Mitigating EHS Risk by using Robotics Technology

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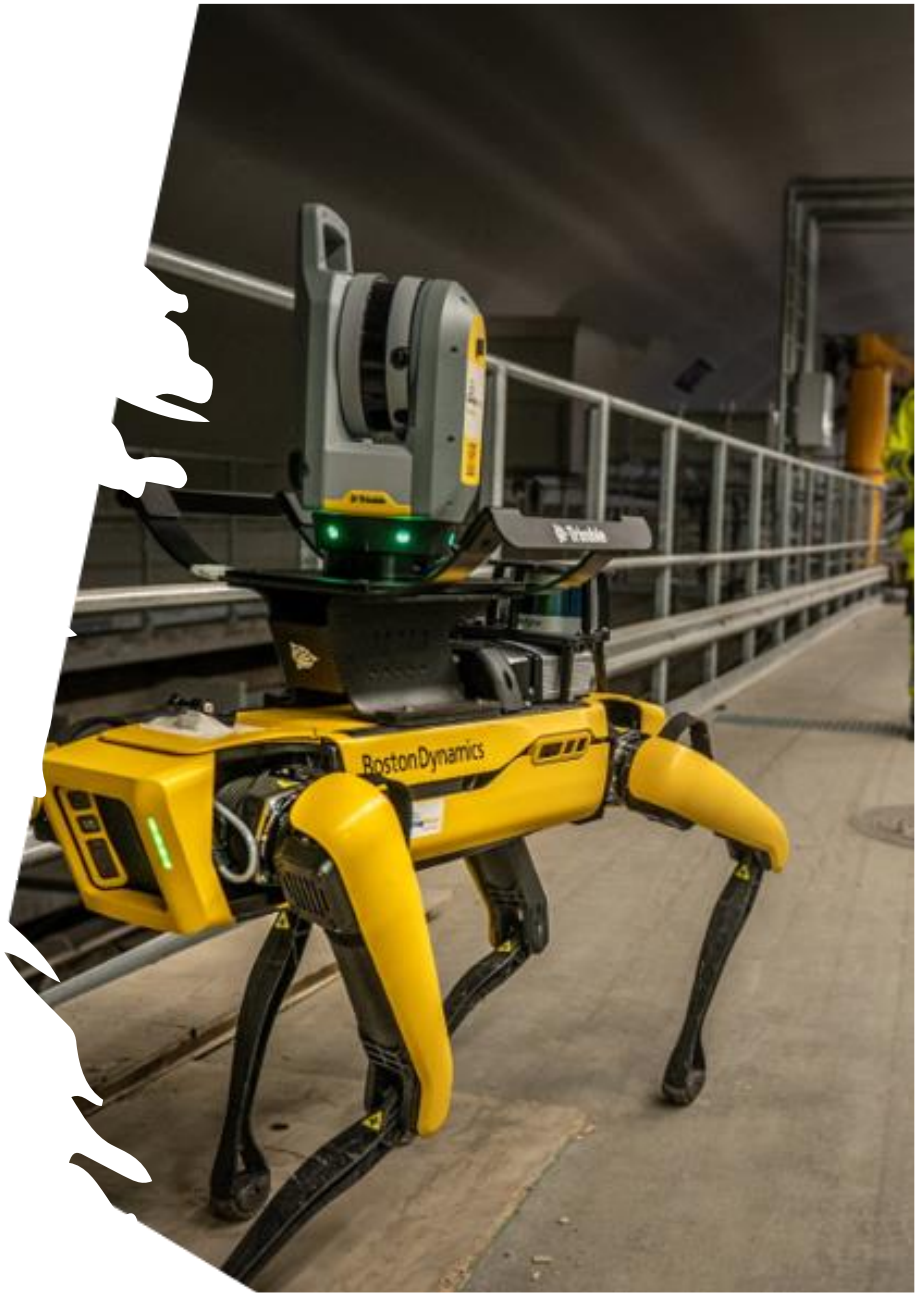
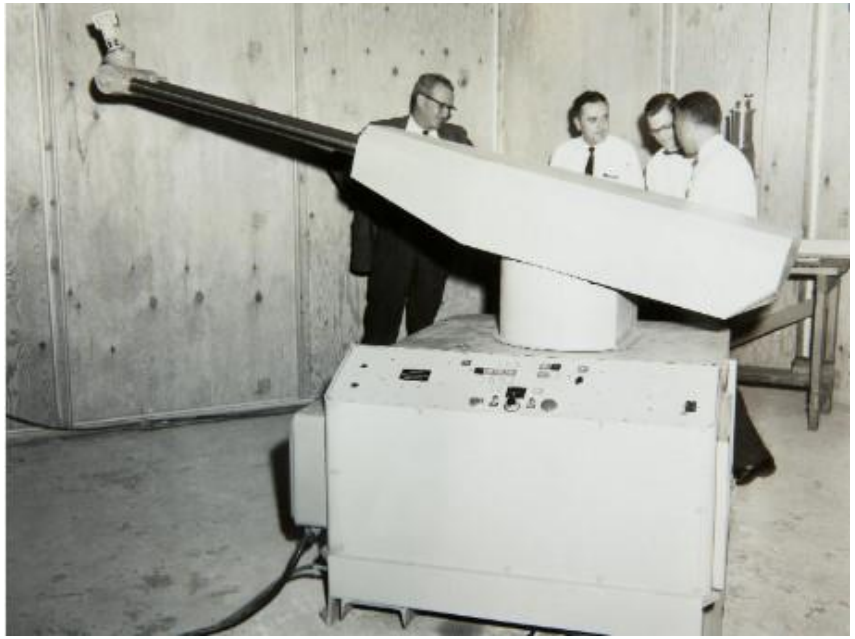
“If you aim for nothing you will hit it every time" – Zig Ziglar

Importance of inspections and safety in various industries

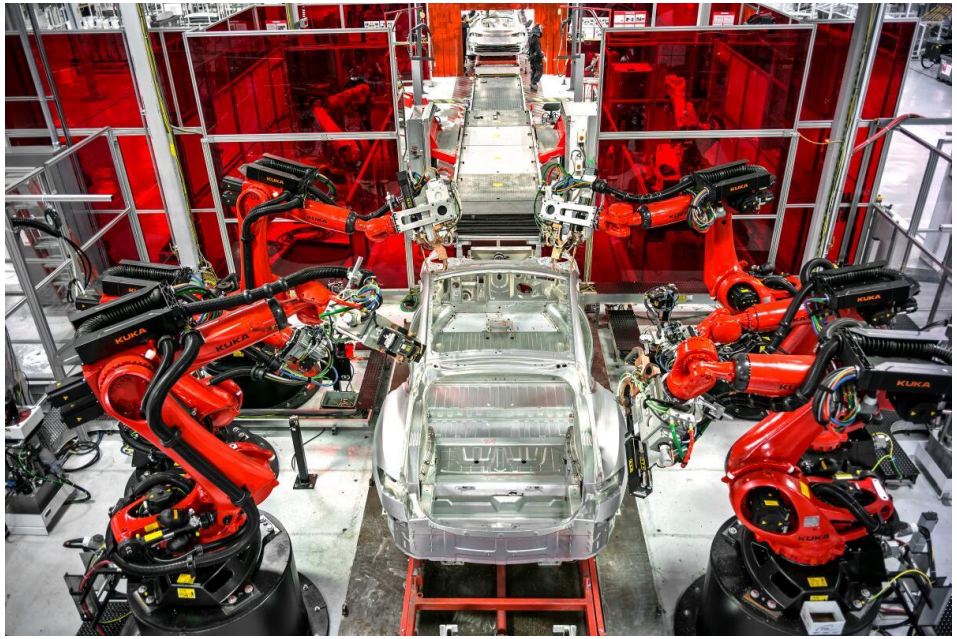
- Oil and Gas
- Renewable Energy
- Urban Infrastructure
- Overview of how robotics can revolutionize these processes:
- Improve efficiency
- Reduce human risk
- Enhance data accuracy



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

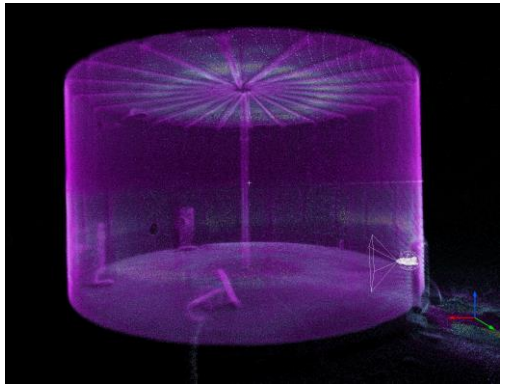
Infrastructure and Ecosystem Monitoring
- Use of robotics for dam, bridge, and pipeline inspections
- Monitoring marine environments and ecosystems with autonomous underwater vehicles (AUVs)
- Impact on environmental conservation and infrastructure maintenance

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



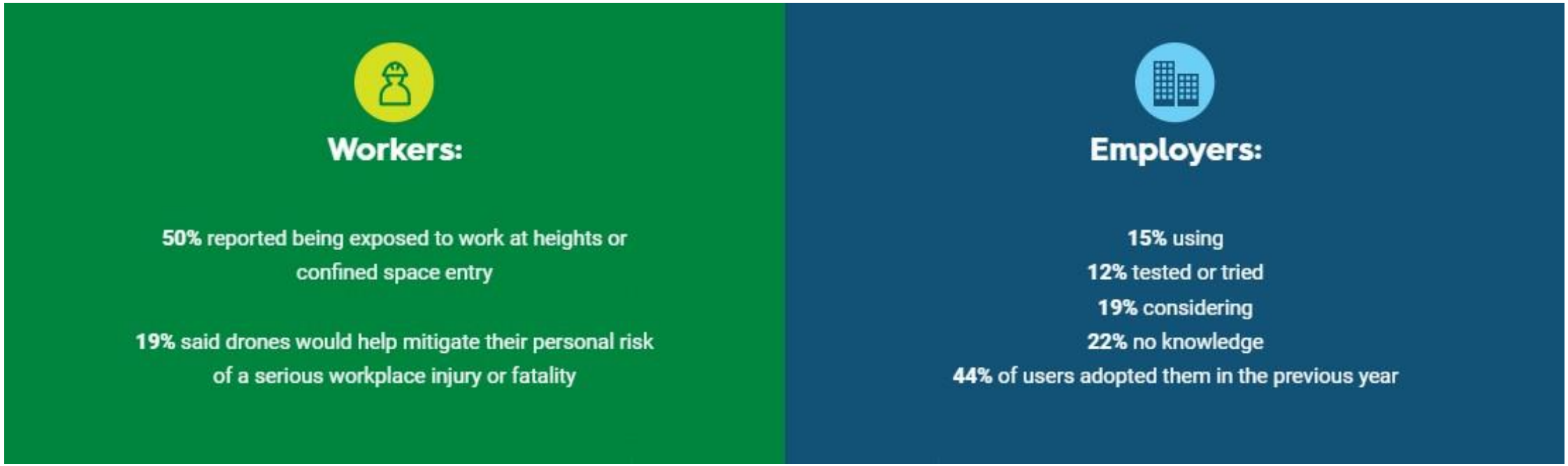
Specific applications of drones in inspections:

- 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



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

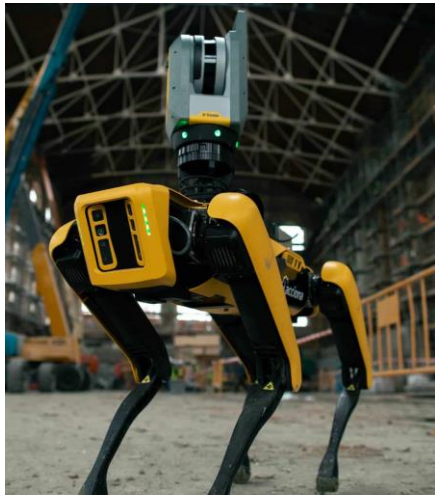
Industries & Uses

- **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.

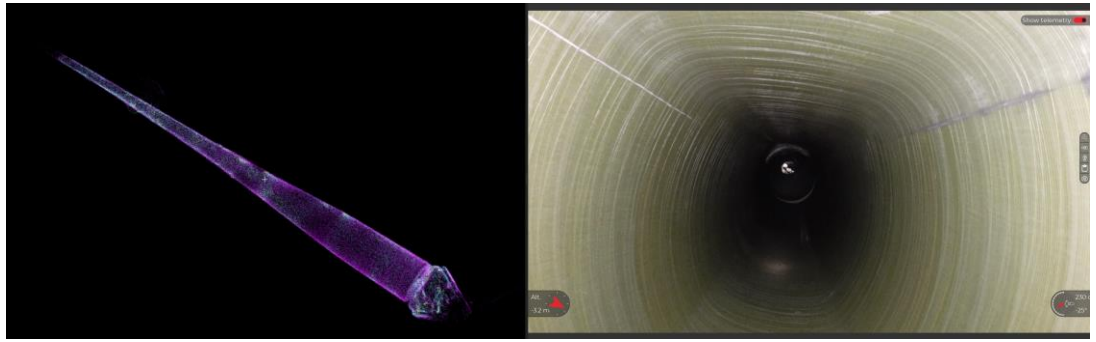
Applications:

- Industrial site monitoring.
- Security and perimeter surveillance.
- Environmental and regulatory compliance.

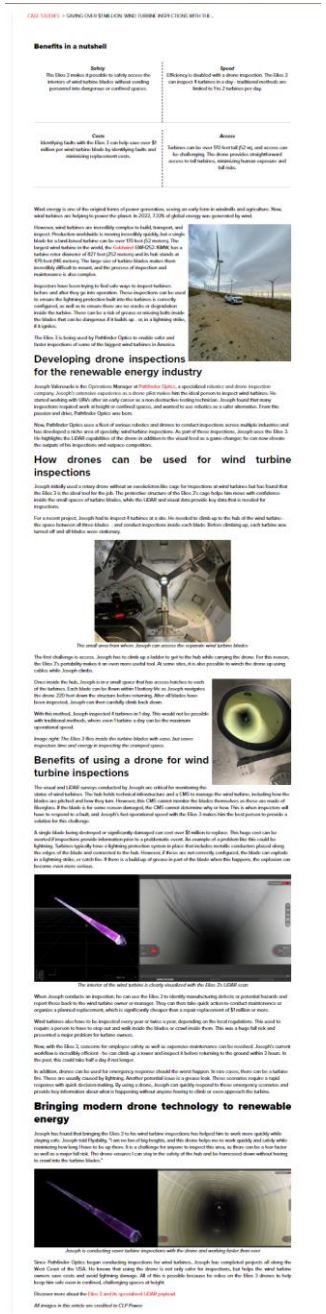
Safety Benefits of Drone in a Box:

- **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



Title	Preventing over $1 million in costs: the Elios 3 for wind turbine inspections Saving over $1 million: wind turbine inspections with the Elios 3
Description	A drone inspection for wind turbine blades can help avoid over $1 million in replacement costs by identifying faulty equipment early.
Key benefits	Safety - The Elios 3 makes it possible to safely access the interiors of wind turbine blades without sending personnel into dangerous, confined spaces. 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. 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. Cost - Identifying faults with the Elios 3 can help save over $1 million per wind turbine blade by helping avoid replacement costs.



Benefits in a nutshell

Developing drone inspections for the renewable energy industry

How drones can be used for wind turbine inspections

Benefits of using a drone for wind turbine inspections

Bringing modern drone technology to renewable energy

Certifications

INFRARED TRAINING CENTER

Q & A Time

Thank You

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