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What to know about drone-in-a-box technology for utility-scale solar O&M & Construction

20 May 2025

5:00 pm – 6:00 pm | CEST, Berlin
10:00 am – 11:00 am | CDT, Chicago
11:00 am – 12:00 pm | EDT, New York City

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Welcome!

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Do you have any questions? ❓ 🙋

Send them in via the Q&A tab. 👉 We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 📹

We‘ll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience. 👀 💡

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Drone-in-a-Box Technology for Utility-Scale Solar O&M & Construction

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Zeitview: Advanced Inspection Solutions for Solar

Zeitview: Who we are.

The only solution covering assets across multiple verticals (wind, solar, property, electric utility, and telecom) throughout their entire lifecycle in a single product.

1

Pre-Construction
Site selection and construction planning

2

Construction
Track progress of work compared to planning

3

Commissioning
Verify construction and set performance baselines

4

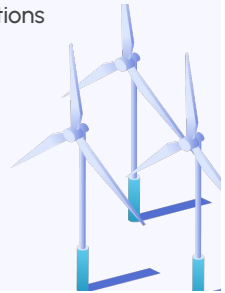
Operation & Maintenance
Better Capex/Opex decisions based on property condition

5

Sell/Acquire
Confirm condition and overall state of your Property

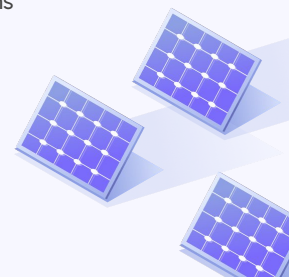
Wind Energy

Wind Turbine Inspection Systems & Solutions



Solar Energy

Solar Asset Inspections

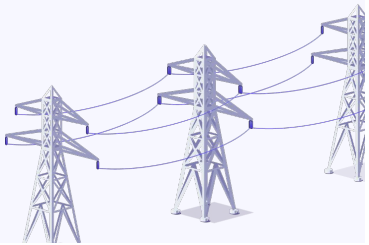


Properties

Land Acquisition, Asset Management, Property Inspection

Telecom & Utilities

Visual inspections, Orthomosaic & Topography Mapping, 3D Models



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Solar Inspection Landscape Today

Solar Inspections Today

Solar energy is booming—yet inspection practices are still catching up.

- **Why Aerial Inspections?**
  - Identify and localize issues that monitoring systems can't detect
  - Cover large areas quickly
  - Repeatable and cost efficient
- **How?**
  - Piloted Drones
  - Manned aircraft
  - Alternative: Manual ground inspections
- **Applications**
  - Pre-construction (Topography, Hydrology, etc…)
  - Construction Monitoring
  - Operations Inspections such as aerial thermography
- **Current "Best Practices"**
  - Thermal inspections 1-2 a year
  - Bi-weekly/monthly Construction monitoring

Solar Inspections Today

The challenge: There is clear benefit of frequent inspections in solar, but data acquisition costs limit the numbers of inspections per year.

- Depending on the market, data acquisition costs can be 40%-80% of the overall inspection cost
- Partial inspections of assets become uneconomical due to deployment cost, especially for remote assets
- Technicians trained as pilots often unavailable due to other high priority tasks

Opportunity: Automating inspections with drone-in-a-box systems fills the gap between annual scans and real-time insights—unlocking continuous visibility at scale as well as other solar operation applications.

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Introduction: Drone in a Box

What is Drone in a Box?

A semi-autonomous aerial inspection system—on standby, on-site.

A Drone-in-a-Box system is a self-contained unit housing a drone, charging station, and control system that:

- Lives at the solar site full-time
- Launches, flies missions, and lands automatically
- Captures visual and thermal data for inspection & analysis
- Operates on a scheduled or event-triggered basis

How It Works

- Mission Scheduling – Programmed flight paths based on time, weather, or alerts
- Semi-Autonomous Launch – Drone deploys from weatherproof docking station
- Data Collection – Gathers imagery and thermal data with GPS precision
- Auto-Return & Recharge – Drone lands, uploads data, and recharges itself

Requirements

- **Docking Station**
  Weatherproof, powered, and capable of autonomous charging and data transfer.
- **Reliable Connectivity**
  LTE, 5G, or site Wi-Fi for remote control, data upload, and mission scheduling.
- **Security Perimeter**
  A defined, secure area for takeoff and landing—clear of obstacles, vehicles, or unauthorized personnel.
- **Power Source**
  Continuous power for the dock, ideally with backup or solar integration options.
- **Regulatory Clearance**
  Local airspace permissions or BVLOS waivers, depending on operational scope.

Advantages of Drone-in-a-Box

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Increased Inspection Frequency

- Daily or weekly thermal/visual scans—far more frequent than manned flyovers.
- Catch faults early, before production is lost.

Flexible Deployment

- Rapid response capability: DIAB systems can be deployed on-demand for immediate inspections, incident monitoring, or urgent site assessments.
- Adaptable to changing needs: Easily repositioned or reprogrammed to support evolving operations, seasonal demands, or dynamic environments.

Safer Remote Operations

- No need to send staff into the field for routine checks.
- Supports remote O&M models and off-hours operations.

Consistent Data Workflows

- Establishes a steady rhythm of inspection data instead of large, infrequent data dumps.
- Enables better task planning and prioritization

Cost-effective Over Time

- Reduces truck rolls, labor costs, and downtime.

Drone-in-a-Box for Construction

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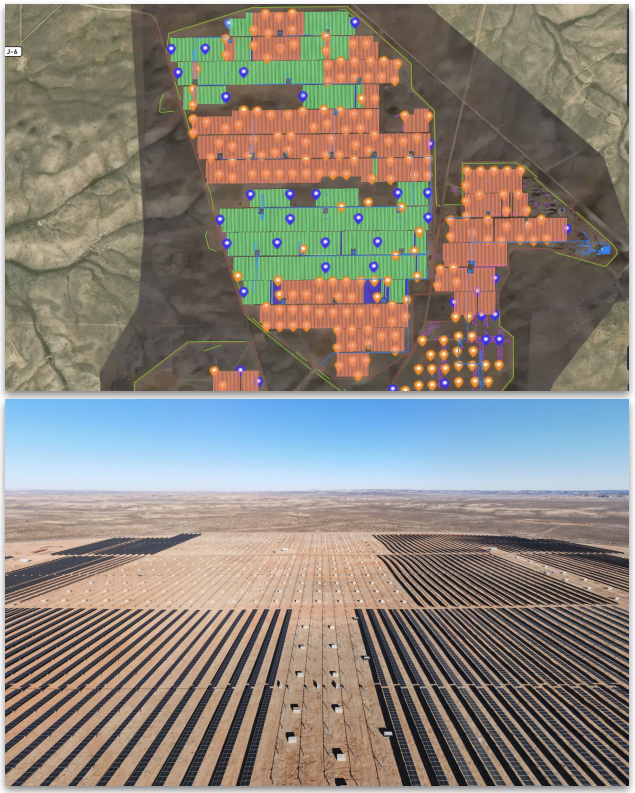
Drone-in-a-Box systems provide always-ready, on-site drone automation for modern construction teams.

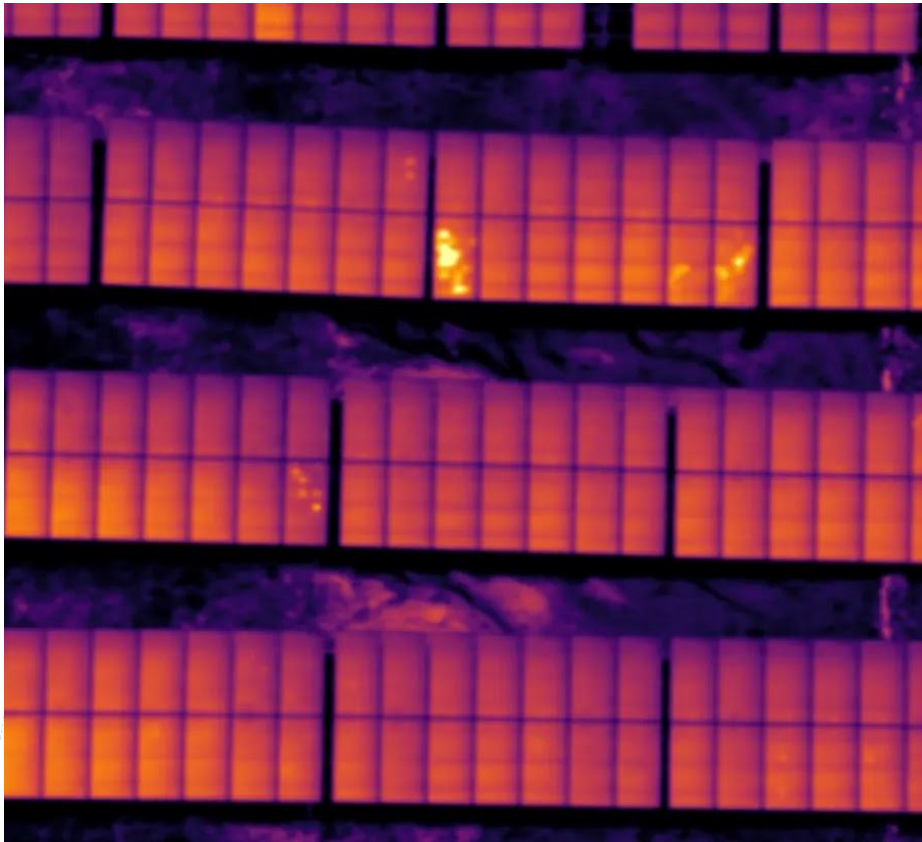
- **Track progress faster** – View planned vs. completed install status with timely updates
- **Document site logistics** – Record deliveries and monitor laydown yards with full visibility
- **Minimize costly rework** – Detect install errors early before they become expensive fixes
- **Enable remote monitoring** – Let stakeholders oversee progress and safety from anywhere
- **Protect local environments** – Detect and log wildlife or habitat disruptions during construction
- **Reduce on-site risk** – Lower risk by limiting personnel in the field for inspection purposes



Drone-in-a-Box for Operations

Drone-in-a-Box systems provide always-ready, on-site drone automation for operations teams.

- **Increase DC availability** – Frequent inspections to identify offline BOS equipment early, particularly strings
- **Preventative maintenance** – Identify remediate issues quicker before the escalate
- **Decrease uncertainty** – Check systems alerts quickly and efficiently via drone imagery
- **Less truckroles** – Quickly discern between communication errors and performance issues without sending technicians
- **Full visibility** – Check on vegetation, soiling and other issues as needed
- **Solar Technicians Utilization**– O&M staff can focus efforts fixing issue instead of finding them



Beyond Inspections

Drone-in-a-box systems aren't just for scheduled inspections—they're a flexible on-site tool for a wide range of operational needs:

- **Fence Inspections** – Replace manual fence inspections with semi-automated drone flights
- **Security Monitoring** – Perform perimeter sweeps or investigate triggered alarms
- **Fire Lane Inspections** – Ensure regulatory compliance with frequent checks on fire lane conditions
- **Safety Oversight** – Remotely monitor crews, traffic, or weather-related risks
- **Storm Response** – Assess site conditions and damage after extreme weather
- **Site Documentation** – Capture footage for reporting, training, or stakeholder updates
- **Many more**

When the drone lives on-site, you're never far from the full picture.

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Limitations and Challenges

Limitations and Challenges of Drone in a Box

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Site Configuration Constraints

- Fragmented sites (e.g., multiple parcels separated by roads) limit semi-autonomous flight continuity.
- Moving the dock manually between sections undermines semi-automation benefits.

Airspace and Airport Proximity

- DIAB systems can't operate within 3–5 miles of major airports without FAA agreements.
- Controlled airspace requires additional regulatory coordination.

Regulatory Complexity

- Beyond Visual Line of Sight (BVLOS) waivers can take 6+ months to obtain.
- National BVLOS waivers are emerging but come with stricter limitations.

Range and Coverage Limits

- A single DIAB system typically covers up to ~1500 acres (250–300 MW), depending on layout.
- Oversized sites may require multiple DIAB units or hybrid approaches.

Weather Dependency

- Like all drones, DIAB is grounded during heavy rain, high wind, or dense fog.

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Compliance & Regulation

Regulatory Landscape for Drone in a Box in U.S.

Key Considerations for U.S. Operations (FAA):

- Beyond Visual Line of Sight (BVLOS) Waivers:
- Typically required for autonomous DIAB operations
- Site-specific waivers take ~6 months to obtain
- A nationwide BVLOS framework is emerging with added restrictions

Controlled Airspace & Proximity to Airports:

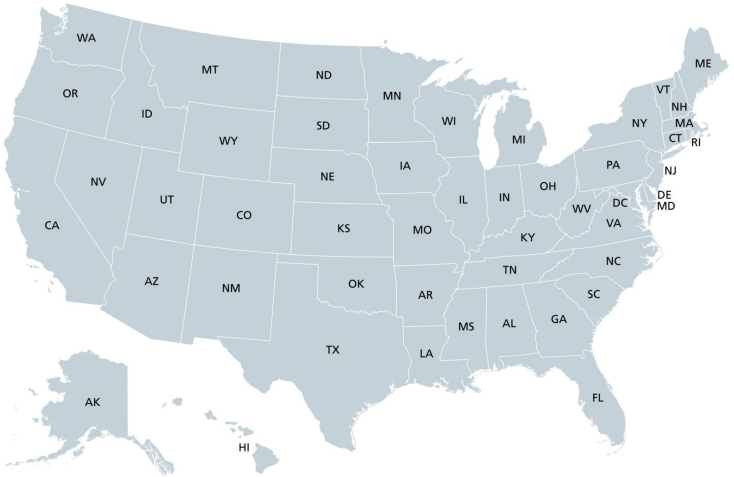
- Operations within 3–5 miles of airports need special FAA agreements
- Urban areas and high-traffic airspace add further complexities

Flight Over Non-Controlled Areas:

- Standard waivers do not cover flights over public roads or segmented parcels
- Corridor waivers can be pursued but are less common and more complex

Remote ID & Safety Protocols:

- Compliance with Remote ID requirements to ensure aerial visibility
- Ongoing regulatory adjustments are anticipated as drone tech becomes more prevalent



Regulatory Landscape for Drone in a Box in Europe

Unified Regulations Under EASA:

- Common framework for commercial drone operations across EU member states
- Emphasis on risk assessments and standard operating procedures tailored for autonomous systems

Classification & Operational Limitations:

- Drone operations categorized under specific risk and performance classes
- Detailed operational limitations such as maximum altitude and geographic boundaries

Permission & Licensing Requirements:

- Mandatory operator and pilot certifications where applicable
- Local civil aviation authorities manage additional operational permissions, especially around critical infrastructure

Adaptability & Future Updates:

- Rapid regulatory evolution as the market grows
- Greater support for innovations like DIAB expected as autonomous aviation becomes standardized

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Site Selection: for Drone-in-a-Box

Drone In a Box Scenarios: Size & Location

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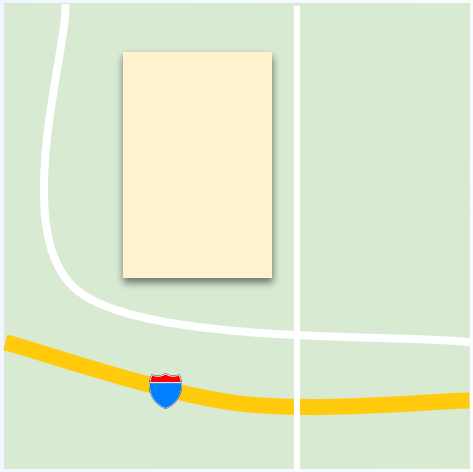
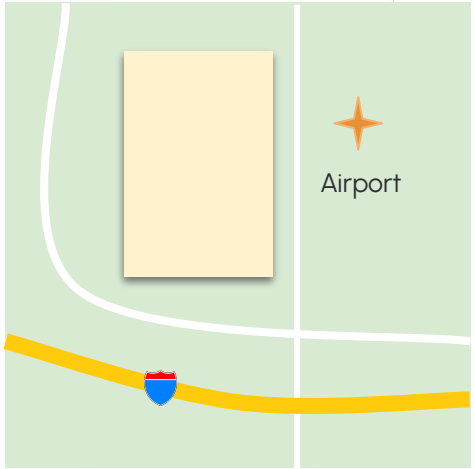
Site A



Site details

- 250-300 MW
- Class G airspace
- One access controlled location

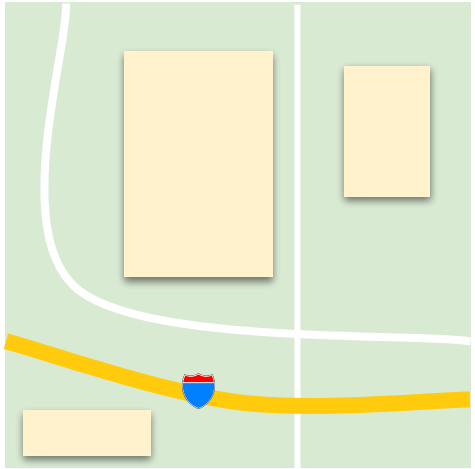
Site B



Site details

- 250-300 MW
- Near controlled Airspace

Site C



Site details

- 250-300 MW
- Split up blocks across public roadways

Drone In a Box Scenarios: Topography & Landscape

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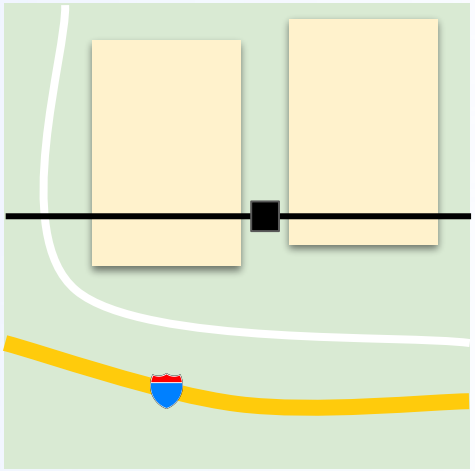
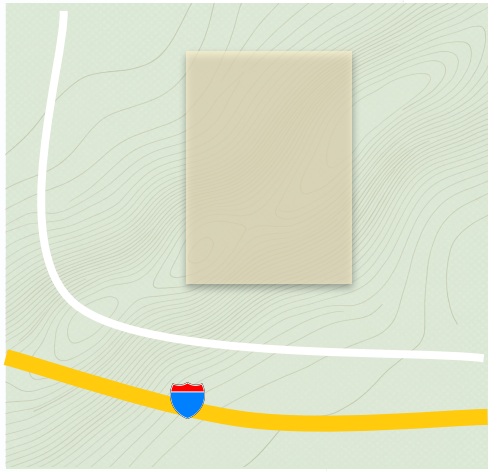
Site D



Site details

- 250-300 MW
- Substation in middle of site
- Power Lines traversing site

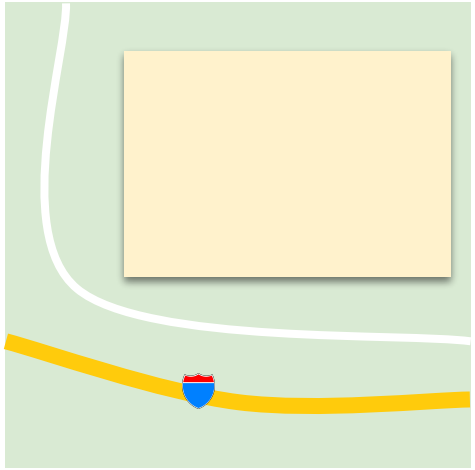
Site E



Site details

- 250-300 MW
- Extreme Terrain on site

Site F



Site details

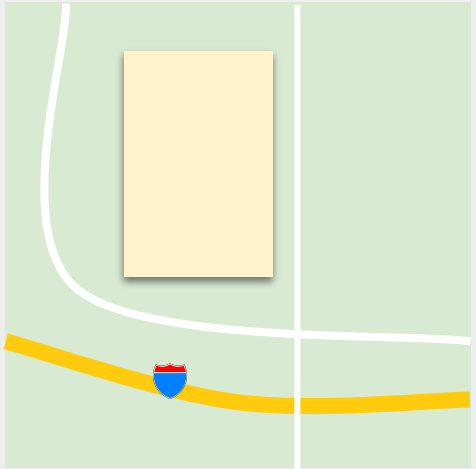
- 1 GW
- Large site

Example: Site A

Ideal Candidate: Remote, Single-Block Site

- Large site (250–300 MW, ~1500 acres)
- Remote, no nearby airports
  - No airspace restrictions
  - Contained geography = easy full coverage
  - High ROI through automation

Site A



Site details

- 250-300 MW
- Class G airspace
- One access controlled location

Example: Site B

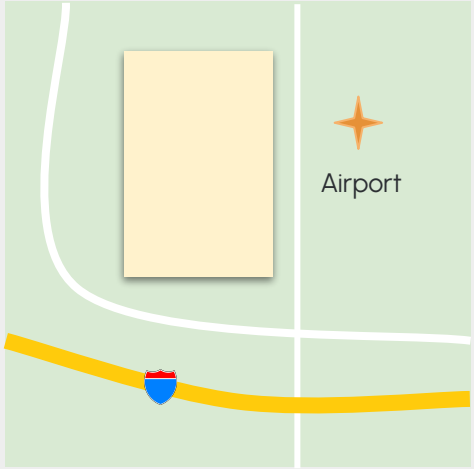
Challenging: Site Near Busy Airport

- Smaller site within 3–5 miles of controlled airspace
  - Requires airport coordination
  - National BVLOS waiver might not apply
  - Adds lead time and complexity

Alternative Solution :

- Manned aircraft or non-DIAB drone ops

Site B



Site details

- 250-300 MW
- Near controlled Airspace

Example: Site C

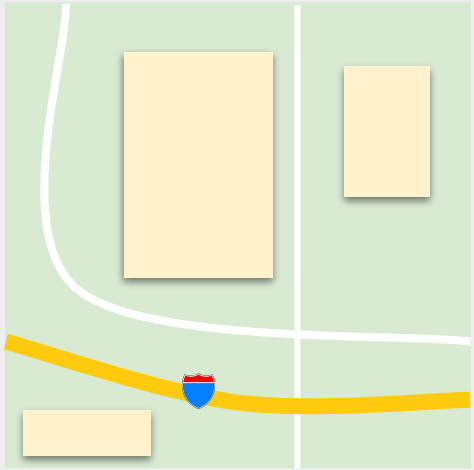
Challenging: Fragmented Site with Public Roads

- Multiple parcels separated by roadways or mixed land use
  - Regulatory limits on crossing public roads
    Site-specific waiver required
  - Reduces value of "autonomous" operation

Alternative Solution:

- Manned aircraft or non-DIAB drone ops
- Multi Dock ops
- Movable Dock ops

Site C



Site details

- 250-300 MW
- Split up blocks across public roadways

Example: Site D

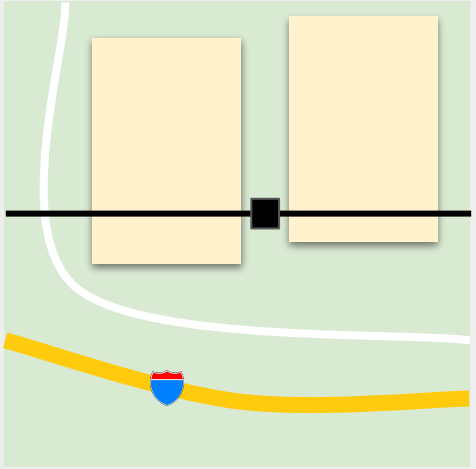
Challenging: EMF Interference

- Large site (250–300 MW, ~1500 acres)
- Remote, no nearby airports
  - No airspace restrictions
  - Contained geography = easy full coverage

Alternative Solution:

- Manned aircraft or non-DIAB drone ops
- Multi Dock ops
- Complete Dock set up location

Site D



Site details

- 250-300 MW
- Substation in middle of site
- Power Lines traversing site

Example: Site E

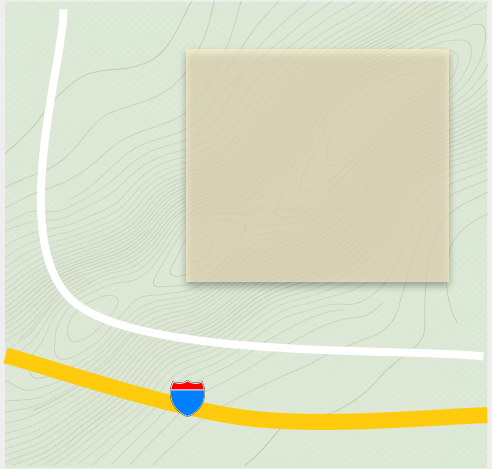
Challenging: Extreme Terrain

- Large site (250–300 MW, ~1500 acres)
- Remote, no nearby airports
  - No airspace restrictions
  - Contained geography = easy full coverage

Alternative Solution:

- Manned aircraft or non-DIAB drone ops
- Multi Dock ops
- Complete Dock set up location

Site E



Site details

- 250-300 MW
- Extreme Terrain on site

Example: Site F

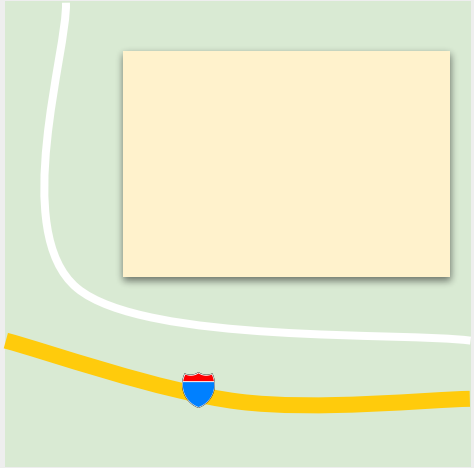
Challenging: Site too Large

- Large site (1 GW)
- 6 miles/10km wide
- Remote, no nearby airports
  - No airspace restrictions
  - Contained geography = easy full coverage

Alternative Solution:

- Manned aircraft or non-DIAB drone ops
- Multi Dock ops

Site F



Site details

- 1 GW
- Large site

Is DIAB Right for Your Solar Site?

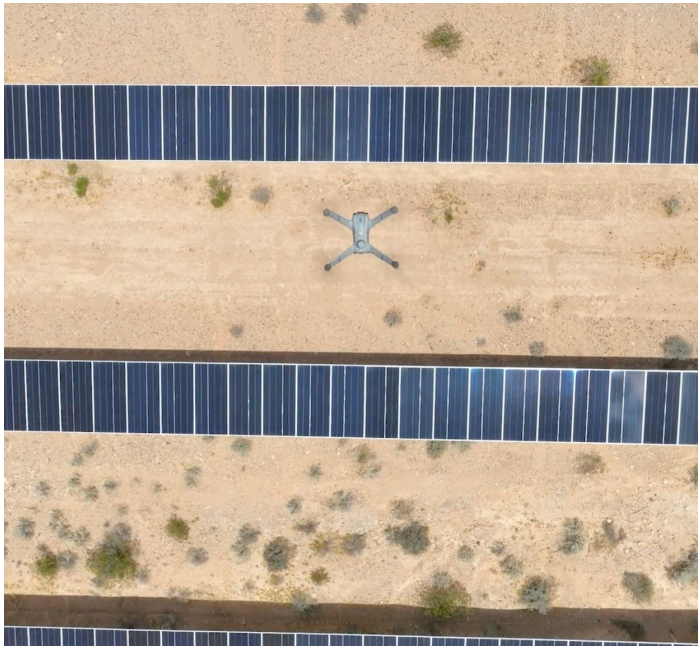
Key Takeaways
Inspections are evolving: From piloted systems to automated solutions—DIAB offers real-time, high-resolution insights with minimal human intervention.

- **Best-fit sites:** Large, contiguous solar farms in rural locations benefit most today due to regulatory and technical limitations.
- **Real ROI:** DIAB can deliver faster fault detection, reduce downtime, and optimize technician dispatch—translating directly into recovered revenue.
- **Regulations matter:** The tech is ready, but the airspace must be too. Site selection and waiver planning are critical to success.

Looking Ahead
Regulations are maturing, especially in the U.S. and Europe—expect broader BVLOS access and faster deployment timelines.

- DIAB isn't just about inspection—think real time visibility, safety, and incident response in one integrated solution.

If you're thinking long-term reliability and scalable solar operations, DIAB is no longer the future—it's the differentiator.



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Video Demonstration

Get the Right Tools for the Job

Maximize asset longevity, reduce risk, and improve visibility—no matter your operation size or site type.

- **Drone-in-a-Box (DIAB):** Automated, on-site, and always ready for recurring inspections
- **Full-Scale Aircraft**: Best suited for large-area surveys and rapid portfolio level data collection
- **Standard Drone Operations:** Flexible, pilot-operated flights for targeted inspections

Our team of experts will work with you to:

- Match the right tool to your site and budget
- Optimize inspection frequency and coverage
- Deliver insights that extend asset life and reduce downtime

Let's build a smarter, safer inspection strategy—together.

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Q&A

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Thursday, 22 May 2025
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10:00 am – 11:00 am EDT, New York City

Unlocking installer value in AC-coupled residential storage

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