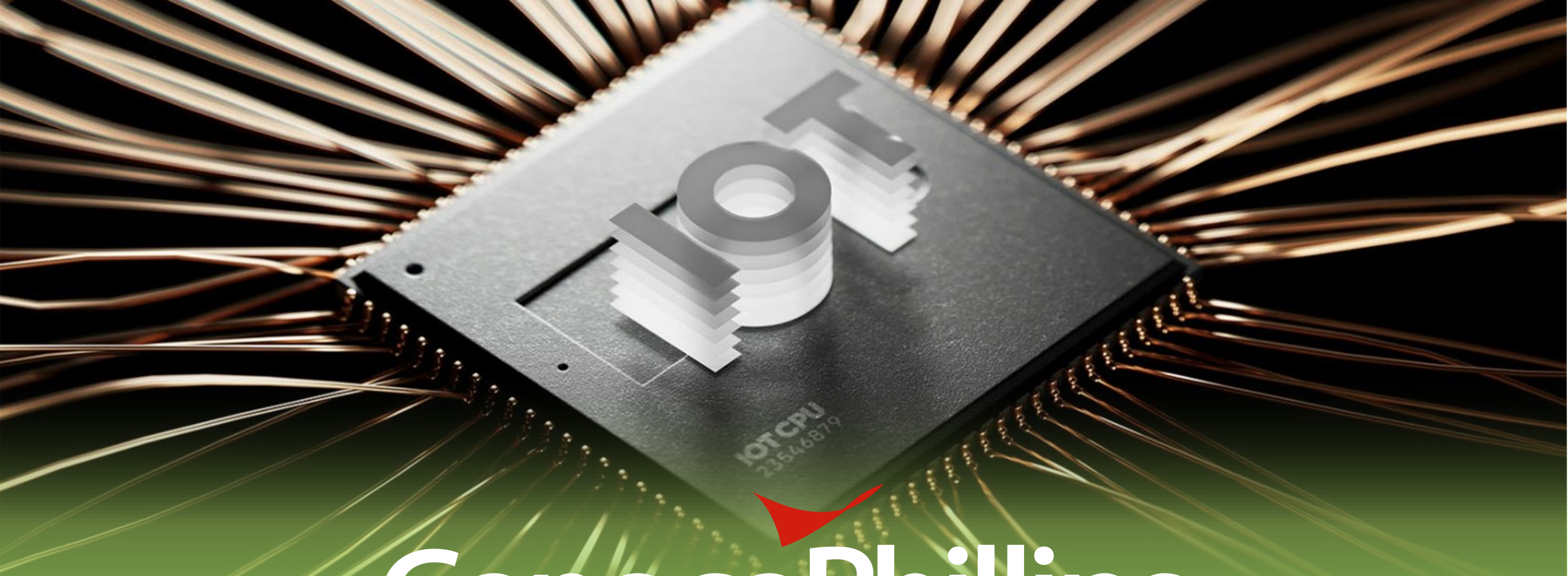

ConocoPhillips

IoT, Autonomous Systems, Process & People Behaviour – The Magic Combo

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Why are **Analytics** essential to IoT & Autonomous Systems?

"Data is inherently dumb, it doesn't actually do anything unless you know how to use it and how to act on it, because algorithms are where the real value lies; algorithms define action,"

November 2015 – Gartner Symposium 2015 in Barcelona, Peter Sondergaard, senior vice president and head of research at the analyst house

http://www.v3.co.uk/v3-uk/news/2433966/algorithms-key-for-turning-dumb-data-into-real-business-benefits

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Making Sense of Big Data

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IoT – Information lifecycle

1. Plan

- Start small, use available data
- Targeted outcome
- RIO analyze

2. Acquire

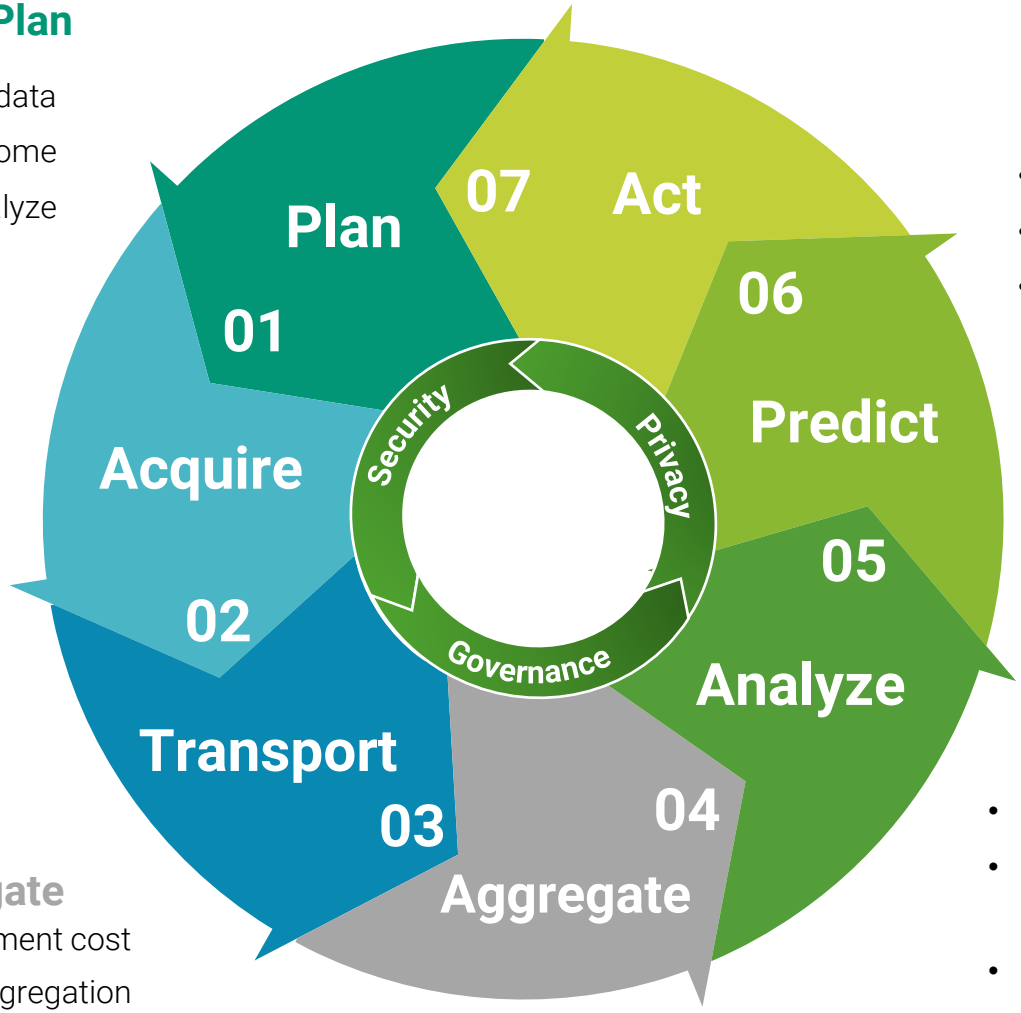
- Sensors, controllers and actuators
- Edge security and manageability
- Gateways

3. Transport

- Minimize bandwidth consumption and solution latency
- Ethernet, WiFi, Cellular, ZigBee, MQTT
- Edge/Fog Solutions

4. Aggregate

- Minimize data management cost
- Tiered data aggregation
- Cloud brokering



7. Act

- Tailored to specific situation
- Mobile applications
- Visualization layer

6. Predict

- Predictive models

5. Analyze

- Slice and dice data-sets to understand odd behavior
- Use machine learning to detect patterns invisible for humans
- Convert data into insights

Industry Case Studies

- Protecting Business Assets & High Value Commodities with IoT and Analytics

- IoT in Process Performance, Efficiency& Predictive Maintenance

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Protecting Business Assets & High Value Commodities with IoT and Analytics

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People Data from a Different Perspective

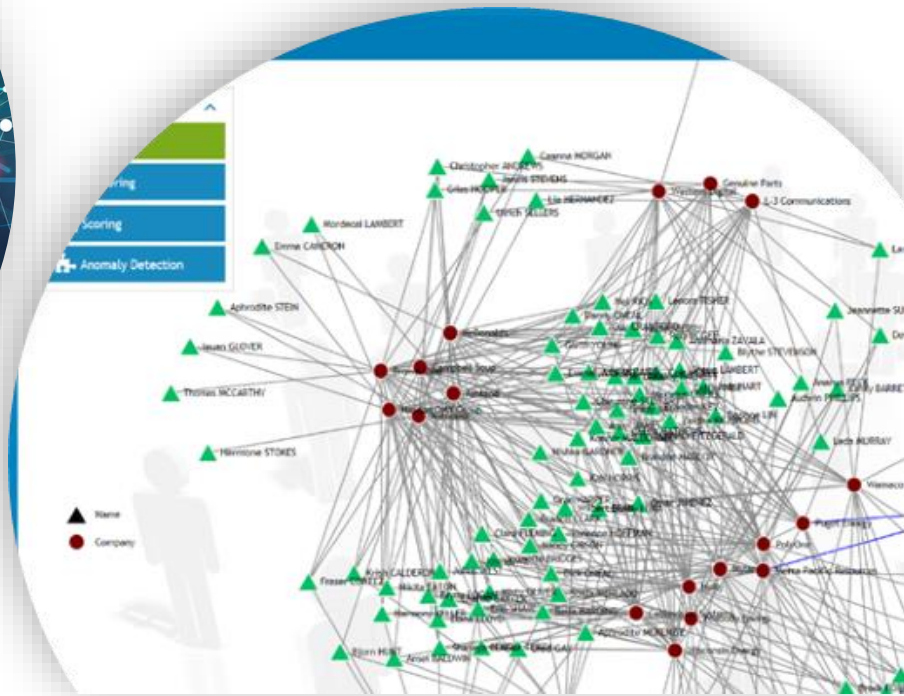
Questionable People Behaviour

- Movement outside of the norm
- Movement around High-Risk Incidents
- Irregular Sequences and Links of Behaviour & Movement

Network Analytics

- Who's talking to whom and how does it relate to Behaviours above
- Joining Intel from External Sources & Social Media

Manipulation of Security Systems & Procedures



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Joining People Data with Plant & Other Processes

Process Performance Anomalies

- Performance vs. Expected Target
- Unplanned Stoppages/Breakdowns & People at the Brim of this
- Irregular Sequences and Links of Behaviour & Movement

Irregular Behaviour of Systems

- Failure & manipulation of Monitoring & Security Controls
- Missing Data & Audits of Data Sequencing

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Bringing it all together – Adding Product Losses to the Mix

Manipulation of Checks & Balances

- Anomalies in Product Recoveries
- Irregular behaviour in areas with open access to High Value Products

External Sources of information

- Text Analytics on Unstructured information Reported
- Social Media Behaviour monitoring

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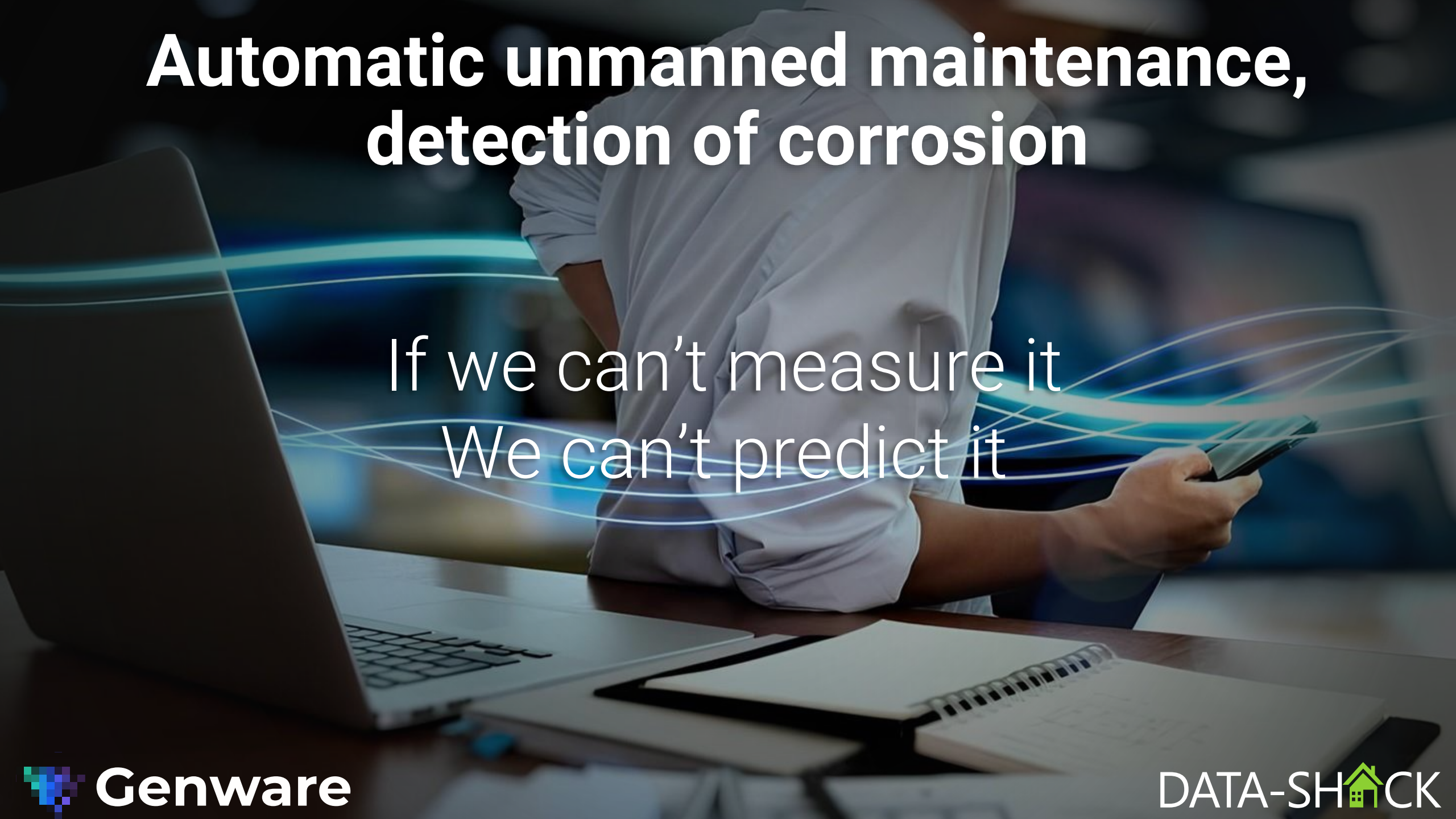
Keys to Success

Functional Task Team including:

- Domain/Business/Process Experts
- Security/Intelligence Industry Leading Experts
- Analytics Expertise & Extensive Experience
- Technology Expertise
- Correct & Efficient Deployment & Training
- Management Buy-in & Support

Automatic unmanned maintenance, detection of corrosion



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The Case...

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The Top-Drive

- Over 2000 sensors
- Mandatory total service every 5 year – VERY expensive
- Designed to run at 100% , 24/7
- Inspections & Repairs need to be fully Automated

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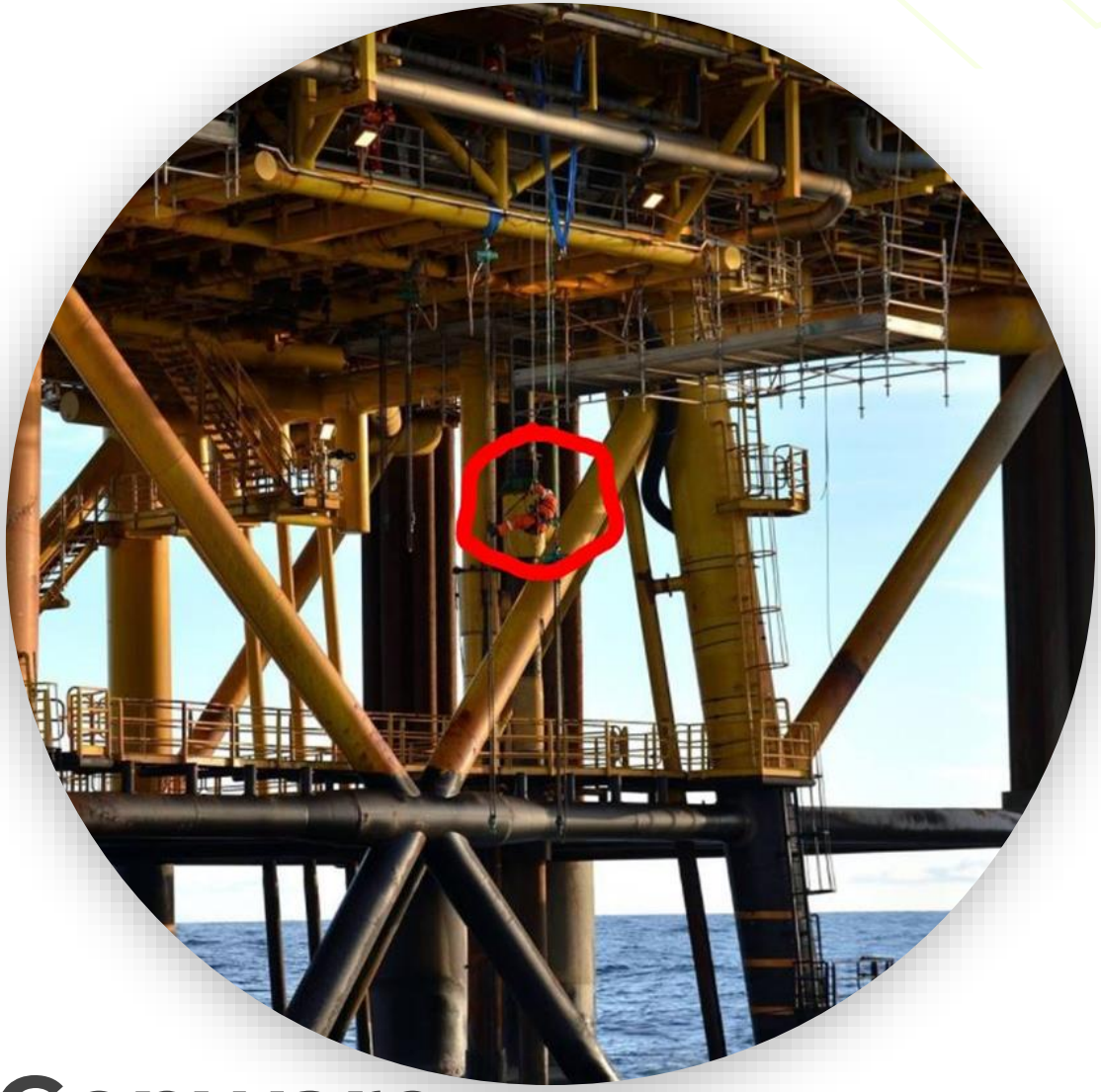
Platform Inspections



The Old Way…

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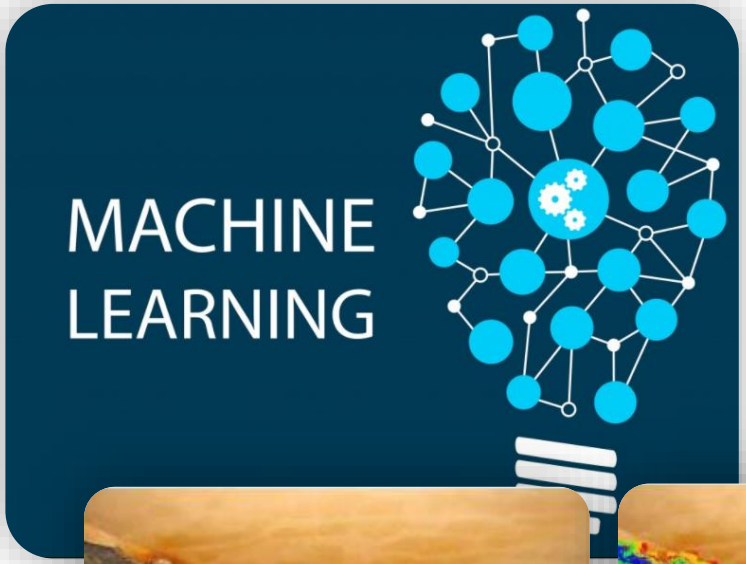
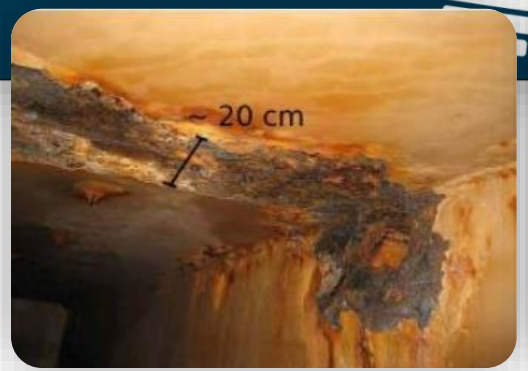
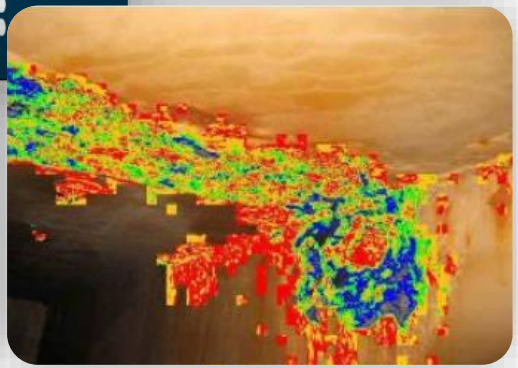
Platform Inspection Surveys the new way

Generation 1.0

Manually operated drone + Machine Learning for auto detection of corrosion







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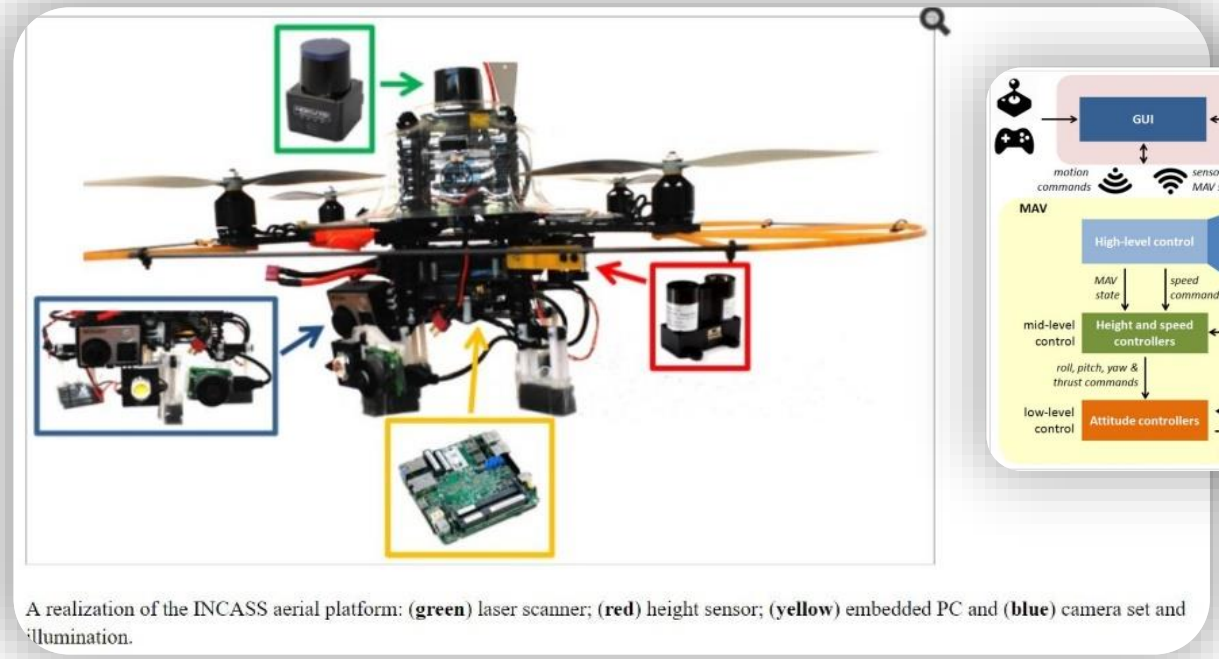
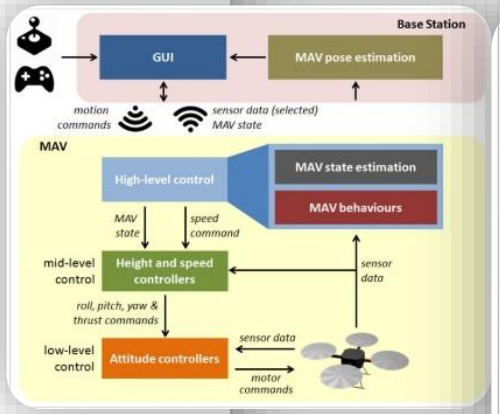
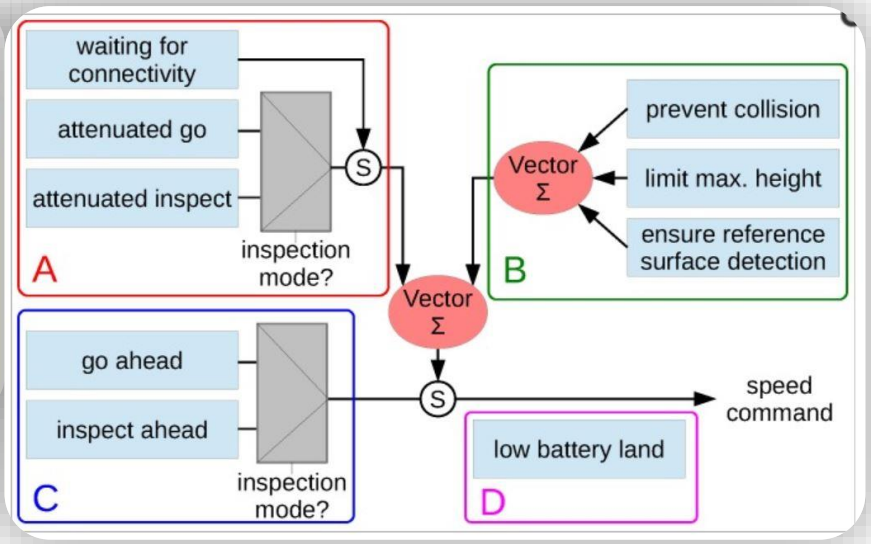
Generation 2.0

Fully automated drone inspection + Machine Learning for corrosion detection and tracking



A realization of the INCASS aerial platform: (**green**) laser scanner; (**red**) height sensor; (**yellow**) embedded PC and (**blue**) camera set and illumination.





All flights recorded, and can be done again automatic → **autonomous Drone and inspection**

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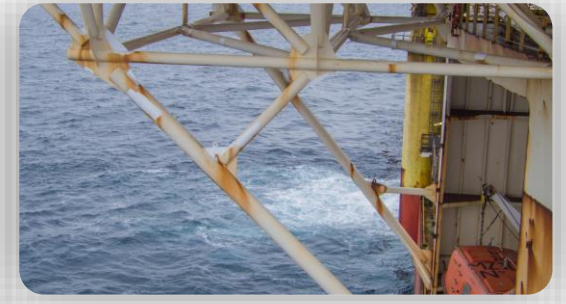
The Red Challenge



Also needed to add shape and surface structure

Where to start?

Convert this

To this, pixel by pixel

Spreadsheet created from file: C:\Users\Christer\Dropbox (Precise Prediction)\Precise Prediction_DSC7311.JPG

	7346 Var7346	7347 Var7347	7348 Var7348	7349 Var7349	7350 Var7350	7351 Var7351	7352 Var7352	7353 Var7353	7354 Var7354	7355 Var7355	7356 Var7356	7357 Var7357	7358 Var7358	7359 Var7359	7360 Var7360
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4122	12433081	12235704	12038325	11446960	10986923	10526632	9869472	9475741	9278362	8949656	8752277	8687511	8688025	8294296	8229016
4123	12301495	12366520	12234934	11643569	11249581	10658218	9869472	9409948	9278362	9015449	8818070	8753304	8753818	8228503	8229016
4124	12432567	12234934	12103348	11577776	11315374	10920876	10001058	9672350	9344155	9015449	8949656	8884890	8688025	8227989	8294296
4125	12629946	12366520	12037555	11511726	11380397	10920876	10132644	9869729	9475741	9147035	8884377	8884890	8622232	8096917	8294296
4126	12761532	12629178	12168627	11511726	11314604	10855083	10264230	9935522	9475741	9081756	8752791	8490646	8622232	8228503	8228503
4127	12761532	12563385	12037041	11642542	11380140	10789290	10264230	9738143	9278362	8950170	8818584	8424853	8622232	8294296	8162710
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4132	12102318	11050660	10195866	9999514	9408151	8685455	8818325	8621205	8555925	8491416	8557209	8229016	8163223	7901079	7835286
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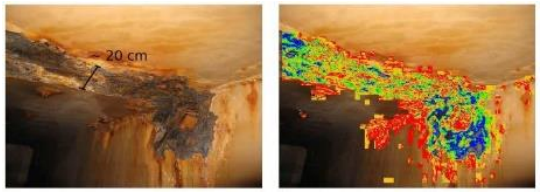
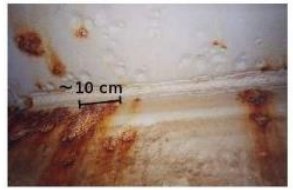
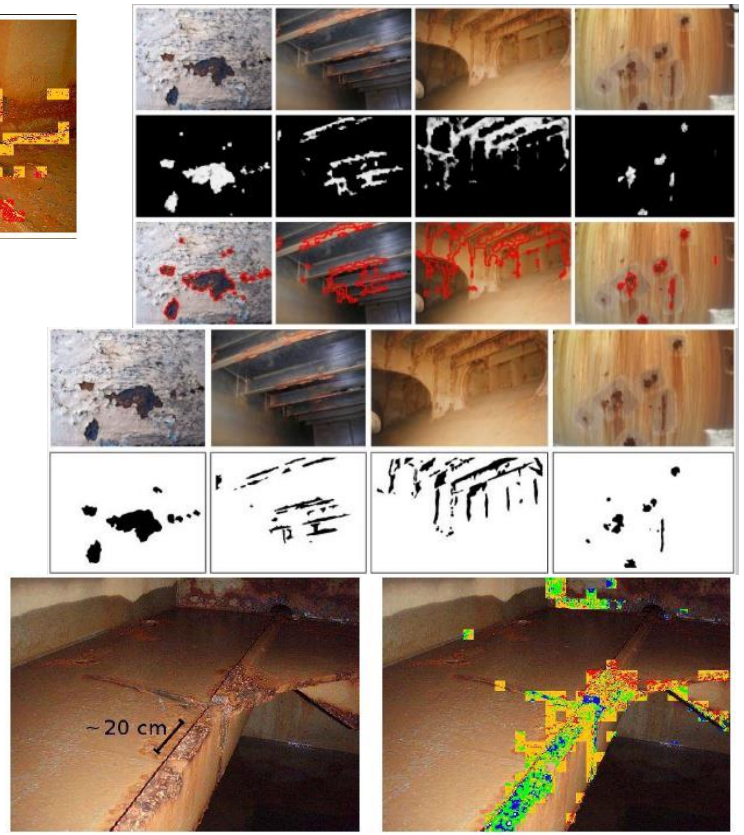
Some Examples





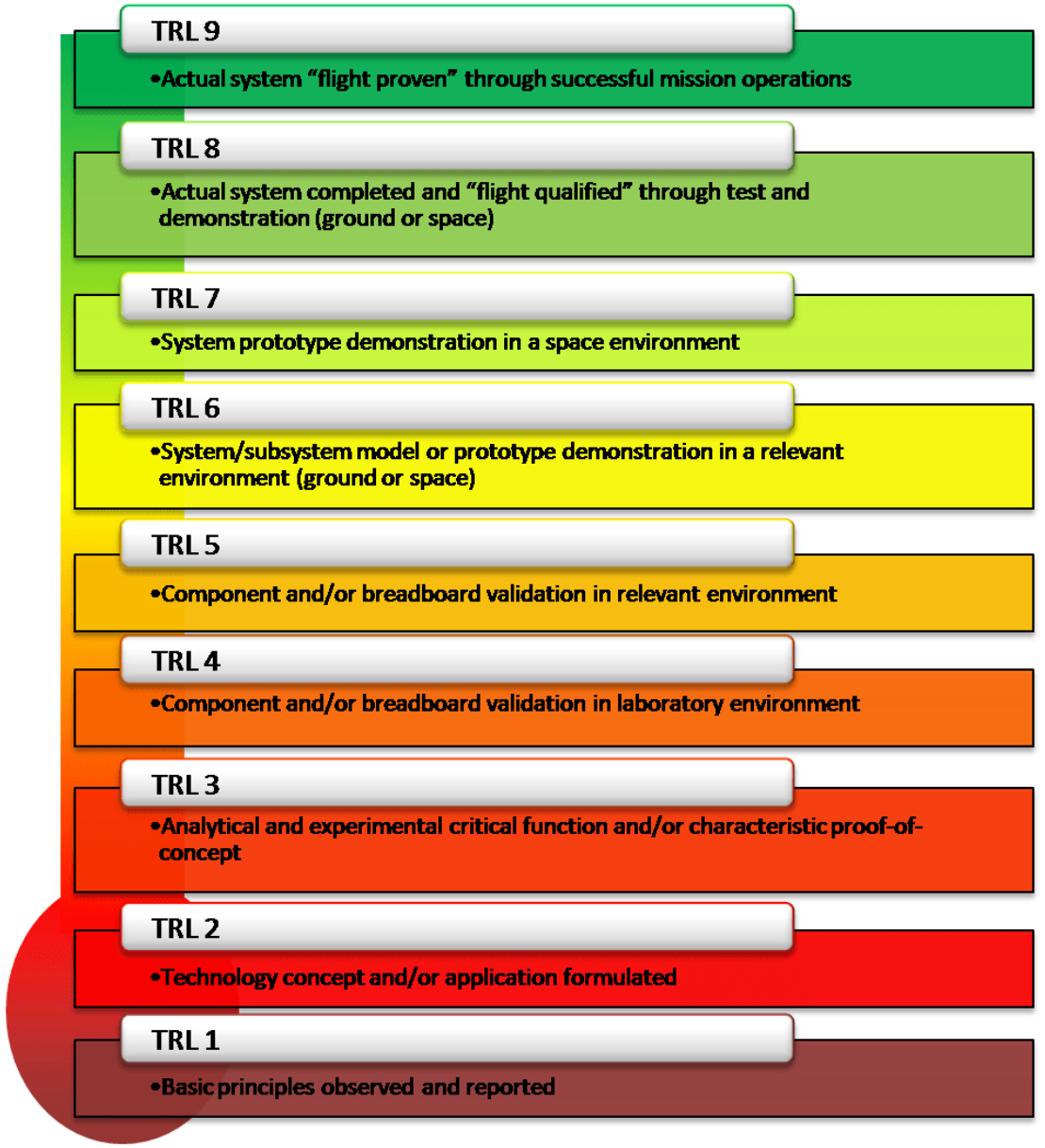
Corrosion Score

#234	0.32
#123	0.31
#324	0.27
#763	0.26
#352	0.24
#765	0.21
#675	0.20
#943	0.18
#629	0.14
#662	0.14
#834	0.12
#536	0.10
#735	0.08



How far are we now…

THIS PROJECT GOT US TO LEVEL 9



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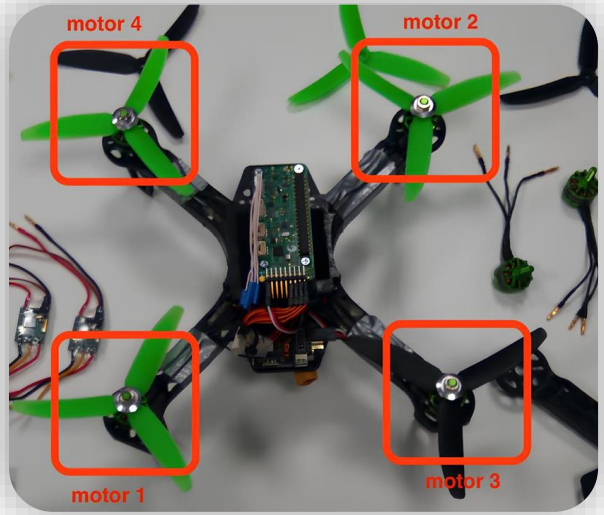
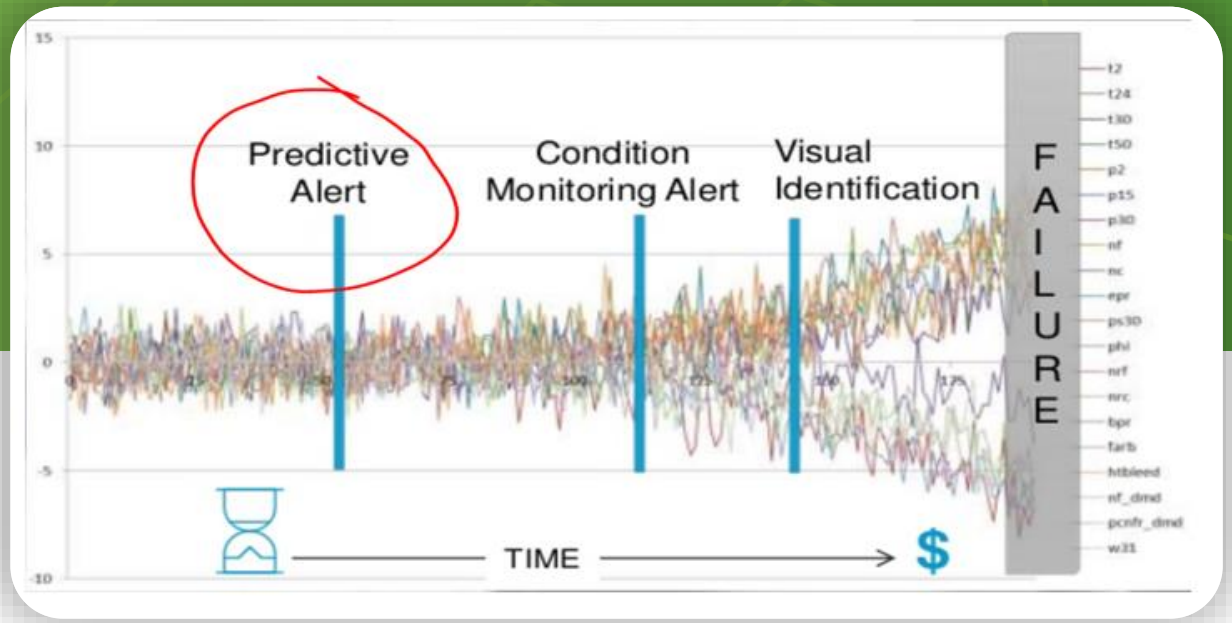
Predictive Maintenance of the Drone Itself

The picture shows sensor data from a case were the drone crashed because of a rotor failure.





Available data was analysed and showed that the cause showed up in the data several flight hours before the crash.

When we added this intelligence to the drone, the drone took a decision to fly back to base and “asked” for the rotor to be replaced when needed.

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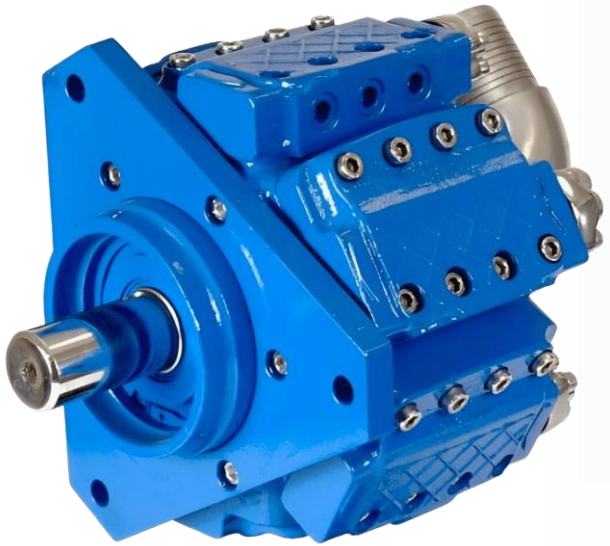
Process optimization

Analyses for proactive Maintenance



Automatic Alarms

Maintenance To-Do list based on actual needs

UnitID	Maintenance Score
#234	0.32
#123	0.31
#324	0.27
#763	0.26
#352	0.24
#765	0.21
#675	0.20
#943	0.18
#629	0.14
#662	0.14
#834	0.12
#536	0.10
#735	0.08

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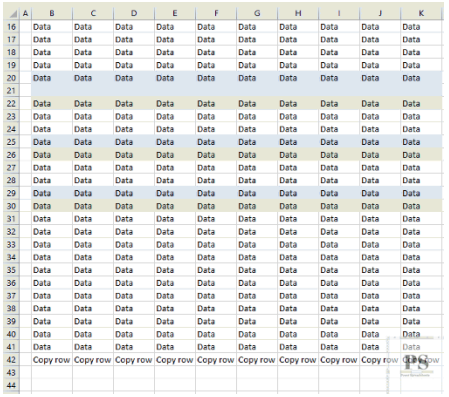
Reactive Input - Proactive Output

Component I

Component II

Component III

Component IV



Data is translated into the same language and format

Data is analyzed and provides feedback on operational deviations in the components or in the interaction between these and the analysis module addresses learning

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Benefits

Benefits of Drone predictive maintenance

Security: More secure and reliable equipment & drones

Economy: Avoid expensive shutdowns & repairs

Optimized maintenance cycles: The equipment & drones let you know if and when any parts need to be replaced.

Safety: Save lives by not doing unsafe inspections

Intelligent PPE: The Hawk – Use Case

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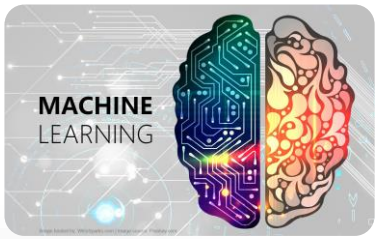
Connected Intelligent Equipment, Cameras & Drones

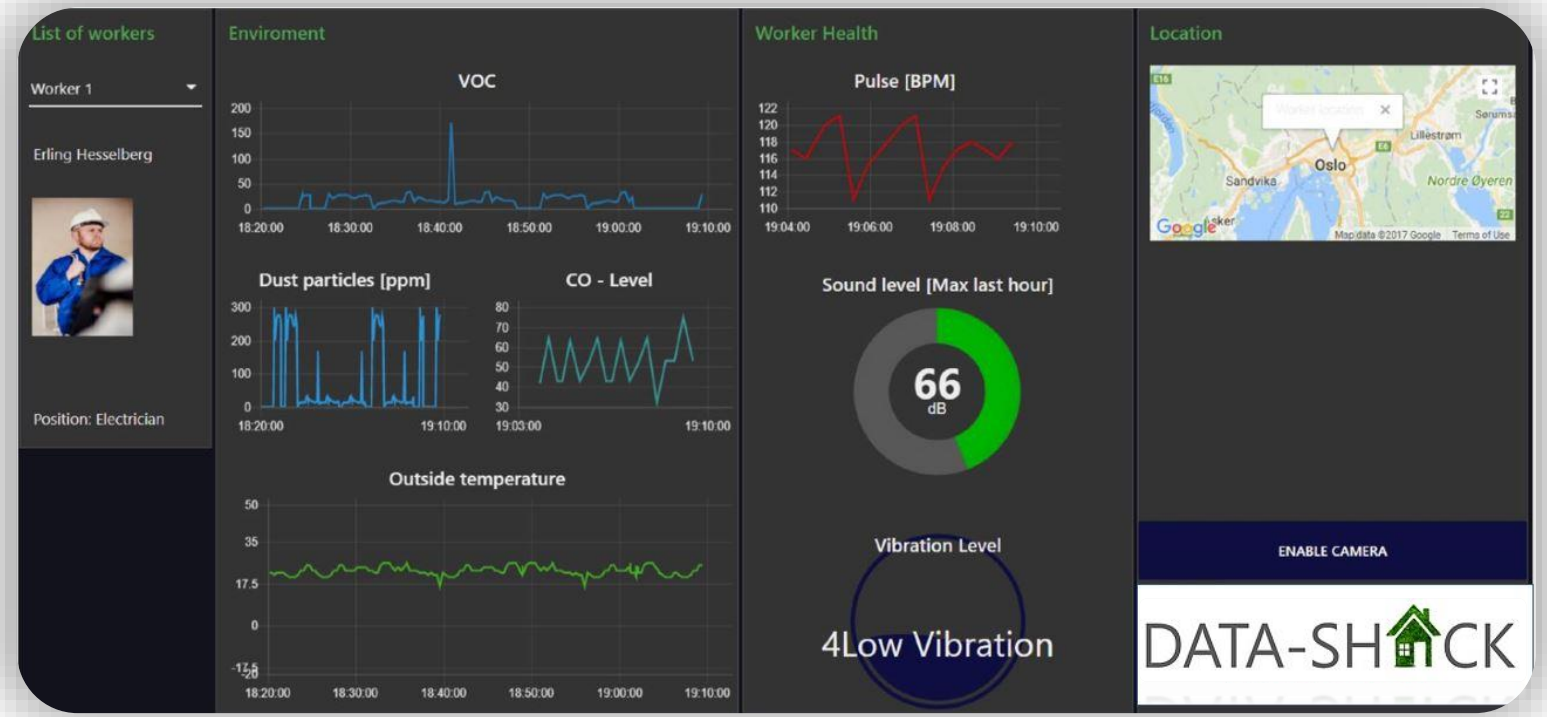
Drones

Mini computers

Sensors

MS Azure (Data Lake) IoT Cloud





All presented in a live Dashboard

IoT Intelligent Drones

Intelligent Drones with sensors and Edge ML
Our Machine Learning for Drones will make the drone intelligent

Examples of sensors

- Sound
- Light
- GPS
- Dust
- Gas
- Vibration
- Gyro
- Air Quality / Air Pollution (many different sensors)

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