Intro to Small Unmanned Aircraft Systems & Recreational Drones

Photography

“A picture is worth a thousand words”

Brownie Camera (1900)

Introduced the “snapshot” to the masses!

Snapshot vs. Photograph

A snapshot captures a moment; a photograph captures a memory.

A photograph tells a story and makes the viewer think and ask questions.

A photograph is a view of something many others have seen before but seen from a new perspective.

Commercial photography is as an artistic expression of a vision, but with the goal of advancing a business or cause.

Photography Niches

Food	Stock	Event
Sports	Street	Aerial
Macro	Portrait	Wildlife
Fashion	Still Life	Weather
Newborn	Landscape	Architectural
Documentary	Long Exposure	Photo-journalism

Aerial Photography

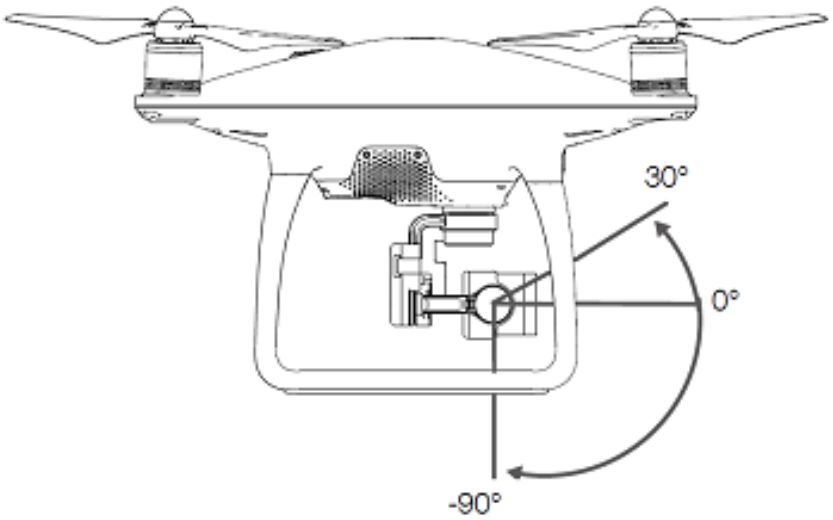
Aerial Photography gives a new perspective of things viewed from above. It is literally a "bird's eye view" of the world.

Early Aerial Photography

New York City – 1930 by Fairchild Aerial Photo

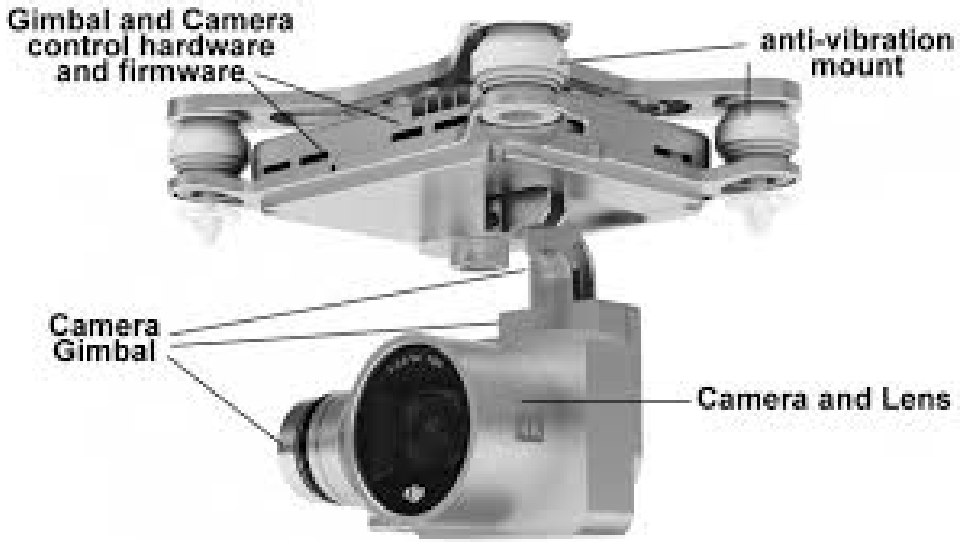
Aerial Photography

- DJI Matrice 600 Pro Drone +**$5,000**
- DJI Ronin MX 3-Axis Gimbal Stabilizer +**$1,600**
- Hasselblad H6D + 28mm lens +**$37,000**



- Provides a stable platform for a camera
- Designed for specific camera & drone model
- 2-Axis & 3-Axis Stabilized
- Integrated or separate control

Gimbals



- Joystick Control
- Head Tracking

Gimbals

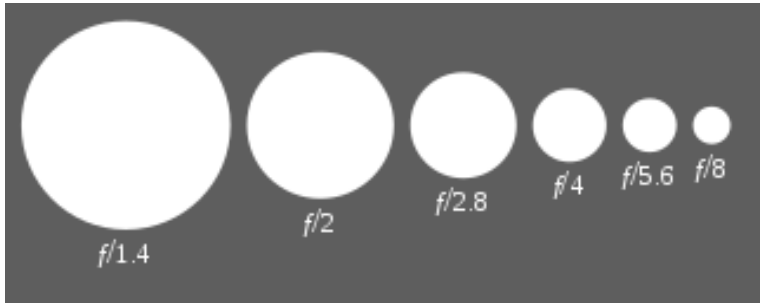
Camera Basics

Three Primary Adjustments

- **Aperture** – "f-stop" or shutter opening

  f/1.2 – f/2.0 – f/2.8 – f/4.0 – f/5.6 – f/8.0 – f/11 – f/16

- **Shutter Speed** – in seconds or fractions of a second
- **ISO** – sensor sensitivity




THE EXPOSURE TRIANGLE
APERTURE
SMALL
LESS EXPOSURE
LARGE
MORE EXPOSURE
SHUTTER SPEED
SLOW
MORE EXPOSURE
FAST
LESS EXPOSURE
ISO
LESS EXPOSURE
100
MORE EXPOSURE
6,400

Exposure Choices

- **Small aperture** increases the depth of field so more of the photo is “in focus”.
- **Fast shutter speed** “stops the action” and gives a sharp photo.
- **Low ISO** setting reduces the noise or false pixels. It also reduces the sensor heating.

Videography

“Cinematic Shutter Speed” is where shutter speed is set at double frame rate, or as close as is possible. This creates the most realistic video with a certain amount of motion blur from frame to frame.

Example:

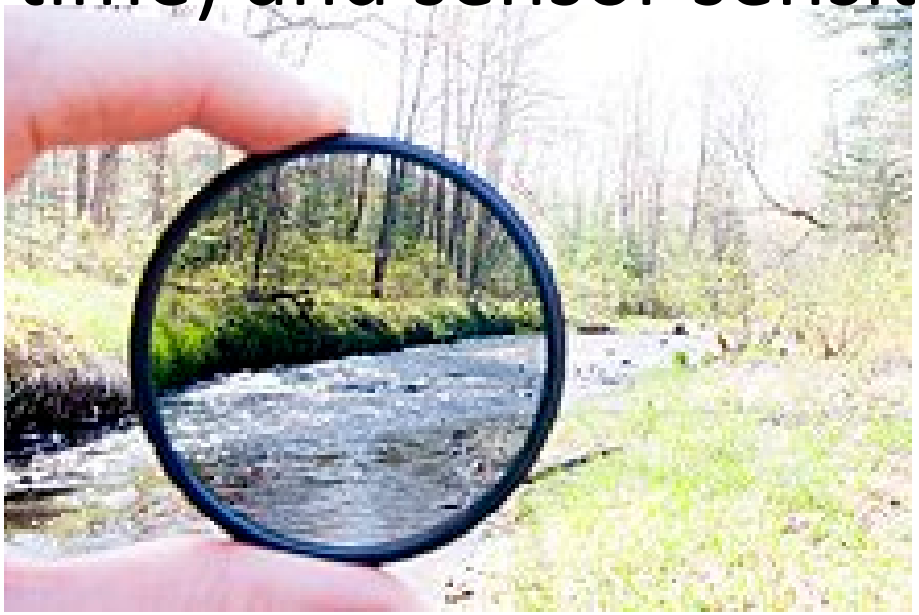
120 FPS x 2 = 240 or 1/240th shutter speed

60 FPS x 2 = 120 or 1/120th shutter speed

30 FPS x 2 = 60 or 1/60th shutter speed

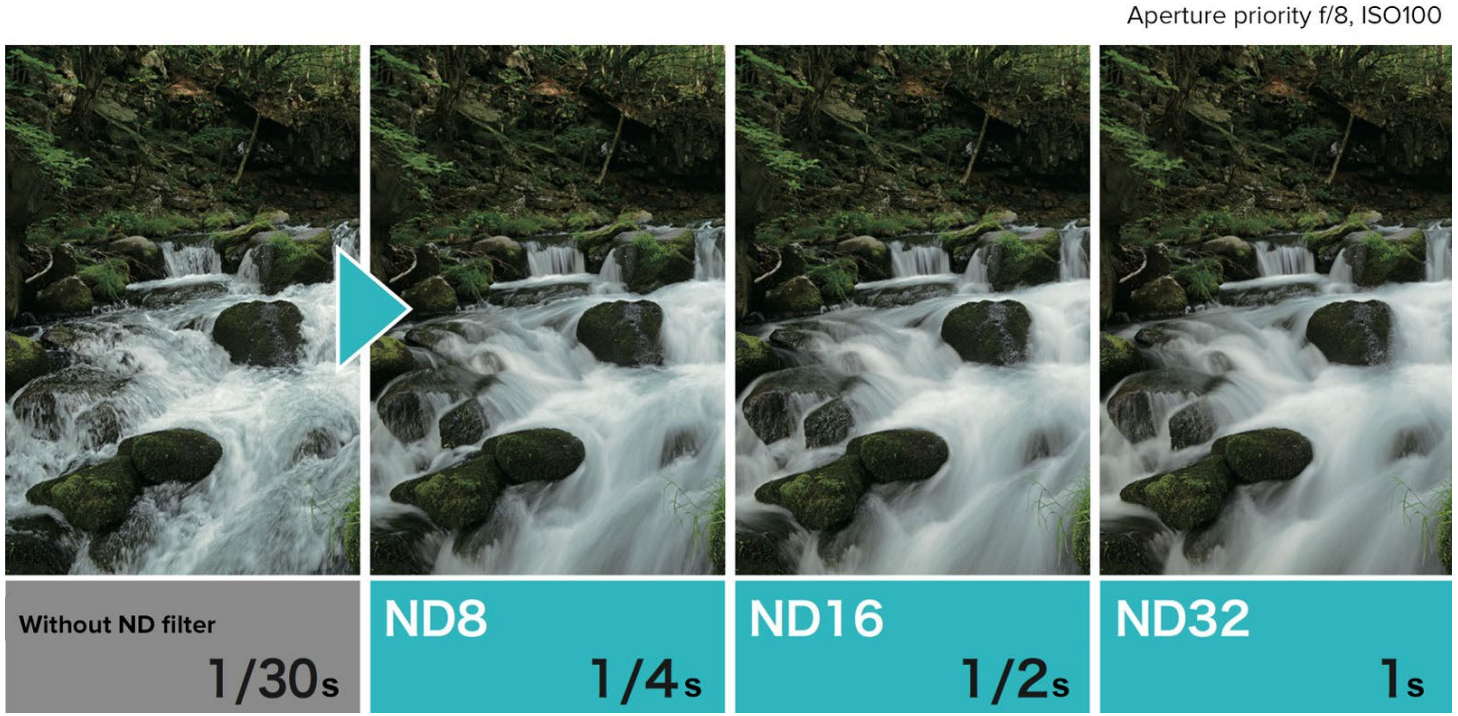
Neutral Density Filters

A neutral-density filter (ND) reduces the light intensity. Doing so allows the photographer with a fixed aperture drone to select the desired shutter speed (exposure time) and sensor sensitivity.



Neutral Density Filters

Use neutral-density filters (ND) to reduce incoming light which allows you to set the shutter speed.



Mavic 3 Camera Specs

Sensor

- 4/3 CMOS, Effective pixels: 20 MP

Lens

- FOV: 84° – Format Equivalent: 24 mm
- Aperture: f/2.8 to f/11
- Focus: 1 m to ∞ (with autofocus)

ISO Range

- Video and Still Image: 100-6400

Shutter Speed

- Electronic Shutter: 8-1/8000 sec

Photo Format

- JPEG/DNG (RAW)

Drone Camera Specs

- **Video Resolution**
  5.1K: 5120×2700 @ 24 to 50 fps
  Cinema 4K: 4096×2160 @ 24 to 120* fps
  4K: 3840×2160 @ 24 to 120* fps
  FHD: 1920×1080 @ 24 to 200* fps

*Videos recorded at high framerates will be played as slow-motion videos.

- **Video Formats**
  MP4/MOV

Photography is more than Megapixels

12 MP Cameras

Videography is more than Resolution

- 4K
- 1080i
- 720p
- WVGA

Each of these shoots in 4K resolution.

What is the view medium?

Print or Video?

- **Print – image size is important – larger print size or cropped images are better more MP and larger sensors.**
- **Video – view on a phone, a monitor, high-definition TV or large projections – commercial uses require higher resolution**

PPI vs. DPI

Video screens use pixels to create an image
Pixel are measured in Pixels Per Inch (PPI)
Monitors have from 94 to 145 PPI
(In 1984 the original Mac screen had 72 PPI)

Printers use ink to create an image
Ink is measured in Dots Per Inch (DPI)
5x7 or 4x6 photos are fine with 300 DPI
8x10 photos need 600 DPI to look good

Print Image Size Ratio (W x H)

35mm camera film = 36mm x 24mm (3:2)

Drones have a 3:2 or 4:3 aspect ratio

Standard Print Paper Sizes (USA)

- 4x6 (3:2)
- 5x7 (7:5)
- 6x8 (4:3)
- 8x10 (5:4)
- 8x12 (3:2)
- 10x12 (6:5)
- 10x15 (3:2)
- 11x14 (14:11)
- 11x17 (17:11)
- 12x16 (4:3)
- 12x18 (3:2)
- 16x20 (5:4)
- 20x24 (6:5)
- 20x30 (3:2)

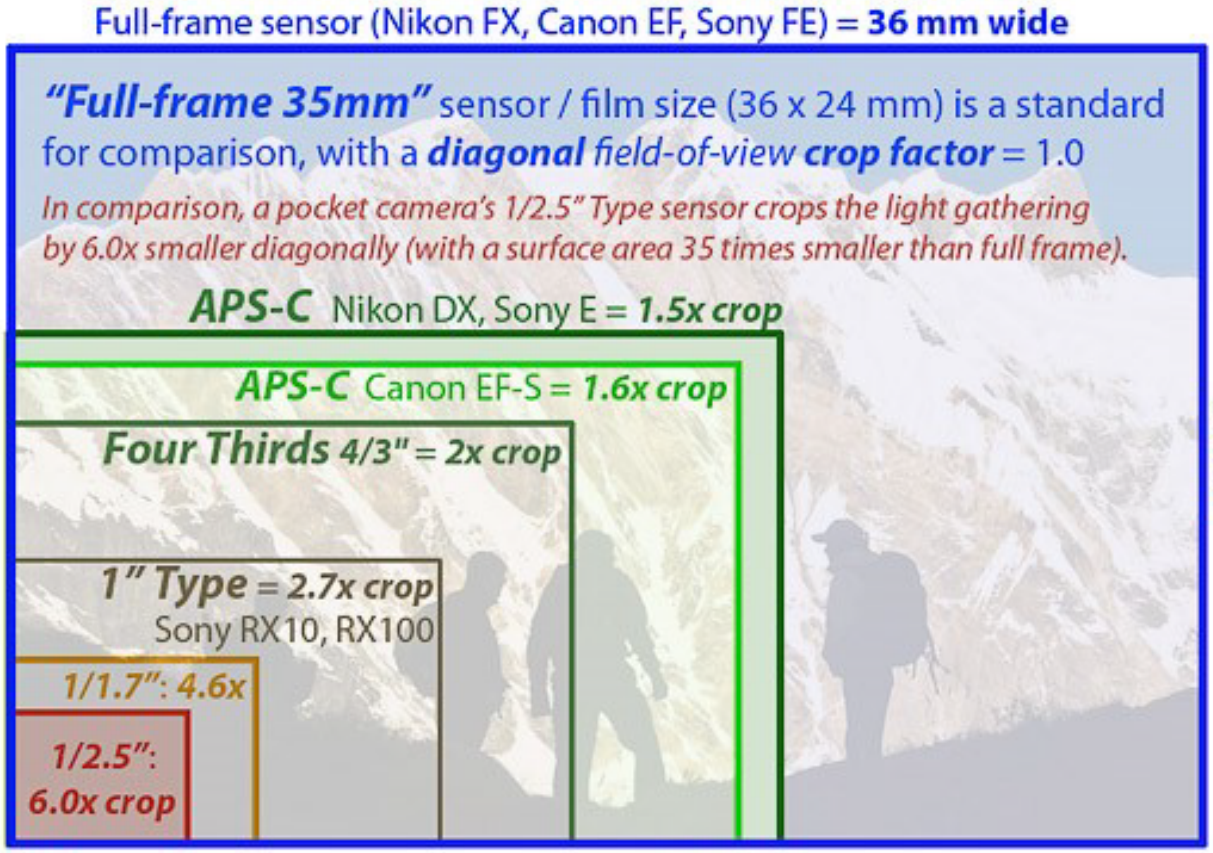
Video Image Size Ratio (W x H)

Drones have a 3:2 or 4:3 native image ratio but can be cropped to 16:9

- Facebook*/Instagram* = 1:1 (1200 x 1200 pixels)
- Standard TV = 4:3 (640 x 480 pixels)
- HDTV = 16:9 (1920 x 1080 pixels)
- 4K Ultra HD = 16:9 (3840 x 2160 pixels)
- Cinema 4K = 17:9 (4096 x 2160 pixels) – Letterbox on a HDTV
- Ultra-widescreen = 21:9 (10240 × 4320 Pixels) – shown in theaters

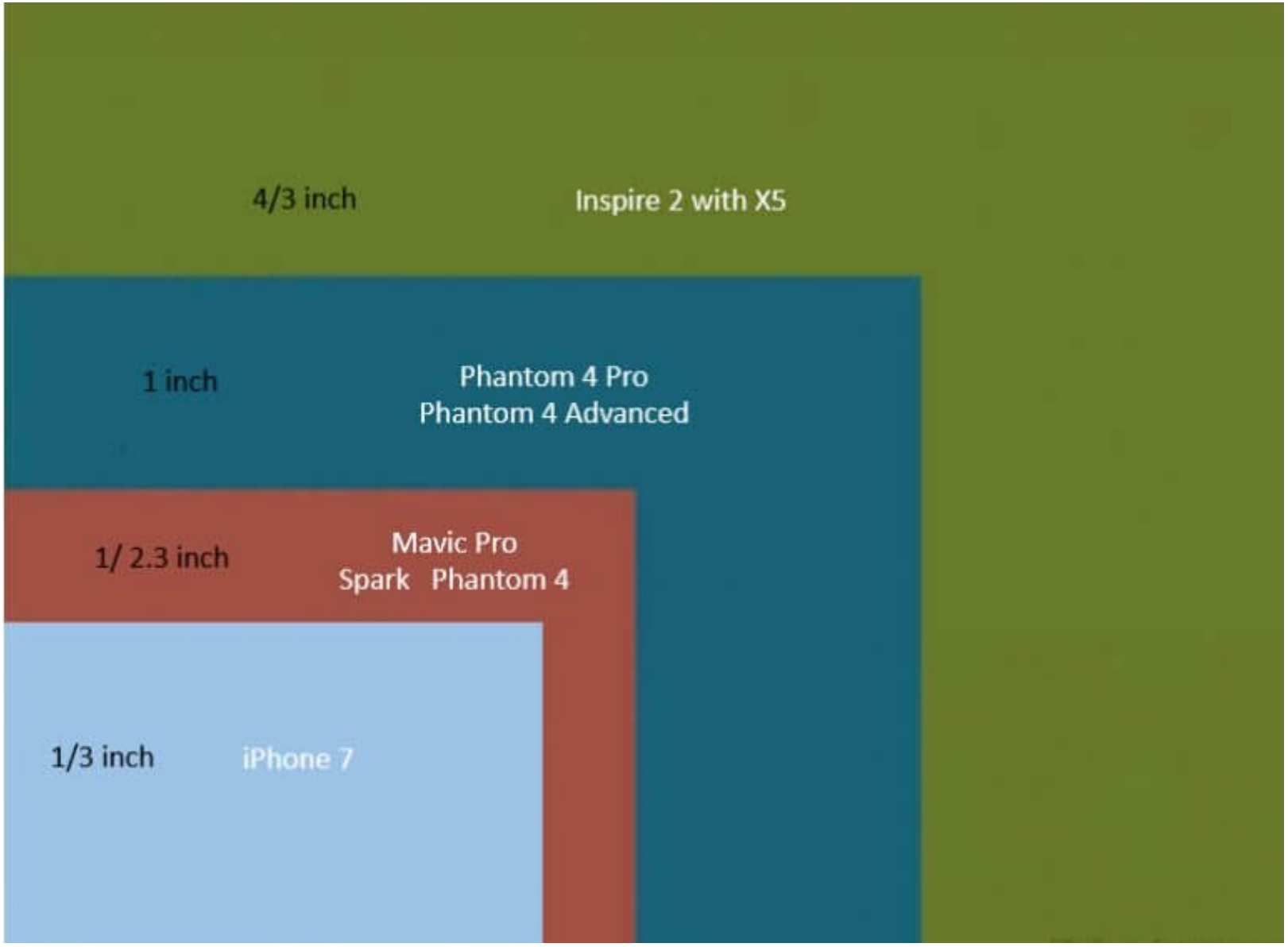
* *Social media offers different sizes for different purposes from profile photos to cover photos.*

For new **digital cameras**, a bigger **sensor area** captures better quality, but requires larger diameter, bulkier lenses.
To **optimize** the size of a serious **travel camera**, consider ***1-inch Type sensor*** or up to ***APS-C* sensor size**.



Compact & pocket zoom cameras have small, noisy sensors, tiny enough to extend superzoom lens reach.

APS-C sensor gathers 15 times more *light (area)* than a ***1/2.5" Type*** sensor, and 2.4 times less than ***Full Frame***.


4/3 inch
Inspire 2 with X5
1 inch
Phantom 4 Pro
Phantom 4 Advanced
1/ 2.3 inch
Mavic Pro
Spark Phantom 4
1/3 inch
iPhone 7

JPEG or RAW (DNG)

Post processing a RAW photo in Lightroom or Photoshop can greatly improve photo quality over a compressed JPEG.

Normal Lens

Fisheye vs. Normal

Normal Lens

24mm	50mm	85mm	200mm
✗	✗	✓	✓

Stable Hover

Stable hovering requires an advanced flight control system and onboard sensors.

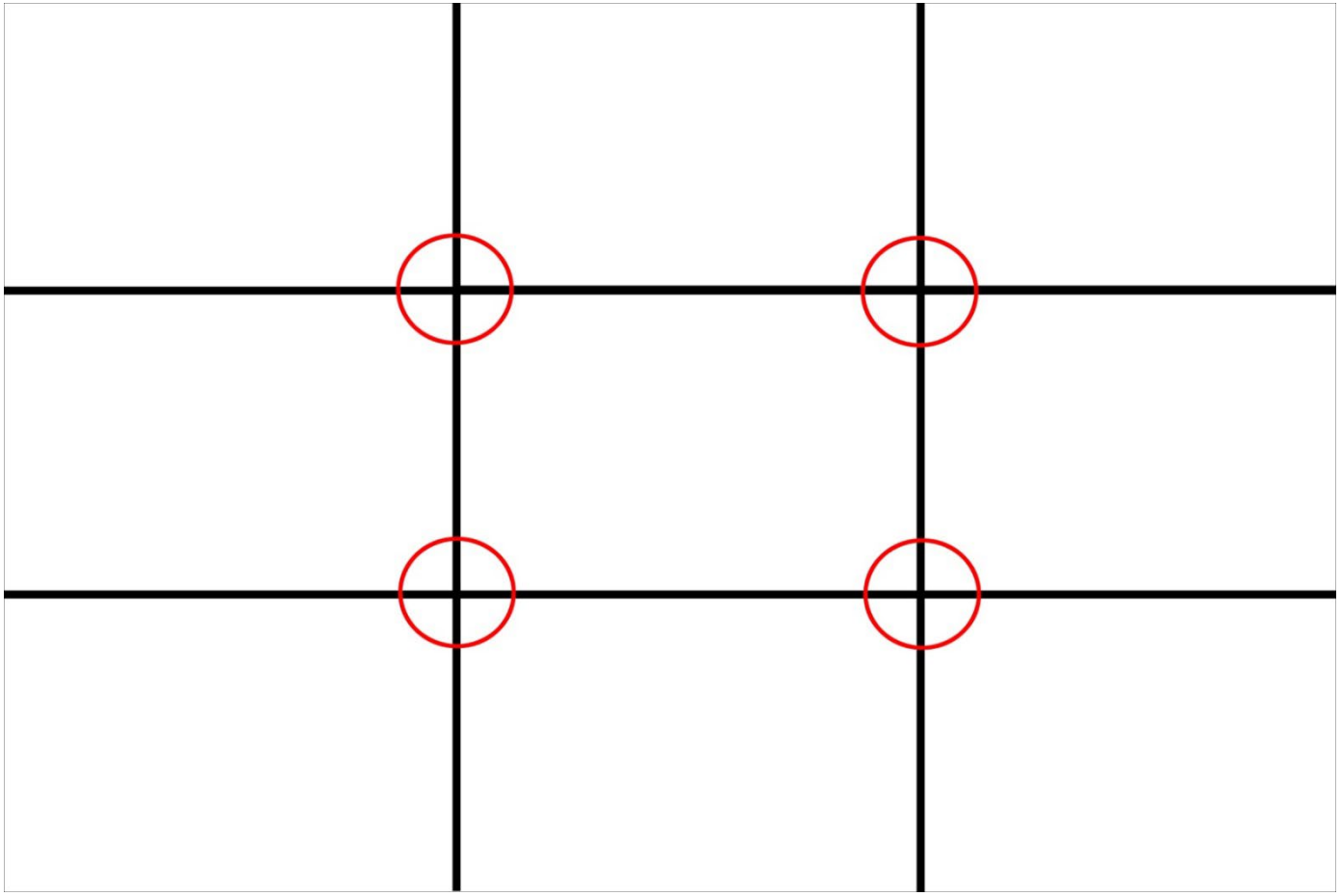
Flight Time

Most camera drones will fly for 20+ minutes, which is plenty of time to take a good photograph. So don’t worry about flight time but carry 2 or 3 extra batteries.

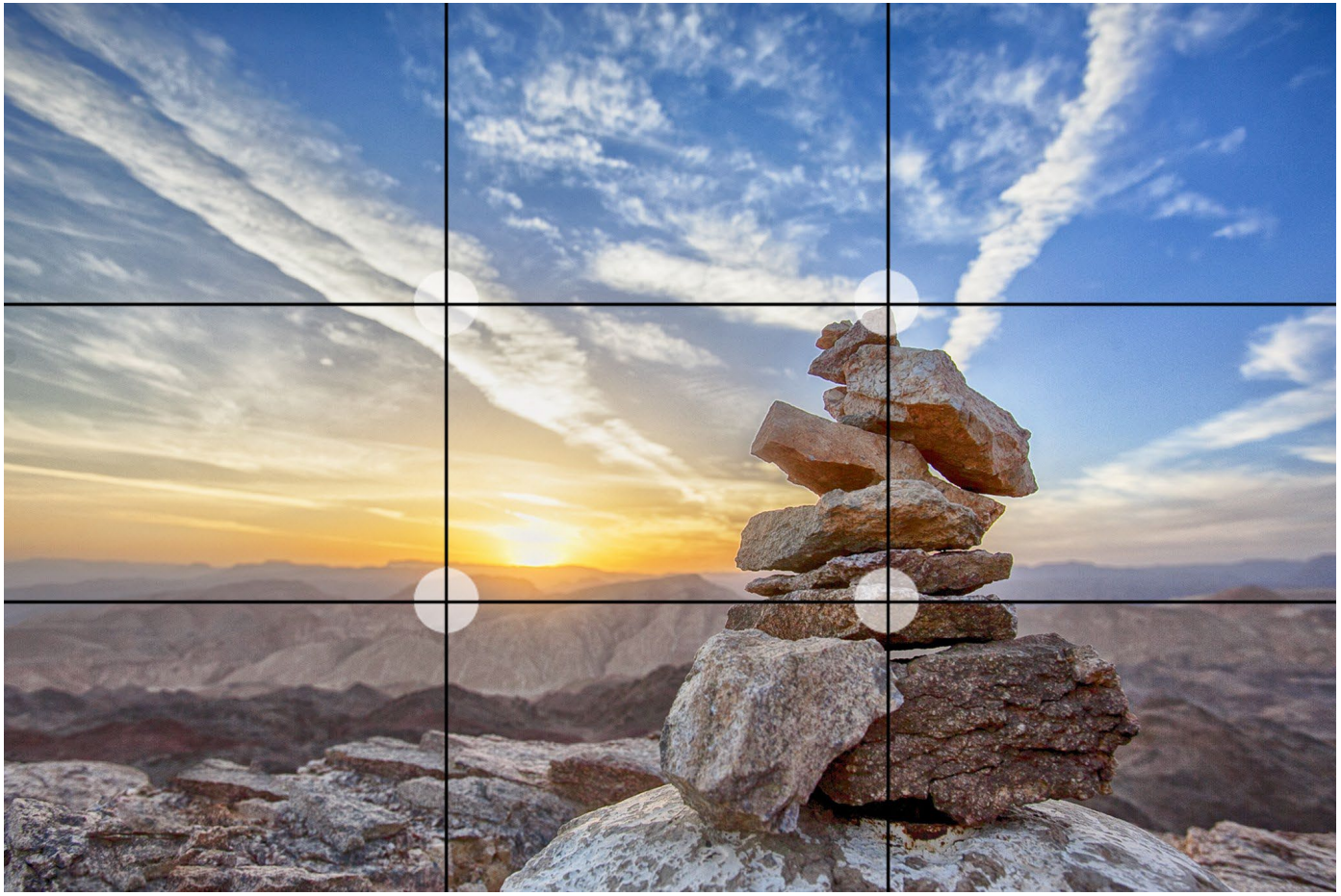
Basic Photography Composition

- Rule of Thirds
- Leading Lines
- Symmetry
- Patterns

Rule of Thirds



Rule of Thirds

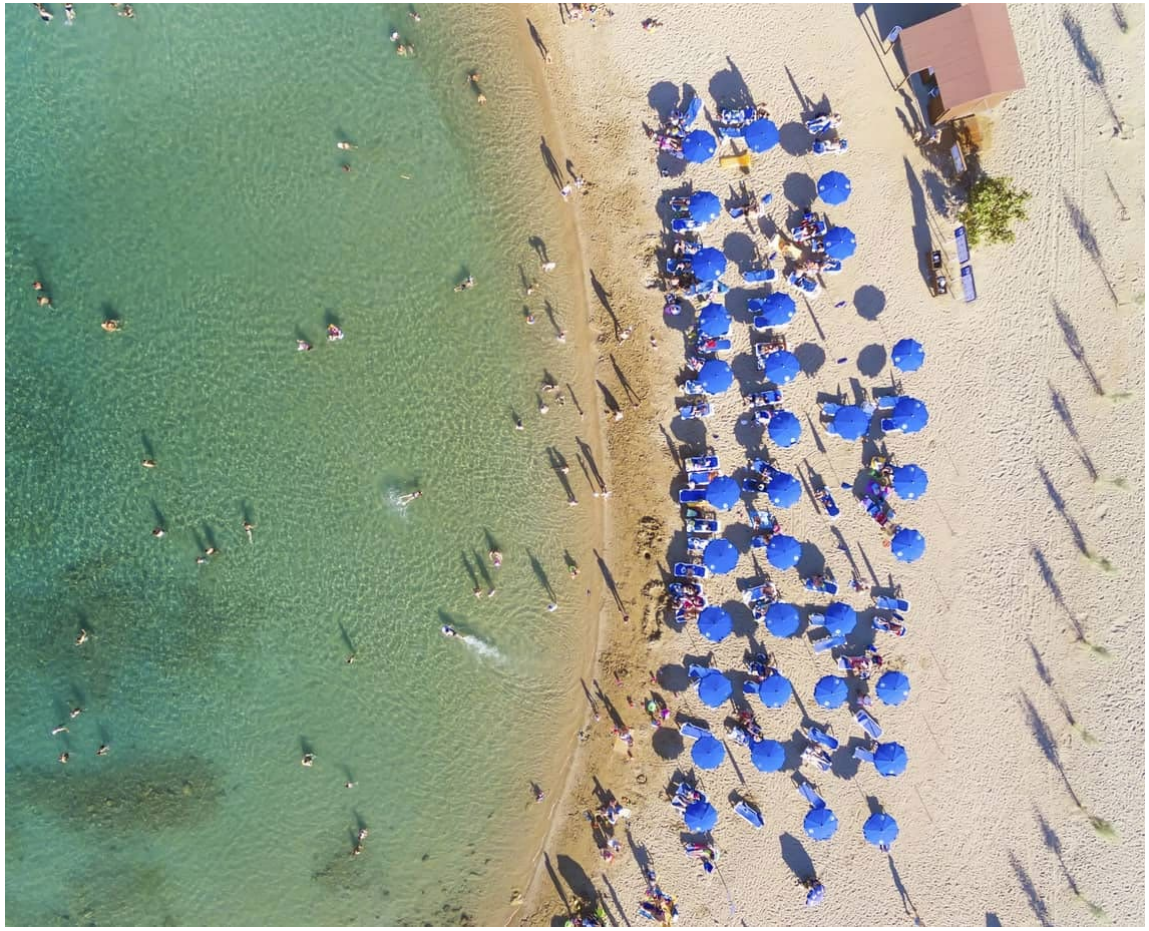


Leading Lines give Structure

Patterns

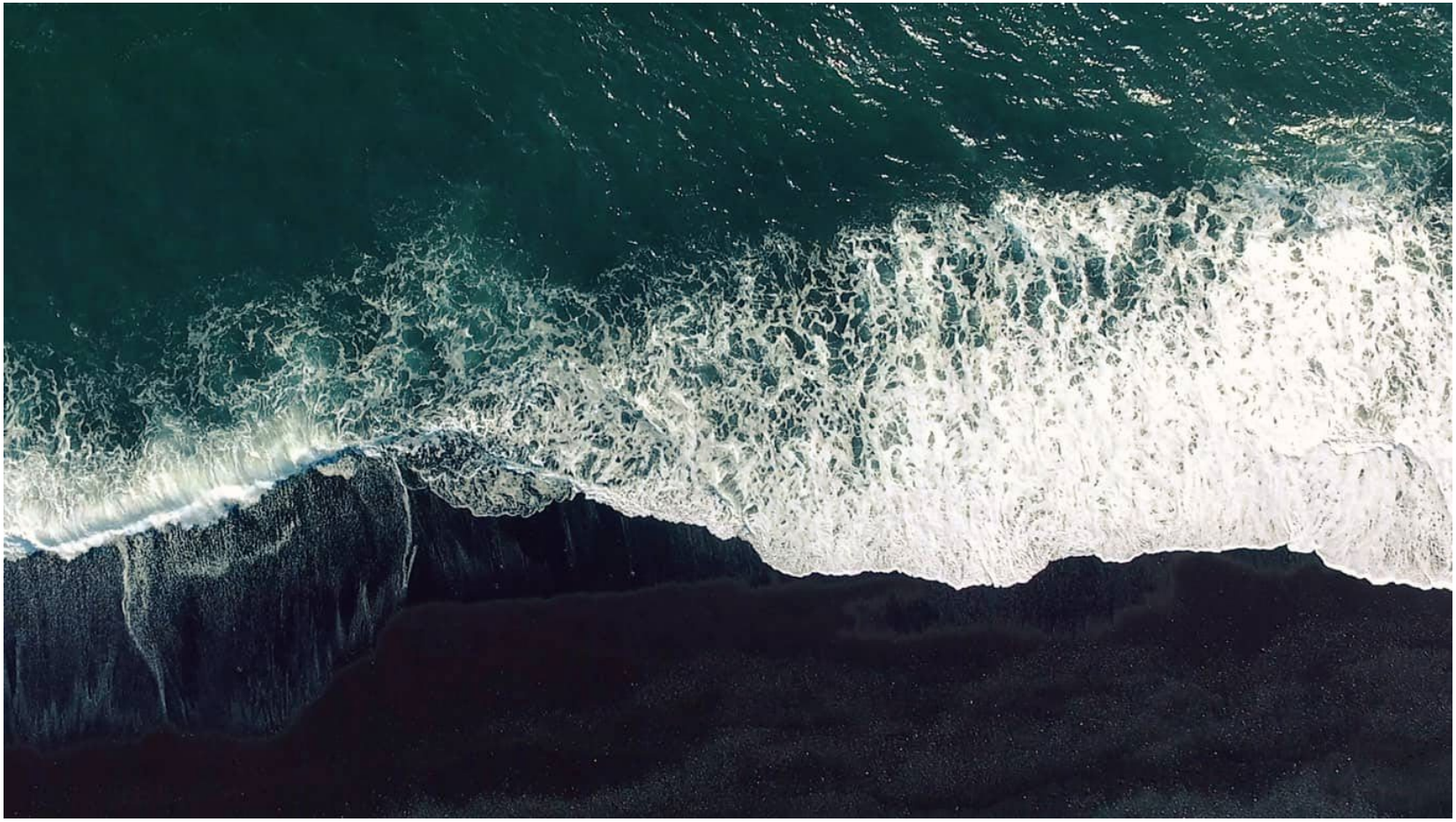
Symmetry

Include People in the Photo

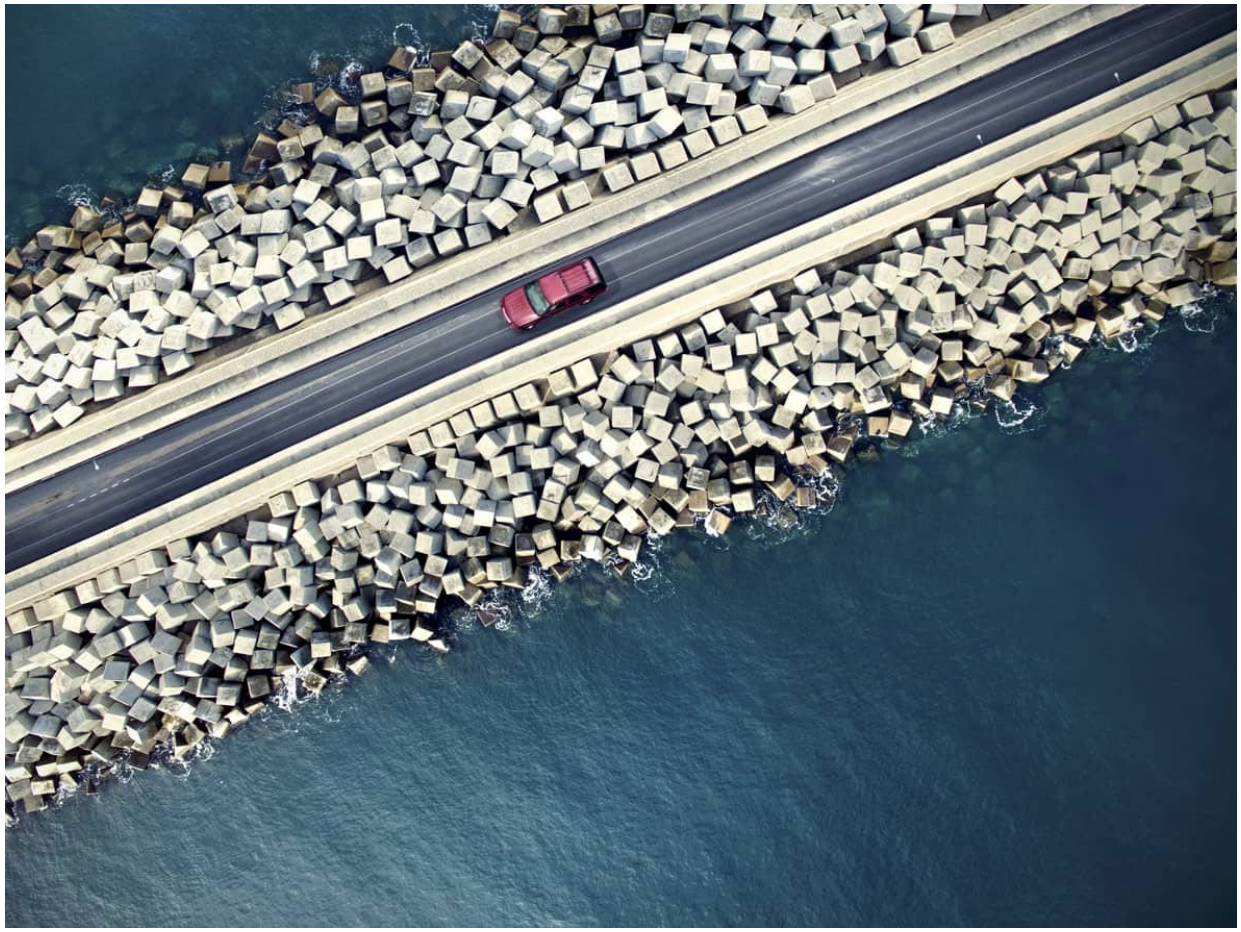


Look for Color

Look for Color



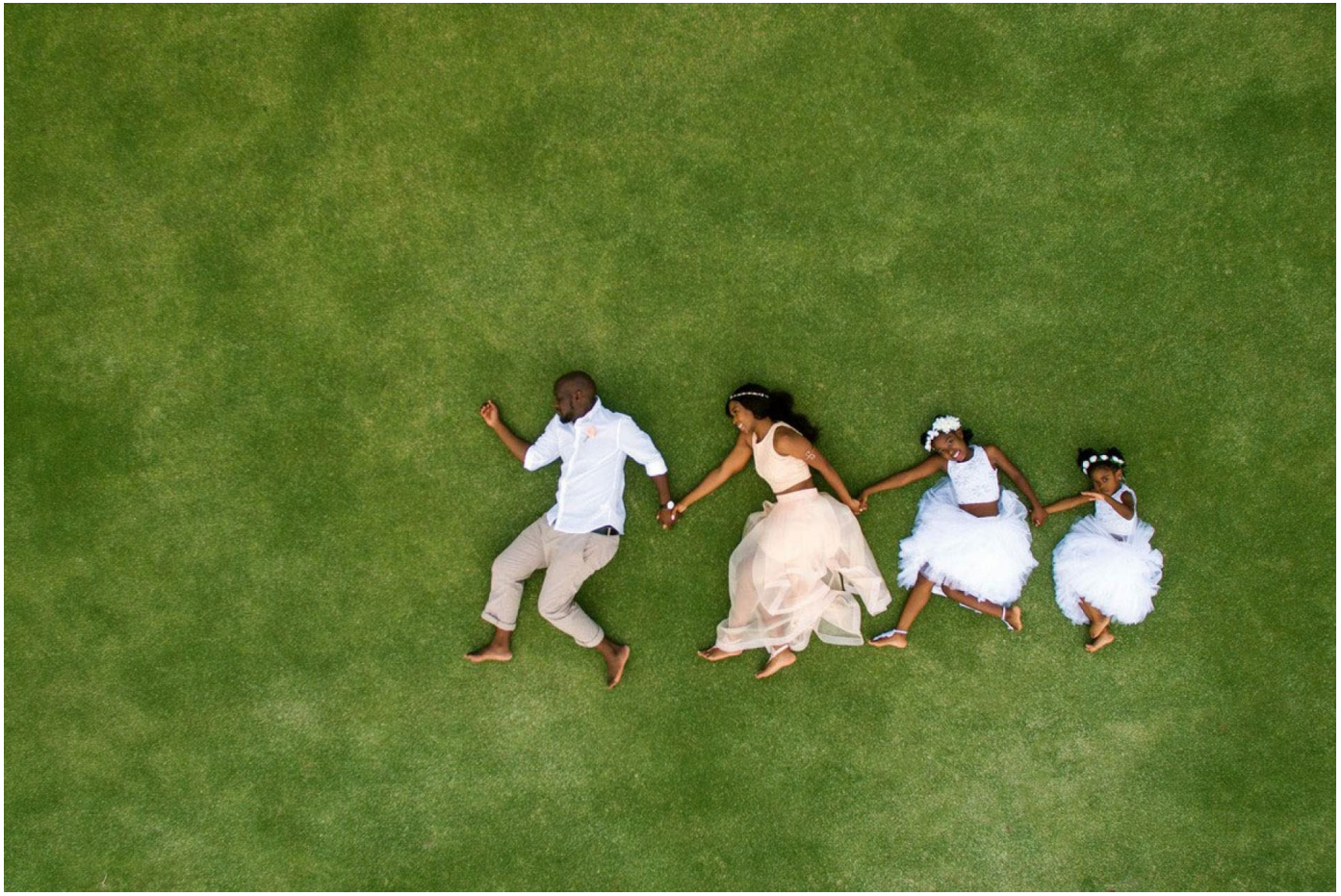
Texture Creates a 3-Dimensional Look



Commercial Aerial Photography

Wedding Photography

Andrew Morgan – Tanzania



Baldwin Foley – Family Photo

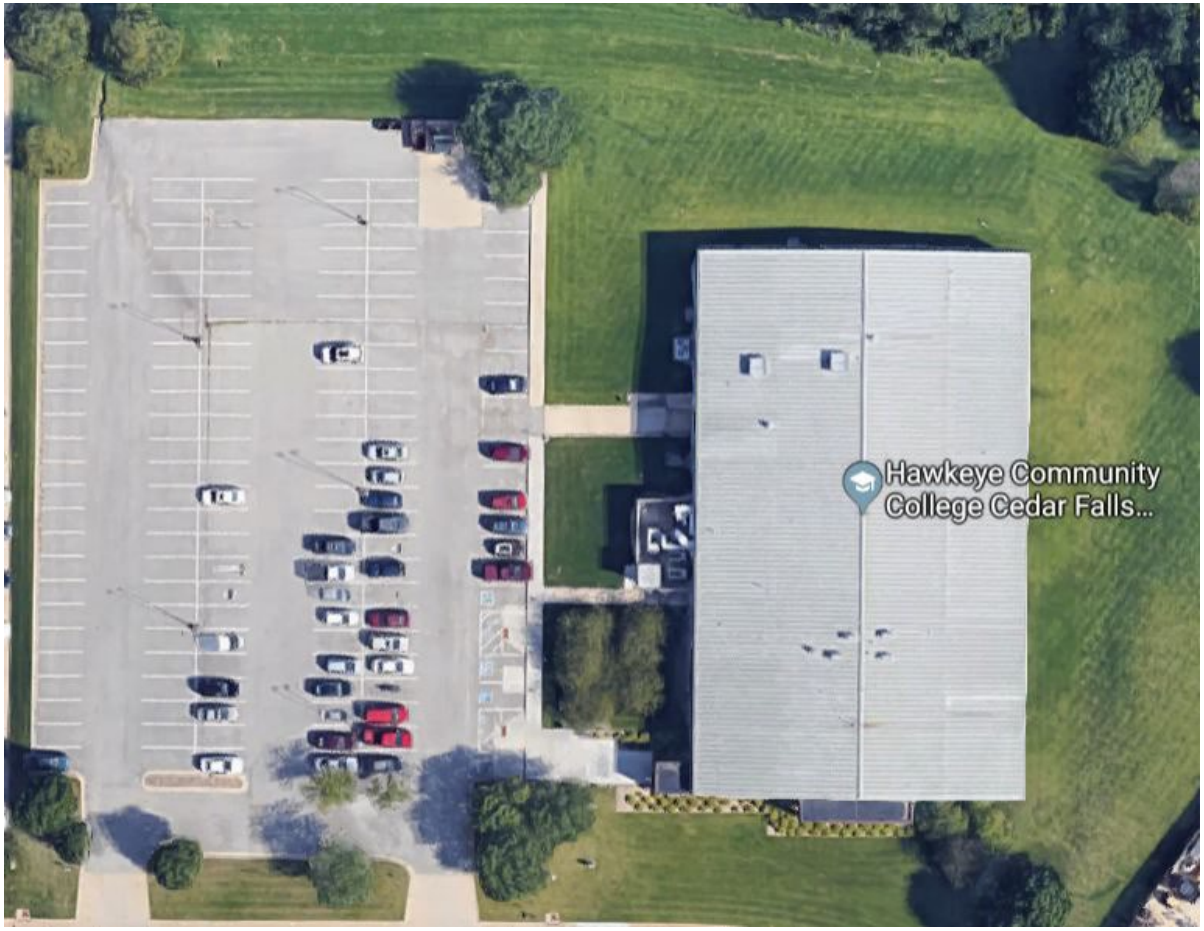
Flowerama – Iowa City, IA

Real Estate – Cedar Rapids

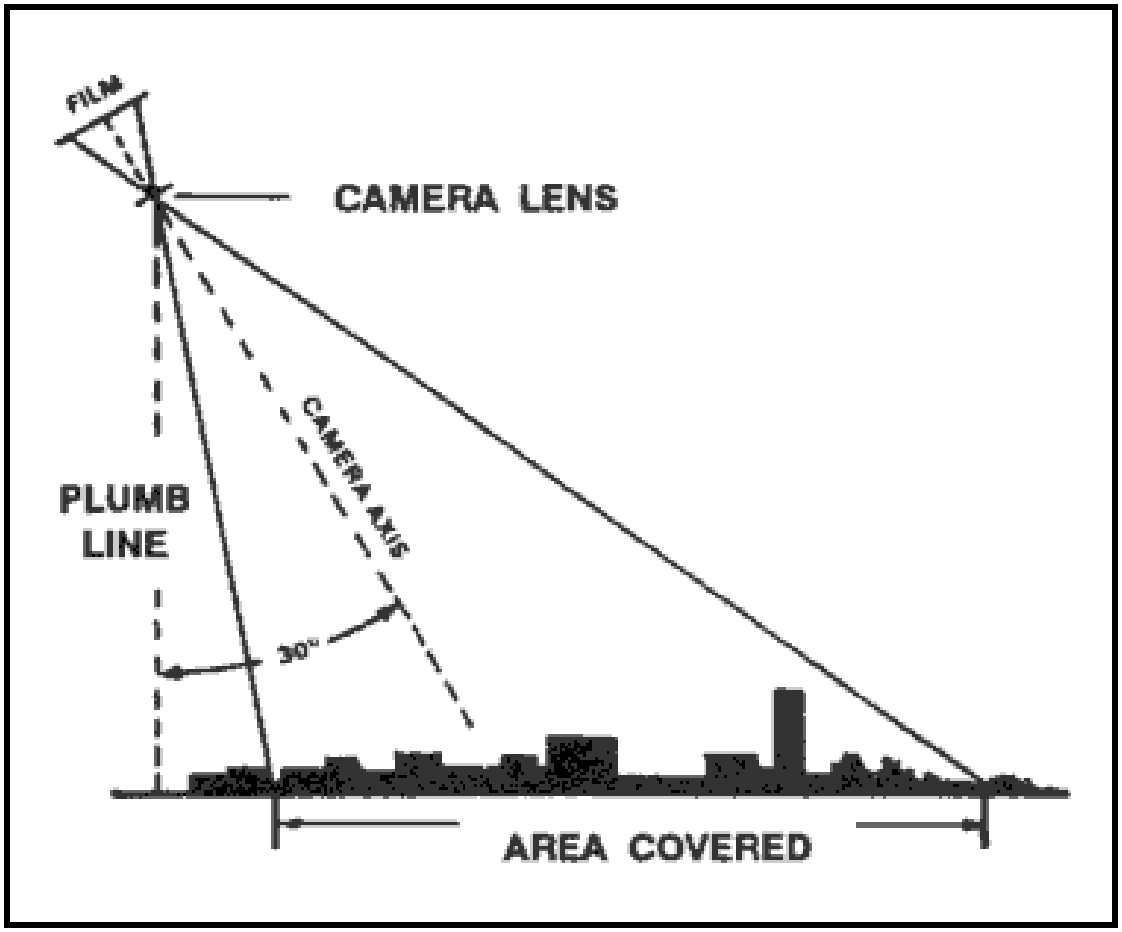
Types of Aerial Photographs

- ***Low Oblique*** – photographs taken from a low angle – No Horizon
- ***High* or *Steep Oblique*** – photographs taken from a high angle – Visible Horizon
- ***Vertical*** – photographs taken straight down
- ***Orthophotos*** – vertical photographs which have been geometrically "corrected" to be usable as a map

Orthophotos



Low Oblique

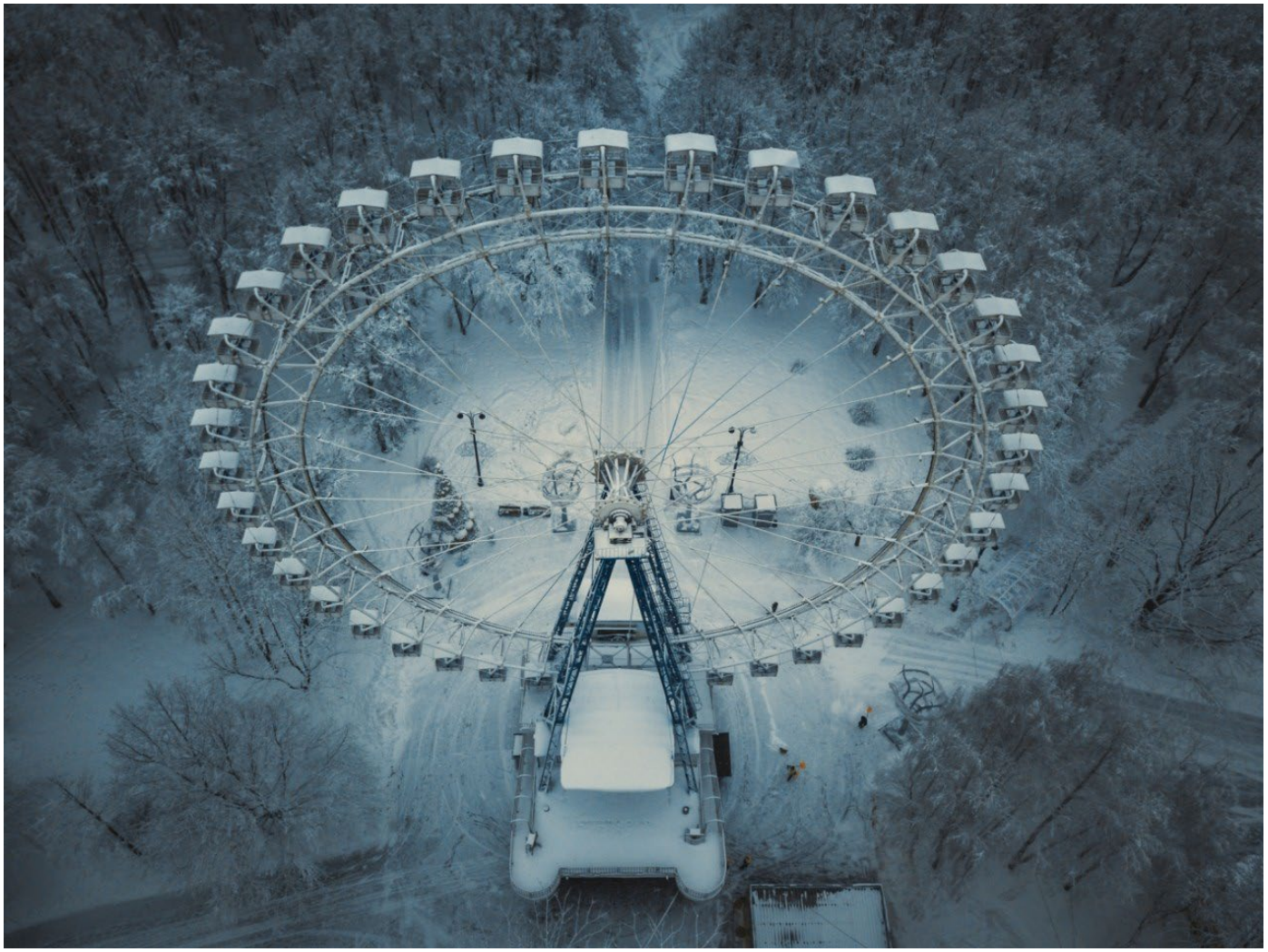


Tuilp Fields, by Anders

Plovdiv by Night, Bulgaria, by Ice Fire

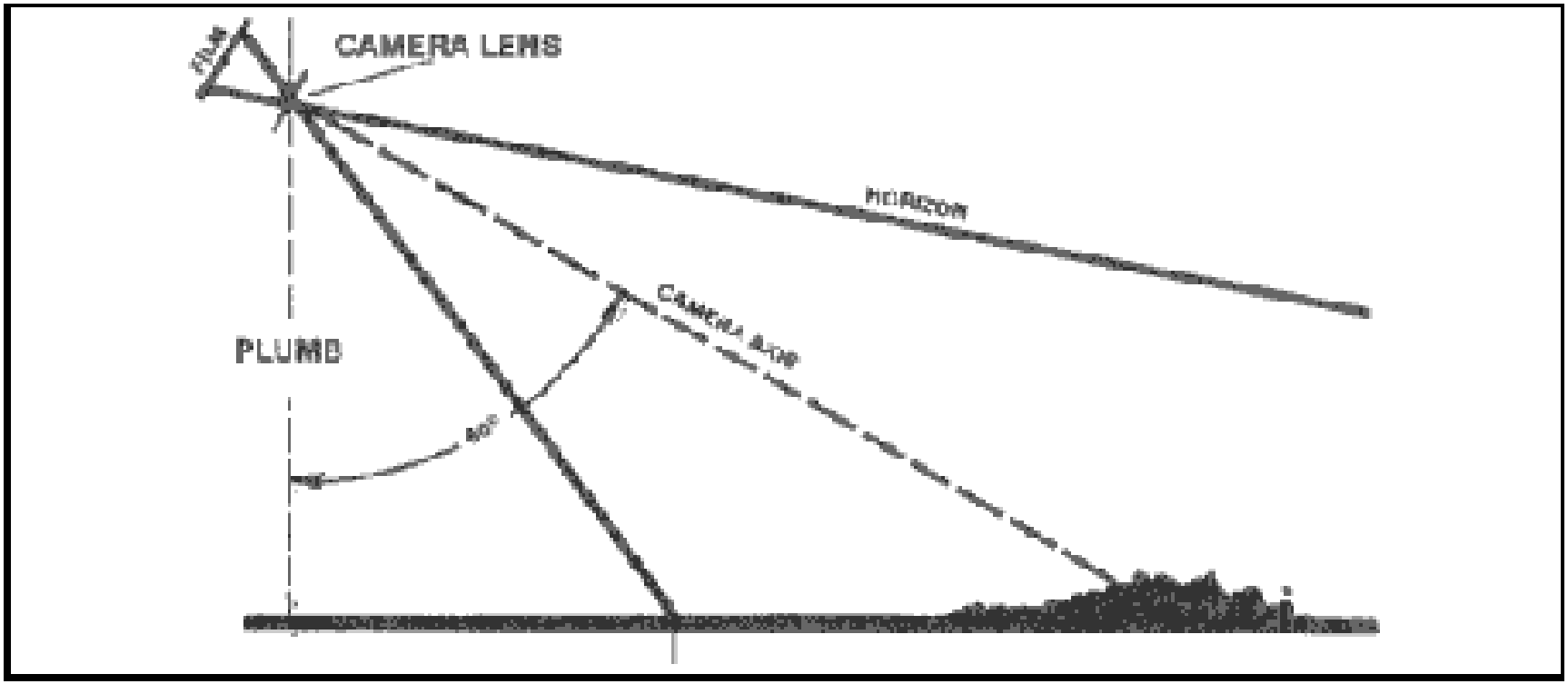
Kids on Sand Dune – SkyPixel Contest

Urban Frozen Fun - Sergey Farenyuk



Mont-Saint-Michel, SkyPixel Contest

High or Steep Oblique



Basilica of Saint Francis of Assisi, Umbria, Italy - Francesco Cattuto

'Above the Mist' Maringa Cathedral, Brazil by Ricardo Matiello

Mont-Saint-Michel, by Wanaiifilms

Lost Island, French Polynesia
by Marama Photo

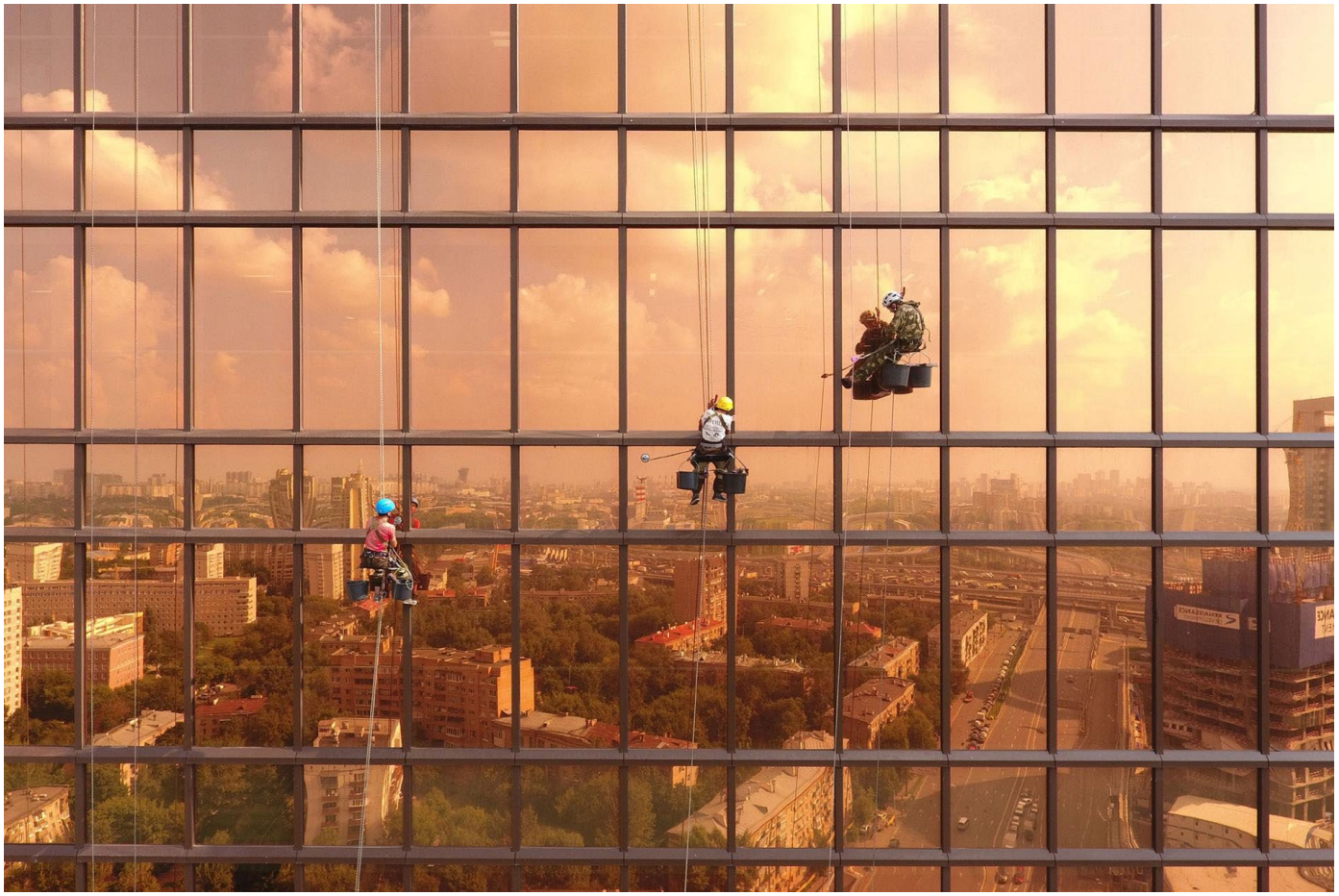
Francis Scott Key Monument
by Terry and Belinda Kilby

Baltimore's Inner Harbor
by Elevated Element

Seven Foot Knoll Lighthouse
by Elevated Element

Geese Meeting the Winter - Terje Kolaas

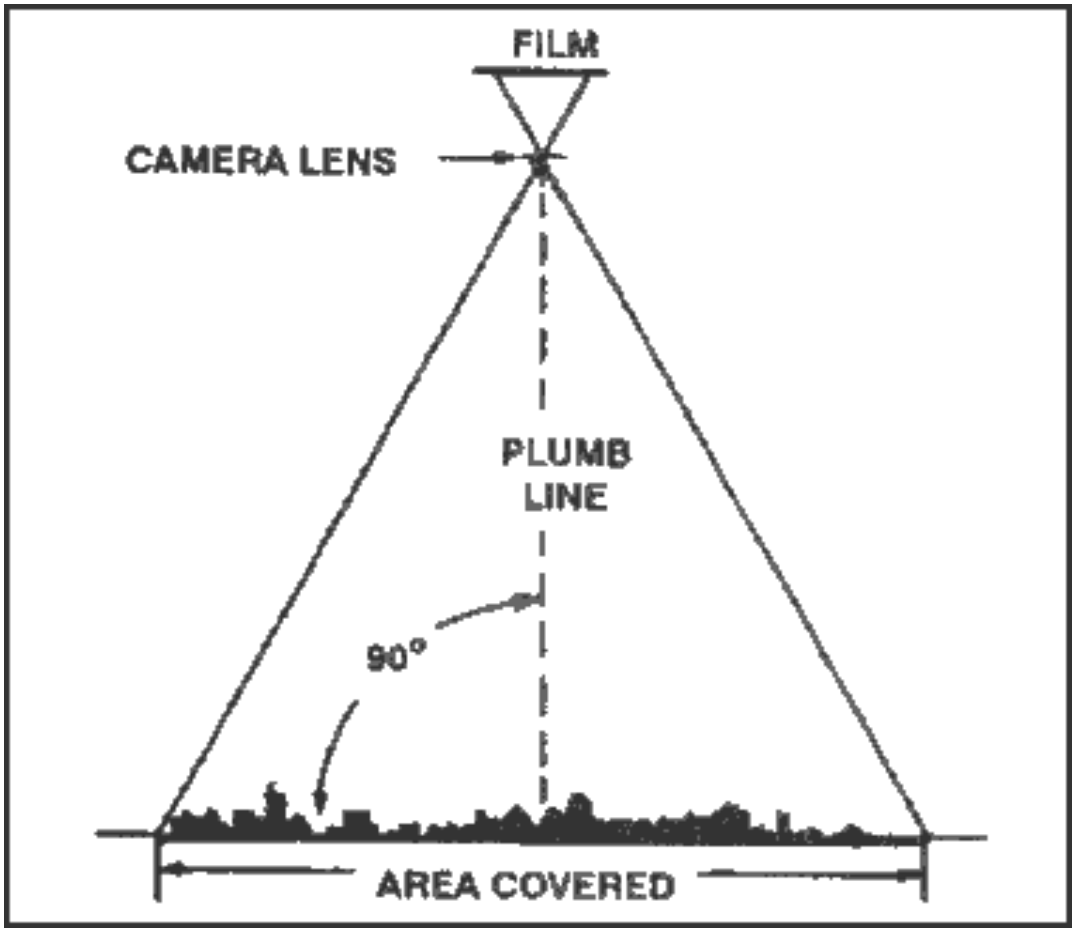
ALEXEYGO – Moscow, Russia



Polk City Sunset

QC Drone – Des Moines

Vertical



Moab Rock Climbing by Max Seigal

Chugach Mountain Range, Alaska
by Eric Dupin

Snorkeling with Sharks
by Tahiti Fly Shoot

Where's Wally, Limassol Carnaval
by Fly Over Media

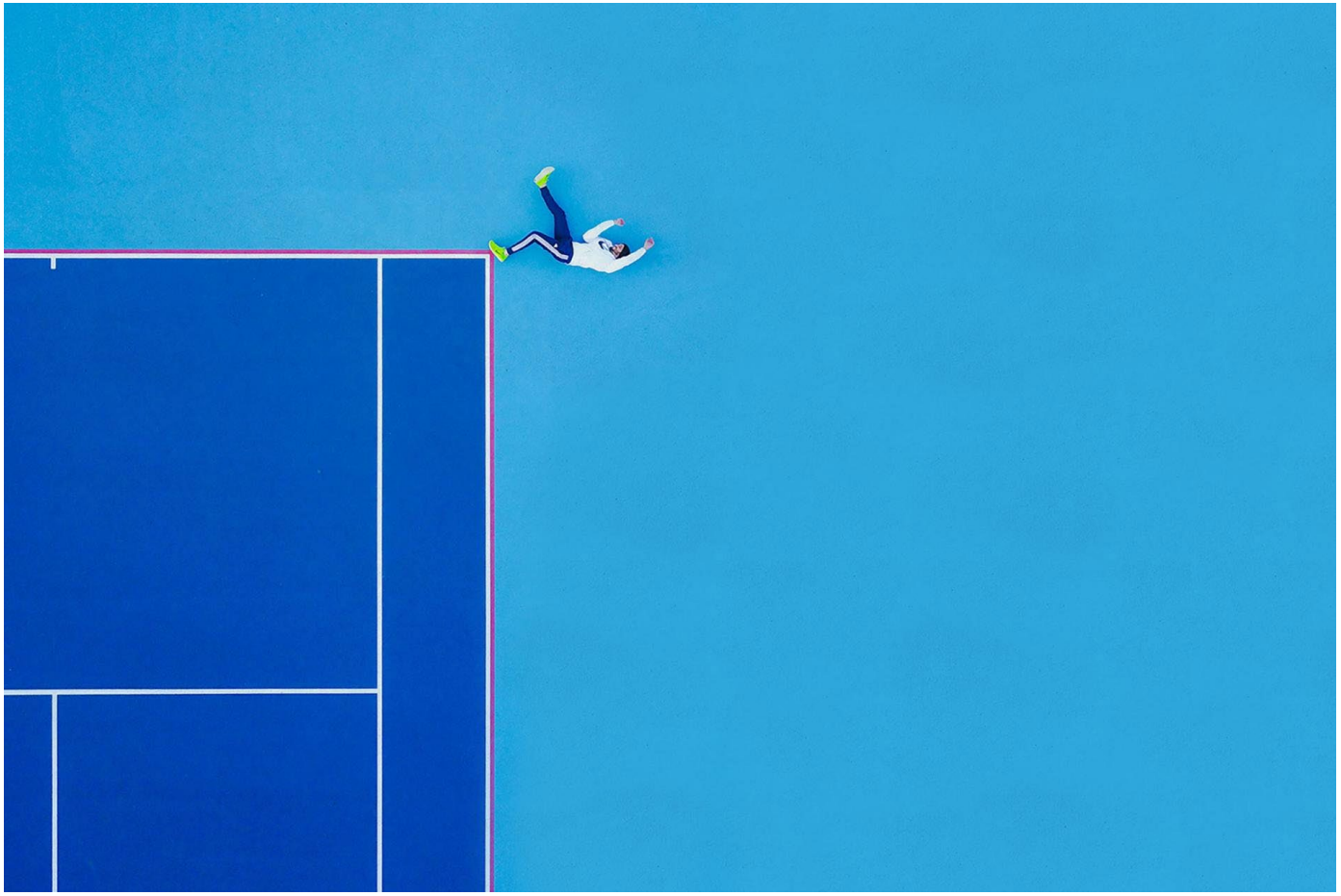
Calin Stan – Transylvania, Romania

JCOURTIAL – Provence, France

Luke Maximo Bell – South Africa

Wrong Way Buddy! - John Cowpland

Martin Sanchez – New Jersey



TOMINSPIRES – Chiang Mai, Thailand

Scrap Combine Yard, Colfax, IA

Ghost Ranch, Abiquiu NM

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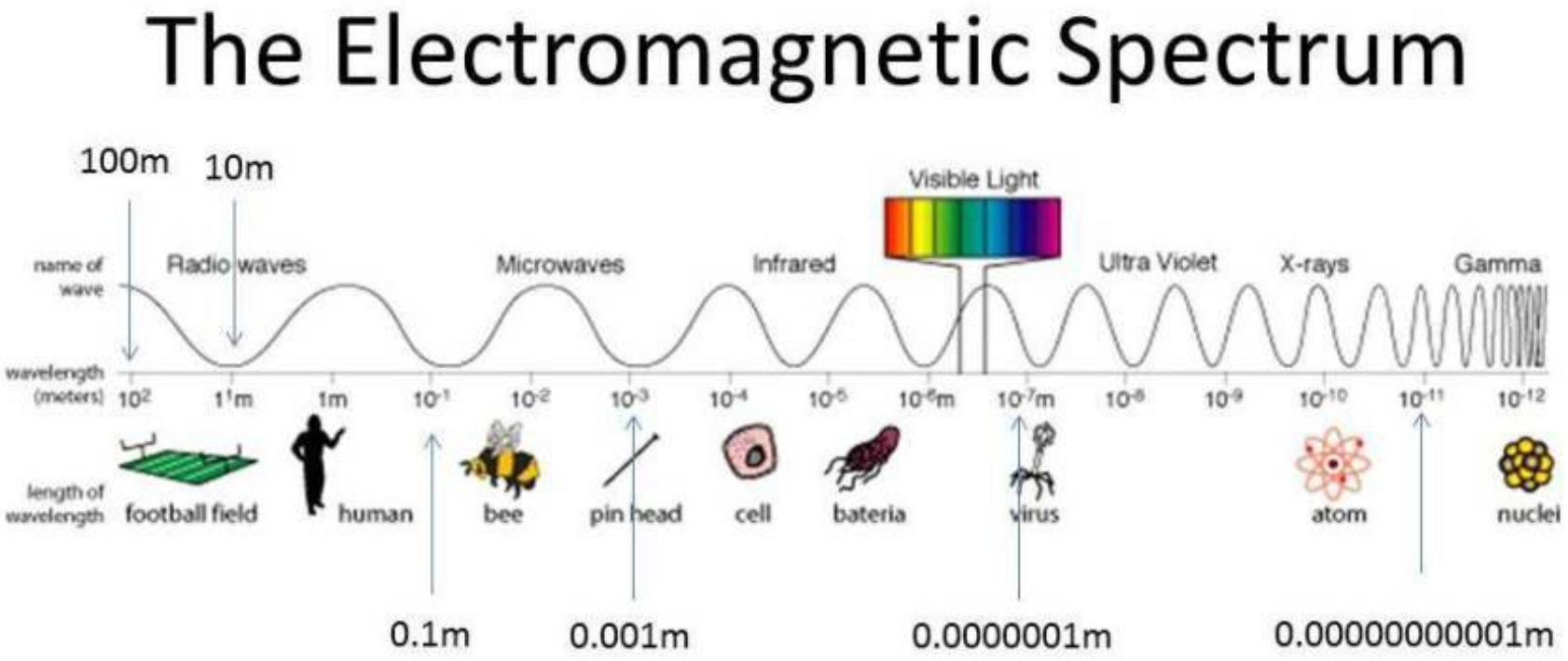
Drone Photo Tips

- Check the weather forecast
- Shoot in RAW or DNG format
- Utilize the thirds grid overlay for composition
- Stick to a lower ISO
- Take advantage of Auto Exposure Bracketing
- Be prepared to improvise
- Create higher resolution images with panoramic shots
- Experiment with both aspect ratios (16:9 or 4:3)
- Use camera lens filters
- Seek out symmetry, patterns, and lines
- Play with lights and shadows
- Take a drone “selfie”

Photography Beyond the Visible



Picture credit: NASA. Arrows & numbers added by Baldscientist.

Infrared, Thermal & Night Vision

All three use the same camera with a CCD sensor

Infrared – daylight, monochrome or false-color, plants reflect infrared light

Thermal – day or night, false-color, relies on temperature differences between object and background

Night Vision – nighttime, monochrome image, requires a light source such as a red LED

FLIR – Forward Looking Infrared

Search and rescue operations for missing persons especially in wooded areas or water – Can see through smoke and haze

Monitoring wild game habitats

Detection of energy loss or insulation defects in buildings in order to reduce energy consumption

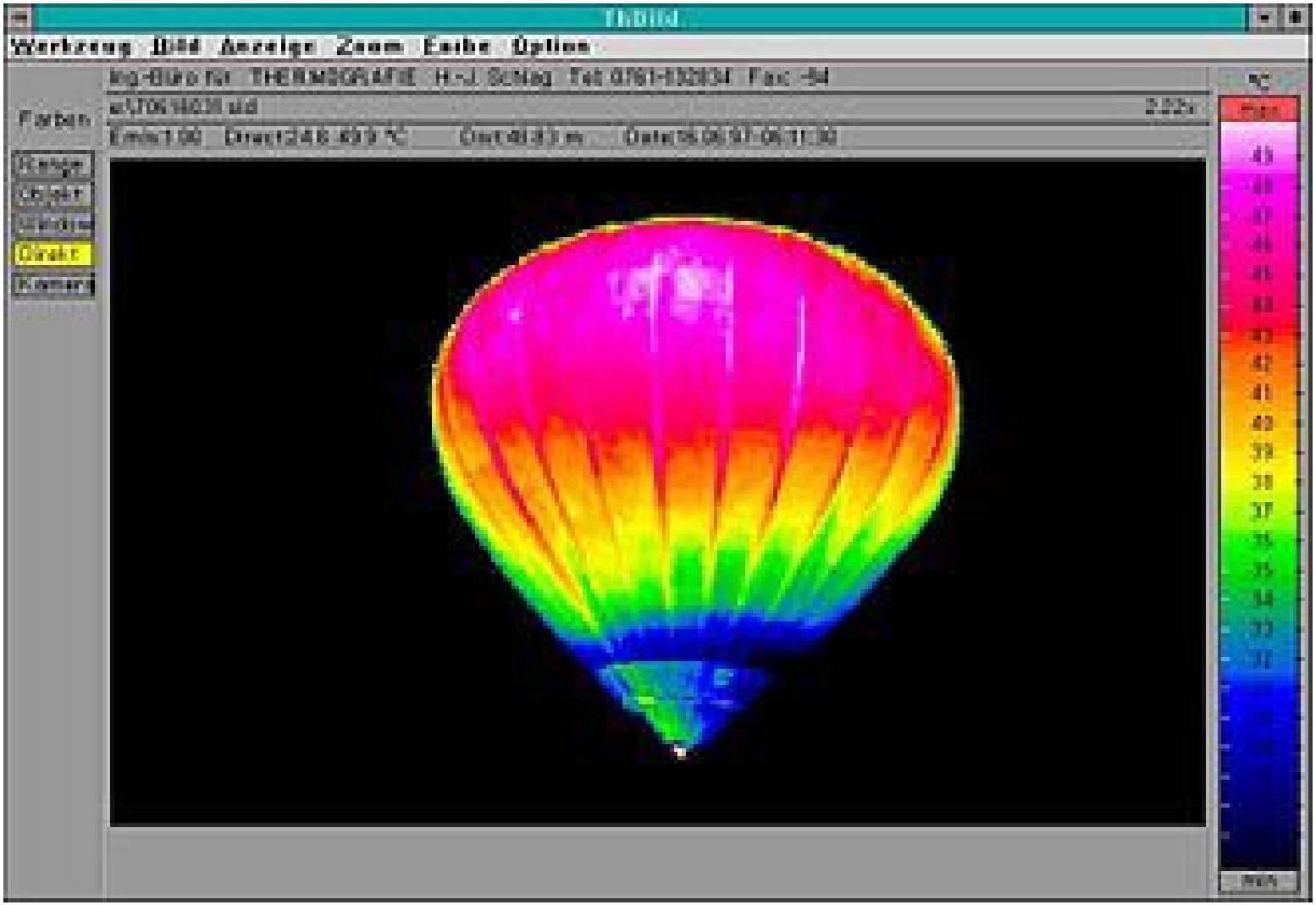
Pinpoint sources of ignition during firefighting operations

Detecting faulty or overheating electrical joints, connections and components

Night driving

Infrared Photograph

Thermal Image



What to consider when buying a photo drone

- Megapixels & Resolution
- Sensor Size
- Aperture – fixed or variable
- Field of View (FOV) – wide angle or telephoto
- Shutter type – electronic or mechanical
- Shutter speed – up to 1/8000 second
- ISO range – 100 up to 6400
- Photo Flight Modes – tripod, cinema, movie modes


Any
Questions