



OIL AND GAS ASSET INTEGRITY MONITORING: THE NEEDS AND CHALLENGES

Ron Cramer
Shell International E&P
Inc.

ASSET INTEGRITY AND PROCESS SAFETY



BOARD
RT
FIRE
(ured)



WHY WE NEED SENSORS AND SENSING SYSTEMS

☐ Safety – save lives

Sensing in cars

Sensing large systems – bridges, airplanes

Monitoring the condition and operation of our assets

☐ Sustainability – save energy

Buildings: anyone in room

Mobile devices: what is user doing

Optimize our operations: smart everything

☐ Security – save assets

Building: human or threat intrusion detection

Equipment: item moving when it shouldn't be

Location information without GPS: *"Where are we?" "Where is it?"*

Detect leaks before they occur

☐ Massive coverage of our assets can change the nature of the oil & gas industry

UBIQUITIOUS SENSORS

There have been four revolutions that have shaped modern society:

- Agrarian revolution – 5000 BC
- Industrial revolution – 1800's
- Computer revolution – 1980's
- Internet/WWW – 1990's

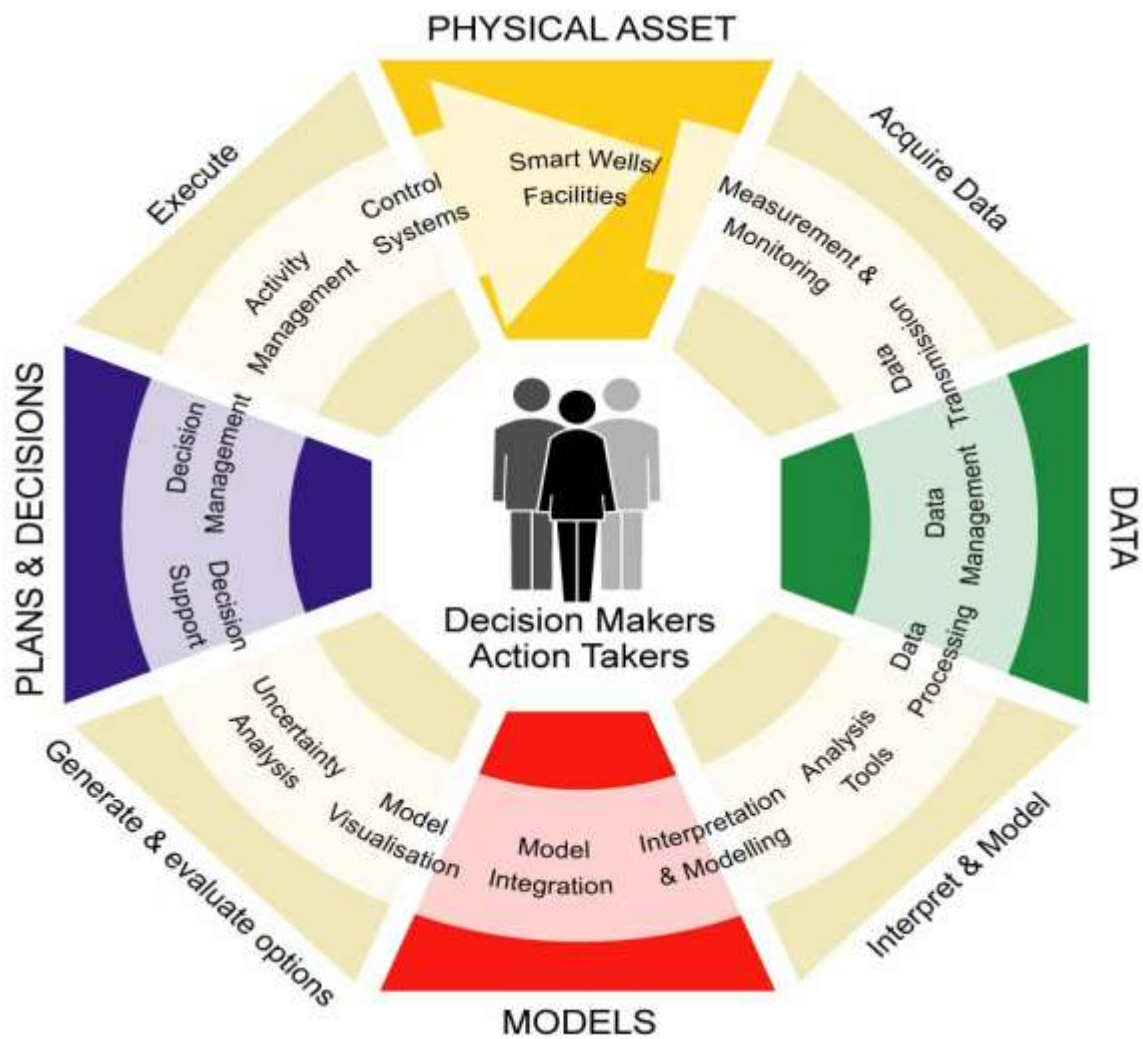
The next revolution will be driven by cheap sensors coupled to micro-processors and lasers

Michio Kaku, City College, NY

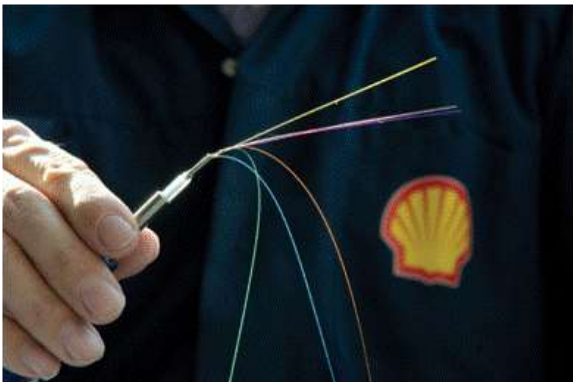
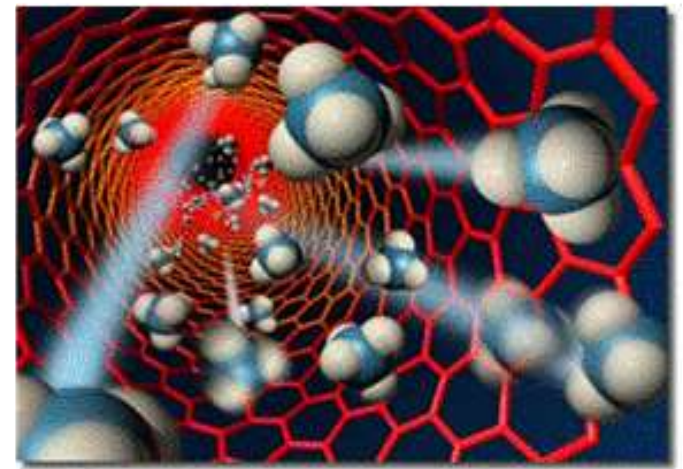
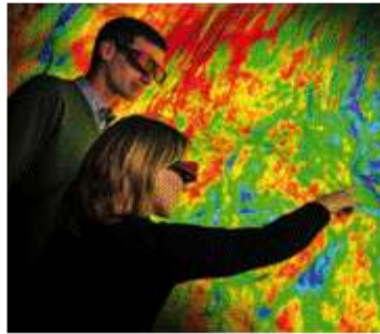
GOAL: OUR ASSETS ARE SAFE AND WE KNOW IT

From operational and asset condition data to business decisions





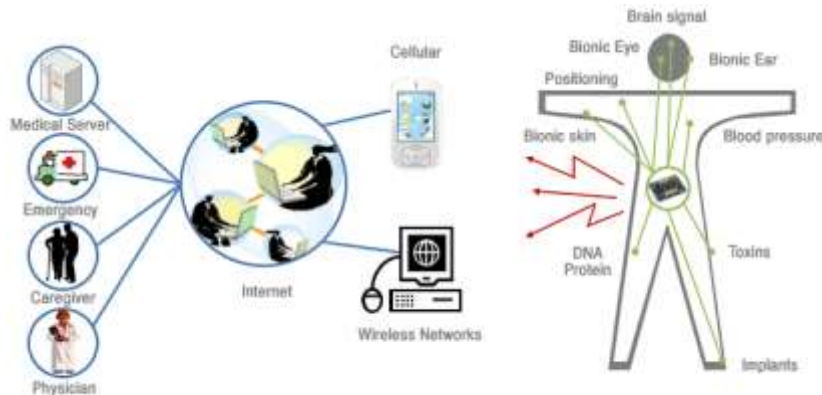
THE DAWN OF A TECHNOLOGICAL REVOLUTION



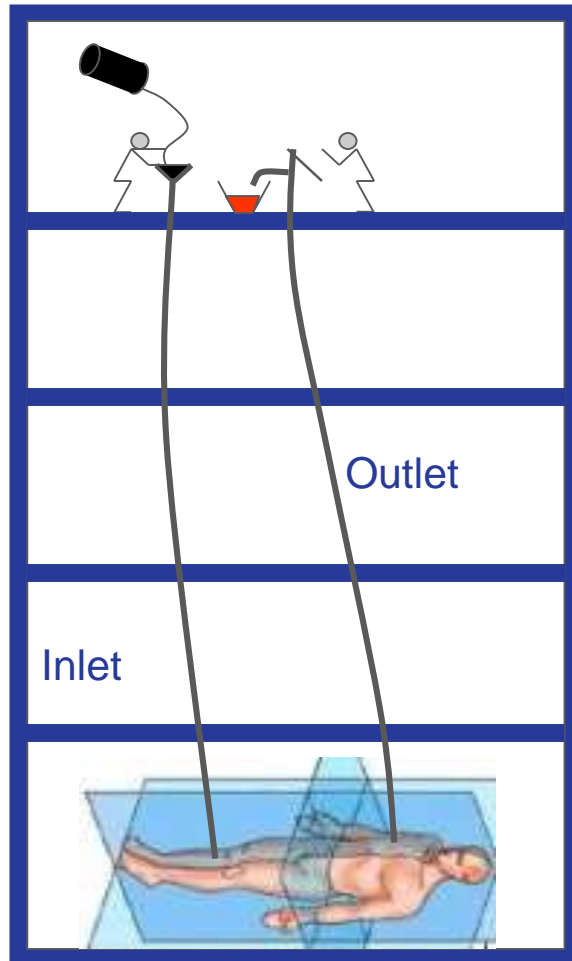
Courtesy Sandia National Laboratories
SUMMIT™ Technologies
www.mems.sandia.gov



REMOTE SENSING AND OPERATIONS IN OTHER AREAS



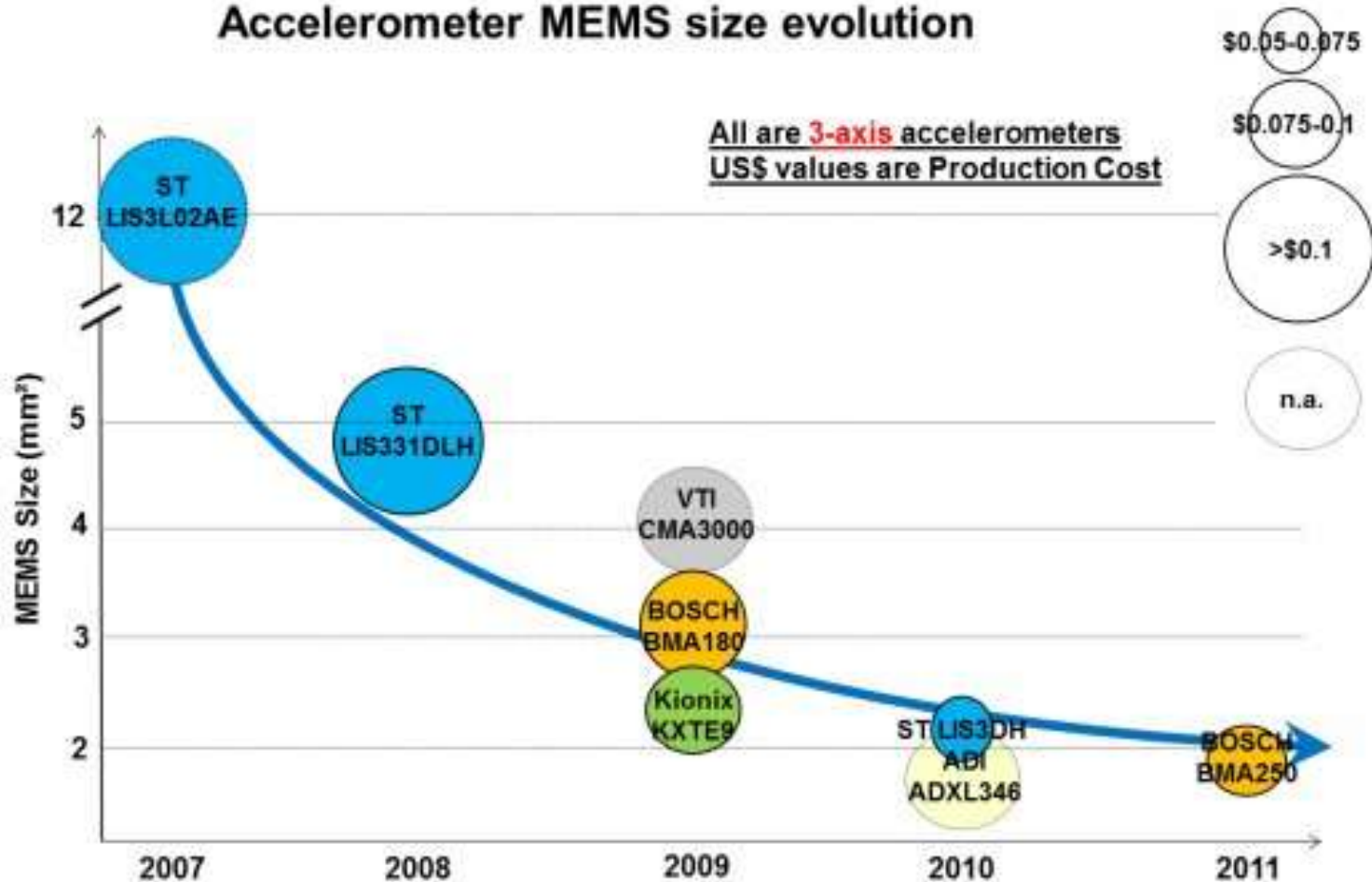
A HEALTHCARE ANALOGY



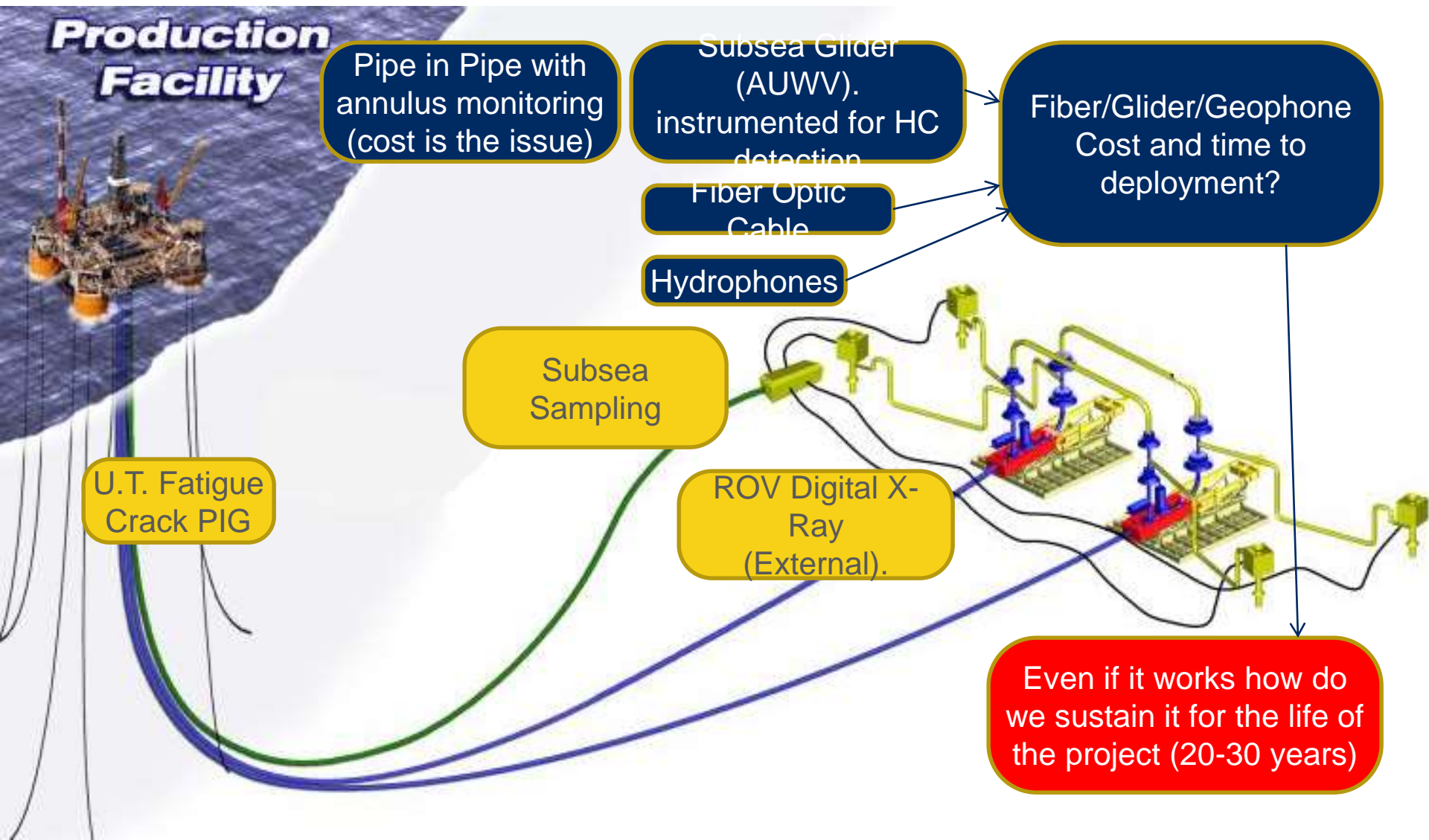
- Our patient is remote
- Our methods are primitive
 - *We have limited access, limited data*
- We would like to diagnose and administer our care more precisely
- To do this we have to learn the health, physiology, and symptoms of our patient
- We can do that by drastically raising the density and quality of information that we collect and analyze

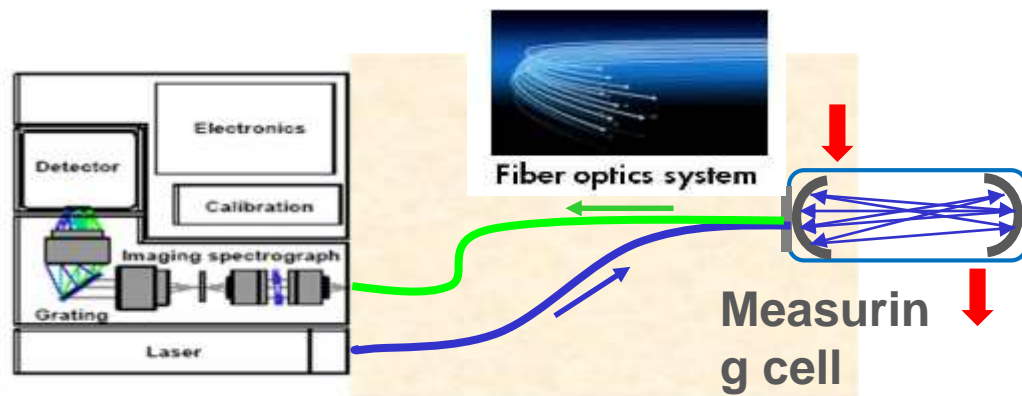
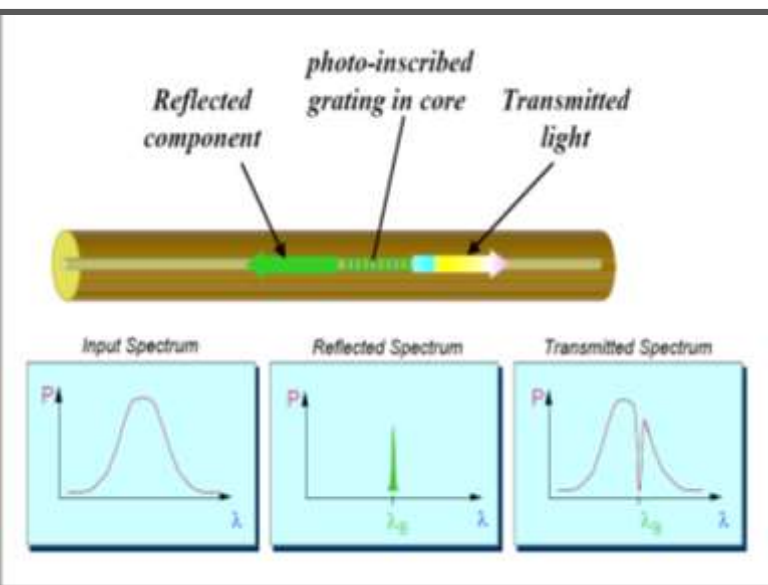
COSTS COMING DOWN, PERFORMANCE INCREASING

Accelerometer MEMS size evolution



NEW TECHNOLOGIES FOR INTEGRITY AND SUBSEA LEAK DETECTION





HOW DOES IT ALL WORK TOGETHER?



These are common systems

- Existing and emerging sensors
- Power generation and storage
- Signal conditioning and transmission
- Networking
- System architecture
- Data analysis

This is the approach

- Prior applications in other industries
- Conversion to O&G – Specific algorithms to convert signal to information
- Integration into a functional system
- Partnership with technology suppliers: industry and academia

These are the sensor elements

- MEMS for Vibration, acoustic detection, temperature
- SONAR, RADAR
- Magnetic detectors
- Ultrasonic

These are the systems

- Quick route to failure - Gamechanger
- Autonomous underwater vehicle
- Fixed subsea sensor networks
- Fixed acoustic/temperature/chemical/US sensors network onshore
- Versatile and expandable framework

