

# Drones for inspection at DSM

EPSC WG Digitalization

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NUTRITION · HEALTH · SUSTAINABLE LIVING



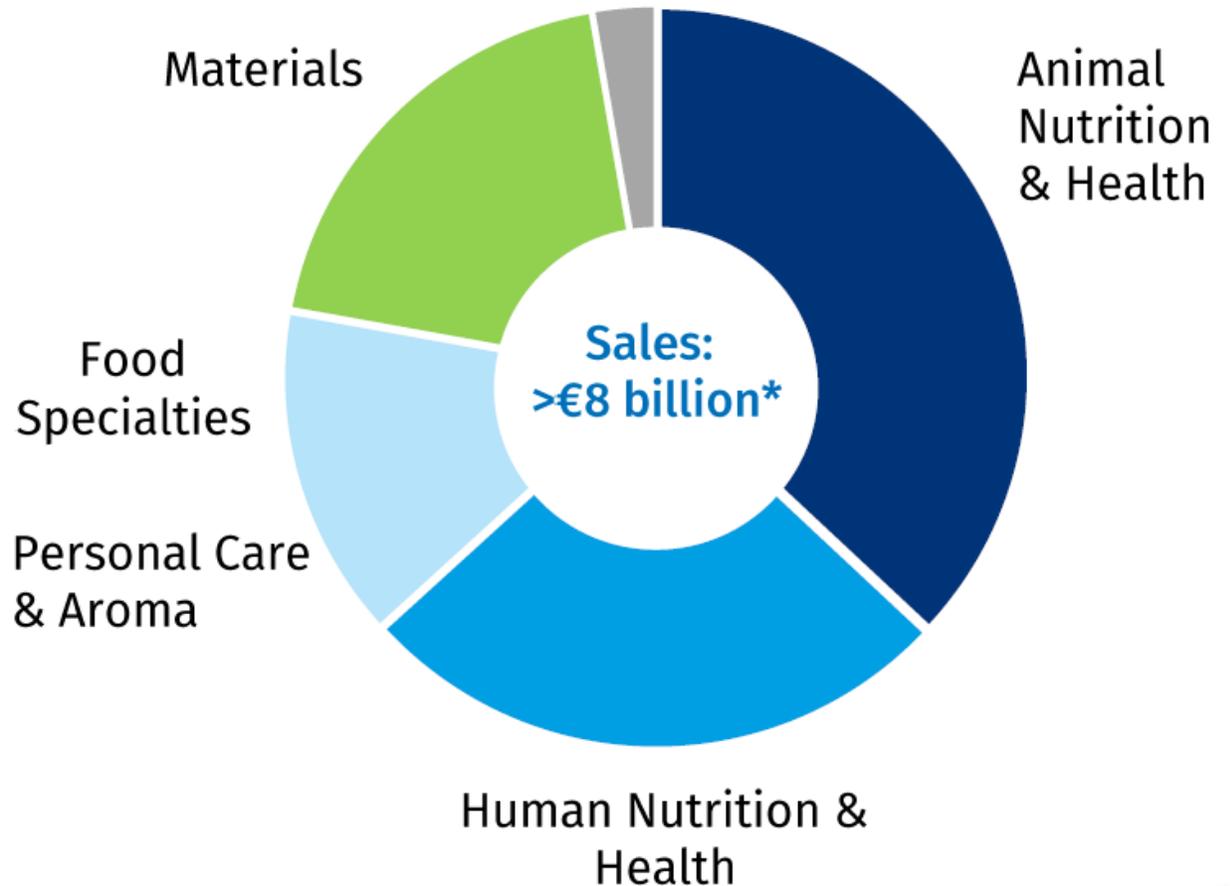
**DSM**

BRIGHT SCIENCE. BRIGHTER LIVING.

# DSM at a glance

## 2020 numbers

- Global company with ~80% of sales in Nutrition and 43% of sales to high-growth economies
- Intrinsically innovative with 20% of sales from products launched in the last 5 years
- Highly engaged workforce across the world of ~23,000 employees\*\*
- Purpose-led strategy aligned with the UN Sustainable Development Goals
- ESG (Environmental, Social and Governance) leader in MSCI and Sustainalytics



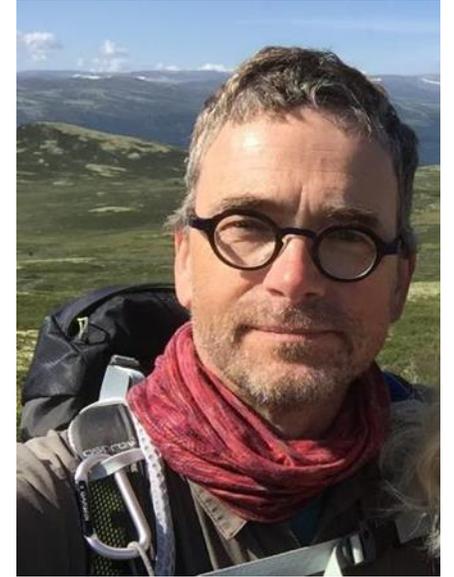
# Agenda - setting the scene

*It's about inspection, not drones*

## Subjects:

- What makes the drone: aeronautics - sensor - both
- Place of drones in the inspection landscape:  
**reduce confined space entry / improve safety**
- Drones as an interlude between in person inspections and sensor data collection
- Quality of drone images
- Interpretation of drone images - acceptance by authorities
- Drones doing NDT
- Examples
  - Applications in hazardous locations
  - Applications for efficiency

Presenting:

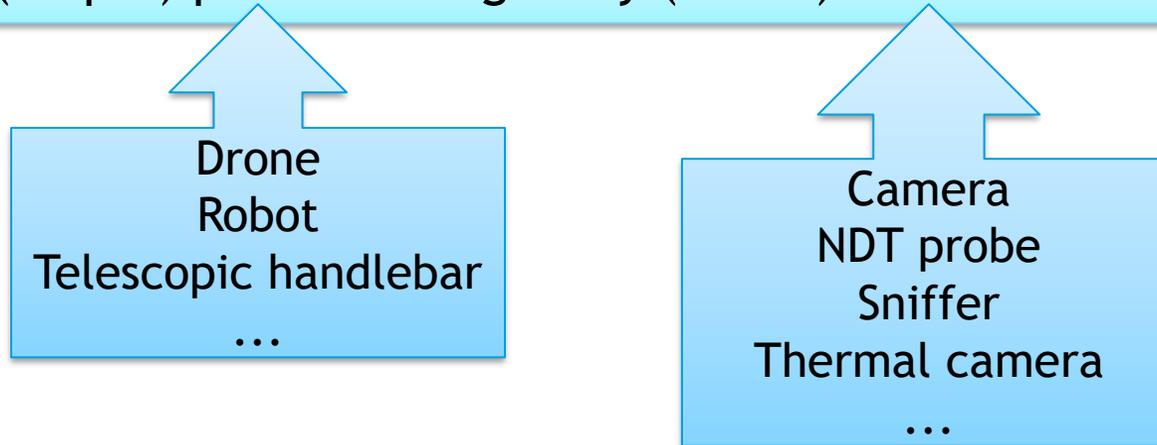


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# Drone - definition

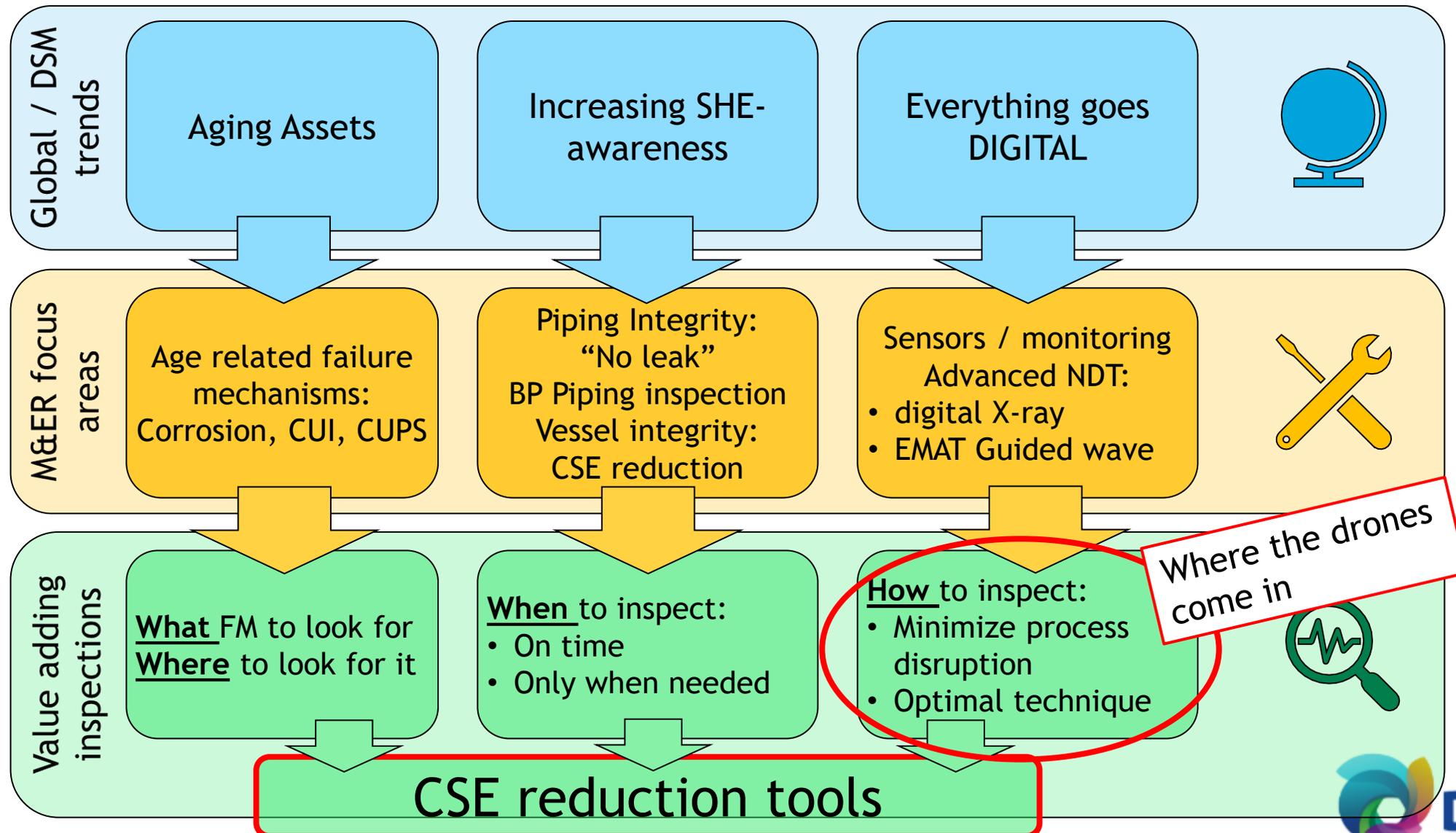
A drone is a (stupid) platform to get my (smart) sensor to where and when I want it



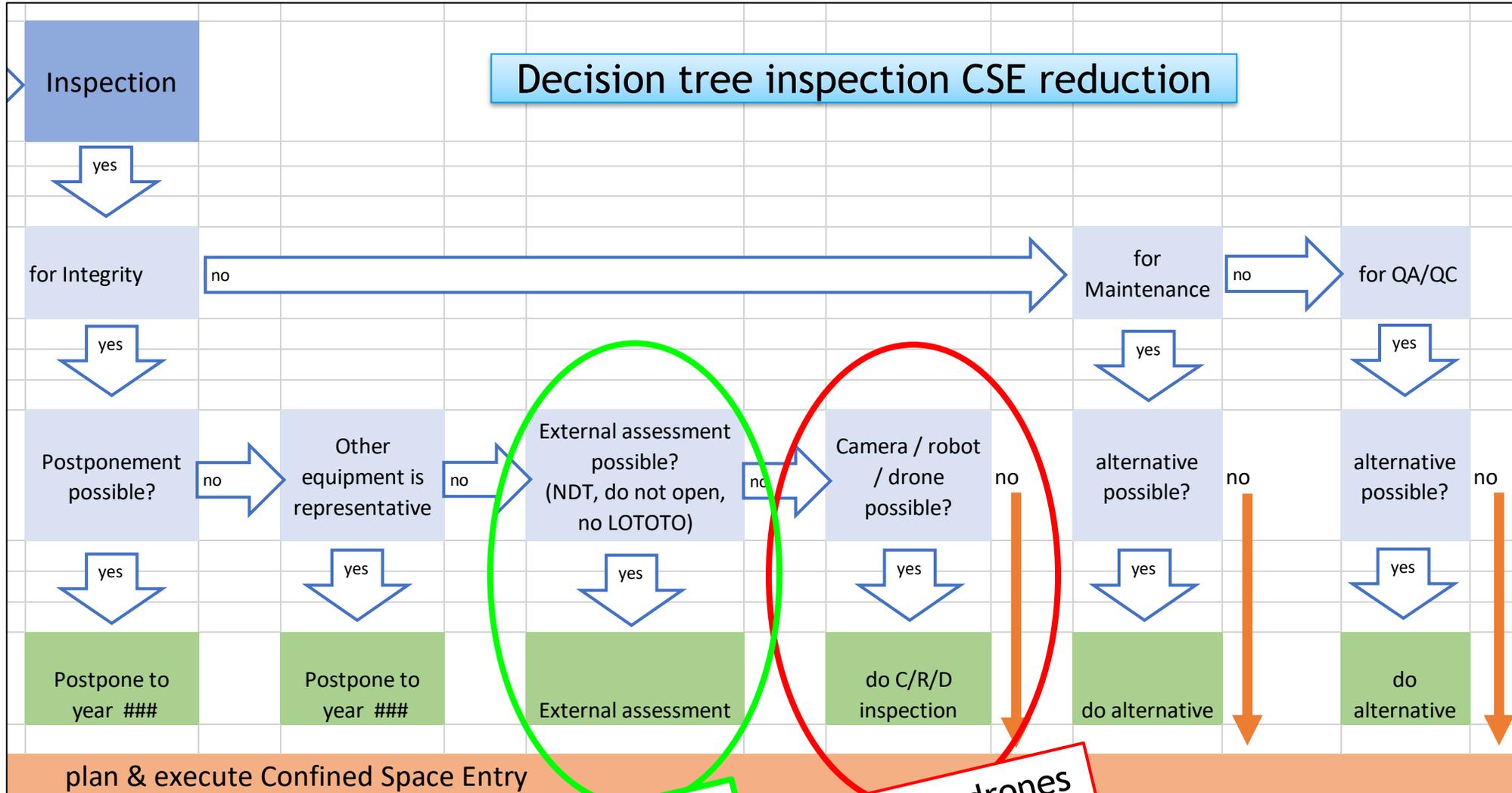
Digitalization drives sensor development and deployment;  
more and better sensors will reduce the need for drones as a delivery platform.

*“In the past my phone had a cord (and was always on);  
now it has three cameras, GPS and Lidar” (and a dead battery sometimes)*

# CSE reduction in larger perspective + role of drones



# Options to prevent / reduce inspection CSE



Sensors!

Where the drones come in

# Roof Inspection supported by Drone @ DPM Heerlen

Technology supports Safe &  
Efficient Operations



Picture 1: The roofs of DPM Heerlen

The Maintenance Department of DPM Heerlen is continuously looking to optimize their performance, especially if there is an important safety issue involved.

Therefore they performed the roof inspection with the support of a drone. The drone, equipped with a high resolution camera, flew over the facilities. The inspector gave the drone operator instructions where to fly, to zoom in and where to take pictures for evidence. The whole inspection took only 4 hours.

Next to the improvements on safety (no longer working on heights) and efficiency, the images captured by the drone were used to generate a

- Less working on heights → improved safety
- Less time needed → from 40 to 4 hours for the whole inspection
- 3D model of the roof created → better and easier future maintenance of the roof

# Drone Tank inspection Arcadia (2017)



- Main objective: prevent confined space entry
- SEE: <https://www.youtube.com/watch?v=dW-5PTej3R4>  
“drones and guns and motorcycles” - own experiment
- Done in 2017: image resolution adequate?
- Inspection of spray-dryer (no internals, explosion suppression membranes)
- Inspection of T-9020: agitator inside



# Drone and camera inspection of half-filled storage tank (2018)

Drone inspection

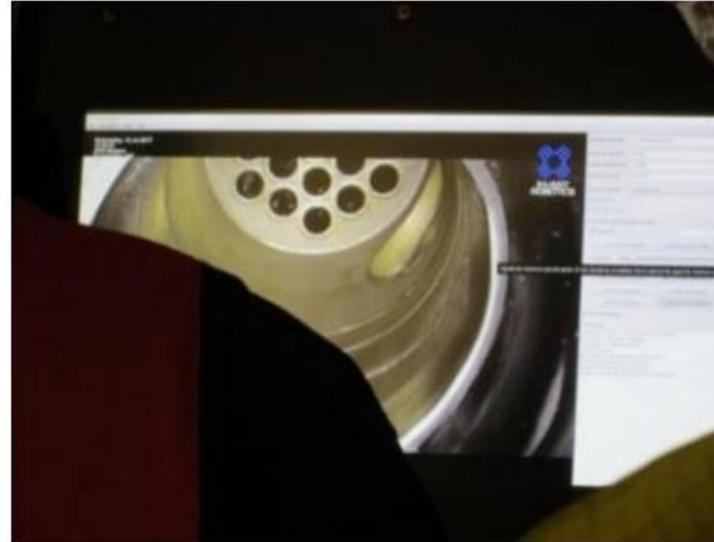


Camera on robotic arm



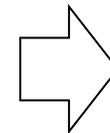
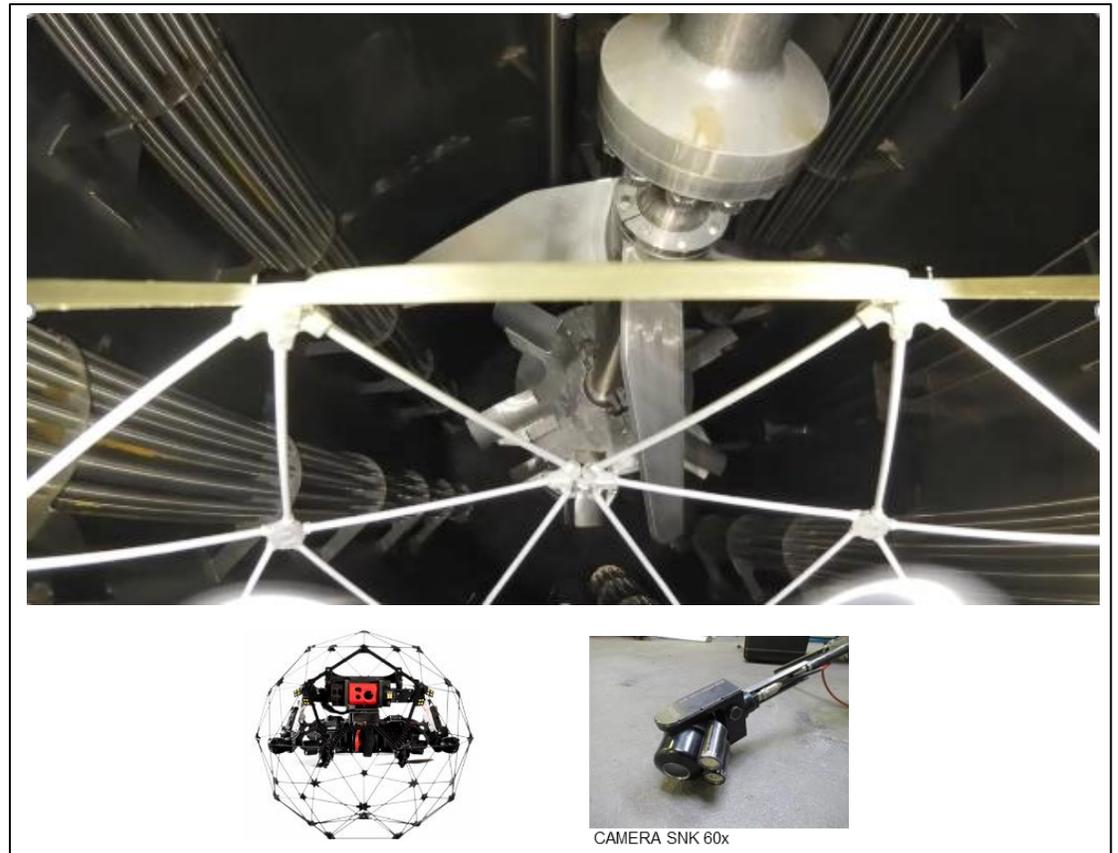
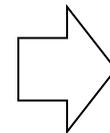
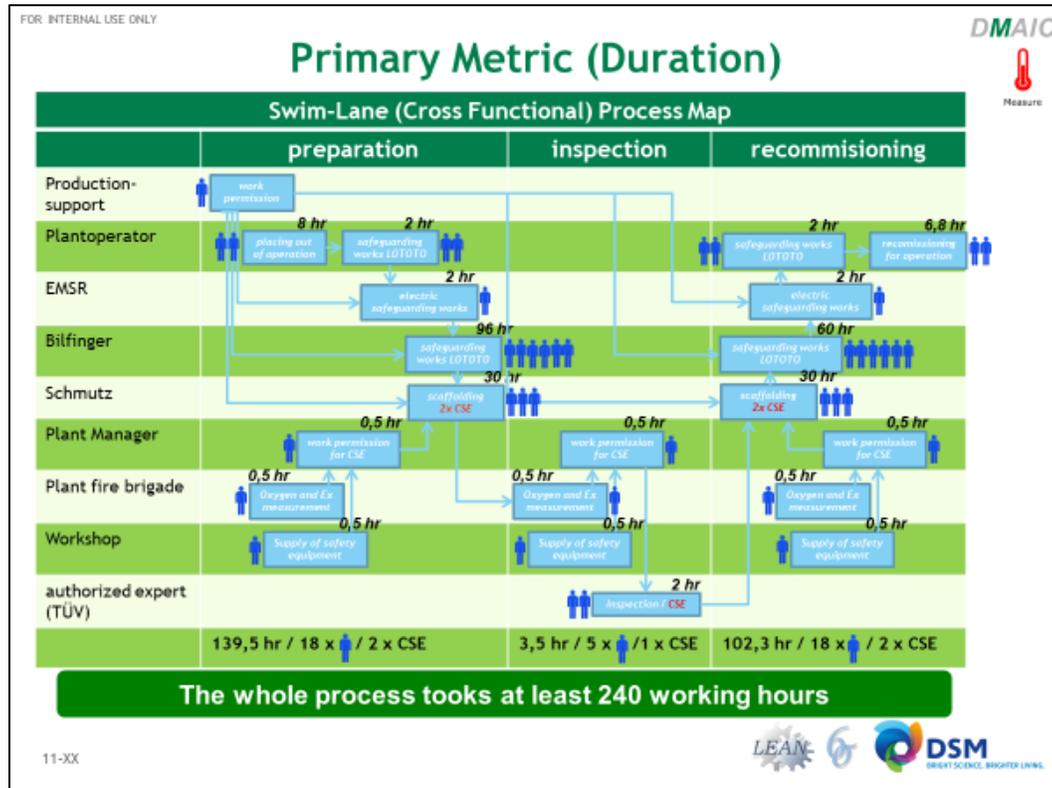
- C-steel tank, 20 m diameter
- Inspection of roof supports
- Drone/camera: 2h, k€ 1, no downtime
- Traditional: empty, clean, scaffold: 6-8 weeks, k€ 200
- Drone can't cope with rain or wind

# TÜV Inspection confined space with robot (2017)



- Traditional: 5 yearly internal inspection of the vessel together with an expert from TÜV, including confined space entry.
  - In 2017 we performed the inspection with a robot camera system, with approval of the TÜV inspector.
  - Excellent image (better than drone)
  - Longer operational time (hours)
  - Movement is slow, less versatile
  - More expensive than drone, less than confined space entry
- 
- Remark from TÜV inspector:  
*“It’s hard to watch on the screen, but more comfortable compared to entering the vessel.”*

# Fermenter inspection with drone and camera (2020)

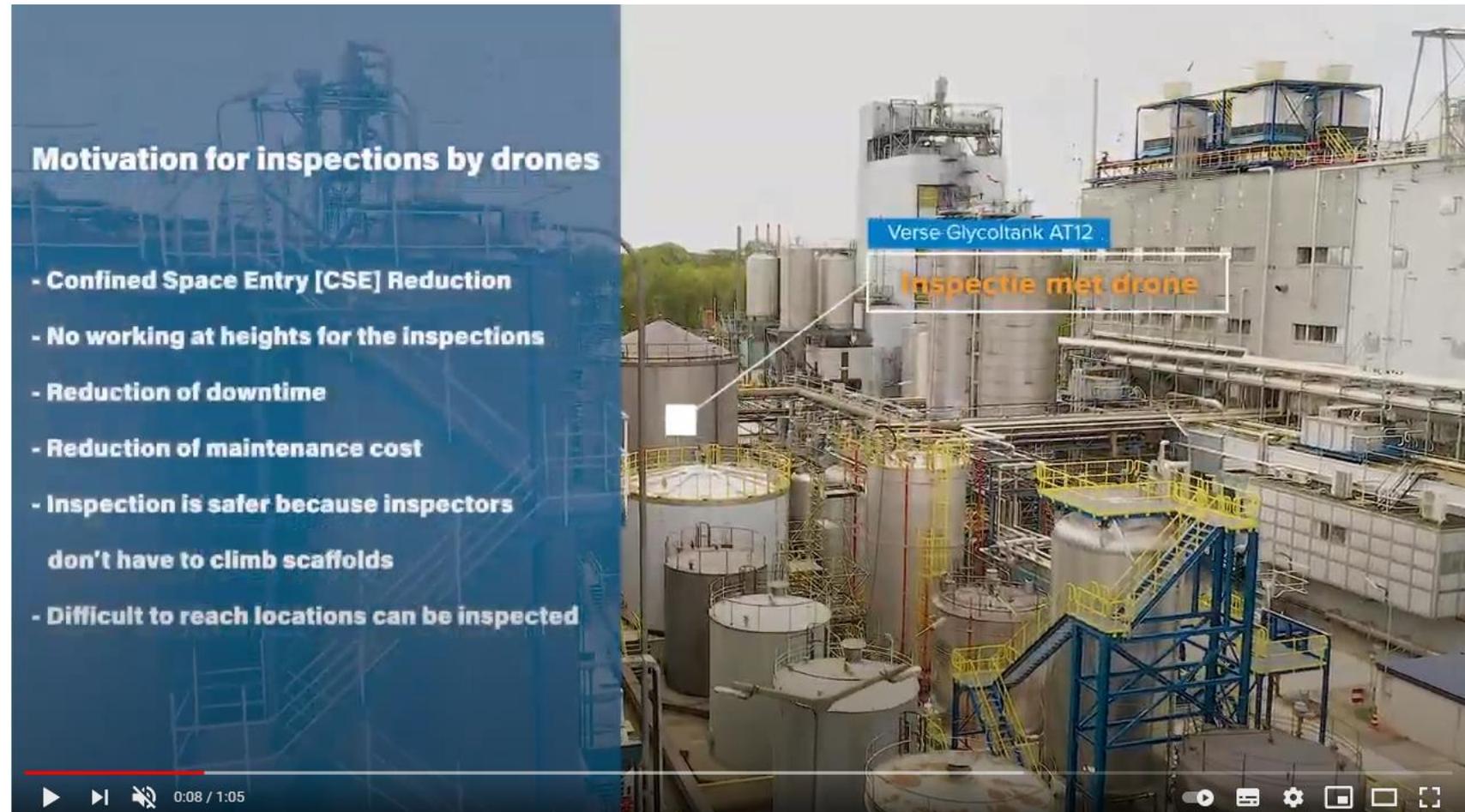


Before: 240h work for 2h inspection with CSE

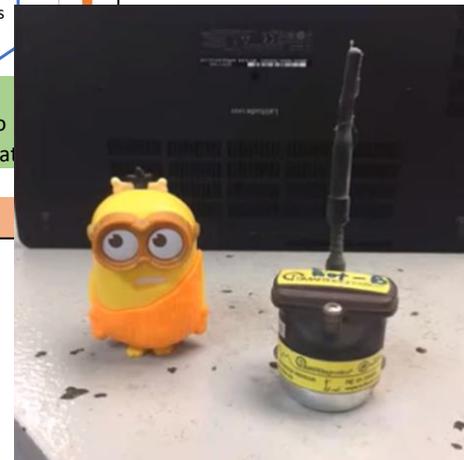
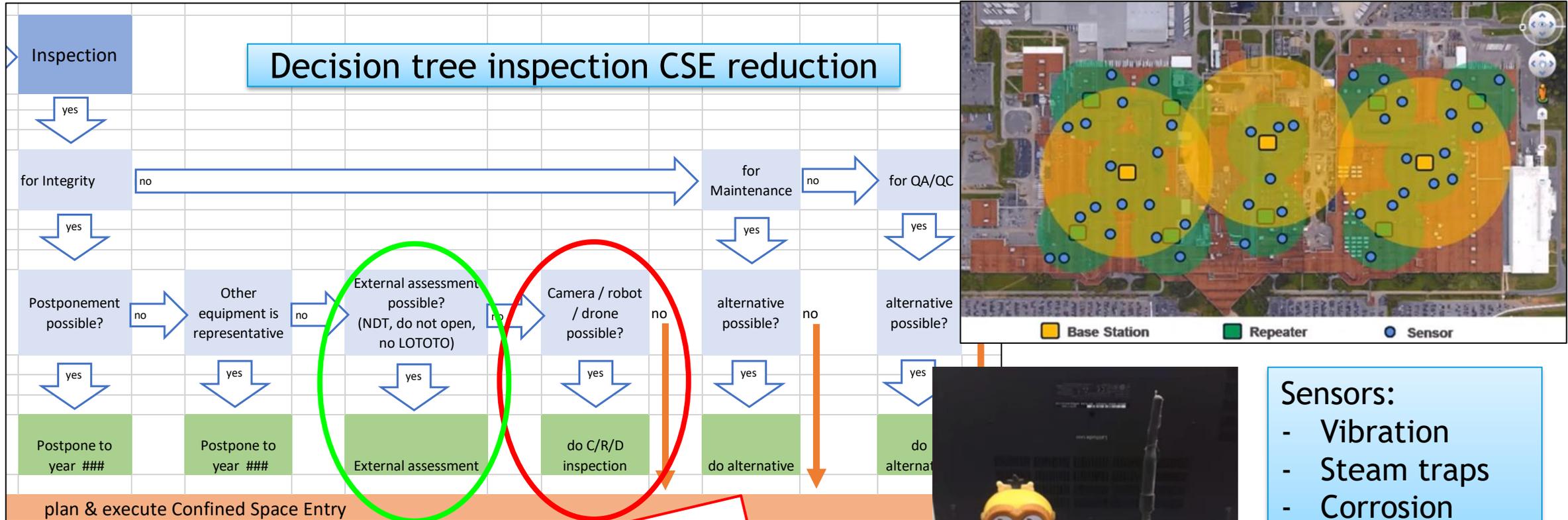
Now: 4h work for complete inspection with camera / drone, no CSE  
Image quality is good and stable

# Tank inspection Emmen: visual + NDT

- <https://www.youtube.com/watch?v=K647e6vXtxk>
- Visual inspection
- Ultrasonic wall thickness measurements



# Drive from drones to (continuously monitoring) sensors

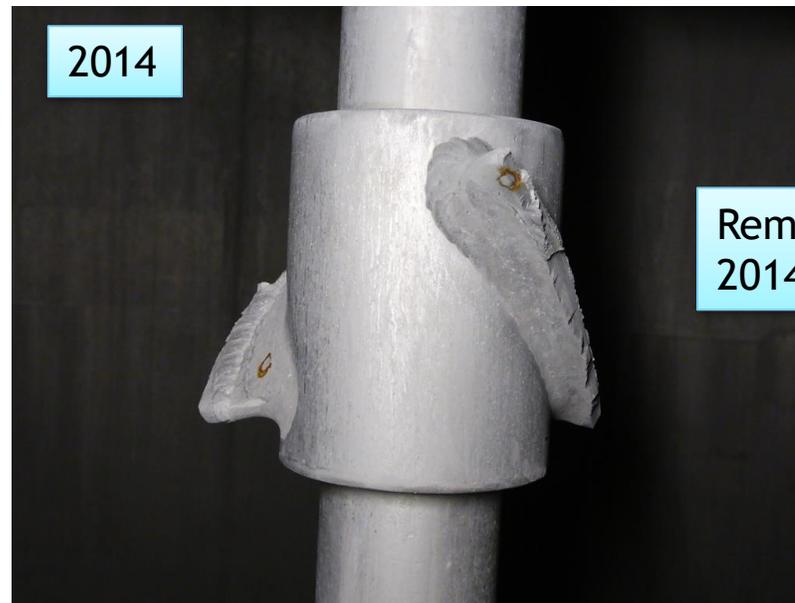


- Sensors:**
- Vibration
  - Steam traps
  - Corrosion
  - ...

**Sensors!**  
**Continuous**  
**Where the drones come in**  
**Sometimes**

# Quality of images adequate for interpretation?

Agitator blades are OK?



# Summary

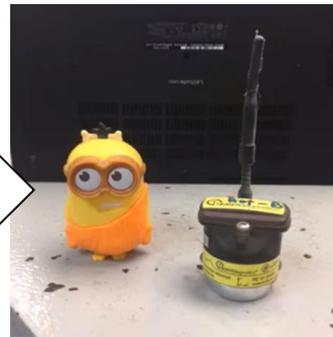
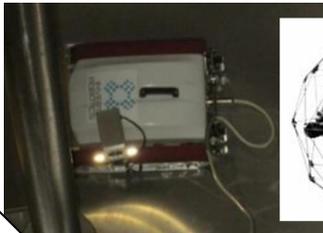
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# Next steps

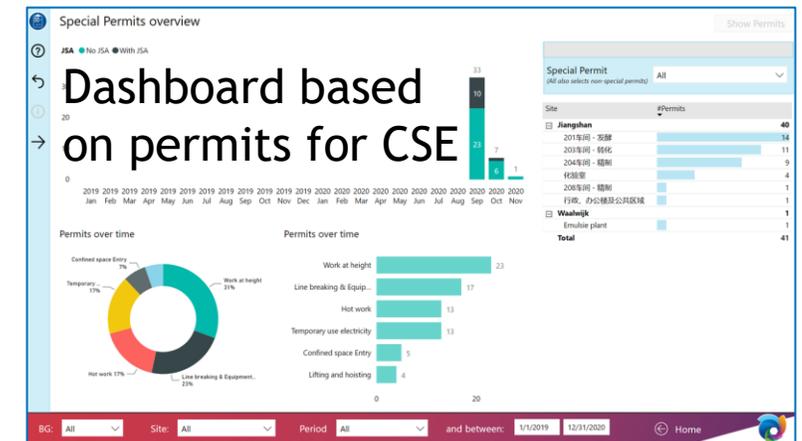
- Drones improve safety: prevent confined space entry
- Drones improve efficiency (e.g. inspection of roofs, chimneys)
- Drone-sensors are mainly visual, NDT is emerging
- Non-entry inspection (= no drone) preferred

## Future developments:

- More sensor inspection capability
- Drones for cleaning & repair?
- Automated drone image interpretation
- Dashboard to monitor reduction of CSE



Smaller vessels may require no more than a GoPro camera for adequate inspection.



# Questions?