DRONES IN CONSTRUCTION

ENTERPRISE UAS

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RANDALL WARNAS

RANDALL@DSLRPROS.COM

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SURVEYING

WHY PEOPLE ARE TURNING TO DRONES

Improved Efficiency

Increased efficiency of your geographic information collection & streamline data processing

Reduced Cost

Save on equipment & labor costs by automating data collection and analysis with drone & software solutions

Enhanced Safety

Using drones to automate manual tasks that typically require working at height or in dangerous environments

Powerful Insights

Accurate aerial data to create industry- standard deliverables like DSM, DOM, and 3D models with drone and software solutions

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DRONE LANDSCAPE
COUNTRY OF ORIGIN

The drone space is dominated by one manufacturer, DJI. Based in China, scrutiny over data security has led to significant efforts to diversify the market with more domestic players.

DJI MAVIC 3 ENTERPRISE

CHINESE

TELEDYNE FLIR SIRAS

HYBRID

PARROT ANAFI USA

DOMESTIC

COST

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DRONE TYPES

MULTI L

WingtraOne RX1R II

42 MP camera

110 ha (272 ac)

93 m (305 ft) altitude

Other fixed-wing drones

20 MP camera

70 ha (173 ac)

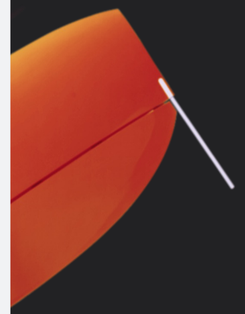
57 m (187 ft) altitude

Multicopter drones

20 MP camera

8 ha (20 ac)

44 m (144 ft) altitude



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DRONE LANDSCAPE

FEATURES

SIZE		
FLIGHT TIME	**25 MIN**	**+60 MIN**
RANGE	**1 MILE**	**9 MILES***
IP RATING	**NONE**	**IP54**

*Flights beyond visual line-of-sight (BVLOS) requires permission given by the FAA and is the single most limiting factor to more rapid drone adoption across all verticals.

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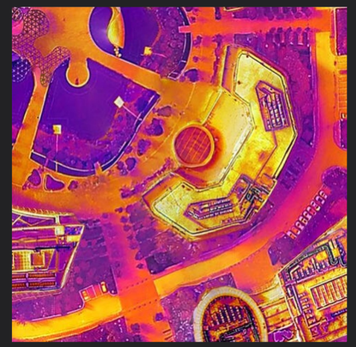
DRONE LANDSCAPE
DATA CAPTURE

Drone
Photogrammetry

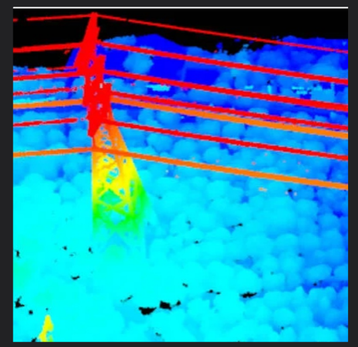
2D Orthomosaic
Map

3D Orthomosaic
Map

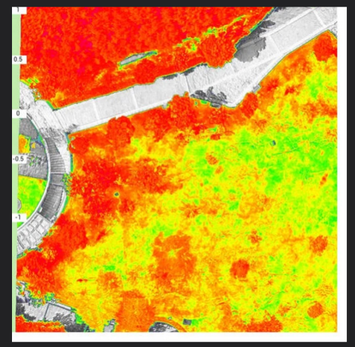
3D Models



Thermal Map



LiDAR Point Cloud



Multispectral Map

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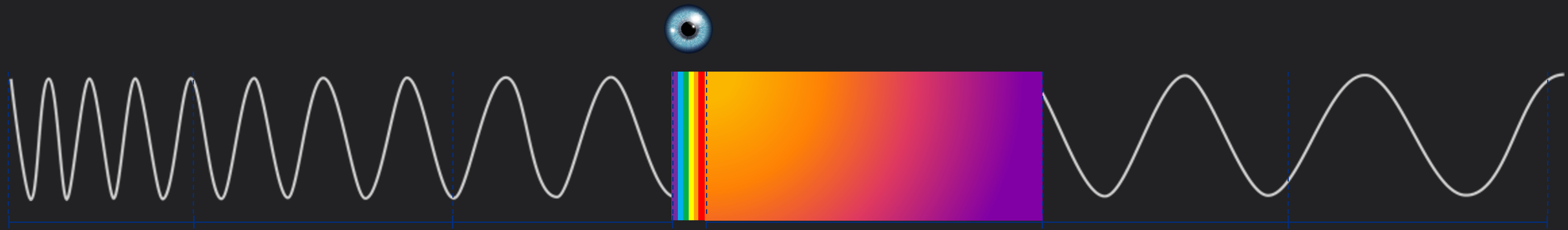
THERMAL

MOST PROMISING PAYLOAD FOR UAS



SEE IN TOTAL DARKNESS

SEE THROUGH OBSCURANTS

MEASURE TEMPERATURE

ENHANCED LONG RANGE IMAGING

ACCURATELY DETECT PEOPLE & ANIMALS

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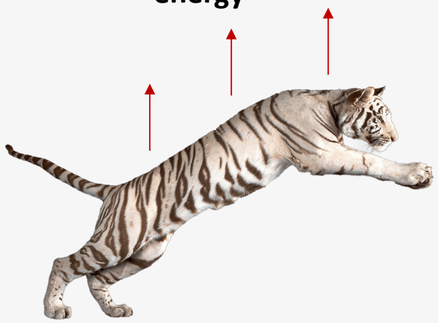
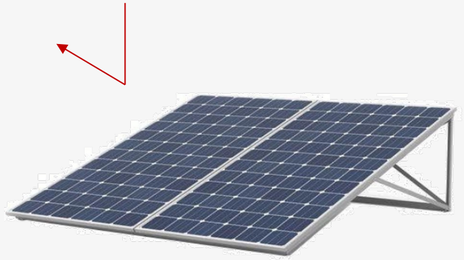
THERMAL ENERGY

Creates energy and absorbs energy



Absorbs energy during the day

Reflects energy



Inspect an hour after sunset
Not all anomalies require repair

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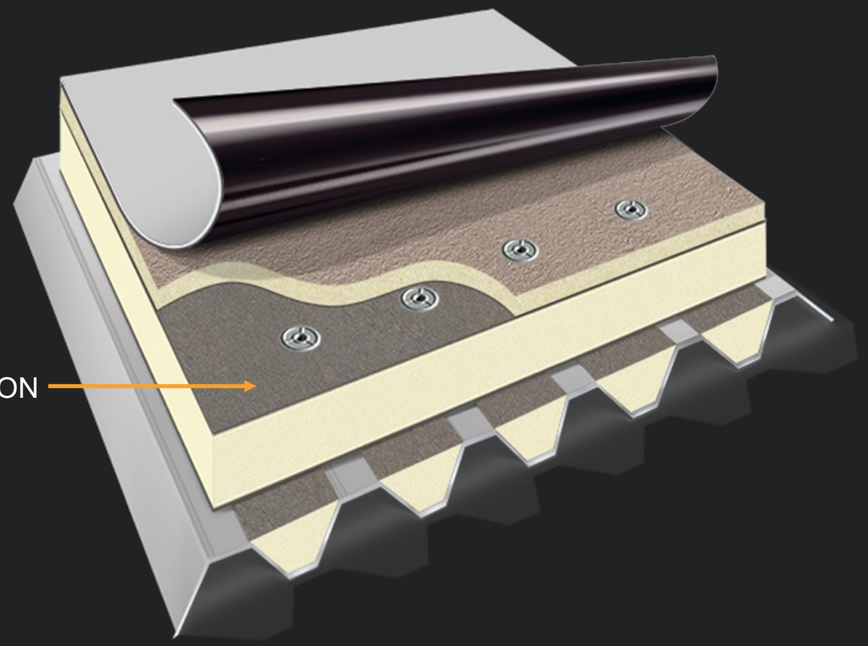
ROOFING MATERIALS



INSULATION LAYER

Polyiso

Polyurethane sprayed foam

Lightweight insulating concrete

Perlite

Modified bitumen

Single ply (TPO,PVC,EPDM)

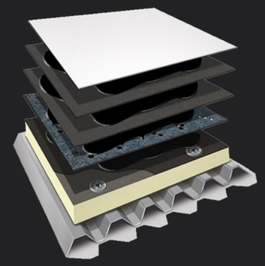
Metal

Shingle

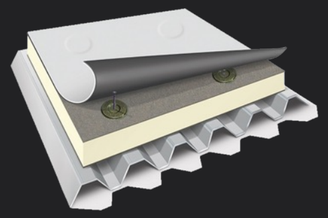
Tile

Coatings

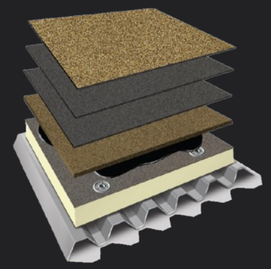
LIQUID MEMBRANE SYSTEM



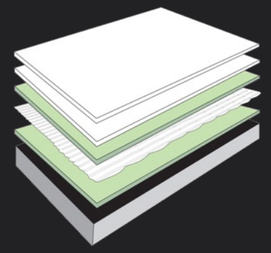
SINGLE PLY



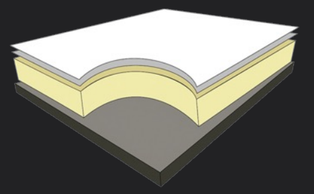
SINGLE PLY (2)



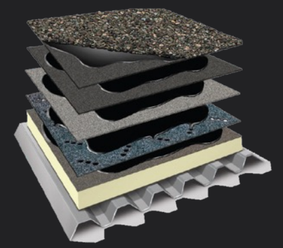
MODIFIED BITUMEN



COATING



FOAM



BUILT UP

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THERMAL EMISSIVITY

Material	Emissivity (€)
Aluminum alloy-oxided	0.40
Aluminum-highly polished	0.04-0.06
Aluminum-oxidized	0.11-0.31
Aluminum-Anodized sheet	0.55
Brass-Oxidized	0.60
Brass-polished	0.03
Chromium-polished	0.10-0.38
Copper-polished	0.02-0.05
Copper-heated at 600˚C	0.57
Gold-pure, highly polished	0.02
Iron-polished	0.21
Iron-oxidized	0.94
rusted iron plate	0.65
Iron-rough steel plate	0.94-0.97
Lead-gray and oxidized	0.28
Mercury	0.09-0.12
Nickel-polished	0.12
Nickel-oxidized	0.37-0.85
Platinum-pure polished plate	0.05-0.10
Platinum-wire	0.06-0.16
Silver-pure and polished	0.02-0.03
Stainless steel-polished	0.16
Stainless steel-oxidized	0.74-0.87
Tin-bright	0.07-0.08
Tungsten-filament	0.32-0.39
Zinc-polished commercial pure	0.05
Zinc-galvanized sheet	0.23

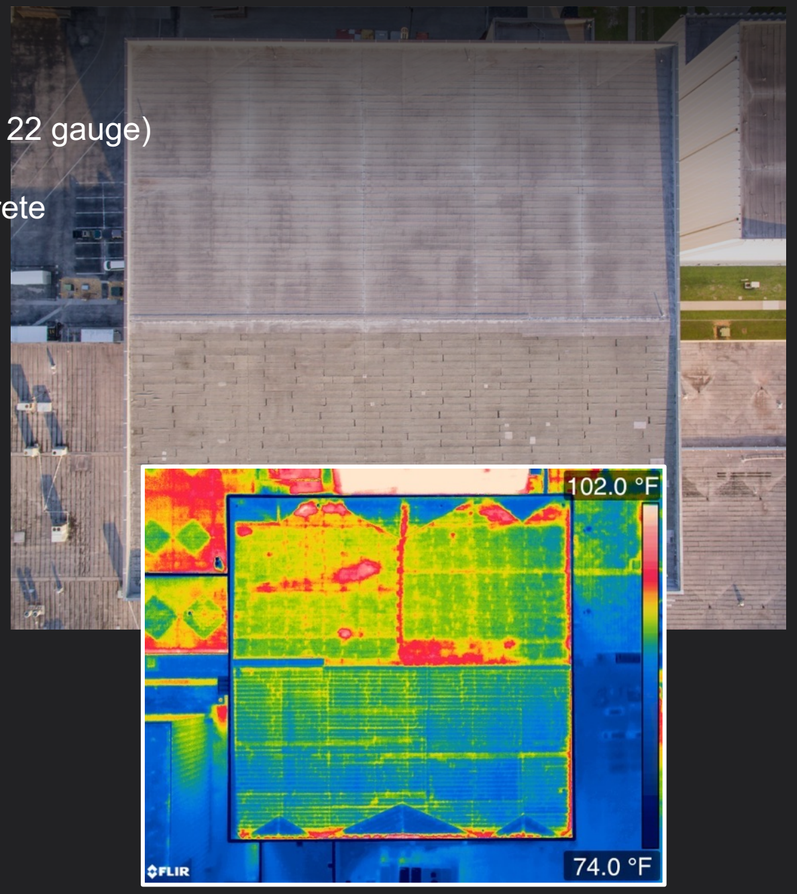
METALS

Material	Emissivity (€)
Asbestos Board	0.96
Asphalt, tar, pitch	0.90-0.98
Brick-red and rough	0.93
Brick-fireclay	0.75
Carbon-filament	0.53
Carbon-lampblack	0.96
Cement	0.54
Ceramic	0.90-0.94
Concrete	0.92-0.97
Frost crystals	0.98
Glass	0.80-0.95
Human skin	0.98
Ice	0.96-0.98
Marble-polished light gray	0.90
Paints, lacquers, varnishes Black	0.90-0.95
Paints, lacquers, varnishes aluminum paints	0.55
Paints, lacquers, varnishes flat black lacquer	0.96-0.98
Paints, lacquers, varnishes white lacquer	0.95
Paper	0.94
Plastic	0.84-0.94
Porcelain-glazed	0.92
Propellant-Liquid rocket engine	0.90
P.V.C.	0.91-0.93
Quartz-opaque	0.75
Rubber	0.95-0.97
Sand	0.90
Snorw	0.96-1.00
Soil	0.92-0.95
Tape-Masking	0.92-0.95
Wallpaper	0.85-0.90
Water	0.95-0.96
Wood-planed oak	0.82-0.89

NONMETALS

ROOF DECKING

- Wood/plywood
- Metal (generally 22 gauge)
- Structural Concrete
- Gypsum
- Tectum



Most important factor to get accurate radiometric data.
Is the material's ability to emit energy as a ratio to a blackbody.

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THERMAL ROOFS

RISK MITIGATION

SAFETY

Each year in the U.S. more than 310 construction workers are killed and more than 10,350 are seriously injured by falls from heights.

Credit: US Department of Labor

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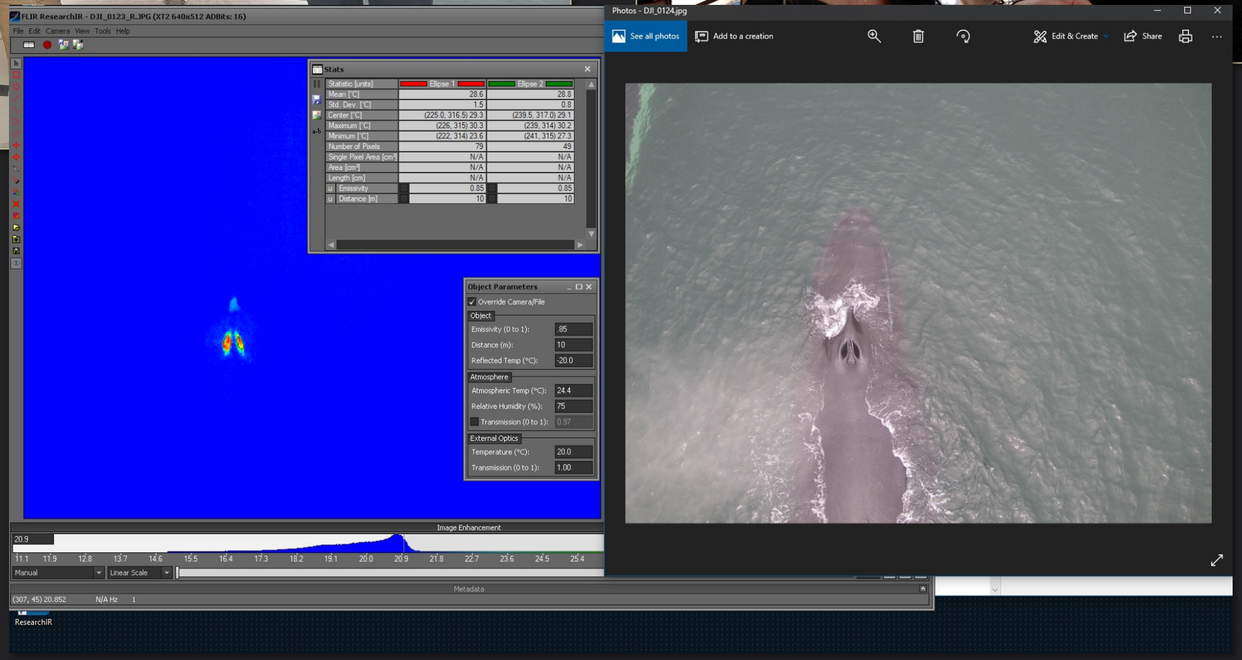
THERMAL WHALES



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DRONES
IN CONSTRUCTION

- Up to 8x more time efficient
- Cost saving
- Highest levels of safety
- Less accurate but largely meets job accuracy
- Improved data results
- Access to remote locations

AEC USE-CASES

Architecture/
Engineering

Progress
Monitoring

Building
Inspection +
Maintenance

Stockpile
Volumetrics

Heritage
Preservation and
Research

USE-CASE
ARCHITECTURE ENGINEERING

Traditional Challenges

Lack of precise position data costs time and labor.

2D designs are unable to illustrate the spatial information required.

BIM designs can be quite different from the reality model.

How Drones Empower

3D model creation with accurate positioning data.

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USE-CASE
PROGRESS MONITORING

Traditional Challenges

Tracking construction projects involving many teams and a large site is difficult.

Fixed cameras often fail to capture critical progress information.

Large quantities of video footage can drown out critical details.

How Drones Empower

Drones can create accurate 2D and 3D models of the site on-demand.

3D models can be used to track dynamic changes or daily progress.

USE-CASE
BUILDING INSPECTION

Traditional Challenges

Time consuming and dangerous manual, rope-access techniques which require walking across rooftops and scaffolding.

Difficulty in visualizing the building in its entirety.

Manual inspections do not produce standardized digital results.

How Drones Empower

Opportunity to quickly build a detailed 3D model of a building to facilitate construction acceptance, routine inspection and maintenance.

High resolution close-up photos of buildings to create detailed models for inspection.

USE-CASE

STOCKPILE VOLUMETRICS

Traditional Challenges

Manual missions take days or weeks in hard-to-reach locations, where personnel can be exposed to hazardous materials.

Unable to render detailed models that yield accurate volume measurements.

How Drones Empower

Quickly deploy drones in hard-to-reach areas to collect high-resolution aerial images for point clouds and precise 3D models.

Fly as regularly as needed and generate accurate models on demand, covering large sites in just days.

DJI Terra (photogrammetry software) can provide volume, distance, and surface measurements

USE-CASE
HERITAGE PRESERVATION

Traditional Challenges

High cost and inefficiency are making it difficult to create digital archives.

Ineffectiveness in capturing details that meet the accuracy requirements of the project.

How Drones Empower

High-resolution images of complex structures for accurate 3D models, creating digital archive and streamlining maintenance.

Close-up photos of buildings to create detailed models.

Assistance in identification, protection and preservation. Benefit to industries such as tourism and education.

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DRONE SOFTWARE

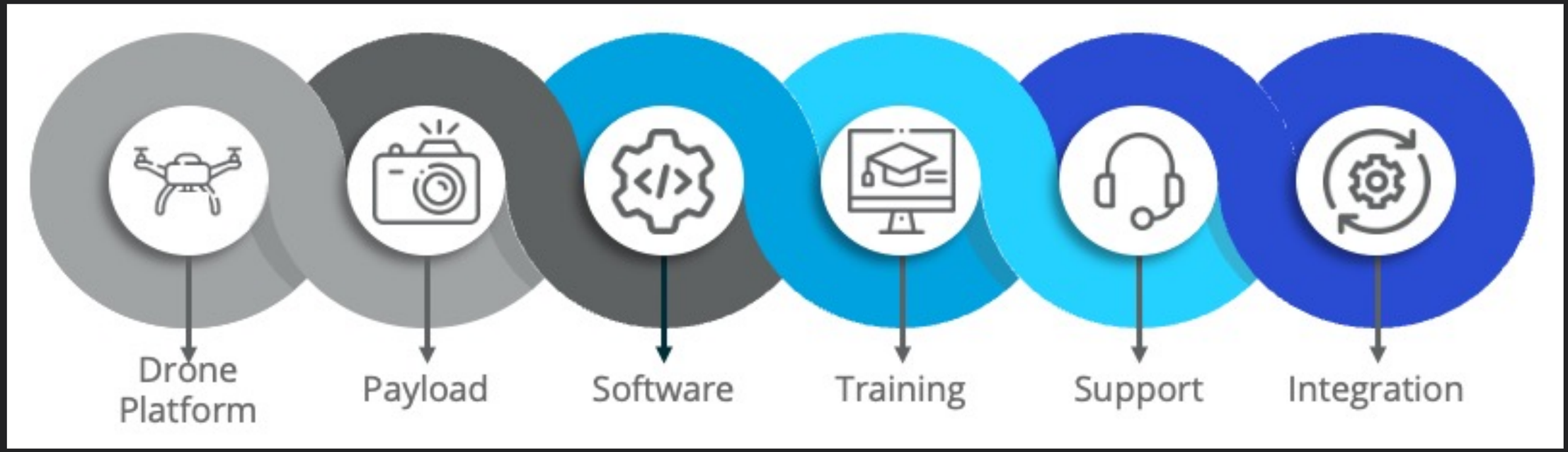
PIX4D

Bentley®

DroneDeploy

esri®

DRONE PROGRAM



SALES@DSLRPROS.COM

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QUESTIONS?

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