Moog – What do we do?

**Industrial Group**
Motion control solutions for plastics, power generation, wind energy, metal forming, heavy industry, testing, and simulation.
2015 Turnover $522M USD

**Aircraft Group**
Primary and secondary flight controls for commercial and military aircraft.
2015 Turnover $1,087M USD

**Space and Defense Group**
Motion control solutions for satellites, space vehicles, launch vehicles, missiles, armored vehicles, naval systems and surveillance.
2015 Turnover $381M USD

**Components & Medical Group**
Slip ring and motion technology products for industrial, medical, marine, aerospace, and defense markets.
2015 Turnover $536M USD

2015 Total Sales $2.526B USD
Moog – Where are we based?

*Americas*
- USA
- Canada
- Argentina
- Brazil

*Europe & Africa*
- Austria
- Germany
- Luxembourg
- United Kingdom
- France
- The Netherlands
- Ireland
- Norway
- Italy
- Russia
- South Africa
- Sweden
- Spain
- Turkey
- Finland
- Switzerland

*Asia Pacific*
- Japan
- Philippines
- China
- India
- Korea
- Australia
- Singapore
- Hong Kong

When Performance Really Matters®
Focal Technologies Corporation

Focal is a marine-focused technology company providing electrical slip rings, fiber optic rotary joints, swivels and multiplexer solutions for the harshest offshore environments.

Highlights

- ISO 9000 certified since 1994
- ISO/IEC 80079-34:2011 (Explosive atmospheres)
- On-time-delivery of >92% for FY15
- <0.25% warranty returns for FY15
- Responsive and customer centric organization with strong technical support and global service
Focal – Subsea Oilfield Communication (SOC)

Design and manufacturer of robust and highly reliable Subsea Oilfield Communication (SOC) systems for drilling (BOP) and production (well-head) controls. Able to satisfy niche communication applications including subsea sensor systems and topside installations.
SOC Market and Technology Trends...

- Products to be qualified and screened to API 17F and ISO 13628-6.
- Long term growth towards developing smarter and autonomous subsea systems.
- Growing demand for subsea systems to be populated with more complex sensors.
- Growing demand for longer step outs and higher bandwidth communication channels.
- Growing interest in remote health condition monitoring systems.
- Cost reduction pressures:
  - Cross industry standardisation growing (i.e. MCS-DCS Interface Standardisation - MDIS).
  - Fibre optic v copper based communication infrastructure challenges.
  - Wet mate connectors (Fibre Optic v Copper).
  - More demand for legacy hardware and software upgrades.
  - “Buy” v “Design & Build Your Own” communication hardware debate.
Focal – SOC Product Family Overview

When Performance Really Matters®
Focal – 922 Fibre Optic Modules (MES & FOM)

Ethernet Switches & Fibre Modems
Managed Ethernet switches with integrated Fiber Modems capable of handling step outs up to 200Km and operating at speeds up to 100Mbps.

922 Managed Ethernet Switch (MES)
- 10 Port 10/100/1000 Base-T(X) Copper & Fibre Ethernet Switch
- IEEE 1588 V2.0 Time synchronization & Redundancy with RSTP, HSR, PRP. HW support for Layer 3 Capabilities
- SIIS Level III

922 Fibre Optic Module (FOM)
- 7 port 10/100 Base-T(X) Copper & Fibre Ethernet Modem/Switch
- SIIS Level III

Applications
- Surface to Subsea Fiber Modems
- Long distance subsea data links
- Subsea Electronics Modules (SEM) and Distribution Boxes
- End Nodes and Standalone systems

When Performance Really Matters®
Focal – 922 Copper & Fibre Optic Hybrid Module (DSL)

Long Range Copper & Fibre Optic Hybrid Modem
High Speed Copper Modems with extended step outs and multiple media support (Twisted pair, Copper Ethernet and Fibre) and integrated serial to Ethernet gateways.

922 DSL Hybrid
- 10/100 Base-T(X) & DSL Hybrid Ethernet Modem (Fibre & PLM Enabled) with integrated Serial Server, CAN and 3 port Fast Ethernet Switch.
- Supports three modem types (DSL, Serial and Optical) with integrated managed Ethernet switch and multi protocol serial device server (RS232,422,485,CAN) on a single card.
- DSL distance up to 6Km with operating speeds up to 15Mbps
- SIIS Level III

Applications
- Surface to Subsea Modems
- BOP Controls Comms Systems
- Copper/Fibre Optic Comms Redundancy Management
- End Nodes and Standalone Systems

When Performance Really Matters®
Focal – 922 Gateway & I/O Modules (QSS & 420)

**Gateways & I/O Modules**
SIIS Level I, II, III, IWIS compatible Serial to Ethernet gateways that enables easy media conversion to facilitate integration of non-Ethernet sensors to modern Ethernet based control systems

**922 Quad Serial Server (QSS)**
- 4 Channel Serial (MODBUS RTU, PPP, RS232/422/485)
- CAN, 24 X 4-20mA to Ethernet GATEWAY with integrated 3 port Ethernet switch.
- Scalable design, offers a simple option to add additional serial ports
- SIIS Level I, II & III and IWIS compatible.

**922 4-20mA Interface Card (420)**
- Copper/Fiber 4-20mA to MODBUS TCP GATEWAY
- x8 isolated 4-20 mA inputs
- SIIS Level I & III

**Applications**
- Green/Brown field sensor integration (IWIS)
- Sensor Nodes
- Subsea Factories
- Upgrades To Analogue and Serial Communication Systems

*When Performance Really Matters*®
Focal – SOC Product Family Software User Interface

Environmental and fibre optic condition monitoring options available...

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Focal – SOC Product Roadmap For 2017

- Power Line Modem Card
- Subsea Nodes
  - Standalone or pressure compensated
  - Up to 6,000 m depth rated
  - Remotely configurable & field upgradable
  - Options for acoustic backup link, internal sensors, external sensors, and customer supplied equipment
- Solenoid Valve Driver Card
  - Remote and local control for up to x24 valves
  - IP connectivity
  - Advanced condition monitoring
  - Pressure tolerant options
- Topside Equipment Interface

When Performance Really Matters®
When Performance Really Matters

Focal – (Build) or (Buy & Adapt) or (Buy & Integrate)?

Qualified Of The Shelf (QOTS) or Commercial Of The Shelf (COTS) debate?

<table>
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<tr>
<th></th>
<th>Moog Focal Solution (QOTS)</th>
<th>Industrial Solution (COTS)</th>
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<tr>
<td><strong>API 17F Qualification</strong></td>
<td>✓ Moog Focal will maintain API 17F Q1 qualification over the product life cycle. Clients will never need to qualify a Moog Focal SOC product.</td>
<td>✗ Initial qualification and re-qualification is usually the responsibility of the client.</td>
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| **Locked BOM & Configuration Control** | ✓ All Bill of Materials (BOM) are locked.  
✓ Change notification and approval.  
✓ OEM part numbers for unique configurations. | ✗ Bill of materials are not locked, and changes may require the client to re-qualify the unit.  
✗ Unique configuration needs to be managed by the client. |
| **Product Availability** | ✓ > 10 years | ✗ 2 - 5 years typical |
| **Design Life & Reliability** | ✓ > 20 years | ✓ 5 - 10 years typical |
| **Parts Obsolescence** | ✓ Parts obsolescence will be managed for the life of the product.  
✓ Work with customers to mitigate impact of parts obsolescence. | ✓ Parts obsolescence will be managed for the life of the product.  
✗ Further re-qualification may be required. |
| **Documentation** | ✓ Delivered documentation can be tailored to unique client requirements.  
✓ Certificate of Conformance, test results, document schedules, compliance matrices, etc. | ✓ Limited standard documentation available. |
| **Design Support** | ✓ Custom variations, qualified, rapid, software, firmware, PDR / CDR, custom variation of firmware and hardware, family of products. | ✗ Minimal design support for low volume products.  
✗ Limited scope of supply. |
| **Technical Support** | ✓ Dedicated staff of Engineers and offshore certified field technicians ready to provide detailed support. | ✓ Generic technical support on products. |
| **Designed for Subsea Enclosures** | ✓ All products are designed to be compact and thermally efficient for use in subsea pressure bottles. | ✗ Typically large and not designed for use subsea. |

Focal QOTS products will typically offer 20%-50% savings when compared to COTS products during the lifetime of a project!

When Performance Really Matters®
Focal — Summary

Focal SOC products are specifically designed and qualified for permanent subsea installation and have ....

✓ A family of scalable solutions designed, qualified and screened to relevant standards (e.g. API, ISO, DNV) for subsea communication applications.

✓ A robust and fault-tolerant design for high reliability applications.

✓ Supported rapid development of product solutions thereby reducing investment costs for our customers.

✓ A field proven portfolio of Qualified of The Shelf (QOTS) solutions.

✓ An advanced product development plan that will add new and innovative products in 2017.

✓ An established track record for low cost of ownership over the lifetime of our SOC products.

*When Performance Really Matters®*
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