Industrial Presentation Architecture Parallel Session Monday October 6th 2003

Kevin Hall SEA CON (europe) Ltd

Presentation Overview

- SEA CON® Group
- SEA CON (europe) Ltd Recent Industry Related Projects
- SEA CON® Product range
- Dry Mate Fibre Optics SEA CON (europe) Ltd
- Wet Mate Fibre Optics SEA CON® Advanced Products
- Closing Statement/Questions

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Who are

?

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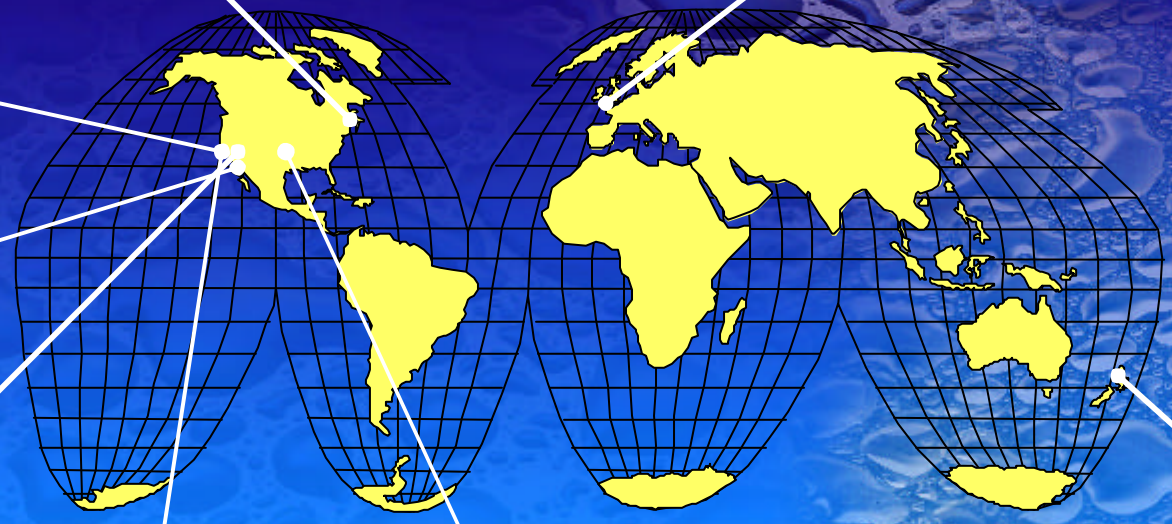
SEACON

Manufactures of underwater and harsh environment electrical and optical connectors, harnesses and cable solutions world-wide for over 40 years

SEA CON® World-wide



Westerly, RI

El Cajon, CA

Tijuana, Mexico

La Quinta, CA

La Mesa, CA

Gulf Area Houston

Great Yarmouth

Auckland
New Zealand

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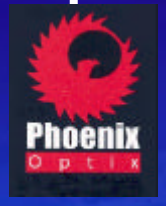
SEACON phoenix INCORPORATED



- Fibre Optics
- Custom Moulded Assemblies
- Optic Patch leads
- Design /Manufacture
- Project Management

SEACON global PRODUCTION

- G/M Seals
- Mil Spec
- RF Coax
- WET-CON
- MICRO
- ALL-WET
- RM
- XS
- GRE
- HUMMER
- Manufacture

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- SEACON 55
- U-Mate
- WET-CON
- Fibre Optics
- Metal Shell(MSS)
- F.I.T.A
- Custom Moulded Assemblies
- Encapsulation
- Design/Manufacture
- Project Management

SEACON advanced PRODUCTS

- HydraStar
- HydraLight
- MicroStar
- CM2000
- Photon
- Design

SEACON giannini INSTITUTE

- Limit Switches
- Proximity Switches
- Underwater Switches
- Design/Manufacture

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Eni
Tecnomare

GEOSTAR/ORION

Geostar

(Geophysical and Oceanographic Station for Abyssal Research)

(Ocean Research by Integrated Observation Networks)

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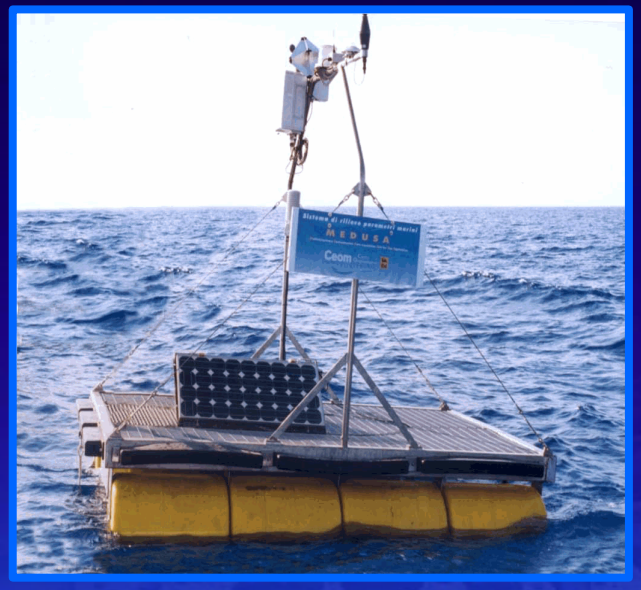
ORION Ocean Research by Integrated Observation Networks

GEOSTAR-3

Antares Project
Main Junction Box Cable Interface

- 48 channel optic & 4 electrical MSSS connector complete with Polyethylene cable over moulding

MEDUSA



TRIAS

Eni

Tecnomare

SARA

(SeaSottomarino Autonomo Robotizzato Antartico)

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Dry Mate Products


RM/XS series


55 series


PEEK 55
NEW


MSS
optics

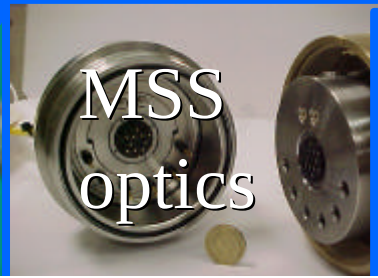

Micro MINI-Con


MINI-CON

MSS


Fibre optics


Opti-Con
NEW


MSS
optics


HUMMER
NEW

Wet Mate Products

Fibre-Optics Dry-mate

- Single-mode
- Multi-mode
- Electro/optical hybrid
- Insertion loss < 0.50dB typically <0.2dB
- Up to 20,000 psig
  - (approx 45,000ft/13,700m)
- Glass sealed options available

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Electro/Optic Connector

- Modular OTS (Off The Shelf) electro/optic connector
- 4 shell sizes
  - 4, 8,12 & 20 channels

    In any electrical or optical configuration
- Oil Filled hose as standard configuration with Moulded unit as a cost option

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OPTI-CON

SEACON advanced PRODUCTS

Wet Mate Fibre Optics

VLVvT
Oct 2003

Fibre Optics
Wet-Mate


HydraLight


HydraStar


Photon


S Series NEW


NEW MicroStar

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Optical Wet-Mate Connectors

- **The alignment and coupling of these very fine glass fibres underwater is the challenge facing optical wet-mate connector designers**
- **And to achieve it;**
  - Without significant contamination
  - Without high optical losses
  - Without further degradation over long periods of time

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Optical Wet-Mate Connectors

- **SEA CON® are one of the worlds leaders in the design, development and supply of optical wet-mate connectors.**
- **The full series of products are:**
  1. **HydraStar -** Electro/Optical (Hybrid), 8-channel
  2. **HydraLight -** Optical only, 8-channel
  3. **MicroStar -** Optical only, 4-channel
  4. **S-Series** – Optical only, modular channels
  5. **Photon** – Electro/Optical (Hybrid), modular channels

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HydraStar - Introduction

- The HydraStar was developed and patented by Lockheed Martin (Patent Number 5,838,857 Issued 17 Nov. 1998)
- SEA CON® / Brantner & Associates Inc continue marketing, designing, engineering, developing and manufacturing under license to Lockheed
- Now on the market for over 6 years with a field proven track record

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LOCKHEED MARTIN

HydraStar – Track Record

- **Deepest recorded operating depth: 9,900 feet (3,017m)**

- **HydraStars are being used on:**
  - Deepwater drilling systems
  - Seabed seismic systems
  - Subsea control systems
  - Scientific research programs

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HydraStar - Features

- Simple and robust with few moving parts
- Fluid filled pressure balanced
- Extremely reliable
- Functionality independent of depth
- Extensively tested and qualified
- Unique & simple design

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HydraLight - Introduction

- The HydraLight is a field proven, 2nd Generation optical wet-mate connector, based on the identical mating and optical coupling techniques of the successful HydraStar series
- It is an 8-channel optical only wet-mate connector
- Optical jumper assembly testing is also being conducted with the close cooperation of Bennex Omnitec in Norway
- The connectors were installed subsea in July 2002
- Over 120 units supplied to date

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HydraLight – Features

The ROV HydraLight version offers the following additional features over the successful HydraStar series:

- **Significantly improved optical performance**
- **Superior highly compatible fluorosilicone elastomers**
- **Superior synthetic oil compensation fluid**
- **Protective cover over plug sliding sleeve**
- **Fully seawater compatible interior**
- **Additional qualification testing**
- **Stronger operating springs**
- **8-channel optical only**
- **Modular ROV handle interface**

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MicroStar – Introduction

- The MicroStar is a slim-line 4-channel optical wet-mate connector, rated for higher operational temperatures
- The design is based on the identical mating and optical coupling techniques of the successful HydraStar & HydraLight
- Initially designed for the "tubing hanger / master valve block" interface associated with subsea-trees
- Excellent optical performance
- To be qualified

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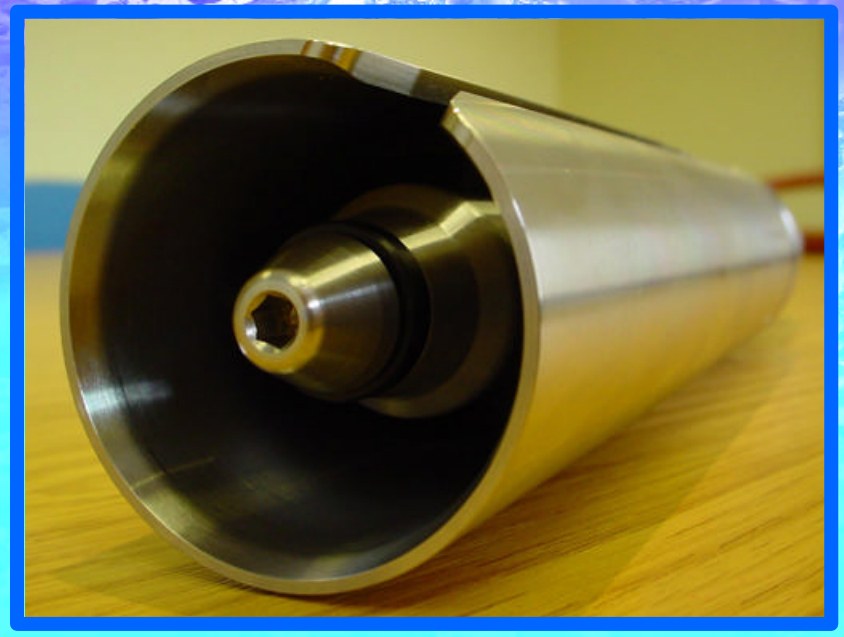
MicroStar - Specification

- Small diameter of 1.8” (46mm)
- Higher temperature rating to 121°C (250°F)
- Superior HNBR elastomers
- Superior synthetic oil compensation fluid
- 4-channel optical wet-mate
- Seawater compatible interior
- Mate/de-mate cycles: <25
- Maximum depth: Will be 23,000 feet (7,000m)
- Optical attenuation: <-0.5dB
- Back reflection: <-30dB



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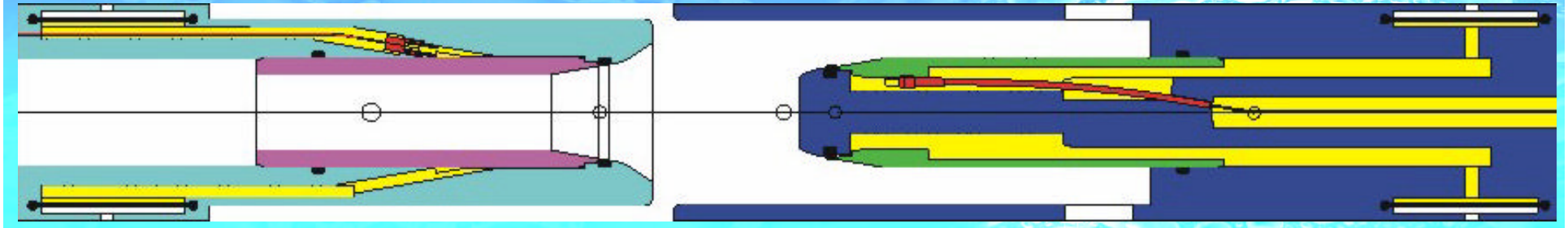
HydraStar, HydraLight & MicroStar

How They Work

- The optical fibre ferrules are housed within oil filled enclosures.
- During coupling, each connector half joins together, sealing against the other before allowing the optical couplings to take place within the benign oil-filled environment.

Receptacle Plug



- The next series of slides demonstrate the coupling sequence of the HydraStar:

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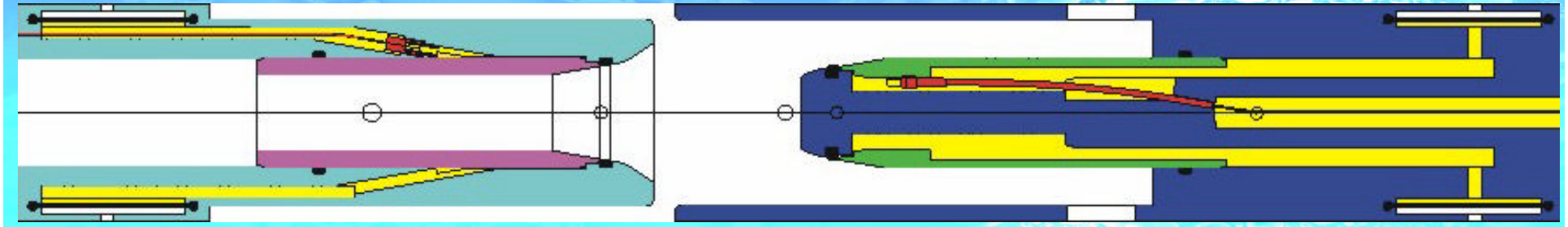
HydraStar, HydraLight & MicroStar



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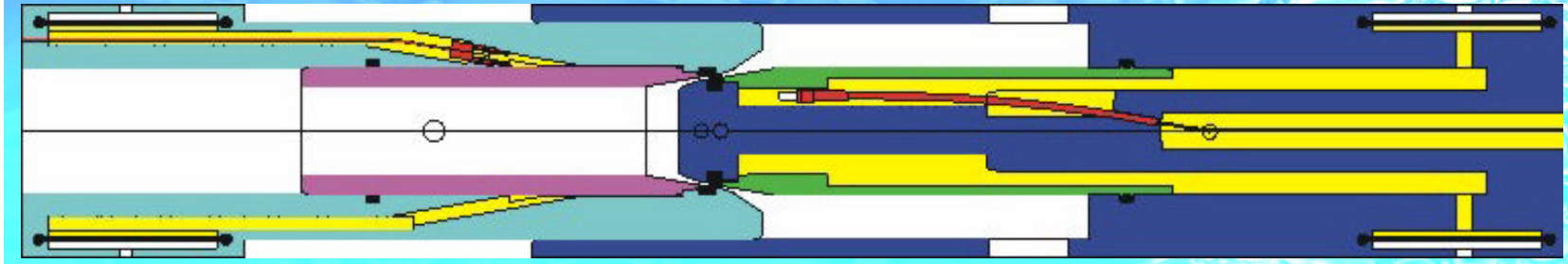
HydraStar, HydraLight & MicroStar



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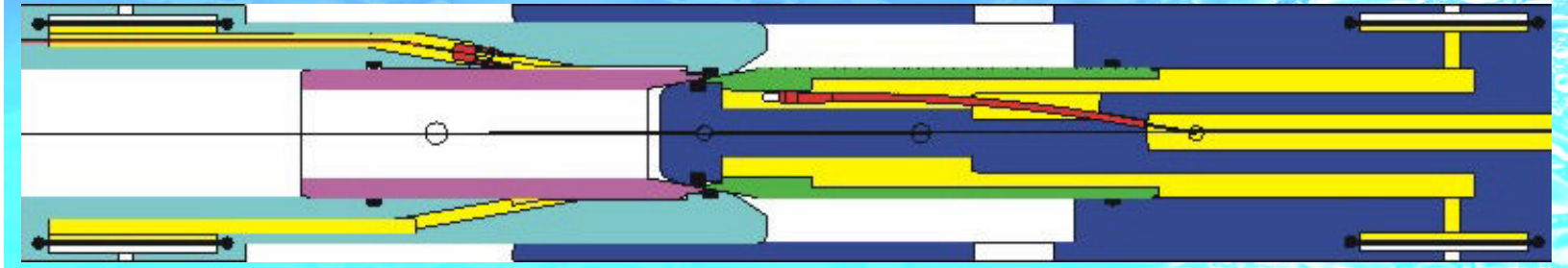
HydraStar, HydraLight & MicroStar



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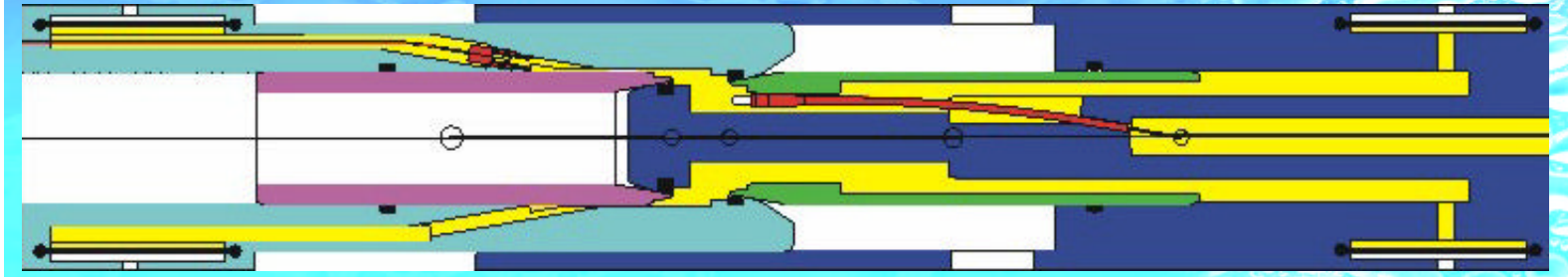
HydraStar, HydraLight & MicroStar



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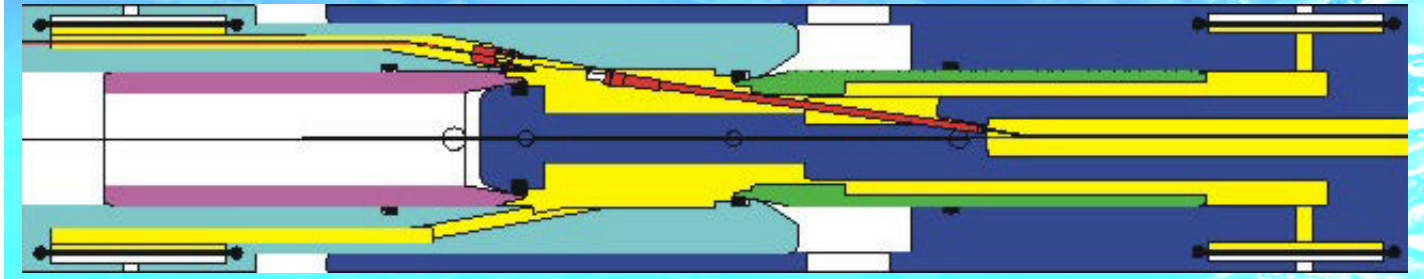
HydraStar, HydraLight & MicroStar



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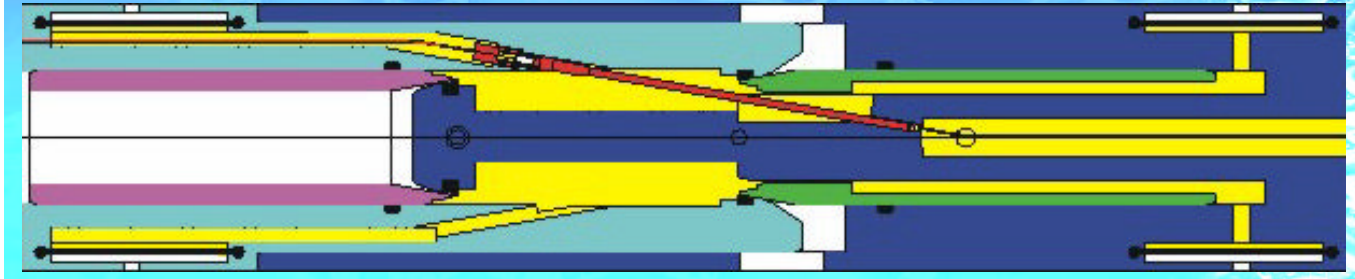
HydraStar, HydraLight & MicroStar



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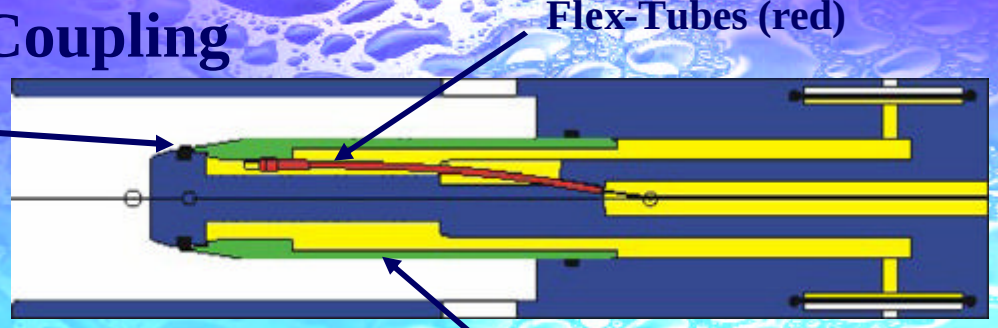
HydraStar, HydraLight & MicroStar

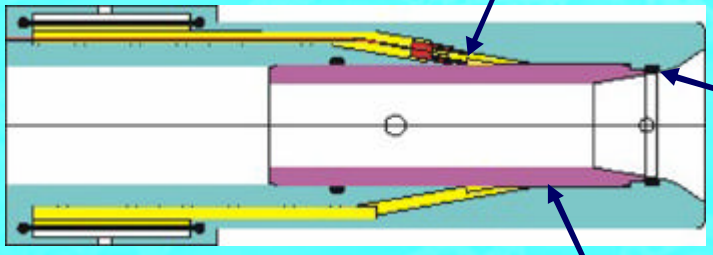
The coupling of the connectors is done in 3 stages

1. **Physical Alignment**
2. **Joined Chambers**
3. **Optical & Electrical Coupling**

Plug



Receptacle



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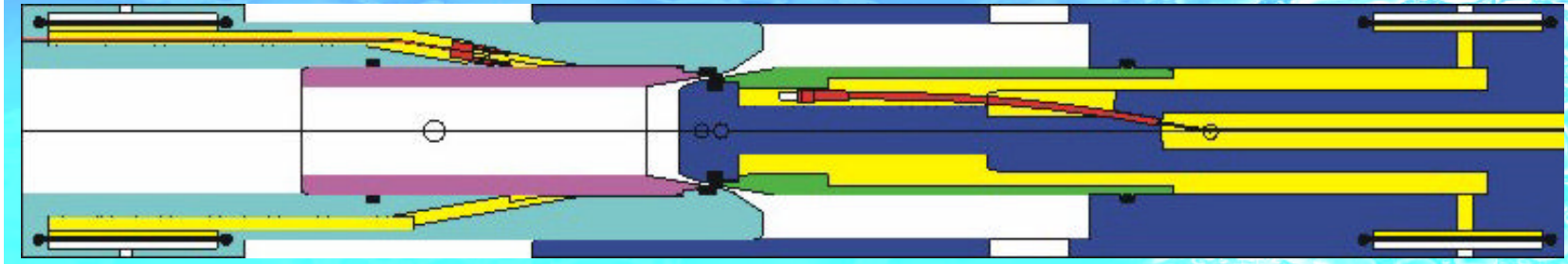
HydraStar, HydraLight & MicroStar

Stage 1 – Physical Alignment – End Seals Engage

- This drawing shows the physical orientation and alignment of the two connector bodies PLUS the engagement of the front seals
- The seals squeeze out external fluid and contaminants from the joint before sealing on the other half of the connector



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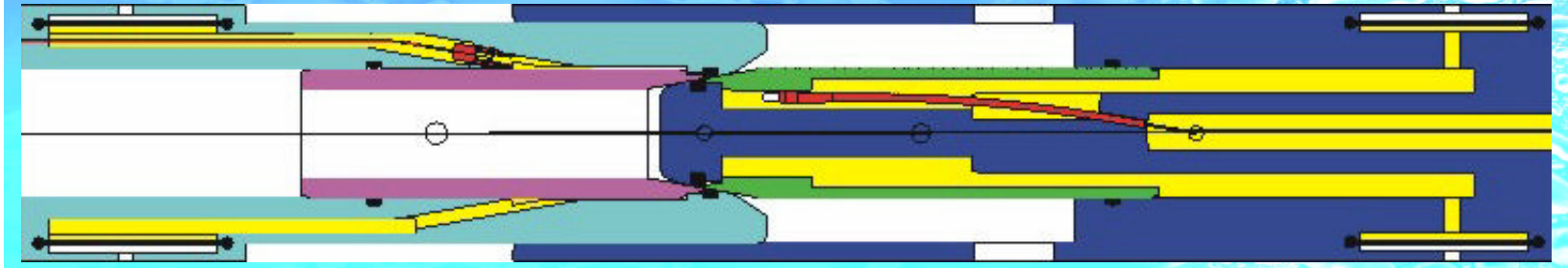
Stage 1 – Physical Alignment - End Seals Seal

- The receptacle internal sleeve (pink) is now sealed against the front-end of the plug connector (blue)
- The external cover sleeve on the plug connector (green) is sealed against the receptacle housing (cyan)



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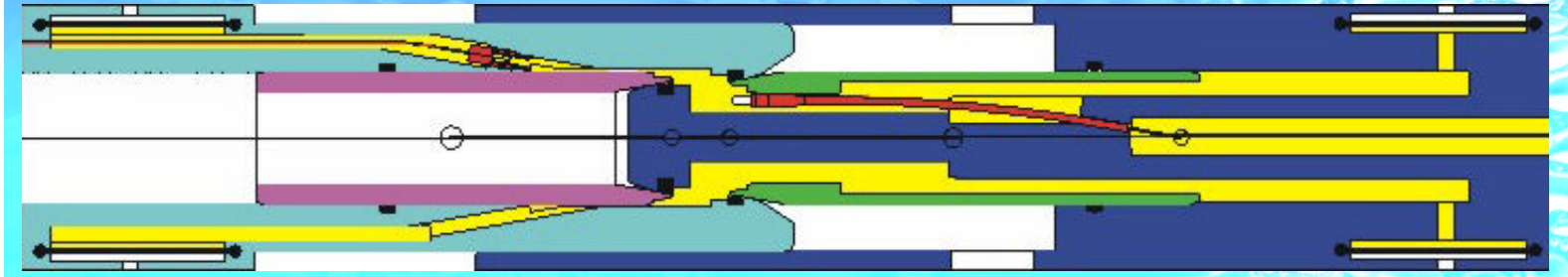
Stage 2 – The Joined Chambers

- As the connector continues to be mated, the sealed connectors are opened thereby joining the fluid filled chambers of both connector halves into a single patented “Joined Chamber”.



- Both halves are volume matched so no net flow of fluids between connector halves

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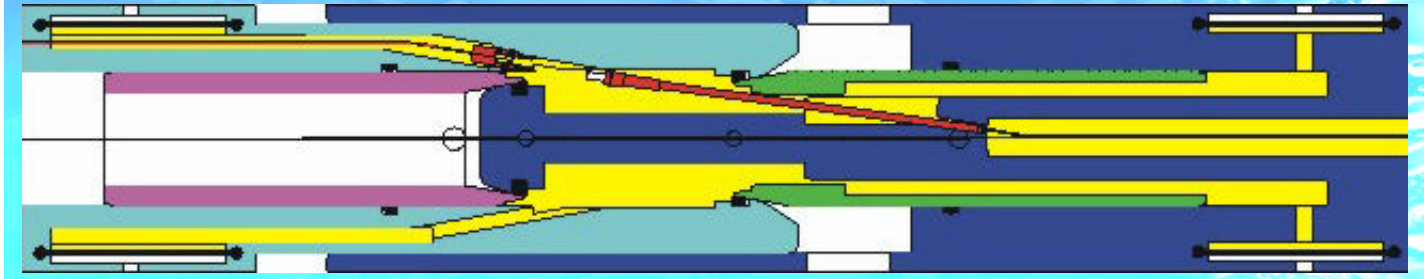
Stage 3 – Making of Contacts – Flex Tubes Deploy

- The flexible contact guide tubes (Flex-tubes) of the plug splay and align with the contacts via guide-ways in the receptacle half.



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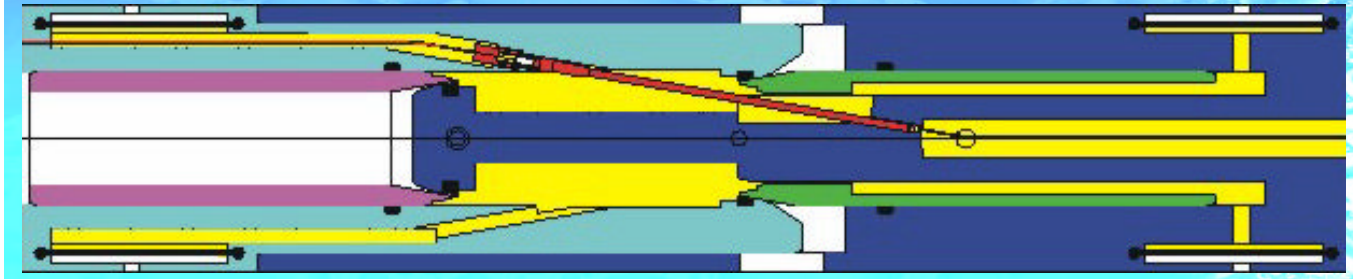
Stage 3 – Making of Contacts – Mated Connector

- The transition from two separate chambers to a single “joined chamber” is now made.



- The optical couplings have taken place in a controlled and benign oil-filled pressure compensated environment.

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HydraLight – 18 Month Qualification Testing

Optical Performance

- Optical Attenuation
- Optical Cross-Talk
- Optical Back Reflection
- Optical Performance Longevity

Environmental Testing

- Thermal Shock Test
- Mechanical Shock Test
- Vibration

Mechanical Tests

- Locking Device
- ROV Force Test
- Mating Forces
- Mate/De-Mate Speeds
- Maximum Misalignment
- Sliding Sleeve Tolerance to Misalignment
- Sliding Sleeve Integrity
- Flex-Tube Bending Capabilities

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S-Series Optical Wet-Mate

- The S-Series is a small, low cost, optical wet-mate connector similar to the Photon but at a higher specification
- All sealing mechanisms and optical coupling technology are based on field proven technology
- It has been designed as
  - Small size
  - Inexpensive
  - Low life-cycle
  - Optical coupling within oil-filled bladders
  - Modular contacts

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Photon Optical Wet-Mate

- The Photon is a small, lower cost, optical wet-mate connector
- All sealing mechanisms and optical coupling technology are based on field proven technology
- It has been designed as:
  - Small size
  - Inexpensive
  - Low life-cycle
  - Optical coupling within oil-filled bladders
  - Modular contacts
  - Electro/Optical

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Closing Statement

- **SEA CON® as a group are just one of a small number of manufactures at the leading edge of fibre optic connector technology both Dry and Wet mate.**

- **We are committed as a group to maintain our position in our respective market and will help lead the way in accommodating the ever increasing demands of the expanding industry spectrum.**

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Thank You

Any questions please feel free to ask

or alternatively come and see us during the breaks

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