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a QinetiQ company

Power network monitoring with DAS

Fault detection and damage prevention

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OptaSense Inc.

Part of the **QinetiQ Group**, a UK based multinational R&D organisation ($1bn annual)

OptaSense founded in **2007**

Approximately **160** staff

Over **150** patents filed

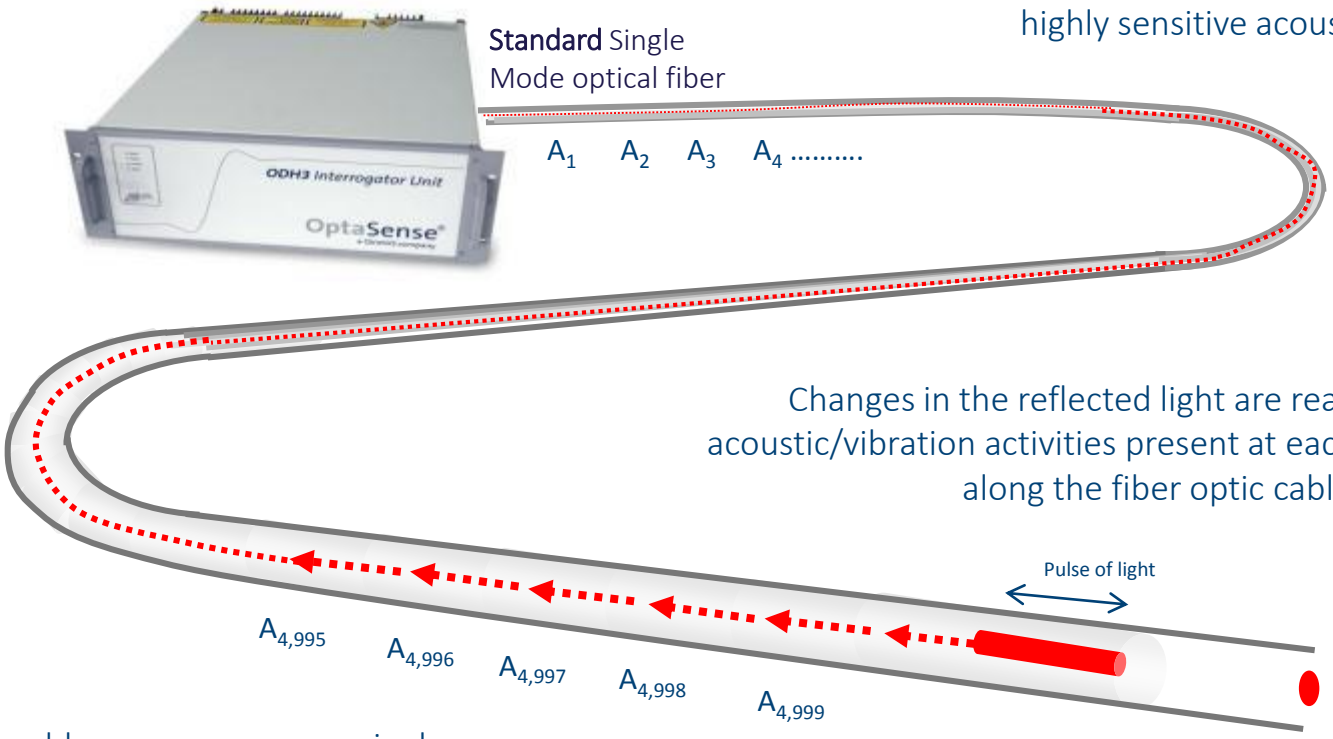
Headquartered in the UK with offices in the USA, Canada, UAE and Australia

Over **500** systems installed and commissioned in over **50** countries (20,000 miles)

OptaSense Operations Centre, Calgary

Distributed Acoustic Sensing

OptaSense® employs a coherent reflection technique which uses the **Rayleigh** backscatter phenomenon to convert the fiber into a highly sensitive acoustic sensor



Deployable on very common single-mode G.652 or G.655 fiber optic cables

Up to 25 miles per unit

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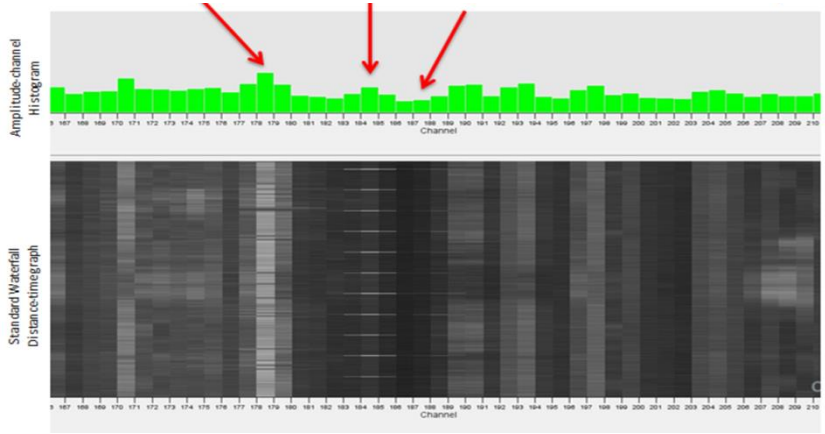

Cable fault detection

Online and offline fault detection with high accuracy

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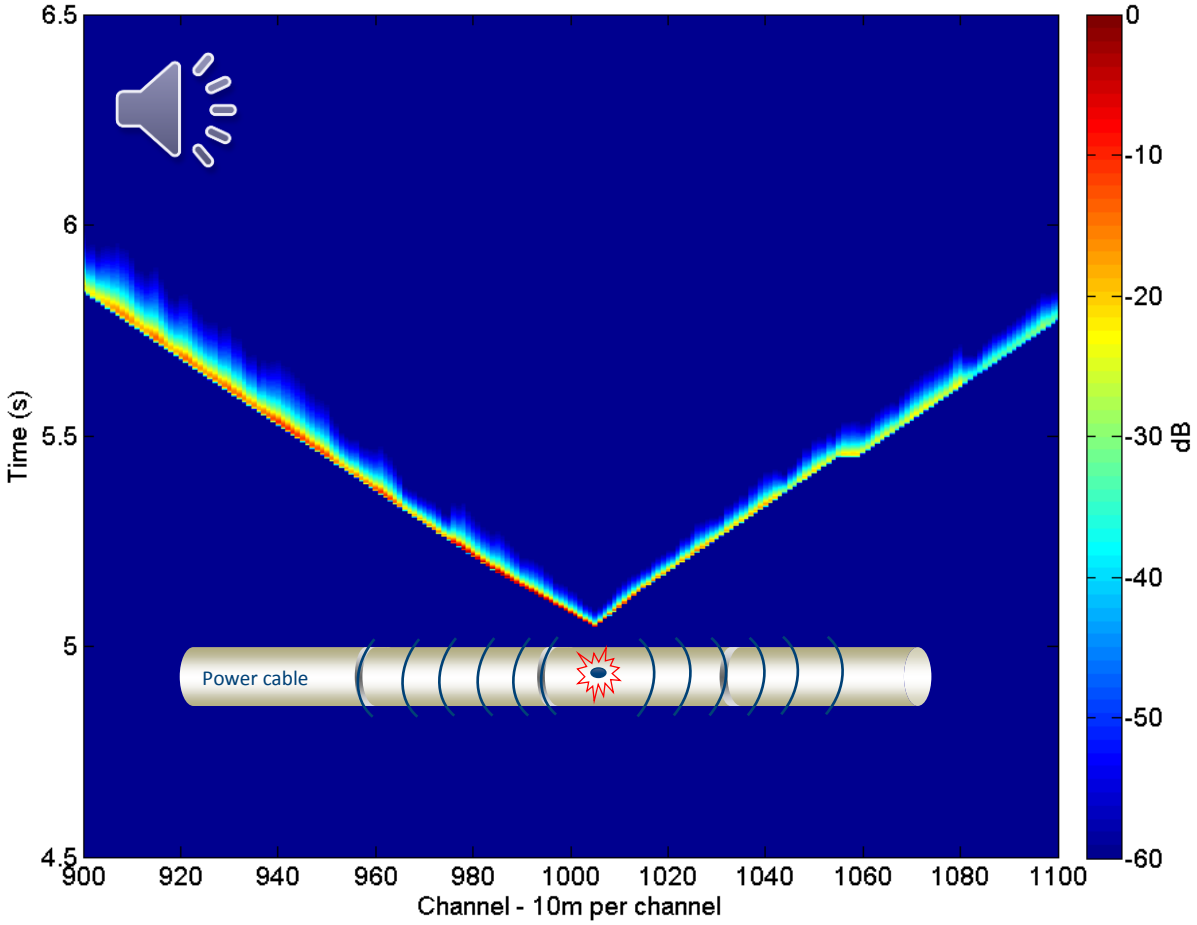
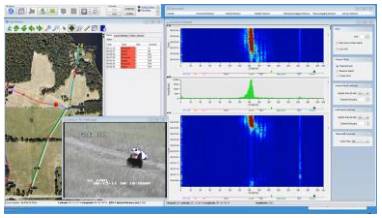
ONline fault detection and location



- Acoustic detection of a sudden discharge, seen as a shockwave travelling up and down the fiber - a ‘negative pressure pulse’
- A unique signal that can be characterized - part of OptaSense’s acoustic signature library for automated alarming
- Location accuracy to 10m or ~30ft, with further geo-calibration possible prior to repair works
- Higher location resolution available at shorter monitoring distances (e.g. ~10ft at 8 miles)



Example of shockwave from explosion

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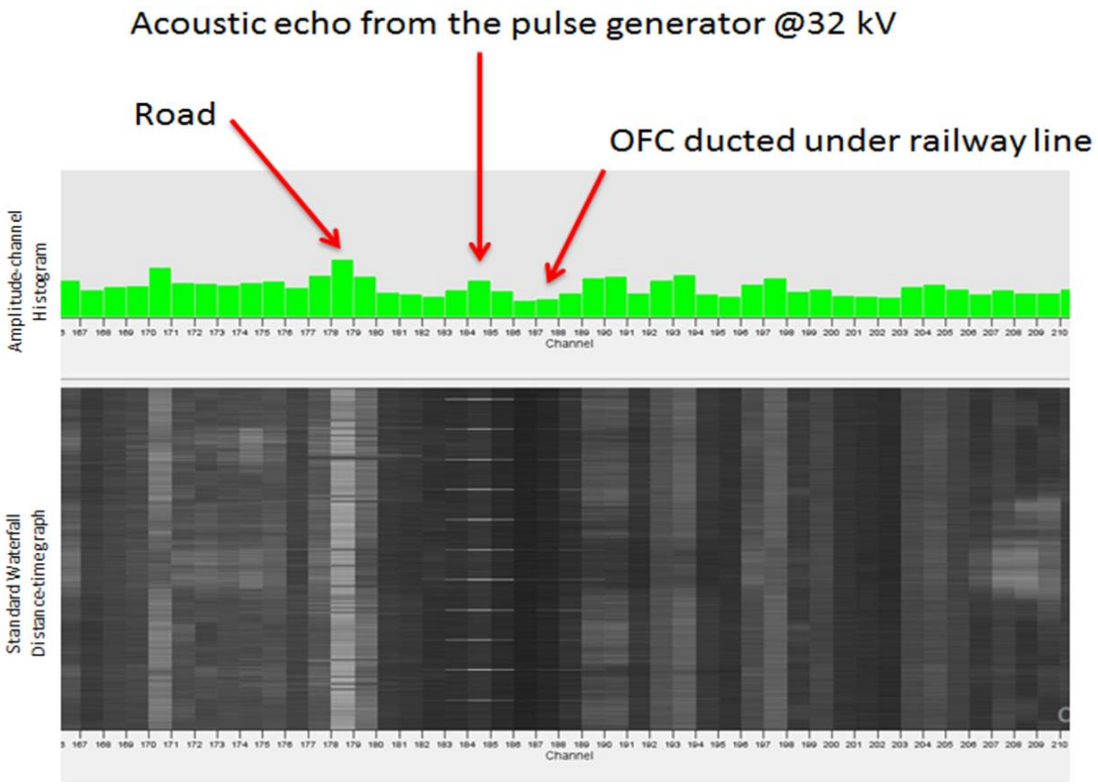
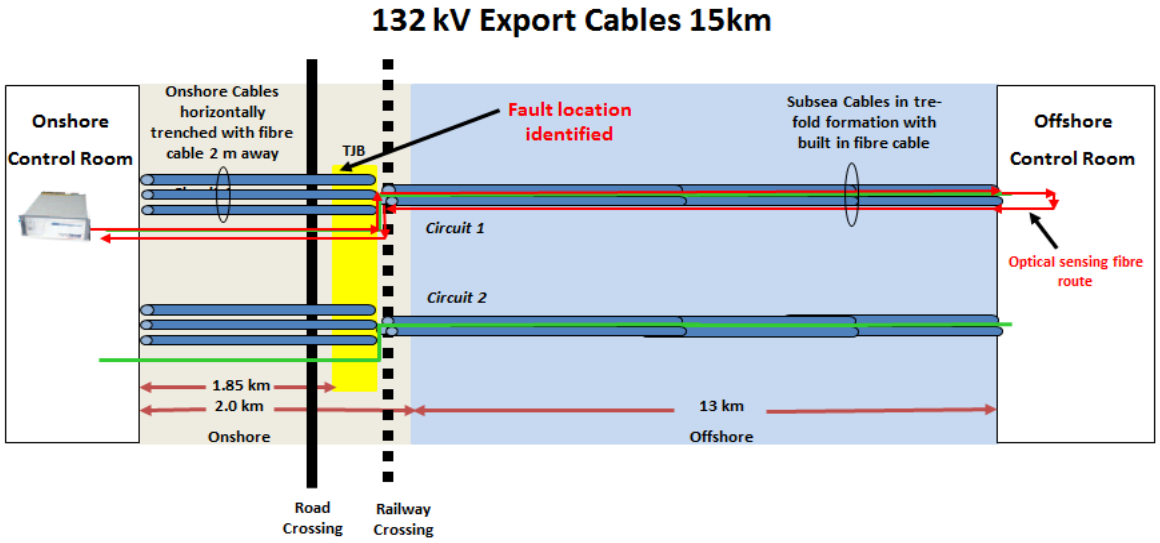
OFFline fault detection and location



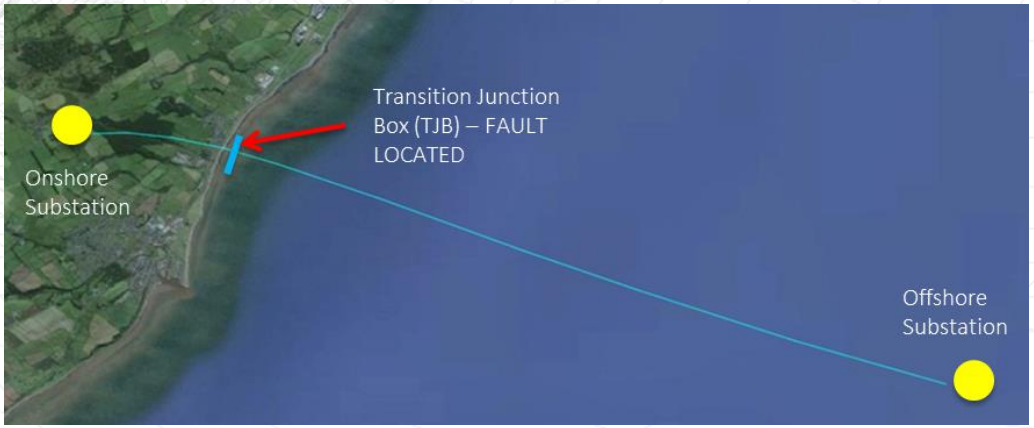
- Fault monitoring during energization – detect and locate faulty joints
- Detect existing faults with DAS using pulse generators, by the acoustic ‘echo’ at the fault location
- Reduced down-time, faster repair and increased safety for repair crews
- Faults located with 10m or ~30ft accuracy, meaning less disruption and cost in restorative works

Fault detection case study



- Offshore wind farm in the UK
- OptaSense called in to investigate location of cable fault on critical export cable (80MW sitting idle and TDR not accurate enough)
- OptaSense connected DAS system to pre-existing fiber

- Using pulse generator (thumper) signal analysis, the fault was detected and located within a day
- Saved the operator millions in downtime (a week instead of months) through rapid fault location / repair
- Online monitoring would have saved even more



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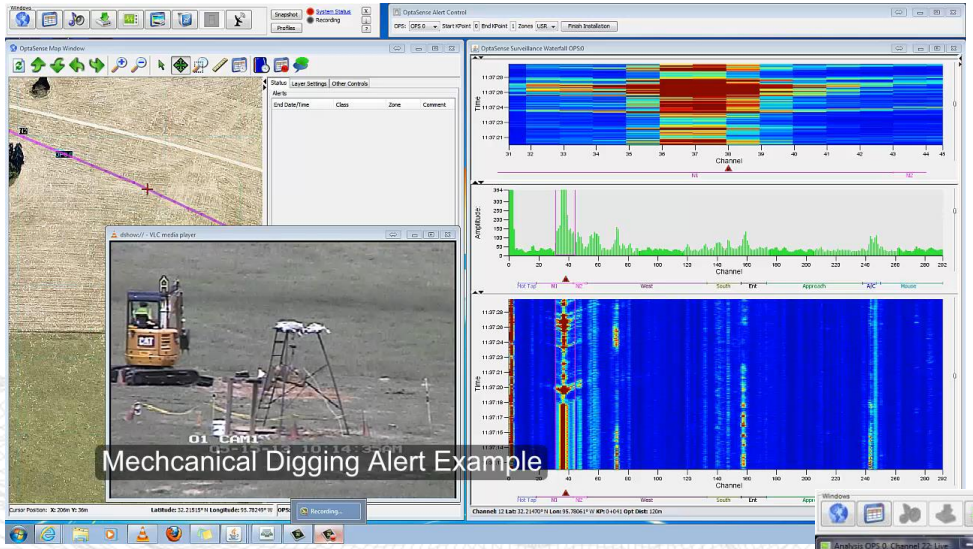
Cable damage prevention / detection

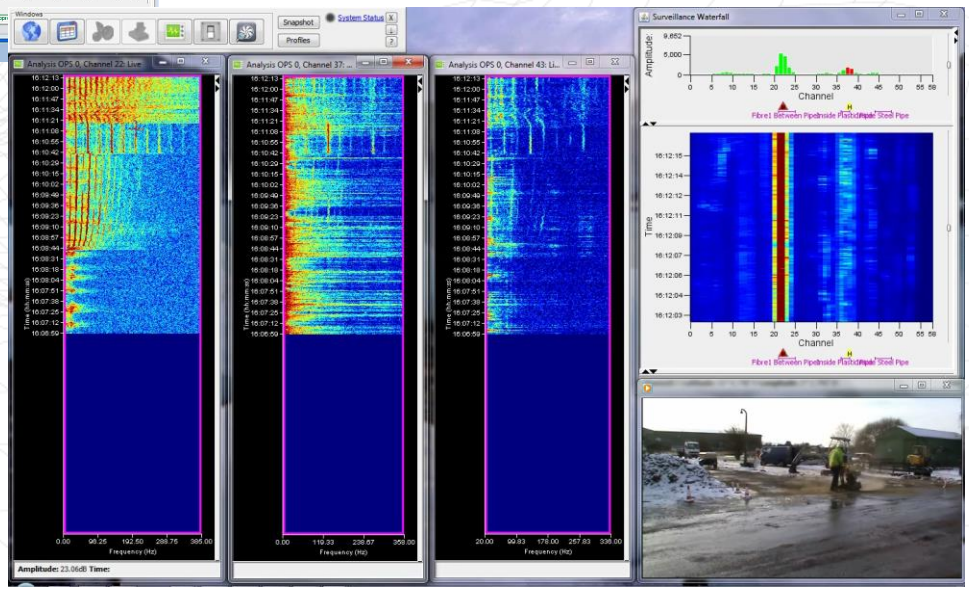
Real time intrusion detection using same hardware

Damage prevention / detection



- Additional capability available with the same hardware, just different detector package
- Highly configurable to different threats and environments (e.g. urban vs rural)
- Real time alerting to enable intervention and damage prevention

- Can also be applied for offshore cables, e.g. damage from anchor drag
- Aerial cables, detecting sabotage or theft
- Fiber can also be placed around substations and other facilities for **perimeter** security, cueing to CCTV cameras



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Summary

An online, real time monitoring solution with DAS

DAS product line

- DAS interrogator units and associated hardware (refer to Specs):
  - 6 mile unit
  - 12 mile unit
  - 25 mile unit
- Detector suite:
  - Online fault detection
    - Shockwave detection
    - Real time – location accuracy of ~30ft (or less)
  - Offline fault detection
    - Acoustic echo detection from pulse generators
    - Real time with location accuracy of ~30ft (or less)
  - Intrusion detection for damage prevention
    - Construction activity
    - Sabotage or theft
- Integration routes available
  - Relay alerts to C2, Cameras, mobile devices (OPC, Http/XML)

19” telecom rack mounted hardware

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Additional applications (in R&D)

- Onshore cables
  - Galloping lines / ice damage
  - Hotspots, fault prevention
  - Fault type classification

- Offshore cables
  - Vortex induced vibration
  - Buried depth monitoring
  - Anchor damage detection
  - Very long distance damage / fault detection

  - Other applications?

Summary of benefits