

Flooding Detection System for Flexible Annulus Integrity Monitoring

Olivier MESNAGE
TechnipFMC

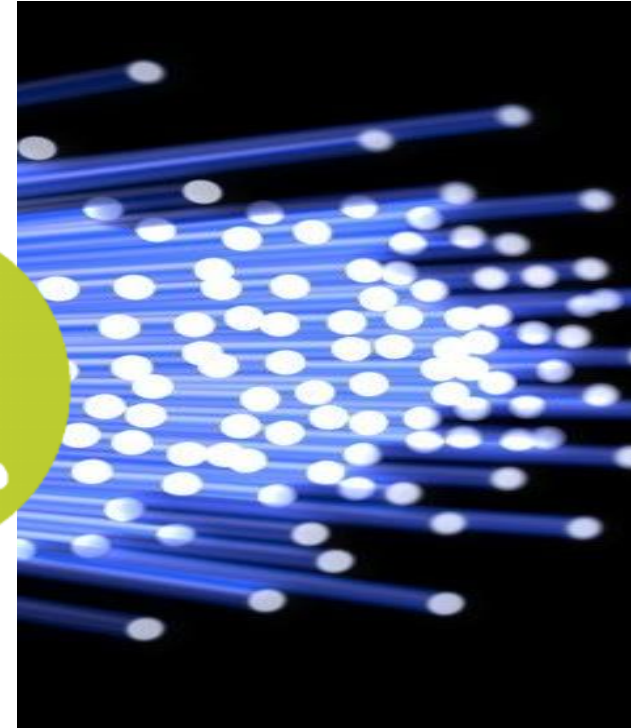


AGENDA

- Interest of DTS monitoring
 - Annulus Flooding Detection
 - Global SURF surveillance system
- TechnipFMC complete DTS offer
 - From the instrumented riser to the Monitoring software



Optical fiber distributed sensing (DTS) integrated in flexible risers increase safety & revenues



What DTS Monitoring will bring to operators



1- OPEX reduction

- Digitalization: better productivity
- ROV cost cutting
- Inspections cost cutting



2- HSE improvement

- Better knowledge of riser condition
- Riser integrity improvement
- Early leak detection



3- Production improvement

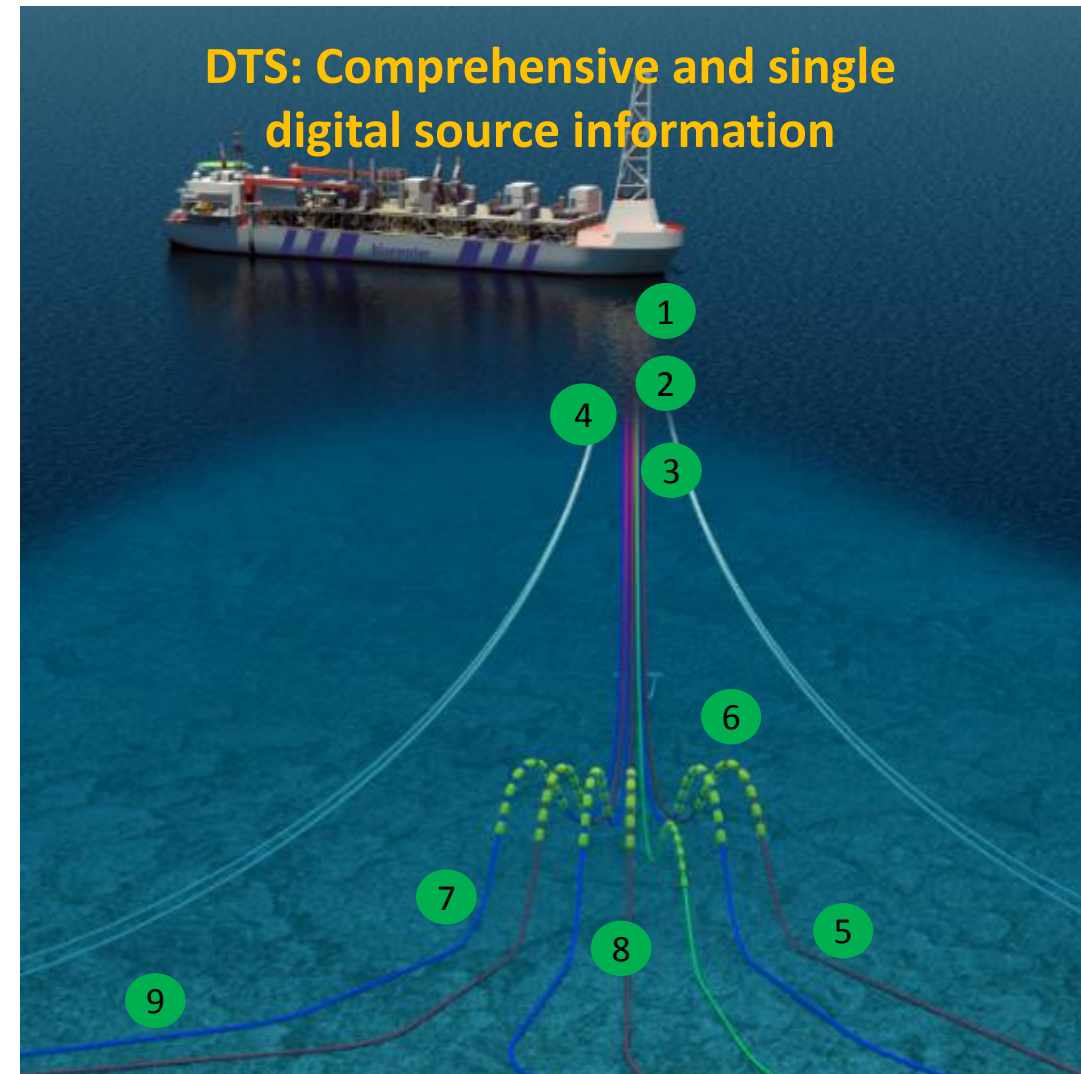
- Hydrates plugs detection
- Flow management improvements



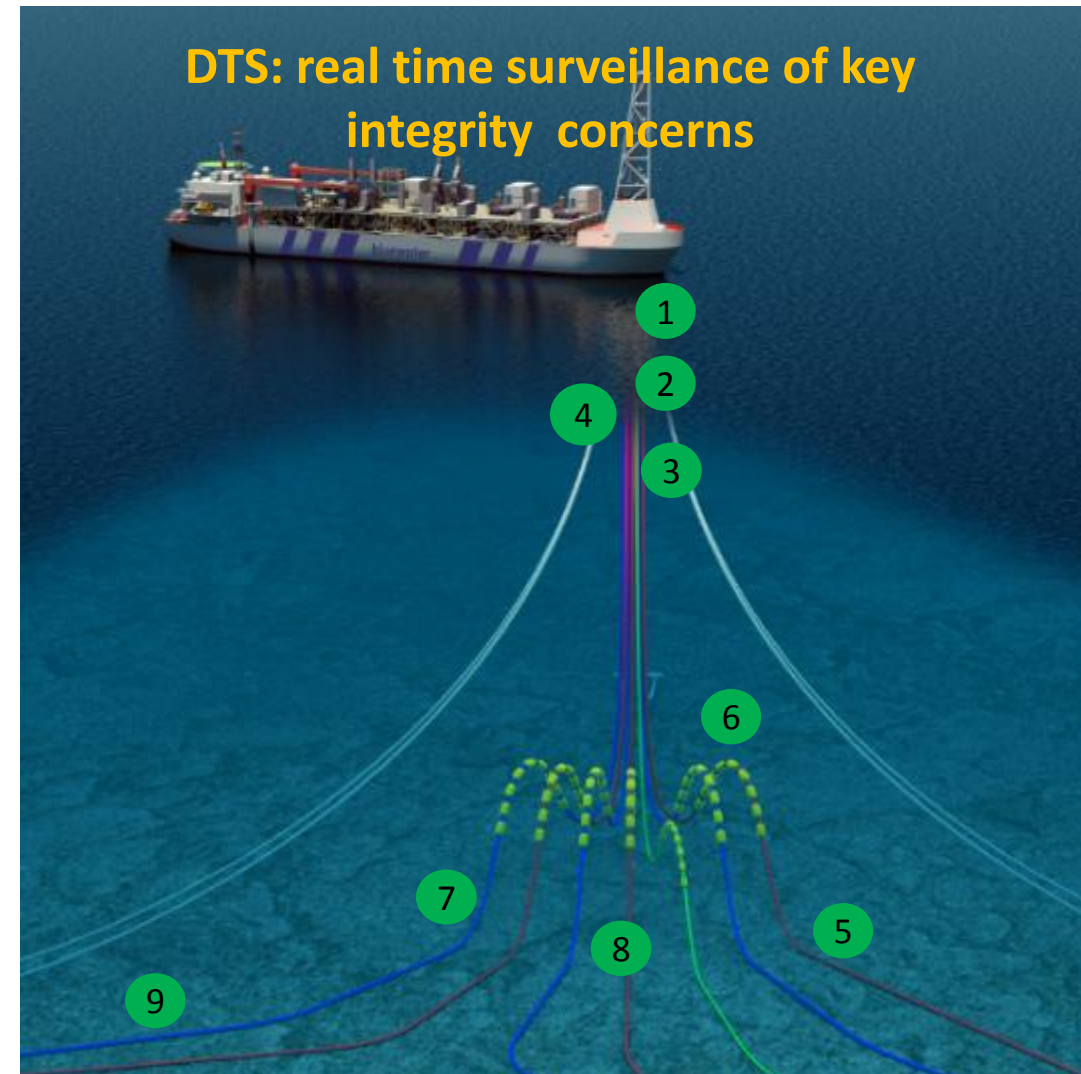
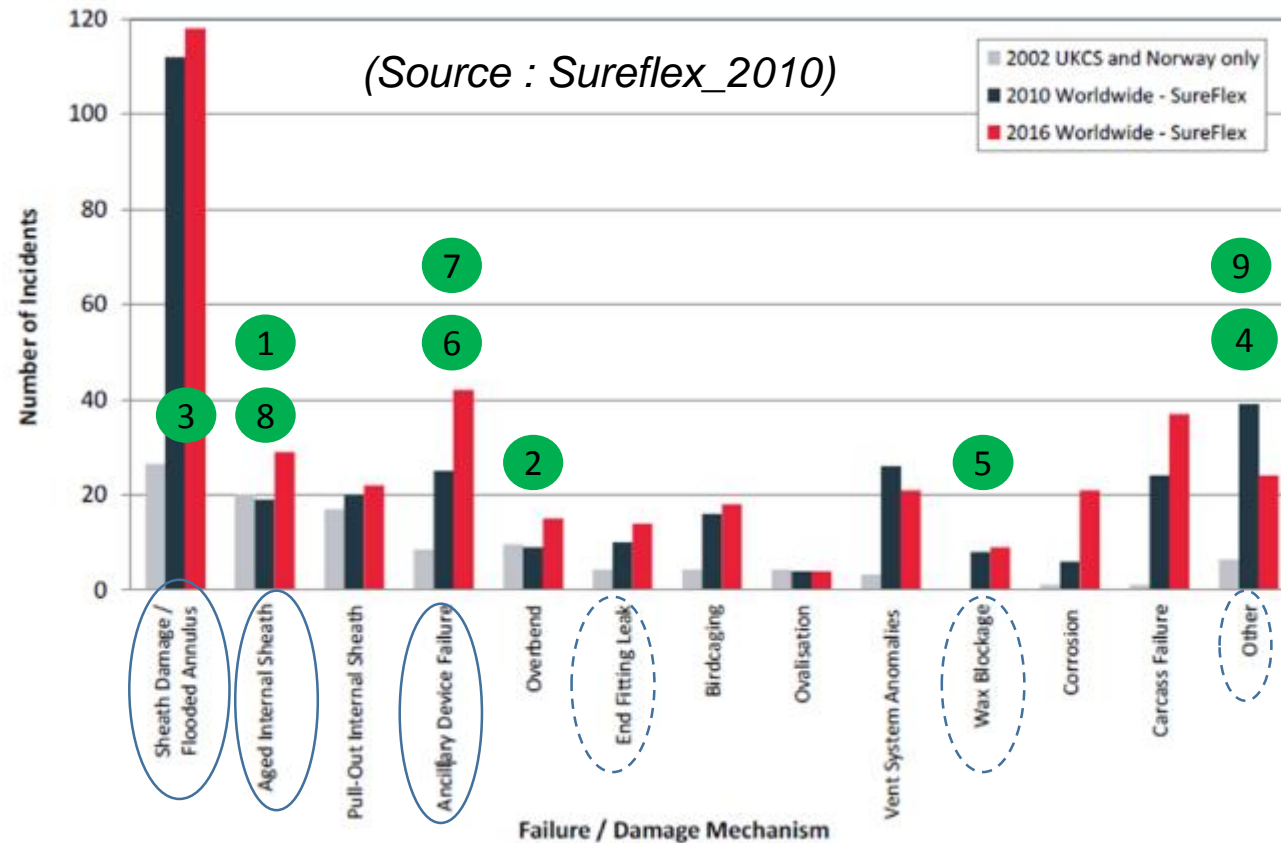
DTS is your permanent subsea vision:

DTS reduces OPEX: a single sensor for all

N°	Parameter of interest	By ROV	By topside Inspection	By DTS
1	Temperature under stiffener	✗	✗	✓
2	Bend stiffener presence	✓	✗	✓
3	Annulus flooding condition	✗	✓	✓
4	Marine growth thickness	✓	✗	✓
5	Hydrate presence	✗	✗	✓
6	Buoyancy clamp sliding	✓	✗	✓
7	Vertical anchor integrity	✓	✗	✓
8	Touch down point stability	✗	✗	✓
9	Riser trenching	✓	✗	✓

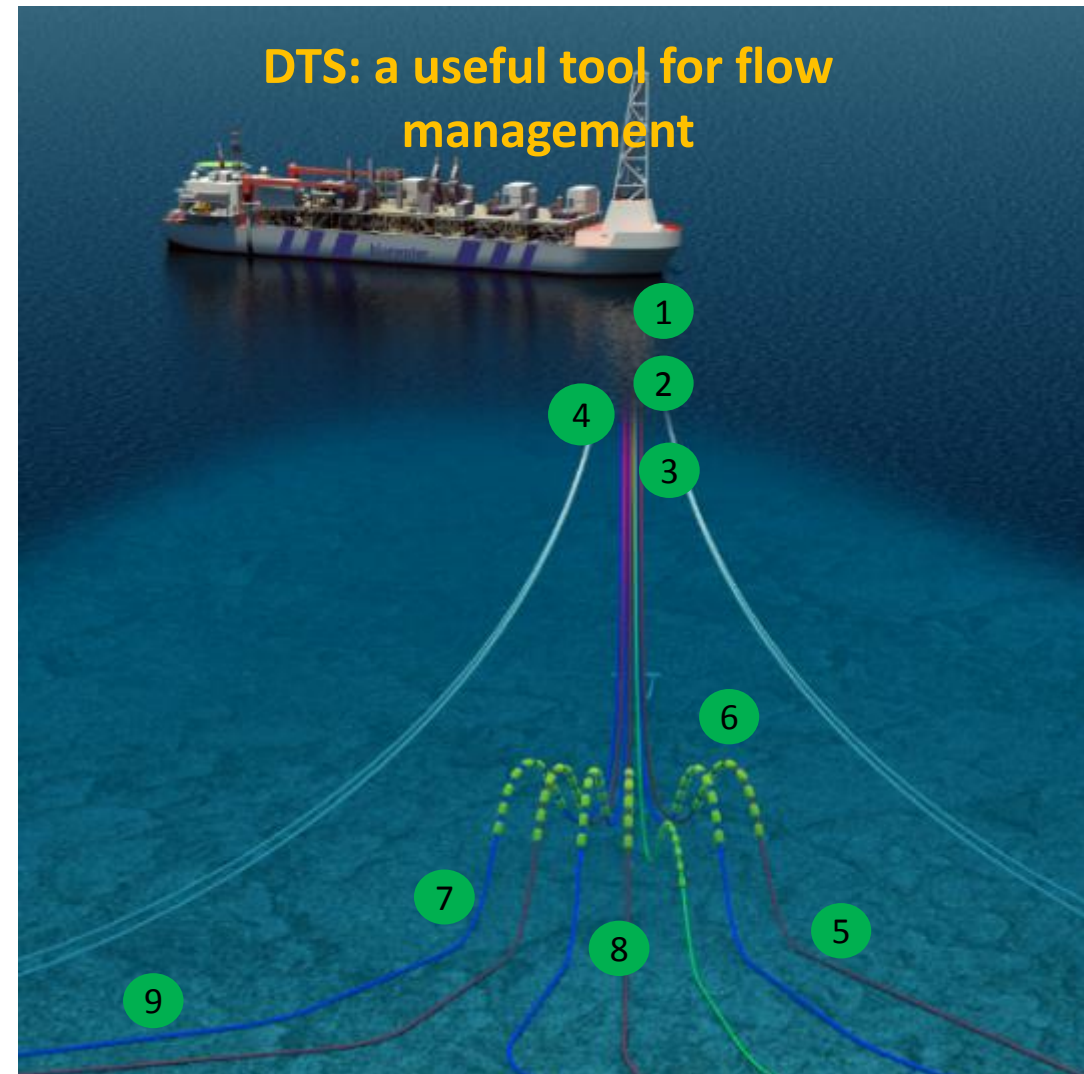


DTS improves HSE: a single sensor does better



DTS improves production:

- With DTS temperature along the riser, bore temperatures in the full riser section can be calculated and allow:
 - Detection and localization of hydrates and wax plugs
 - Maximum temperature capacity of the riser system (cold & hot spot surveillance)
- DTS will be useful during shut down & restart operations



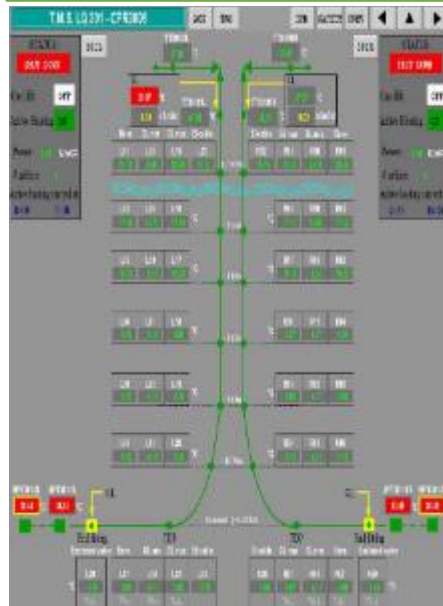
TechnipFMC: 15 years of experience in DTS

DTS: Distributed Temperature Sensing with optical Fiber

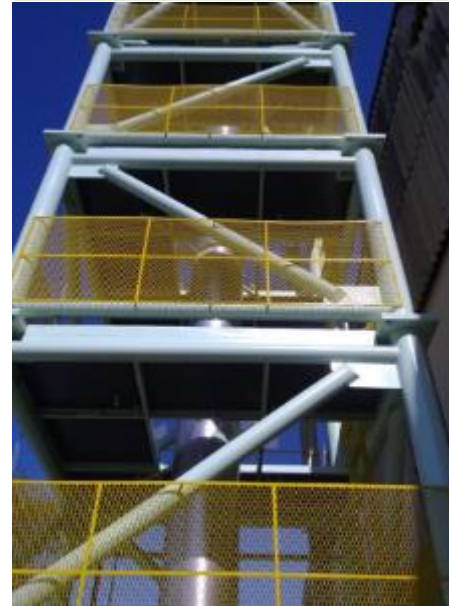
15 years ago:
First qualified
prototype with DTS



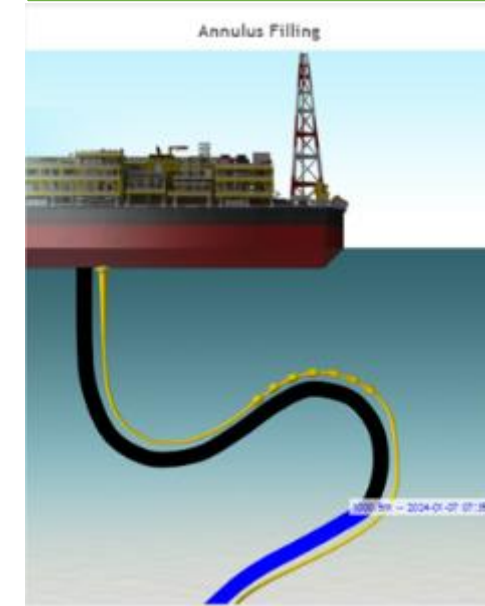
10 years ago:
First operational
risers with DTS



3 years ago:
DTS qualification for
flooding detection



Today:
Real time DTS
condition monitoring



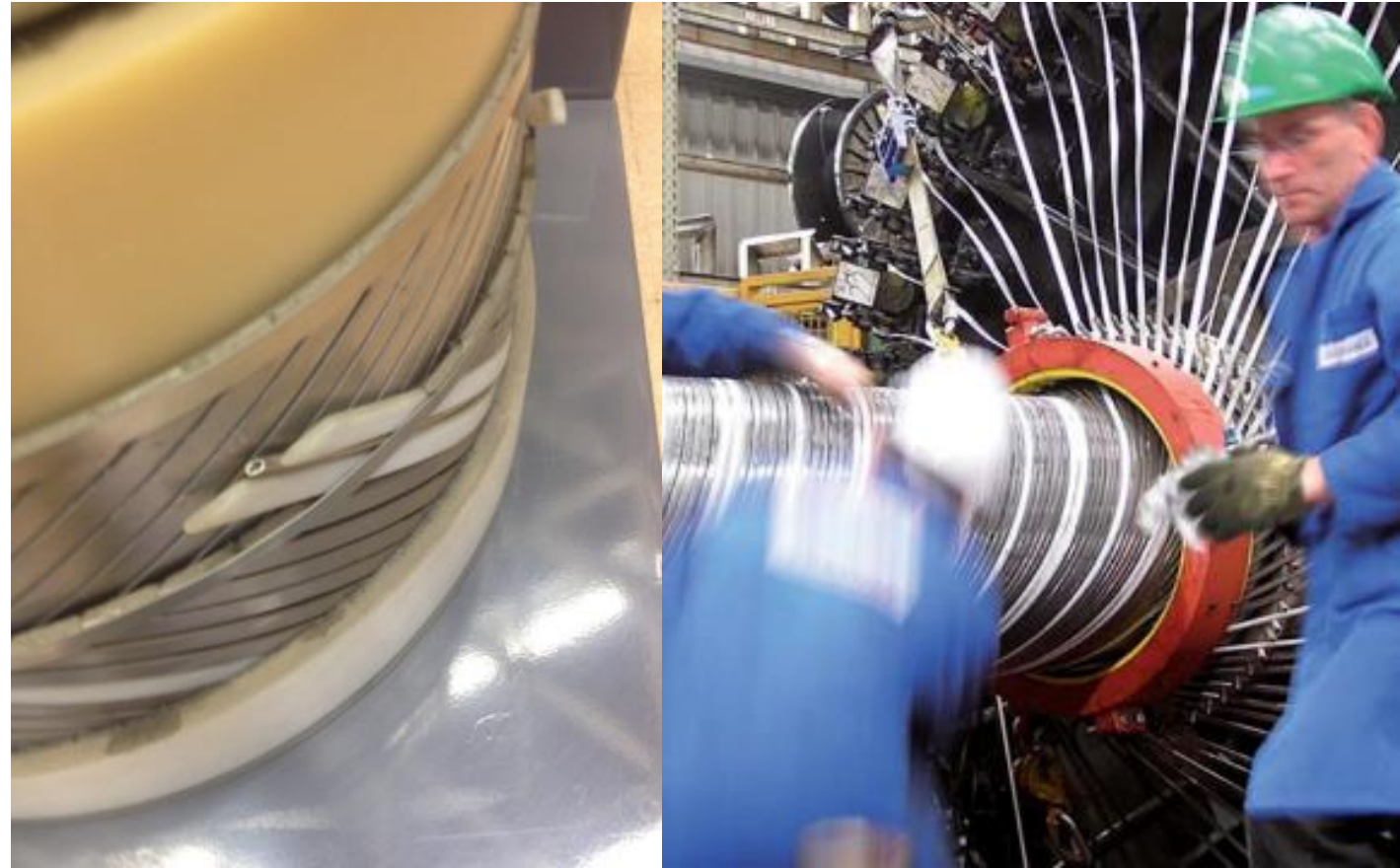
Flooding detection qualification

- 1 year full scale test campaign to validate annulus flooding models
- 6" Riser tested with real operating condition
- 0,5 l/min water ingress flowrate is sufficient for detection
- 5°C temperature difference between bore and seawater is sufficient
- 64 configuration tested in blind mode to benchmark algorithm



The offer: TechnipFMC DTS-ready Riser

- The riser is delivered with two integrated steel tube in one armour layer
- The cost impact on the Riser procurement CAPEX is optimized
- More than 80 risers have been manufactured in 5 years



The offer: TechnipFMC DTS system

- TechnipFMC will deploy an optical fiber in the riser offshore
- TechnipFMC offer will include a DTS monitoring unit designed by Omnisens
- Omnisens has been part of the full scale flooding test
- Long term agreement plan
- Omnisens has a significant oil & gas track record including offshore deployed systems

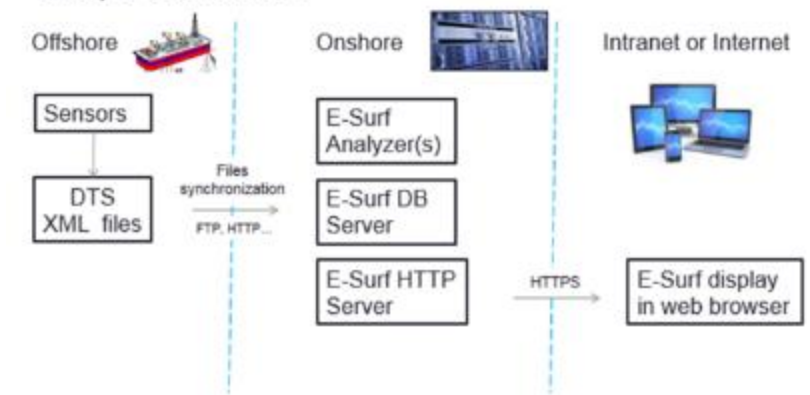


The offer: TechnipFMC real time monitoring software

- e-surf real time monitoring software
- Outer sheath breach detection
- Water diffusion in annulus detection
- Secured HTTP based software accessible from any web browser
- HTML5 interface deployable on all types of supports



Sample architecture



Conclusions

Investing in a DTS monitoring for flexible risers will benefit to operators:

- Integrity Management OPEX cost will be reduced
- IM productivity will be improved
- Riser operation safety will be improved
- Riser production capacity will be improved

Operators should now ask riser project teams to request DTS option in tender

**RISERS AND FLOWLINES MONITORING SYSTEM
SPECIFICATION**

