EMERGING TECHNOLOGY PLATFORMS TO OPTIMIZE OPERATIONS FOR THE OIL & GAS INDUSTRY

Thomas Katucki
Senior Research Associate

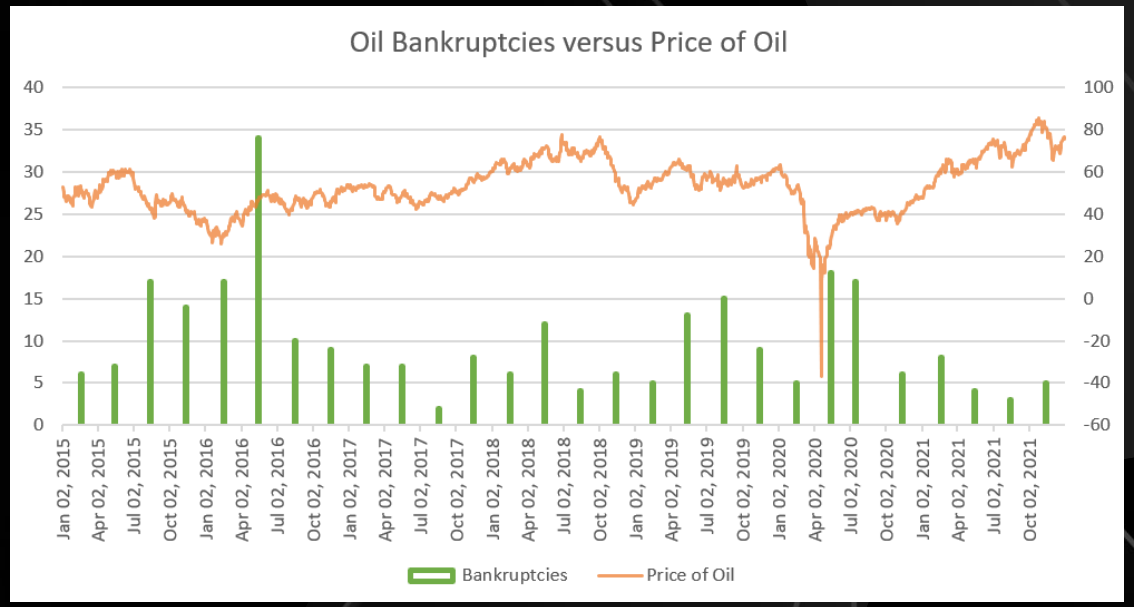
CONTINUED RISKS

- The oil and gas industry continues to face several challenges that include:
  - **Operational risks posed by aging infrastructure.**

Image source: ABC News (AP, FILE)

CONTINUED RISKS

- The oil and gas industry continues to face several challenges that include:
  - Operational risks posed by aging infrastructure.
  - **Volatile oil prices impacting current and future revenue.**



CONTINUED RISKS

- The oil and gas industry continues to face several challenges that include:
  - Operational risks posed by aging infrastructure.
  - Volatile oil prices impacting current and future revenue.
  - **Shortage of skills related to an aging and retiring workforce.**

Image source: National Association of Safety Professionals

CONTINUED RISKS

- The oil and gas industry continues to face several challenges that include:
  - Operational risks posed by aging infrastructure.
  - Volatile oil prices impacting current and future revenue.
  - Shortage of skills related to an aging and retiring workforce.
  - **Reactions to varying degrees of pressure from shareholders, governments, and consumers.**
  - **Implementation of complex and large digital transformation projects across multiple business areas.**

EMERGING TECH PROVIDES A SOLUTION

Maturation of platform technologies will solve fundamental challenges for the oil & gas industry on different time scales

- **Robotics**

Image source: Apptronik

EMERGING TECH PROVIDES A SOLUTION

Maturation of platform technologies will solve fundamental challenges for the oil & gas industry on different time scales

- Robotics
- **Quantum technology**

Image source: Google Quantum AI

EMERGING TECH PROVIDES A SOLUTION

Maturation of platform technologies will solve fundamental challenges for the oil & gas industry on different time scales

- Robotics
- Quantum technology
- **Satellite imagery**

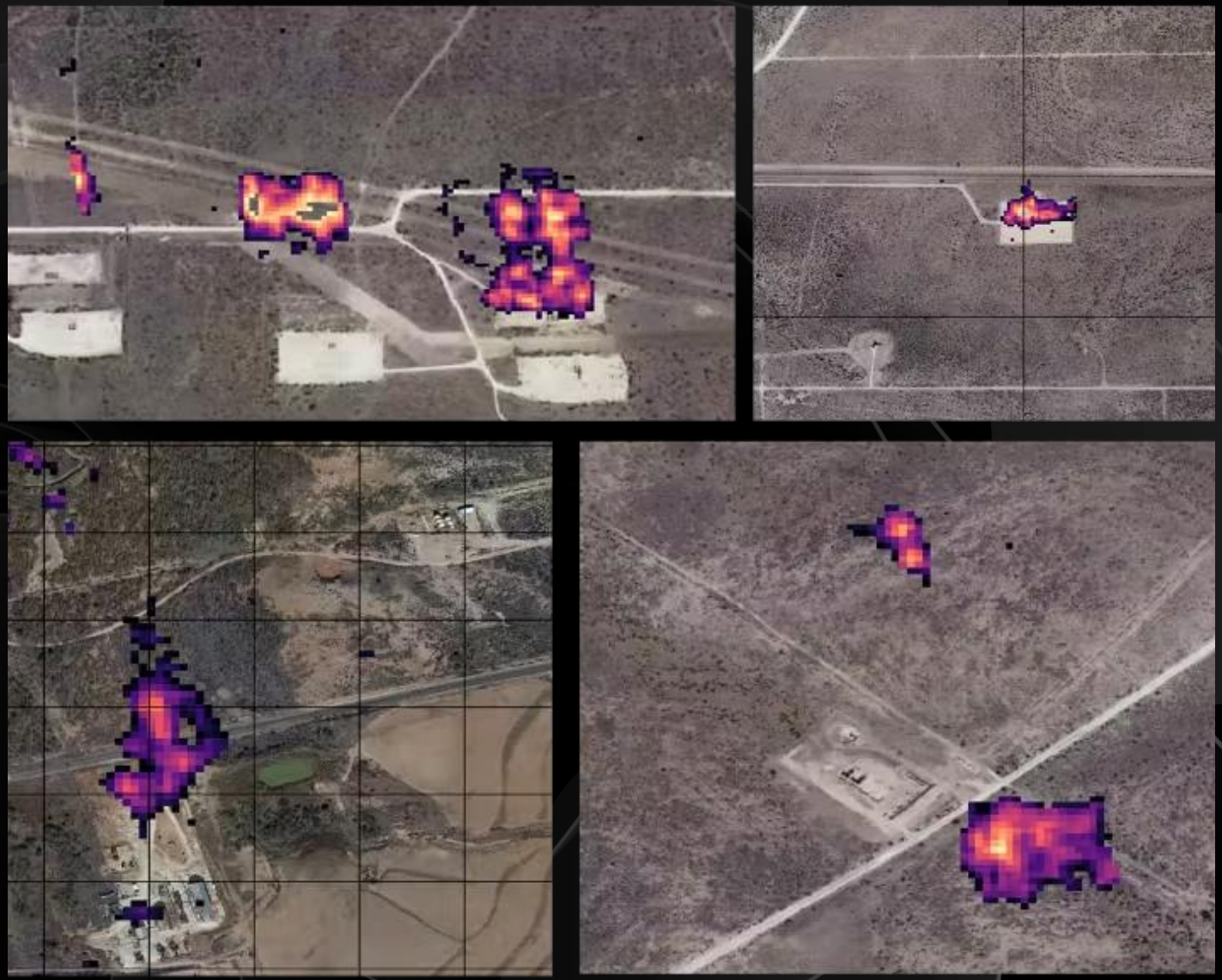
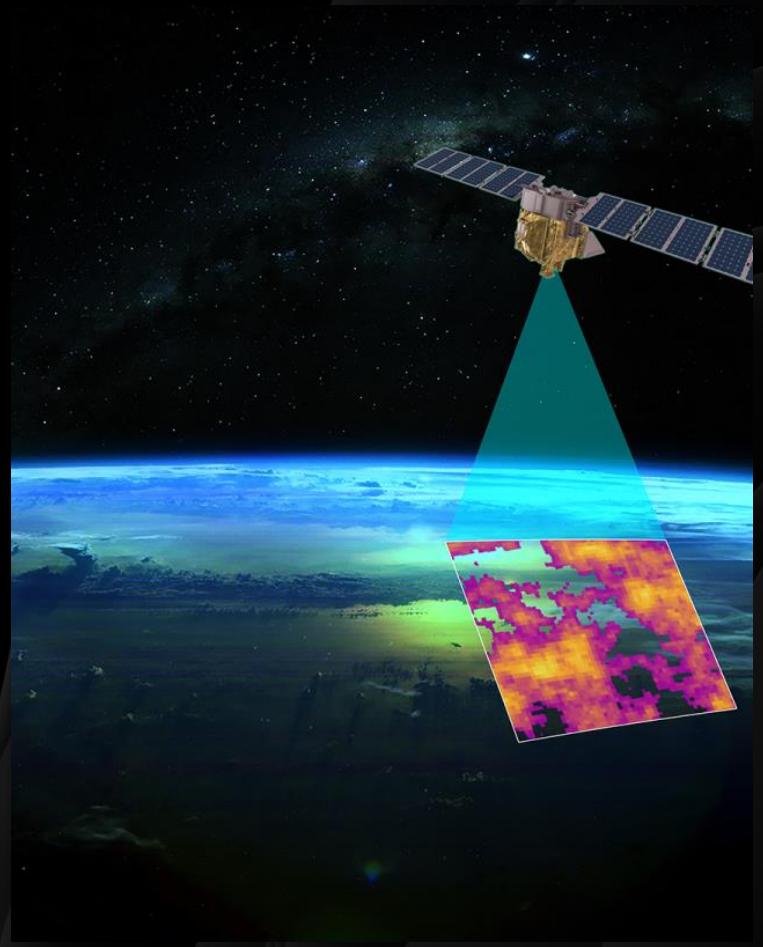
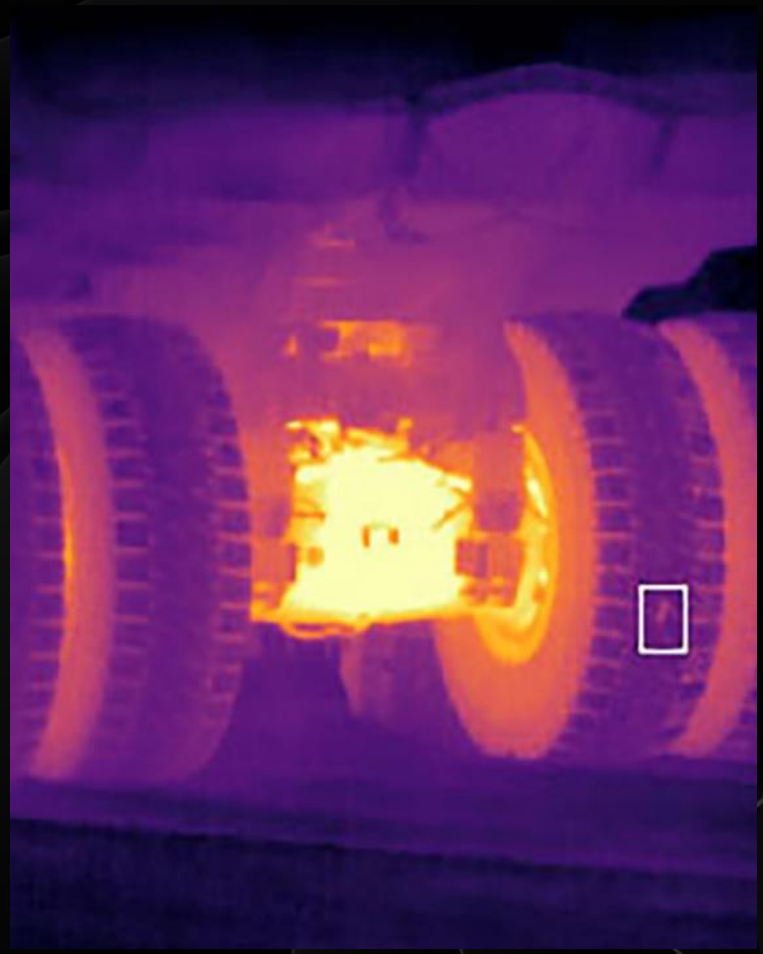


Image source: Orbital Sidekick

REGULATORY COMPLIANCE



RISK MANAGEMENT



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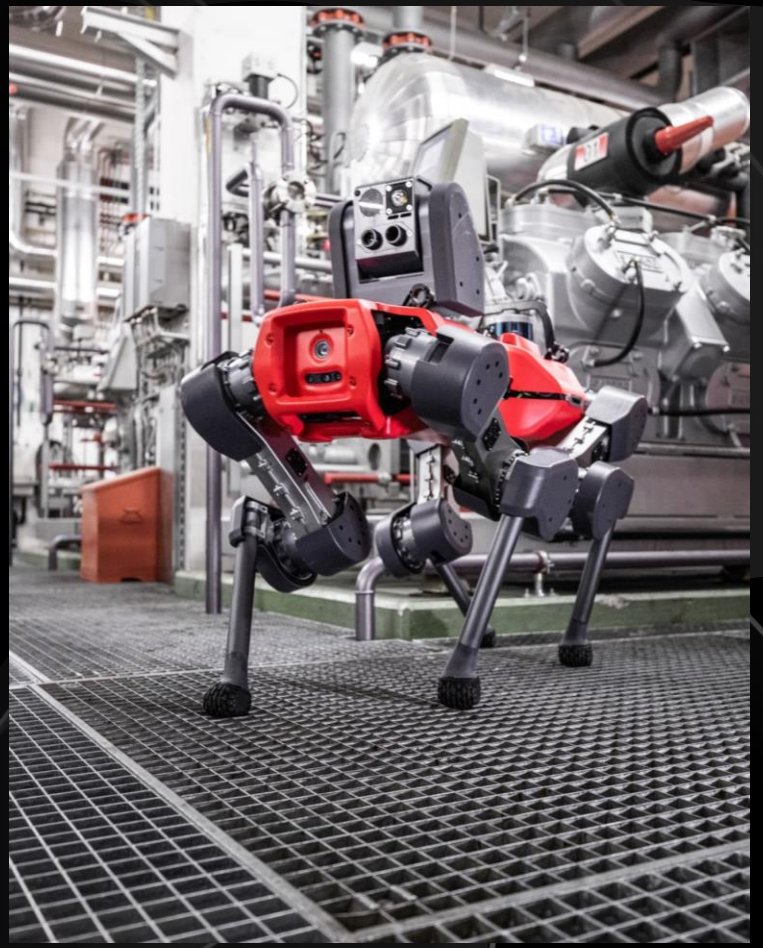
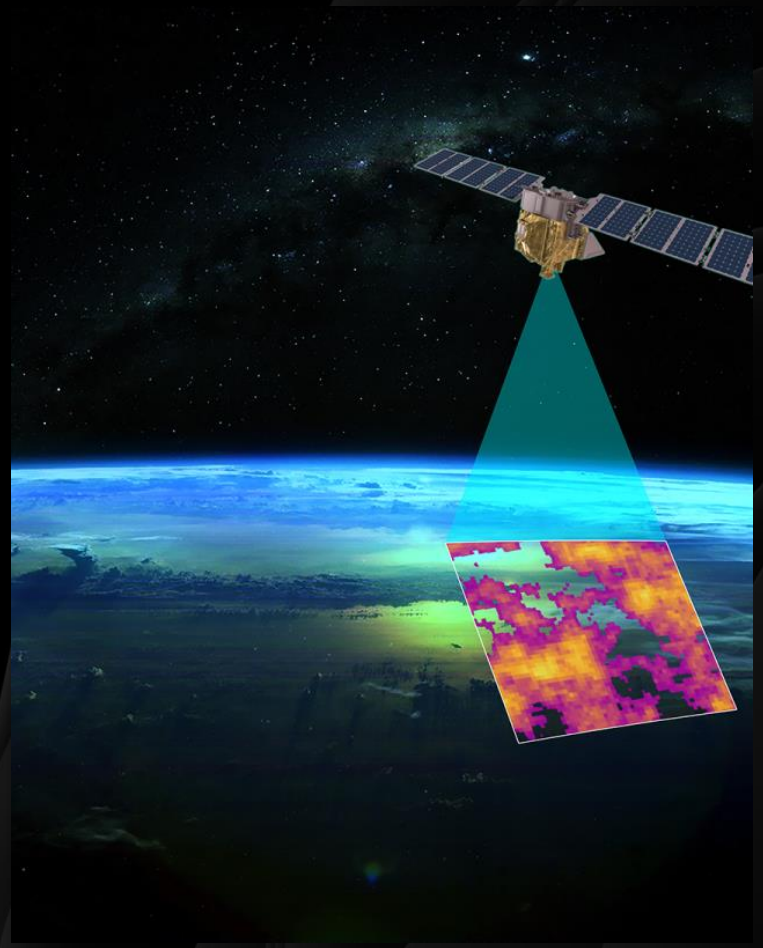


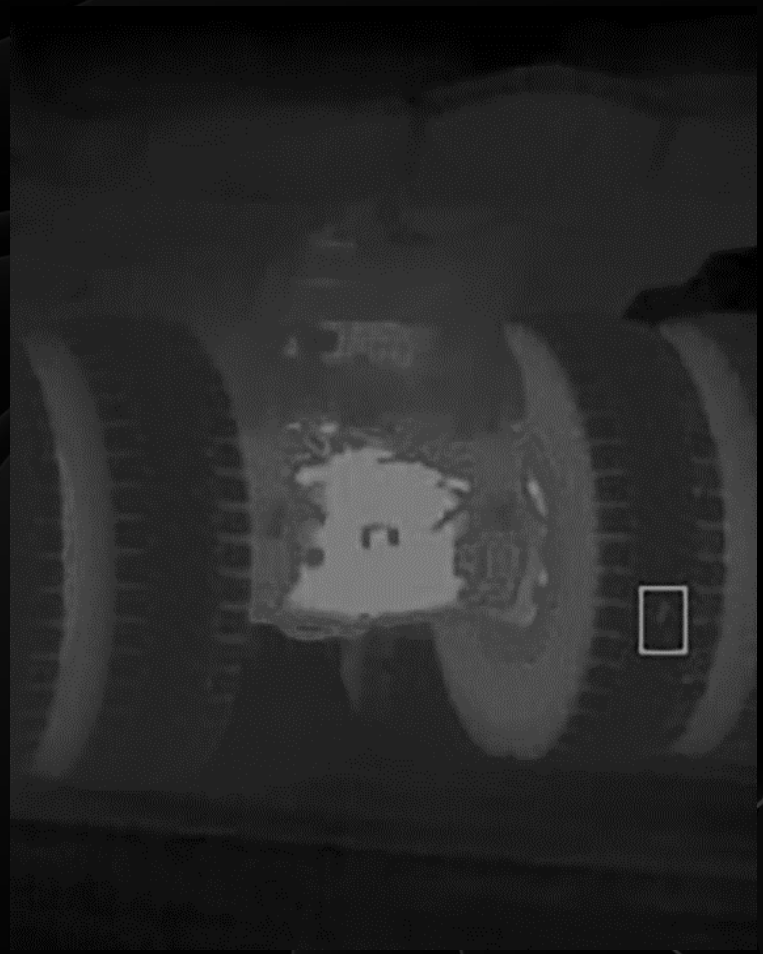
Image sources from left to right: MethaneSat, Teledyne FLIR, and ANYbotics

REGULATORY COMPLIANCE

RISK MANAGEMENT

AUTOMATION





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GLOBAL INFRASTRUCTURE MONITORING IS INCREASINGLY MARGIN CRITICAL

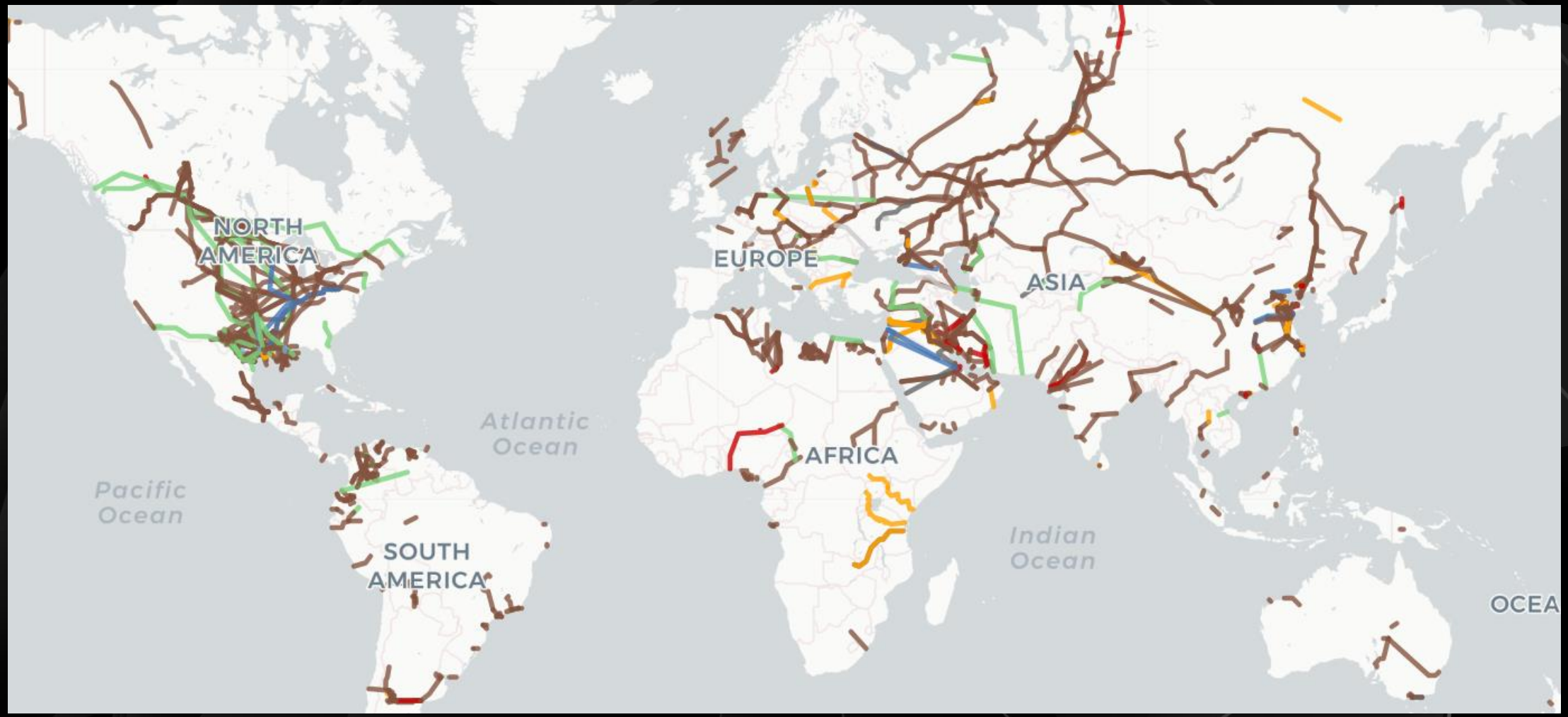

Image source: Global Energy Monitor

SURVEYING ACTIVITY FROM THE GROUND

Ground surveillance ranges from point-source sensors to emerging solutions covering wide project areas.

Most existing solutions have limited detection distances and can be costly to install across large sites.

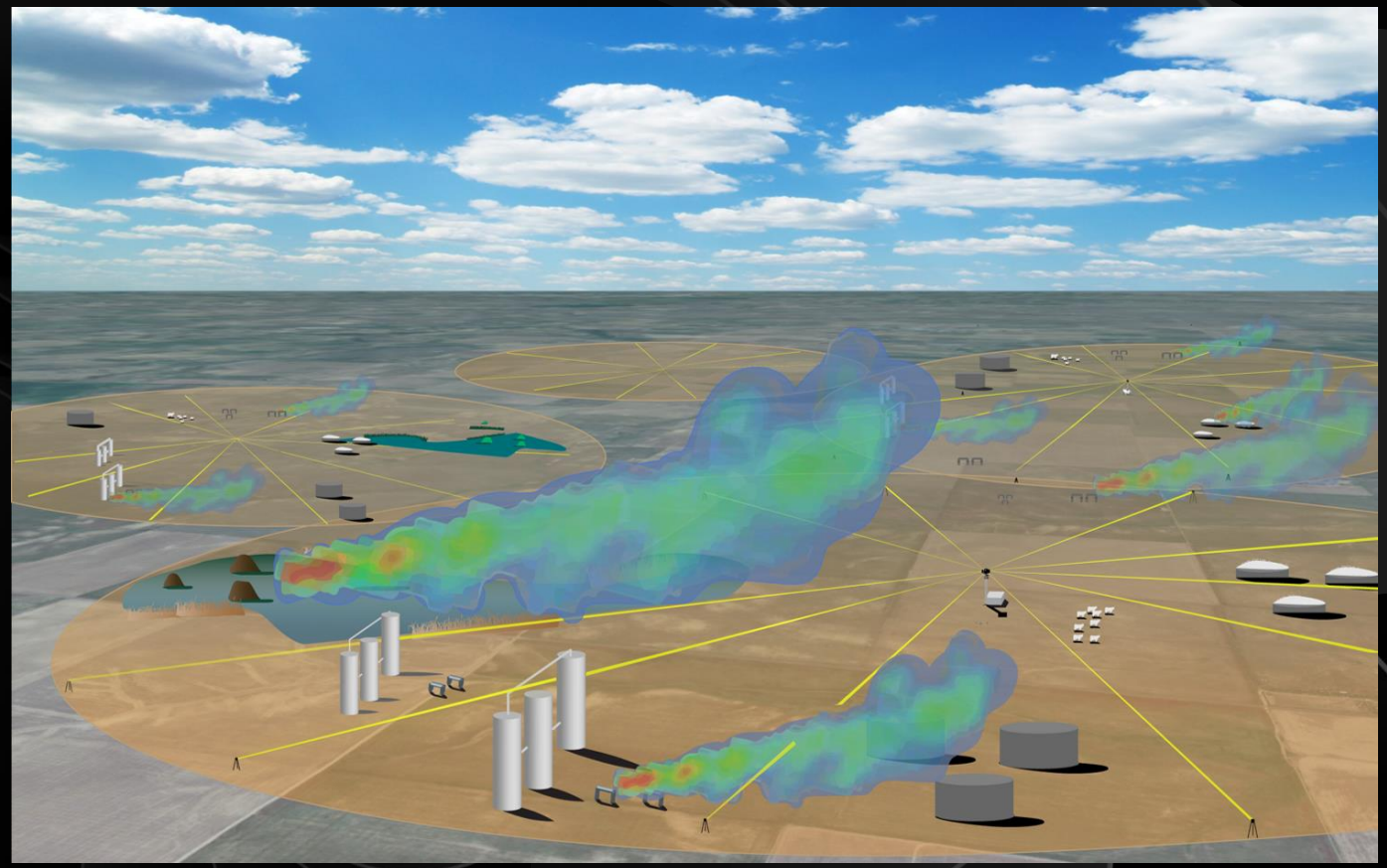

Image source: National Institute of Standards and Technology (S. Sizemore)

SURVEYING PROJECTS FROM THE AIR

Aerial surveillance with drones, airplanes, and balloons offers monitoring solutions.

Distance limitations, shortages of pilots, and risks limit global impact.

Image sources from top to bottom: ZenaDrone, Eurekalert (Kairos Aerospace now Insight M), and Sceye

TRACKING SMALLER EMISSIONS

The ability to accurately track emissions with satellite imagery has improved drastically over the past several years.

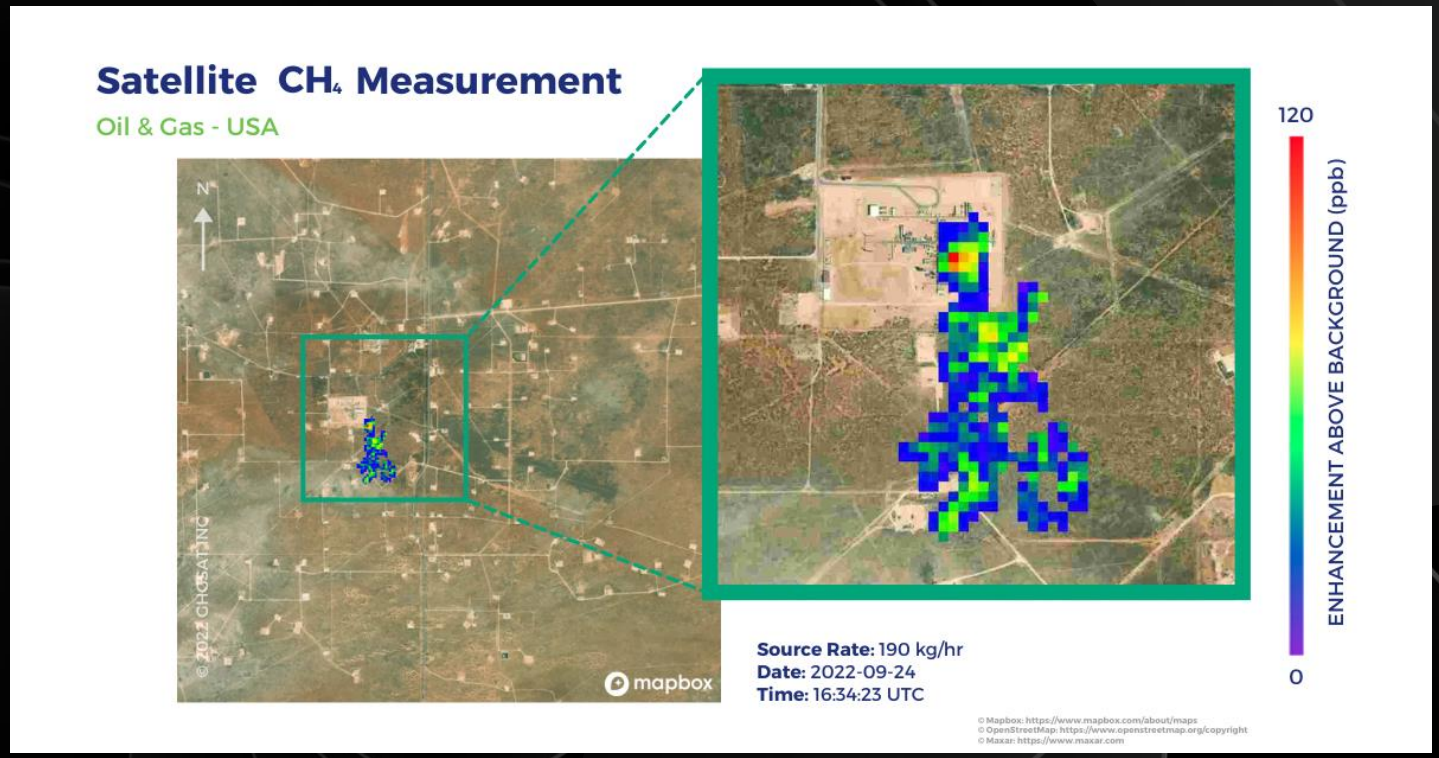

Image source: GHGSat Inc, Mapbox

THIRD-PARTY EMISSIONS TRACKING

The UN's International Methane Emissions Observatory showcases initial methane tracking results from the Methane Alert and Response System at COP28.

Other methane-tracking sources are emerging to point out super emitters.

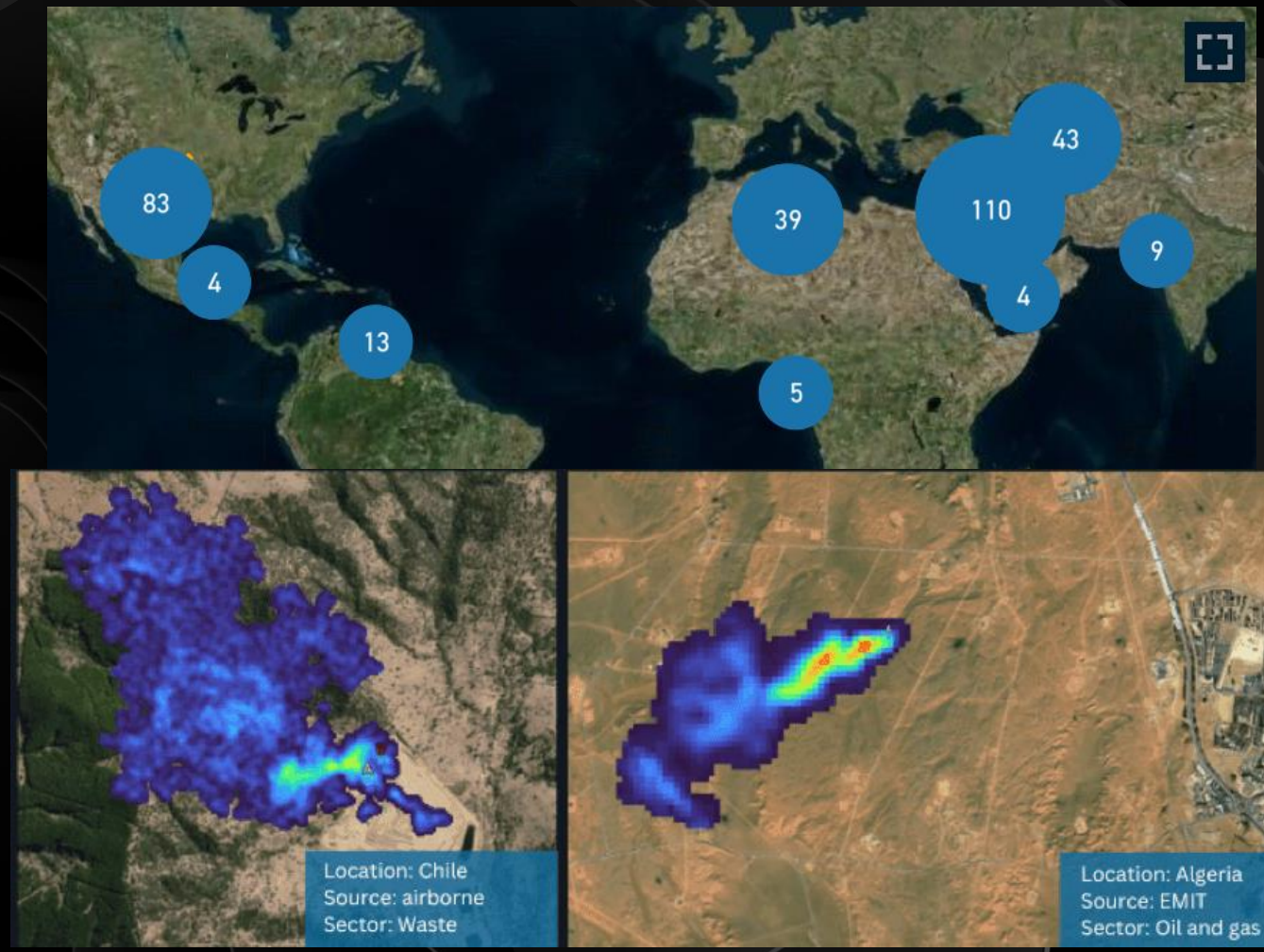

Image sources from top to bottom: UN Environment Programme and Carbon Mapper

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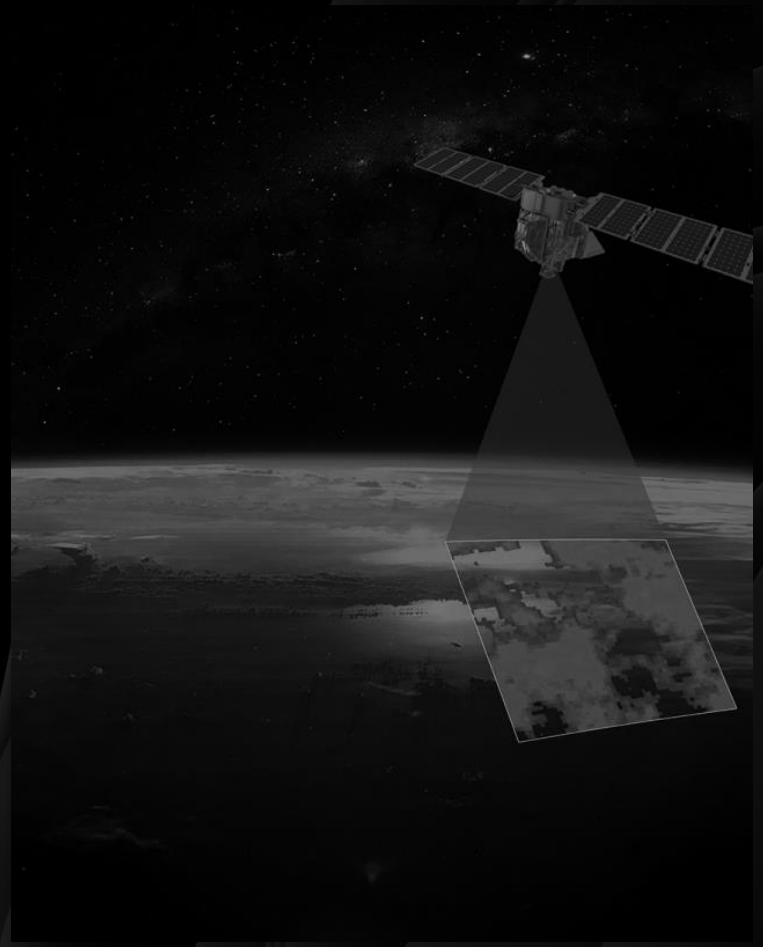


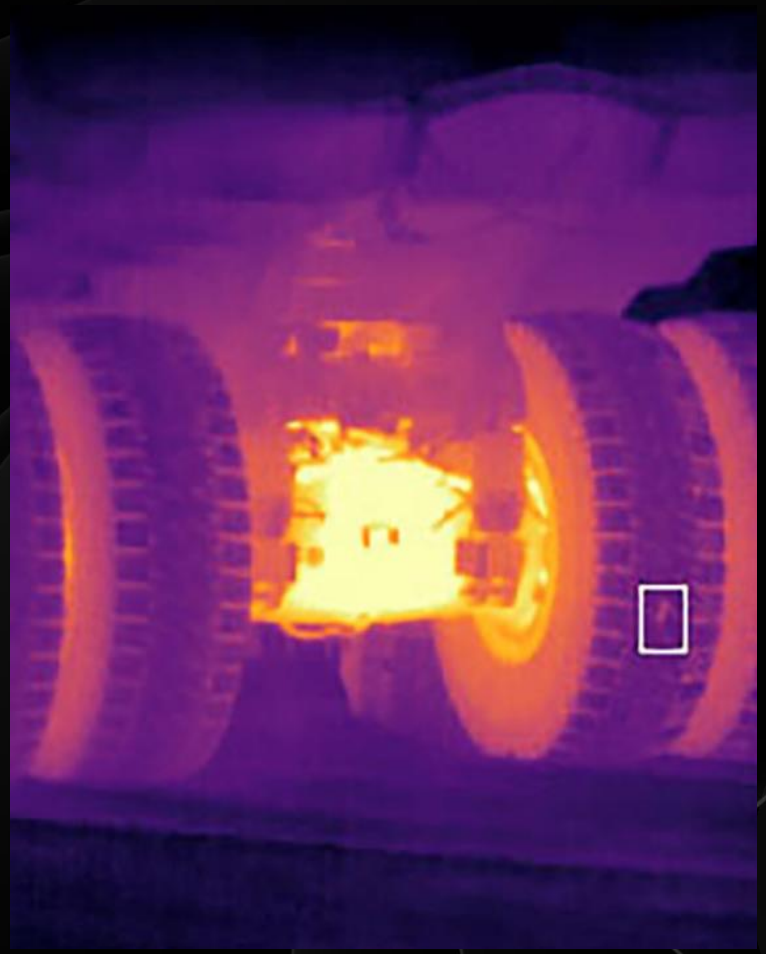
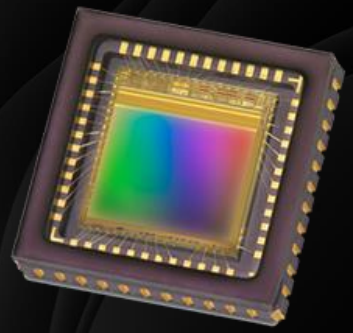
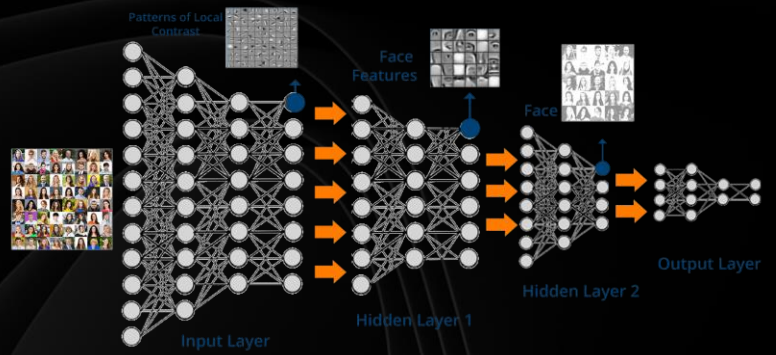


Image sources from left to right: MethaneSat, Teledyne FLIR, and ANYbotics

IMPACT OF COMPUTER VISION

Computer, machine, or other advanced vision systems are divided into three main technology areas:





Sensors

Algorithms

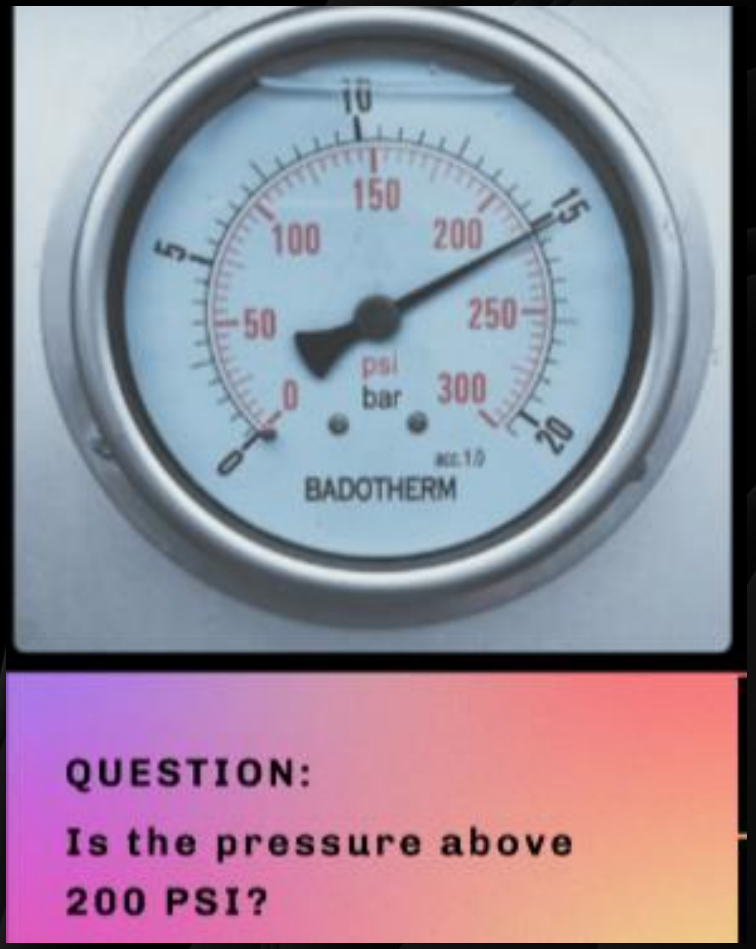
Processors

VALUE OF COMPUTER VISION

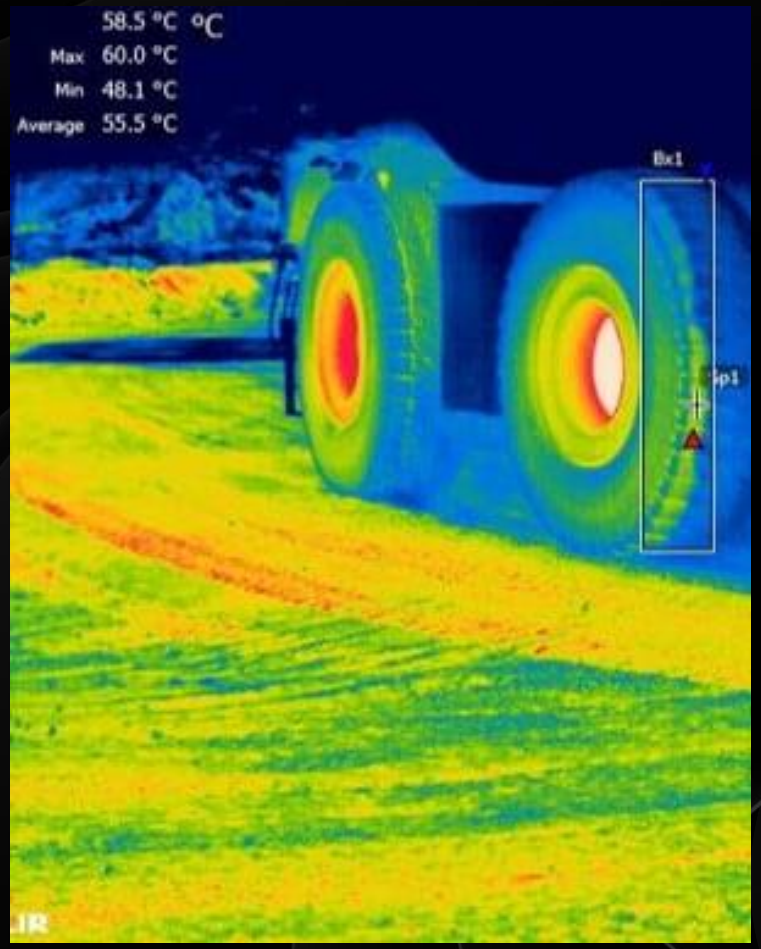
Computer vision can identify anomalies or risks with better accuracy than human workers, thereby mitigating risk and increasing operational efficiencies.

Image source: Eigen Innovations

GROUNDLIGHT



TELEDYNE FLIR



SEADEEP

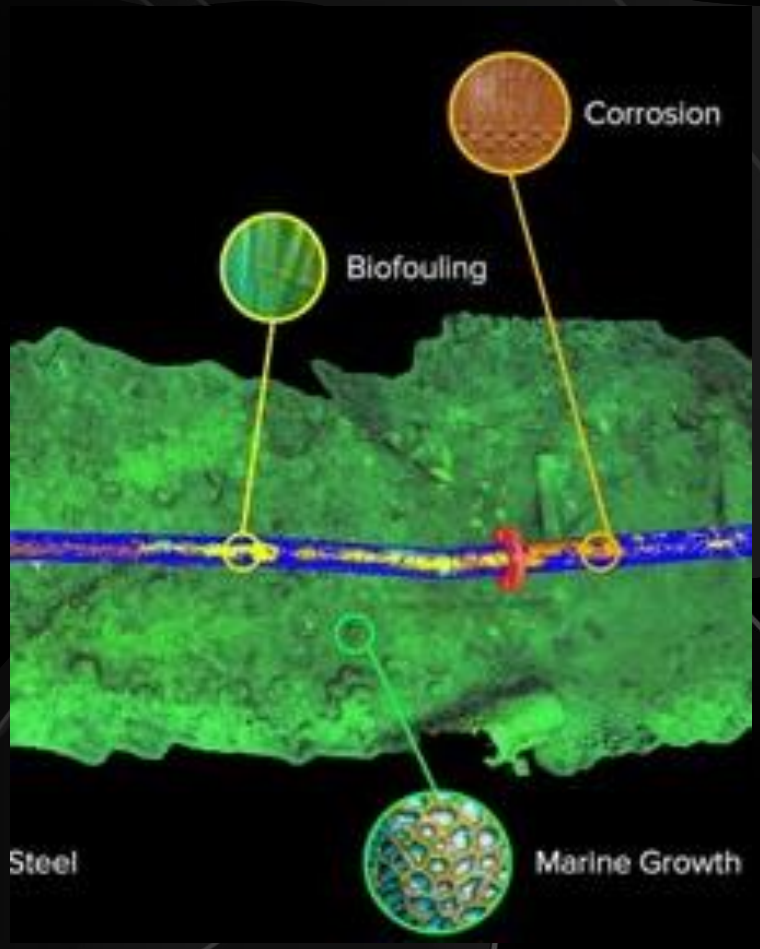


Image sourced from left to right: Groundlight, Teledyne FLIR, and SeaDeep

PREDICTING POTENTIAL SITE RISKS

Satellite imagery (synthetic aperture radar) can detect land subsidence and predict sinkholes or land movement.

Image source: Semantic Scholar (Lynn Highland, USGS)

ADJUSTING PROJECT RISK

Quantum sensors offer several emerging solutions ranging from GPS/PNT alternatives to underground awareness to novel corrosion detection.

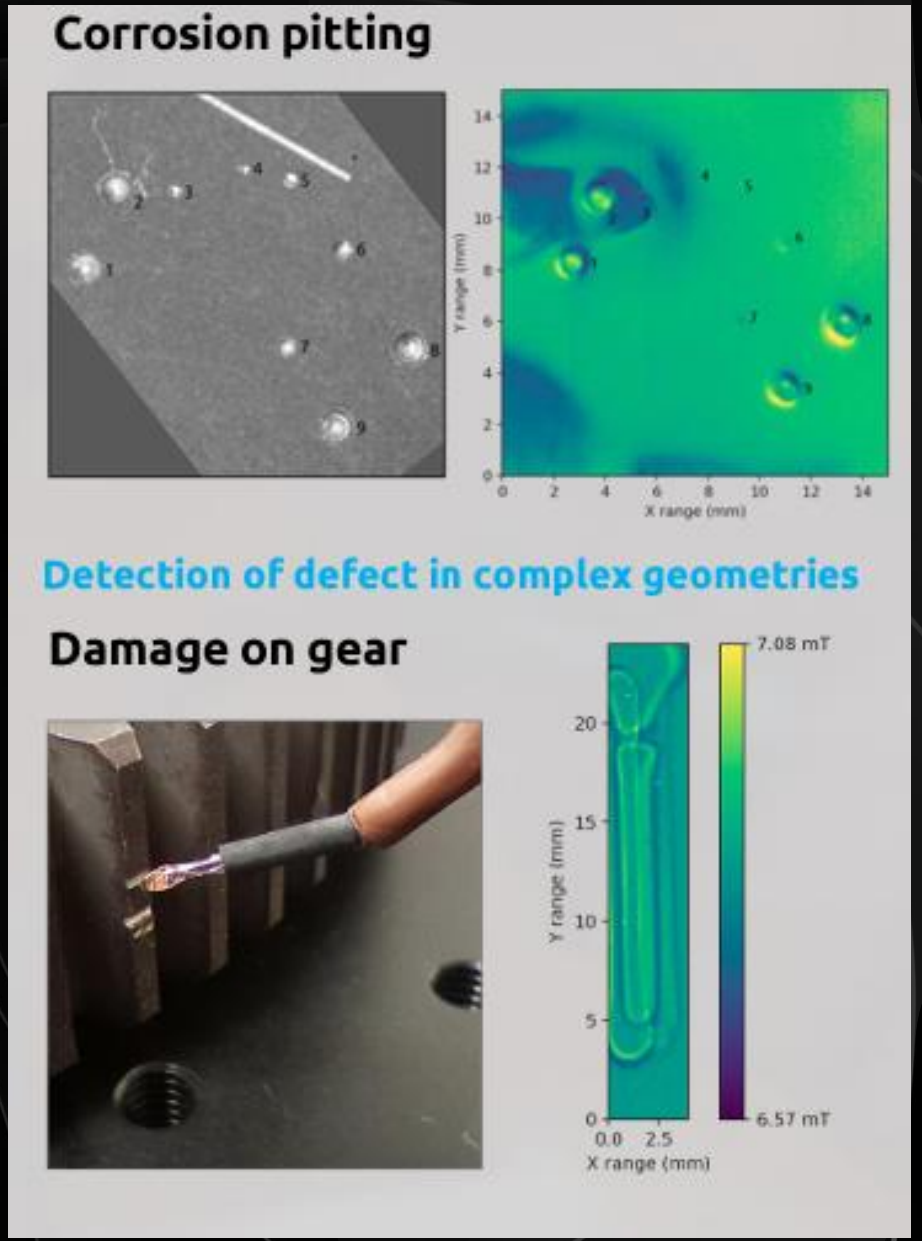


Image source: Kwan-Tek

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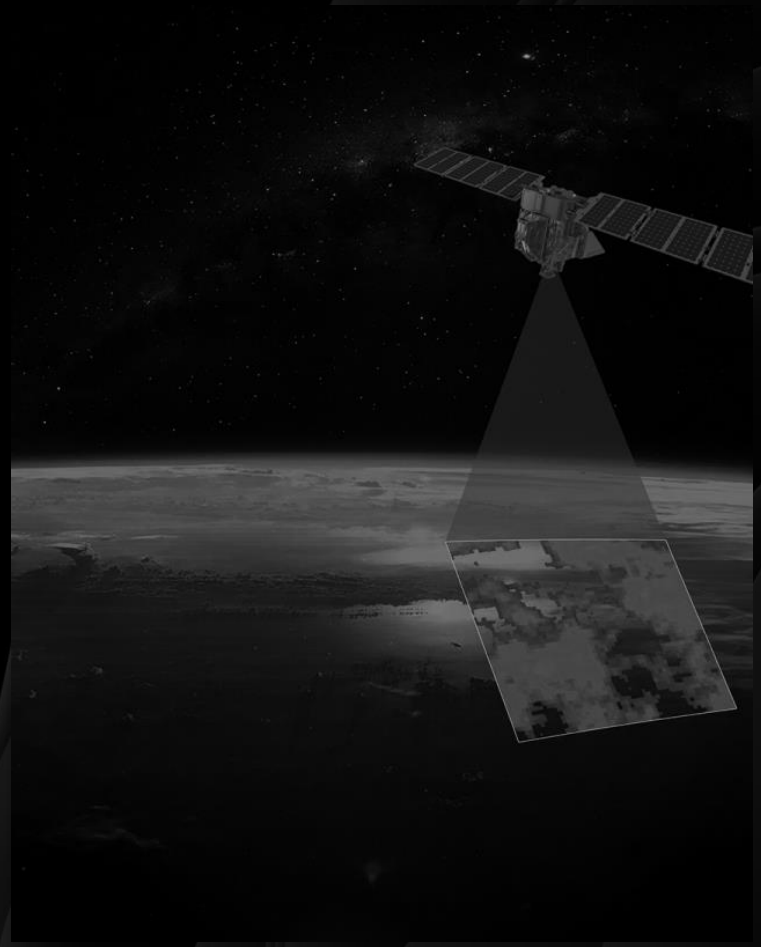


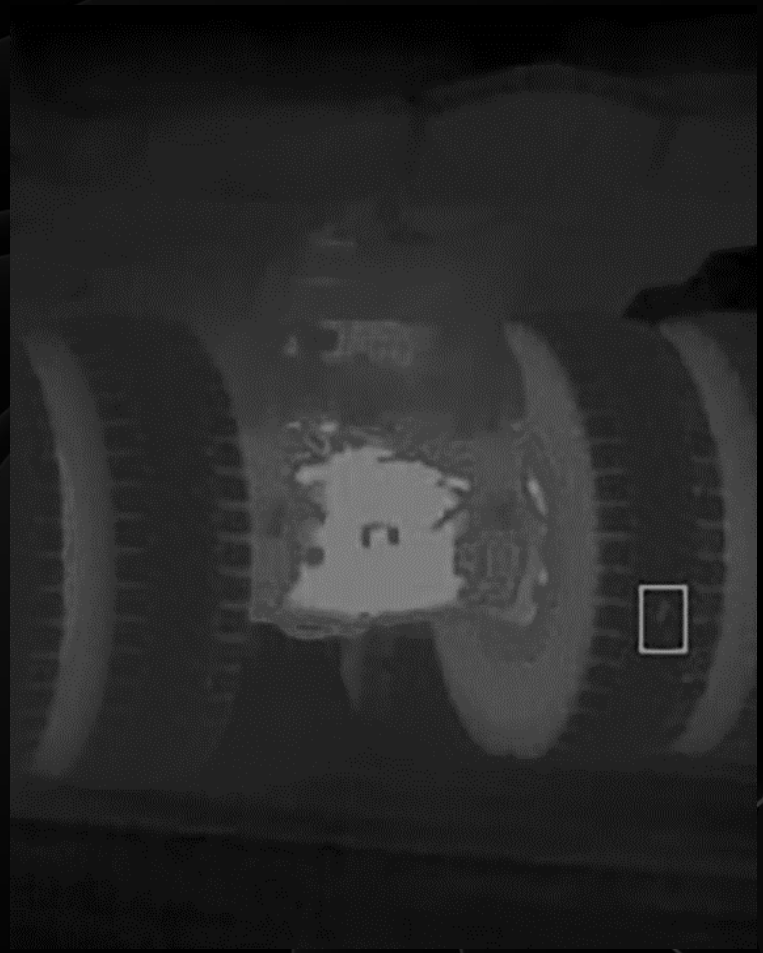
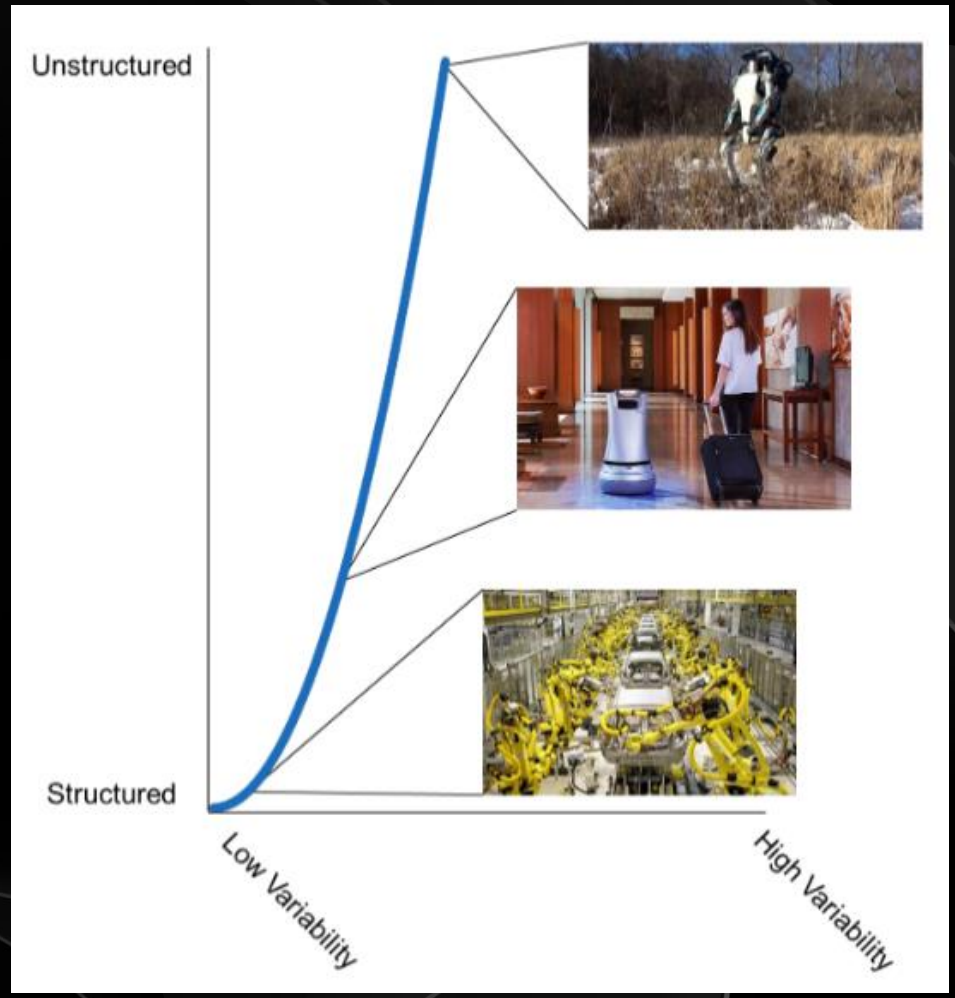


Image sources from left to right: MethaneSat, Teledyne FLIR, and ANYbotics

STRUGGLES WITH UNSTRUCTURED AREAS

Oil and gas companies have primarily implemented robotic applications through direct operator control.

In some areas, applications have been implemented with semi-autonomous operations.



CURRENT VERSUS FUTURE DEVELOPMENT

Gecko Robotics

Applied Impact Robotics

Sanctuary AI

Nauticus Robotics

Apptronik

Image sources from left to right: Gecko Robotics, Offshore, Applied Impact Robotics, Sanctuary AI, and IoT World Today (Apptronik)

IMPROVEMENTS IN LAB AUTONOMY

Semi-autonomous implementations are gaining traction across chemical, mining, and oil & gas operations.

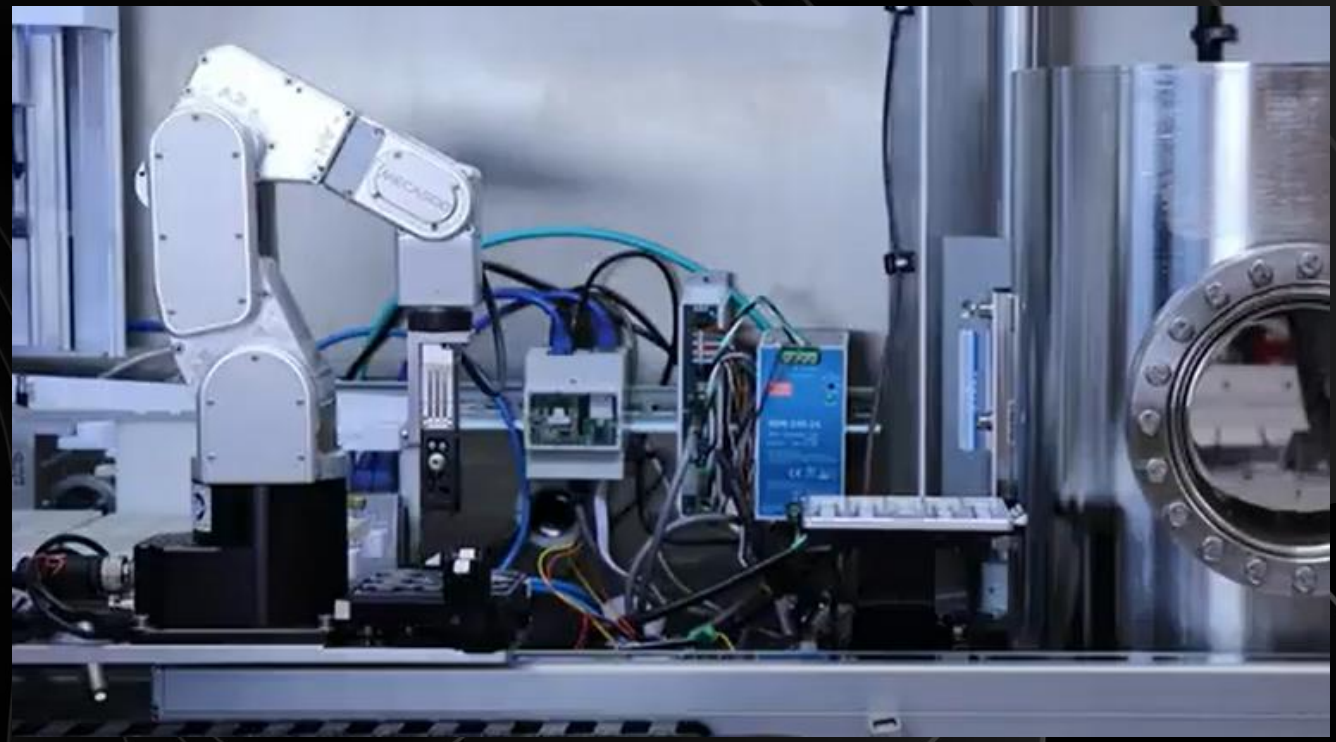


Image source: Mecademic

ROBOTIC INSPECTION SYSTEMS

Emerging robotic solutions enable more impactful asset monitoring across oil and gas facilities.

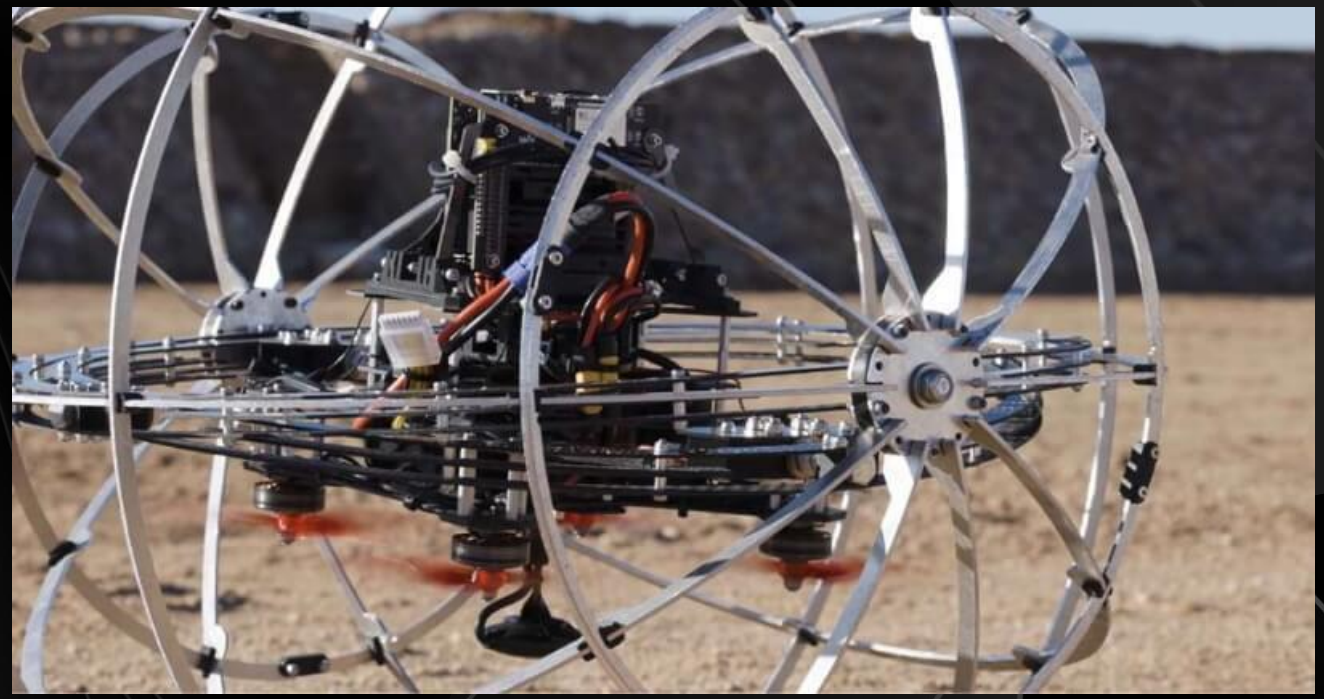


Image source: Revolute Robotics

IMPROVEMENTS IN OVERALL AUTONOMY

Software developments allow semi-autonomous operation of construction and maintenance vehicles with tele-operation backup.

Image source: Construction Equipment Guide

AUTOMATED INTELLIGENCE

Sensors and satellites monitor site activity, check third-party interference and land encroachment, provide competitive intelligence, and oversee joint venture projects.

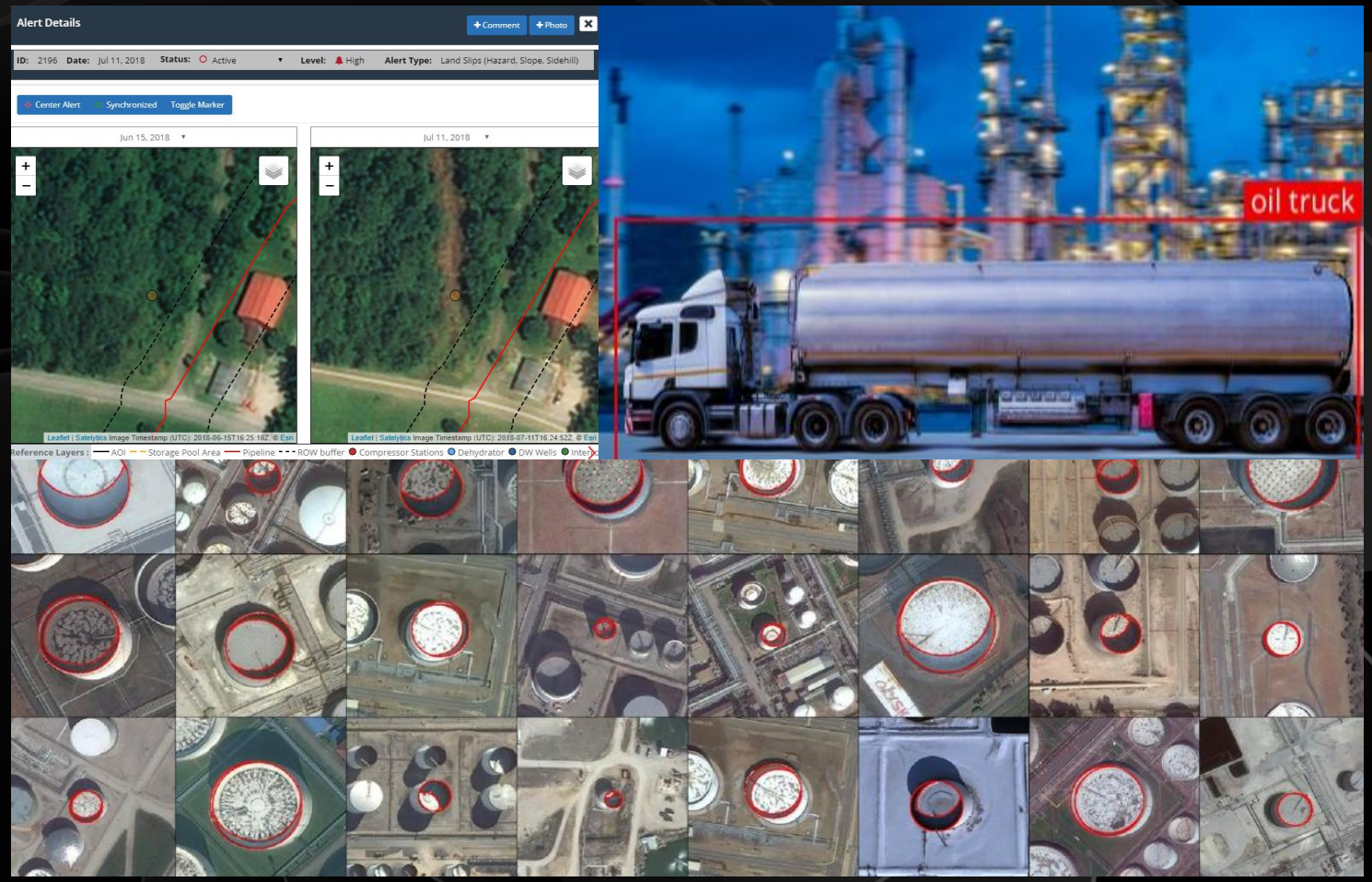


Image sources from left to right: Satelytics, ImageVision, and Via Satellite (Orbital Insight)

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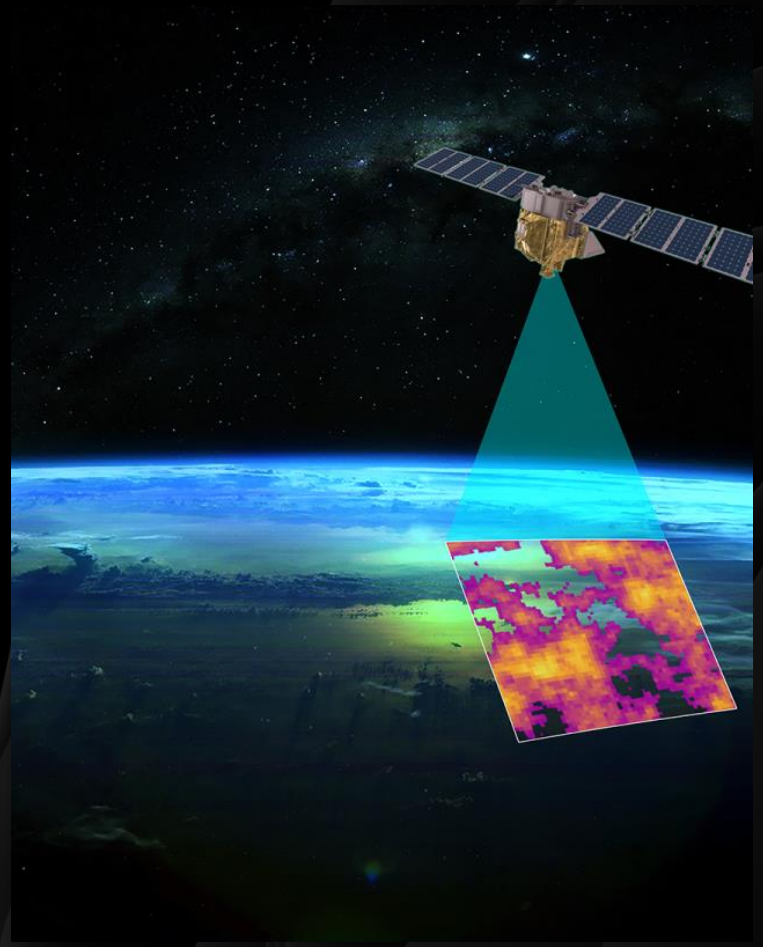

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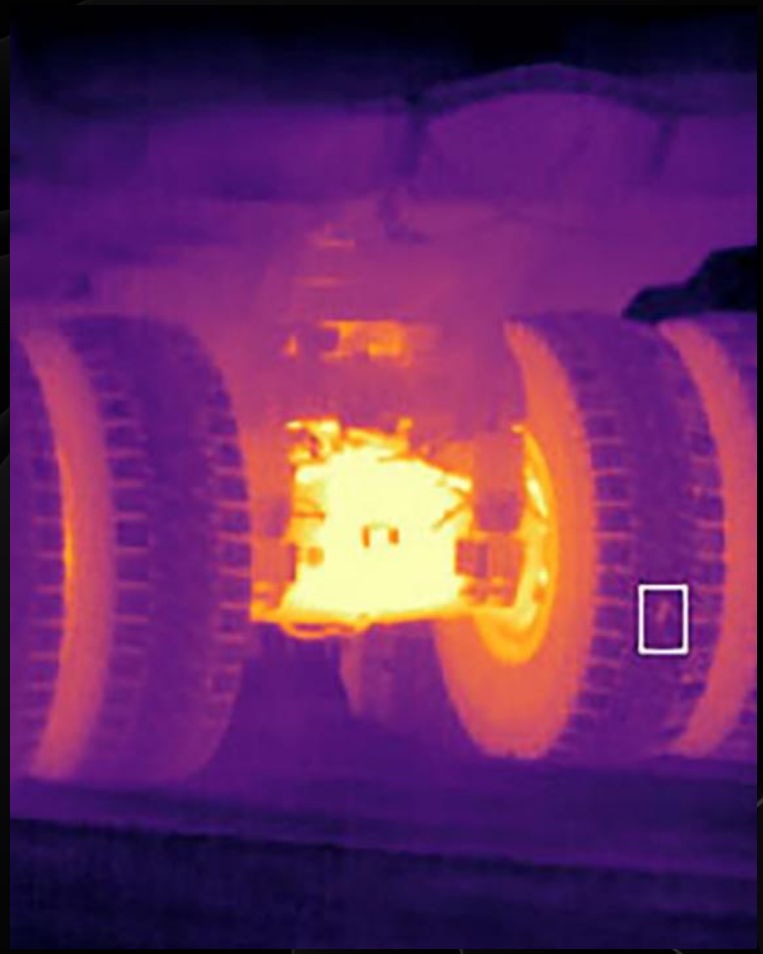

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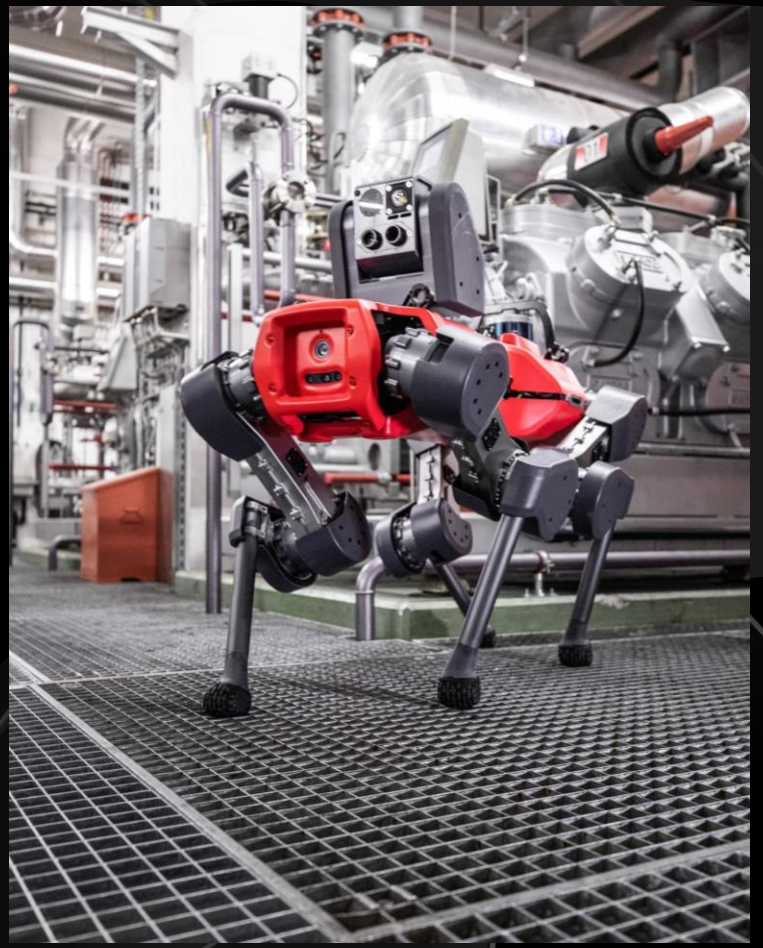

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ROADMAP FOR IMPLEMENTATION

	2025	2026–2030	2030~
Regulatory Compliance	Satellite imagery	Emerging greenhouse gas sensors	
Risk Management	Computer vision	Quantum sensors	Quantum computers
Automation	Robotics (structured environment)	Autonomous inspection systems	Humanoid robotics

KEY TAKEAWAYS

1

Automating near-term compliance and productivity challenges frees operational teams to pursue long-term innovations.

2

Specific use-cases for automation should align with regulatory compliance, risk management, and workplace productivity.

3

Autonomous technologies do not cohere into a safe, risk free, and cost-effective, drop-in solution.

THANK YOU

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