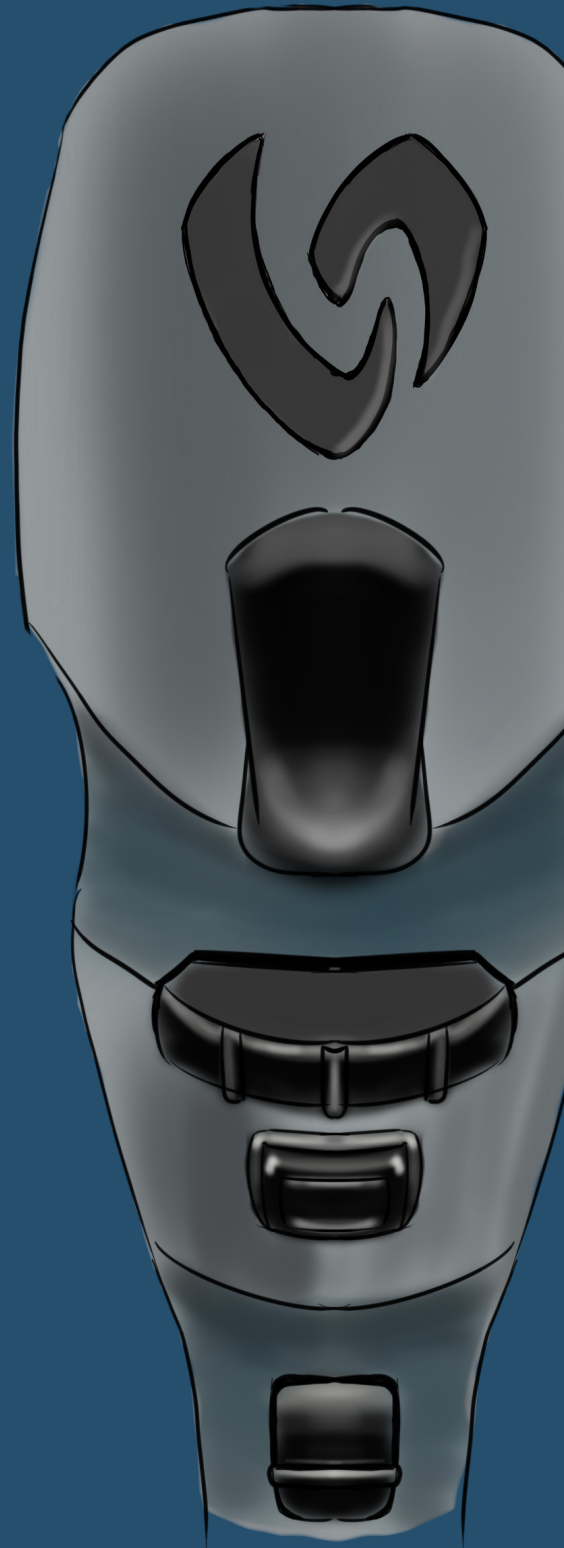
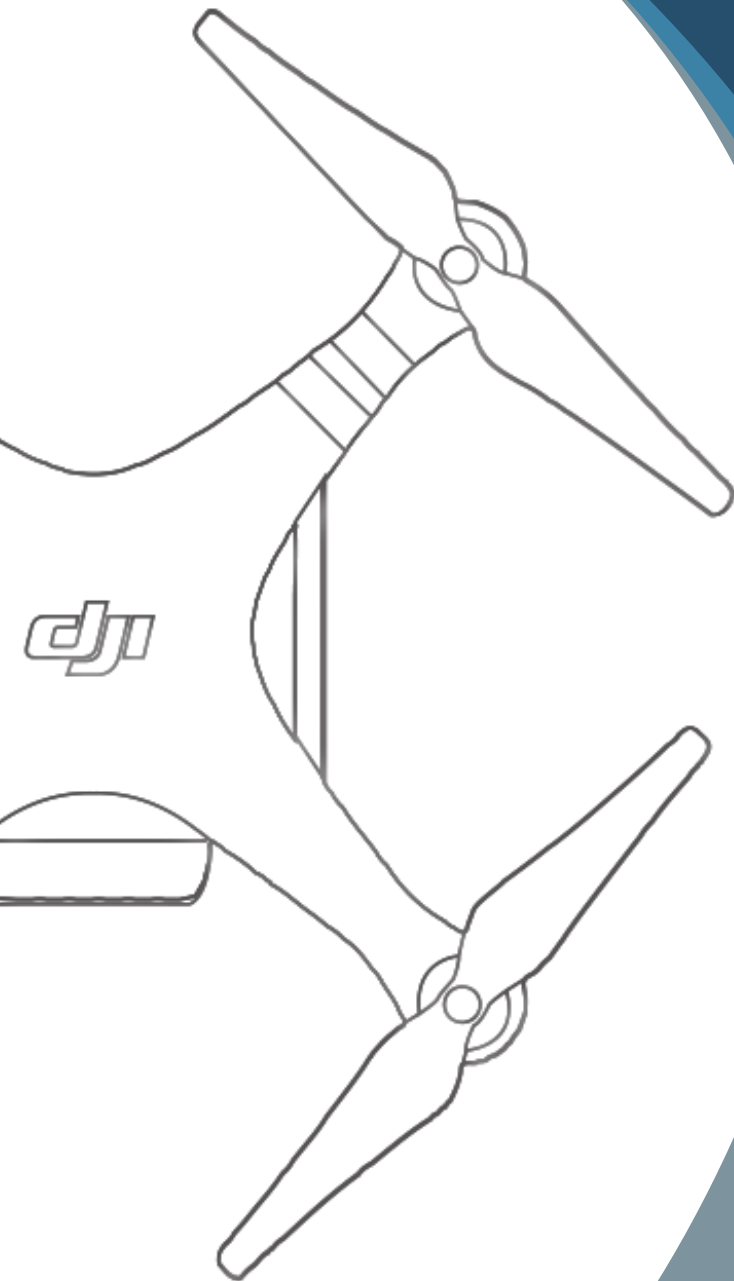


AERIAL GO

DRONE CONTROLLER



VINCENT HOLBROOK

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The History of Drones

"Drone" or "UAS" refers to any aerial vehicle that is unmanned. So by this definition, the earliest unmanned aerial vehicle was seen in **1839**, when Austrian soldiers attacked the city of Venice with **unmanned air balloons** filled with explosives.



The Wright Brothers' famous **Kitty Hawk** flight was in the autumn of 1900, and only 16 years later Great Britain developed the **first pilotless winged aircraft**: the Ruston Proctor Aerial Target.

The Aerial Target was based on designs by Nikola Tesla and was controlled with **radio control** much like the drones of today (though the technology was much more rudimentary.)



The Wright Brothers' famous Kitty Hawk flight



The Ruston Proctor Aerial Target

A year later, an American alternative was created: the Hewitt-Sperry Automatic Airplane. After an impressive test before representatives of the US Army, a more advanced mass-producible version was commissioned: the **Kettering Bug**.



Modern Military Drones

UAV technology improved throughout World War II (which saw a number of technological advancements as we all know) and into the Cold War as well.

But they were largely seen as unreliable and expensive novelties – nowhere near as reliable as the exciting new innovations in manned aircraft like the Flying Fortress and the SR-71 **Blackbird**.



Modern drone warfare began in earnest in **1982**, when Israel coordinated the use of battlefield UAVs alongside manned aircraft to wipe out the Syrian fleet with very minimal losses. The Israeli Air Force used military drones to recon the **enemy's position, to jam communications, and to act as decoys** that would prevent the loss of pilot life.

Modern military drones typically serve one of two purposes. The first is **combat surveillance**, in which a human pilot uses radio control to fly a drone to different waypoints to scan and mark enemy positions.

The second is **tactical reconnaissance**, in which a mini drone (not much larger than the commercial drones we write about here in most cases) flies on autopilot to predesignated targets to take pictures before returning to a home base.

Commercial Drone History

Non-military drone use began in earnest in **2006**. Government agencies for **disaster relief, border surveillance and wildfire fighting**, while corporations began using drones to **inspect** pipelines and **spray pesticides** on farms.

As unmanned aerial vehicle technology improved in the military sector, those same technological improvements could be used in the private sector.



Recreational drone use only took off very **recently**, and it's grown fast. One of the main reasons for this is that the Federal Aviation Administration had to be convinced that commercial drones were **safe** to allow and determine proper regulatory measures. So in 2006, FAA issued a **commercial drone permit**. They issued an average of **2 of these permits a year** for the next eight years.



Then, in 2013, Amazon CEO Jeff Bezos announced that the company was considering using drones as a **delivery method**, igniting the public's interest in drone history. In 2015, the FAA issued **1000 drone permits**, a number which more than tripled to **3100 permits** in 2016 and which has continued to grow in the time since.



Modern Commercial Drones



DJI is one of the top consumer drone manufacturers, known mainly for their *Mavic* series. The *Mavic* series has become the quintessential drone for new to intermediate pilots and videographers.



Parrot makes some of the best drones on the market. Their *ANAFI* camera drone is always a favorite in lists around the web. Additionally, their *Bebop 2.0* is even more robust than the original, with a 25 minute battery life and powerful motors for flight in greater altitudes.



Yuneec started with a ready-to-fly fixed wing RC airplane. Eventually, transitioning into aerial video quadcopters. In 2017 they launched the *Typhoon H520*, designed specifically for commercial applications, and In 2018, they launched the first ever voice-controlled drone, *Mantis Q*.



Even though GoPro's only attempt at a drone flopped, we can't ignore the fact that they were one of the first to create a collapsing design, which would be a new trend of drone design in the years following, as well as creating a way to integrate their gopro



Commercial Drone Technology

There have been at least five significant stages within the evolution of commercial drone technology. In a fundamental sense, the challenges began with the ability to fly drones reliably and regularly as needed.

Stage One- Development of reliable controls and stable flight capability

This stage was the threshold for commercial drone utilization. The systems became reliable tools and predictable systems. The commercial use price points emerged at a level that businesses could buy and deploy systems in large volumes. Automation added simplicity to drone operation as many onboard systems were automated by advancing technology. The net result was drone systems that were easier to operate and available to a larger group of trained pilots.

Stage Two- Upgrades for Onboard Cameras and Sensors

Improvements in cameras and sensors produced reliable imagery and reports. The reliability of the drone system ensured the accuracy of the data collected and that the system could duplicate its procedures exactly. Data processing went to desktop level, and employees could perform tasks routinely with automated systems and enterprise software. At this scale of



Stage Three- Scalability of Drone Usage

A constant challenge of incorporating drones into a business routine is in reaching the desired scale with accuracy and precision. Drones must not only test successfully, but they also must go into real-time usage at the rate and level of action needed by the organization.



Stage Four- Data Management and Machine Learning

Regular use of drones in essential functions produces data compilations. These continue to a point beyond the level of efficient human processing. Firms must integrate database management into the drone data collection systems. As the databases become large and complex, firms turn to machine learning to optimize usage of the data. Utilizing machine learning algorithms, the machine begins to signal changes, spot defects, identify patterns, and indicate trends.



Stage Five- Drone Systems Integration

Drone functions and data blend seamlessly into the overall business design for data collection, analysis, and application. Rather than becoming routine, drone analytics open new vistas for drone data and drone device innovations.



What's the problem?

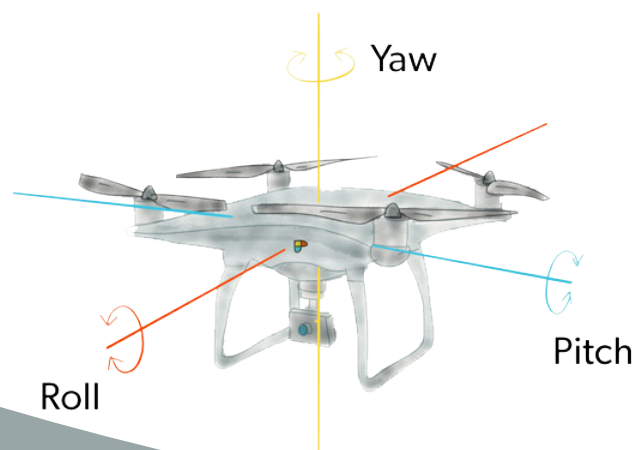
With the exploding popularity of recreational drone flying, thanks to companies such as DJI, 1,000s of people are now in the same air space as airplanes and helicopters. This poses many problems involving safety and regulations.

Diving deeper I discovered that most, if not all, drone piloting is controlled by remotes that are extremely similar to video game controllers. Joysticks and buttons can make younger pilots connect the two experiences, taking away from the seriousness of piloting a drone.



Another Issue is the learning curve, the joysticks don't reflect the actual motion of the drone, unlike actual planes. Yaw, Roll and Pitch are done by moving the joysticks in different linear directions

The operations are void of anatomical literacy and does not consider human centric design.



Current Controls



Almost all controllers have a confusing and illogical format for controlling the drone. The mapping is unnatural and completely opposite to the way the body of the drone actually moves.

The military just recently introduced the Black Hornet Drone, straying from the commercial drone and controller design, allowing it to be more compact and easy to travel with. The controller sits in the middle of two compartments that each hold one drone, the display, tethered by a cable, can be latched to the back of the housing, making it easy for a soldier to carry the entire unit like a backpack. The controller functions like a tv remote, with two sets of D-pads and a trigger. The rest of the functions are controlled by the display's two buttons.



Recently, a new controller hit the market, the FT Aviator, designed by a former astronaut, resembling the look and functionality of a real helicopter stick. It enables the user a real sense of flying a craft that behaves in an extremely similar way.

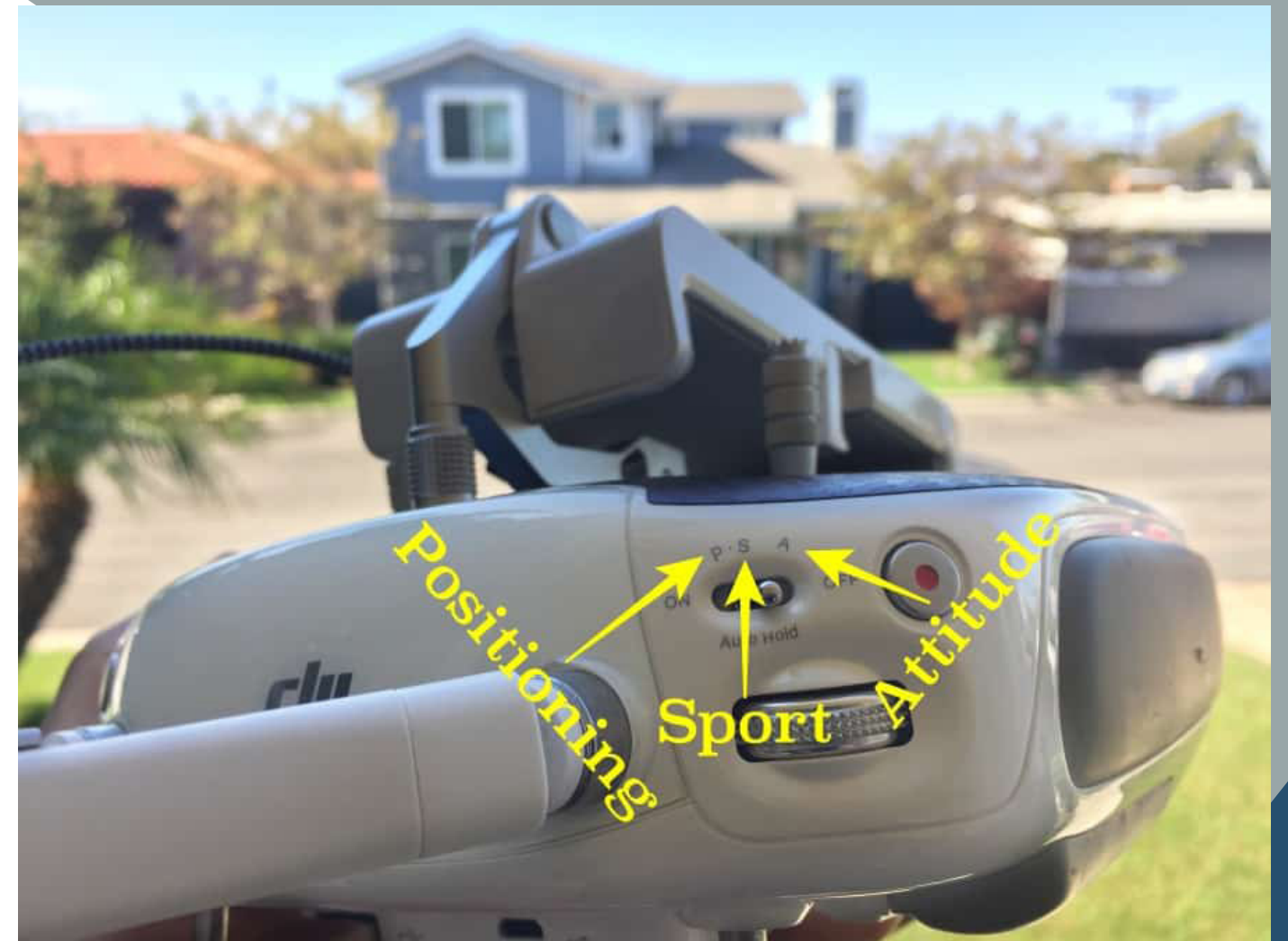
Manual Flight Modes

Position Mode: use almost all features such as the anti collision sensors, GPS and Glonass for the positioning, VPS sensors to keep the position above the floor and much more.

Sport Mode: anticollision sensors are automatically switched off. Max speeds and tilt can be reached.

ATTI Mode: drones keep their altitude through barometric pressure. The position won't be stabilised using GPS or Glonass, as it is the case in most other modes. That means if the drone goes with the wind, it probably won't keep the same position, you will often have to readjust and so you will develop a feeling for flying.

Beginner Mode: this mode will ensure that the drone does not fly away farther than thirty metres – horizontal and vertical. Also the speed is reduced about fifty per cent.



Autonomous Flight Modes

Course Lock Mode: Fly in a straight line while focusing on an object constantly, useful when flying through narrow areas.

Home Lock Mode: If the drone is outside the range of sight and you need to make it back, this mode will allow the drone to fly back to the home point.

Point of Interest Mode: drone will automatically rotate around the object while making it the centre of your pictures.

ActiveTrack Mode: evaluates the pictures live and follows the objects or persons marked on the screen.

TapFly Mode: tap on the screen, adjust the speed and press "Go!". The drone will directly fly towards the aim.

Waypoints Mode: define an exact flying route on a map, by using Waypoints here and there, and then you determine the altitude and the speed you would like the drone to have.

Follow Me Mode: automatically follow persons or objects, while the drone tries to make them the centre of your videos.

Cinematic Mode: braking is softer, and turns have a smoother motion.

Tripod Mode: braking distance is reduced and the speed of the drone is reduced.

Fixed Wing Mode: Like a big plane with wings the drone yaws around the vertical axis and rolls around the long axis in cases of rudder angle to the side. So the drone tilts and the gimbal tilts also to create a very realistic cockpit feeling.

Terrain Follow Mode: the drone follows automatically an uneven surface by keeping a certain previously determined height.

Draw Mode: draw a route on the screen using your finger and the drone will automatically fly this route.

FT Aviator Controller

Fluidity, a fairly new company in the drone industry, has been making headlines with their release of the FT Aviator Controller. For many pilots, this new design is exciting for the future of Drone Flying and is considered to many as a "step in the right direction".

However, as exciting as it was before release, it has many shortcomings that pilots discovered while testing it after release.



Cons:

- Only a bluetooth accessory, not a full controller, due to not having a built-in transmitter
- (Yaw) twisting control is limiting, especially to users with carpool tunnel.
- Potentiometer is bad, the drone does not respond smoothly, it jerks.
- Bottom hand (base) is not comfortable
- Display (First person view) position is awkward.

Pros:

- Heads-Up display
- Better mimics the natural movements of the drone.
- Solid build quality
- Top hand fits well



Interviews

I wanted to get some opinions from others on what they thought about the current controllers for drone flying.

Elizabeth Timko No flying Experience



"I have always wanted to try flying a drone but the controller looks daunting and like a video game, which I am very bad at so I have refrained from trying".

So, I decided to let her try flying for the first time. Here's what she said after:

"Ya, nope, I did not feel confident flying it, the controls did not make any sense."

I shared with her my design and idea and here's what she had to say:

"Controlling the drone makes way more sense, I'm surprised they don't work like this already. Make it and maybe I'll try flying again."

Branson Davis Experienced FPV Pilot



"Flying is second nature to me now, it took a few years to figure it out, but now it's no problem."

I shared with him my design and idea and here's what he had to say:

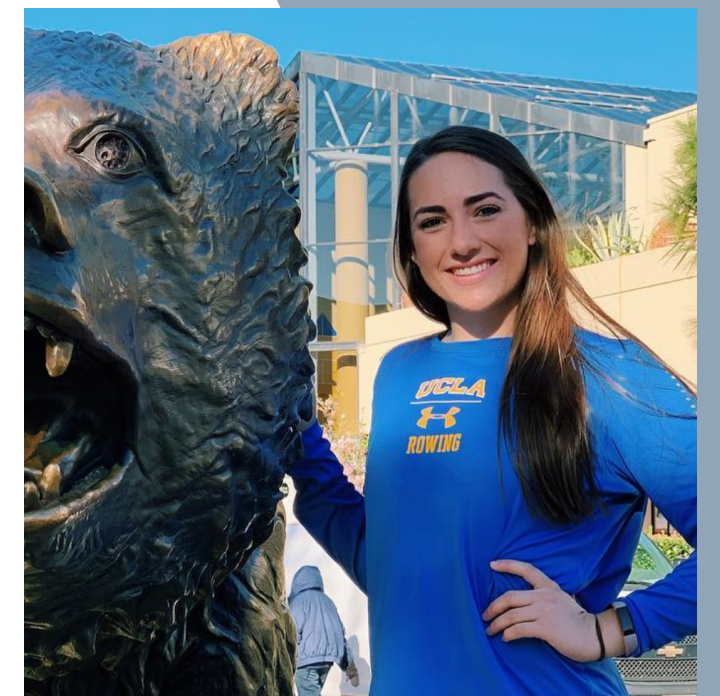
"I would love this for my friends to get into flying with. None of them want to get into the hobby since there's such a big learning curve. I also think this would be amazing for more complex maneuvering."

"Learning to fly took awhile and everytime I think I finally know how to fly, I always find myself in a situation where I have to teach myself new flight maneuvers on the spot."

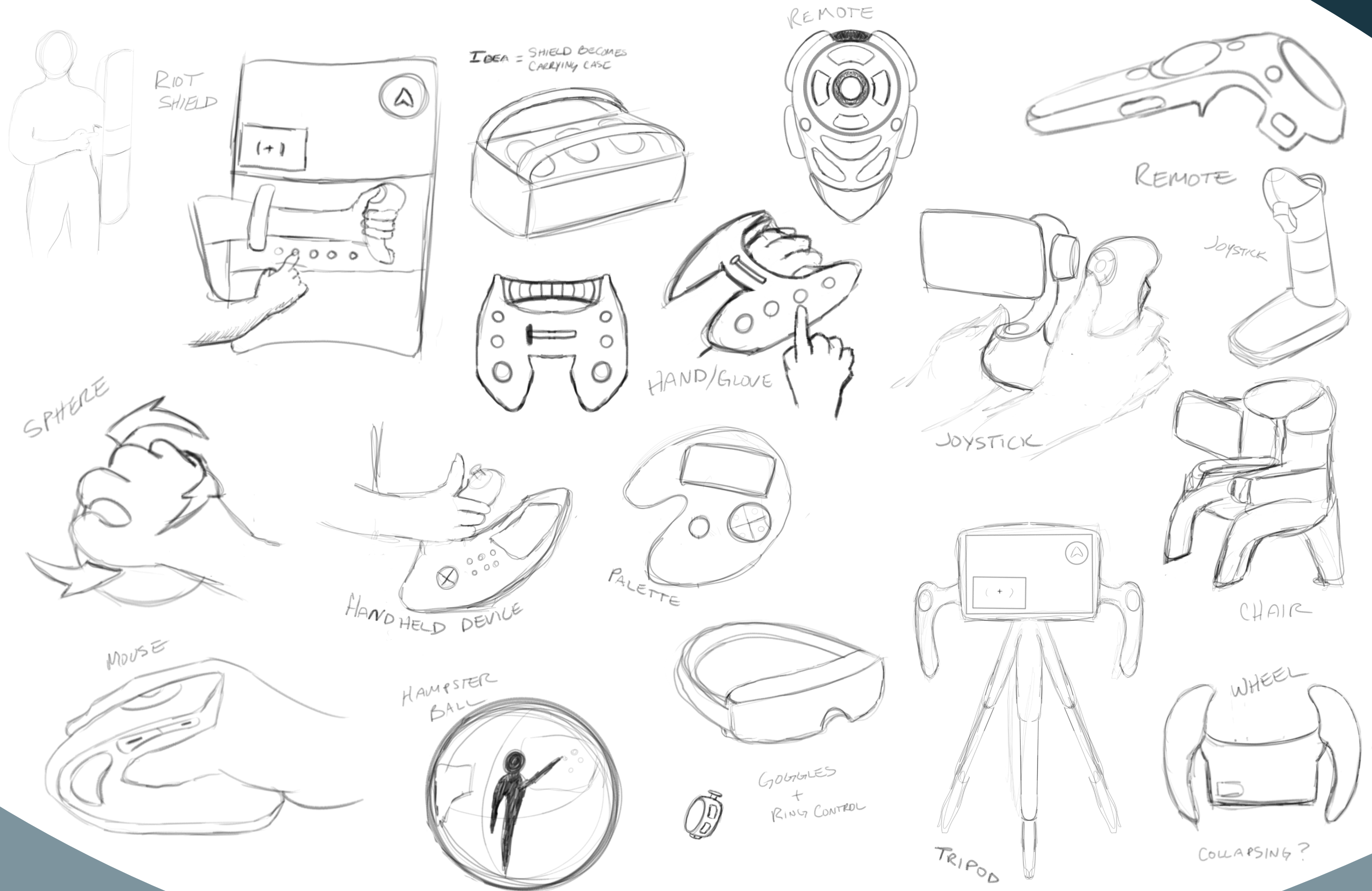
I shared with her my design and idea and here's what she had to say:

"Your design is extremely promising, I wish something like that existed on the market, that made flying feel more natural and connected to the drone."

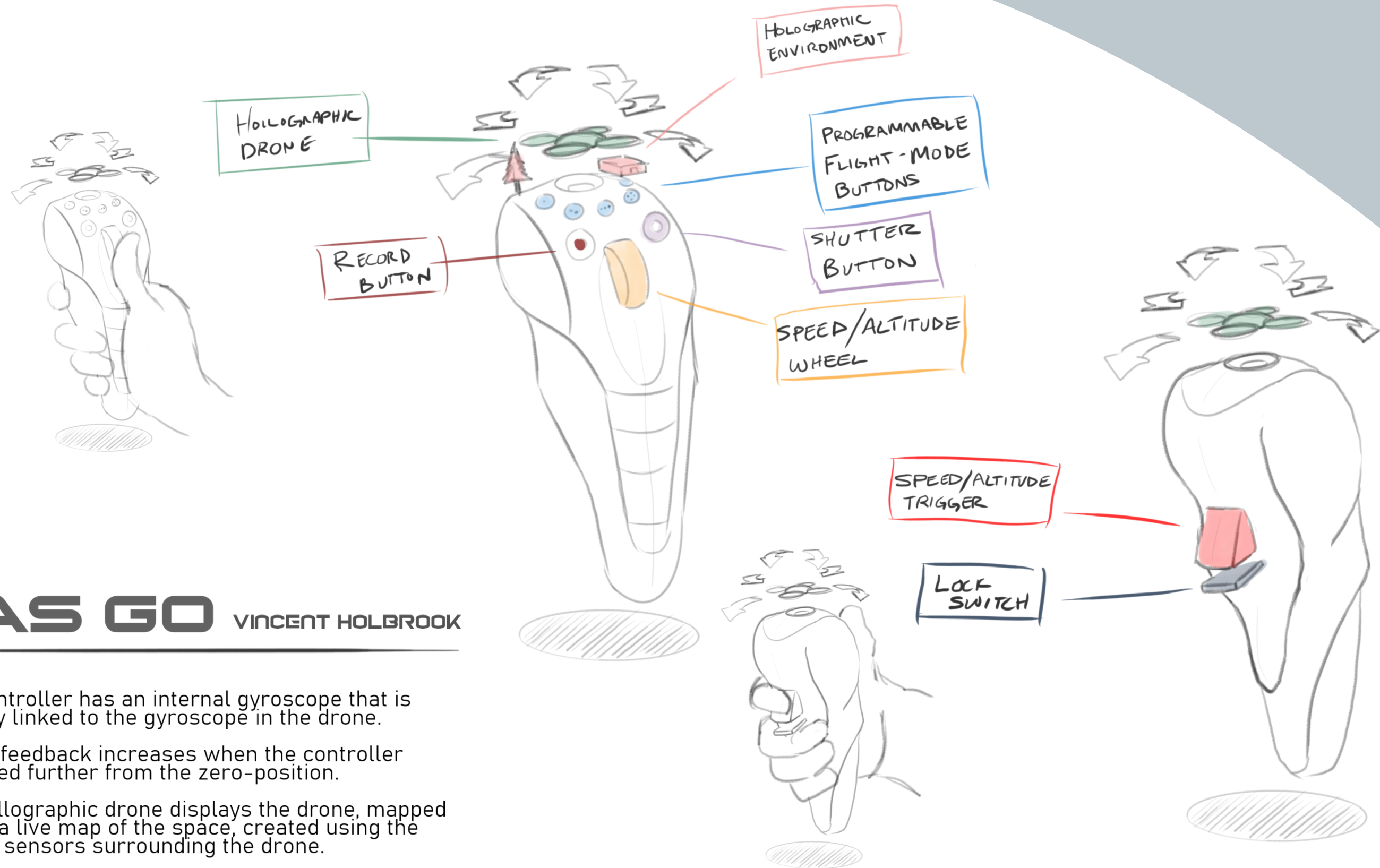
Whitney Wood Experienced Cinema Pilot



Initial Ideations



Idea #1



UAS GO VINCENT HOLBROOK

The controller has an internal gyroscope that is directly linked to the gyroscope in the drone.

Haptic feedback increases when the controller is moved further from the zero-position.

The holographic drone displays the drone, mapped within a live map of the space, created using the optical sensors surrounding the drone.

Idea #2



UAS GO VINCENT HOLBROOK

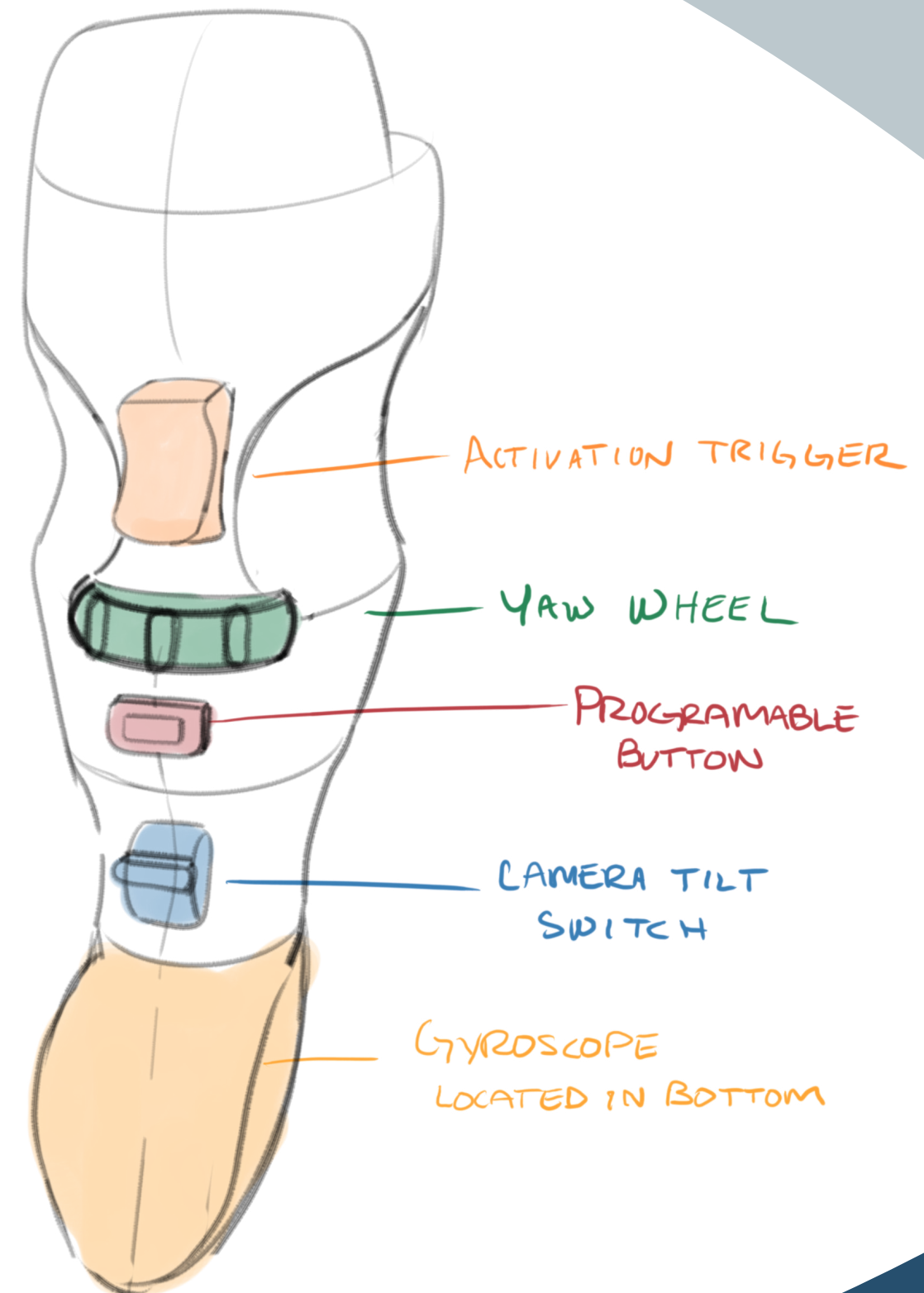
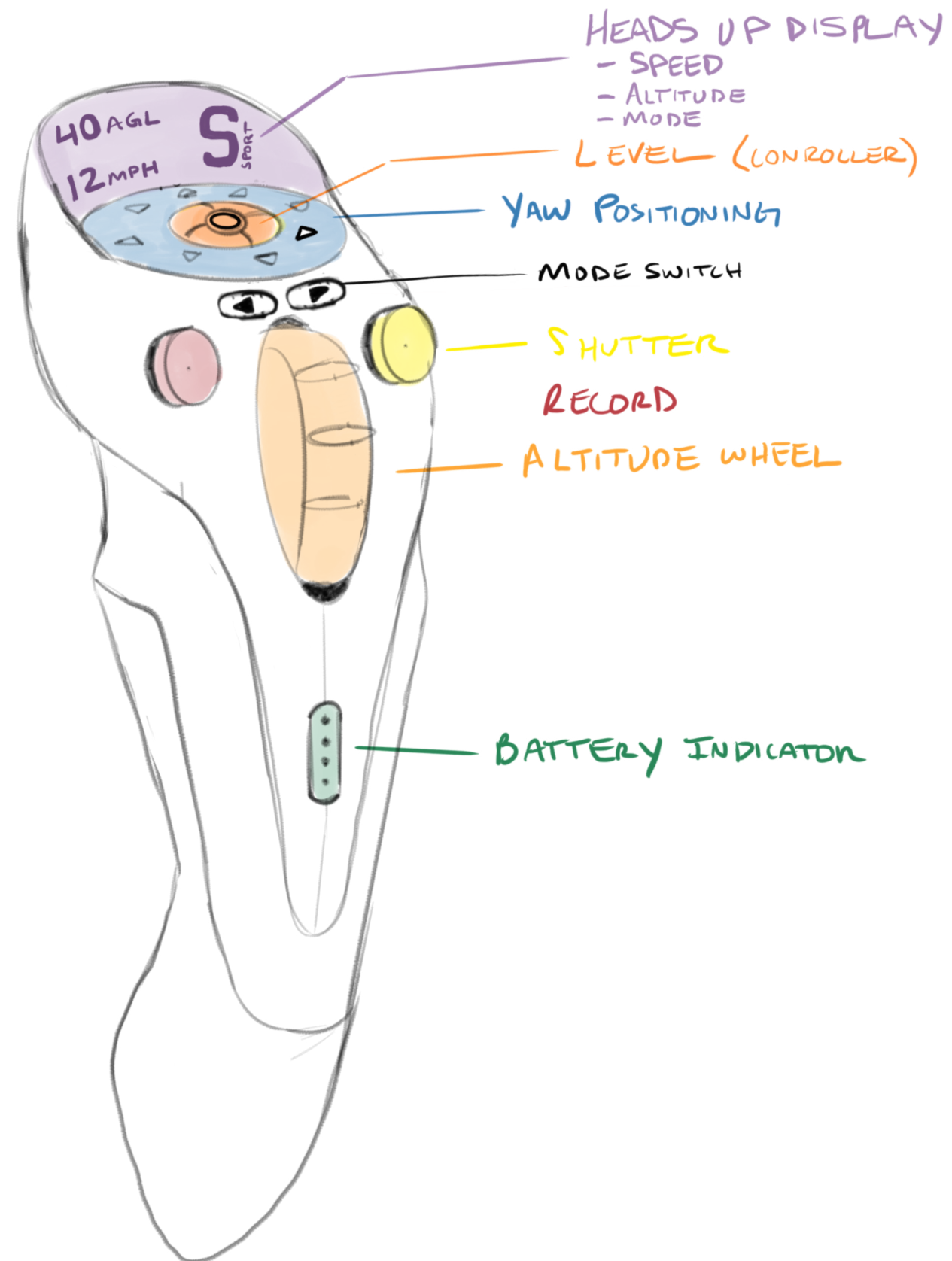
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Idea #3

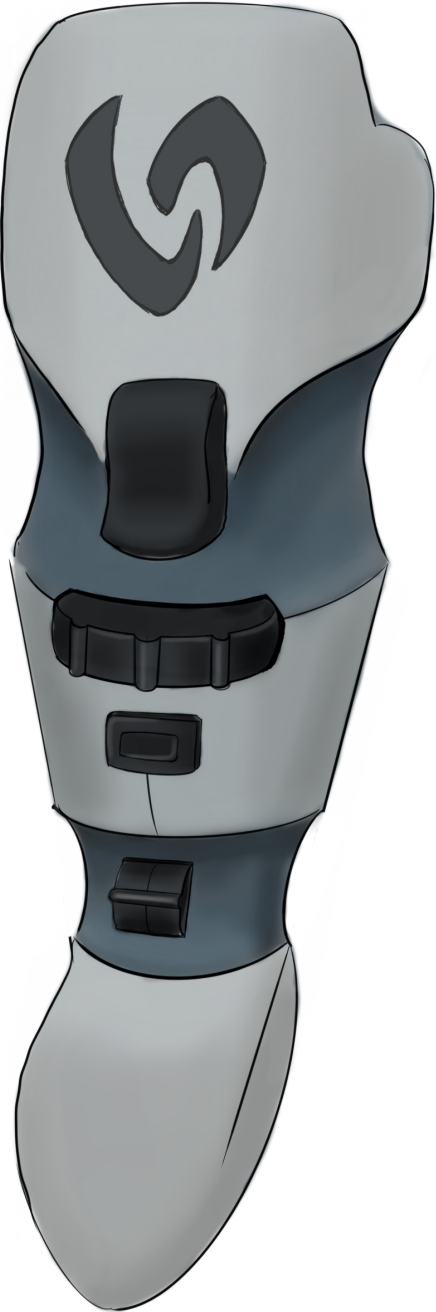


Final Design

FRONT



BACK

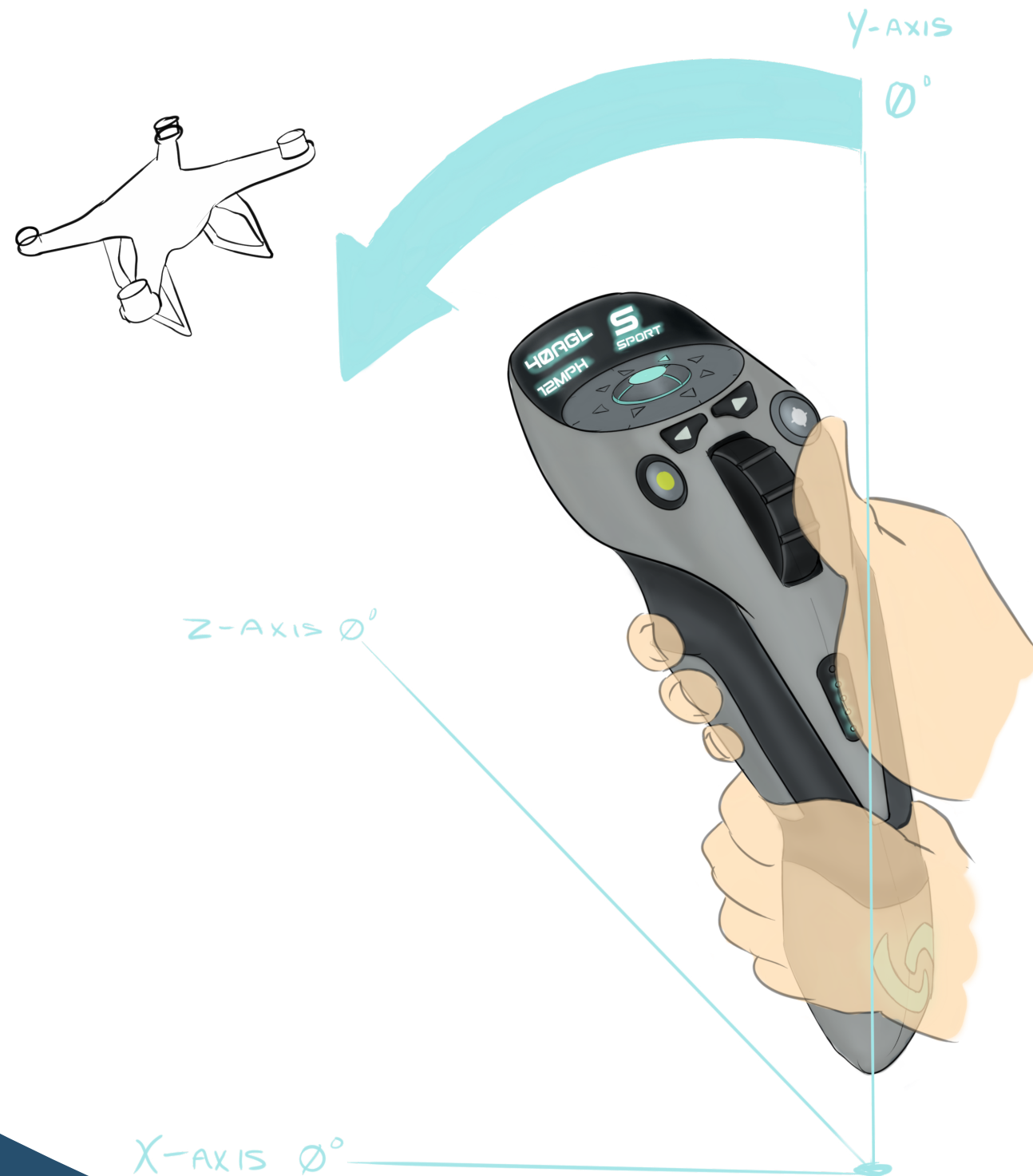


The Interface



Flying the Drone

The controller has an internal gyroscope that is directly linked to the gyroscope in the drone. The user moves the controller like a large joystick, similar to a helicopter stick, the drone moves accordingly.



Haptic feedback increases when the controller is moved further from the zero-position.

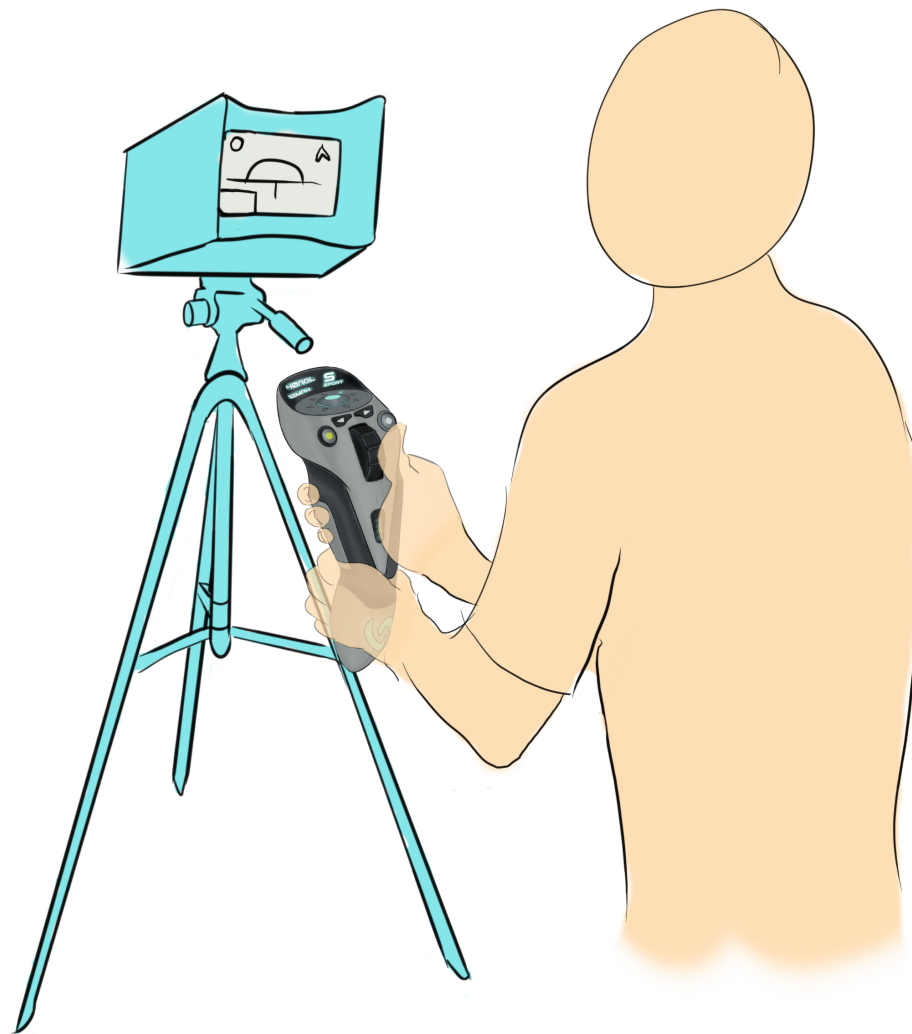
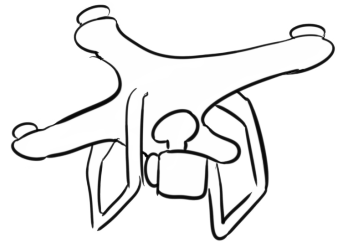


First Person View?

There are great options for drone pilots nowadays for viewing a first person broadcast while flying. This display is very important for pilots who capture cinema and even more so for racing pilots who need to view the drone feed in real-time.

Options that work great with the Aerial Go Controller are:

- Tripod set ups and other standing monitors.
- FPV Goggles, there are hundreds of options on the market, however this can greatly reduce a pilots "line of sight" to the drone, but for many pilots it is a good trade off.



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