

V-LIFE: A Technology for the Rejuvenation of Subsea Insulation Resistance Failures

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Introduction

The next four slides are a copy of what was presented at SCDU in 2011.

The subsequent slides reflect Viper Subsea's technology development initiated in part by the subsequent discussion at that SCDU Conference



Electrical Failures

Electrical Failures in connectors and cables can result in one of three failure modes:

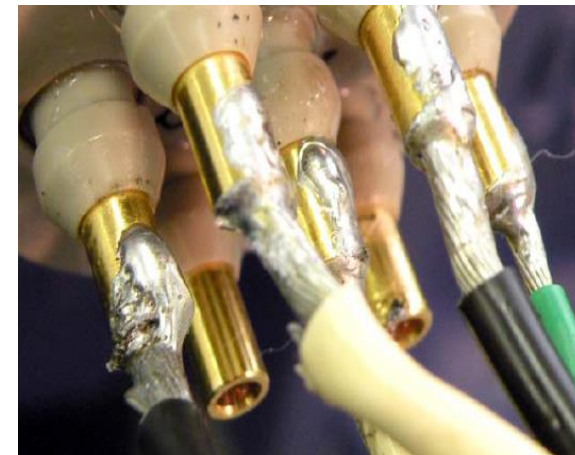
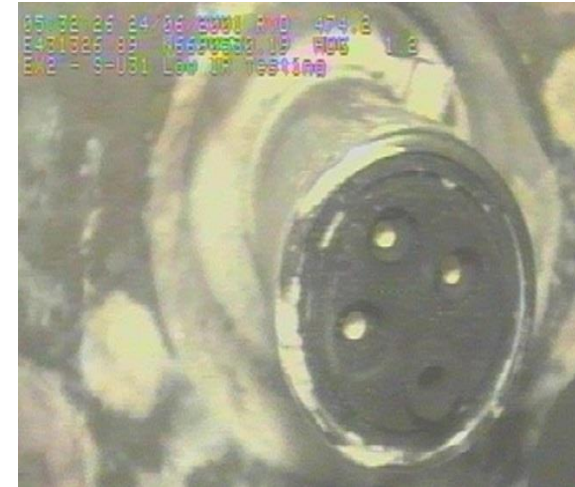
- Short Circuit
- Open Circuit
- Line Insulation Failure – current leakage to earth

Fault types can be classified as either:

- Intrinsic – the fault relates to design, materials or hardware assembly
- Extrinsic – the fault relates to handling, installation, environment, mechanical stressing and/or misapplication

Intrinsic Failures

- Elastomeric failures (including bellows)
- Polyethylene moulding failures (cathodic disbondment)
- Nascent Hydrogen in Umbilicals and gassing
- Poor soldering (flux, excessive quantity, sharp edges)
- Use of incorrect crimping tools
- Cracks in epoxy in connectors
- Shuttle pin assembly failure





Extrinsic Failures

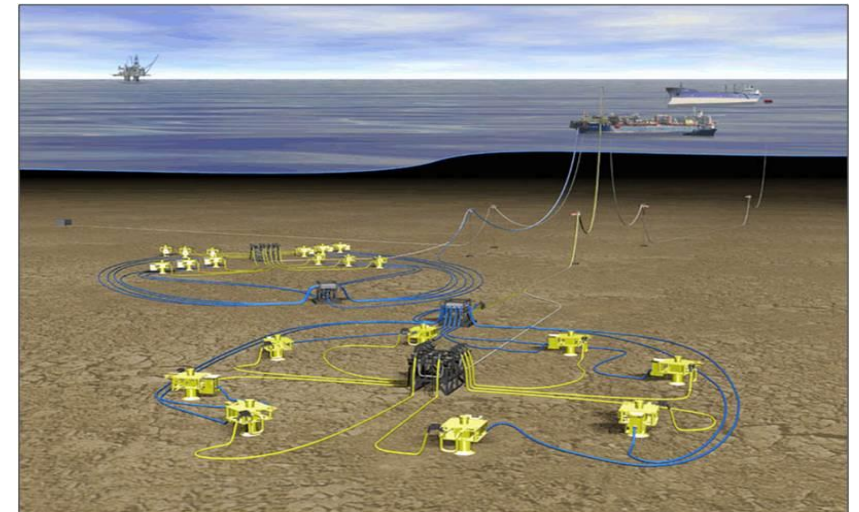
- Calcareous and/or marine deposit around compensation and pin shrouds
- Lateral mechanical stresses placed on connectors when cables are installed on structures
- ROV impact damage
- Connectors left exposed subsea for too long (not properly parked or protected)
- Cable sheath damage
- Fishing/trawl board impact
- Water trees/Electric trees
- Water permeation into insulation



Water ingress into electrical cables

Moisture ingress can occur in long-term wetted cables and results in:

- Decrease in dielectric strength
- Increase in leakage currents
- Continual degradation leading to eventual failure
- $\approx 73\%$ of all subsea electrical failures





Subsea Electrical Integrity Management

Two Approaches:



A VIPER SUBSEA SOLUTION

Fault Location, Monitoring and Analysis



A VIPER SUBSEA SERVICE

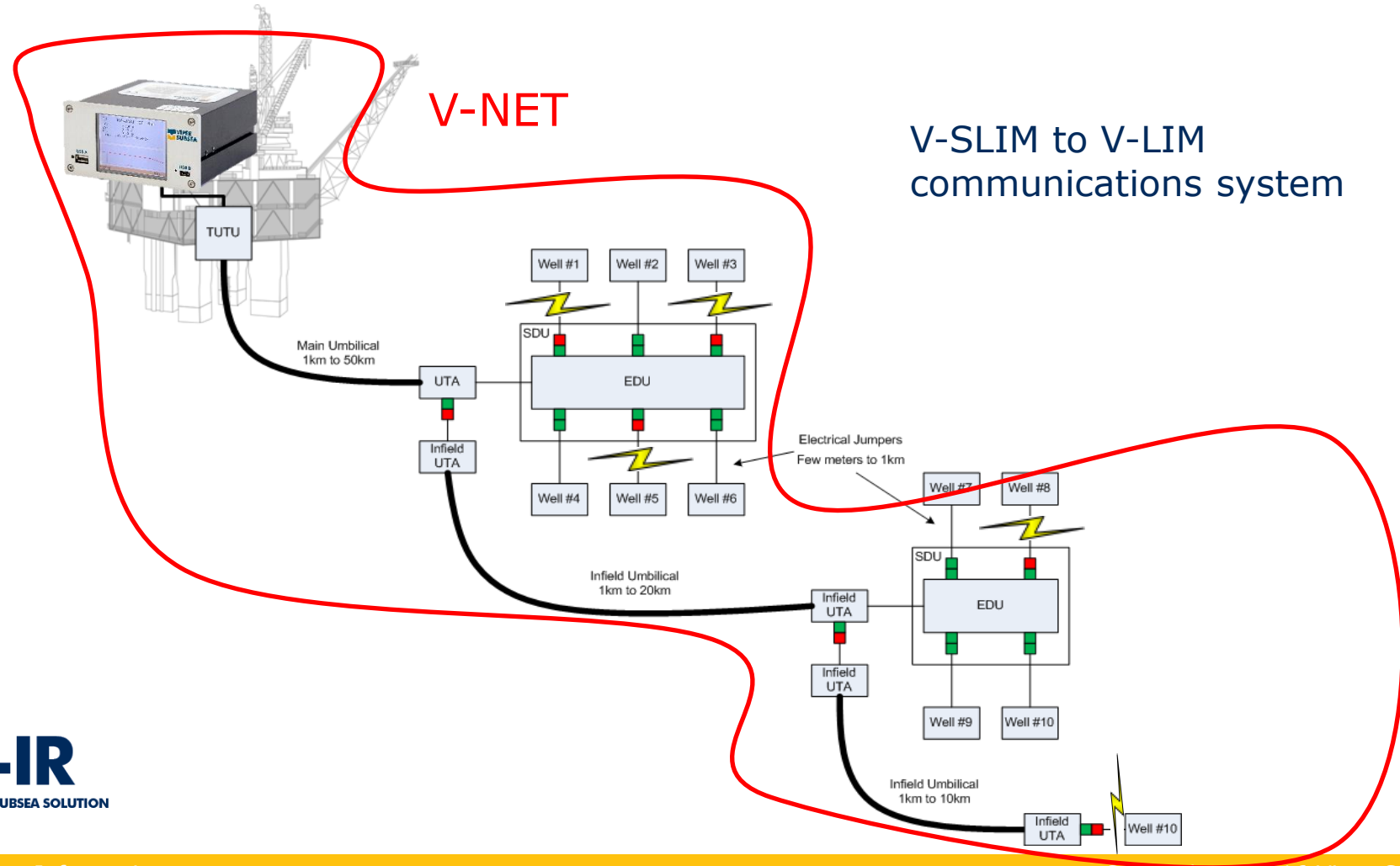
Fault Remediation

V-IR : Subsea Integrity Monitoring



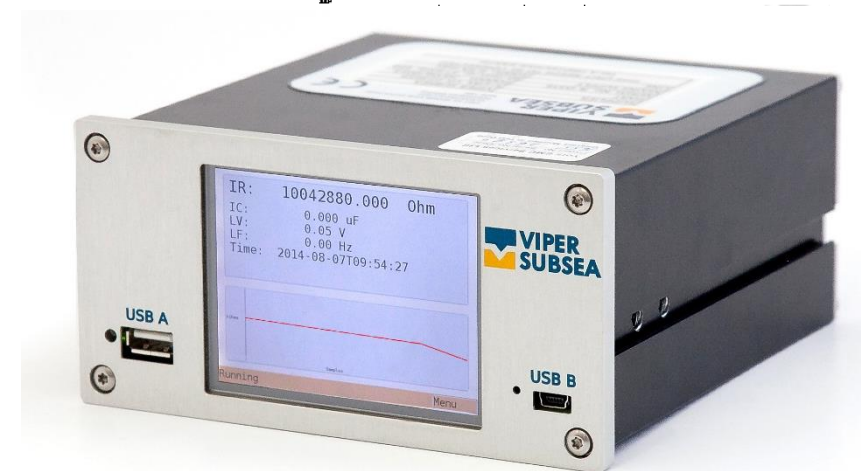
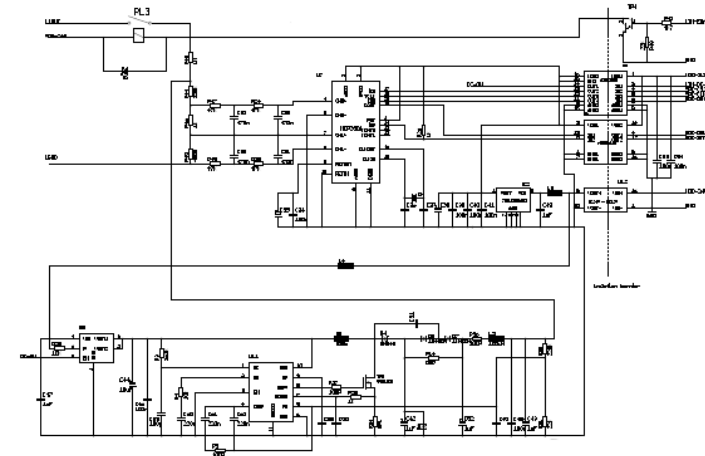
- JIP established with five Super Majors as sponsors
- Development of key V-IR system components:
 - V-LIM Topsides Line Integrity Monitor
 - V-SLIM Subsea Line Integrity Monitor
 - V-NET Subsea-to-surface communications system
- Shallow water trial started Q2 2016

Subsea-to-Surface Communications



V-LIM – Line Integrity Monitoring

- High accuracy and high stability monitoring
 - IR Monitoring 1kohm to 1Gohm
 - Capacitance
 - Dielectric Absorption Ratio
 - Polarisation Index
 - Voltage, Current, Power, Frequency
- Acts as a topside modem for V-NET
- Incorporates V-LIFE hardware
- EC, UL, FCC, RCM Approved



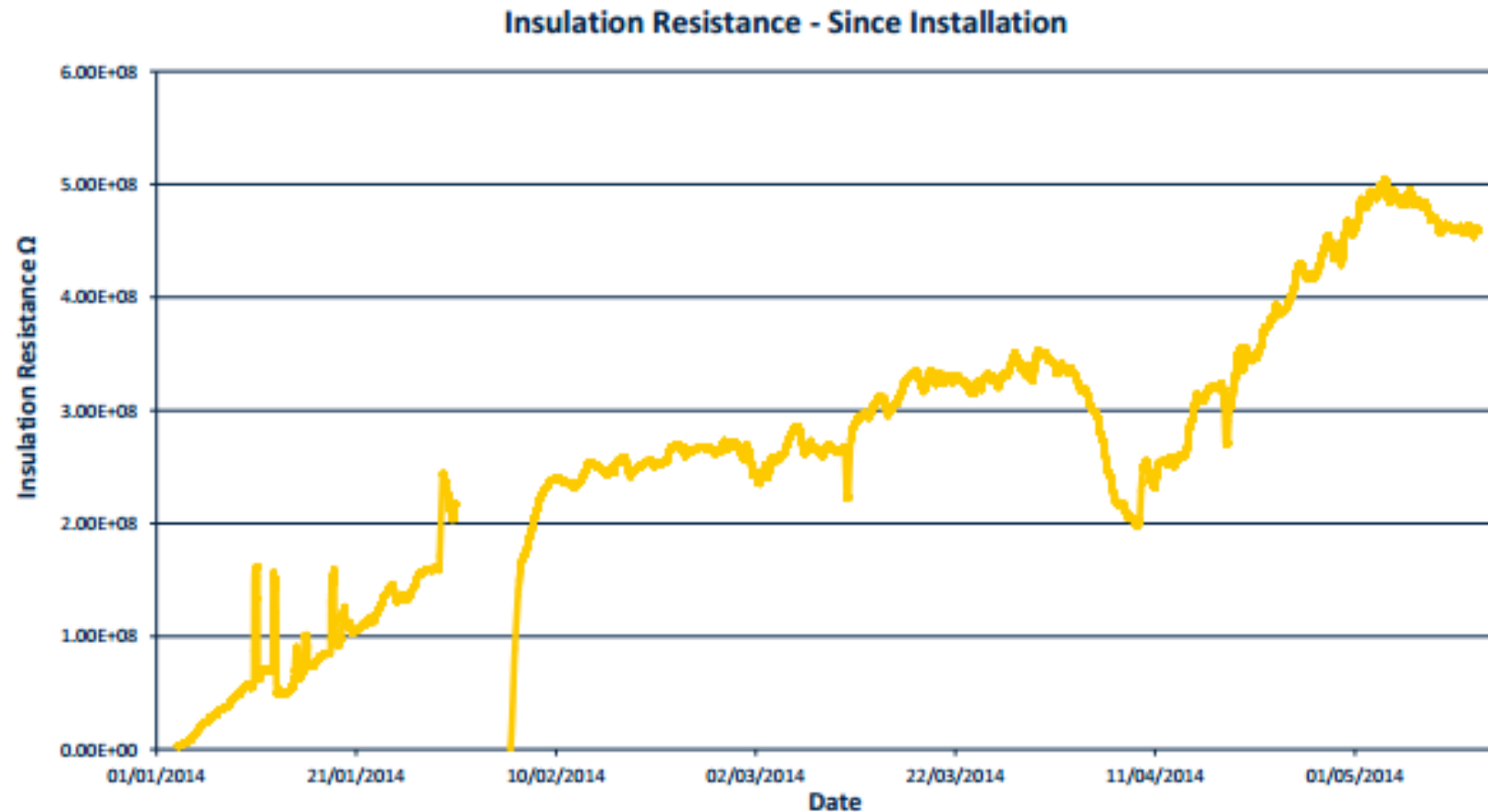
V-LIFE

- V-LIFE is a scientific breakthrough and an established offering by Viper Subsea.

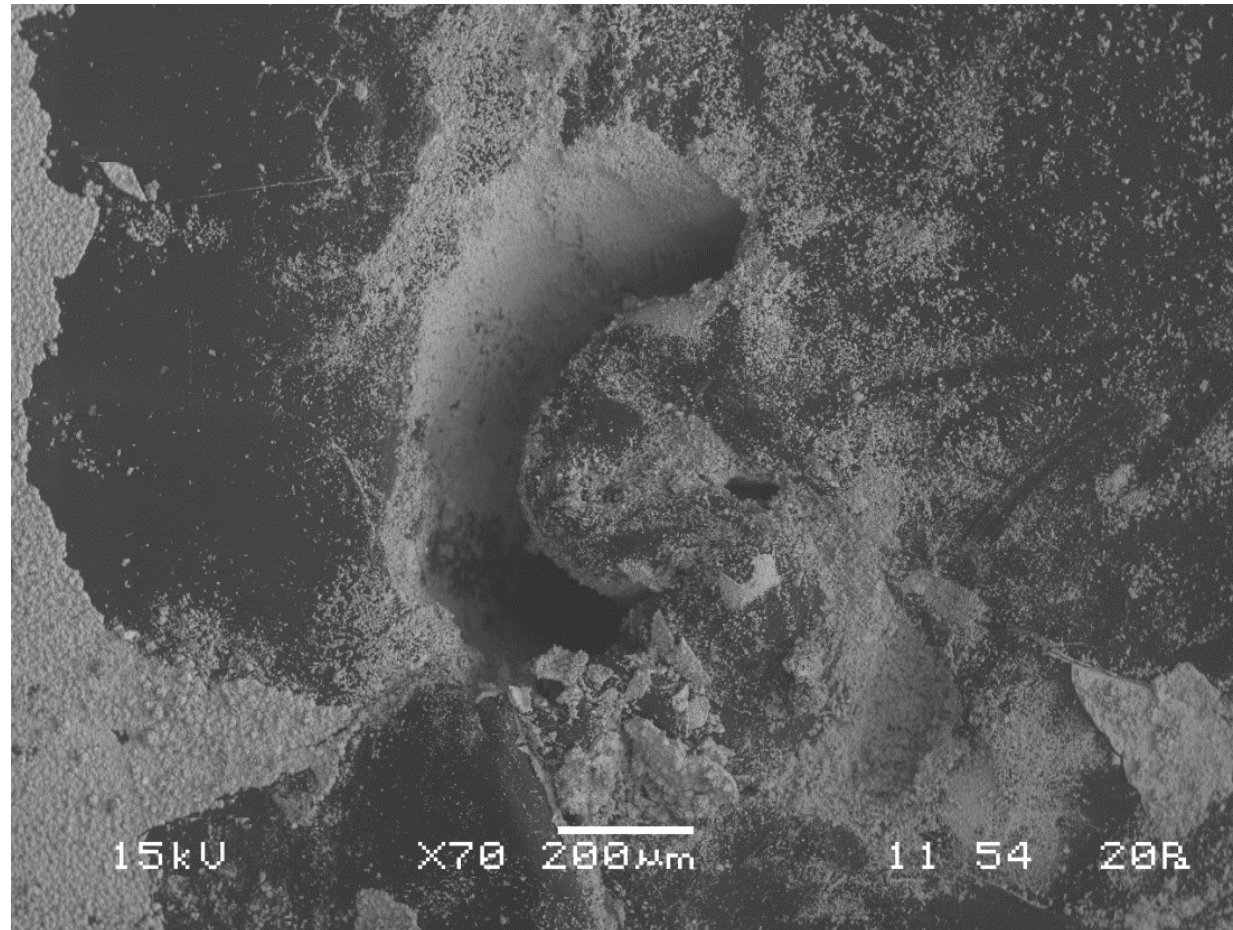




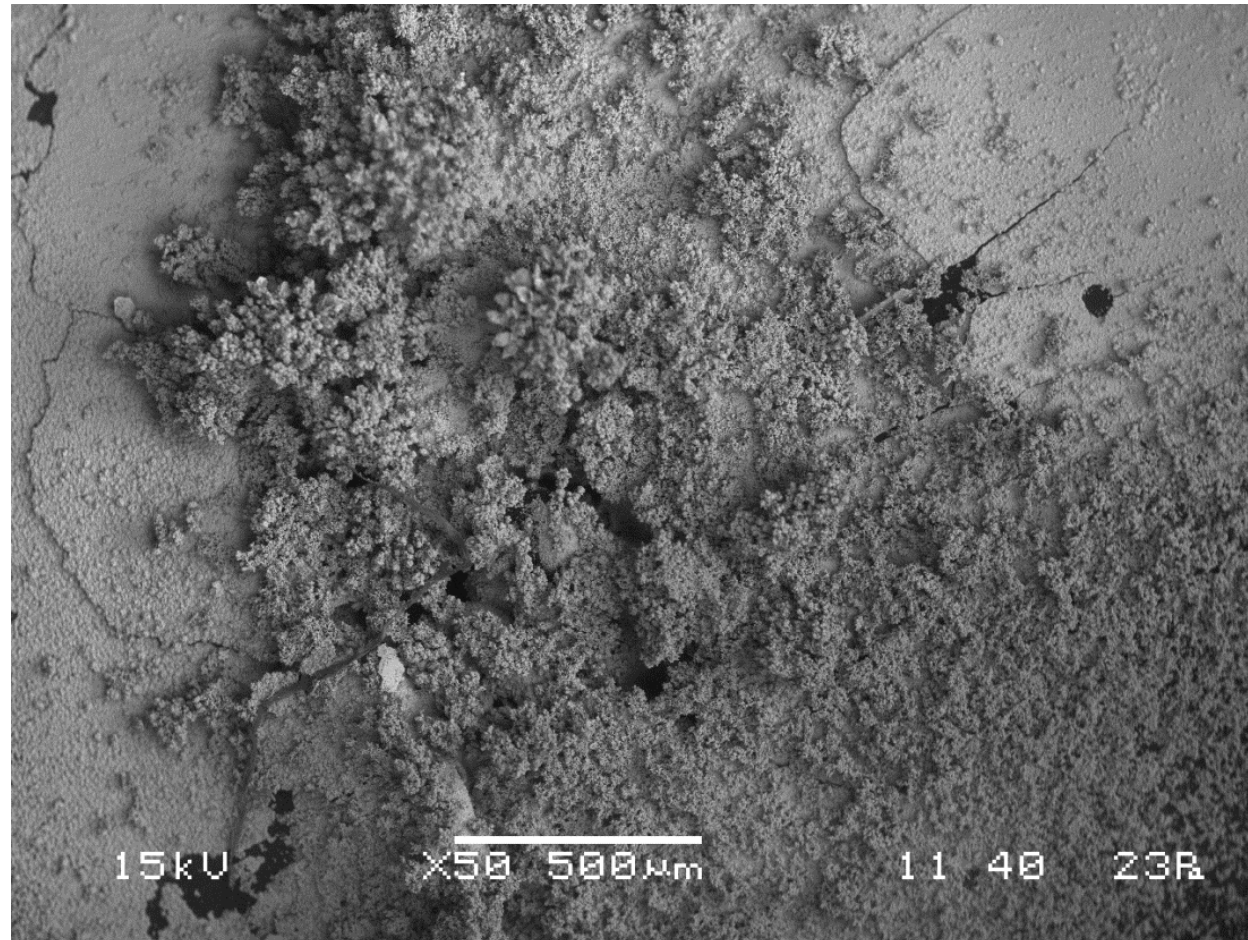
Example of a V-LIFE Restart



Insulation – pre-passivation

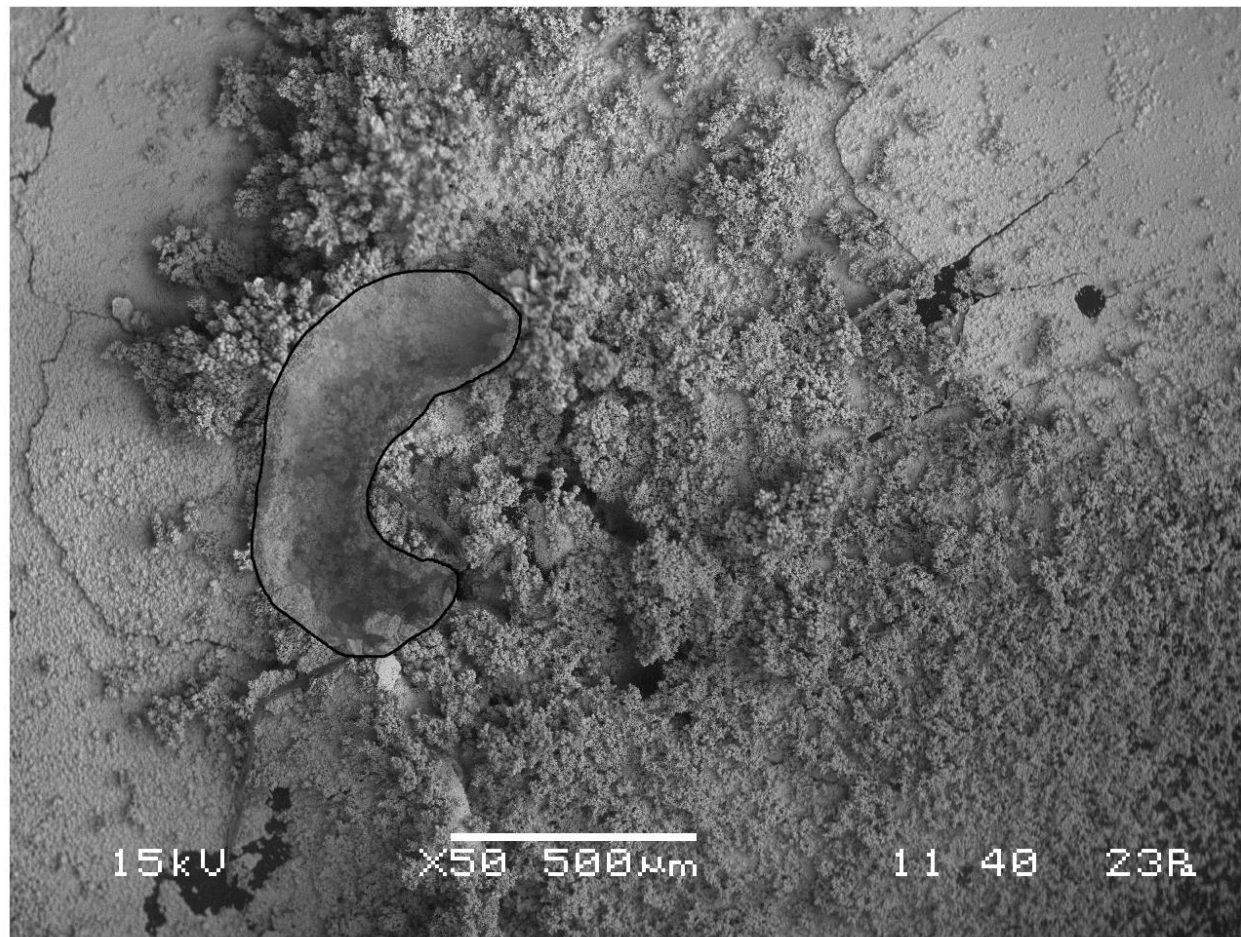


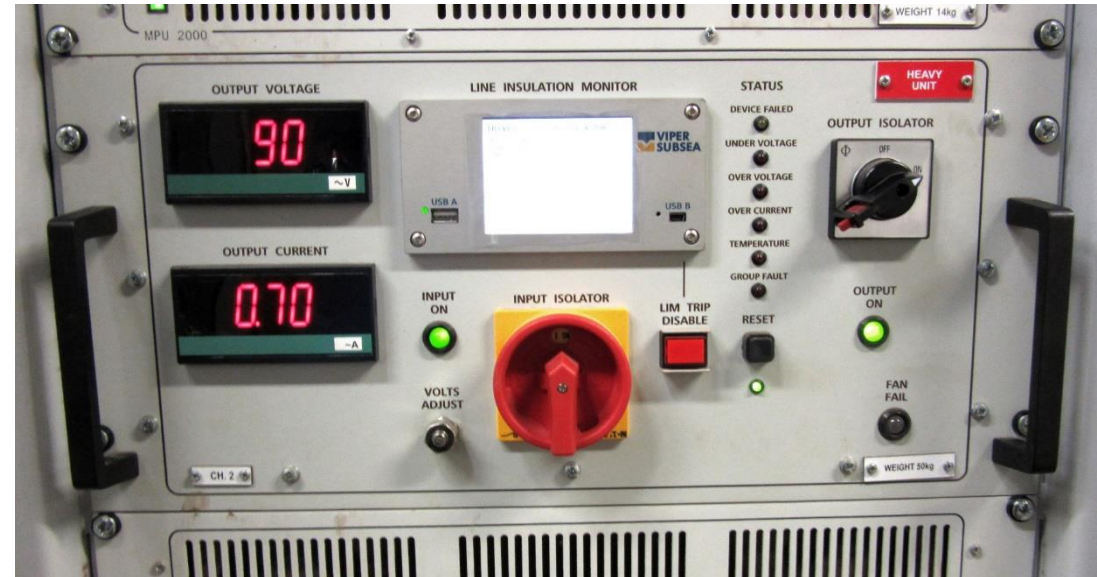
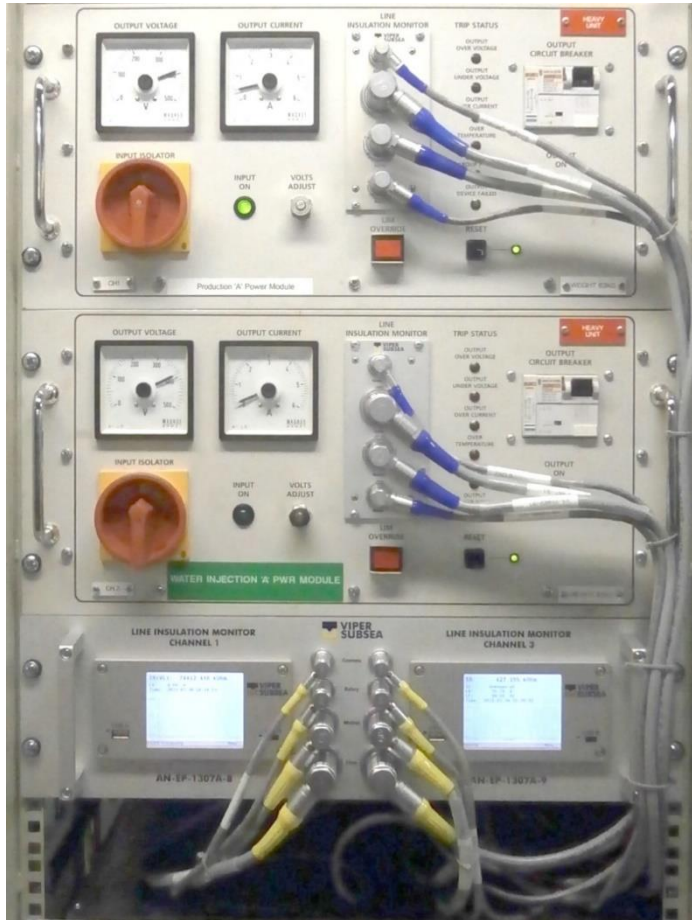
Insulation – post passivation






Passivated cable with approximate pore position









Data sources:
<http://SubseaIntel.com>
<http://questoffshore.com/subsea-database/>
All data presented is for projects currently in production or suspended production



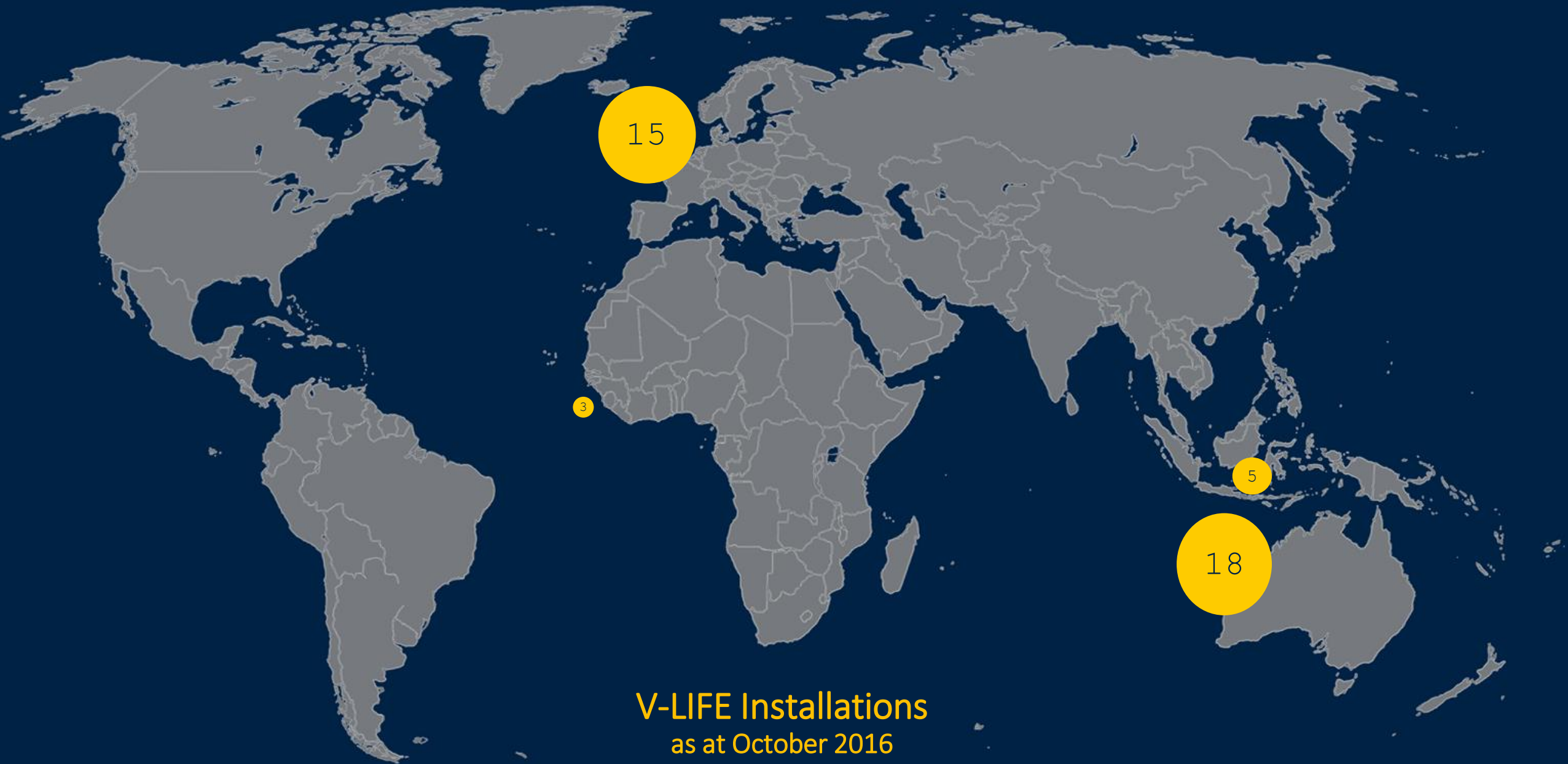
total number of projects



total number of subsea wells



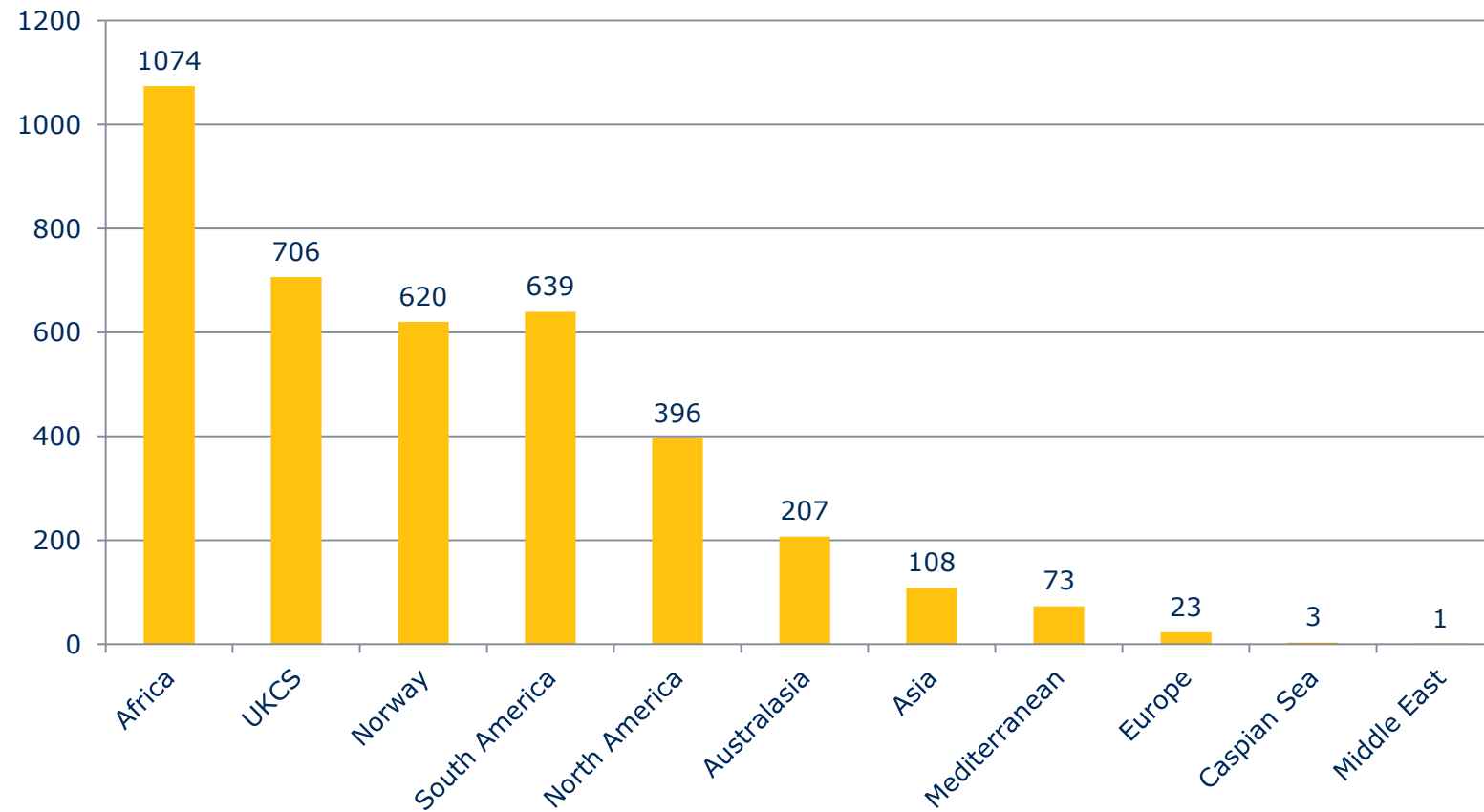
assumed percentage of projects with Insulation Resistance problems





Existing Subsea Installations

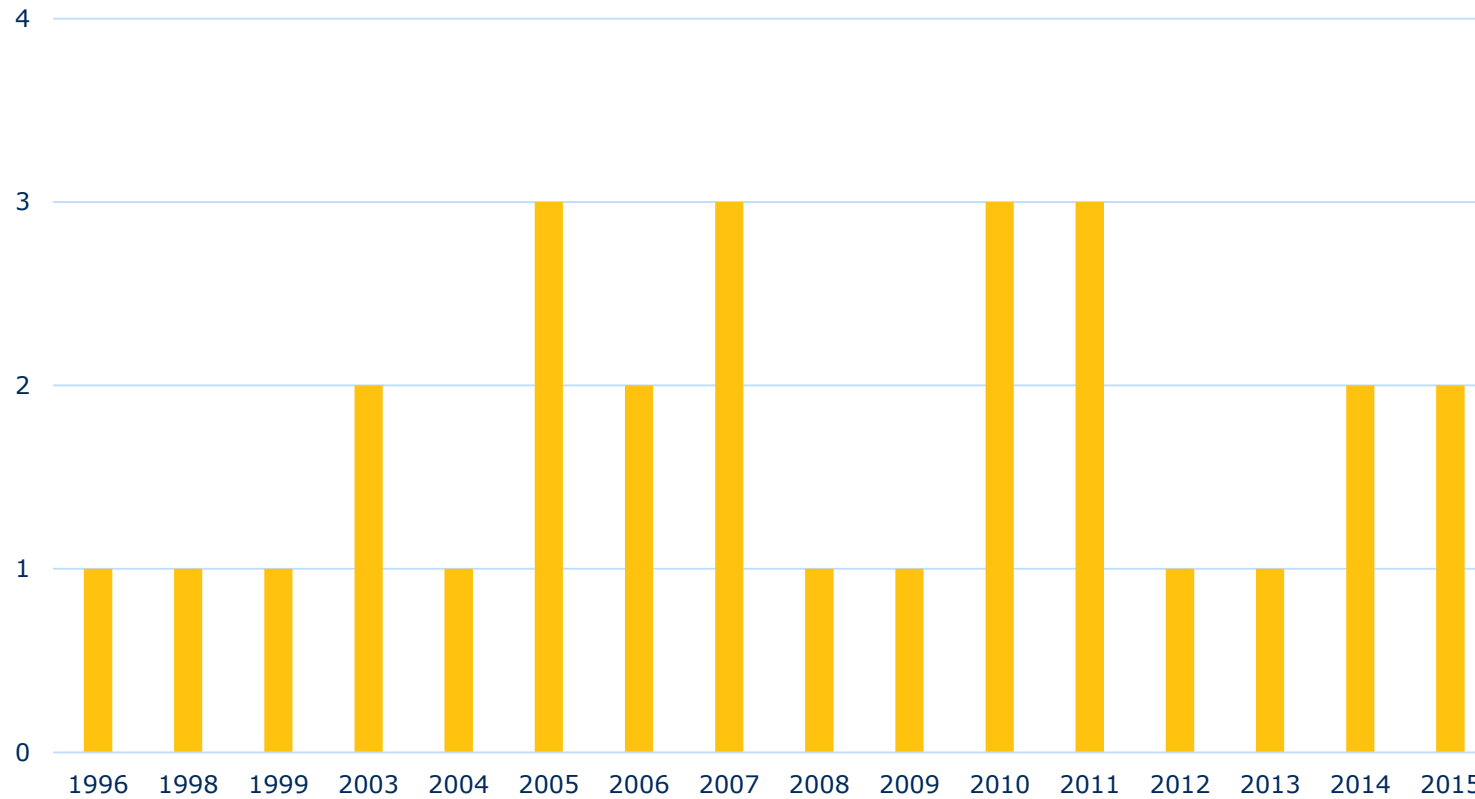
No. of Subsea Trees by Region





Australian Subsea Installations

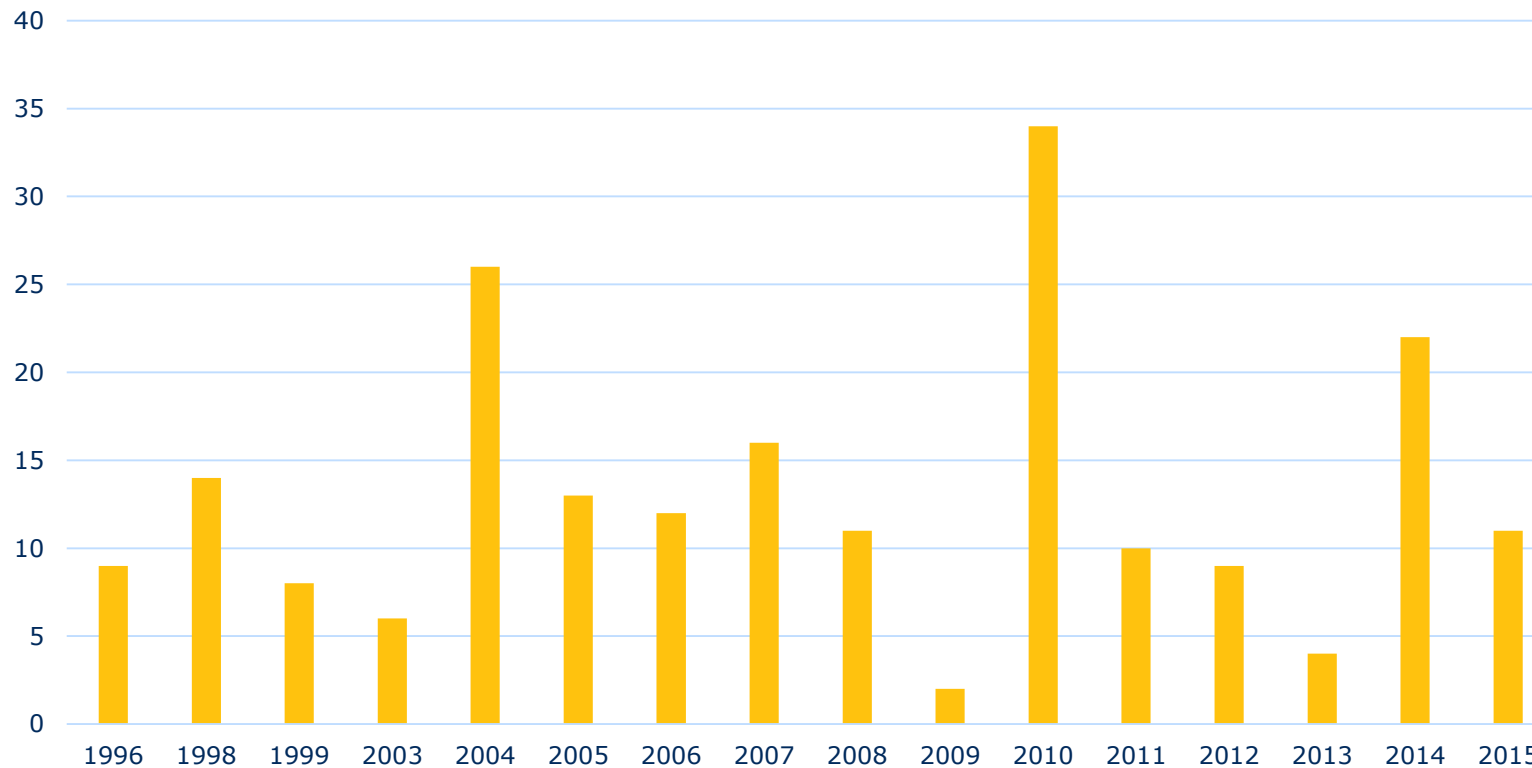
Year On Stream vs Number of Projects

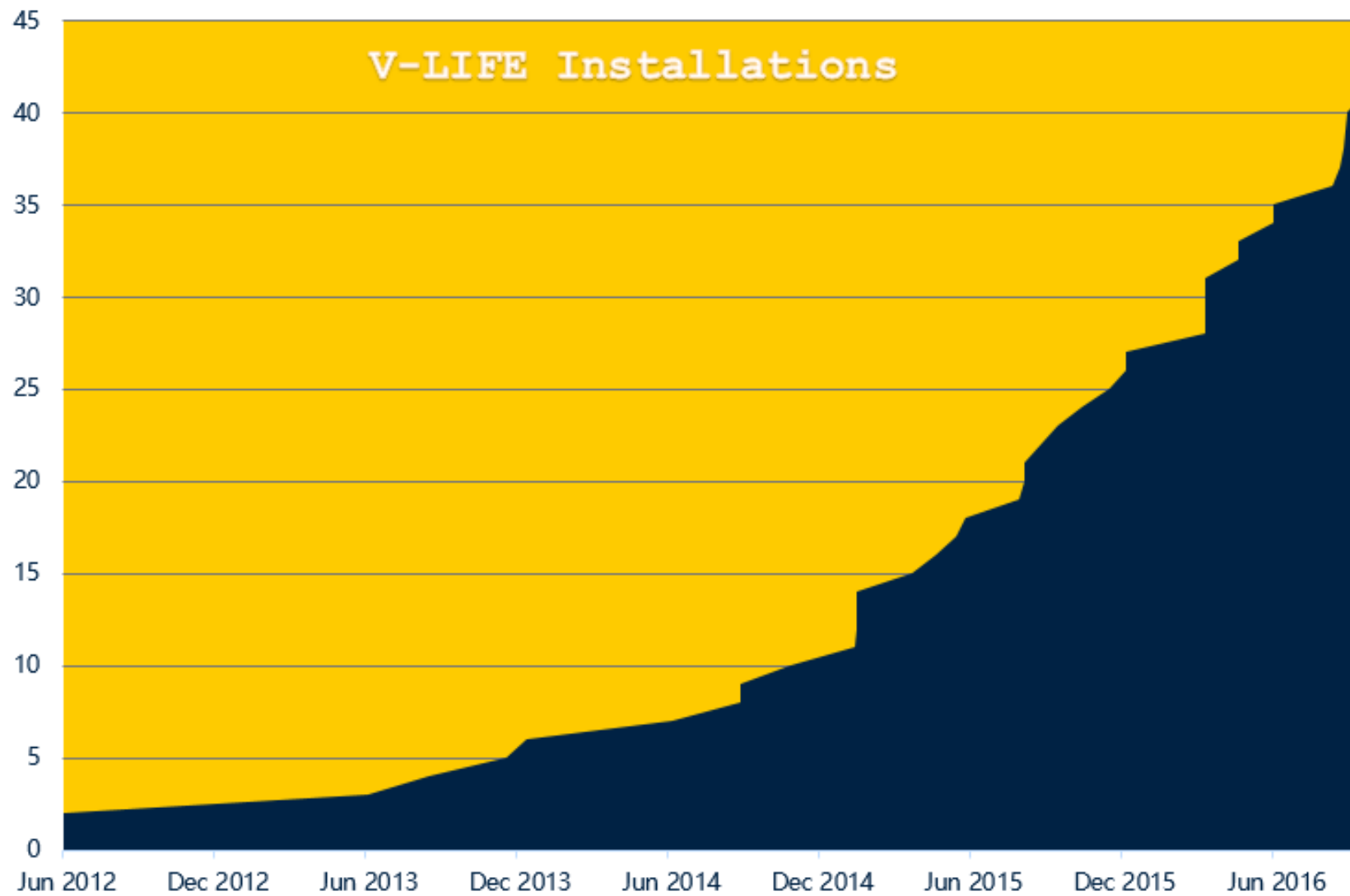




Australian Subsea Installations

Year On Stream Vs Number of Wells

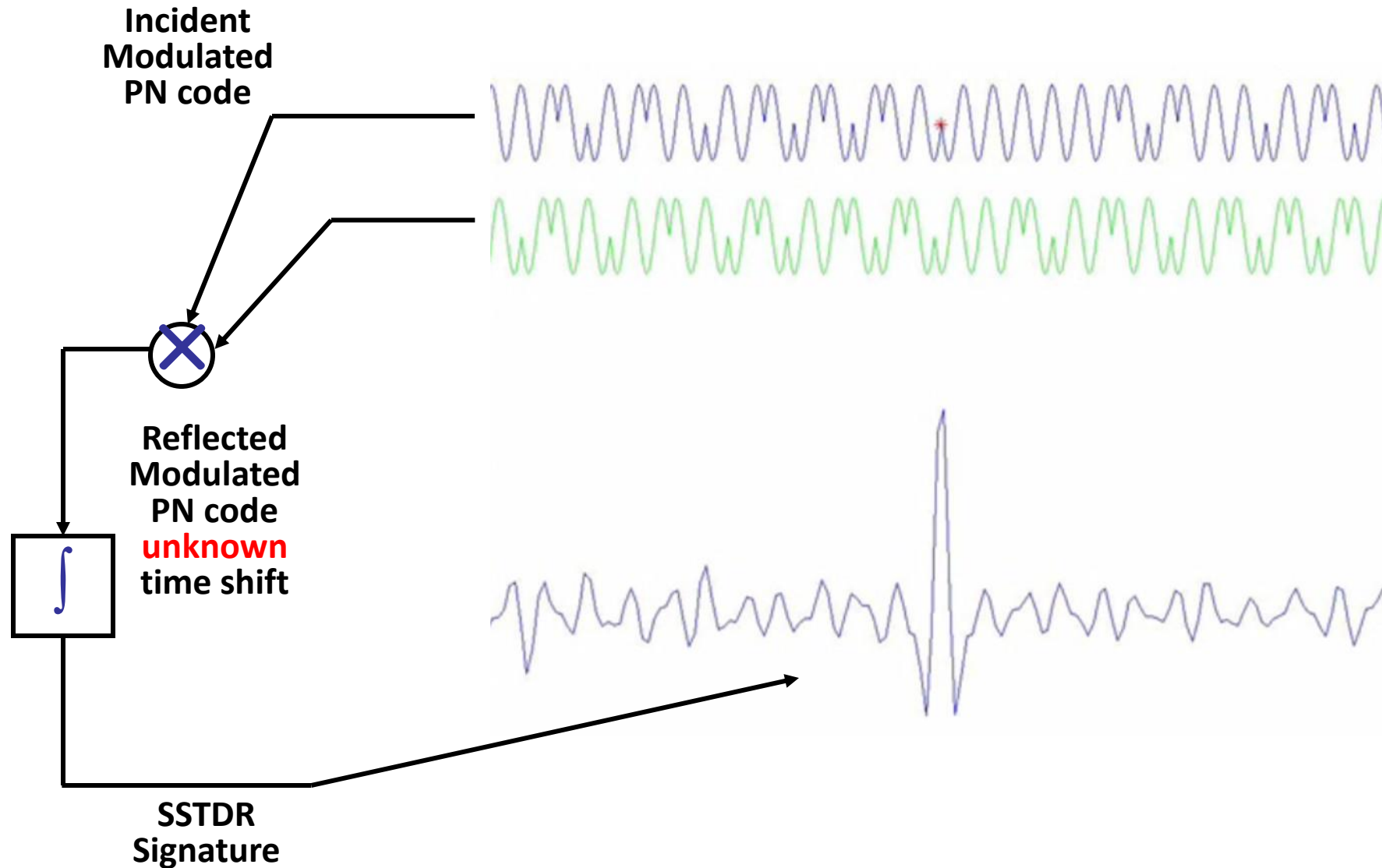






What's the next innovation in electrical integrity?

SSTDR: Spread Spectrum TDR



CableGuardian™

The first platform to provide live fault location information for both insulation and conductor faults

A system of distributed units providing constant:

- Monitoring and trending of cable integrity and basic electrical parameters
- Identification and location of:
 - Short circuits
 - Open circuits
 - Intermittent faults
 - Insulation Resistance degradation





That's all Folks!
Any Question?