



Project Tango Teardown

Teardown of the Project Tango developer phone in April 2014.

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INTRODUCTION

It's 2014, and the future is *now*. Google's engineers have been hard at work bringing the virtual to reality with projects like Google Glass, and their newest 3D mapping tech, Project Tango. We got our hands on one of the Tango's prototype development kits, and we can't wait to bust it open. Join us for a little Tango Delta (that's 'Teardown' for those who don't know their [phonetic alphabets](#)) of this camera-studded developer phone.

Immerse yourself in our virtual world by following tech talk on our [Twitter](#), find futuristic friendship via [Facebook](#), or enjoy the instant photography found on our [Instagram](#).



TOOLS:

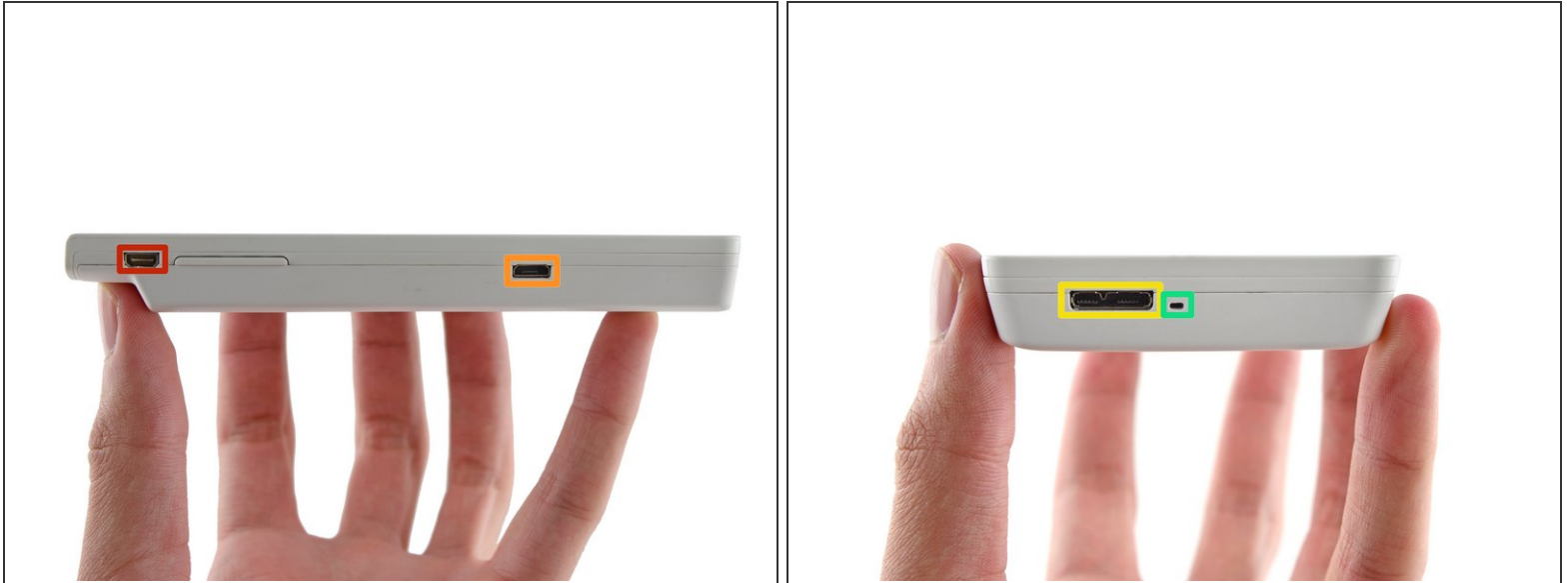
- [Phillips #000 Screwdriver](#) (1)
 - [iFixit Opening Tools](#) (1)
 - [Tweezers](#) (1)
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Step 1 — Project Tango Teardown



- Project Tango is basically a camera and sensor array that happens to run on an Android phone. Google didn't share many specs beyond the camera array, but we dug up a little more:
 - Snapdragon 800 quad core (up to 2.3 GHz per core) CPU with 2 GB LPDDR3 RAM
 - 64 GB internal storage, expandable by microSD
 - 5" LCD screen
 - 9-axis accelerometer/gyroscope/compass
- And of course, the depth-sensing array: an infrared projector, 4 MP rear-facing RGB/IR camera and 180° field of view fisheye rear-facing camera

Step 2



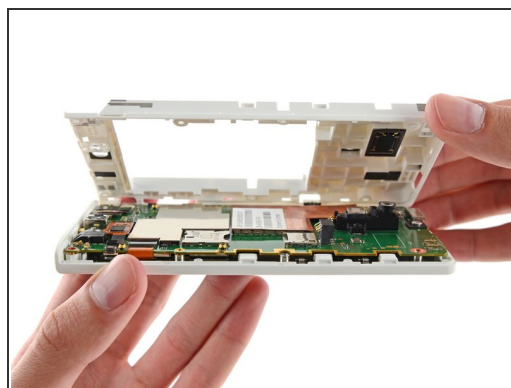
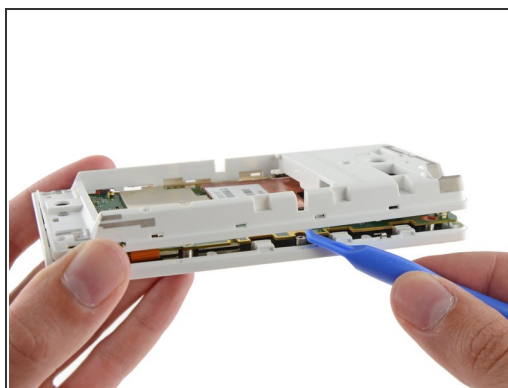
- While Google may have its head in the Cloud, they've made sure to allow for hardware connectivity.
- Tango features several ports, all free of those annoying plastic doors:
 - Micro HDMI
 - Micro-USB
 - USB 3.0
- And a way for you to emotionally connect, a microphone grille. [Awww.](#)

Step 3



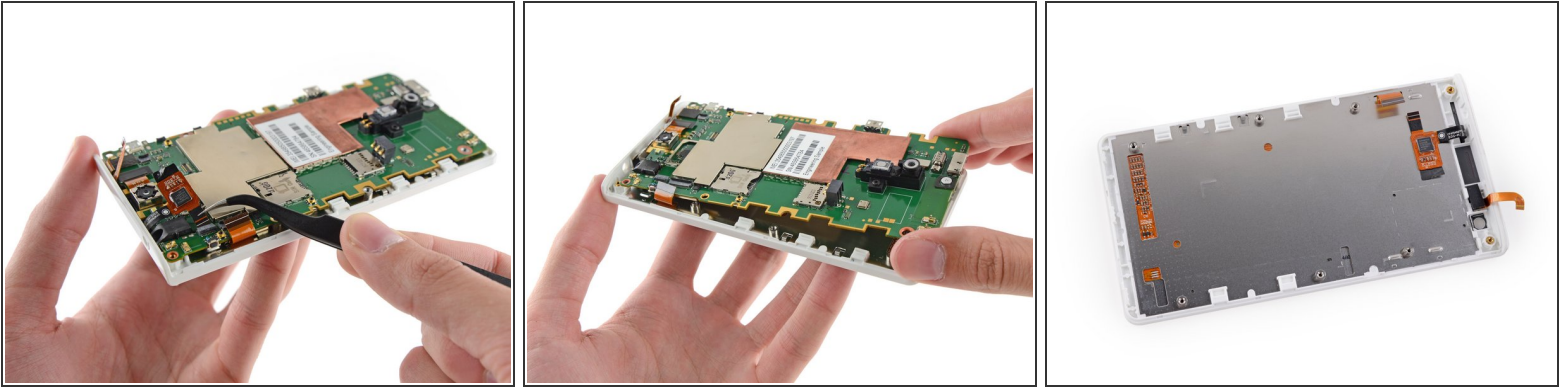
- A thumbnail is the only tool you need to pop off Tango's rear cover and access the battery. (Well, a thumb would probably be pretty useful, too).
- Cover off, battery out. Simple. Tango's development brainpower went into what's inside the phone, not into fancy [chamfered edges](#) or [curved metal unibody enclosures](#).
- [Tango bears](#) a hefty 3000 mAh battery, ready for developers to [take it to the limit](#).
- ① 3000 mAh may be big for a smartphone, but if it weren't for the ultra low power requirements of the [vision coprocessor](#) powering Tango's 3D imaging, it'd have to be a [lot bigger](#).

Step 4



- Removing the battery gives us an immediate view of the motherboard.
- But more importantly, affords quick access to the SIM and microSD slots.
 - While this construction means a couple extra steps to eject the cards, it also means fewer moving parts, and an eject mechanism that can never fail.
- [The turn of a screw](#), and pry of an opening tool and the motherboard is fully revealed.
- Not a lick of adhesive in sight—just a loudspeaker with pressure contacts [nestled snugly](#) into the midframe.
- The midframe, manufactured by [Kuang Fa Plating Co](#), also houses a few integrated antennas, likewise connected via handy, cable-free spring contacts.

Step 5



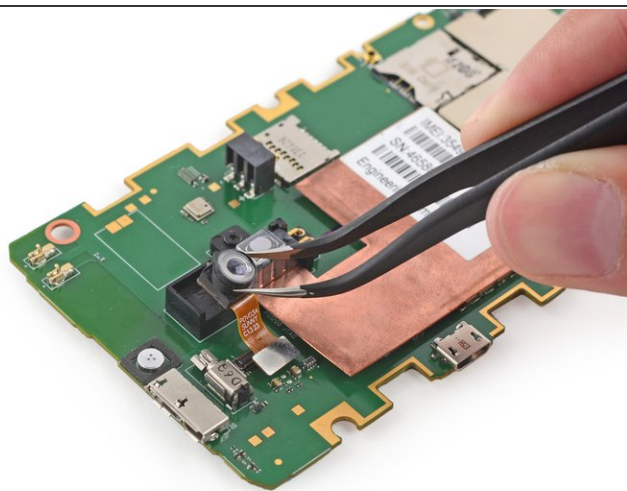
- A few connectors to disconnect, some stickies to de-stick, and the motherboard is free.
- Tango's sole purpose in life is to bring an exciting technology that's thus-far been limited to [game consoles](#) and [Mars rovers](#) to a mobile platform.
- As such, it doesn't waste time with flashy looks or a slim body. It just packs its tech into a box in the simplest way possible. This is by far one of the easiest to disassemble phones we've encountered, giving the [Fairphone](#) a run for its money (or, ideally, some repairability pointers).
- The 5" display assembly wears a Synaptics [S3202](#) ClearPad 3 series touchscreen controller.

Step 6



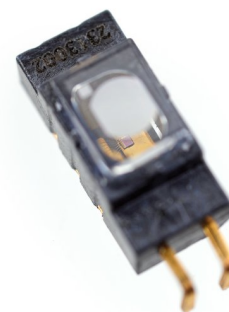
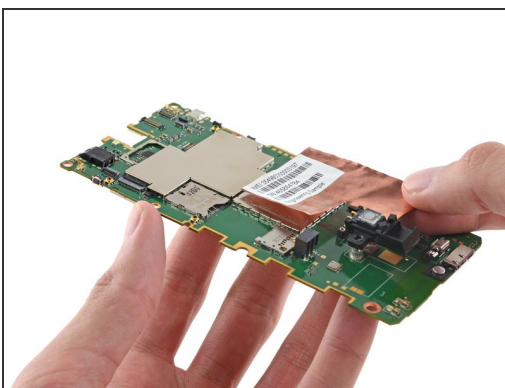
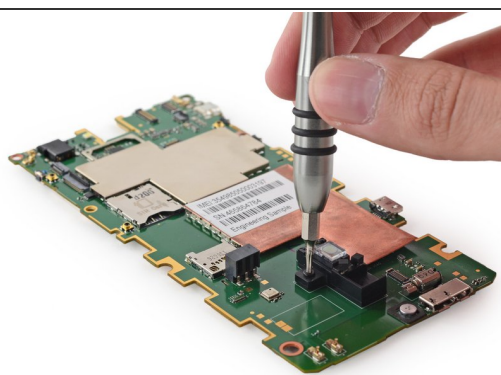
- We pluck the earpiece speaker from the light adhesive keeping it in touch with its pressure contacts.
- The [mysterious markings](#) on this ultra new, and ultra custom device continue to elude us. Our searches find nothing useful.
- Next on the plate, two delicious cameras, 'SUNNY' side up.
- The selfie-cam has a 120° field of vision (FOV), which is akin to the (depth perceiving) [field of view of the human eye](#).
- So what we're saying is, [when you take a selfie, it looks back into you](#).
- Tango's 'standard' cellphone camera is a 4 MP OmniVision double-whammy [RGB and Infrared sensor](#) that allows for high-res photo and video, as well as depth perception.

Step 7



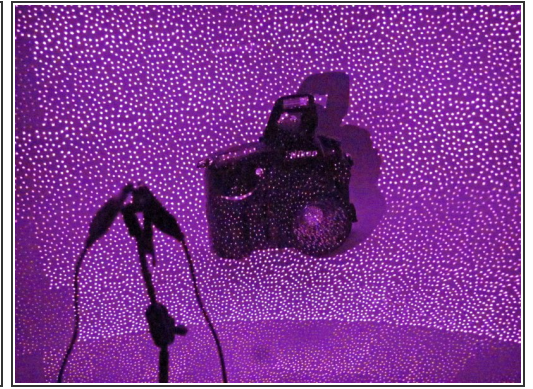
- Another one bites the dust. Or the lure. This fisheye lens caps a low-power [OmniVision CameraChip](#).
- The fisheye lens enables a 180° FOV, while the sensor balances resolution and frames per second to record black and white images for motion tracking.

Step 8



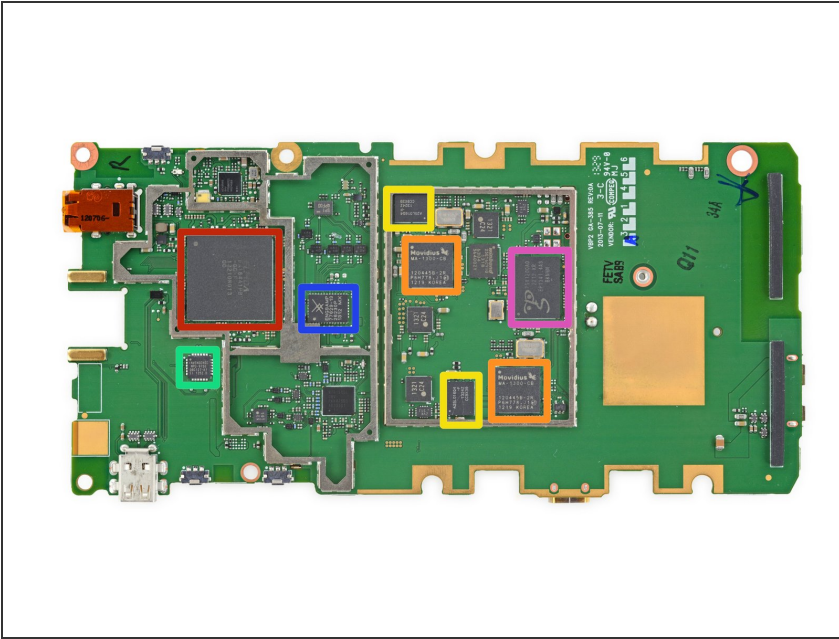
- A huge chunk of copper provides electrical grounding and thermal dissipation for the lower sensor array. Something must get pretty warm down here...
- ...And it looks like we've found our culprit, an infrared projector. Deep inside this tiny glass-topped box lives a series of infrared LEDs, powered by some hefty leads (for a smartphone).

Step 9 — Science with iFixit!



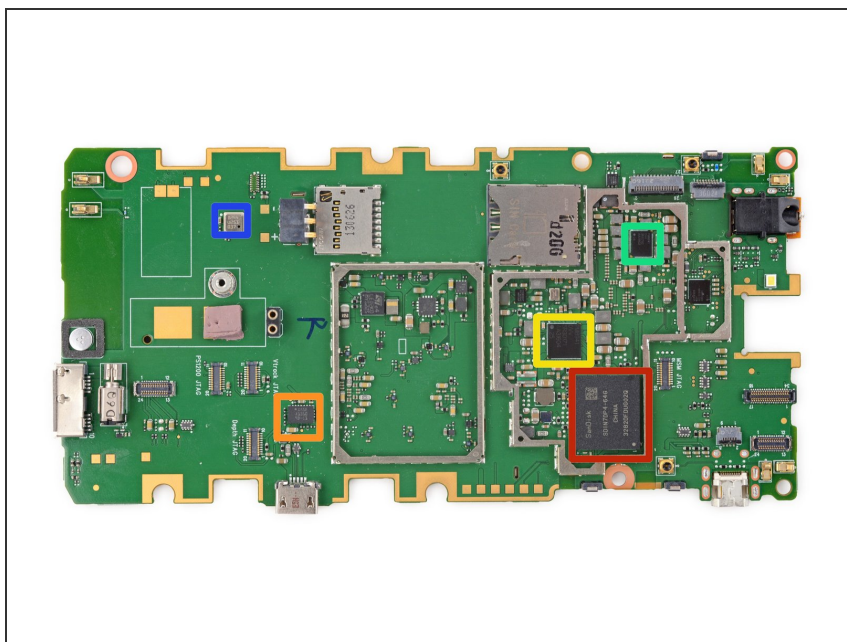
- Google didn't want us turning on our unit, so we had to figure out our own way to [power up](#) the IR projector.
 - A little gentle power applied, a [home-hacked IR camera](#), and presto! Shiny dots on the photo room wall!
 - The bright grid of dots shows that Tango works similarly to the original [Microsoft Kinect](#), with a grid of dots to be captured by the IR sensors of the 4 MP camera, building a depth map.
- ❗ How does a grid of dots build a depth map? [With science](#).

Step 10



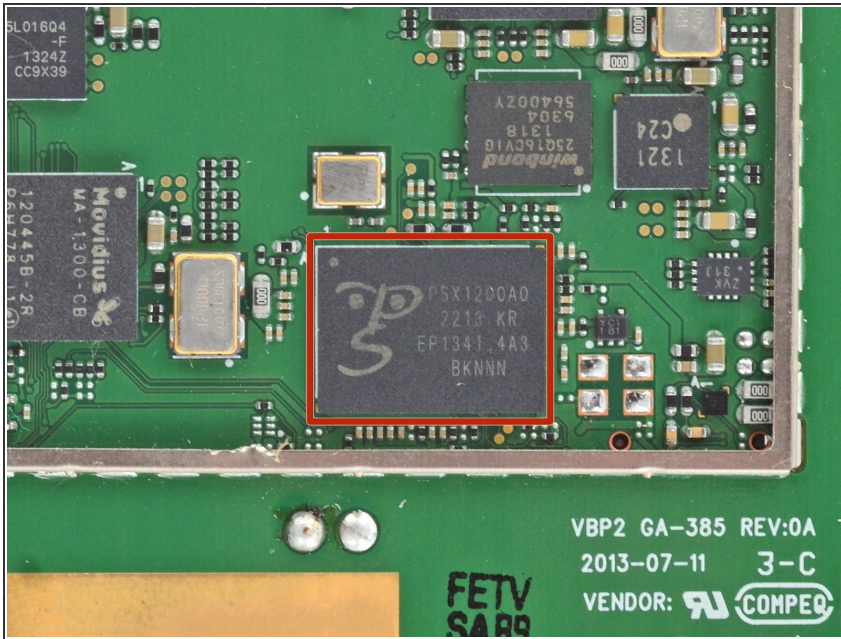
- What's cooking in Tango?
 - Elpida [FA164A1PB](#) 2 GB LPDDR3 RAM, layered above a Qualcomm [8974](#) (Snapdragon 800) processor
 - Two Movidius [Myriad 1](#) computer vision co-processors.
 - Two AMIC [A25L016](#) 16 Mbit low voltage serial flash memory ICs
 - InvenSense [MPU-9150](#) 9-axis gyroscope/accelerometer/compass MEMS motion tracking device
 - Skyworks [77629](#) multimode multiband power amplifier module for quad-band GSM/EDGE
 - PrimeSense [PSX1200](#) Capri PS1200 3D sensor SoC

Step 11



- The back of the board includes:
 - Bosch Sensortec BMP180 pressure sensor
 - SanDisk [SDIN7DP4-64G](#) 64 GB iNAND flash memory
 - Bosch BMX055 IMU
 - Qualcomm [PM8941](#) Power Management IC
 - Qualcomm [PM8841](#) Power Management IC

Step 12



- Whoa, hold your horses, what's this? We found some unexpected new tech in Tango.
- This appears to be PrimeSense's new [Capri PS1200 SoC](#) 3D imaging chip, unexpected for a couple of reasons:
 - Just last year, Apple bought PrimeSense, manufacturer of the Kinect's 3D vision hardware. Speculators assumed we would be seeing this hot new hardware in an upcoming iOS device, with intent of [mapping 3D spaces](#). Looks like Tango beat Apple to the punch with their own tech?
 - Also interesting, Movidius has been getting [plenty of time in the spotlight](#) lately, as the ultra-low-power successor to PrimeSense's 3D throne, finally a solution for mobile devices. So what's PrimeSense doing here, alongside Movidius?

Step 13



- i** While this top-secret prototype is hardly a consumer device, we're happy to give it a Repairability Score, especially since it may serve as an example of how simple a smartphone's construction can be.
- Project Tango Repairability Score: **9 out of 10** (10 is easiest to repair).
 - The battery can be replaced in seconds with no tools.
 - Seven screws hold the entire device together.
 - Several modular components can be replaced independently: speakers, cameras (all three!), IR projector, and display assembly.
 - A few components remain soldered onto the motherboard, increasing replacement difficulty. These include the vibrator motor and USB ports.

To reassemble your device, follow these instructions in reverse order.