AirPods Pro Teardown

Apple further expands their collection of...

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INTRODUCTION

Apple further expands their collection of professional equipment, this time with a set of AirPods Pro. Apple's line of wireless buds certainly has a fraught history on the teardown table—will its "pro" iteration be any different? We're hoping Apple brought that repairability score up a little (it's never too late to change), but only a teardown will tell.

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TOOLS:

Small Vise (1)
Heat Gun (1)
Halberd Spudger (1)
Curved Razor Blade (1)
Probe and Pick Set (1)
Tweezers (1)
Ultrasonic Cutter (1)
Metal Spudger (1)
Isopropyl Alcohol (1)

Step 1 — AirPods Pro Teardown



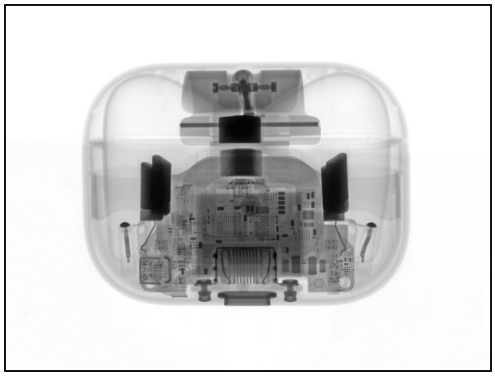
- Along with the "Pro" moniker comes a whole bunch of extra features:
  - Active noise cancellation, Transparency mode
  - Inward-facing microphone for the adaptive equalizer
  - Custom-designed Apple H1 wireless chip with Bluetooth 5
  - IPX4 water resistance

For all that, each AirPod Pro weighs fully a third more than the prior version at 0.19 oz (5.4 g).

- The charging case also got notably chunkier at 1.61 oz (45.6 g).
- Not that more heft is necessarily a bad thing at all—our latest iPhone teardowns showed some mildly bulked-up devices with huge corresponding increases in battery life.

Step 2





- The AirPods Pro come in another dental-floss-style case, which opens to reveal the two li'l 'Pods peekin' out.
- Turning that case around, we find an abridged origin story and a pairing button.
- We've run into trouble before, so we're going to let our X-ray equipped friends at Creative Electron scout out the insides before we dive in.

Step 3



But wait—since this is a professional device, our friends gave it a professional X-ray treatment. Check out this awesome 360° video!

- Things these AirPods could dress up as for Halloween:
  - Jetpack
  - Astronaut's life support system
  - A teardown engineer's worst nightmare

Step 4





- Time for a showdown! What does the "Pro" bring to the table?
  - Replaceable silicone tips for professional noise isolation and enhanced fit.
  - A professionally-postured short, stout body and similarly small charging case.
  - Added pro-level mesh grilles for pressure equalization.
  - The bottom microphone grille shrinks and angles itself out the edge for professional voice recording and phone calls.

Step 5







- We spot a new case model number—**A2190**—while the "buds" are marked **A2083** and **A2084** respectively.

- There's also the telltale "no garbage" icon, which means either (a) this product is not garbage, or (b) this product is not to be thrown in the garbage.

  Hint: it's "b"—and probably also "a", but only if the batteries can be replaced in a couple years when they wear out.

- At the bottom of the barrel we have contact—spring contacts for charging, that is.

- Will these Pro 'Pods be easier to repair or recycle than their amateur counterparts? Trust us, we're just as excited to find out as you are.

Step 6



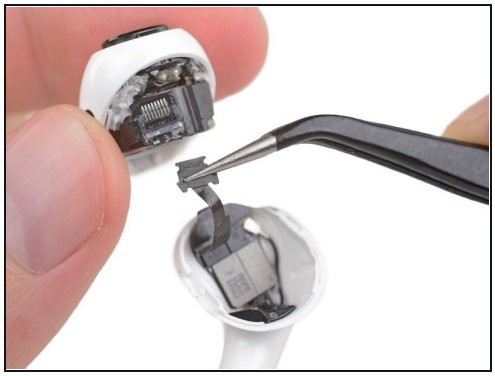


- First things first—let's replace the one openly replaceable component! The silicone eartips snap off and back on with a satisfying click.
  - Most silicone tips slide over a groove on the outside of the earbud. Apple's design uses some fancy engineering and (surprise!) isn't compatible with any typical silicone tips.
  - That means you won't be able to use your favorite aftermarket tips with these, but Apple at least made their official replacement tips just $4 for when your tips tear or get lost.
  - As much as we like standardized parts, these fancy tips do provide the benefit of a larger opening for sound than we'd normally see in an earbud.
- Now that the soft silicone is out of the way, it's time to bring out the big (heat) guns. We don't want to be too presumptuous, but we *think* we know what we're about to get into...
- A little pressure from the trusty vise opens up the seal around the head of the AirPod, and our halberd spudger eases the Pod open slightly further.

ⓘ This definitely looked easier in the product video.

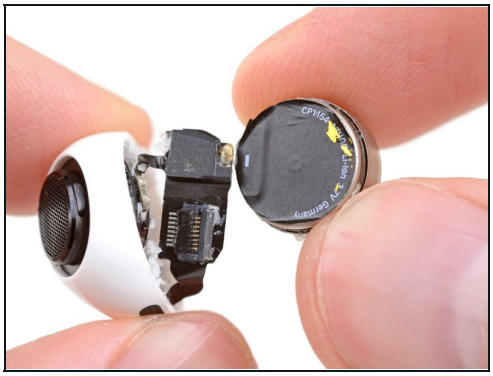
Step 7





- First thing we spot inside is ... glue. (We're not exactly surprised, but always a smidge disappointed.)
- Second thing we spot is—wait, what? A button cell battery? Now *that's* a genuine surprise.
- Another eyebrow-raiser: the ribbon cable connecting the stem to the in-ear portion has a nice deliberate bit of extra slack, and a tiny detachable ZIF connector.
- The connector has a light coating of glue, and safely separating the cable is *extremely* delicate work. Are we up to it? Yes we are.
- It was at this point during our teardown that this AirPod let out a tiny scream—a little *awooo*, if you will. We're not saying that these things are haunted, but our video team experienced something similar during their disassembly, and they recorded it, so it's not just our imagination!
  - It's likely that something we're doing during disassembly is momentarily overloading the speaker driver somehow. Rational thoughts aside though, these things are haunted.
- Now, back to that battery ...

Step 8


- Between us and the (heat-sensitive) battery is a moat of white, rubbery, alcohol-resistant adhesive. Left with no other options, we carefully begin manual excavation.
  - Picking around this little bomb is what you call EOP (Explosive Ordnance Paleontology). Well, okay, we might be the only ones who call it that.

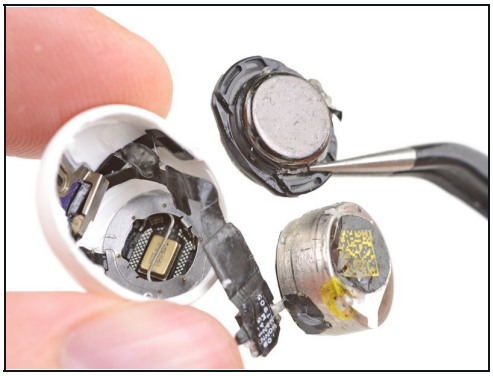
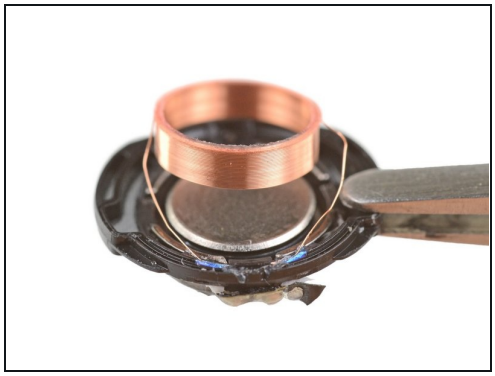
- The battery is tethered by a soldered cable—so even though you can *get* to it, it's still not easily replaceable at this point.

- Hey wait, this looks familiar—could this be the same battery that we found in the Galaxy Buds?
  - They're both German-made, lithium-ion button cells running at 3.7 V—but the Galaxy Buds' (slightly larger) battery reads CP1254, while the one in the AirPods Pro is labeled CP1154.

- Physically, the CP1154 has 14% less volume than the 200 mWh CP1254. With the power of math, we estimate that this battery packs ~168 mWh.

- **Teardown update:** after some more hands-on time with this mystery cell, we've peeled up all the goopy stickers and found a tiny Wh rating! We weren't too far off with our guess—the battery is officially rated at 0.16 Wh.
  - This is a huge boost from the 93 mWh cylindrical batteries in the AirPods 2, and is closer to its pro kin, the PowerBeats Pro.

Step 9

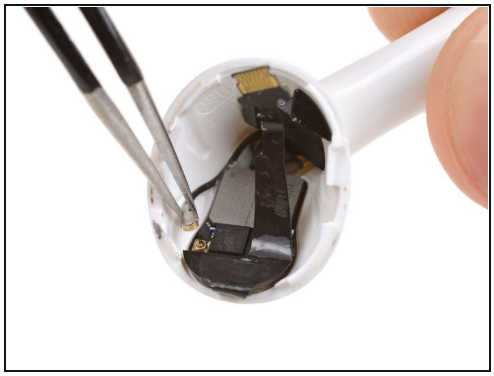
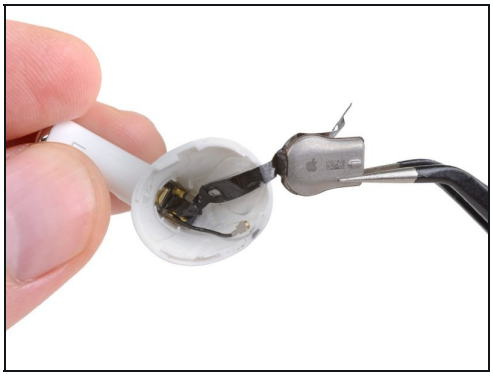




- With the battery dangling to one side, we keep digging. This clear plastic brace kept the driver in place, until we pulled on it too hard.

- Next, the star of this 'Pod—the (relatively) large driver, which lifts out to give us a peek at the microphone that listens to the *inside* of your ear.
  - Apple uses this mic to actively adjust the levels of whatever you're listening to (like in the HomePod), and to determine whether or not your tips are fitting correctly.

- This driver might be *called* the driver, but the one actually doing the real driving is the voice coil.
  - In principle, these work like any other speaker. Current creates an electromagnetic field in the coil, which moves the speaker cone to pump those sick beats into your ears. It also creates the "anti-noise" to cancel out any anti-sick ambient noise.

Step 10


- Back at the tail end of the AirPod, we disconnect a cute little coax connector and untangle Apple's custom SiP, where the H1 and other chips live.

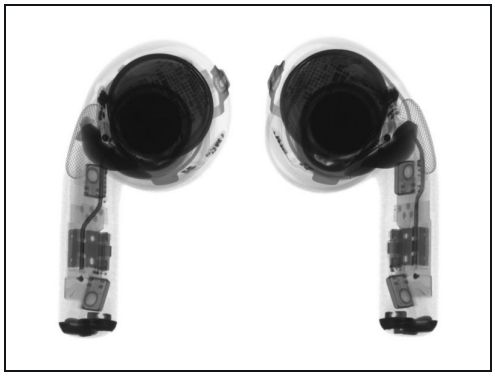
  This tiny board is even smaller than what we found last time, and probably afforded Apple a lot of extra space in the AirPods Pro compared to the standard AirPods.

  - Try as we might, we aren't able to pry apart this package—we'll have to take Apple at their word that it's just silicon in there, and not some form of magic.

- **Update**—thanks to the awesome community, we now have some pretty good guesses as to what these chips are:
  - Most likely a Bosch IMU (Inertial Measuring Unit), which helps with Apple's Spatial Audio feature
  - Most likely an STMicroelectronics accelerometer, which helps with speech detection and noise cancellation

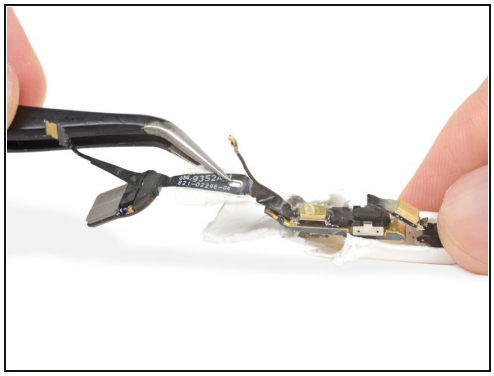
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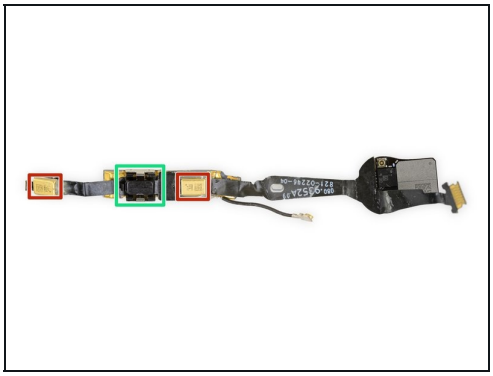


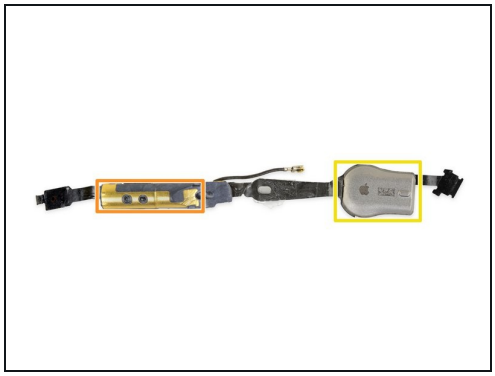


- We make one last friendly attempt to get inside the stem through the cap at the bottom.
- Prying at the seam removes the cap relatively easily, but there's no way all that's left can exit through here.
- After too much meticulous disassembly, we're done being nice—and reach for the ultrasonic cutter.
  - Luckily the 'Pod's anti-noise defenses don't stymie our sonic action.
- Is all this carnage really necessary, when we have such beautiful X-rays? Yes. Yes it is.

Step 12

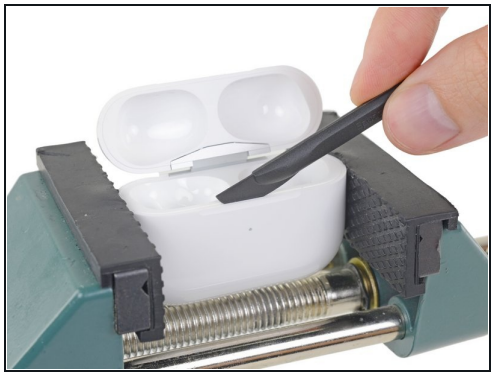






- Our forced entry pays off! With the plastic cleared away, everything inside the stem comes out in a long wiry noodle. Inside, we find:
  - A couple golden microphones
  - Some gilded antenna hardware
  - Still hanging on at the top, that fancy chip package where the H1 sleeps
  - A mysterious black rectangle flanked by metal brackets—could this be the new *force sensor*? If so, it's likely either a capacitive sensor registering finger taps, or a tiny strain gauge sensor sensing squeezes.

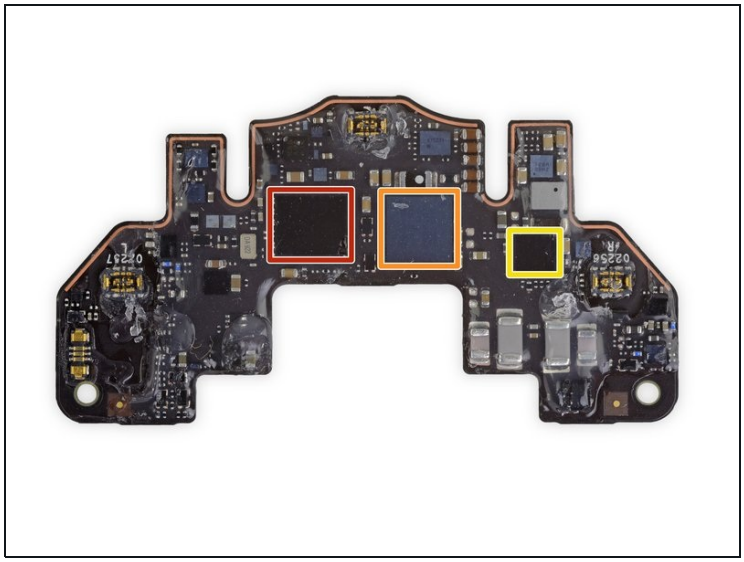
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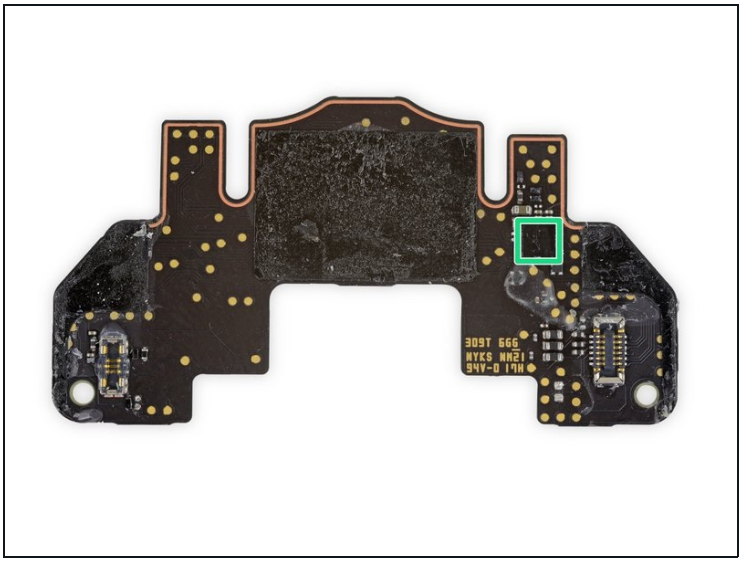




- With our 'Pod in pieces, we whip out the vise again to crack open the holster.
- We have to deform the case pretty heavily to get our ~~foot~~ spudger in the door, but it appears no permanent damage is done.
- With the right leverage, and proper application of strength, the hidden glue gives way and the innards transform into outtards.
  - ...including the battery, which proved more of a pain to remove last time.
- It's all a bit tethered together, but so far this part isn't so bad—as long as you know the secret technique.

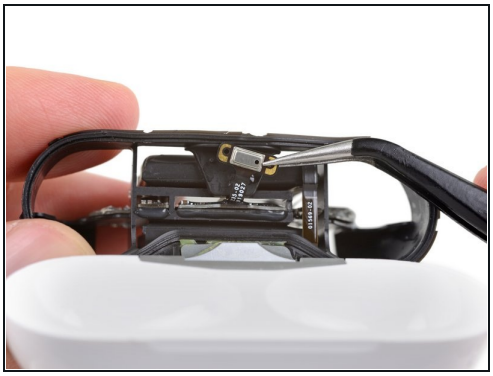
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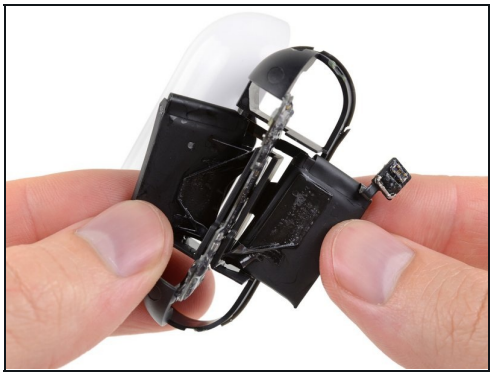




- Finally, some chips we can sink our teeth into:
  - STMicroelectronics STM32L476MG 32-Bit ARM Microcontroller
  - Broadcom BCM59356 wireless charging module
  - (Both of the above are also found in the second-gen AirPods case)
  - Texas Instruments BQ25116A Battery Charger
  - NXP 610A3B KN3308, possibly a charging IC

Step 15





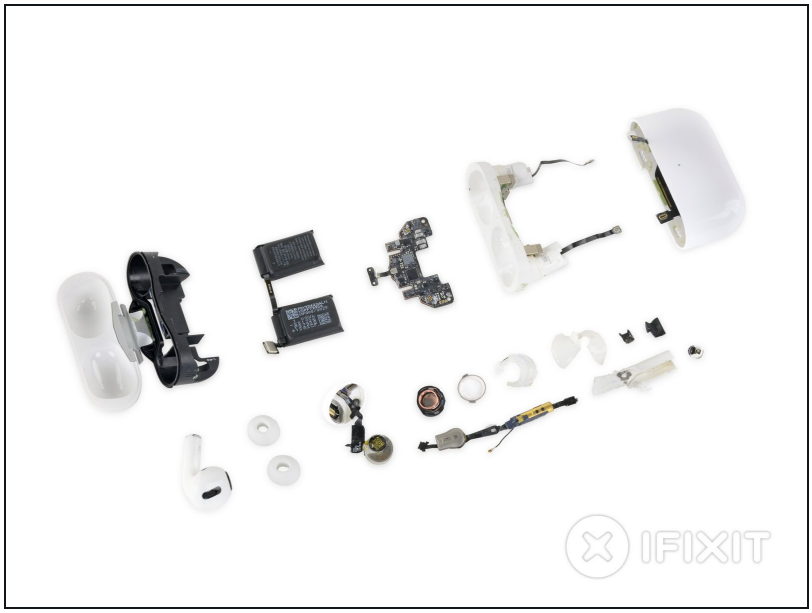


- This little silver guy lives near the top, right between the charging pockets for the 'Pods. What's it for? It looks a bit like a microphone.

- Did we say "battery" before? Make that *batteries*—two of them! Or two cells at any rate.
  - At 1.98 Wh, the Pro battery flexes solidly on the amateur AirPod 2's single-cell 1.52 Wh case battery, as well as the 1.03 Wh Galaxy Bud case.

PSBTW, the Lightning port is indeed still modular—theoretically replaceable if it breaks, *if* you can scrounge up a replacement.

Step 16



- In a surprisingly candid statement, Apple apparently confirmed that these Pro 'Pods **are not** repairable, only replaceable, and are no better in this regard than the earlier versions.

- We can't believe we're saying this, but we're inclined to disagree about the second part—these could potentially be a *tiny bit* more repairable.
  - If not for Apple's statement, we might have guessed they planned to repair these by replacing the in-ear portion of the 'Pods (battery + driver + crusty old earwax) and *reusing* the original stems—including the SiP, antennas, microphones, and squeezy sensor. It's not much, but it's something!

- That said, there's still no good way to perfectly reassemble a dismantled 'Pod, unless you happen to work in the AirPod assembly line at the factory.

- With all that in mind, we have a repairability score that won't surprise you.

Step 17 — Final Thoughts



- AirPods Pro earn a **0 out of 10** on our repairability scale (10 is the easiest to repair):
  - While theoretically semi-serviceable, the non-modular, glued-together design and lack of replacement parts makes repair both impractical and uneconomical.