

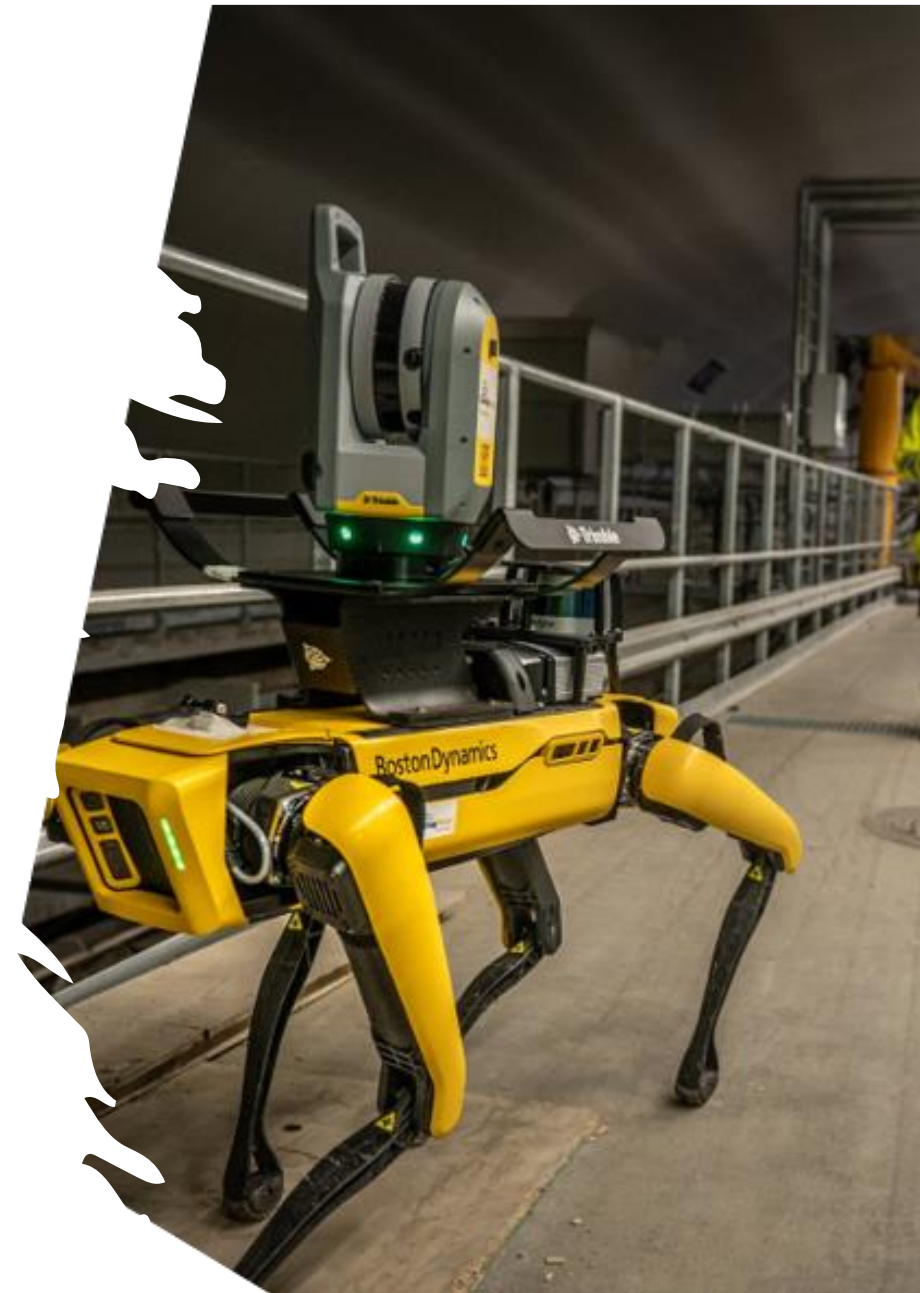
Mitigating EHS Risk by using Robotics Technology

Joseph Valenzuela, Operations Manager -
Pathfinder Optics Corporation

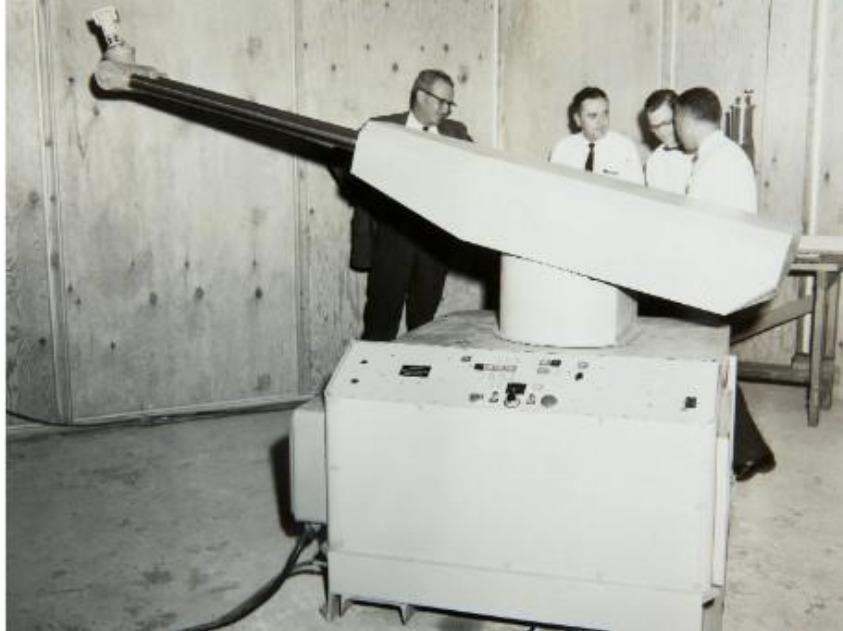
“If you aim for nothing you will hit it every time” - Zig Ziglar

Importance of inspections and safety in various industries

- Oil and Gas
- Renewable Energy
- Urban Infrastructure
- Overview of how robotics can revolutionize these processes:
 - Improve efficiency
 - Reduce human risk
 - Enhance data accuracy



How It All Started



General Motors 1961
New Jersey
Stack and move hot metal



Tesla 2023
California
Assemble multiple parts

TYPES OF ROBOTICS



Drone in a Box

- DJI
- Percepto
- Skydio



Crawlers:

- Deep Trekker crawlers
- Boston Dynamics' Spot



Drones (UAVs):

- DJI
- Thermal Cameras
- OGI cameras
- Flyability
- Parrot
- Skydio



Submersibles:

- DTG3
- Photon
- Chasing

Robotics Application

Hazardous Environment Applications

- Robotics in confined spaces to eliminate human entry risks
- Inspection of wind turbine internal blades and solar fields
- Overhead power line inspections using drones

Water Management and Agriculture

- Use of drones for aerial surveillance of water bodies and crop fields
- Robotic crawlers for inspecting irrigation systems and water treatment plants
- Case studies demonstrating improved safety and efficiency

Infrastructure and Ecosystem Monitoring

- Use of robotics for dam, bridge, and pipeline inspections
- Monitoring marine environments and ecosystems with autonomous underwater vehicles (AUVs)
- Impact on environmental conservation and infrastructure maintenance

Electrical Operations and Industrial Applications

- Robotic arms for high-voltage switchgear maintenance
- Automated systems for hazardous material handling
- Examples of robotics reducing human exposure to dangerous substances

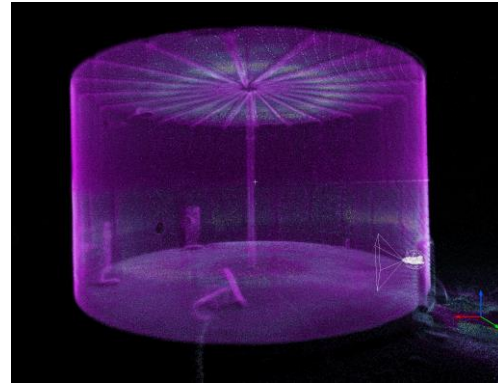
Inspection of Critical and Difficult-to-Access Areas

- Drones and crawlers for inspecting inside piping and other hard-to-reach locations
- Submersibles for underwater infrastructure inspections
- Benefits of remote inspections in terms of safety and cost

Forestry Management and Energy Sectors

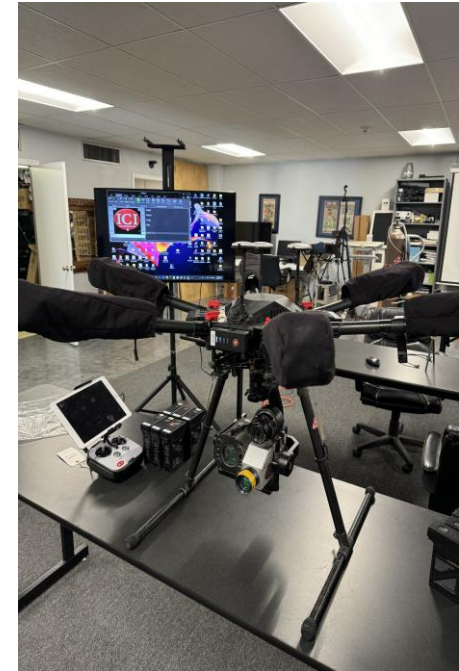
- Drones for forest monitoring and fire detection
- Robotics in traditional energy (e.g., oil rig inspections)
- Role of robotics in renewable energy maintenance (e.g., solar panels, wind turbines)

Drone Information



Specific applications of drones in inspections:

- Infrastructure inspections (bridges, pipelines)
- Crop monitoring and management
- Silo inspections
- Emergency response (search and rescue)
- Confine Space
- Leak Detection



Advantages of using drones:

- Access hard-to-reach areas
- Provide aerial views for better real time analysis
- Reduce risks to human workers

National Safety Council Survey For Drones



Workers:

50% reported being exposed to work at heights or confined space entry

19% said drones would help mitigate their personal risk of a serious workplace injury or fatality



Employers:

15% using

12% tested or tried

19% considering

22% no knowledge

44% of users adopted them in the previous year

Findings from the NSC Safety Technology in the Workplace Survey of 500 employers and 1,000 workers from safety-sensitive industries.

Submersible Information



REVOLUTION ROV



PIVOT ROV



PHOTON ROV



DTG3 ROV

Industries & Uses

- **Oil & Gas**
 - Inspection and maintenance of underwater infrastructure
 - Leak detection and construction support
- **Water Tanks & Infrastructure**
 - Inspection and cleaning of water storage tanks
 - Maintenance of underwater infrastructure
- **Search & Rescue**
 - Locating and retrieving submerged objects
 - Assisting in underwater rescue operations
- **Oceanography & Research**
 - sea exploration and mapping
 - Sample collection and ecosystem study

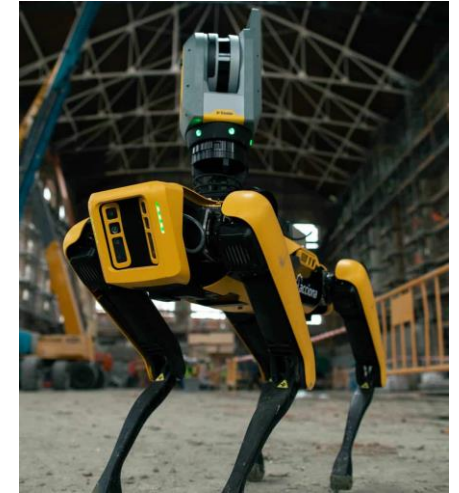
Safety Considerations for Inspection Submersibles

- **Structural Integrity**
 - **Materials:** High-strength materials to withstand underwater pressures
 - **Design:** Compact and robust design for various environments
- **Operational Safety**
 - **Remote Operation:** Operated from the surface, reducing human risk
 - **Advanced Control Systems:** Precision control for maneuvering in tight spaces
 - **Real-Time Feedback:** Cameras and sensors provide immediate data to operators
- **Maintenance and Reliability**
 - **Regular Inspections:** Routine checks to ensure all components function correctly
 - **Redundant Systems:** Backup power and controls to prevent failures
 - **Serviceability:** Easy maintenance and repair procedures
- **Emergency Protocols**
 - **Failsafe Mechanisms:** Automatic return to surface in case of malfunction
 - **Training:** Operators trained in emergency procedures and troubleshooting
 - **Safety Guidelines:** Strict adherence to operational protocols to minimize risk

Crawler / Spot Information

Safety Benefits of Crawler Robotics:

- Reducing Human Exposure
- Operate in dangerous environments (e.g., confined spaces, underwater, toxic areas).
- **Emergency Response:**
- Access disaster areas safely.
- **Remote Operation:**
- Control from safe distances.
- **Enhanced Situational Awareness:**
- Real-time data and 360-degree video provide better understanding of environments.
- **Autonomous Capabilities:**
- Autonomous navigation reduces the need for human intervention in risky areas.



Pipe Trekker:

- **Overview:**
- Specializes in pipeline inspection robots.
- **Key Products:**
- *PT200*. For small to medium pipes.
- *PT500*. For large pipelines.
- **Applications:**
- Sewer and water pipes.
- Industrial pipelines.
- Oil and gas sectors.

Boston Dynamics:

- **Features:**
- Agile and able to navigate rough terrain.
- Equipped with 360-degree cameras for comprehensive inspections.
- Payload capacity for carrying sensors and tools.
- Can be programmed for autonomous missions or controlled remotely.
- **Applications:**
- Industrial inspection and maintenance.
- Data collection in hazardous environments.
- Remote monitoring and surveillance.
- Public safety and disaster response.

Drone In A Box



- **Overview:**
- Autonomous drone solution with AI-driven analytics.
- **Key Features:**
- Rugged and all-weather station.
- Integrated with advanced analytics for real-time insights.
- Seamless integration with existing security and monitoring systems.
- Automatic alerts and reporting.
- **Applications:**
- Industrial site monitoring.
- Security and perimeter surveillance.
- Environmental and regulatory compliance.

Safety Benefits of Drone in a Box:

- **Reduced Human Risk:**
 - Perform inspections and monitoring in hazardous environments without human presence.
- **Improved Emergency Response:**
 - Quickly deploy drones for real-time assessment in emergency situations.
- **Enhanced Data Accuracy:**
 - High-resolution imaging and real-time data analytics reduce human error.
- **Operational Continuity:**
 - 24/7 availability ensures continuous monitoring without the need for human intervention.
- **Remote Accessibility:**
 - Operate and monitor drones from any location, enhancing safety and efficiency.

Pathfinder Optics Case Study



<p>Title</p>	<p>Preventing over \$1 million in costs: the Elios 3 for wind turbine inspections</p> <p>Saving over \$1 million: wind turbine inspections with the Elios 3</p>
<p>Description</p>	<p>A drone inspection for wind turbine blades can help avoid over \$1 million in replacement costs by identifying faulty equipment early.</p>
<p>Key benefits</p>	<p>Safety - The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces.</p> <p>Speed - Efficiency is doubled with a drone inspection. The Elios 3 makes it possible to inspect 4 turbines in a day, whereas traditional methods barely cover 1 to 2 turbines per day.</p> <p>Access - Turbines can be over 170 feet tall, and access can be challenging. The drone provides straightforward access to tall turbines, minimizing human exposure and fall risk.</p> <p>Cost - Identifying faults with the Elios 3 can help save over \$1 million per wind turbine blade by helping avoid replacement costs.</p>

Benefits in a nutshell

<p>Safety</p> <p>The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces.</p>	<p>Speed</p> <p>Efficiency is doubled with a drone inspection. The Elios 3 can inspect 4 turbines in a day, whereas traditional methods barely cover 1 to 2 turbines per day.</p>
<p>Cost</p> <p>Identifying faults with the Elios 3 can help save over \$1 million per wind turbine blade by helping avoid replacement costs.</p>	<p>Access</p> <p>Turbines can be over 170 feet tall, and access can be challenging. The drone provides straightforward access to tall turbines, minimizing human exposure and fall risk.</p>

Wind energy is one of the original forms of power generation, using an early form of windmill and water wheels. Now, wind turbines are helping to power the planet. In 2022, US wind generated 13.8% of global energy generated by wind.

However, wind turbines are a complex machine with many parts. As wind turbines age, they require regular maintenance and repairs. Inspecting these wind turbines to identify faults early, before they become major issues, can help avoid replacement costs. The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces.

Inspection has been long to find a way to inspect blades. Before and after the Elios 3, inspections were done by hand. Inspectors would climb the tower to reach the blades. This was a dangerous and time-consuming task. The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces.

Developing drone inspections for the renewable energy industry

As the renewable energy industry grows, the need for efficient and safe inspection solutions is increasing. Inspecting wind turbines is a complex task that requires access to confined spaces. The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces.

Now, Pathfinder Optics uses a fleet of autonomous and semi-autonomous drones to conduct inspections across multiple industries and has developed a new set of proprietary inspection solutions. As part of these solutions, we built the Elios 3. It highlights the USDF capabilities of the drone in addition to the usual features of a drone: flight time, range, payload, and camera resolution.

How drones can be used for wind turbine inspections

Inspecting wind turbine blades without sending personnel into dangerous, confined spaces can help avoid replacement costs. The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces.



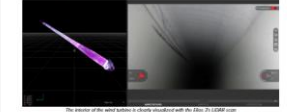
The small drone allows for easy access to the interior of wind turbine blades.

The first challenge in using a drone to inspect wind turbine blades is getting into the confined spaces. The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces.

Benefits of using a drone for wind turbine inspections

The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces. This is a significant benefit for wind turbine inspections.

A large blade being inspected is significantly longer than most drones can fly. The Elios 3 makes it possible to inspect 4 turbines in a day, whereas traditional methods barely cover 1 to 2 turbines per day.



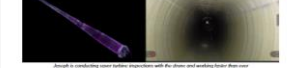
The view from the Elios 3 drone shows the interior of a wind turbine blade.

When inspecting wind turbine blades, it is important to identify faults early, before they become major issues. The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces.

Now, the Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces. This is a significant benefit for wind turbine inspections.

Bringing modern drone technology to renewable energy

Inspection has been long to find a way to inspect blades. Before and after the Elios 3, inspections were done by hand. Inspectors would climb the tower to reach the blades. This was a dangerous and time-consuming task. The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces.



The view from the Elios 3 drone shows the interior of a wind turbine blade.

Now, the Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces. This is a significant benefit for wind turbine inspections.

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Certifications



Q & A Time

Thank You

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