FLIR

NEW PRODUCT INTRODUCTION

LightHouse 3.6 Axiom UAV App

UPDATE FOR RAYMARINE AXIOM, AXIOM PRO & AXIOM XL

Axiom UAV: Key Benefits

- Simple launch, in-flight control and return-to-boat controls for Unmanned Aerial Vehicles
- Provides expanded aerial viewing and photography capabilities to anglers, cruising boaters and first responders
- Big-screen viewing of live aerial images on the Axiom Multifunction Display

Axiom UAV Videos

- Take to the Skies with Raymarine Axiom UAV and LightHouse 3.6
- Raymarine Axiom Pro Multifunction Display & UAV Integration

Axiom UAV for Fishermen

Find fish faster with an eye in the sky.

- *Virtual Tuna Tower* allows small boats the benefit of increased height of eye when scouting fishing grounds.
- Investigate weed-lines, water breaks and other areas of interest quickly and easily.
- Get a birds-eye view of backwater channels, creeks, marshes and flats areas.
- FISH ON mode auto-launches, orbits and records fishing action from the sky.

Aerial view of a school of Tarpon captured with a DJI Mavic Pro fitted with a polarized lens filter.

Axiom UAV for Cruising Boats

A true birds-eye view of all your navigation challenges.

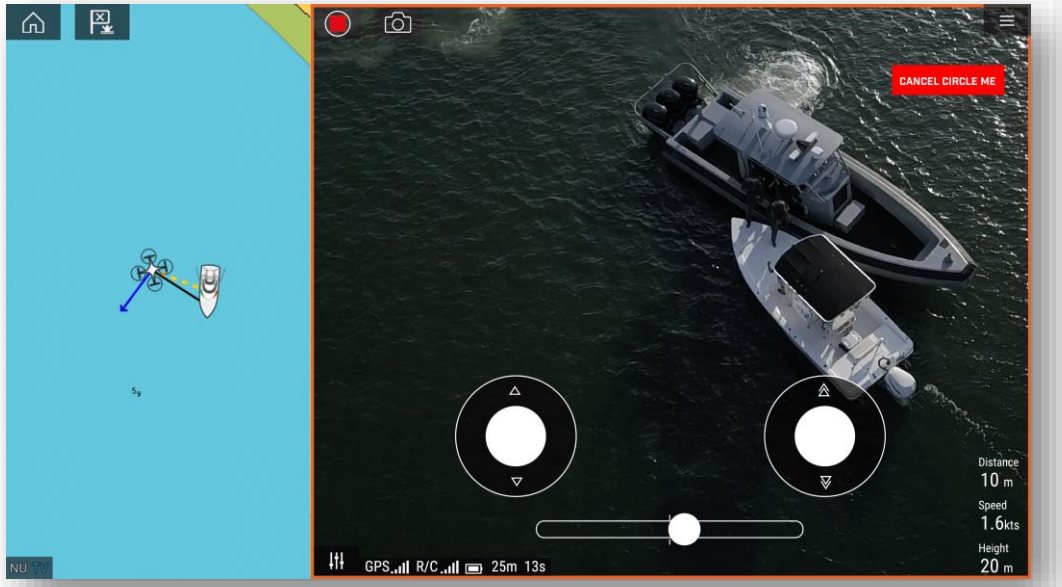
- View anchorages, marinas or tight passages from the air.
- Scout ahead to see navigation aids, landmarks, traffic or other distant objects
- Identify reefs, sandbars, and other shallow submerged objects of interest.
- CIRCLE ME mode automatically launches, orbits and records video of your boat underway.

Axiom UAV lets cruising boaters explore the environment around them from the air, providing a new perspective on navigation.

Axiom UAV for First Responders

An airborne asset for all sizes of patrol boats.

- Conduct surveillance of contacts of interest from the air.
- Search by air for floating debris, contraband, vessels, or people.
- Maintain a safe standoff distance from suspect vessels while maintaining a watch on activity.
- CIRCLE ME mode automatically launches the UAV, tracks the boat, orbits the scene and collects video evidence.



Axiom UAV is a true force multiplier that lets public safety and law enforcement agencies accomplish more missions with less expensive resources.

Compatible Raymarine MFD Hardware

AXIOM 7, 9, 12

AXIOM PRO 9, 12, 16

AXIOM XL 16, 19, 22, 24

Compatible Raymarine MFD Hardware

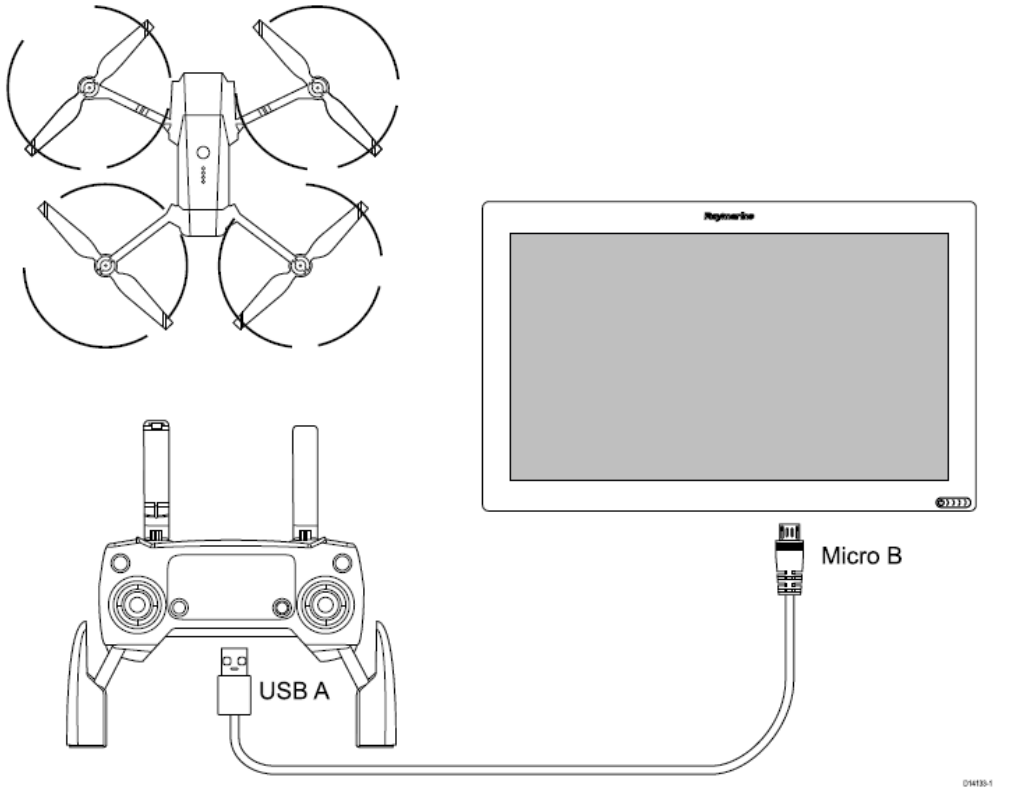
- All Axiom family MFDs must be updated to LightHouse 3.6 or higher.
- Axiom UAV is not available for eS and gS-Series LightHouse 3 products.
- The LightHouse UAV app is not part of the default page set. Consumers will need to construct a custom page and select Axiom UAV from the list of apps.

Axiom UAV: Compatible Drones

DJI MAVIC PRO ($999 US MSRP)

DJI MAVIC PRO PLATINUM EDITION ($1,099 US MSRP)

Simple USB Connection to Axiom



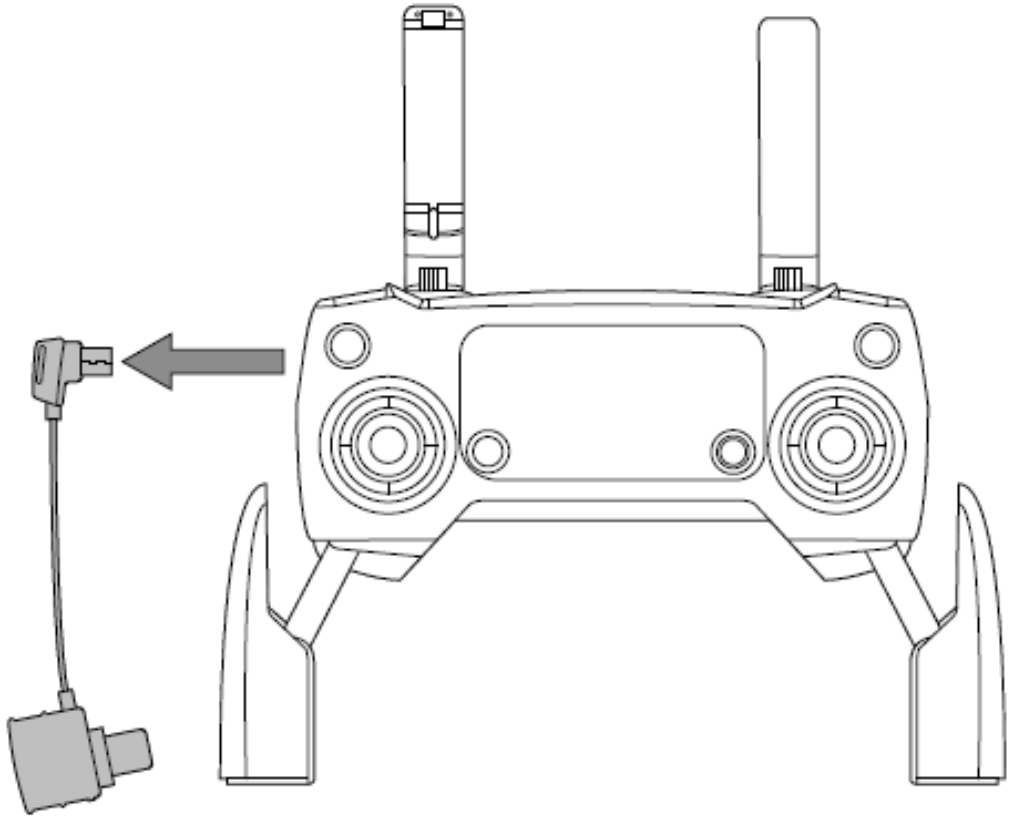
- Link the Mavic's remote controller to Axiom's rear Micro USB port.
- Requires a USB A to Micro USB cable, sold separately.
- This is a very common cable, often supplied with USB-rechargeable devices.

Important Notes:

- Currently it is not possible to plug a UAV controller in via the USB A port on the RCR-USB card reader.
- On Axiom XL systems with only 1 MFD, you will need to unplug the card reader from the display to connect the UAV.
- The UAV video is only displayed on the MFD it is directly plugged into. UAV video is not transmitted across the SeaTalk^{hs} network.

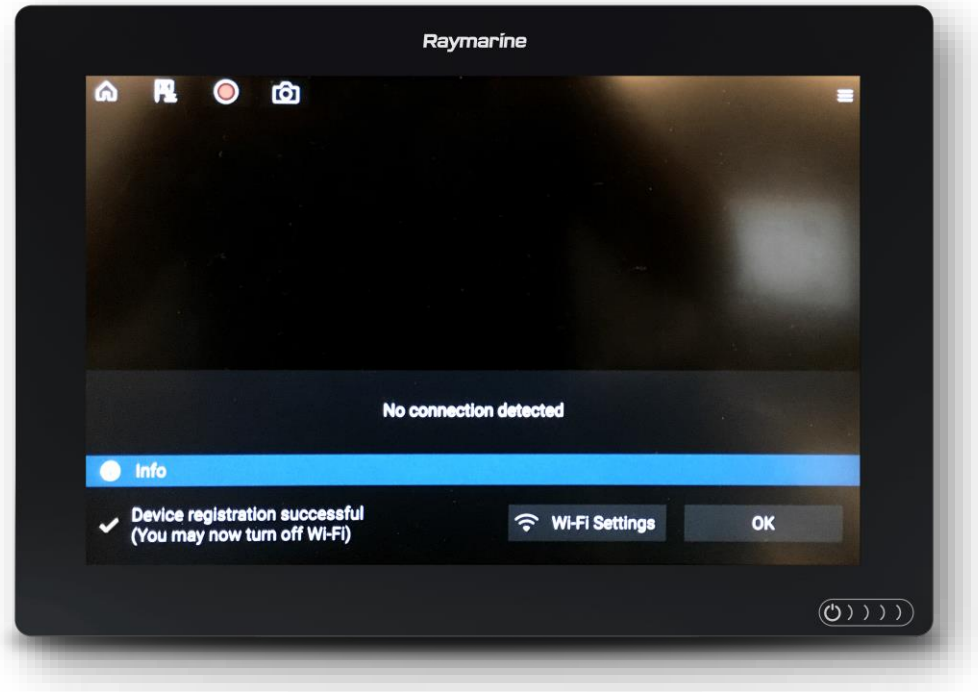
DJI Controller Cable Setup

- Remove the mobile device RC cable from the side of the DJI Mavic controller.
- The bottom-facing USB A port will not switch on until this cable is removed.
- It is not possible to be connected to both Axiom and a mobile device simultaneously.



Registering the UAV App

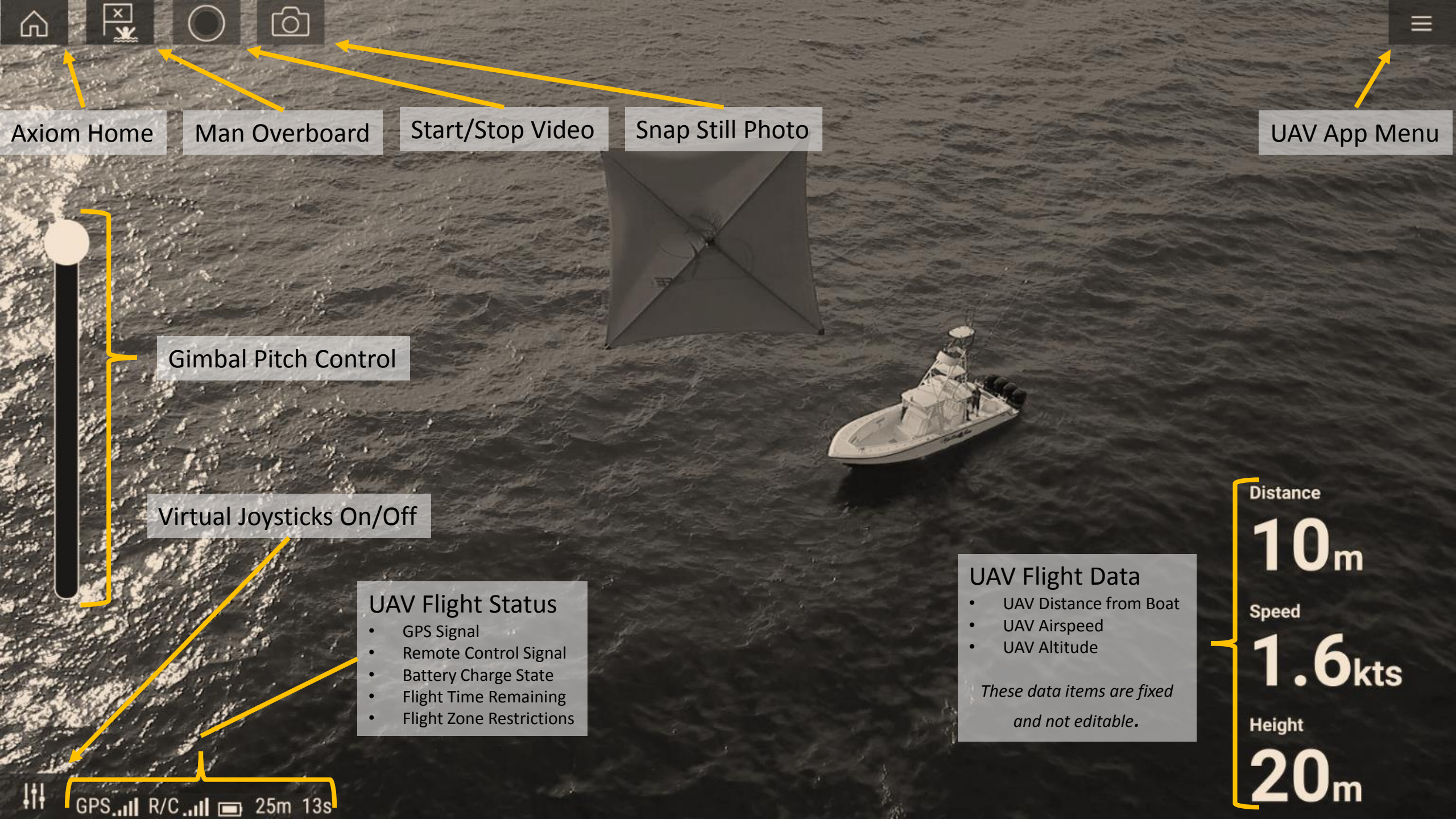
- A Wi-Fi connection to the internet is required to register the application…
  - …the first time you open the UAV app.
  - …after a MFD factory reset.
  - …after a MFD software update.
- The MFD will contact DJI's servers to register and unlock the application.
- Vessels traveling out-of-range for cellular or satellite internet service must pre-register their app before heading out.



UAV App Successfully Registered Online

Data and Video Links

- Axiom relays UAV command data and updated vessel position via the Mavic's remote controller.
- Axiom receives UAV status, telemetry, and live video via the Mavic's remote controller.
- Live HD video from the UAV's gimbal is streamed via USB cable to the Axiom display.
- UAV can be controlled in-flight from the Axiom, or from the Mavic's remote controller.
- MFD control is limited if Sport Mode is engaged on the Mavic Pro (with onscreen prompt.)

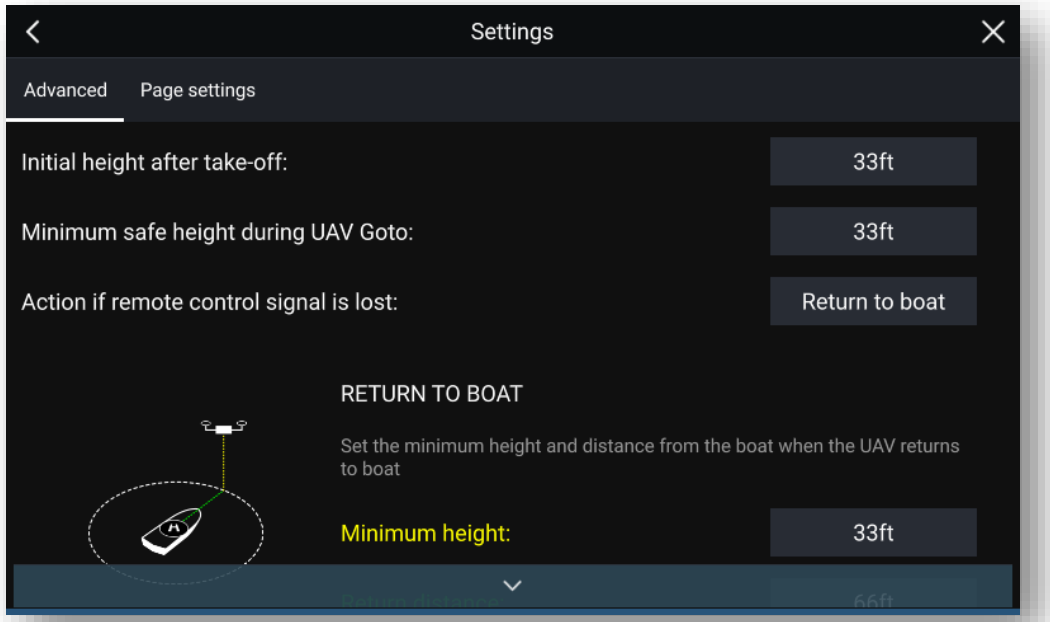

Axiom Home
Man Overboard
Start/Stop Video
Snap Still Photo
UAV App Menu
Gimbal Pitch Control
Virtual Joysticks On/Off
UAV Flight Status
• GPS Signal
• Remote Control Signal
• Battery Charge State
• Flight Time Remaining
• Flight Zone Restrictions
UAV Flight Data
• UAV Distance from Boat
• UAV Airspeed
• UAV Altitude
These data items are fixed and not editable.
Distance
10m
Speed
1.6kts
Height
20m
GPS R/C 25m 13s

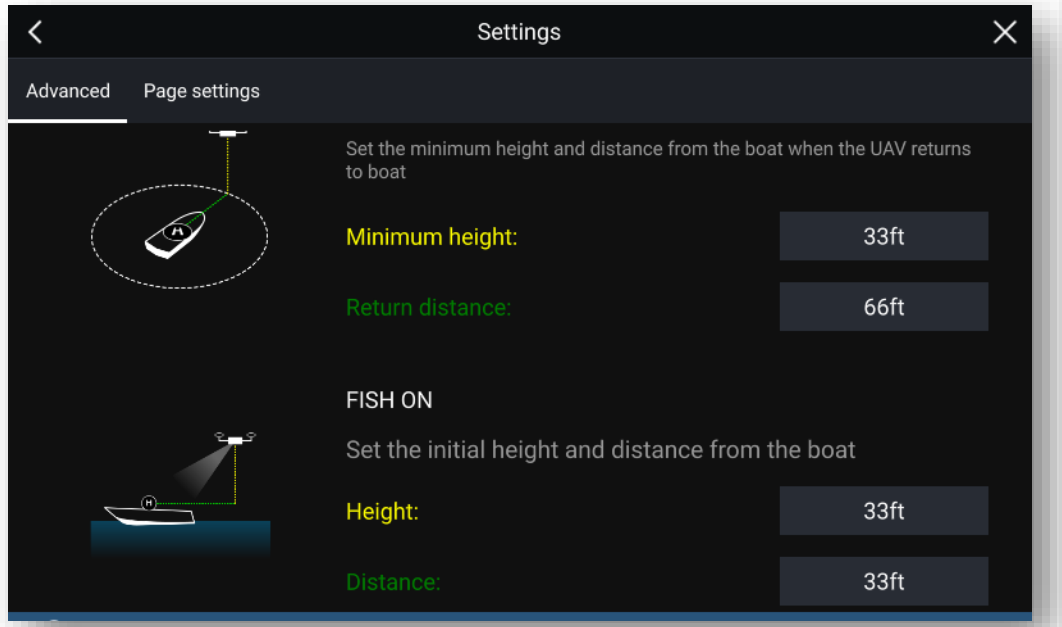
Video Recording and Snapshots

- All video recordings and photos are saved to the MicroSD card onboard the UAV.
- Photos and videos are not saved to the MFD's internal memory.
- In the event you forget to load a MicroSD card into the UAV, you will receive a prompt on the MFD when you touch the record or snapshot buttons.
- The DJI controller also flashes an icon of a MicroSD card as a warning.

UAV Settings Menu

Safety parameters for minimum altitude during flight.





Virtual Joystick Controls

For manual flight of DJI Mavic

- Switch on/off using the settings icon on the lower right corner.
- Mimics Mavic Pro's default (Mode 2) flight controls:
  - Left Stick
    - Climb/Descend
    - Rotate Left/Right
  - Right Stick
    - Forward/Reverse
    - Slew Left/Right

Important Note: When the virtual joysticks are visible, Mavic's remote controller joysticks are *disabled.* Hide the on-screen virtual joysticks to use the remote controller's physical joystick controls.

Automatic Takeoff

- Launches the Mavic Pro automatically after a 3-second countdown.
- Mavic will climb automatically to the altitude specified in the *Initial Height After Takeoff* setting in the UAV App setup menu.
- The height selected should consider the overall height of the vessel including masts, antennas, rigging, outriggers, flags, pennants, etc. plus a safety margin to prevent collision with the UAV.

Takeoff Tips for Mavic Pro

Maximize Safety and Situational Awareness

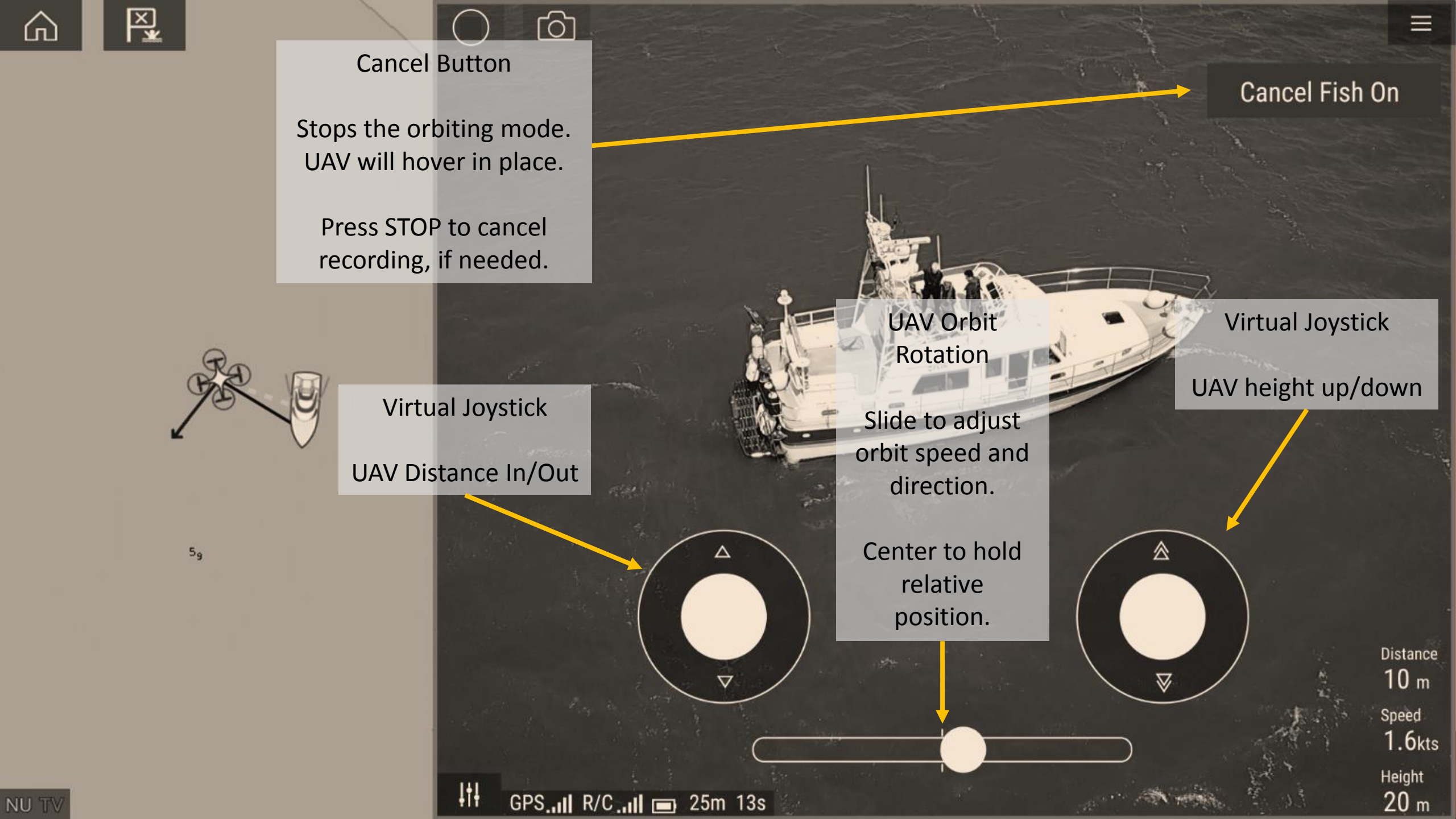
- Minimize vessel headway, wave action and wind. These can surprise you during launching.
- The UAV will liftoff, pause momentarily, then climb to safe altitude.
    - In gusty conditions, or with vessel headway, the UAV may drift during the pause. Be ready!
- Beware of changing relative wind and ground effect (rotor wash) as Mavic clears the deck.
- Face Mavic's camera gimbal towards open water so its launching up and away from the boat. In case of trouble, push both sticks forward and the UAV will fly up and away.
- Maintain a clear takeoff zone, and make sure other passengers and crew are aware of the UAV.

Axiom UAV works on vessels of all sizes. Here a Mavic Pro is launching from the forward hatch cover on a pedal kayak.

Fish-On / Circle Me Mode

Automatic launch, orbit, video recording and vessel tracking

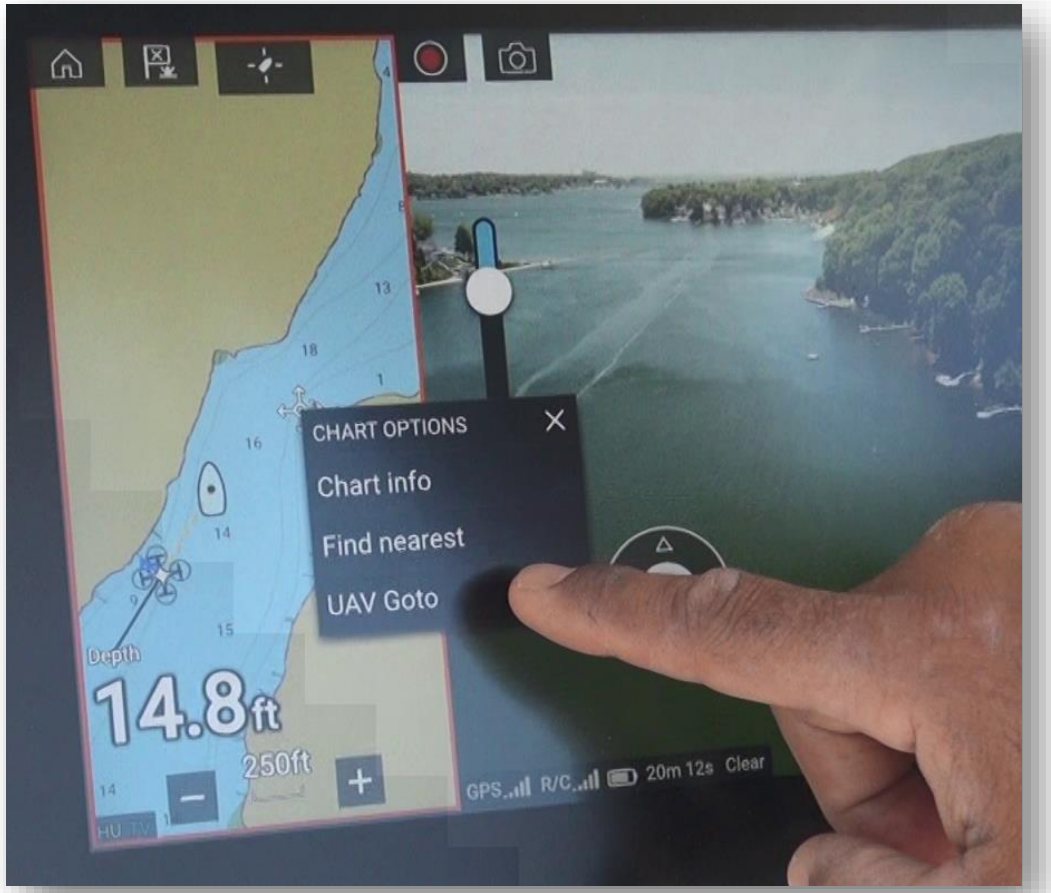
- Same function with different names depending on the vessel type selected on the MFD.
- Automated launch, flight and recording.
- Once airborne the orbit speed, direction, distance and altitude are adjustable.
- Mavic will track the boat underway at vessel speeds up to 10 knots.


Cancel Button
Stops the orbiting mode. UAV will hover in place.
Press STOP to cancel recording, if needed.
Cancel Fish On
UAV Orbit Rotation
Slide to adjust orbit speed and direction.
Center to hold relative position.
Virtual Joystick
UAV height up/down
Virtual Joystick
UAV Distance In/Out
Distance
10 m
Speed
1.6kts
Height
20 m
GPS
R/C
25m 13s

UAV Chart Integration

Touch and Fly automatic flight to charted locations or POIs.

- Splitting a window between chart and UAV will automatically generate a 30/70% split.
- UAV Icon appears whenever the UAV is in flight.
  - Blue Vector: UAV SOG and COG
  - Black Vector: UAV Camera Direction
  - Yellow Dash: Rhumb line from boat to UAV
- UAV GOTO can send the Mavic out on a mission with a long press on the chart.
  - Flies, then hovers on-station.
  - Maintains minimum altitude based on selection in the UAV Settings menu.



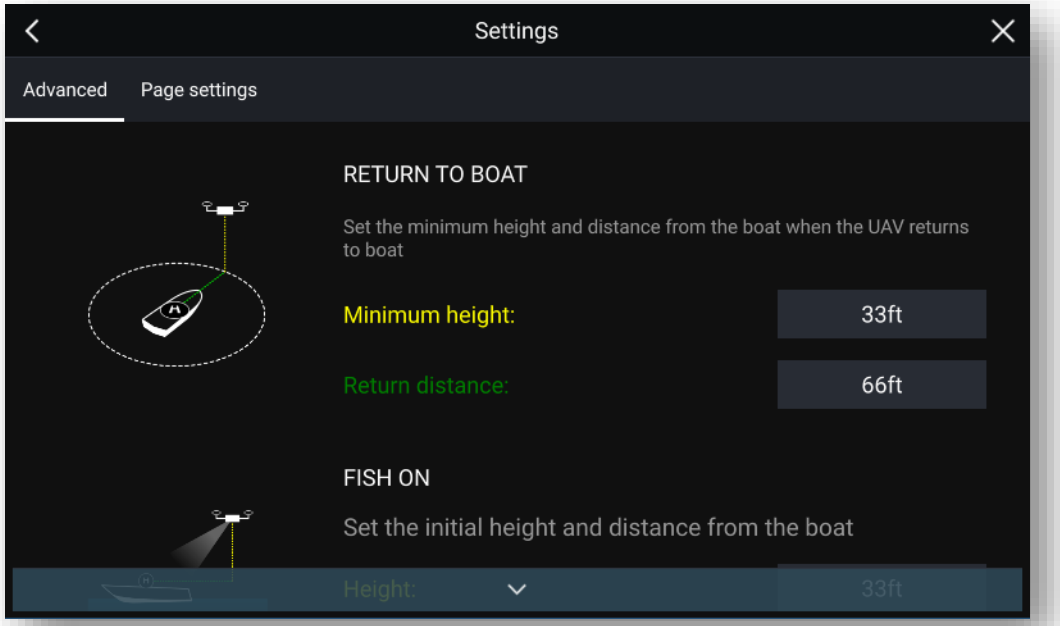
Automatic Return-to-Boat

For routine or emergency UAV recovery

- Axiom regularly updates the UAV with the current position of the boat.
- UAV will return to the boat's position and hover at the pre-selected altitude and distance.
- Pilot should manually land the UAV using either on-screen joysticks or the DJI controller.
- RTB selectable from the menu at any time
- UAV will auto-return at critical low battery threshold. Land immediately!

Return to Boat and Recovery

- Upon executing a return-to-boat, the UAV will return and hover at the preset distance and height specified in the UAV Settings menu.
  - Maintains a safe height to avoid masts, rigging, antennas, outriggers, etc.
  - Maintains a distance offset to ensure the pilot can see the hovering UAV from under the hardtop or bimini.
- The UAV **will not** land itself. The pilot should take manual control to land or recover the UAV.



The Mavic Pro will maintain a minimum safe height and distance from the boat upon return for recovery.

Tips for Landing & Recovery on the Water

LANDING ONBOARD THE BOAT

- Be conservative! Return to boat well in advance of any low battery conditions to minimize stress and ensure reserve power.
- Upon arrival at the boat, take manual control and pilot the UAV with its controller or from the on-screen joysticks.
- Beware of vessel headway, wave action and wind. These can surprise you during landing.
- Beware of changing relative wind and ground effect (rotor wash) as you come over the deck.
- The best alignment for landing is to bring the UAV in backwards. In case of trouble, push both sticks forward and the UAV will fly up and away.
- Maintain a clear landing zone, and make sure other passengers and crew are aware of the incoming UAV.

RECOVERING MAVIC PRO FROM A HOVER

- Manually pilot the UAV with its controller or from the on-screen joysticks.
- Beware of vessel headway, wave action and wind. These can surprise you during landing.
- Bring the UAV to within arms length and hover.
- Keep your face and fingers well clear of the spinning rotors. Consider wearing a face shield and leather or Kevlar protective gloves.
- Gently reach up from below and grab Mavic Pro below its battery pack. It may try to climb as your hand enters its downward-facing vision and altitude sensors.
- Hold on tight and tilt the Mavic 45°. After initially going to full power, Its rotors will then stop automatically.

Assuming Manual Control of the UAV

The pilot can always take manual control of the UAV at any time for maneuvering, positioning or emergencies.

- Virtual Joystick Controls must be hidden using the Controls icon (bottom left) before control is returned to the DJI remote controller.
- Enabling SPORT MODE on the UAV's remote controller at any time will override the MFD controls. Fly with caution as the flight characteristics of the UAV are much more aggressive.
- In an emergency, unplugging the USB cable from the remote controller will enable immediate manual control using the DJI remote controller.

In-Flight Emergency Procedures

CONTROLLER SIGNAL TO UAV LOST

In the UAV Settings menu, you can pre-select to have the UAV perform 1 of 2 actions:

1. Hover in place and wait to re-establish link
    1. When control is reestablished you should land immediately and inspect the UAV system.
2. Return to the boat's last known position
    1. UAV will hover and wait. Attempt to reestablish control and perform a manual recovery.
    2. UAV will attempt to land automatically upon reaching critical low battery. Maneuver the vessel to allow the UAV to land onboard.

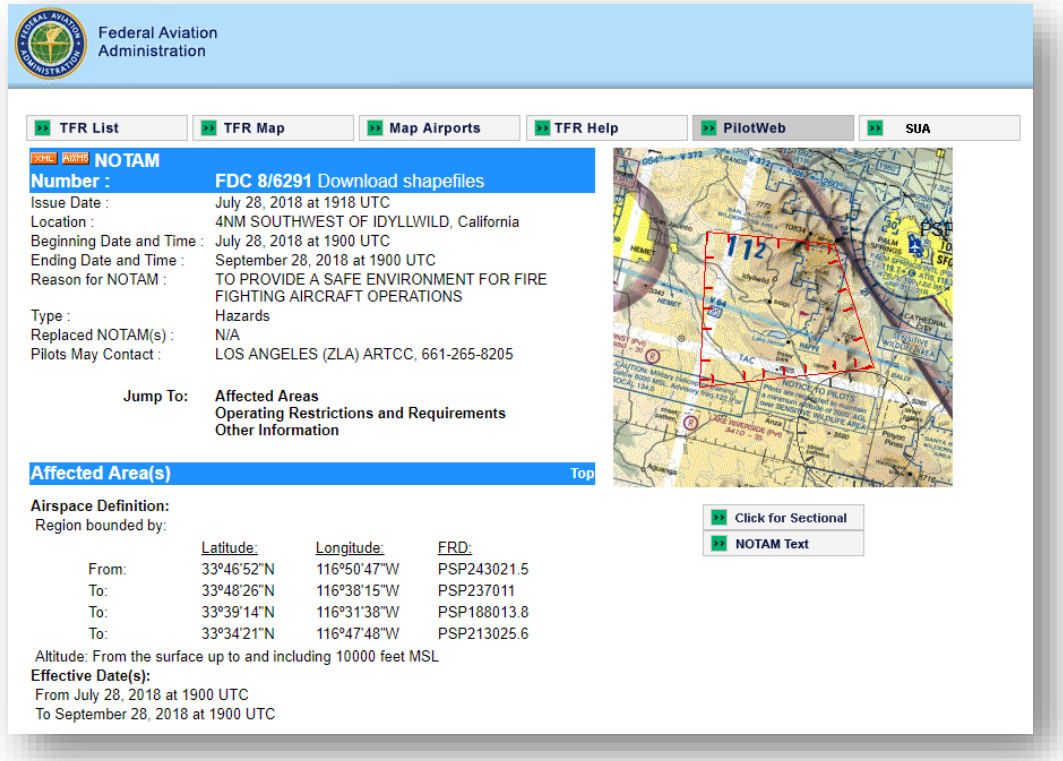
LOW BATTERY WARNINGS

The pilot must maintain awareness of the remaining flight time and distance from the vessel at all times. The prudent pilot will always return to the boat and land in advance of any low battery warnings.

- Normal Low Battery Level Warning – alerts will appear on the MFD and on the DJI controller. Immediately return to boat and recover the UAV.
- Critical Low Battery Warning – upon reaching the critical level, the UAV will automatically perform a return to boat and attempt to land itself. Do not allow the UAV to reach critical low battery while in flight as it could result in damage to or loss of the UAV.

No-Fly Zone Enforcement

- When updated regularly with the DJI 4Go App, Mavic Pro will maintain an onboard database of active no-fly zones.
  - NFZs can change on a daily basis. Always refer to the latest NOTAMS for the area you are flying, or update your Mavic regularly from the DJI app.
- Axiom UAV will enforce these no-fly zones:
  - Takeoff is prohibited when inside a no-fly zone.
  - When airborne, UAV entry into no-fly zone is prohibited. UAV will stop at the boundary.
- No-Fly zones are visible on the DJI Go4 app, or on apps like AirMap, SkyVector, etc.
- At this time no-fly zones cannot be graphically displayed on Axiom
- NFZ status information is displayed on the Flight Status Bar.



Federal Aviation Administration

TFR List | TFR Map | Map Airports | TFR Help | PilotWeb | SUA

NOTAM

Number : **FDC 8/6291** Download shapefiles

Issue Date :	July 28, 2018 at 1918 UTC
Location :	4NM SOUTHWEST OF IDYLLWILD, California
Beginning Date and Time :	July 28, 2018 at 1900 UTC
Ending Date and Time :	September 28, 2018 at 1900 UTC
Reason for NOTAM :	TO PROVIDE A SAFE ENVIRONMENT FOR FIRE FIGHTING AIRCRAFT OPERATIONS
Type :	Hazards
Replaced NOTAM(s) :	N/A
Pilots May Contact :	LOS ANGELES (ZLA) ARTCC, 661-265-8205

Jump To: **Affected Areas** **Operating Restrictions and Requirements** **Other Information**

Affected Area(s) Top

Airspace Definition:
Region bounded by:

	Latitude:	Longitude:	FRD:
From:	33°46'52"N	116°50'47"W	PSP243021.5
To:	33°48'26"N	116°38'15"W	PSP237011
To:	33°39'14"N	116°31'38"W	PSP188013.8
To:	33°34'21"N	116°47'48"W	PSP213025.6

Altitude: From the surface up to and including 10000 feet MSL
Effective Date(s):
From July 28, 2018 at 1900 UTC
To September 28, 2018 at 1900 UTC

Click for Sectional
NOTAM Text

Notice to Airmen announcement concerning a temporary flight restriction (TFR) to provide a safe airspace for fire fighting aircraft.

DJI Mavic Pro Useful Specifications

Specifications for the DJI Mavic Pro, as published on DJI.com

Maximum Speed:	40 MPH (65 KPH, in Sport Mode)
Overall Flight Time:	21 mins normal flight with 15% power reserve)
Max Flight Time:	27 mins (no wind @ 15.5 mph)
Max Hovering Time:	24 mins
Max Travel Distance:	8 miles (13 km, no wind)
Max Transmission Distance:	4.3 miles (7 km, FCC Compliant) 2.5 miles (4 km, CE, SRRC, MIC Compliant)
Satellite Positioning:	GPS/GLONASS
Weight:	1.64 lbs (743 g, without gimbal cover)
Camera Gimbal:	4K Ultra HD with 3 Axis Stabilization
Photo Resolution:	12 MP

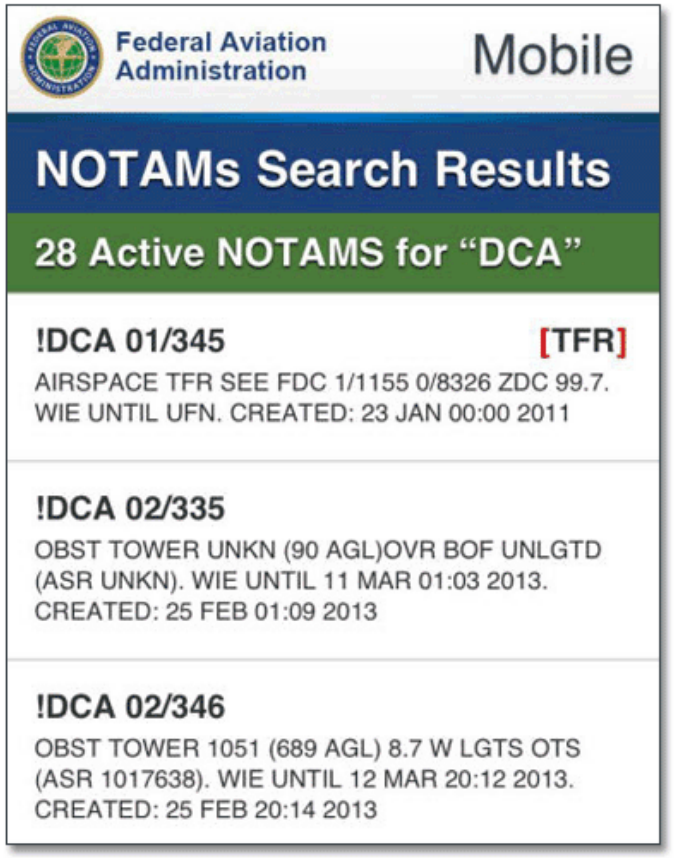
LIGHTHOUSE 3.6 WITH AXIOM UAV

Rules, Regulations and Best Practices Regarding UAVs

Pre-Flight Checklist

Before the Day of Flight

- ✓ Check the weather
- ✓ Update the UAVs firmware
- ✓ Update the DJI Mobile App on your device
- ✓ Review the area you'll be boating/flying
- ✓ Check NOTAMS for your flying area
- ✓ Charge your aircraft and R/C batteries
- ✓ Double-check all parts/components packed
- ✓ Format MicroSD memory card



Pre-Flight Checklist

Immediately before flight

- ✓ Check all equipment needed is present
- ✓ Inspect aircraft for faults and correct if needed
- ✓ Warn any crew or spectators
- ✓ Double-check MFD UAV App settings
- ✓ Remove lens cover and gimbal clamp
- ✓ MicroSD card installed in aircraft
- ✓ Verify R/C and GPS signal strength
- ✓ Propellers tight and free to move
- ✓ Compass and IMU calibrated
- ✓ Battery securely fitted and fully charged
- ✓ Observe wind speed and direction
- ✓ Double check for onboard and surrounding obstacles
- ✓ Remote controller antennas fully extended

Post-Takeoff Checks

Immediately after liftoff.

- ✓ Hover at safety-height for 15 seconds to monitor UAV behavior and sound.
- ✓ Check all controls are responsive from both the remote controller and Axiom MFD.
- ✓ Double check for surrounding air and marine traffic, then proceed on your mission!

When in doubt, bring it back to the boat and live to fly another day!

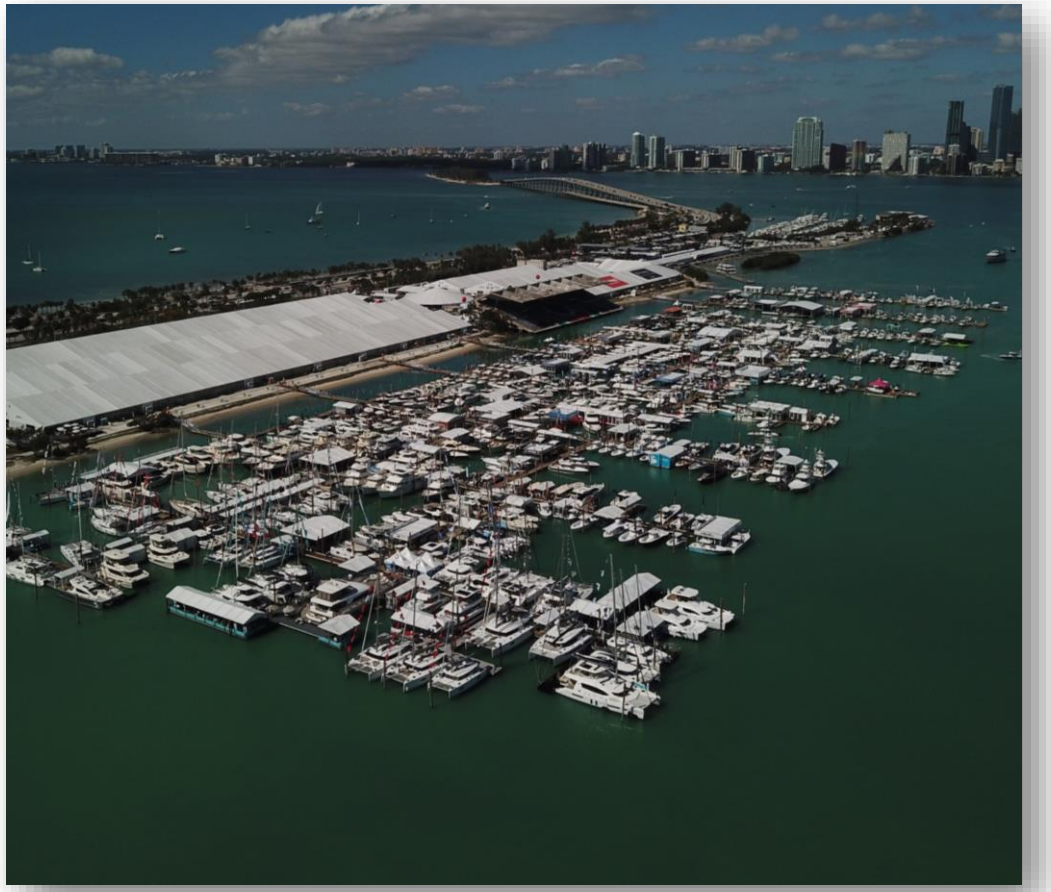
Drone Equipment Essentials

Based on the DJI Mavic Pro

- Extra MicroSD Memory Cards
- Neutral-density/polarized lens filters
- Lens cleaning kit
- Waterproof system case for storage & transport
- Extra flight batteries
- DJI DC Charger or Power Inverter
- Landing pad for wet or dirty areas
- Leather/Kevlar gloves, goggles/face-shield (if hand catching)
- Spare propellers (Mavic has specific left and right props)
- Aviation-band h/h radio (if operating near manned aircraft)
- Fire extinguisher
- Drone log book

Rules for Drones and UAVs Vary Widely

- Be sure to check with your local authorities before flying for specific regulations.
- In addition to national regulations, there are often now regulations at the regional and local level, particularly when flying over land.
- Specific regional restrictions may be in effect for special events, activities, emergencies.
- It’s the responsibility of the pilot-in-command to know the airspace where he will be flying.



Sources for Official UAV & Drone Information

Master country list online at: https://uavcoach.com/drone-laws/

- Australia
  - https://www.casa.gov.au/aircraft/landing-page/flying-drones-australia
- Canada
  - http://www.tc.gc.ca/en/services/aviation/drone-safety.html
- Finland
  - https://www.trafi.fi/en/aviation/unmanned_aviation
- France
  - https://www.ecologique-solidaire.gouv.fr/politiques/drones-aeronefs-telepilotes
- Germany
  - https://www.lba.de/DE/Home/home_node.html
- Italy
  - http://www.enac.gov.it/Home/
- Norway
  - https://luftfartstilsynet.no/en/drones/
- Spain
  - https://www.seguridadaerea.gob.es/lang_en/home.aspx
- United Kingdom
  - http://dronesafe.uk/
- United States of America
  - https://www.faa.gov/Dronezone/

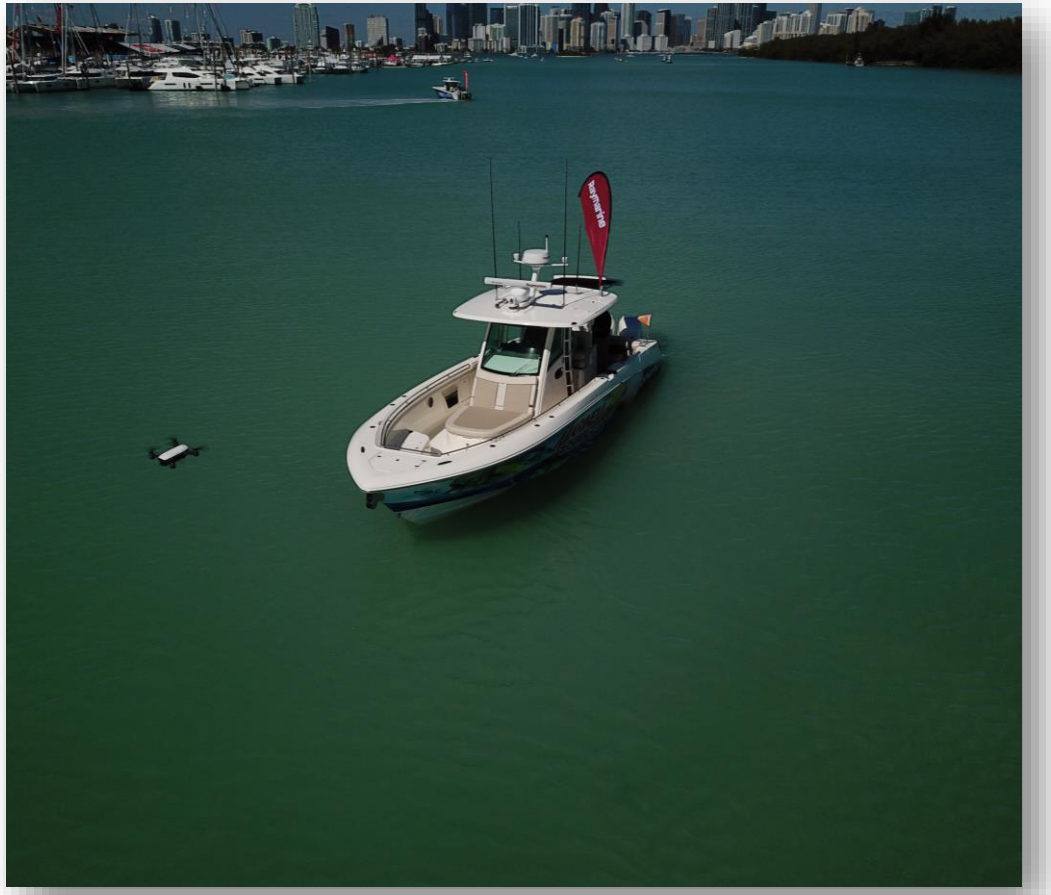
Guidelines for UAVs in the USA

LightHouse 3.6 with Axiom UAV

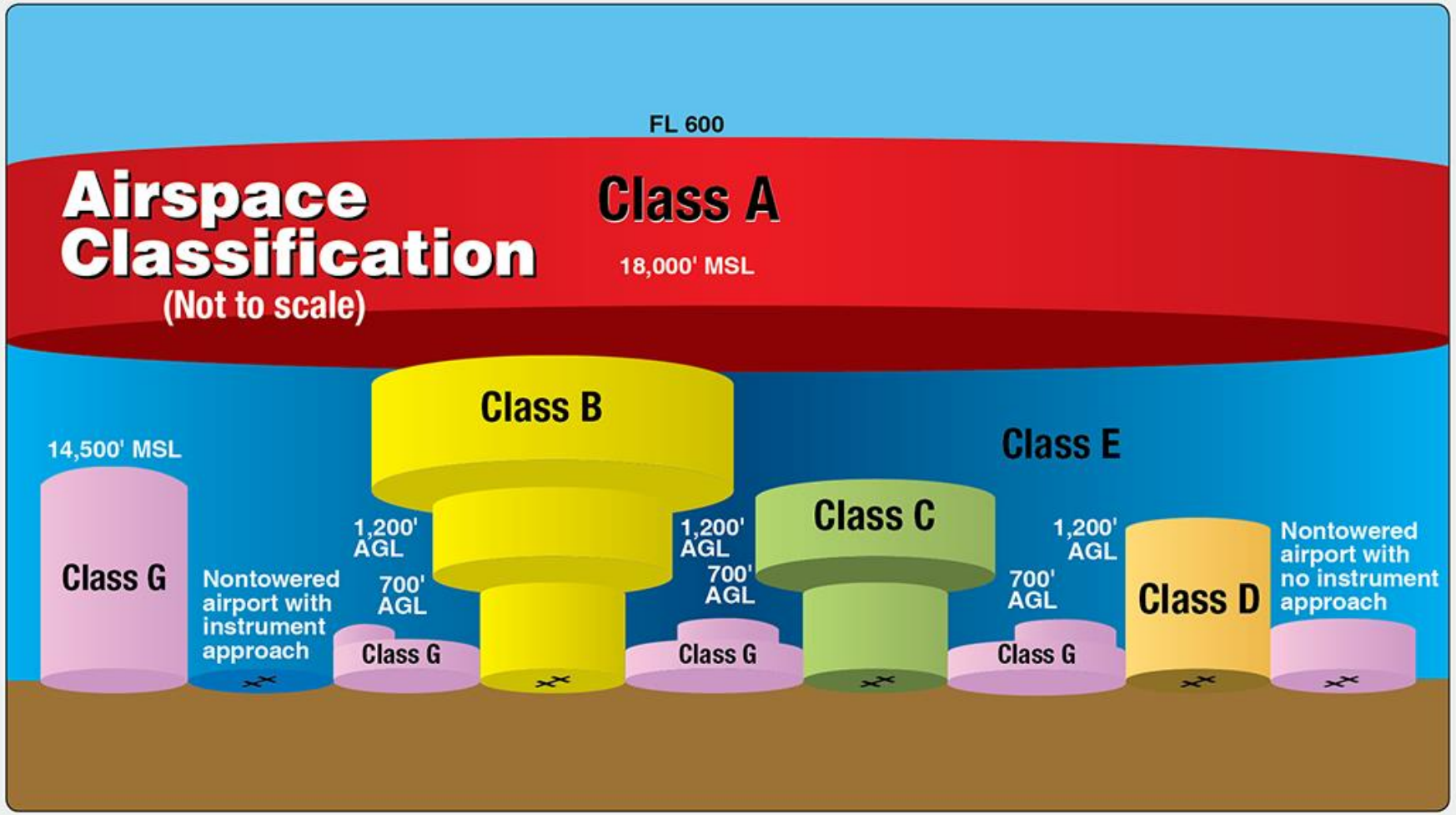
Drone Safety Tips from the US FAA

United States Federal Aviation Administration

- Register your drone
- Keep your drone at or below **400 feet**
- Keep your drone **within your line of sight**
- Be aware of FAA Airspace Restrictions
- Respect privacy
- Never fly near other aircraft, especially near airports
- Never fly over groups of people, public events, or stadiums full of people
- Never fly near emergencies such as fires or hurricane recovery efforts
- Never fly under the influence of drugs or alcohol



US Airspace System Model



UAV Regulations in the USA

- Regulated by the Federal Aviation Administration (FAA)
- Fall into 2 main categories:
  - Small Unmanned Aircraft Systems (sUAS) governed by Part 107 rules.
  - Model Aircraft governed by FAA Section 336 rules.
- All sUAS systems weighing more than 0.5 pounds and less than 55 pounds must be FAA registered.
  - Required for both model aircraft and Part 107 (commercial) systems.
  - Cost to register is $5 and may be completed online.
  - FAA registration numbers must be applied to the aircraft.

Drone Classifications in the USA

FLY AS A MODEL AIRCRAFT (SECTION 336)

- Fly for hobby or recreation only.
- Register your model aircraft
- Follow community-based safety guidelines and within the programming of a nationwide community-based organization.
- Fly aircraft under 55 lbs. unless certified by a community based organization
- Fly within visual line-of-sight
- Never fly near other aircraft
- Notify the airport and air traffic control prior to flying within 5 miles of an airport
- Never fly near emergency response efforts

FLY UNDER FAA SUAS RULES (PART 107)

- Fly for recreational OR commercial use
- Register your drone
- Get a Remote Pilot Certificate from the FAA
- Fly a drone under 55 lbs.
- Fly within visual-line-of-sight*
- Don't fly near other aircraft or over people*
- Don't fly in controlled airspace near airports without FAA permission*
- Fly only during daylight or civil twilight, at or below 400 feet*

* These rules are subject to waiver.

UAVs for Government & First Responders

FOLLOW THE SAME PATH AS BUSINESS USERS

- sUAS Pilots will need to obtain a Part 107 Remote Pilot Certificate.
- Normal Part 107 rules and regulations apply.

http://knowbeforeyoufly.org/for-business-users/

APPLY FOR A CERTIFICATE OF AUTHORIZATION (COA)

- Requested directly from the FAA
- Allows flights at or below 400 feet nationwide in Class G airspace
- Allows self-certification of the UAS pilot
- Able to obtain emergency COAs under special circumstances.

http://knowbeforeyoufly.org/for-public-entities/

What is considered a commercial usage?

FAA sUAS Part 107 Rules

- Anyone who is receiving compensation of **any kind** for the use of their sUAS is considered a commercial user, subject to FAA Part 107 Regulations.
- All commercial users are **required** to obtain a sUAS Remote Pilot Certificate (license) from the FAA.

When is a Licensed Drone Pilot Required?

- Anytime the sUAS/Drone is being operated for compensation of any kind. For example:
  - Equipment demonstrations conducted by FLIR/Raymarine employees at a show or event.
  - A demonstration flight during a dealer visit which may or may not result in an order or sale.
  - Aerial images shot by a Captain or Guide on a paid charter that are provided to customers.
  - Aerial images or video shot for use in a catalog, publication, magazine, or website or monetized blog.
  - Photos or video of someone else's boat done in trade for ice cold adult beverages.
  - Aerial video of landing a big fish that leads to a tournament payout.

The key factor in all of these scenarios is ***compensation.*** Any time something of value is exchanged for UAV usage, the flight is considered to be a commercial operation subject to FAA Part 107 Rules.

Additional Resources for UAV Pilots

INFORMATION, GEAR AND TRAINING

- DJI: https://www.dji.com
- FAA DroneZone: https://faadronezone.faa.gov
- Know Before You Fly: http://knowbeforeyoufly.org
- SkyVector US Aeronautical Charts: https://skyvector.com
- PolarPro Filter Systems: https://www.polarprofilters.com
- Dart Drones: https://www.dartdrones.com/
- UAV Coach: https://uavcoach.com/

USEFUL MOBILE APPS

- DJI Go4 Mobile App
  - Advanced setup and configuration of the Mavic Pro
- AirMap for Drones
  - Real-time airspace data, advisories, rules, and mapping
- PolarPro App
  - location/weather-based camera filter selection guide


FLIR
The World's Sixth Sense®