HTC and Valve have created the best VR gaming headset so far. By **Paul Dempsey**

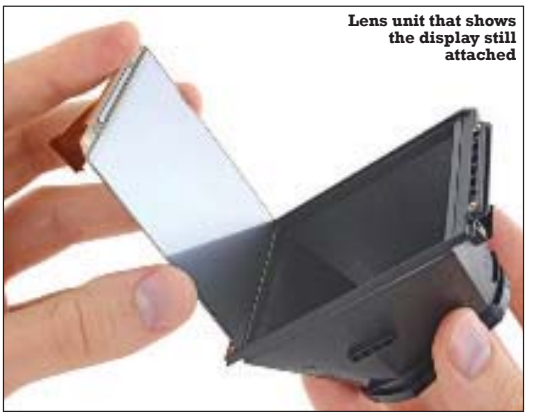
The Teardown

HTC Vive virtual reality headset

Exploded view

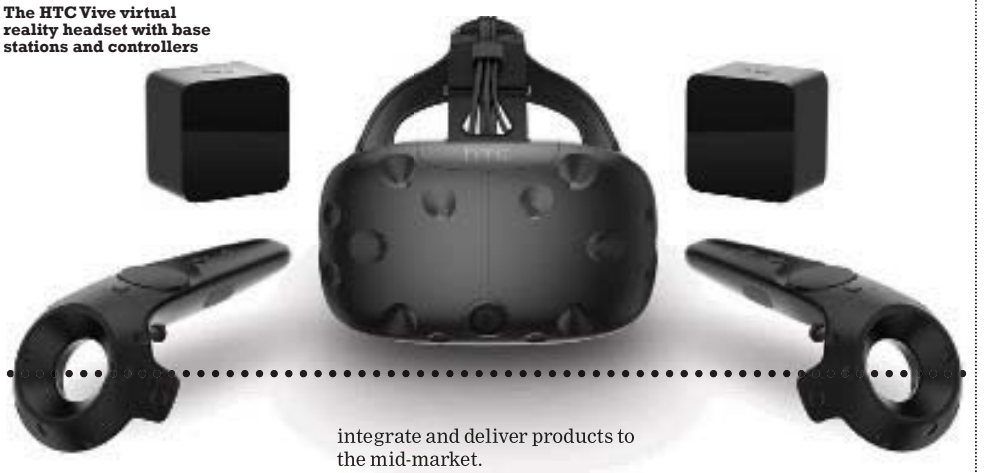
1. Front outer shell with IR filters (left)
2. Front outer shell with IR fliters (right)
3. Lens housing
4. Eyerest
5. Head strap
6. Midframe/headset button assembly
7. Front sensor array
8. Eye relief toggle
9. Gear for eye relief toggle
10. Gear for eye relief toggle
11. Gear for eye relief toggle
12. O-ring for eye relief toggle
13. Foam insert for eyerest
14. 8-ring for foam insert
15. Lens mount (left)
16. Lens (left)
17. Lens mount (right)
18. AMOLED panel
19. Motherboard
20. Front-facing camera
21. AMOLED panel

The Lighthouse display operating and captured by an IR camera



Lens unit that shows the display still attached

IFIXIT/HTC



The HTC Vive virtual reality headset with base stations and controllers

THE ONLY WAY to understand the HTC Vive is to try it. It's not simply that you want to assess the quality of immersive virtual reality (VR) it offers. At first glance, all the first-generation headsets look – well – a bit clunky. You look and wonder, "Is that thing comfortable?"

When used over a relatively short period – we tried three different Vive games for about 15 minutes each – HTC's headset emerges as probably the most comfortable higher-resolution offering currently aimed at consumers (though it still costs a hefty $800/£550 and you'll need to spend at least as much again on the PC platform).

As the exploded view shows, this is a complex product physically as well as in terms of the silicon and sensors inside it. Yet HTC has paid proper attention to balancing the headset's weight. Once your game begins, you do largely forget it's there.

The positioning within your VR world is also cleverly done and effective. Vive's Lighthouse base stations not only sense where you are, but also alert the headset to signal the real physical boundaries around you before you blunder into the wall.

"Each Lighthouse flashes its IR LED array, signalling the start of a cycle. Vertical and horizontal lasers then sweep across the room, and fancy photosensors on the headset and controllers start looking for lasers," iFixit's teardown experts explain. "The tracked headset or controller can then determine its position based on the order its sensors receive the laser sweeps."

Meanwhile, the two wand/trackpad controllers look a little bizarre at first, but prove surprisingly intuitive – for oldies, indeed, they quickly prove a great deal more straightforward than the standard controllers found on an Xbox or PS4.

However, there are two arguably significant ergonomic concerns that various longer playtime users have reported.

First, things can get quite sweaty around the eye sockets after a while. During the demos we attended, HTC did provide sweatguards that sat over the inner foam eyerest because there were multiple users for each test unit.

Second, the first-generation Vive remains tethered to a PC, its Lighthouse position-sensing base stations and more (depending, for example, on your preferred option for audio). Dancing around these multiple cables during a truly 360-degree game can take some time to master. The future of VR will inevitably be wireless.

The specifications do pay off when you're in VR. Combined resolution from the two 1080p AMOLED displays is 2160x1200 and the refresh rate is 90MHz. There is the occasional artefact or visible line, but not enough to prevent an appropriate suspension of disbelief. Your field of view within the VR environment is 110 degrees, just above what we normally have.

At the same time, when you look at the components on the Vive's bill of materials, it quickly becomes apparent that almost all those that can be identified are standard-line (COTS) parts. Of course, much of the heavy processor lifting will be done elsewhere by, typically, an upper-range Intel or AMD CPU/GPU combination.

However, where the COTS aspects of the Vive bode well for the future is in allowing VR headset manufacturers to bring down costs rapidly, as the PC CPUs with sufficient performance are themselves ushered into 'value' hardware by Moore's Law.

Indeed, in June Microsoft decided to license the Holographic OS created for its enterprise-level augmented/virtual reality HoloLens headset to OEMs. It will continue to target higher-end opportunities – some inevitably Xbox launch notwithstanding – but now believes partners like Asus, Acer, Dell, HP and Lenovo can integrate and deliver products to the mid-market.

Coming back to the Vive, however, the big software winner here is HTC's partner – and main developer of the underlying VR technology – Valve. It has its own SteamVR products, it is a prime developer of VR games and, having also seeded the lower-resolution VR for Samsung's Gear system, has come to straddle this nascent market.

Meanwhile iFixit's teardown team says that while the Vive is complicated, the headset, base stations and wands are all relatively easy to fix. It has awarded the whole package a high 8 out of 10 score for repairability.

And coming to the ergonomics that we began with, it's also worth repeating iFixit's observation that "the head strap and face pads are removable and don't incorporate any sensors or electronics that might be prone to failure."

So, the Oculus Rift, for all its Facebook backing, already has one very serious competitor. By autumn we'll see the third big virtual reality headset play for the mainstream, PlayStation VR. And the price tag there is looking to be just $400. *

KEY COMPONENTS

HTC VIVE VIRTUAL REALITY HEADSET

Part	Supplier	Comments
Display	Samsung	2X AMOLED, 91.8mm diagonal, 447ppi, 50Hz. Combined resolution: 2160x1200
System-on-chip	Alpha Imaging Technology	Embedded 32-bit CPU, H.264, image stabilisation, on-chip image signal processing up to 64MP
Microcontroller	STMicroelectronics	ARM Cortex M0, 48MHz, USB, CAN, CEC, on-board flash
Microcontroller	NXP Semiconductors	ARM Cortex M0, 32-bit, up to 50MHz
Transceiver	Nordic Semiconductor	2.4GHz, USB MCU and flash, ISM band
HDMI interface bridge	Toshiba	4k HDMI to MIPI Dual DSI converter
USB hub controller	SMSC	7-port
Memory (flash)	Micron	Separate 4Mb serial flash and 2x 32Mb serial flash devices
USB audio	Cmedia	USB 2.0 with full-speed operation
Buck converter	Texas Instruments	TPS54341
Multiplexer/demultiplexer	Texas Instruments	Bi-directional, 12-channel
Audio codec	Cirrus Logic	Includes programmable DSP
USB repeater	Pericom Semiconductor	USB 3.0-compliant
FPGA	Lattice Semiconductor	One ultra low-power FPGA and one high-performance FPGA
Gyroscope/Accelerometer	Invensense	Six-axis combo
Linear voltage regulator	National Semiconductor	61AE81U L00075B

Note: the components listed here are not exhaustive but restricted to key parts whose suppliers and function could be identified.

Source: *iFixit*