

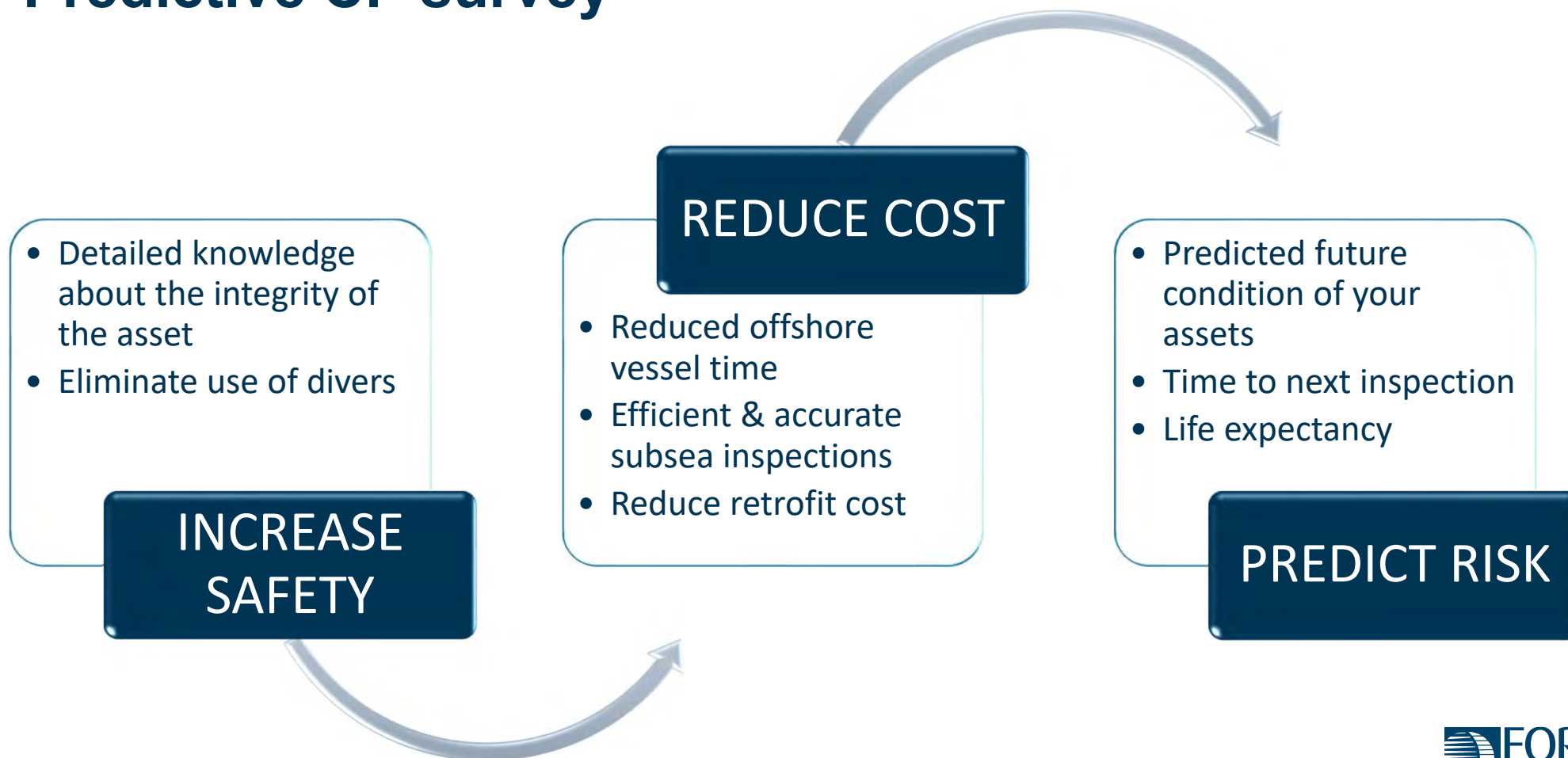


A game changer in value-based subsea inspection






Predictive CP survey







 FPSO / Hulls / Mooring lines




 Offshore wind & power cables




 Flexibles

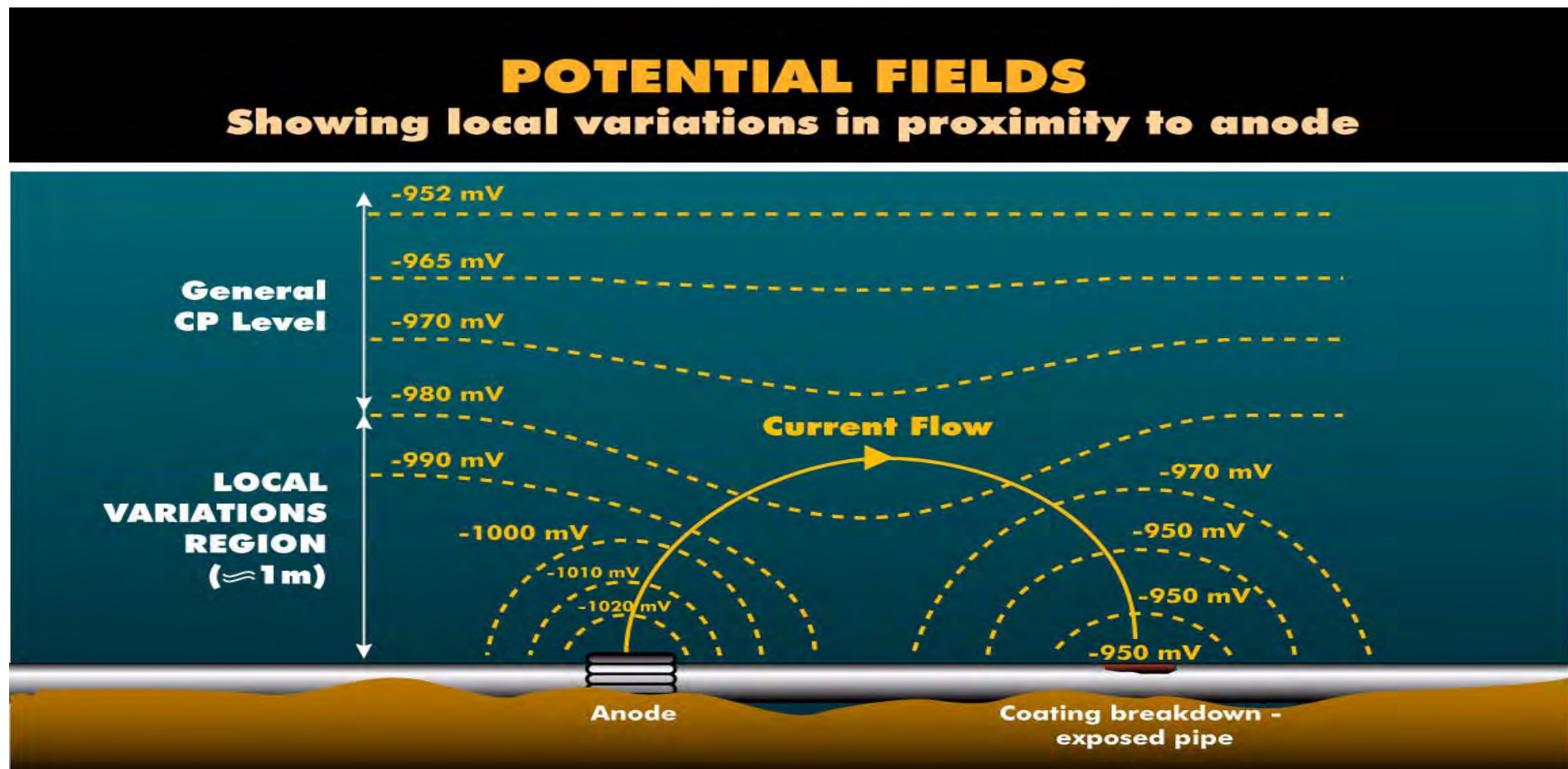
 Jackets / Semi sub & Jack-ups

 Gravity based structures

 Pipelines (buried / exposed)

 In-field structures

Cathodic Protection Principle





Measuring a car battery (V), does not estimate remaining life!



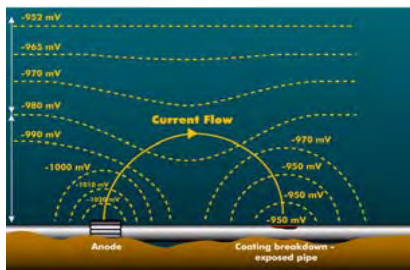
It won't even tell you if the battery is connected...



	Exposed				Buried			
STRUCTURES AND PIPELINES	Stabber/ Proximity/ Drop Cell	Cell to Cell	Dual Cell (Field Gradient)	FIGS (High sensitivity Field Gradient) 	Stabber/ Proximity/ Drop Cell	Cell to Cell	Dual Cell (Field Gradient)	FIGS (High sensitivity Field Gradient) 
Potential profile								
Anode current								
Anode wastage								
Coating damages								
Steel current density								
Current drain to e.g. piles, wells & substructures								
Outer sheath damage on flexible pipes								
Correction of pipe routing								

FiGS[®] – a step change in subsea CP Inspection

Non-contact CP survey, buried structures



Rock dump & Concrete mattresses



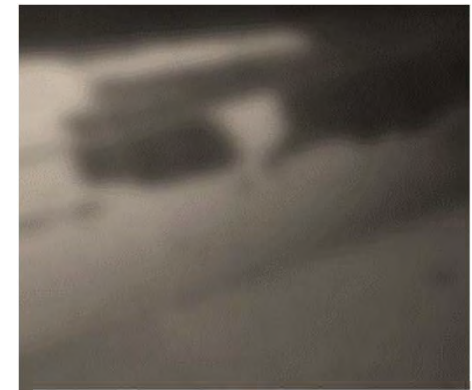
- No need for removal
- No need for stops
- Continuous measurement

Marine growth on anodes, no cleaning



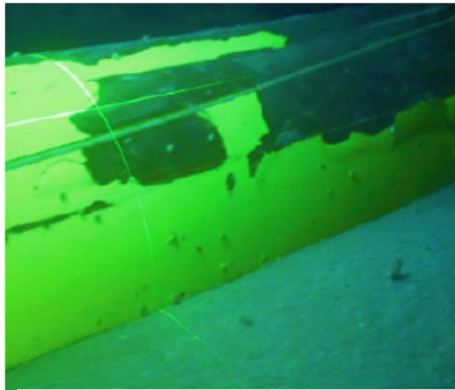
- No need for cleaning
 - Time-consuming with potential of destroying anodes
- No need for stabbing
 - Time-consuming with potential of destroying anodes
- Electrically disconnected

Muddy waters & shallow waters – no issues

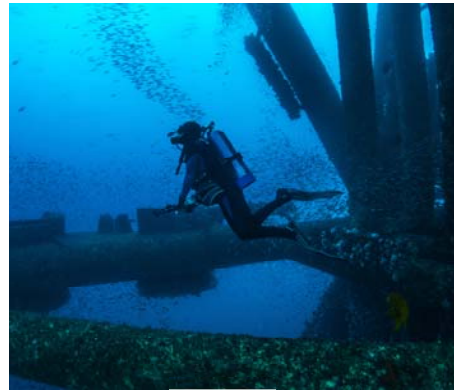


FiGS® – a step change in subsea CP Inspection

Measurements of coating damages



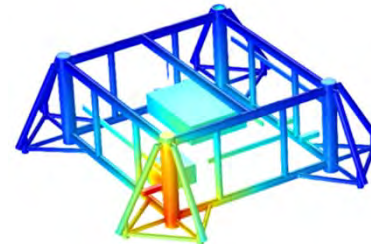
Avoid the use of divers in operations



Accurate data and sensitivity of the sensor

Potential (mV)	Location	Comments
-	ABC-468	Contact measurement possible
-	ABC-321	Contact measurement possible

Checks
snapshot of the status
of knowledge regarding redundancy of the system



Vessel time efficiency



- Non-contact
- Faster CP inspections
- Reduced vessel time
- Inspection of all structures
- Shallow and deep waters



From the PAST to the FUTURE

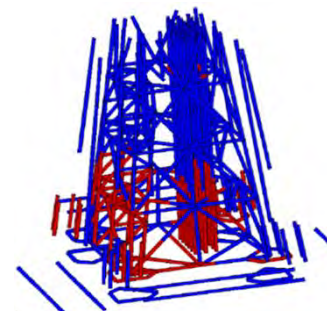
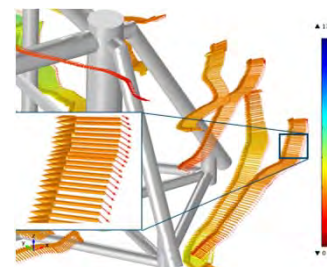
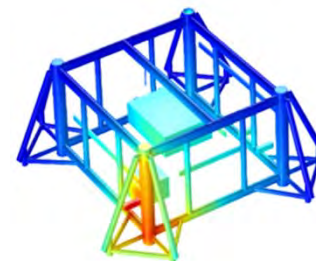
Exposed structures & pipelines

Depth (m)	Potential (mV)	Location	Comments
- 15	- 1000	ABC-123	Steel Contact
- 30	- 980	ABC-246	Steel Contact

Buried structures & pipelines

Depth (m)	Potential (mV)	Location	Comments
-	-	ABC-468	Contact measurement not possible
-	-	ABC-321	Contact measurement not possible

- ✓ Spot checks
- ✓ Only a snapshot of the status
- ✓ Lack of knowledge regarding redundancy of the system



Critical areas

- ✓ non protected/ protected
- ✓ coating damages

Accurate & detailed data

- ✓ current flow inside and around structures
- ✓ is the structure protected
- ✓ or is it protecting other structures/pipelines

Future predictions

- ✓ remaining life
- ✓ time to next inspection
- ✓ effect of modifications
- ✓ ~100% CP status



From the PAST to the FUTURE

- Predictive CP computer modelling (SeaCorr™)



The combination of FiGS® & CP modelling provides full control of the CP system for all structures and pipelines

FiGS® CP surveys – actual condition of the assets



20% of the anodes on a jacket where inactive



Detected 80 new anode sleds on a pipeline



Detected inactive anodes in a template – other surrounding structures were protecting it



Invisible coating defects detected (2 mm gap in field joints)



Measured buried anodes to be active – no need for expensive retrofit of a pipeline

FIGS® Survey = Return on Investment



Typical pipeline retrofit cost broken down:

Design: 2-5%
Materials: 20-25%
Installation: 75-80%

Non-contact = New possibilities

Vehicles:

- Autonomous Underwater Vehicles
- Fast moving ROV
- Inspection Class ROV
- Autonomous Inspection Vehicles

FiGS® Operation window and spec

- 0-5 Km/h (2,7 Knot) (double speed 2019)
- 0-3 meters above pipeline
- Weight: 7,5 Kg (wet)
- Connection: RS232
- 24V DC and 20W each sensor
- Generates 1,5MB/hour
- Can be combined with TSS440



FiGS[®] survey – the fast way to prediction



Jackets

6-12 hours



FPSO

6 hours



In-field structures

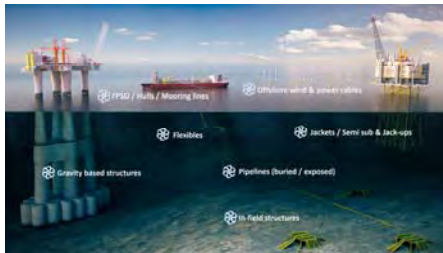
**1hour/
structure**



Pipelines (buried / exposed)

5 km/hour

Summary – FiGS® CP survey



Inspect all assets



No issues during inspection/reduced vessel time



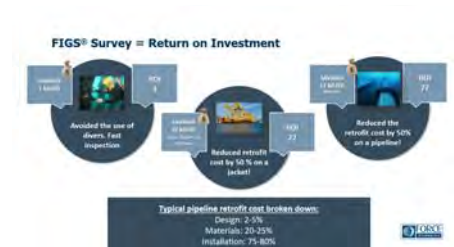
Extensive amount of data



Detailed reports



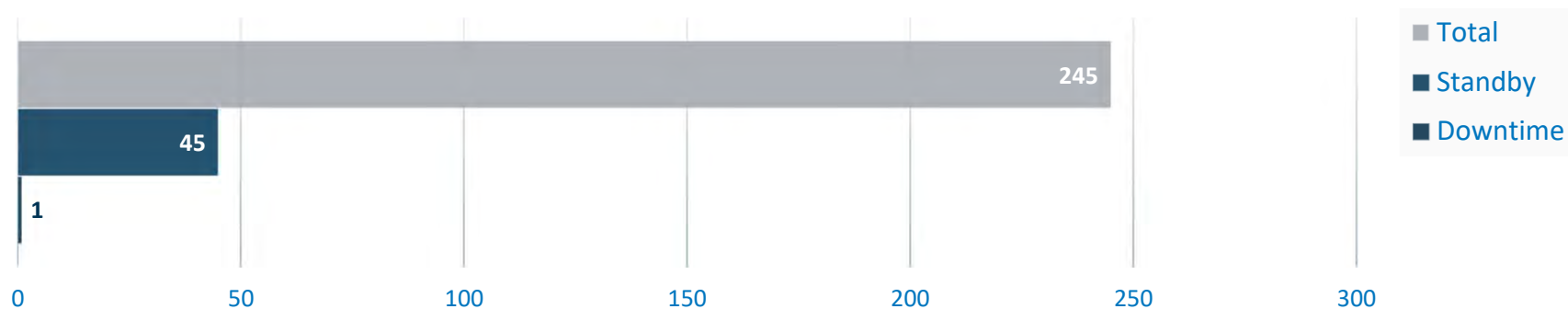
Predict the future/optimize



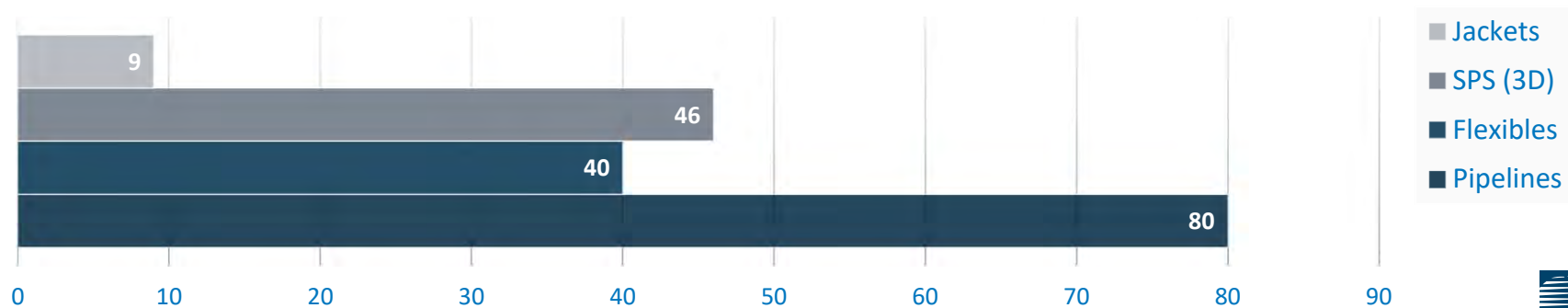
Return on Investment

Year to date

Offshore days 2017 to date



Assets 2017 to date



Clients

 **ConocoPhillips**



AkerBP



REPSOL



Statoil



ONE Gas

DONG
energy

P E R E N C O



HOCHTIEF

Technip



subsea 7

 **bluestream**

DOF

Subsea

SEA

DEEPOCEAN

James Fisher and Sons plc
Marine Services Worldwide



OCEANEERING[®]



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INTRODUCTION

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in

**REDUCE COST
INCREASE
SAFETY
PREDICT RISK**

CP SURVEY OF SUBSEA PIPELINES & STRUCTURES



No divers
reduces
HSE risk



More value
with
less cost



Speed
up the
survey



Predict
service
life



No need
for
excavation