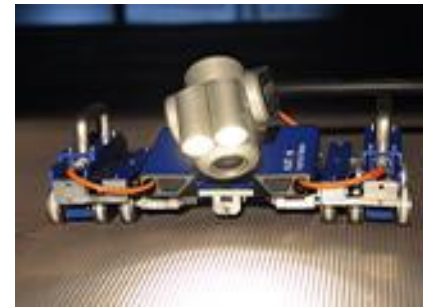




Aerial Robotics in industrial use for inspection and maintenance

Industrial demands, technologies and existing barriers



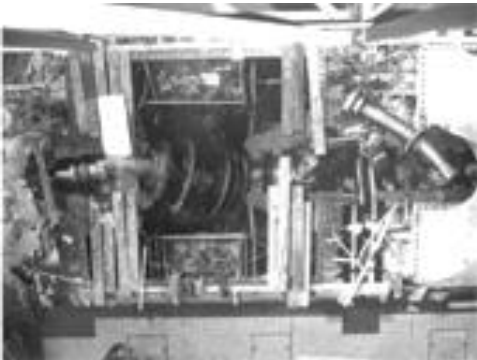
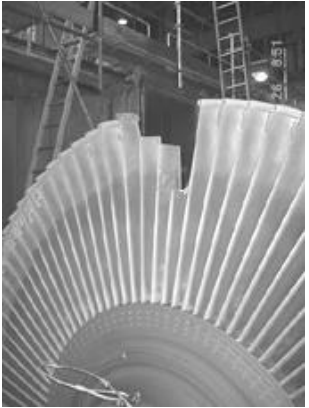
Ekki Zwicker
CEO

Inspection Robotics

Case Power Generation

When things go terribly wrong the economic impact

Steam Turbine



Generator



Boiler



Gas Turbine



Average Power
Plant Age ≈ 35 y
300 MW off the grid
unplanned ≈ 1 Mio € / d

Industry characteristics

- aging infrastructure
- economic pressure
- new business models & mode of operation
- tighter regulations

Petrochemical Industry

When things go terribly wrong ... the economic impact



theguardian

BP oil spill: judge grants final approval for \$20bn settlement

The settlement, first announced in July, will cover environmental damage and other claims by the five Gulf states and local governments, paid out over 16 years

Human safety risk exposure due to ...



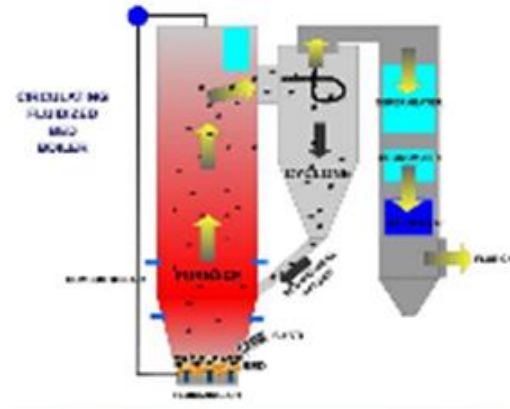
working in height ... working in confined spaces ... hazardous environment



A broad variety of potential & promising applications !!

11 scenarios identified

- #1 Combustion chamber inspection
- #2 Flue stack pipe inspection
- #3 district heating network inspections
- #4 hydro power turbine inspection
- #5 hydro power tail water environmental inspection
- #6 overhead power line inspections
- #7 wind power blade inspection
- #8 dam inspections
- #9 Reactors /Columns Inspection
- #10 Furnace Inspection
- #11 Tank Inspection



Drones are a commodity, autonomy is getting a commodity ...

Intel Acquires Drone Company Ascending Technologies



Aaron Tilley, FORBES STAFF
FULL BIO ▾



Intel CEO Brian Krzanich demonstrates the collision avoidance capability of an AscTec Firefly multi-copter drone with Intel RealSense cameras at 2015 CES. (Photo by Ethan Miller/Getty Images) [-]

Shop for drones



DJI : Phantom 3
SE - Wit
€ 579,59
Centralpoint.be
Free shipping
By Google



DJI : Phantom 4
Pro - Wit
€ 1.765,39
Centralpoint.be
Free shipping
By Google



DJI : Phantom 4
Pro+ Obsidian...
€ 1.922,69
Centralpoint.be
Free shipping
By Google



Sky Eye Prime
thermische drone
€ 27.500,00
Camera IR
By Google



Amewi Mini Fpv
Drone Explorer...
€ 53,99
Conrad.be
Free shipping
By Vergelijk.be

Sponsored ⓘ



Integrated Services are getting a commodity ...



WORKFLOW MANAGEMENT

- > Risk-based inspection and maintenance workflow optimization

AUTONOMY AND ROBOTICS

Aerial



Subsea

Avitas Systems, a GE Venture



Detect, Compute, Analyze, Classify



- > Deep model that detects corrosion
- > Deep models that determine level of severity
- > Transfer learning from existing pretrained deep models

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The Role of Flying Robotics

- **Flying robotics (drone inspection)**
 - Contact free inspection (visual, thermography, ...)
 - Semi-autonomous / autonomous operation
- **Areal workers**
 - Aerial robotic manipulation by the flying robots (cleaning, inspection, repair)
 - Semi-autonomous / autonomous operation
- **Areal workers + mobile robotics:**
 - Transporting & maintenance of mobile robots by aerial worker
 - Semi-autonomous / autonomous operation

Getting the tools into the hands of service providers speeds up the industrial application Start simple or even trivial!

