

Drone & GoPro Photography & Videos

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Preface

- Dennis is a drone & GoPro newbie.
 - flown/photo'd/video'd in four different locations.
- Gerry is a six-year drone veteran (he does GoPro too).
- Dennis used a GoPro to photo/video 26 miles of biking so far.
- Dennis did simple video editing on drone & GoPro videos.
- Gerry's videos are much nicer!

Why a Drone?

- Fun!
- Unique perspectives that would be impossible, difficult, or unsafe with conventional cameras
- Good camera and video performance – motion comp
- Easy to fly with obstacle avoidance and auto-return features
- Small & light. My drone, 3 batteries, controller, misc accessories + bag = 3 lbs. Bag is 7.5”x9”x4”
- Inexpensive: my state-of-the-art drone, controller, extra batteries, charger, & shoulder bag was \$1099

Rules

There is a 15-mile circle centered on DCA, the Washington DC Flight Restricted Zone (DC FRZ). There is an additional restricted zone up to 30 miles from DCA, **Don't fly there!**

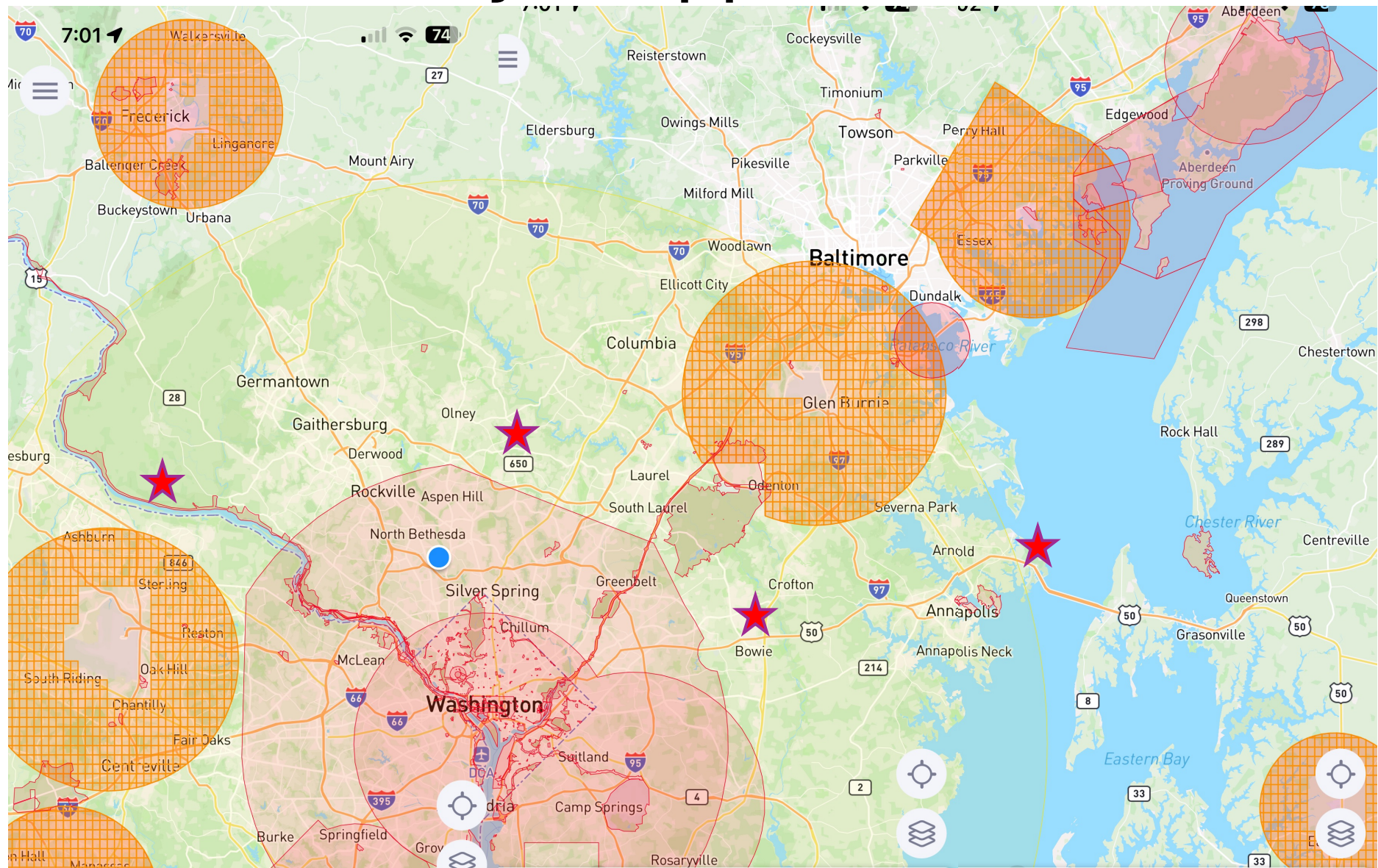
You can fly outside the 30ish mile ring by following some FAA rules (see **Backup**).

- Useful: download an FAA-approved [flight planner app](#) (several to pick from)
- Check rules (Google 'drone' for your intended locations - State Parks, National Forests, Local Parks, etc.)
- Fly your drone at or below 400 feet.

Where to Fly

Interactive map and flight planning from AutoPylot app

★ = Dennis's drone flights



Beginner Drone Site List

Gerry's Recommendations		
Algonkian Regional Park	47001 Fairway Drive	Sterling, VA
Belmont Bay Marina	570 Harbor Side St.	Woodbridge, VA
Burke Lake Park	7315 Ox Rd	Fairfax Station, VA
Carillon Pond Park	Carillon Dr.	Luray, VA
Inner Harbor	Check flight planning app to avoid Class B on south side	Baltimore, MD
James Rumsey Memorial Park	206 N Mill St	Shepardstown, WV
North Beach Pier	9123 Atlantic Ave	North Beach, MD
Occoquan Regional Park	9751 Ox Rd	Lorton, VA
Patterson Park Baltimore	2601 East Baltimore St.	Baltimore, MD
Sandy Point State Park	1100 E College Pkwy	Annapolis, MD
South Fork Shenandoah River		Elkton, VA
Williamsport Power Plant	205 West Potomac Street	Williamsport, MD
Dennis's Recommendation		
McKee Beshers WMA	Multiple sunflower fields + the Sycamore Landing field	Poolesville, MD

Gear

To Fully Appreciate the Portability, here is the DJI Mini 3/4's Size ...



Can go in your camera bag with your camera, carry-on luggage, daypack, coat pockets, small shoulder bag, sling bag, etc.

DJI Mini 3/4, Air 3 and Mavic 3 Pro Sizes



Better Cameras, Longer Flight Times, Higher Prices →

Dennis's
Mini 3/4 Pro
8.8 oz

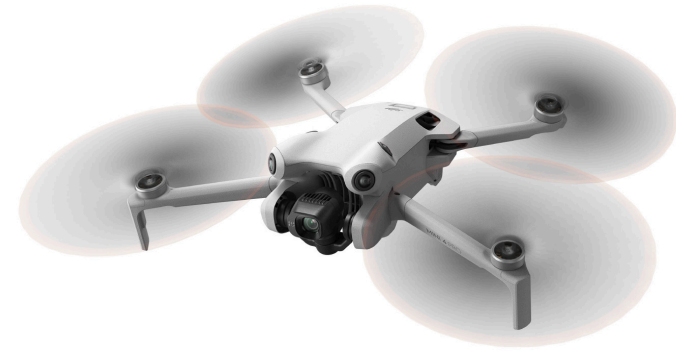
Air 3
25.4 oz

Gerry's Favorite
Mavic 3 Pro
33.8 oz

Nine different drones (sold by B&H) are listed in **Backup** with prices and specs.

Key Features of Mini 4 Pro

(More details in Backup)



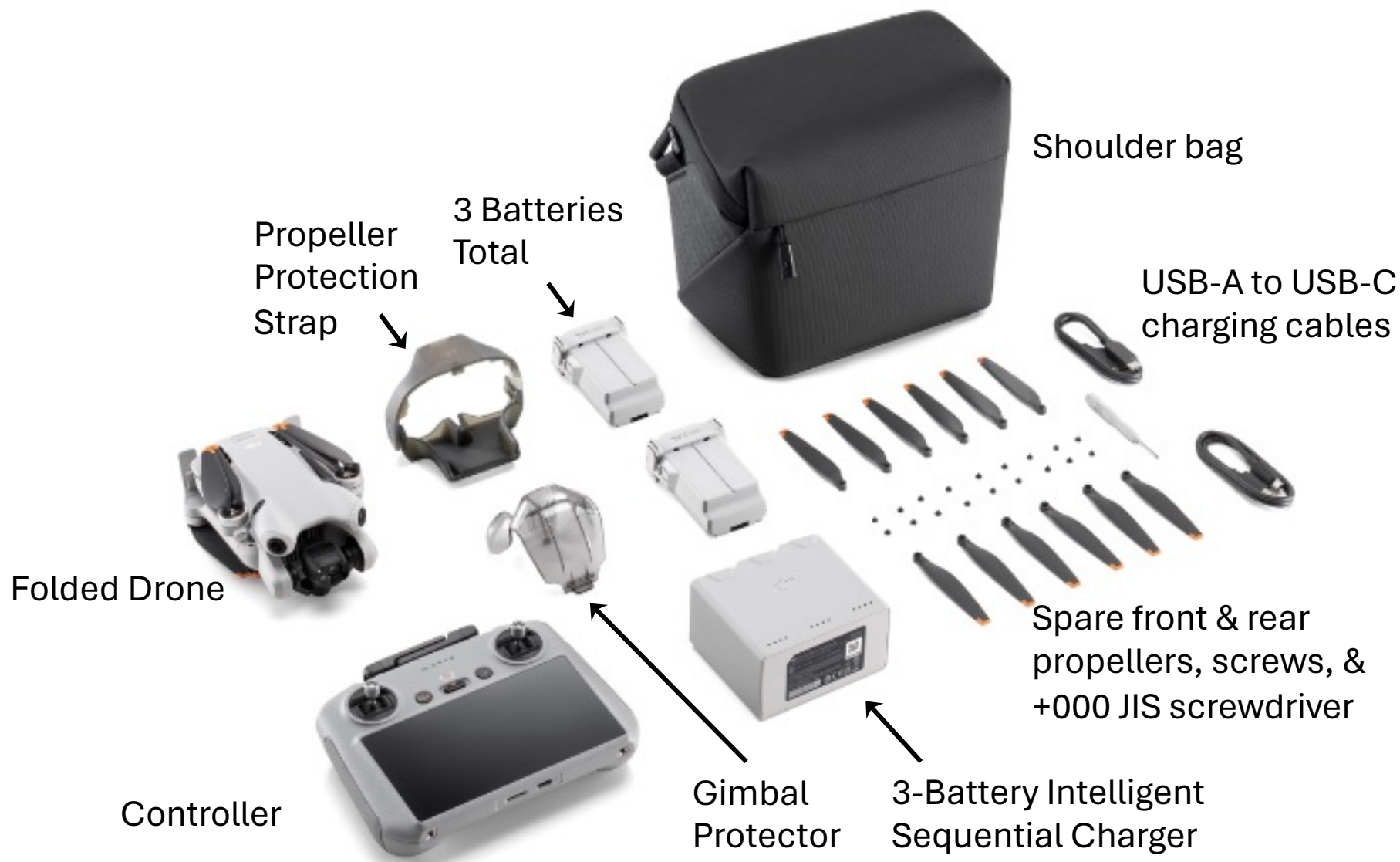
- Max Wind Resistance = 24 MPH
- Max Flight Time Per Battery – 34 Minutes (45 min with “Plus” battery)
- Max Flight Distance = 12.4 Miles
- Max Speed = 35.8 MPH
- Return to Home (take off location) with Low Battery, Lost Communication or On Command with Augmented Reality View
- Automated Take Off & Landing
- Main Camera = 1/1.3” CMOS Sensor Camera
- Lens Focal Length = 24mm (equivalent)
- Still Photo Resolution: 48 MP
- Digital Zoom: 2X Photos, 4X Videos
- Aperture: f/1.7
- Shutter Speed: 2 Seconds – 1/16000 Seconds
- ISO = 100-6400
- Photo Format – Jpeg, Raw or Both
- Max Video Resolution: 4K @ 100 FPS, 1080p @ 200 FPS
- Four Omnidirectional Obstacle Avoidance Sensors + Two Downward sensors
- Geofencing System which Prevents the Drone from Taking Off in Restricted Airspace

Key Features of Mavic 3 Pro



- Max Wind Resistance = 27 MPH
- Max Flight Time Per Battery – 43 Minutes
- Max Flight Distance = 9.3 Miles
- Max Speed = 47 MPH
- Return to Home (take off location) with Low Battery, Lost Communication or On Command with Augmented Reality View
- Automated Take Off & Landing
- Main Camera = 4/3 CMOS Sensor Hasselblad Camera
- Lens Focal Length = 22mm
- Still Photo Resolution: 12 MP, 20 MP and 48 MP
- Digital Zoom: 7X
- Aperture: f/2.8 - f/11
- Shutter Speed: 8 Seconds – 1/8000 Seconds
- ISO = 100-6400
- Photo Format – Jpeg, Raw or Both
- Max Video Resolution: 4K @ 120 FPS, 5.1K @ 50 FPS
- Eight Omnidirectional Obstacle Avoidance Sensors
- Geofencing System which Prevents the Drone from Taking Off in Restricted Airspace

DJI Mini 4 Pro “Fly More Combo” Kit



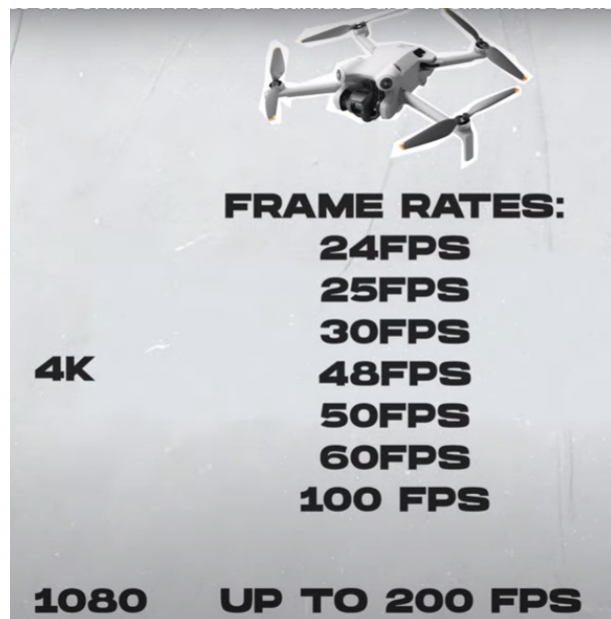
Need to Purchase MicroSD Cards



(~ \$16 each for 128 GB)

Tips for Better Video

Media	Frame Rate	Characteristics	Meas. Mini 4 4K Storage Rqmt	Meas. Mini 4 1080p Storage Rqmt
Feature Films	24 FPS	Cinematic, but choppy with fast movements	890MB/min	378MB/min
TV	30 FPS	Less choppy	897MB/min	387MB/min
Sports Broadcast & Wildlife	60 FPS	More realistic, good at fast action	1.1GB/min	623MB/min
	100-200	Slow Motion	Even more	



Frame Rate	Ideal Shutter Speed = 1 / (2 x FPS)
24 FPS	1/48 Sec
30 FPS	1/60 Sec
60 FPS	1/120 Sec
100 FPS	1/200 Sec
200 FPS	1/400 Sec

Exposure vs Cinematic Challenge

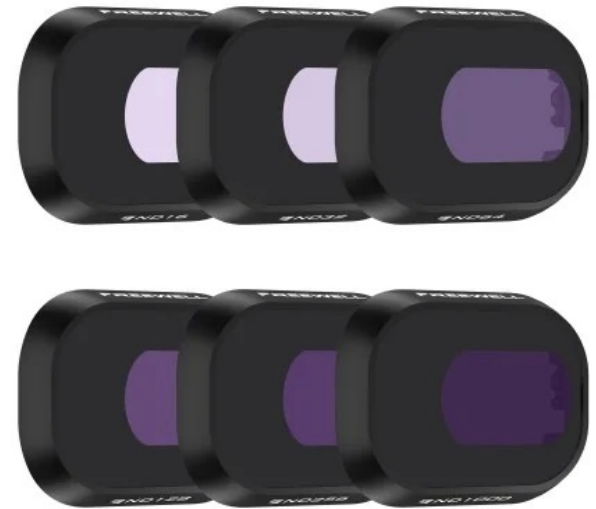
- Most drones have fixed aperture lenses (e.g. f/1.7 for DJI Mini 4 Pro)
- Lowest ISO = 100
- Mini 4 Pro Actual Shutter Speeds on all my Sunny Day Outings: **1/4000 sec**
- But, Ideal Video Shutter Speeds: **1/400 – 1/48 sec**
- Neutral Density Filters to the Rescue:

Frame Rate	Ideal Shutter Speed = 1 / (2 x FPS)	Stops to Adjust 1/4000 Sec to ~Ideal Shutter Speed	Drone ND Filter Type
24 FPS	1/48 Sec	6 stop	ND64
30 FPS	1/60 Sec	6 stop	ND64
60 FPS	1/120 Sec	5 stop	ND32
100 FPS	1/200 Sec	4 stop	ND16
200 FPS	1/400 Sec	3 stop	ND8

ND Filter Sources for Drones

(make sure they are compatible with drone lens)

- Freewell (e.g. “DJI Mini 4 Pro All Day 6Pack” with ND16, ND32, ND64, ND128, ND256 and ND1000 for \$69.99)
- DJI
- PolarPro
- Skyreel
- NEEWER



Gerry's Drone Photos & Videos



Burke Lake







Rumsey Train



Pano



“Dronie” Video: Gerry & Dennis @ Sandy Point State Park:

[Click Here: Dennis-and-Gerry-Dronie.mov](#)



Golden Palace “MasterShot” Video

[Click Here: Golden Palace MasterShot Video](#)



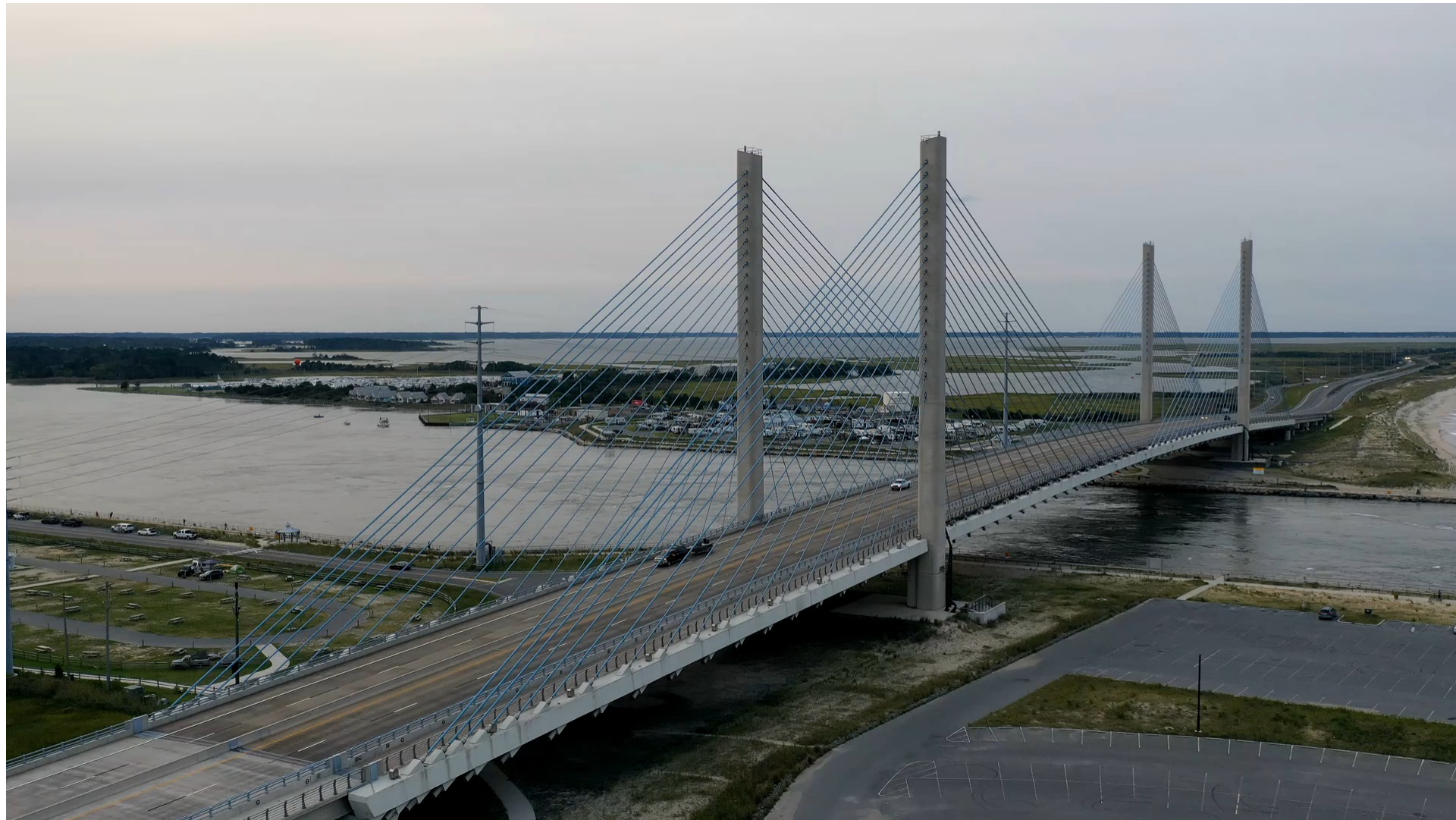
Sandy Point “Asteroid” Video

[Click Here: Sandy Point Asteroid Video](#)



Bridge “Hyperlapse” Video

[Click Here: Bridge Hyperlapse Video](#)



GoPro

Why a GoPro?



- Fun!
- Capture photos and videos while you, or a vehicle, etc, is on the move, or when you can't use your hands.
- Good camera and video performance – motion comp
- Easy to use, even has voice commands.
- Many mounting options.
- Small & light.
- Relatively inexpensive: GoPro Hero 12 with Accessories Bundle (extra batteries, case, head strap, handle mount) ~ \$450.



Rear LCD Screen with Live View and Settings/Controls



GoPro Hero 12 Highlights

- Video Performance: Many options, amazing resolution and frames rates, e.g. 5.3K at 60 fps!
- 10-bit video
- 8x slow-motion
- Several lens modes - HyperView, Wide, Linear (undistorted)
- 'HDR' video mode
- Vertical orientation photo/video support
- 27MP photos, including Raw + JPEG
- Runtime per battery: 58-150 min as function of data rate
- *Emmy Award-winning* image stabilization
- Voice Control
- Phone App Live View & Control
- Waterproof up to 33 ft

Control & Live View with Quik Smartphone App



If you can dream it, the mount exists - a small sampling:

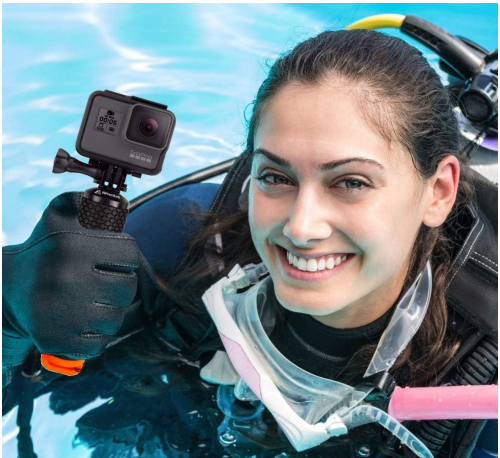
Chest Mount



Head Mount



Backpack Mount



Motion Compensation: Before/After

[Click Here: GoPro Stabilization Clip](#)



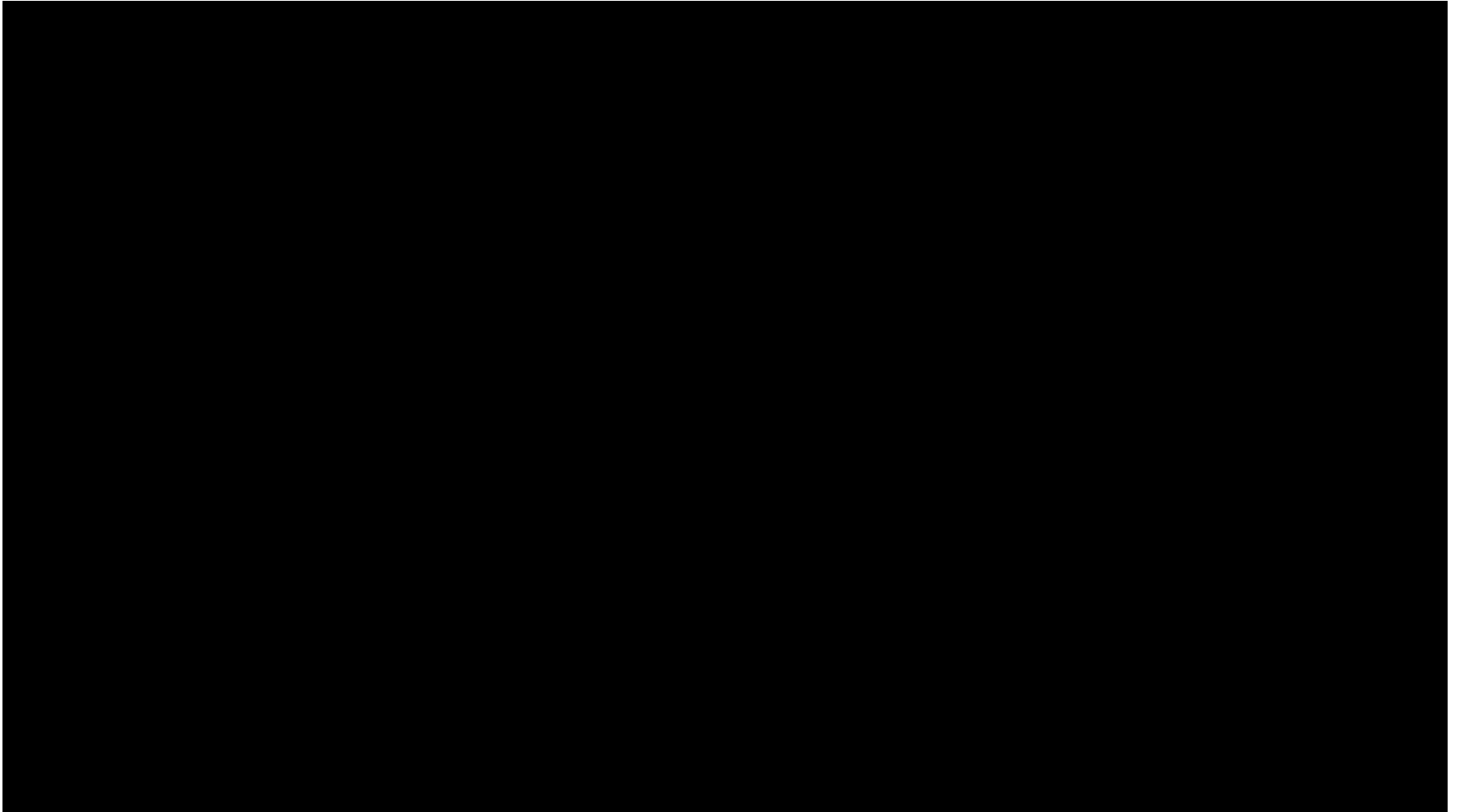
Auto Horizon Leveling

[Click Here: Auto Horizon Leveling Clip](#)



My First GoPro, Edited in iMovie

[Click Here: Monocacy Aqueduct to Point of Rocks Bike Ride](#)



Some Video Editors

[– review article](#)

- Wondershare Filmora – free, Windows & Mac
filmora.wondershare.com/video-editor
- Apple iMovie – free, Mac
App Store, support.apple.com/imovie
- DaVinci Resolve – free, Windows & Mac
blackmagicdesign.com/products/davinciresolve/edit
- VideoProc Vlogger – \$29.95/1 year, \$37.95/lifetime
videoproc.com/video-editing-software/
- The overwhelming majority of professionals working in video editing use either **Premiere Pro** or **Final Cut Pro**. The former is produced by Adobe and is available for both Windows and Mac; the latter comes from Apple, and is Mac-only. Other than that, each has its pros and cons, and you can take a deep dive into the differences in an article [Premiere Pro vs Final Cut Pro](#).

Backup

Washington Metro Area Basics

The National Capital Region is governed by a Special Flight Rules Area (SFRA) within an up to 30-mile radius of Ronald Reagan Washington National Airport.




Don't fly there!

Flying a drone outside 30-mile inner ring from Washington, D.C. **is allowed:**

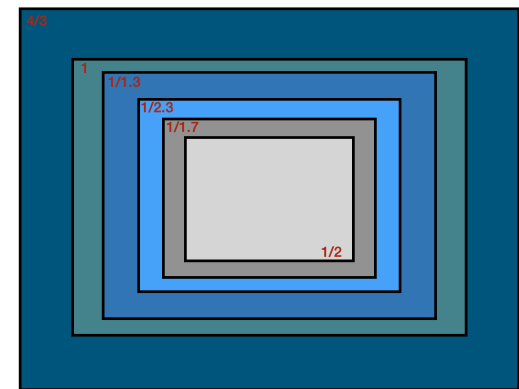
- Drones \geq 8.8 oz (250 g) must be [registered](#) and marked, carry proof of registration. Easy. \$5 fee.
- Download an FAA-approved [flight planner app](#) (several to pick from)
- Take the (easy) [TRUST exam](#) (The Recreational UAS Safety Test) and carry printout of test passage when flying.
- You must follow the [safety guidelines](#) of an FAA-recognized CBO (Community Based Organization) like AMA – The Academy of Model Aeronautics.
- You must fly your drone at or below 400 feet in Class G (uncontrolled) airspace.
- You need to have authorization using [LAANC](#) or [DroneZone](#) apps before flying at or below FAA-authorized altitudes in Class B, C, D, and E controlled airspace (i.e. around airports or enroute/terminal routes).

Recreational Drone Models

Drone Manufacturer	Model	Price (min kit)	Weight	Flight Time	Cameras	35mm equiv	Aperture	Photo Resolution (sensor size)	Max Video size x fps	Obstacle sensing & avoidance
DJI	Mini 3 Pro	\$854	249 g	34 min	1	24mm	f/1.7	48 MP (1/1.3")	4Kx60	Fwd-Bck-Dwn
DJI	Mini 4 Pro	\$759	249 g	34 min	1	24mm	f/1.7	48 MP (1/1.3")	4K x 100	Omni
DJI	Air 3	\$1,099	720 g	46 min	2	24mm, 70mm	f/1.7, f/2.8	48 MP (1/1.3")	4K x 100	Omni
DJI	Mavic 3 Classic	\$1,279	895 g	46 min	1	24mm	f/2.8	20 MP (4/3")	4K x 120	Omni
DJI	Mavic 3 Pro	\$2,189	958 g	43 min	3	24mm, 70mm, 166mm	f/2.8, f2.8, f/3.4	20 MP (4/3") 48 MP (1/1.3") 12 MP (0.5")	4K x 120	Omni
DJI	Mini 2 SE	\$299	249 g	31 min	1	24mm	f/2.8	12 MP (1/2.3")	2.7K x 30	Down
DJI	Mini 3	\$469	249 g	38 min	1	24mm	f/1.7	12 MP (1/1.3")	4K x 30	Down
Autel Robotics	Evo Lite+	\$1,199	835 g	40 min	1	29mm	f/2.8-f/11	20 MP (1")	6K x 30	Fwd-Bck-Dwn
Autel Robotics	Evo Nano+	\$1,090	249 g	28 min	1	23mm	f/1.9	50 MP (1/1.28")	4K x 30	Fwd-Bck-Dwn

-  **Hasselblad 4/3 sensor**
Mavic 3 Classic
Mavic 3 Pro
-  Air 2S -
-  **Mini 3** **Medium**
Mini 3/4 Pro Mavic 3 Pro

-  Avata
-  Mini 2 SE
-  **Telefoto**
Mavic 3 Pro



Relative sensor sizes

Key Features of DJI Mini 4 Pro

- Max speed: 35.8 mph
- Maximum Controller-Drone Operating Distance: 12.4 Miles
- 23.9 mph wind resistance
- Return to Home (the takeoff GPS location) with low Battery, lost Communication, or on Command
- Automatic landing
- Omnidirectional obstacle avoidance

- Still photo resolution: 48 MP
- Max video resolution: 4K at 100 fps / 1080p at 200 fps
- Digital Zoom: 4x1
- Fixed Aperture: f/1.7
- Shutter: 1/16000-2 secs
- ISO: 100-6400, (12,800 extension in video)
- Gimbal Pitch / Roll Control: -90 to 60° / -90 to 0°

- Photo Modes: AEB, Burst Shooting, Interval, Single Shot
- Video Modes: Normal, Night, and Slow Motion
- MasterShots: Drag-select a subject: Manuever drone several ways while tracking subject.
- QuickShots: Drag-select a subject: Six different flight profiles while tracking subject.
- Pano: Create a 3D spherical interactive image around the drone, a 180° pano, wide angle, or vertical.
- Hyperlapse: various flight path options to automatically create a timelapse video

DJI 2-Year Care Refresh Protection Plan with Accidental Damage Protection for Mini 4 Pro

- \$125
- Eligibility Criteria
 - Within 48 Hours of Product Activation
- Start Date
 - Date of Purchase
- Included Support
 - Accidental Damage Protection, Flyaway Coverage, Tech Support
 - up to four replacement units at an additional low cost
 - water damage, collision, and other accidents (\$65 replacement fee)
 - when aircraft go missing during flight (\$235 fee)
 - shipping costs both ways for replacement service.
- Includes Battery Failure Coverage
 - Yes

My Drone Class Instructor: "I destroyed two early models with downward-only sensors (hit bush from below, dropped into water). DJI was very fast at getting me my replacements. They were great."