone.

Sony's Android 12 software is quite plain and close to 'stock' Android, whatever that is these days. It keeps out the way and performs well. A software side bar lets you quickly launch two apps in split screen view, which makes sense on a display this tall. I watched football in a (tiny) window at the top while texting friends in WhatsApp.

Sony also includes in its Music Pro app, which recreates a studio recording set up. You can record audio using the phone's mic or an external mic via the headphone jack. From there, you can use paid-for studio tuning tools to separate audio, de-noise, simulate microphones, and other impressive smarts.

VERDICT

Buying a Sony phone today is quite intentional. You probably won't be swayed to get the rather specialist Xperia 5 IV if you had your eyes on an iPhone 14 originally.

But if you want a phone that packs in every feature you can think of without compromising on performance, build, or battery life, then this is a great choice.

Considering Sony doesn't make many different phones anymore, I implore the company to extend software support for phones like the 5 IV – two years is insultingly little time for such a capable device to be considered up to date with modern Android features and security.

Fix that, and I could recommend the Xperia 5 IV to a wider audience than I currently can. If you want a phone from the top drawer with a great screen, headphone jack, and cameras that act like actual cameras that don't overly rely on software processing, it's a superb choice. Henry Burrell

SPECIFICATIONS

- 6.1in (2,520x1,080; 449ppi) OLED, 120Hz display
- Android 12
- Qualcomm SM8450 Snapdragon 8 Gen 1 (4nm) processor
- Octa-core (1x 3GHz Cortex-X2, 3x 2.5GHz Cortex-A710, 4x 1.8GHz Cortex-A510) CPU
- Adreno 730 GPU
- 8GB RAM
- 128GB/256GB storage
- Three rear-facing cameras: 12Mp, f/1.7, 24mm (wide), 1/1.7in, 1.8µm, Dual Pixel PDAF, OIS; 12Mp, f/2.4, 60mm (telephoto), 1/3.5in, Dual Pixel PDAF, OIS; 12Mp, f/2.2, 124-degree, 16mm (ultra-wide), 1/2.5in, Dual Pixel PDAF
- Selfie camera: 12Mp, f/2.0, 24mm (wide), 1/2.9in, 1.25µm
- Wi-Fi 802.11 a/b/g/n/ac/6e, tri-band, Wi-Fi Direct, DLNA, hotspot
- Bluetooth 5.2, A2DP, aptX HD, LE
- GPS with dual-band A-GPS, GLONASS, BDS, GALILEO, QZSS
- NFC
- USB Type-C 3.2, USB On-The-Go, video output
- Fingerprint scanner (side-mounted)
- Non-removable 5,000mAh battery
- 156x67x8.2mm
- 172g

Fitbit Sense 2

Price: £269 from fave.co/3EApa3b ★★★½☆

Fitbit is rightly considered one of the leaders of the activity tracker market thanks to early mover advantage and slim, well-featured products like the Charge 5. The brand has had a tougher time trying to make a killer smartwatch. 2017's Ionic felt like a prototype, and it even got recalled recently and every customer refunded after a battery defect.

The Versa watches have been slightly better, but have felt like activity trackers that look like watches. 2020's Versa 3 and Sense watches were the best Fitbit smartwatches yet, though similar, and offered music control, select third party apps, and solid battery life.

Now owned by Google, Fitbit has released the Sense 2, which I've had strapped to my wrist for several days. It is a well-made product, but I hesitate to call it a smartwatch because Fitbit has taken away the on-wrist music controls and all third-party apps, including

Google Assistant. I imagine this is because Google wants those features to be exclusive to its new Pixel Watch, which itself uses the Fitbit app to track health metrics. The Sense 2 suffers thanks to its existence.

The main draw of the Sense 2 over the also-new Versa 4 is the Sense 2's body response sensor, which collates several data points to give you feedback on your stress levels. The idea is to highlight your triggers to help you understand what stresses you, and coach you to manage those triggers better.

It's a fine idea, but the execution is clunky. The Sense 2 still feels like it isn't quite finished, and at £269, it's hard to recommend it over an Apple Watch SE or Samsung Galaxy Watch 5.

The Sense 2 has an aluminium frame and overlays the sensors on top of the black bezels around the display.

DESIGN

The Sense 2 is the most premium feeling Fitbit you can get, though it's not as high-end as the original Sense, which had a stainless steel finish and a steel ring around the edges of the screen. This was used to take sensor readings to measure stress.

Instead, the Sense 2 has an aluminium frame and overlays the sensors on top of the black bezels around the display. No fancy steel here, but it's still a good looking watch.

My brushed gold model looked good though, with a light grey strap. It's comfortable and comes with small and large sizes in the box along with a charging cable.

The pebble shape of the body is very similar to the Versa series and it's hard to tell them apart. A clue that it's the Sense 2 is on the underside that sits on your wrist as you wear it, with a curved metal design indicating the inclusion of the new body response sensor that you can't get on any Fitbit.

Thankfully the company has ditched the unreliable touch sensor button of the first

Sense in favour of a physical button on the Sense 2. It's much easier to push and works better when wearing gloves. There's also a single speaker slit on the right edge for taking calls and talking to Amazon's Alexa assistant.

Though a full size watch, it's comfortable to wear all day and night to track steps, heart rate, and sleep continuously. It can continuously monitor your blood oxygen levels while you sleep, and Fitbit's tracking of sleep in general remains one of the best in the game, with clear metrics and features like snore detection if you pay for Fitbit Premium.

Fitbit's software has been updated from the original Sense, and it's much better for it.

FITNESS AND SPORTS TRACKING

As ever, this Fitbit is at its best when tracking fitness activity. From walking to running, swimming to cycling, and a load of other sports, the Sense 2 does a solid job of recording them all.

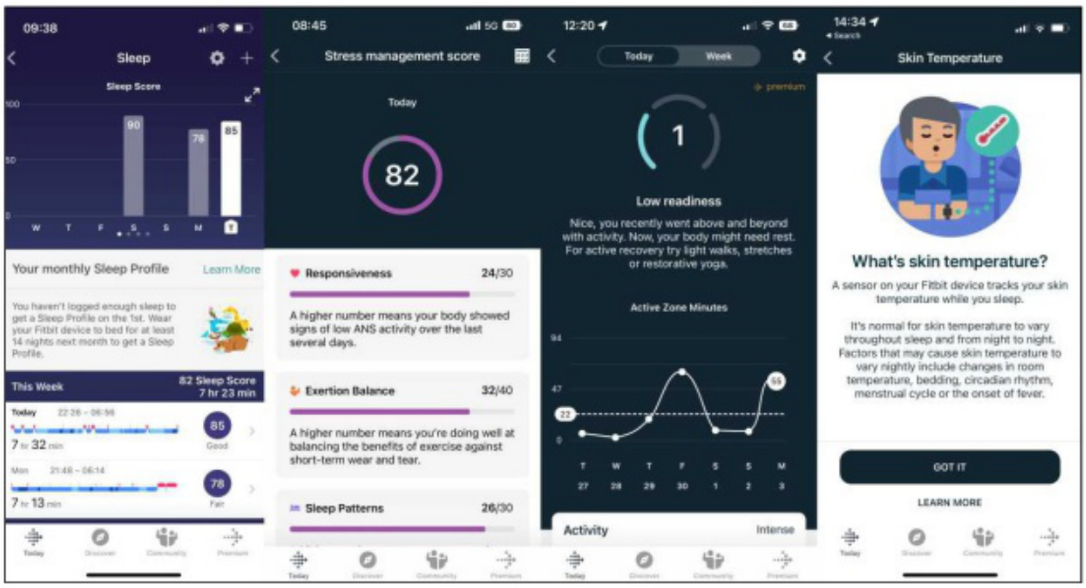
Fitbit's software has been updated from the original Sense, and it's much better for it. I found the Sense 2 quite responsive, with menus flowing and buttons reacting immediately – a low bar, but older Fitbit watches have been very laggy.

It's now based on clearer 'tiles' you can swipe through using the touchscreen. They are dedicated screens for information on heart rate, steps, activity, sleep, exercise, and body responses.

The core Fitbit experience is still excellent. With built-in GPS, the Sense 2 easily and accurately tracked my outdoor run routes, even when I left my phone at home.

I know my way around the Fitbit app after several years, but it is still not very user friendly. You have to dive into menus several layers deep to change the watch face (which you can't do on the watch) or find ways to add friends. The latter lets you keep a leader board of steps against your mates if you want some healthy competition.

The app is still not particularly user friendly.



The app is also where you can track your period by letting you manually input your last start date into the calendar. It can then help you predict your next period, and send you notifications to remind you when you might get your next.

BODY RESPONSE AND OTHER SENSORS

'Body response' is new to Fitbit and exclusive to the Sense 2. Fitbit says the new body response sensor measures continuous electrodermal activity (cEDA) to detect changes in your body. Combined with heart rate, heart rate variability, and skin temperature, the watch can prompt you when it measures a change and asks you to log tour mood: stressed, sad, calm, happy, frustrated, and other moods.

On the original Sense, you had to decide to take a mood reading by selecting the app and placing your palm over the screen, touching the sensors around it. It took two minutes to take a reading and you had to remember to do it frequently to gather data.

Now, the cEDA system can track your alleged mood all the time using its electrodermal sensor so you don't have to remember to do a spot-check reading (which you still can if you want). It also means you're less likely to only take readings when you're really stressed out and thinking about it.

The continuous tracking is good insofar that it flags apparent changes in your mood, but I can't help but feel a watch that buzzes me all the time to ask how I'm feeling and if that feeling is stress is stressful. You can turn off

the body response notifications and can also receive a weekly summary if you prefer.

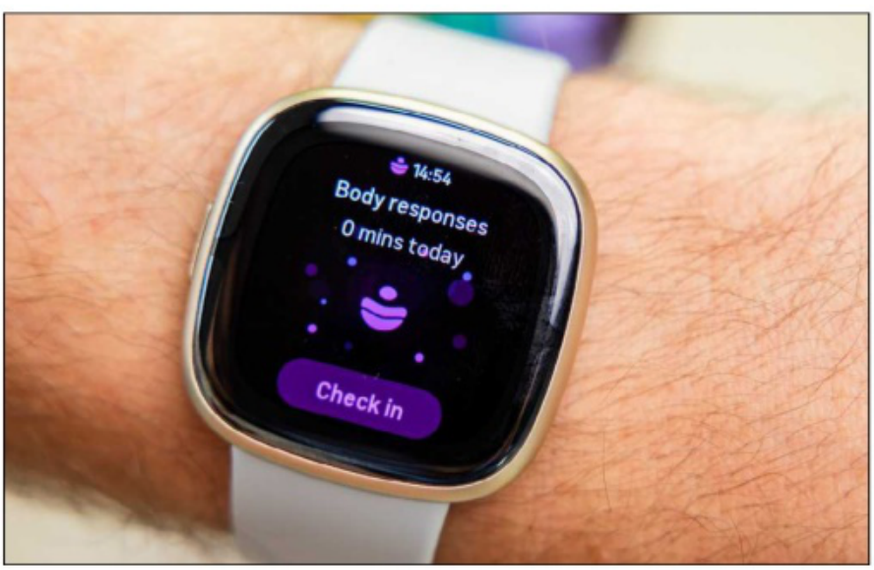
The app spits out a stress management score, but you have to take at least 500 steps, wear the Sense 2 for at least 14 hours, and wear it to bed on a given day to get it. One of my scores was 76/100, the higher the number the better you've managed stress. The score is broken down by responsiveness to stressors, exertion from exercise, and sleep patterns.

There is a fair level of detail if you dig into the app, but as with other Fitbit devices, you'll only get the deepest detail if you fork out for the paid Fitbit Premium service. This costs £7.99 per month or for an annual fee.

Fitbit is one of the few fitness tracker brands that charges a subscription fee to get data insights. Buy an Apple Watch or a Garmin or Polar fitness watch and you get those insights free bar the cost of the watch itself. It's a downside to buying a Fitbit, especially one as expensive as the Sense 2.

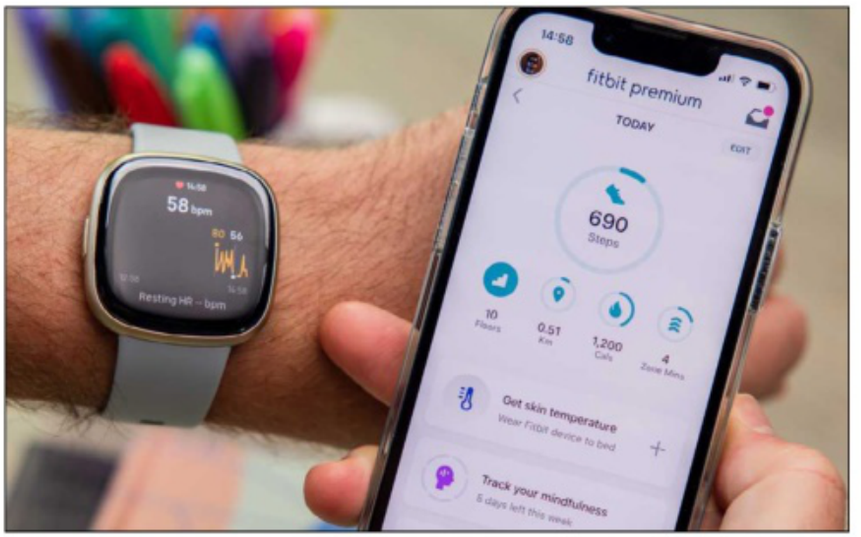
You do get some genuinely useful mindfulness audio sessions if you fork out though, as well as access to tons of workout classes. If you can afford the subscription, it is worth it – but it irks that it is paid in the first place. One of the most useful metrics, your Daily Readiness score that assesses if you're ready to exercise again, is locked behind Premium's wall

Some other non-Premium but key features on the Sense 2 aren't turned on by default, and aren't surfaced well on the watch or in the app. There's a ECG (electrocardiogram) sensor on the watch to look for signs of atrial fibrillation (Afib).



'Body response' is new and exclusive to the Sense 2.

But I didn't realise the Afib feature was off for nearly a week – I found it by tapping on the heart rate tile in the Today view, then swiping through to a second screen and saw a pop up to 'Learn more' about it, where I could turn it on. This is not good app design.



Fitbit is one of the few fitness tracker brands that charges a subscription fee to get data insights.

SMARTWATCH FEATURES

The Sense 2 has lost some smartwatch functionality compared to the original Sense. Although there's built-in GPS that recorded my run routes, the Sense 2 annoyingly no longer supports and type of on-board music playback, so I had to take my phone with me to listen to music. Bafflingly, Fitbit has also removed any kind of music controls too, so you can't pause or change track from your wrist.

To top it off, the Sense 2 also no longer supports any third-party apps. There weren't many available on the Fitbit platform, but one of the good ones was Spotify. It's gone now, and Fitbit confirmed to Tech Advisor they aren't coming back.

It might well be because Google wants to keep its music and smartwatch features exclusive to its new Pixel Watch, which has Fitbit fitness features, and keep the Fitbit brand as fitness only. But it's galling that the Sense 2 is less capable than its two year old predecessor for music playback.

Perhaps even weirder is the absence of Google Assistant on this Google-made Fitbit. On older models you could choose between Assistant and Amazon Alexa, whereas on the Sense 2 you can only use the latter.

The Sense 2 no longer supports and type of on-board music playback: Fitbit has removed any kind of music controls.

Fitbit says the Sense 2 will in the future gain support for Google Maps turn by turn navigation and Google Wallet for contactless NFC payments, but I couldn't test them as it's launching without both. Fitbit Pay doesn't support either of my UK banks (and barely any major UK banks in general) so I was not able to test Fitbit Pay, either.

The only remotely smartwatch thing the Sense 2 can do is take calls on your wrist through the speaker and send you notifications you get on your phone. The former works, but the speaker distorts quite a bit and isn't fun to use. Notifications work well and are consistent, but you can only reply to them on the watch if you are using an Android phone – iPhone is view only.

If you want a Fitbit with decent smartwatch features, you're better off hopping on Amazon and buying an older Fitbit Sense or Versa 3 – which is disappointing.

BATTERY LIFE AND CHARGING

Battery life on the Sense 2 was erratic but generally solid. Even with the always-on display (AOD) turned on (it's off by default) I got three days between charges using the watch 24/7 for GPS runs and to track my sleep.

With the AOD off, it should last you four or five days. This is one of the best reasons to buy a Sense over the similarly priced Apple Watch SE – you get multi-day battery life and the option for an AOD. Most Apple Watches in general only last a day at best.

Charging is via the including USB-A cable with a proprietary end that clips magnetically to the back of the watch.

Charging is via the including USB-A cable with a proprietary end that clips magnetically to the back of the watch. It takes

about an hour to fully charge, and Fitbit says a 12 minute charge will get you an extra day of power, which is about right.

VERDICT

The Fitbit Sense 2 is a solid product that does what it sets out to do quite well, but its stress management features are more niche than the Google Assistant and music playback features that have been stripped from it compared to the original.

If you want to count steps, track all manner of exercise, track sleep, and try and work out why you're so stressed, then it is a good choice – if a little expensive. The watch has practically no smartwatch features at all save for replying to texts if you use Android and is best thought of as a fitness tracker in the shape of a watch.

It's a lot to pay for a watch that holds back features the hardware can cope with, and then makes you pay a subscription to see all your data and insights. If you are already all-in on Fitbit (or want to be) it's a good choice, but Apple people should get an Apple Watch and Android people would be better served by an alternative fitness watch from Polar or Garmin. Henry Burrell

Mark Levinson No. 5909

Price: £999 from fave.co/3vQDpvr ★★★★☆

Mark Levinson is to audio what Lamborghini, Porsche and Ferrari are to automobiles. The high-end brand, named after its legendary founder, has left an indelible mark with audio products priced in the four and five figures.

The Mark Levinson team is looking to add a new – and admittedly atypical – product to that legacy: The £999 No. 5909 wireless noise-cancelling headphone. This is the first headphone model Mark Levinson has ever produced, and it's designed for the busy professional or passionate listener.

What makes this headphone special isn't necessarily its pedigree, premium materials, onboard tech, or noise-cancelling performance (though it has all of those, too). Rather, what's notable

is the No. 5909's voicing to the so-called Harman target curve for headphones. The result? A gorgeous headphone worthy of the Levinson heritage that will exceed the sonic expectations of even the most demanding music lover.

The metallic paint job on the Mark Levinson No. 5909 is just what you'd expect to see on a luxury item such as this.

The unboxing experience, followed by the first time you pick up the No. 5909, seductively whispers luxury audio. The headphones come in three colour options: Pearl Black, Ice Pewter and Radiant Red, the latter of which was the colour of my review sample. Levinson fans will note that the colour combinations are a direct nod to the classic Levinson colour motifs. Mark Levinson audio gear is distinguished by its black and grey industrial design with red accents.

The No. 5909's headband is wrapped in premium leather. The headband's leather top side is rugged while the leather underside is incredibly soft and supple. While the padding doesn't seem generous, I never felt that the headband exerted any unusual or uncomfortable pressure even after long listening sessions.

The matte black, anodized aluminium arms extend smoothly – there's no cheap click-stop here. Best of all, the arms stay firmly in place.

The ear pads are likewise enveloped in soft leather. They were incredibly comfortable on my ears. As you'd expect in a luxury headphone, the leather ear pads are replaceable.

The ear cups are painted in a high-quality, automotive-grade metallic paint. The high gloss look of my Radiant Red review pair was simply gorgeous. The bevelled edge of the Mark Levinson medallion on the ear cups is tinted red in a further nod to the brand's visual design heritage.

The ear cups fold flat for easy storage. At no time did I feel as though the headphones exerted unusual pressure around my ears.

The right ear cup houses the USB-C charging port and controls in a typical three-button array of volume up, play/pause, and volume down. The Levinson design team gave the play/pause button a slight bump, so you can distinguish it easily by feel and get your orientation for the volume buttons. The play/pause button has four additional functions. First, it doubles as the answer/end call function for a paired smartphone. Pressing it twice skips forward. Pressing it three times skips back. Pressing and holding the button activates the voice assistant on your smart device.

The left ear cup houses two buttons. The lower button powers up the headphones and the upper button toggles between passive, noise-cancelling, and ambient-aware modes. The ergonomics of the buttons are near perfect and conform to the natural orientation of your thumb on the ear cup.

The Mark Levinson No. 5909 comes with a generous collection of accessories, including a zippered, hardback carrying case emblazoned with the Mark Levinson logo. The hard case maintains its shape when empty and doesn't fold flat like the one that comes with Sony's WH-1000XM5. That means it does take up space in a backpack or suitcase when empty.

Both the case and the zipper are coated, seemingly to protect the headphones from an errant spill. Inside the case, there's a zippered compartment with ample space for cables and accessories. You don't need to worry about cables falling out or

The Mark Levinson No. 5909 ear cups fold flat for storage in their hardback travel case.

getting tangled in some pocket. It's a minor but oh-so-great feature.

Speaking of cables, the Levinson come with a 1.25m USB-C-to-USB-C charging cable that does double duty as a digital connection to a computer for music playback. There are two USB-C-to-3.5mm cables for connecting to analogue sources: a 4m cable and a 1.25m cable. The 4m cable is ideal for using the headphones with a headphone amp or other desktop source. Also included is a USB-C-to-USB-A adapter, a 1/8-to-1/4in adapter for connecting to headphone amplifiers, and an airplane audio adapter. A Mark Levinson-branded polishing cloth caps things off.

Under the hood, the Mark Levinson No. 5909 feature Beryllium-coated (not pure Beryllium) drivers. The base material is PET (polyethylene terephthalate) that a Mark Levinson representative said is a strong, lightweight, shatterproof, recyclable, and highly sustainable material. The motor magnet material is neodymium.

Driver materials are incredibly important to a speaker or headphone's performance. Beryllium is prized for its combination of lightness, rigidity, and superior pistonic performance. Beryllium drivers typically don't have breakup in the audible frequency range. Mark Levinson's high end loudspeaker sibling, Revel Speakers, reserves Beryllium for its top-of-the-line models.

Battery life is perfect for the executive road warrior. The Mark Levinson No. 5909 is rated to deliver up to 34 hours of playback time without ANC and up to 30 hours with ANC enabled. You can take a transatlantic or transpacific flight round-trip without ever having to worry about charging the No. 5909. With their power-save feature enabled, I charged the Levinson headphones maybe once or twice a week – and that

The Mark Levinson No. 5909 have a USB-C port for charging, but the headphone can also function as a USB audio device. A USB-C-to-3.5mm audio cable for connection to an analogue audio source is also provided.

was using them extensively for video conferencing calls in addition to music and entertainment.

The Levinson sport four microphones in each ear cup (two for phone calls and two for active noise cancellation. You'll have confidence taking or making calls. The No. 5909 come standard with Bluetooth 5.1. Connectivity with my iPhone 12 Pro (which sports Bluetooth 5.0) was outstanding. I could go 50m from my iPhone, including between floors, without missing a beat.

The Mark Levinson No. 5909 is outfitted with microphones inside and outside of each ear cup, four for phone calls and four for active noise cancellation.

I did come across one annoying feature: If you're making a phone call, the Levinson activate their ambient-aware mode and won't allow you to switch to noise-cancellation or passive mode during the call. That's fine in most cases, but if I took a call in a modestly noisy environment, such as an airport or the NYC streets, I found this function to be problematic as the outside noise battled with the caller's voice.

USING THE MARK LEVINSON NO. 5909 WIRED AND WIRELESS

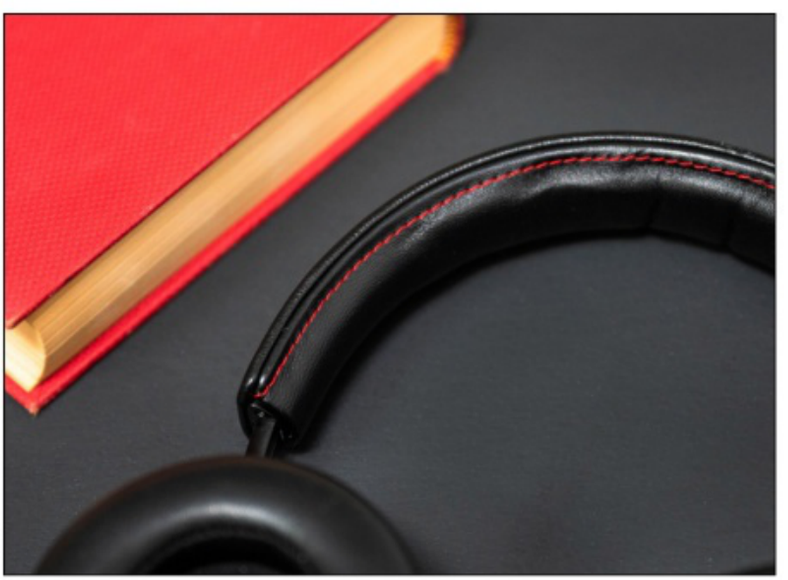
The Mark Levinson No. 5909 headphones feature Qualcomm's QCC5124 DAC. The No. 5909 take no prisoners with their refreshingly thorough support of all modern hi-res streaming codecs. Sony's LDAC hi-res audio codec is on board as is Qualcomm's flagship aptX Adaptive, and Apple's AAC. LDAC can stream up to 96kHz/24-bit audio at rates as high as 990Kb/s over a Bluetooth connection. No matter your preferred streaming source, the Levinson will ensure you'll get the optimum connection for the best possible sound.

There are three distinct wired modes, which is a unique feature of the No. 5909. The first is active analogue audio mode, which works with the USB-C-to-3.5mm cable. It processes

the audio signal through the No. 5909's internal EQ and allows you to cycle through ANC and transparency modes. The headphones must be powered up before you plug in the cable to enable this mode.

The second mode is active USB digital audio. Starting with the headphone turned on, you use the USB-C-to-USB-C cable and listen digitally direct from your computer or digital source. The EQ will use the last setting in the Mark Levinson mobile app. The ANC button will cycle through the modes, and the headphone will charge its battery while you listen.

The third and final mode is pure passive analogue. This delivers the widest frequency response, from 10Hz to 40kHz. Passive analogue engages when the battery is dead, or when you plug in the USB-C-to-3.5mm cable with the headphones turned off. This bypasses all EQ, and the ANC toggle switch on the left ear cup will not work.



The Mark Levinson No. 5909 were comfortable to wear for long listening sessions, even with the surprisingly thin padding on the headband.

ONBOARD TECH AND THE MARK LEVINSON APP

High-end audio gear – Mark Levinson products in particular – typically eschew bells and whistles, flashy features, and anything that might taint the audio signal path. As a result, the Mark Levinson companion app has a Spartan feature set compared to some of its competitors. The app tells you the headphones' current charge and gives you the option to select noise-cancelling or ambient-aware modes, set the auto-off timer, enable on-head detection, and perhaps most importantly, set the Harman target curve bass contour.

On-head detection, off by default in the app, proved to be buggy for me. When I enabled it, I found that music would had a tendency to pause, even though I was still wearing the headphones. I gave up on it and kept the feature off during my review period.

The No. 5909 sports three noise-cancelling modes: high, adaptive, and low. The high and low settings maintain a constant level of noise cancelling, while the adaptive mode automatically adjusts noise-cancelling intensity based on the level of noise in your outside environment. I used the Mark Levinson No. 5909's noise-cancelling features extensively over several months. I took the headphones with me on a cross-country flight from NY to LA as well as on the NY subway and Manhattan's busy streets.

The No. 5909's noise-cancelling prowess is strong and an able companion to the road warrior, although I would rank them behind Sony's WH-1000XM5, which are simply the best noise-cancelling headphones I've reviewed to date.

WHAT IS THE HARMAN TARGET CURVE FOR HEADPHONES?

One of the main selling points of the Mark Levinson No. 5909 is their precision tuning against the Harman target curve for headphones. The Harman target curve is one of the reasons why the Levinson sound so good.

As recently as a decade ago, our understanding of listeners' headphone preferences and the measurements that would best predict them were still in their infancy. That all changed thanks to Dr. Sean Olive and the world-renowned research team at Harman International. This is the same team whose pioneering research, led by Dr. Floyd Toole in the 1980s, gave us the definitive guide for the acoustics and psychoacoustics of loudspeakers, and Todd Welti's subsequent research in the 2000s that determined the ideal number of subwoofers in a rectangular room and their optimal locations.

The headphone research led by Dr. Sean Olive over the past decade is what yielded the so-called 'Harman target curve for headphones'. The company calls the Harman curve the "acoustic equivalent [of] a universally satisfying audio 'recipe' that a vast majority of listeners will enjoy".

The Harman target curve is a sound curve that both trained and untrained listeners preferred for headphone listening. Perhaps unsurprisingly, this response curve closely resembles the in-room response of an accurate loudspeaker in a semi-reflective room, as shown from Dr. Toole's research.

What's perhaps most notable is that preference for the Harman target curve transcends age, geographic location, listener training, and gender. Dr. Olive's research results further showed that 64 percent of listeners preferred

the Harman target curve, while 21 percent (typically listeners over 50 or women with a preference for classical music) preferred the Harman target curve with less bass, and 15 percent (typically younger listeners who were fans rock and rap) with more bass.

The Mark Levinson No. 5909 exhibit first-rate build quality.

Realizing that listeners fall into these sub-groups, the No. 5909 companion app allows you to alter the headphone's target response to match the bass response preference in accordance with Harman's research results.

I ran the gamut with various connection methods with the Mark Levinson No. 5909 headphones: An iPhone 12 Pro, a Fiio M9 hi-res DAP with LDAC, via USB-C to my 16in Intel MacBook Pro, and wired with my Monoprice Monolith desktop balanced headphone amplifier with THX AAA technology. My Roon Nucleus server, Tidal, and Apple Music provided the source material.

Let me cut to the chase: These are the best-sounding noise-cancelling headphones I've ever reviewed. You'll put these headphones on and want to listen to your favourite songs all over again as though you're experiencing them for the first time.

The Levinson's penchant for rendering a dimensional soundstage is uncanny. Songs like Adele's *River Lea*, Norah Jones *Don't Know Why*, Katie Melua's *If You Were a Sailboat* and Michael Jackson's *Smooth Criminal* broke free from the typical headphone incarceration. Listening to a song you've heard hundreds of times through the No. 5909 will make you feel as though you're experiencing that song for the first time.

Vocals were pristine with near perfect timbral accuracy. Vocals were rendered with the clarity, detail, and the flat-out hair-raising purity that you'll experience from a high-end loudspeaker. For example, Elaine Paige's iconic rendition

of *Memory*, from Cats, played through the No. 5909 was intimate, energetic, and intoxicating.

The refinement extends to instruments, which were placed firmly in space and time. There is no muddiness, smearing, or anything to get between you and the music. Notes come across with texture and detail that other noise-cancelling headphones can't match. Discerning music lovers will relish being able to do a deep dive into the micro dynamics of their favourite music.

Songs like Imelda May's *Call Me*, Birdy's *Open Your Heart*, or Yo-Yo Ma's rendition of Ennio Morricone's *Dinner*, from Lady Caliph, through the No. 5909 delivered the songs' intimacy and emotional energy.

The Levinson loved to play big and bold with orchestral works, such as Hungarian Rhapsody No. 2 in C-Sharp Minor, conducted by Leopold Stokowski, delivered the grand staging, transparency, detail, and dynamics that makes classical works shine.

Bass lines are authoritative, pistonic, and under absolute control. I played my typical repertoire of bass tests over and over, shaking my head in astonishment. The No. 5909 delivered the deep bass lines on Bonnie McKee's *Trouble* and Lorde's *Royals* with authority. Bass on Holly Cole's I can see clearly now and the O-Zone Percussion Group's *Jazz Variants* were ridiculously clean, textured, and delivered without any hint of bass bloat, all while keeping vocals and accompanying instruments clearly articulated.

The refinement and control you'll find in the Mark Levinson No. 5909 allows the listener to move toward a deeper musical experience, appreciate the complexity of musical layers, and unfold more details in the music.

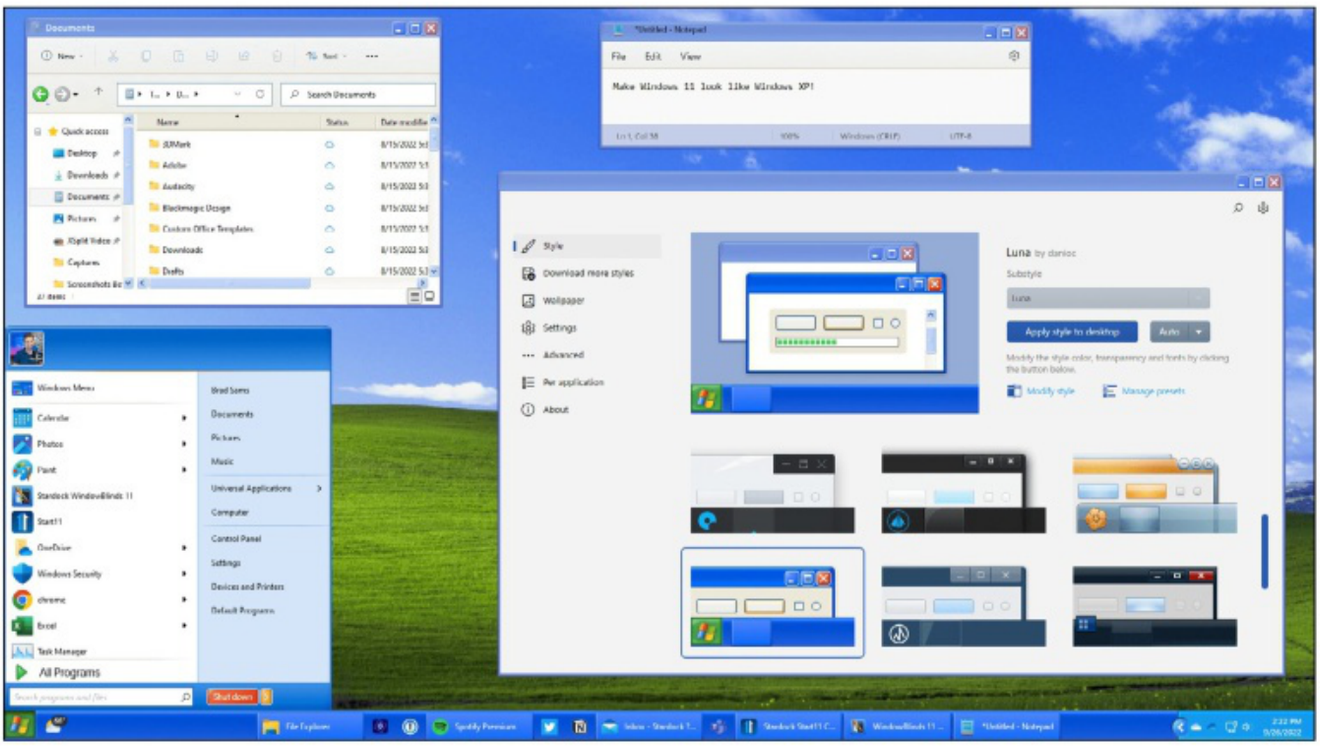
VERDICT

If you're looking for what is arguably the best-sounding noise-cancelling

You can purchase replacement memory foam ear cups for the Mark Levinson No. 5909 should they become damaged over time.

headphone on the market today, and aren't intimidated by their £999 price tag, look no further than the Mark Levinson No. 5909. They are the pinnacle expression of the science of headphone sound.

These are luxurious headphones with premium build quality worthy of the Levinson heritage and will satisfy the most demanding music lover. A few functional quirks aside, if strong noise-cancelling performance and pristine sound are the top of your priorities, and you don't care for extraneous bells and whistles, then the Mark Levinson No. 5909 deserve the top spot on your list. Theo Nicolakis. Theo Nicolakis



Transform Windows 11 into XP with WindowBlinds 11

WindowBlinds 11 is available for a reduced price during beta. MARK HACHMAN reports

If you really don't like the look and feel of Windows, Stardock Software is back at it. The company's latest beta of WindowBlinds 11 allows you to make Windows 11 look and feel like XP.

WindowBlinds 11 allows for unique customization of the Windows Start menu, taskbar, window frames, control buttons, and more using desktop interface themes called skins, according to the company. It can also be paired with Start11, which modifies the Start menu, for further customization.

The app costs £17.37. You can download the beta from the Stardock site (fave.co/3VgUH09). The software

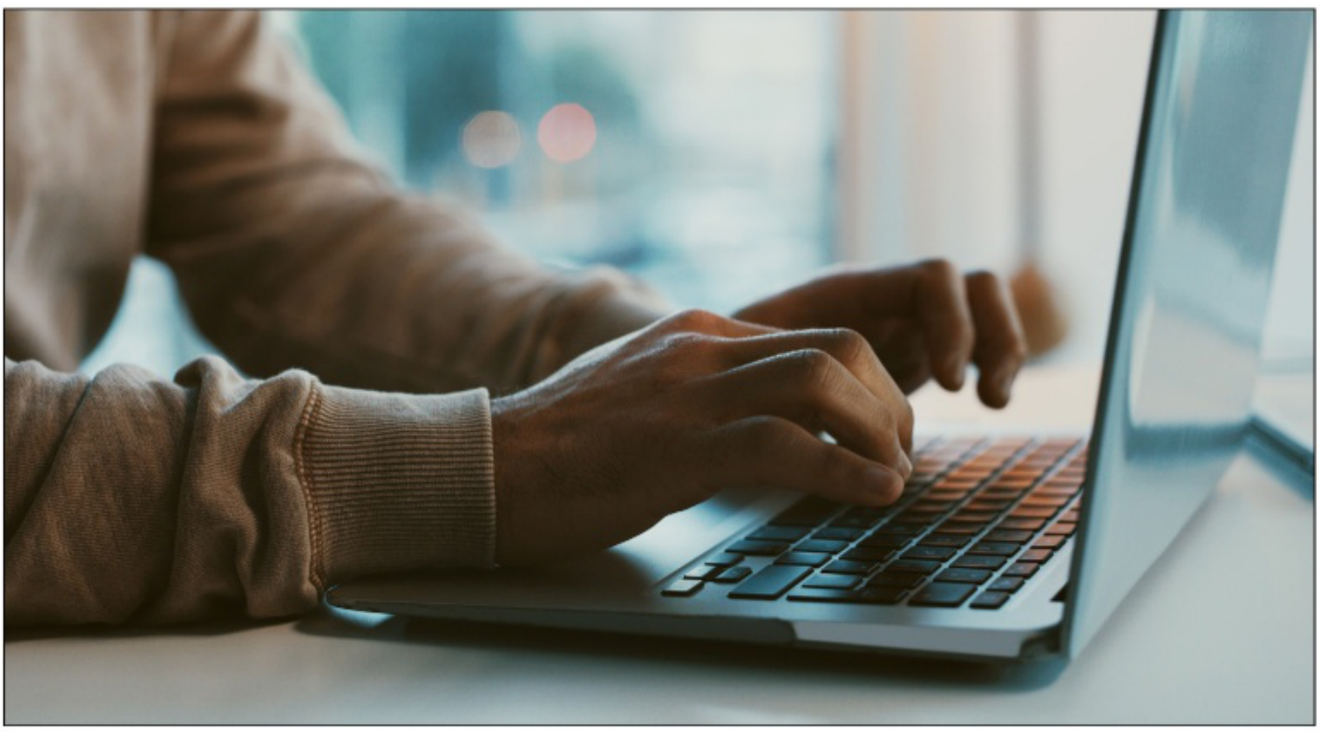
will only work with release builds of Windows 11 or Windows 10, not the Windows Insider beta builds that Microsoft makes available to test out new Windows code.

"Windows 11 introduced a new design language for the OS but we know it's not for everyone," said Brad Sams, vice president of Stardock Software, in a statement. "With WindowBlinds 11, you can enjoy the benefits of a modern OS, but also the flexibility to customize the interface to fit your own personal theme."

New features include:

- Automatic dark mode.
- Enhanced high-DPI support for new skins.
- Marketplace browser for skin library.
- Autoscaling for legacy skins to improve visual fidelity.
- Support for File Explorer Tabs and Taskbar Widgets.

WindowBlinds 11 comes equipped with an in-app browser to make it even easier to find new skins to download from sites like WinCustomize, which archives skins to allow users to tweak and refine their Windows experience, the company said.



Credit: Getty Images/Delmaine Donson

Can’t find that file? These advanced Windows Search tips can help

Use indexing, File Explorer, and even Photos to beef up Windows’ search capabilities. MARK HACHMAN reports

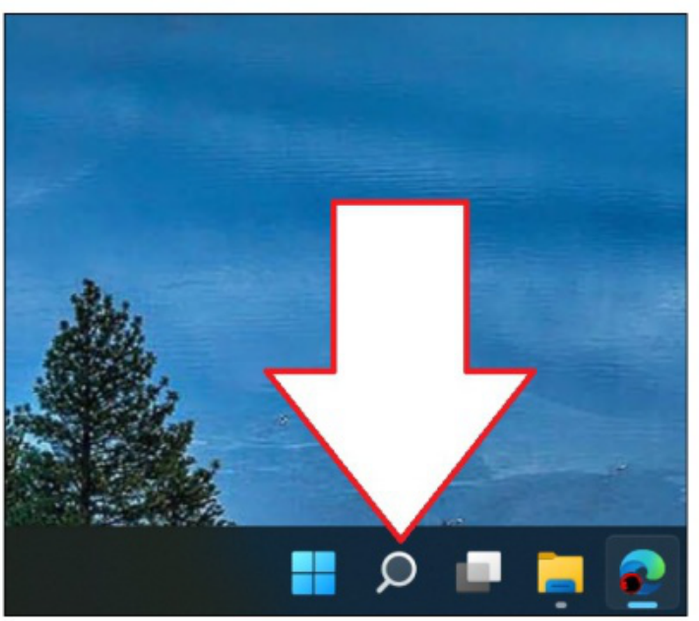
Let’s face it: searching your PC for files within Windows has always been mildly confusing, especially with several options for searching right within Windows 10 and 11. But if you’re convinced that a particular file is hidden somewhere on your PC, try these tips to find it and get back to work.

We can’t guarantee that finding a file will be as easy as using a search engine like Google. (Incidentally, Google once made a desktop search engine for your PC, but it has since been discontinued.) But realizing what Windows is searching, when it’s doing it, and how to interpret results should make life much easier.

Finally, it's important to realize that there are essentially two search mechanisms built into your PC: the built-in Windows Search, and File Explorer. The first should is best for commonly used files, while File Explorer's search function is a power tool that can be used to root out more deeply hidden files. Both Windows Search and File Explorer are integrated with Microsoft's OneDrive cloud storage, but File Explorer does a better job of letting you know which files are where.

Before you begin, there are two things you need to know: where to search, and what to search. Windows Search appears as the 'magnifying glass' icon on your Windows 11 taskbar, and the search box on your Taskbar in Windows 10. In Windows 11, there's a search box at the top of the Windows 11 Start menu, which magically reconfigures the Start menu into the Search menu when you click on it. Windows File Explorer also has a search box at the top of its search window, as well.

The one search box you shouldn't use is the search box at the top of the Widgets panel on Windows 11, and the similar location on Windows 10. This search box searches only the web, and won't find the files on your PC that you're looking for. For the purposes of this article, we're going to ignore that search box and focus on how to optimize searches for files on your PC, instead.

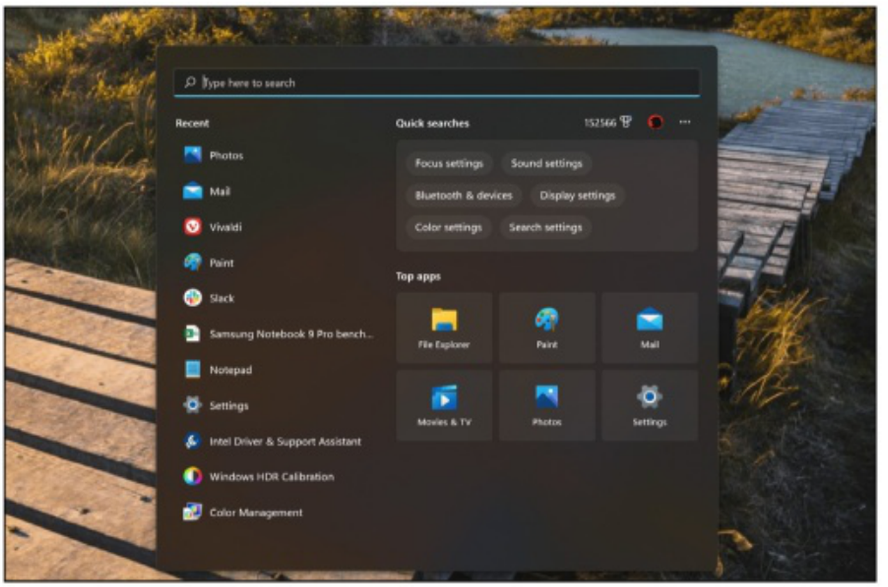


On Windows 11, Windows Search can be accessed from the Taskbar.

HOW TO USE WINDOWS SEARCH

The basic Windows search presents itself each time you click the Search icon: on the left you'll find a column of recently searched-for apps; on the right, you'll see Windows' guesses at some searches it thinks you'll be interested in, plus some Top apps that presumably many users search for. Remember, some users launch apps simply by searching for them.

None of this feels especially personalized, especially when you



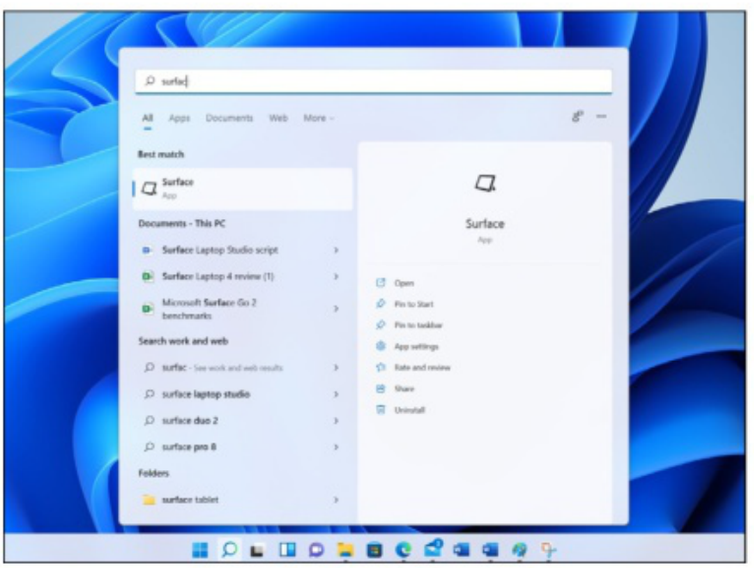
By default, Windows Search is pretty bland.

consider that any recent documents aren't found in Search at all; those are listed under the Recommended section within the Start menu, instead. Microsoft obviously feels that most users won't use Search at all, but the disconnect – recent apps in one section, recent documents in another – still feels unnatural.

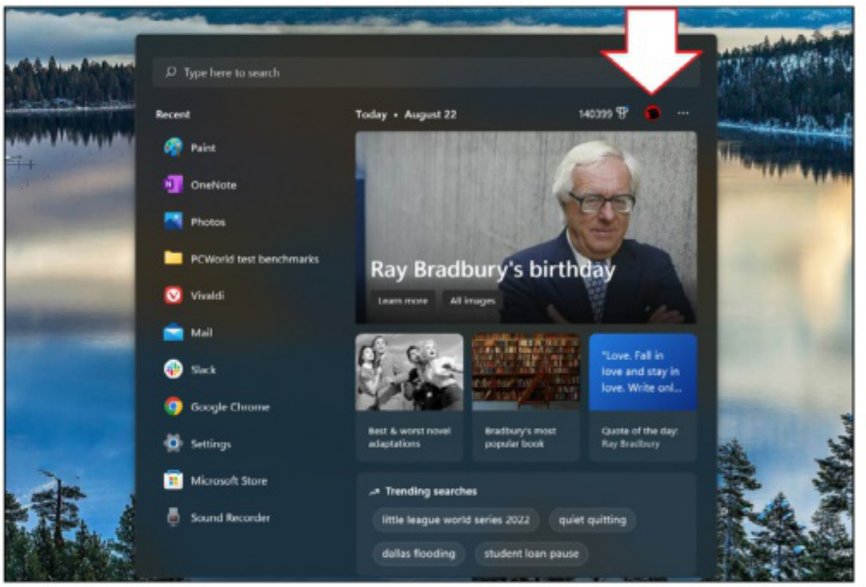
Fortunately, typing in the search box transforms Search into something more useful: Suddenly Windows starts making an attempt to find the document you're looking for. Unfortunately, Search only makes a stab at one file it thinks you're searching for, plus a folder, then branches off into results from the web, your Documents folder, and so on. It's pretty simple; you can't use Boolean searches (x and y, for example). If you get lucky, great. Otherwise, File Explorer may be more helpful for finding the files you need – which we'll talk about later.

Window Search, by default, is rather blah and neutral – a bit like Windows 11, actually. There are two hidden capabilities of Windows Search, though, which you may not be aware of: configuring Search as a work tool, and, conversely, making Search more fun and useful for personal use.

The latter won't solve any of Windows Search's shortcomings, but it



Windows Search in action.



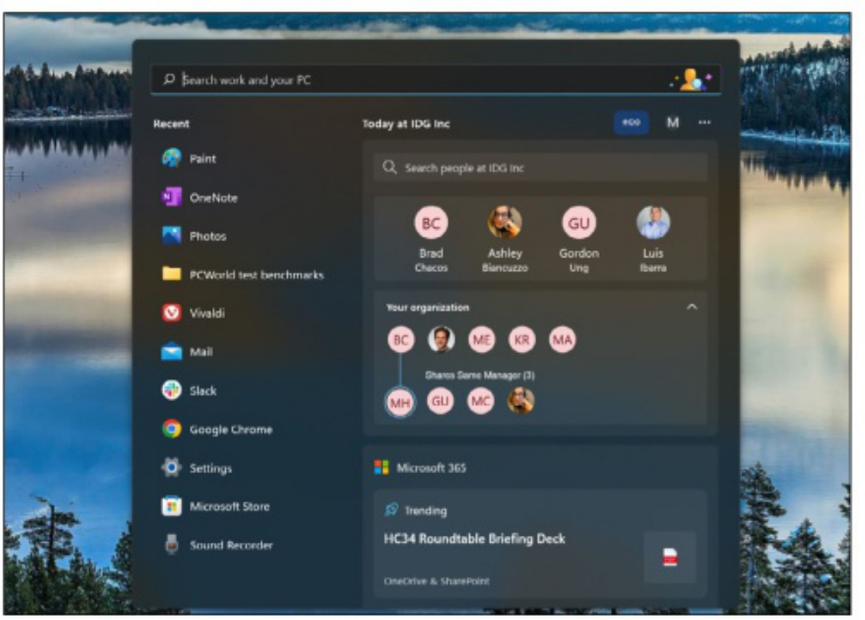
This screen shows the 'search highlights' that are attached to a personal account. To swap between a work and personal account, click the icon underneath the arrow.

will make Search closer to something you'd find online. Within the Windows 11 Settings menu, go to Privacy & security > Search permissions, then scroll down to 'Show search highlights'. Toggle this to the 'on' position.

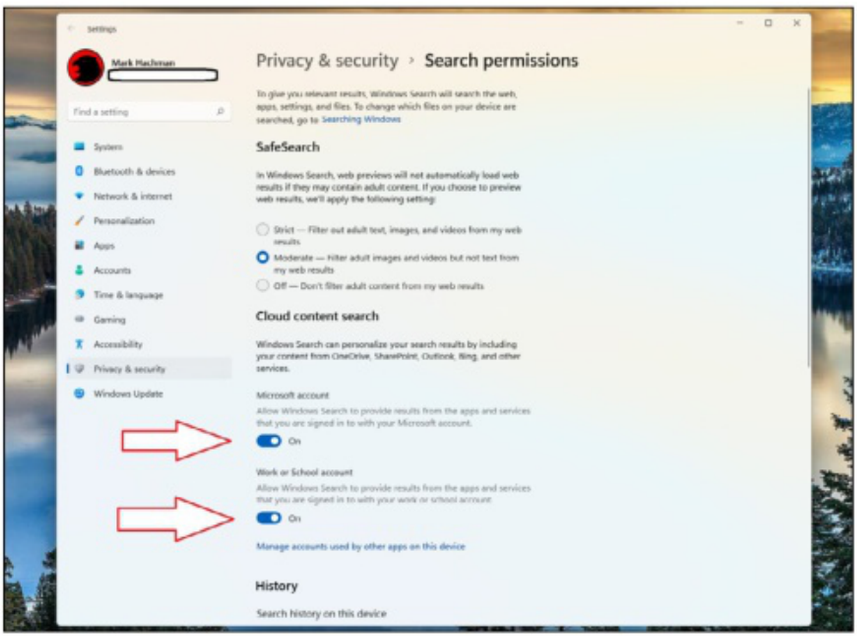
The result will replace the Top apps in Search with a large image sourced from the Bing image database, together with some related image 'searches', as well as a separate section of searches just below.

If you use the same PC for work and play, you may be aware that Bing can be configured to generate work-specific results, such as org charts that describe how other employees fit within the organization. Those same results can appear within Windows Search, as well, provided you're logged into both accounts. To toggle back and forth between the two, simply click on the small icon to the left of the 'ellipsis' menu in the upper right-hand corner of the screen.

Doing so will add a pair of additional search categories: a people search (which will unearth co-workers, their



Windows Search, but at work.



If you use the same PC for work and play, make sure that both of these options are toggled on.

contact information, and more), as well as a Trending list of documents at the bottom of the screen. (You may need to enter the Settings menu again, then Privacy & security > Search permissions) and toggle on both options under Cloud content search – 'Microsoft account' and 'Work or School Account – to enable this.)

These work results may or may not be relevant to you, personally. Again, Windows' best guess may sometimes be way off.

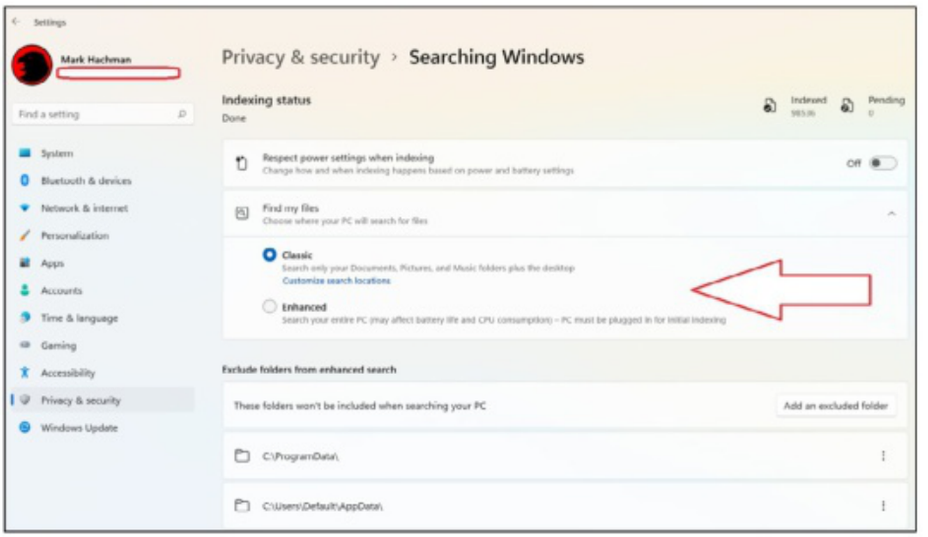
INDEXING AND SEARCHING

Neither of those methods actually improves Windows Search, though. To do so, the first place to start is improving how your PC indexes files.

Your PC 'knows' which files are on it via a search index, which collects the name and the contents of your PC's files inside a small, dedicated database. But by default, only four locations are indexed: Documents, Pictures, Music, and any files stored on the desktop. What about the rest?

There's no reason that Windows Search can't index your entire PC. (Windows warns that this may affect battery life and CPU consumption, but the trade-offs are probably minimal.) To do so, enter the Windows 11 Settings menu (Privacy & security > Searching Windows), click on 'Find my files', and the drop-down menu will expose either a 'Classic' or 'Enhanced' index mode. The latter will index your entire PC.

Windows is pretty intelligent about how and when it indexes, so the process will take a while. A small tally in the upper right-hand corner will tick up and down as Windows finds new files, then indexes them. The same control menu allows you to essentially turn off indexing while on battery to save



The search indexing controls within Windows 11.

power. (Indexing can take several hours to compete when first run, but will turn briefly on and off as you make changes to your PC.) The same control panel also allows you to manually exclude certain folders, in case there are folders with confidential information you don't want to surface, or for some other reason.

Note that Windows makes some intelligent decisions about what to store, even with "enhanced" mode turned on. The size of the index depends, of course, on what files are actually indexed; Microsoft's support page explains that the index will be about a tenth the size or less of the total space those files take up. It will be a bit more if you're indexing smaller files or computer code.

Selecting the 'Advanced indexing options' inside the Searching Windows Settings panel reveals that some apps send files to the index by default: Outlook and OneNote, for example, index files by default to speed up searches. But there's even another layer: this Control Panel app allows access to 'Advanced' controls. Here, you can choose which file types are indexed, as well as how they're indexed – either by the file name alone, or by the file name and the contents.

As for the latter, you'll probably be just fine living with Windows' default decisions. But you do have the option of making a specific file type searchable by its contents if that's what you want.

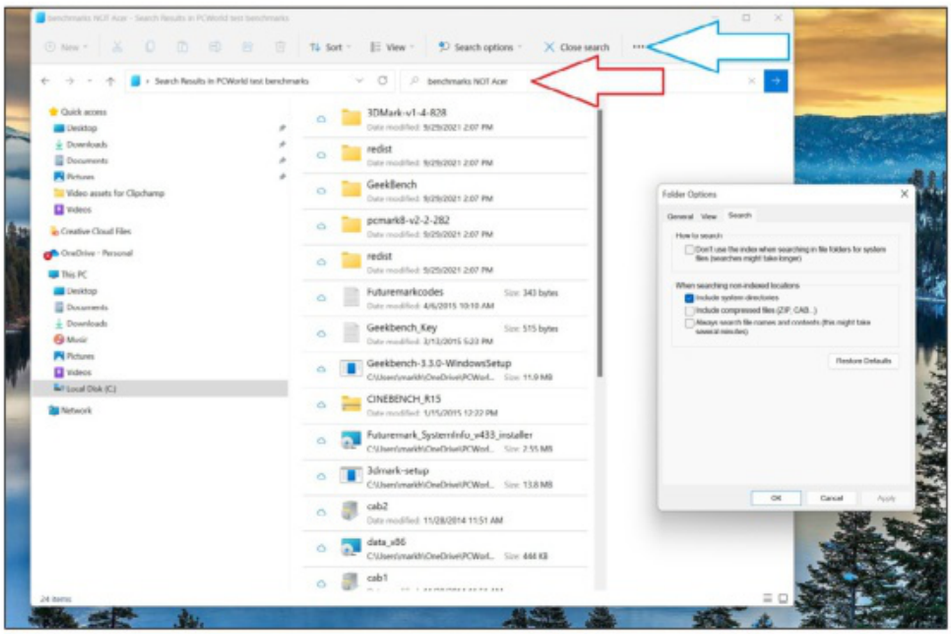
FILE EXPLORER

Using Windows' File Explorer will be the slowest but most accurate option, with flexibility that other options don't offer.

File Explorer offers a search box at the upper-right, with the caveat that box searches whichever folder of your PC you have currently open: If you have the Documents folder open, for example, Documents and any subfolders are searched by default. File Explorer search

uses the folders that your PC has access too, making no distinction between cloud-native and local files; if your PC stores placeholder files locally, they'll be searched just like any other file.

The File Explorer search box will autofill several recent searches, saving you the trouble. Boolean searches work here, too, so if you want to search for 'sales proposal NOT Acme', the search will exclude proposals made to Acme Corp.



Windows 11's File Explorer contains both a search box (red arrow) as well as additional search options (blue arrow).

Finally, File Explorer offers what some of you may have been looking for all along: a detailed 'search options' menu right in the centre of the screen. Weirdly, however, that menu only seems to materialize after you've typed in a search term inside the search box. The search options are there to refine that search, with intuitive options that include 'kind' (email, journal, task, picture, and many more), and whether the file exists in a subfolder, a compressed folder, an entirely different folder, and more.

File Explorer also has the advantage of an optional preview pane, by which you can get a look at a photo, PDF file, or document without needing to technically open it. The preview pane's default size is small enough that you'll likely have to open the document to use it, but you can at least get an idea of whether it's the document you were looking for.

PHOTOS

Most of us take photos with our smartphones, possibly edit them, possibly post them to social media – and never look at them again. But how do you find a specific photo years after the fact?

Here, Windows Search isn't helpful,

but the Photos app is, sort of. As a test, I searched my Photos folder on OneDrive via File Explorer for any photos of 'Las Vegas' – home to many CES trade shows over the years. File Explorer turned up nothing, but using the Photos search box at the top of the app I was able to turn up several related photos. Photos is also useful for searching specific scenes ('snow' or 'beach') although its knowledge of your photo's metadata seems a little skimpy.

It's here that backing up photos to multiple cloud storage providers pays off. While Windows contains a multitude of privacy controls, Google's own Google Photos app basically indexes everything, using facial recognition, metadata, and more – and using it produced hundreds of photos of products we've all forgotten about by now.

There are other dedicated search utilities for Windows: Everything, Grepwin, DocFetcher and more, if Windows Search can't find what you're looking for. The point, though, is that Windows Search by itself doesn't seem particularly useful. But with a little knowledge and tweaking, it can be.

Credit: Getty Images/gorodenkoff

How to use the Windows HDR Calibration app to make your monitor shine

The app is simple, free, and won't require anything but an HDR display, Windows 11, and your eyes. MARK HACHMAN reports

More and more high-resolution displays are quietly including HDR capabilities as an added feature – and now Windows 11 will help make sure they're used to the best of their ability with the new Windows HDR Calibration app (fave.co/3VjC4bL).

It's available for free from Microsoft via the Microsoft Store, was a small app that Microsoft launched alongside the Windows 11 2022 Update (22H2). It doesn't appear to depend on Windows 11 22H2 specifically, though it does require Windows 11.

The app ships with some relatively strict hardware requirements (fave.co/3EAFuRv): you'll need an AMD Ryzen with integrated Radeon graphics or an 11th-gen Intel Core chip (Ice Lake) or higher. Alternatively, the app will work with pretty much any processor with a discrete GPU (AMD RX400 or Nvidia GeForce GTX 1000 or later). Of course, you'll need an HDR-capable display, too.

WHAT'S HDR, AGAIN?

High-dynamic range content more closely emulates the range of light as it fades from the deepest blacks to the brightest brights. If you've ever watched a dark scene and noticed a faint glow around even pitch-black scenes, that's not HDR. HDR essentially instructs the display to make those pitch-black scenes as dark as possible, but to dial up the brightness when necessary. When configured correctly, HDR enables a nice upgrade in picture quality.

What our explanatory article describes in more detail can be summed up briefly: HDR works best when the display is capable of both high contrast ratios (for the darkest darks) as well as a high light output (for the brightest brights). That can be achieved in several different physical ways. One important tell, though, is the HDR rating of your display: An HDR10 or HDR400 display may not put out quite enough light to make HDR truly effective, but an HDR1000 display does.

There's one other important point: in the Windows 11 Settings menu (System > Display > HDR) Windows should tell you if your display is certified for HDR. That's important, as that communicates to the Windows 11 OS that HDR is enabled. "HDR certified displays typically work great out of the box without any additional calibration," Microsoft's Windows HDR Calibration app page notes. "However, you should still consider using the Windows HDR Calibration app on your HDR display."

In other words, if your display is certified, it probably works just fine already – though the app can tweak it further. If Windows doesn't report your display as certified (even if the box says it is), the Windows HDR Configuration app is exactly what you'll need.

In all, configuring your HDR display is a simple process, takes only a few minutes, and there's even a quick fix if you think you've messed it all up.

HOW TO USE THE WINDOWS HDR CALIBRATION APP

As luck would have it, a vendor had recently pitched me on evaluating an Innocn display for some related

testing of USB-C dongles and Thunderbolt docks. Innocn, a Chinese brand I'd never heard of, sent me the Innocn 27M2U, a 27-inch 4K HDR1000 display. Though it was factory-configured, with an HDR1000 label on the box, Windows did not report it as a certified HDR display – perfect for configuring with this new app.

1.

(One note: For best effect, make sure the display is directly attached to your notebook or desktop, rather than via a USB-C dongle or Thunderbolt hub. While I found that a direct Thunderbolt-to-USB-C cable between my laptop and the display enabled HDR, routing it through a USB-C DisplayLink dock did not – fine for productivity, but not for HDR movies or gaming.)

1. Make sure your display is HDR-enabled, and HDR is turned on

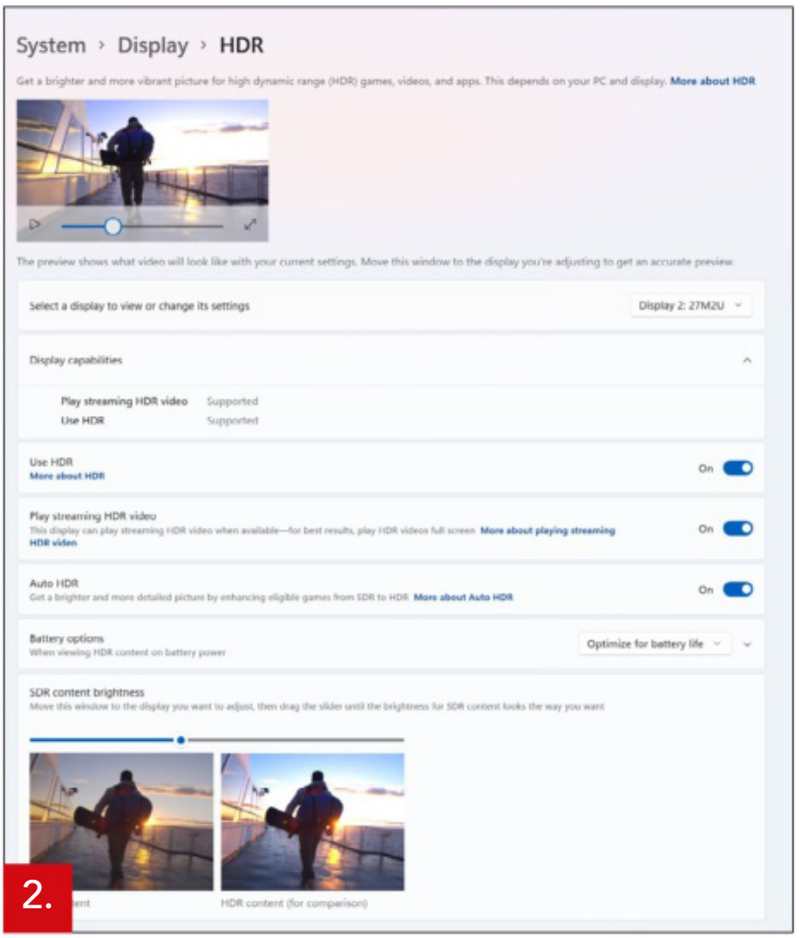
Enabling HDR capabilities on your display varies from display to display, so your best bet is to follow the instructions in your manual. It will almost certainly mean using your monitor's on-screen display and navigating through a few menus. Your monitor may have more than one HDR option, such as 'HDR Design' or 'HDR Gaming'. Pick whichever one works for you.

Some of our older HDR400 test monitors developed an ugly bluish cast when HDR was enabled. You can certainly step through the configuration process to see if that goes away, though they just might not work that well with HDR enabled.

If your display also has post-processing effects turned on by default, you may wish to turn them off – or not! Establishing the right HDR "look" for your display is largely subjective – pick what works for you.

2. Make sure that HDR is enabled for your display within Windows 11

Make sure HDR is turned on within Windows 11 by going to the Settings



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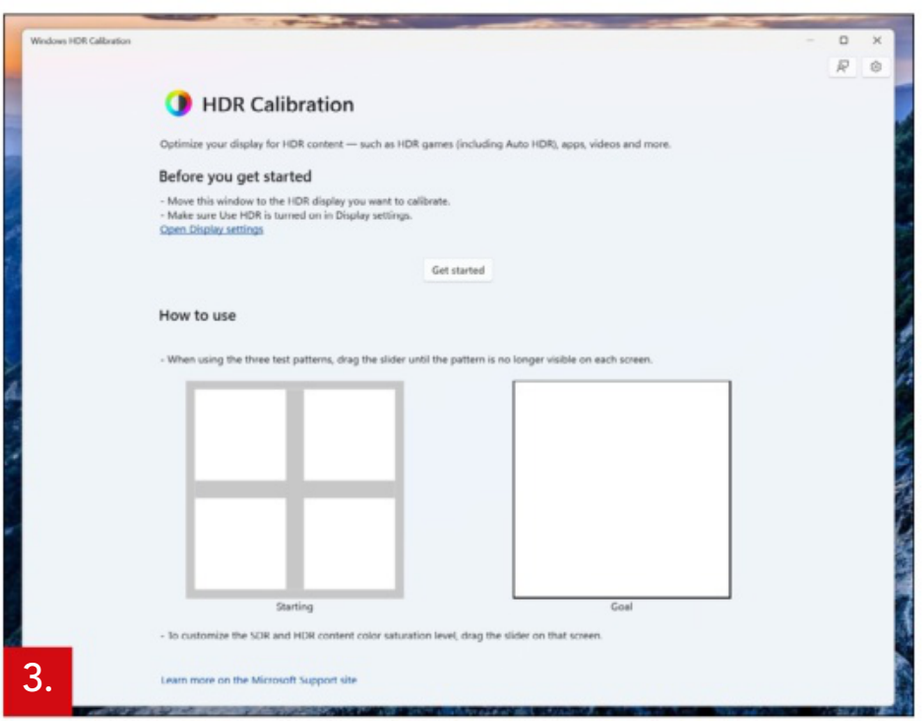


3.

menu, then System > Display > HDR. Be sure to pick the correct display!

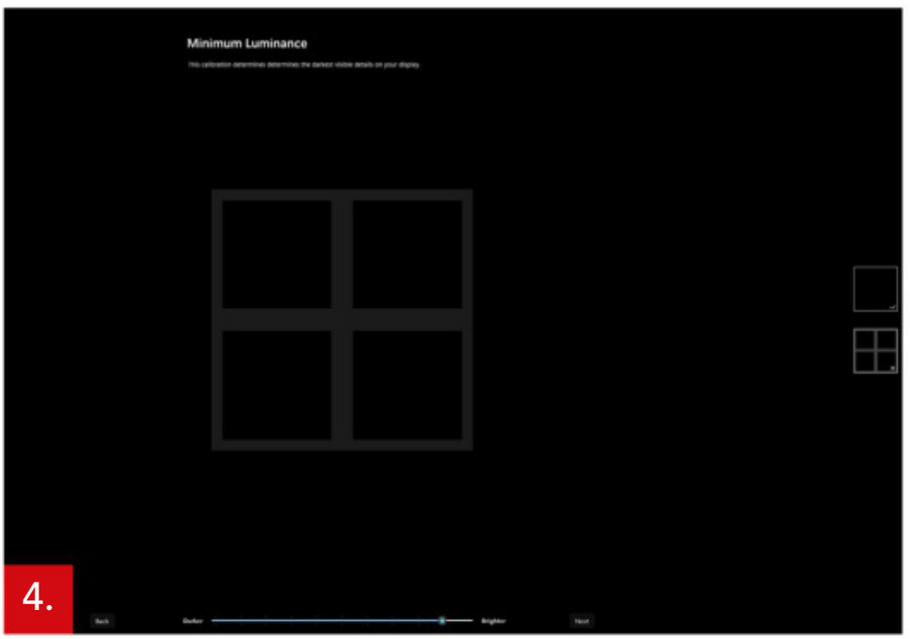
Ensure that HDR is enabled by turning on the appropriate toggle switches. Some choices are up to you – if you're configuring a laptop display, you may want to turn off HDR to save power if you're running on battery.

3. Launch the Windows HDR Calibration app on the correct display

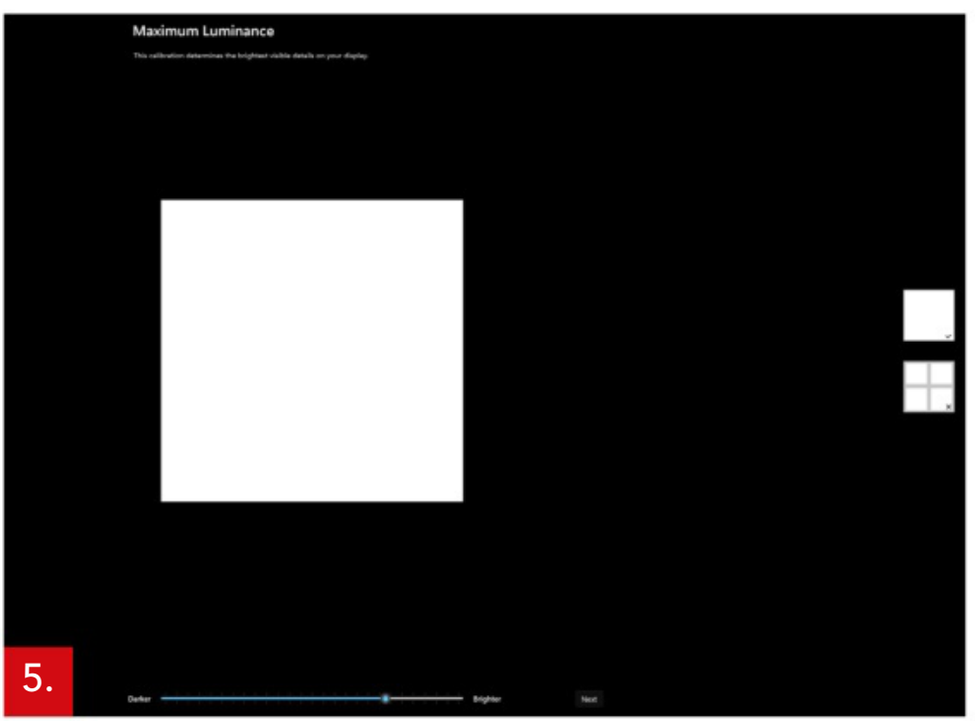
Launch the Windows HDR Calibration app, and drag it to the display you want to configure. The app won't work (and will notify you of such) if it's opened on a display that's not capable of HDR.

4. Begin stepping through the Windows HDR Configuration app by setting the minimum luminance

The first thing the Windows HDR Configuration app



asks you to do is set the minimum brightness. Adjust the slider at the bottom of the screen until the 'window pane' icon disappears into blackness, as the icons to the far right indicate.



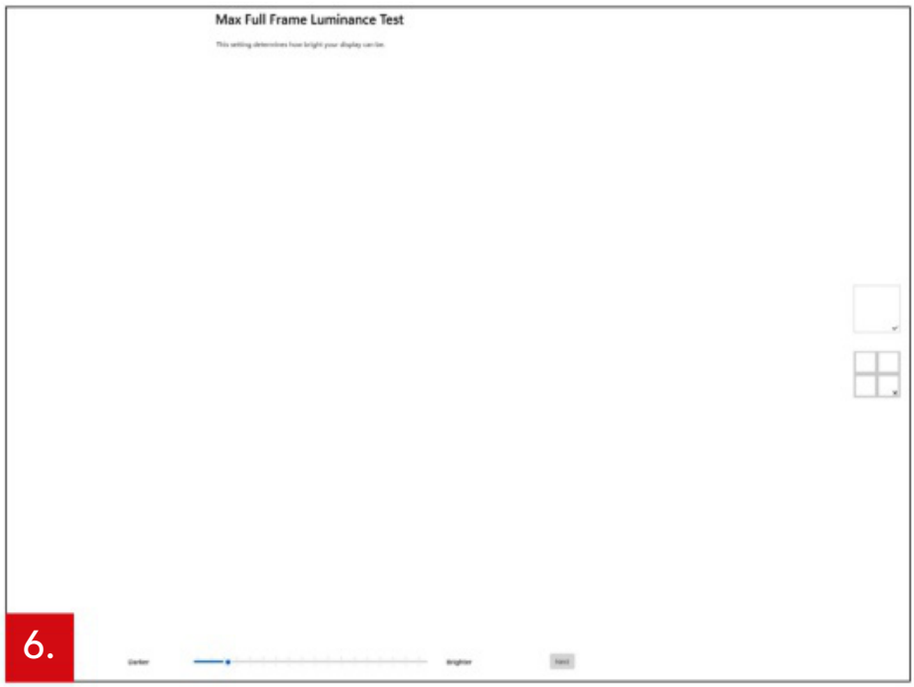
5. Set the maximum luminance within the Windows HDR Configuration app

Repeat this step, just by setting the maximum luminance. Again, adjust the slider until the window pane disappears. The emphasis here is showing the brightest details your HDR monitor can display.

6. Set the full-frame luminance with the Windows HDR Configuration app

By now you should be moving quite quickly through the HDR Configuration app. The only difference here is you're adjusting the luminance for the display as a whole.

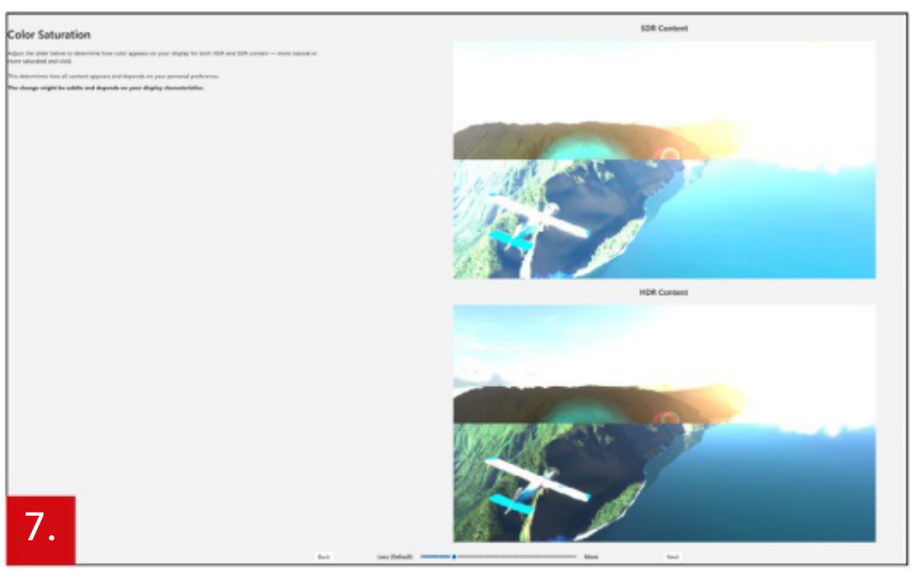
In some displays, this really doesn't matter. The Innocn 27M2U, however, employs local dimming – it uses an array of independent LED



backlights that can be turned on or off. (This helps with contrast.) In this case, you can (hopefully) ensure that the display is generating the same amount of light across the screen.

7. Adjust the colour saturation with the Windows HDR Configuration app

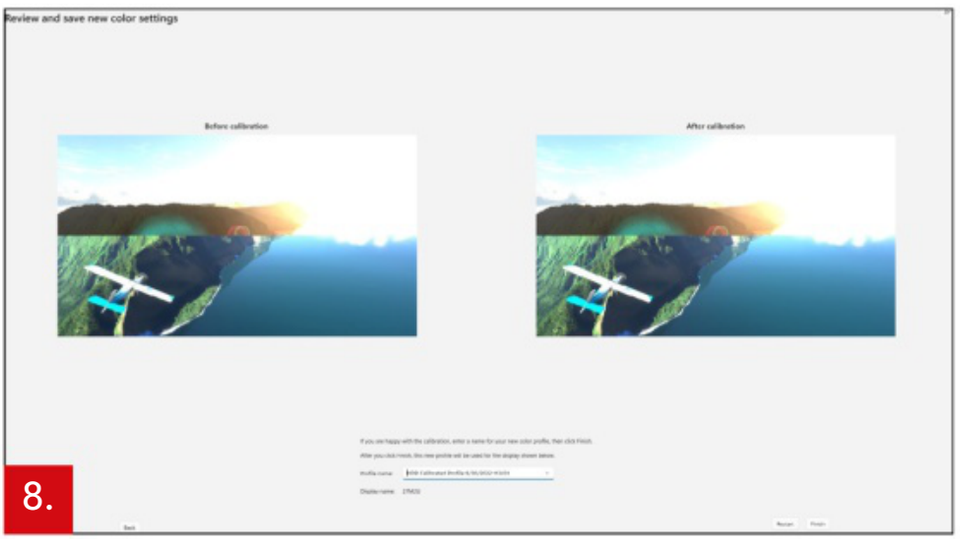
Here, you can theoretically adjust how colours will display on your HDR monitor when HDR is on or off. This is extremely dependent on your monitor, and on the three test displays we used, we could detect absolutely no difference when the slider was adjusted.



8. Review the changes made in the Windows HDR Configuration app

Here, you'll see what changes, if any, were made to your HDR display output by using the Windows HDR Configuration app. (The only reason you don't see any difference here is that we previously configured the display, and the changes, if any, were too subtle to see.)

Clicking Finish will save the colour profile you established via the HDR Configuration app.

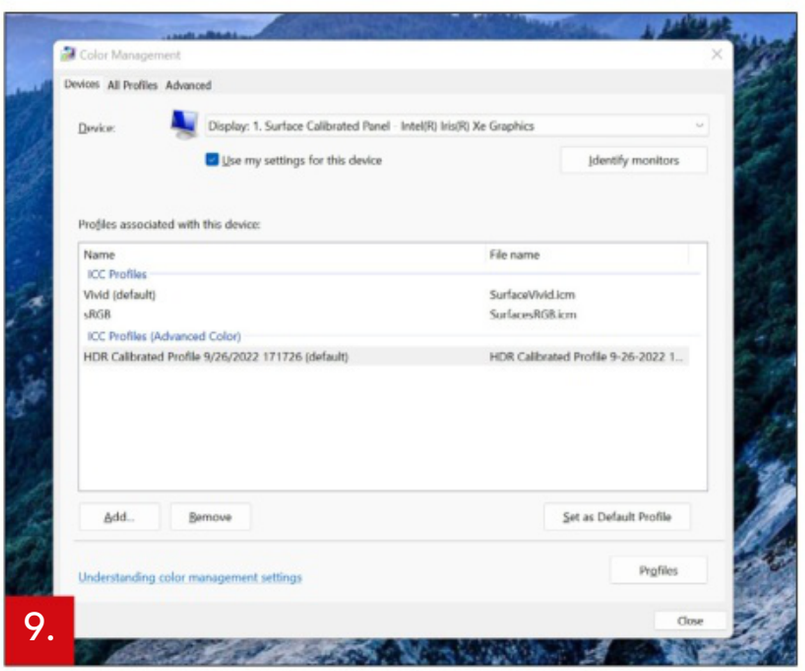


8.

You'll notice that there's an 'ICC Profile/s (Advanced Colour)' for each display. You can set that profile as the default, or remove it entirely if you didn't like the results. Note that you're free to create as many colour profiles as you'd like for whichever displays the app supports – you may want different profiles for gaming, or watching movies, or whatever.

9. Afraid you messed up something? Here's how to delete that colour profile

The new HDR colour profile you just saved can be managed within the Windows Control Panel. Select the Start button, type colour management, then select the profile in the list of results.



9.


FOUNDRY
Formerly IDG Communications