

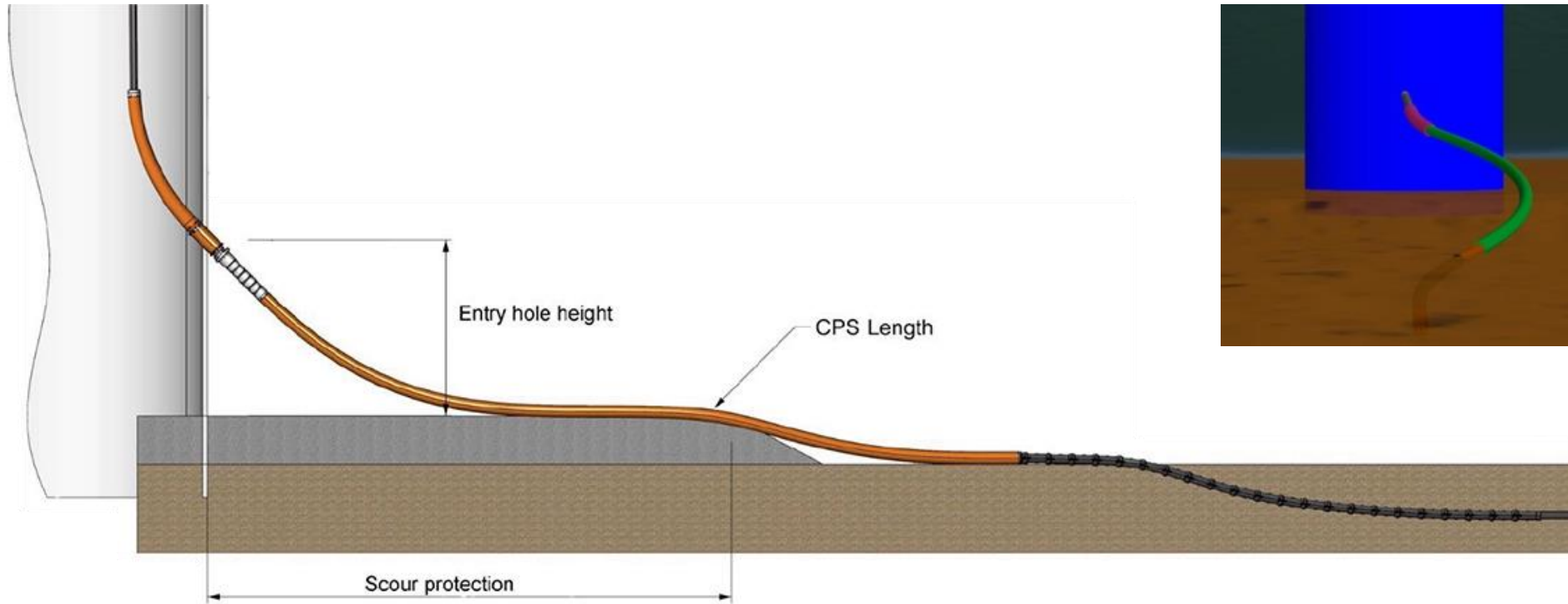


Industry experience informs future cable protection system design

Henrik Bang-Andreasen
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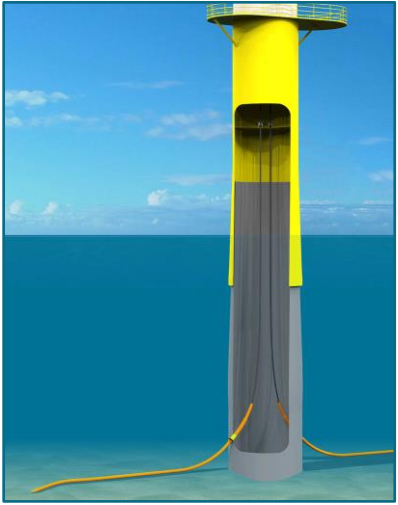
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So, what does a cable protection system actually do?

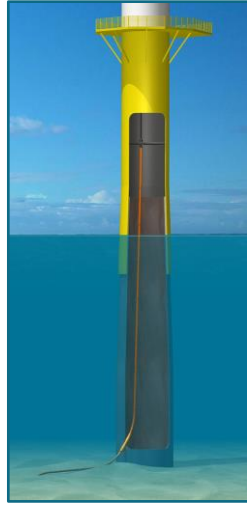


- Protects cable-to-cable maximum bend radius and strain
- Protects against wave and tidal induced currents to 50/100-year ultimate limit state (ULS)
- Mitigates thermal runaway at steady state (100% load)

Seaproof Solutions experience



Seaproof CPS



Seaproof Long CPS



CPS for J-tubes



Onshore pre-installed CPS



J-tubeless CPS



Retrofit J-tube

“

Seaproof Solutions boasts
an unrivalled zero-failure,
zero cable damage record

Key industry developments



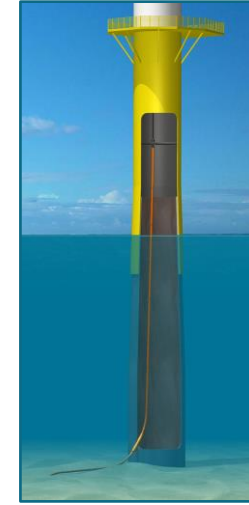
Vindeby, 1990



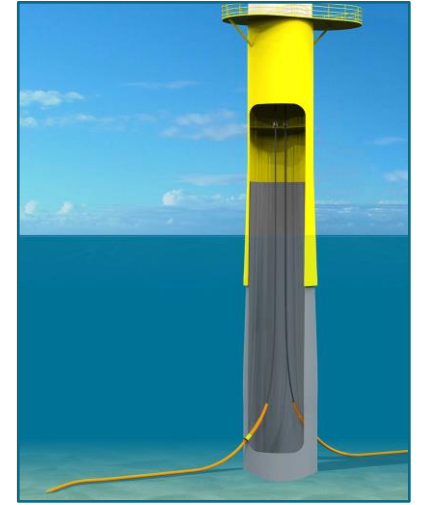
London Array, 2011



Humber Gateway, 2013



Veja Mate, 2017



Hornsea 1, 2018



**Seaproof Solutions has
successfully installed
1500 CPS systems**

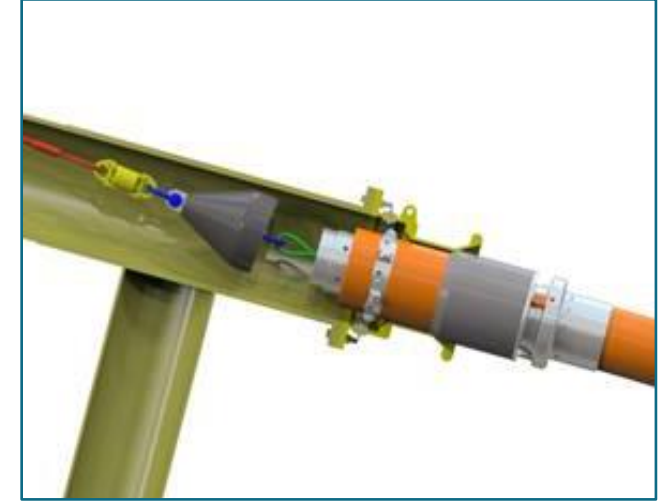
CPS product evolution



Units stored onboard Siem vessel ready for fast installation



Onboard Siem vessel



FID based J-tube solution

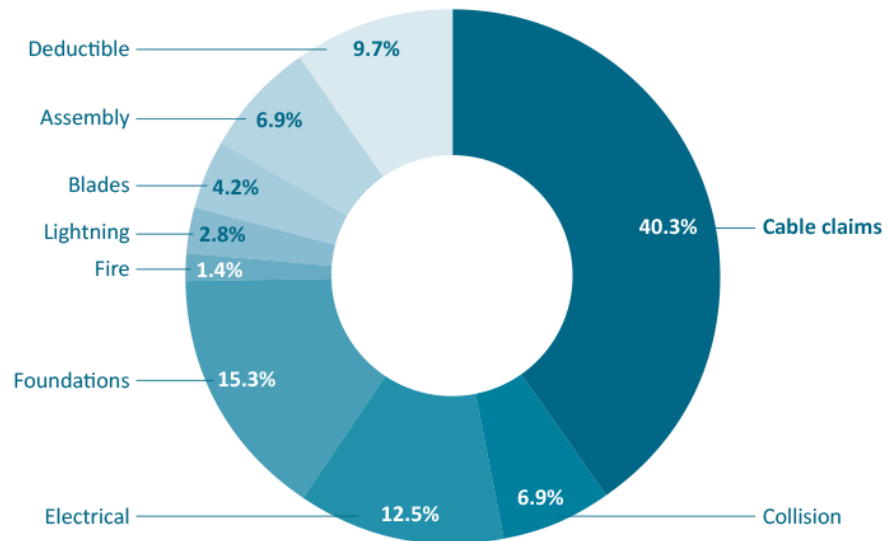
- From internal J-tubes to J-tubeless and integrated CPS/J-tube
- Removal of J-tube = cost reductions
- Full length protection vs latch interface
- From oil & gas ancillary equipment for flexible flowlines to cable installation contractor responsibility in offshore windfarms
- Installation-friendly design to fit back deck

Cable failures

- Cable failures responsible for vast majority of claims: 82%+ in 2016
- Majority of failures occur at foundation or splice
- Little understanding of CPS-systems with zero-failure track record

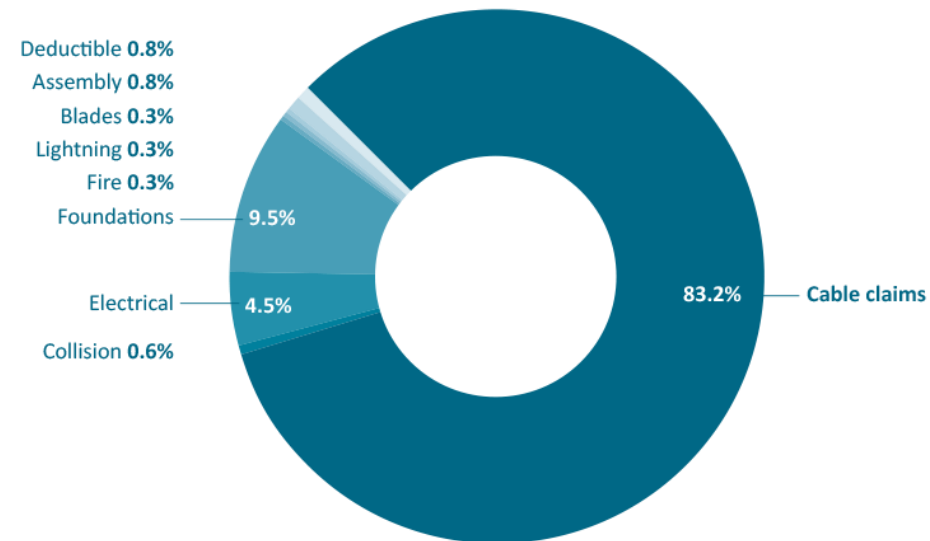
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% Share - total number of claims



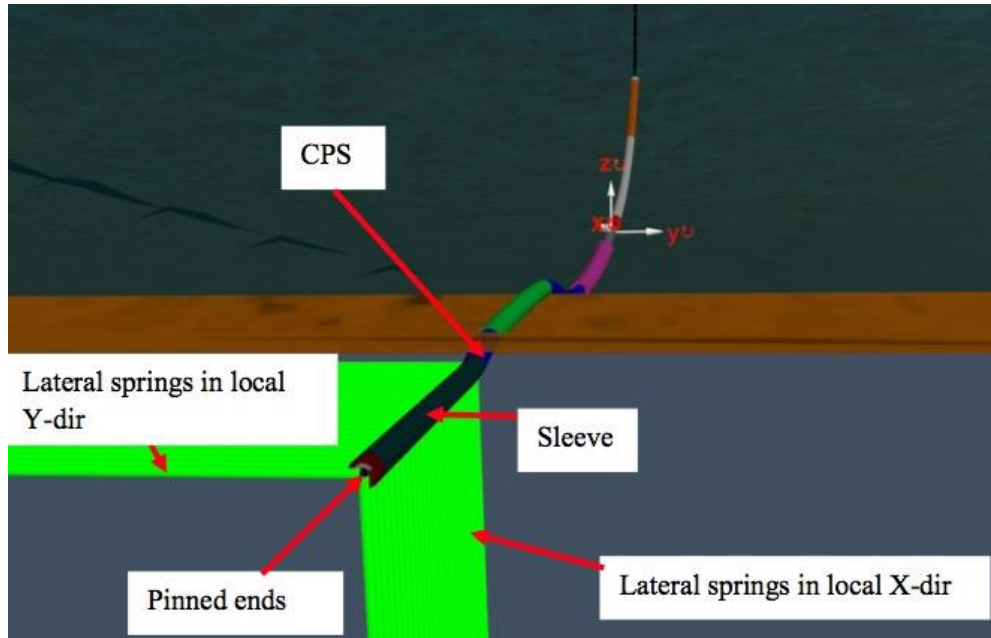
% Share - total claims cost

Source: Lloyd Warwick & Codan



Current situation

- Capex (procurement cost)
- Cost of installation, often measured by CPS length
- Ultimate limit state (ULS), driven by wave period time and height
- Cable OD: 66 kV cables and large IAC's 800mm²
- Cable loss per meter



Q&A

Global Wind Day Seoul



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