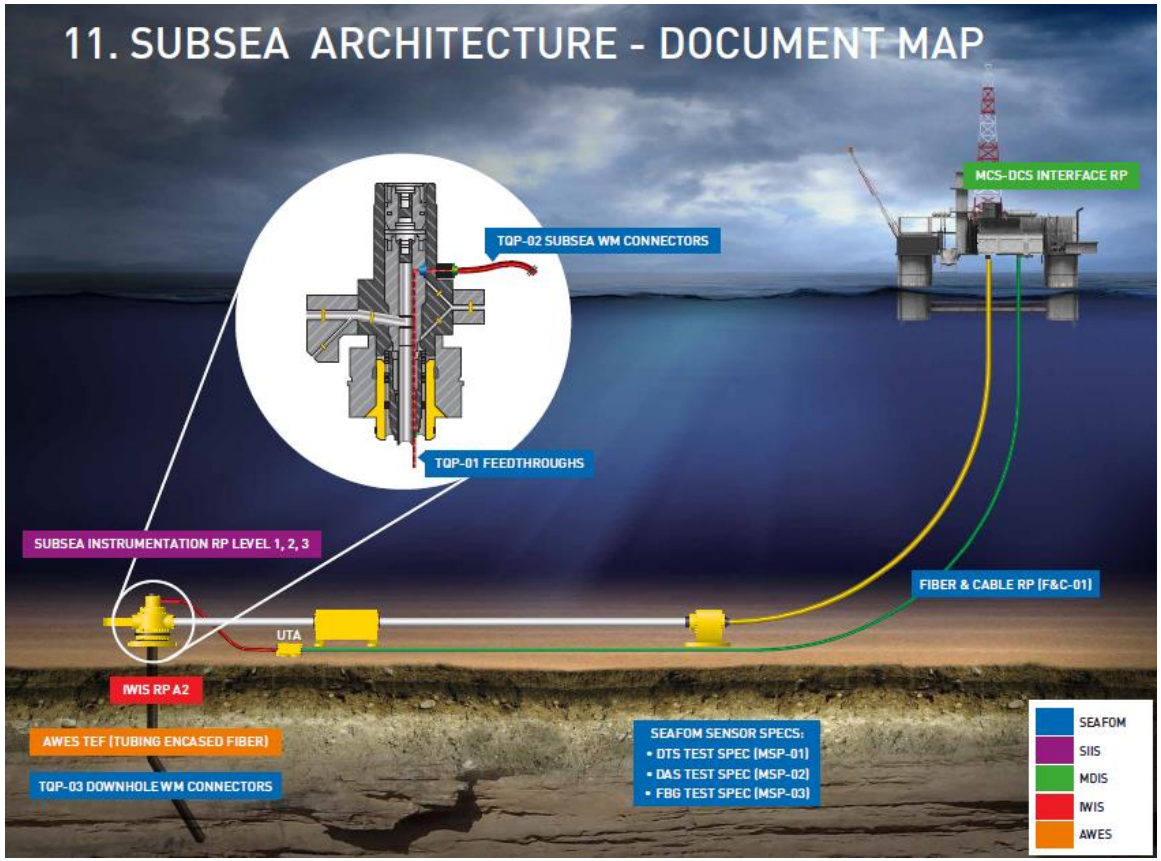
Membership Pack – SEAFOM in Summary

2017

Fiber Optic Monitoring Group

Introduction

SEAFOM exists to facilitate the growth of fiber optics sensing in subsea, dry tree, and land well applications as well as within subsea infrastructure



Value drivers

- Knowledge sharing
- Networking
- Develop recommended practices for eventual adoption as industry standards
- Dissemination of today's fiber optic technology & applications and its commercial applicability to the Oil & Gas Industry

SEAFOM – Member Benefits

SEAFOM's value proposition is based around its unique membership base that allows consistent collaboration across a broad range of fiber optic providers and users.

- Develop and steer formation of recommended practices
- Operator supply chain engagement and technology influence
- Consistent focus on knowledge sharing and inter-company collaboration
- Key focus on addressing overall reliability of fiber optic systems intended for deployment in complex scenarios
- Bi-Annual SEAFOM™ "Industry Events" focused on marketing and promotion of the entire membership supply chain to a wide operator audience
- Promotion of closer collaboration and knowledge sharing across industry and the research and development activities within Academia*
- Supply chain support and stimulation, especially for the smaller / newer vendor members who enjoy access to a wide array of established end-users (Operators) and other potential vendor partners
- Active promotion of training related to the deployment of fiber optic technology within the Oil & Gas arena

*Academic members benefit from free membership

SEAFOM – Member Benefits

SEAFOM's value proposition is based around its unique membership base that allows consistent collaboration across a broad range of fiber optic providers and users

- Participation in the development of detailed fiber optic product qualification testing requirements with technical representatives from both suppliers & buyers (versus individual operator specific qualification requirements) of fiber optic system components which will lead to lower product development costs & delivery schedules.
- SEAFOM meetings occur in the same location as SWiG to enhance networking opportunities and to cater for the fact that many attendees are involved with both groups

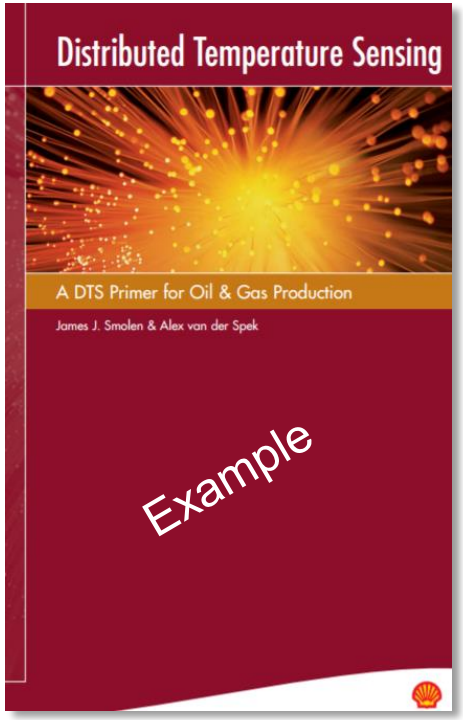
*Academic members benefit from free membership

SEAFOM – Member Benefits

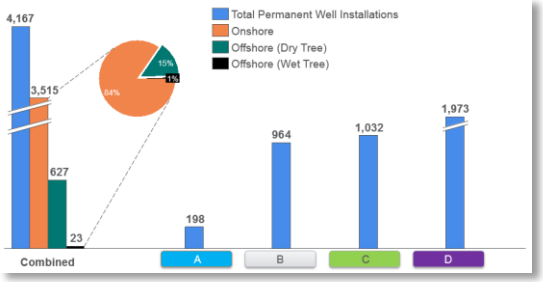
Oilfield Fiber Optic technologies and membership base solutions are promoted through special events, publications & deployment surveys

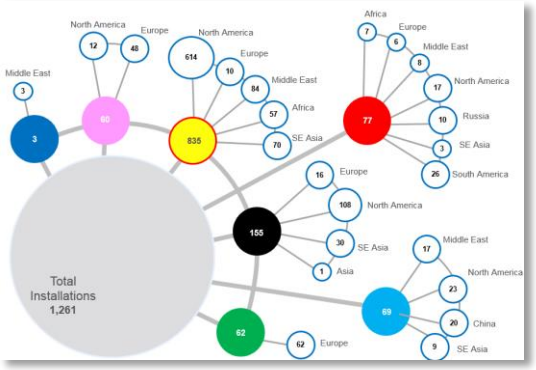
Annual SEAFOM Industry Promotional Events promoting SEAFOM members to wide number of End-Users

Publication of a New Industry Primer detailing Fiber Optic Sensing for Downhole applications (2017)



Publication of first ever deployment survey of global downhole Fiber Optic installations (2016)





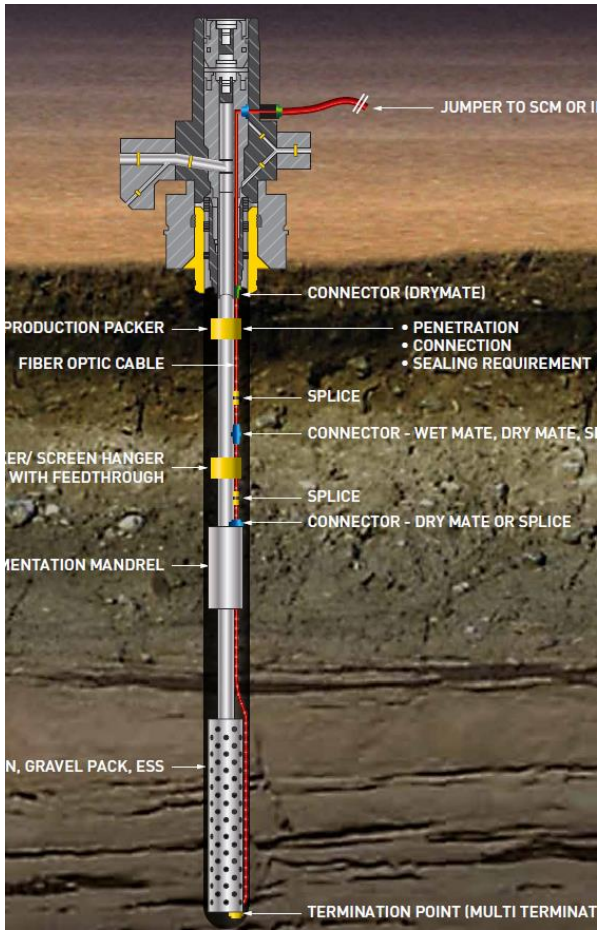
About SEAFOM

SEAFOM meetings focus on knowledge sharing, progressing working group activities and promoting networking

- SEAFOM meetings take place over 2 consecutive days and occur once per quarter (working group communication is ongoing)
- The location of SEAFOM alternates between the US (usually Houston) and Europe

	Day 1	Day 2
Morning	• Knowledge sharing presentations	• Knowledge sharing presentations • Working groups
Afternoon	• Networking lunch • Working groups • Networking	• Networking lunch • Networking • Depart
Evening	• Networking event • Networking dinner	• -

Typical SEAFOM meeting format



Current members

SEAFOM's growing membership includes organizations across the supply chain

Operators

Chevron
MAERSK OIL
Shell
Statoil
TOTAL
woodside

Supply chain vendors

AFL
AkerSolutions
ALCATEL SUBMARINE NETWORKS
AMETEK
AP SENSING advanced photonic
BAKER HUGHES
BRUGG CABLES
CORNING
DEEPLINC
DE REGT MARINE CABLES
FAZ TECHNOLOGY
FBGS
FIBERCORE
FMC Technolo
FEBUS OPTICS
Fotech
GE
Gooch & Housego
HALLIBURTON
LIOS TECHNOLOGY
NEC
NUFERN
ofs A Furukawa Company
omnisens
OneSubsea
OZ Optics
OptaSense
roxar
Schlumberger
SIEMENS
SILIXA
smart fibres
TE SEACON DEUTSCH
TE SUBCOM
TELEDYNE OIL & GAS
Verrillon
Weatherford
YOKOGAWA

Academia

C-FER Technologies
CITY UNIVERSITY LONDON
cmr Christian Michelsen Research
Fraunhofer UK
TNO

Industry recommended practices

There are currently 8 SEAFOM recommended practices completed (or under development) that will ultimately be submitted to API in order to promote standardization and greater industry alignment

Ref	Name	Status	Publication / API submission date
MSP-01	Measurement Specification for Distributed Temperature Sensing	Completed	Updated Dec 2015, API in 2016
MSP-02	DAS Parameter Definitions and Tests	Ongoing	Publish Dec 2017
AWES-DIG	FBG based Monitoring Systems - Recommended Practice For the Qualification of Downhole Instrumentation / Sensors	Completed - AWES Collaboration	AWES publish 2nd rev Sept 2017
F&C-01	Fiber and Cable in Harsh Environment - Recommended Testing Procedures	Completed	Published 2015
TSD-01	Functional Design and Test Specification for an Optical Feedthrough System used in Subsea Xmas Tree Installation	Completed	Planned update for 2018, API in 2018
TSD-02	Functional Design and Test Specification for Subsea electrical / optical connectors and jumpers	Completed	Completed Feb 2016, API in 2017
TSD-03	Functional Design and Test Specification for Downhole Electrical and Optical Connectors and Assemblies for in-well sensing applications	Ongoing	Publish Dec 2017
AWES TEF	Tubing Encase Fiber document (developed in collaboration with AWES, the Advanced Well Equipment Standardization group)	Completed - AWES Collaboration	Published 2016

Note: Measurement Sensor Performance (MSP); Test Qualification Plan (TQP); Fiber & Cable (F&C)

Overview: MSP-01

Measurement Specification for Distributed Temperature Sensing

Objective

- To provide a guide, specifically focused on "Distributed Temperature Sensing" (DTS) which enables:
  - Every DTS customer to select a product based on comparable specifications derived from identical parameter definitions and comparable test procedures
  - Every DTS manufacturer to specify and test their instrument performance following the same parameter definitions and test procedures as anybody else

Deliverables

- A set of DTS performance parameter definitions, test setups and testing procedures, which are valid for any brand or model of a DTS system.
  - The document does not pose any requirements on the actual DTS performance, nor is it intended to actually define any specific acceptance criteria for any given application, nor to limit any user to use any brand of DTS with any desired/compatible fiber and cable.

Value contribution

- What does this document provide to the industry:
  - A harmonized definition of the key DTS performance parameters together with standardized procedures on how to test them.
- Intended end-users of the document?
  - Decision makers and technical buyers at oil service providers or operators
  - DTS equipment manufacturers

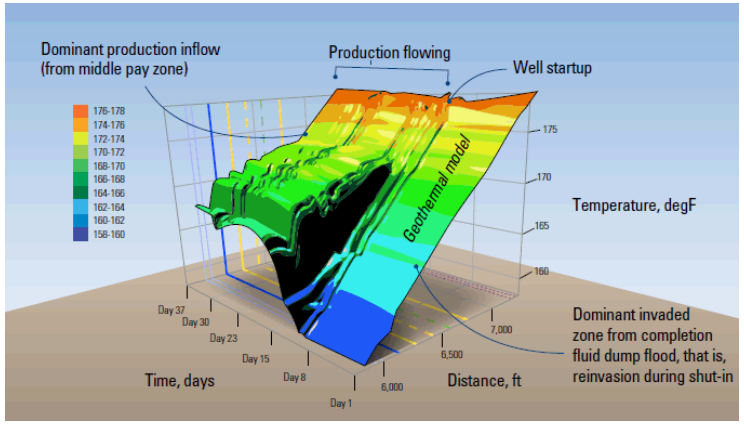


Image Source: Schlumberger

Overview: MSP-02

DAS Parameter Definitions and Tests

Objective

- Development of a guide to standardize parameter definitions, measurement metrics and recommend test and or characterization processes approaches to assess the performance of DAS Interrogators used in Oil and Gas applications such as cementing, completion, stimulation, production , logging, seismic, and other down hole measurements.

Deliverables

- Document MSP-02 aims to clearly define DAS measurement and performance parameters and identifies basic in-lab test processes to support evaluation of DAS Instruments as a means to verify capabilities.
- The aim of this document is to be a standard to support common language for end-user specification development, and a process means for verification.

Value contribution

- What does this document provide to the industry:
  - A set of standards to define DAS measurement and performance parameters
  - A reference for operators to support determination the suitability of DAS offerings to meet the intended measurement objectives of an operator
- Intended end-users of the document?
  - DAS Implementation operator personnel inclusive of those without optical measurement expertise.

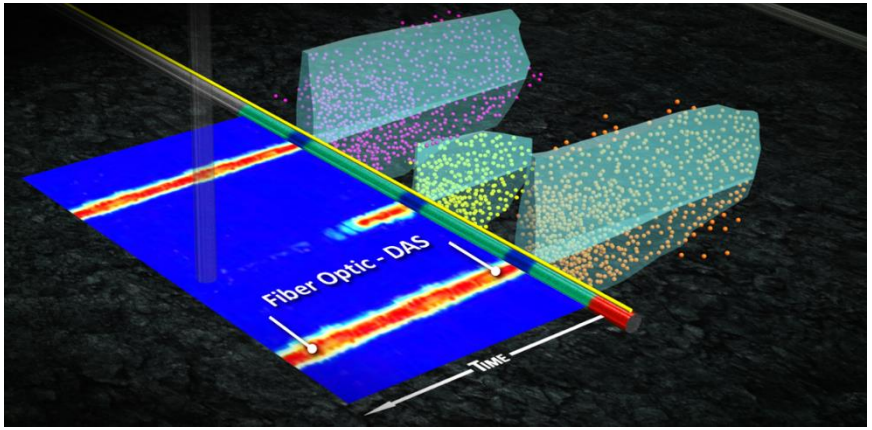


Image Source: Halliburton

Overview: AWES-DIG Rev 2

FBG Sensor Systems - Recommended Practice For the Qualification of Downhole Instrumentation / Sensors

Objective

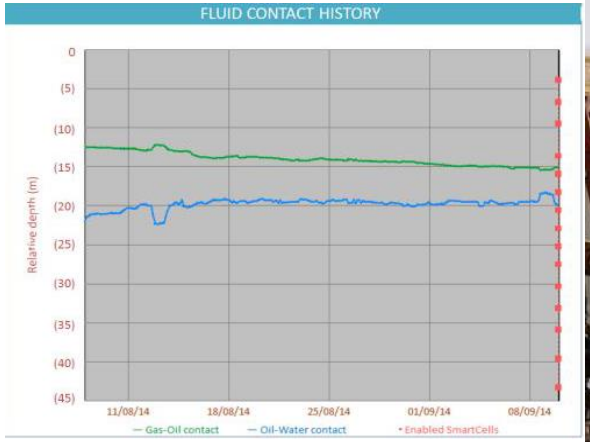
- To agree a set of performance metrics and recommend test procedures to assess the performance of Downhole Instrumentation and Sensor systems used in Oil and Gas applications.
- Note: Work Group Collaborated with AWES to update the existing AWES-DIG document to appropriately include fiber based sensors downhole

Deliverables

- Best Practice document covering specifications of downhole measurement systems and methods of validating those specifications.
- We are not recommending minimum or target values - these are up to the end-user to specify, according to the requirements of their application.

Value contribution

- What does this document provide to the industry:
  - A single point of reference for specifications and test methods. This will allow suppliers and operators to realise commercial and operational benefits by providing a single specification that all can qualify their products to and purchase against
- Intended end-users of the document?
  - Technology developers, to give them a rigorous basis for testing, qualification and making good technical proposals
  - Operators, to help assure them a product is fit for their application and to assist in requesting and checking suppliers' proposals.



Fiber Optic Monitoring Group

Image Source:

Overview: TSD-01

Functional Design and Test Specification for an Optical Feedthrough System used in Subsea Xmas Tree Installation

Objective

- To define a minimum performance specification for an optical feedthrough system (OFS) to be used in intelligent well applications through vertical or horizontal subsea Christmas (Xmas) Trees (XT)
- This document specifically addresses the interface between the subsea environment of the XT and the downhole or reservoir environment for transmission of optical data through the XT.

Deliverables

- Recommended practice document outlining
  - Specification of minimum design and functional requirements
  - Specification of minimum qualification and factory acceptance test requirements

Value contribution

- What does this document provide to the industry:
  - A consolidation of the various individual company Design and Test Specification documents allowing for significant cost reductions for suppliers and operators by providing a single specification that all can use and qualify their products to.
- Intended end-users of the document?
  - Personnel involved in technology development, fabrication and delivery of referenced connectors, project planners and project executioners utilizing these connectors in their projects

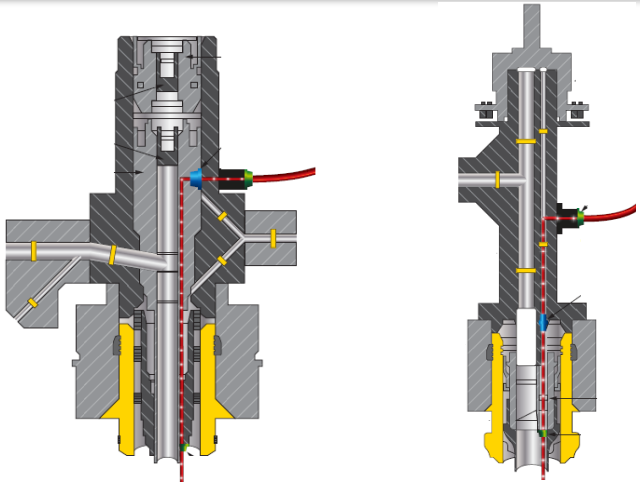


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Image Source: SEAFOM Architecture Diagrams

Overview: TSD-02

Functional Design and Test Specification for Subsea electrical/optical connectors and jumpers

Objective

- To define the minimum requirements for design, fabrication, testing and qualification of the following types seawater exposed dry-mate and wet-mate subsea connectors and jumper assemblies for subsea production equipment
  - Electrical
  - Electrical / Optical - Hybrid
  - Optical

Deliverables

- Recommended practice document outlining
  - Specification of minimum design and functional requirements
  - Specification of minimum factory acceptance test requirements
- The Ethernet testing described is relevant for communication links utilising Ethernet subsea, even if parts of the link is not seawater exposed i.e. internal to instruments or subsea control modules.

Value contribution

- What does this document provide to the industry:
  - One common specification which merges and improves on the various requirements from all available subsea connector and jumper specifications, whilst removing cost driving disparate requirements.
- Intended end-users of the document?
  - Personnel involved in technology development, fabrication and delivery of referenced connectors, project planners and project executioners utilizing these connectors in their projects

Image Source: SEACON

Overview: TSD-03

Functional Design and Test Specification for Downhole Electrical and Optical Connectors and Assemblies for in-well sensing applications

Objective

- To provide a consolidation of the various Vendor Design and Test Specification documents allowing for a Recommended Practice document which outlines the minimum design and functional requirements, and the minimum qualification and factory acceptance test requirements for a In-well Optical/Electrical Connector and Penetrator assemblies and their associated TEF/TEC interface to be used in intelligent well applications

Deliverables

- Recommended practice document outlining
  - Specification of minimum design and functional requirements
  - Specification of minimum qualification and factory acceptance test requirements

Value contribution

- What does this document provide to the industry:
  - A consolidation of the various individual company Design and Test Specification documents allowing for significant cost reductions for suppliers and operators by providing a single specification that all can use and qualify their products to.
- Intended end-users of the document?
  - Personnel involved in technology development, fabrication and delivery of referenced connectors, project planners and project executioners utilizing these connectors in their projects

Image Source: Baker Hughes

Overview: F&C-01

Fiber and Cable in Harsh Environment - Recommended Testing Procedures

Objective

- To recommended test procedures for the key parameters of optical fibers and cables used in Oil and Gas applications such as Distributed Temperature Sensing, Logging and other down hole measurements.
- Provide a series of recommended practices to assess the performance of fiber and cable, and not specify values for the various parameters to be met by the manufacturer

Deliverables

- In light of the absence of official standards for harsh environment fiber optic cables, users of these fibers and cables created this document as a first step toward having a common set of procedures in order to assess performance in these environments
- While exact environmental conditions vary between each application, the intention is that this document be a discussion point between the manufacturer and the customer

Value contribution

- What does this document provide to the industry:
  - Framework to structure testing
  - A common starting point
  - Flexibility to customize to proprietary needs
  - Guideline for Operators to select relevant tests
- Intended end-users of the document?
  - Manufacturers of fibers and cables
  - Integrators of fiber sensing systems

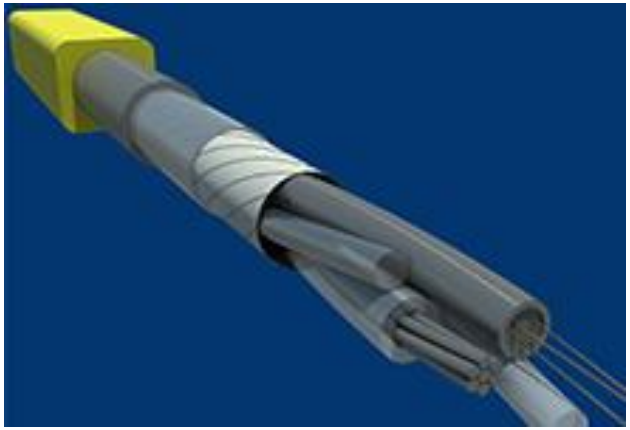

Image Source: Schlumberger

Contacts

For membership enquiries please contact the JIP Manager:

Michael Sequeira

or

Sally Marriage

Michael.sequeira@otmconsulting.com; sally.marriage@otmconsulting.com

www.otmconsulting.com

UK office: phone +44 1372 631950

otm