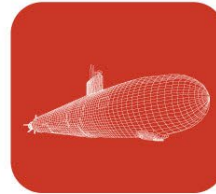
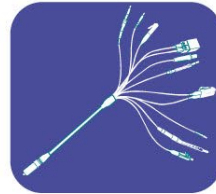
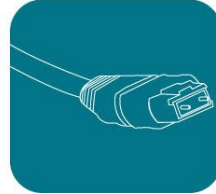
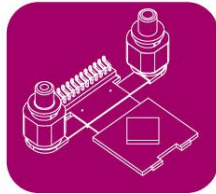
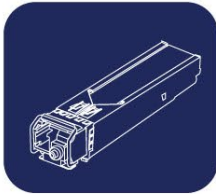


COTSWORKS[®]

Rugged Optical Network Component Solutions

www.cotsworks.com

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About COTSWORKS

COTSWORKS, INC. is an innovative manufacturer of rugged optical components and subsystems for harsh environment networking and sensing applications.



Commercial OR Custom-Off-The-Shelf components are integrated across multiple engineering disciplines to WORK in the most consistent, highest quality, performance, and cost-effective process and configurations.

Optical Transceivers, Simplex and Complex Cables, and Test Equipment are designed for Commercial and Military Aerospace, Military Tactical, Industrial & Energy, Rugged Networking and Sensor markets.



AS9100, ISO 9001, and ATEX certified, founded in 2006, with 100+ employees in North America, Europe, and representatives in Asia and Middle East. Privately funded with investment from Industry leaders.

The COTSWORKS logo, featuring a large blue letter 'C' on the left with radiating lines, followed by the word "COTSWORKS" in a bold, blue, sans-serif font with a registered trademark symbol (®) to its upper right.

COTSWORKS®

Markets and Product Application

COMMERCIAL AEROSPACE



MILITARY AEROSPACE



TACTICAL VEHICLES



SUB SEA



APPLICATIONS

Flight Deck Displays | In-Flight Entertainment and Cabin Crew Interfaces | Electronic Warfare | Radar Systems | Flight Recorders | Heads Up and Down Displays | Storage Devices | Cameras | Towed Array Networking

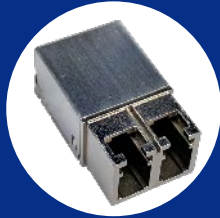
FIBER NETWORK ADVANTAGES

- Reduces data wire weight by up to 70%
- Increase network bandwidth and enables multiple protocols on one fiber
- Enables powerful edge computing network architectures
- Reduces EMI concerns in composite airframes Vs copper wire

Opto-Electronic Platform



RJ 1-10G
(2 Channel,
Dual TX/RX or
Duplex, SX, SR,
LX, LR, LR4)



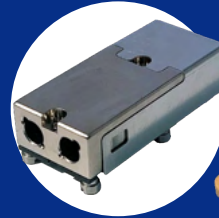
RJ-28G
(2 Channel,
Duplex, possible
Dual TX/Rx),
SR, SWDM)



**RJ-10G-
CWDM/DWDM**
(2 Channel
Duplex External
Modulation),
CWDM, DWDM)



RCP™ 1-10G
(4 Channel,
Quad TX/RX or
Dual Duplex)
MM or SM,
SWDM or LR4)



Essential™
1-28G
(2 Channel,
Duplex, TX or
RX, LR4 Bi-Di),
SWDM or LR4)



QSFP
1, 10, 40 or 100G
(8 Channel
TX or RX,
Quad Duplex)



SFF 100M-4G
2 channel Dual
TX/RX or Duplex

SFB 1-3G
1 channel, Bi-Di
TX and RX)

Ethernet, Fibre Channel, SDI, HDMI, A818, SFPDP protocol support

COTSWORKS ships 100,000 channels/year into Boeing and Airbus commercial aircraft and many USA and EMEA warfighters, transports, rotorcraft, and radar/sonar system systems worldwide.

Interconnect Platform



LC-T™

All metal body, robust metal clip, no tools needed, high pull force.



LC-R™

1.25 mm ferrule with metal screw based latching system. Comes with locking termini & screw kits.



Lightly™

ARINC 801 innovation to simplify installation. No FOD risks: Built-in insertion/removal tool on back-end.



POF M29504

Plastic Optical Fiber terminus designed to accept single core 1000µm plastic fiber. MIL-PRF-29504 style.



C-Beam™

Pin and socket style optical terminus pair with replaceable hood and lens feature.



LC-T801™

LC-801™

Converts LC receptacles to ARINC 801 receptacles.

COTSWORKS develops its own rugged termini for use with our transceivers or in-line networks in vehicles

- COTSWORKS manufactures simplex and complex fiber optic cable assemblies using the highest quality materials and processes available.
- Terminated, rugged fiber cables with Military or Commercial Aerospace grade termini and connectors are made to meet and exceed industry certifications.



ARINC 801



MT



LC



M29504



Jewel

CONNECTORS

- D38999
- Micro D38999
- EN4165
- EN4694
- GPRB/EPXB
- ARINC 600
- TFOCA
- M28876
- M83526
- MPO
- SMA
- Expanded Beam



Product Platform Benefits

Optical Transceivers

- Better Tx, Rx values
- Wide temperature operation
- Meet Mil/Aero environmental
- Vertically integrated supply of transmitters and receivers
- COTSWORKS' Firmware: Better control, features, security across platform

Optical Fiber Cables

- Better IL and RL
- Inspected endfaces
- Termini and connectors from major OEMs on same cable
- Internal teams create drawings and build to industry standards or customer needs
- COTSWORKS' termini adds value in features, usability

Transceivers and cables can be tested with COTSWORKS' automated test equipment

The logo features a stylized blue sunburst on the left with a white 'C' in the center. To the right, the word 'COTSWORKS' is written in a bold, blue, sans-serif font with a registered trademark symbol.

COTSWORKS®

Optical Test Platform

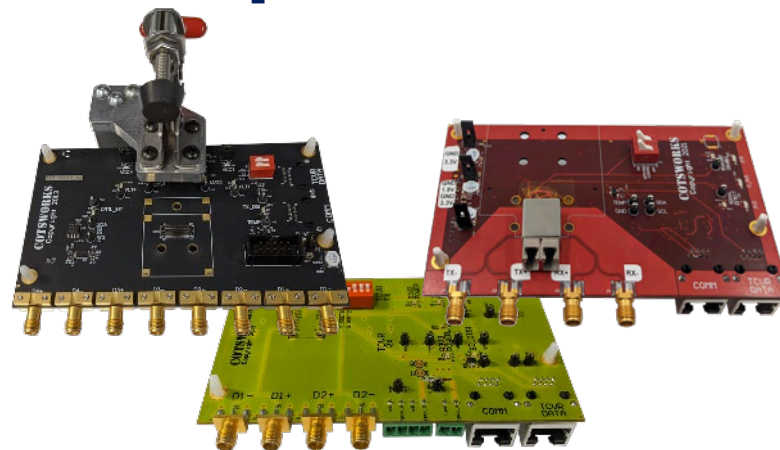
Optical Integrated Test (OIT) Platform



The (OIT) Platform can be integrated into a production line to test and validate the performance of the optical link while under data or environmental stress testing

- 2, 4, 12, or 36 port configurations in standard 19" rack
- User specified port operation, function and performance
- Modular internal design allows reduces cost, support time
- Built-in cable calibration tool reduces optical fiber referencing
- API commands for Python and other scripting
- Dedicated interface port for PC monitor and control
- Web server enables software control of hardware functions

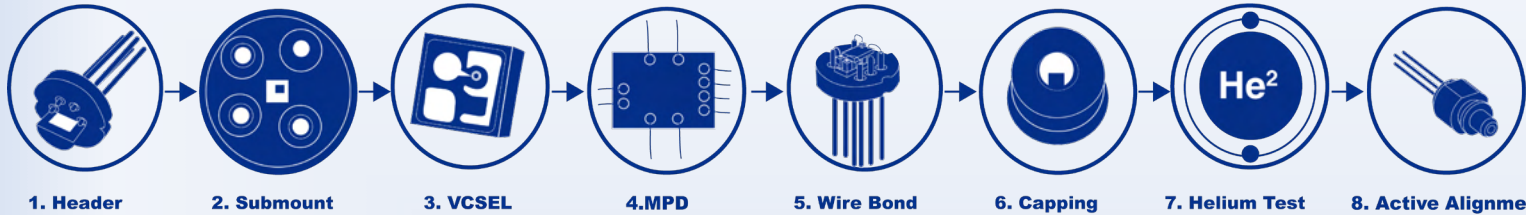
Test Boards/ Interposer Boards



COTSWORKS test boards are ideal for testing and troubleshooting optical transceivers. They can be modified into Interposer Boards routing the electrical signals from COTSWORKS' transceivers to an existing PCB.

- SMA electrical interfaces
- Clampdown feature available on all boards
- Spring header receptacles for fast and easy transceiver mounting
- Convenient test points for DDMI interface
- Easy to read LED indicators for visual function verification
- Easy access signal detect test points
- Easy access TX Disable D.I.P. switches

Optical Sub-Assembly Platform



- **ISO 7, Class 10,000 Cleanroom** houses optical alignment, encapsulation, test equipment capable of producing **OSAs** operating at 100M to 28Gbps
- **Process Capabilities:** Burn-in, active alignment and capping, curing, performance testing, harsh-environment reliability testing, visual and optical inspection
- **Next Generation Process Capabilities:** Die attach, fiber metallization, micro-welding, wire bonding, TO-can welding, mechanical test, and hermeticity test
- **Design Engineering:** Optical paths including lens creation, selection, forming, silicon bench, chip on board taking light from a solid-state semiconductor to precise fiber coupling.



TOSA

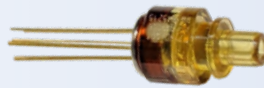
Transmitter Optical Sub-Assembly



980nm, SWDM,
CWDM4, LR4,
CWDM, DWDM

ROSA

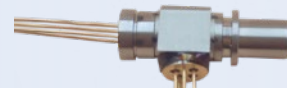
Receiver Optical Sub-Assembly



980nm, SWDM,
CWDM4, LR4,
CWDM, DWDM

BOSA

Bi-Directional Optical Sub-Assembly



1310nm/1310nm,
1270nm, 1310nm,
1330nm, 1490nm,
1550nm



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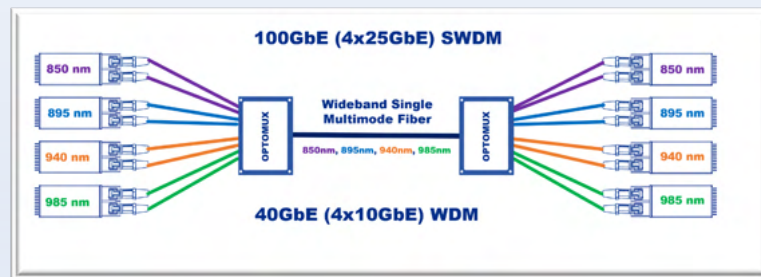


COTS (Commercial-Off-The-Shelf)

COTSWORKS	VS	COTS (Commercial-Off-The-Shelf)
Rugged Environmental Design, MIL and Aero Standards	Product Design Goals & Criteria	Low-cost focus, data/telecomm standards, limited obsolescence plans
3-5 year design cycle with 10+ year use and enhanced EOL support	Product Lifecycle	3 year product lifecycle, upgrades are cost and commodity driven
-40°C to +95°C, shock, vibration, humidity, and thermal cycling	Operational Performance	Commercial temperature operation
Solder or screw mount harsh environment electrical with Mil/Aero fiber termini	Interface Design	Card edge, optical quick release via plastic tabs
Controlled supply chain with approved locations for key vendors	ITAR Requirements	Commercial based supply chain
Tight control of mechanical configurations, incoming inspection, and design	Design Tolerances	Industry standard tolerances for international and cross vendor support
Controlled supporting data & documents	Datasheet Specificity	High level overviews with average performance and limited warranty
"2 Clicks" to a datasheet and application engineering support	Customer Support	Web, email, limited personal interaction
Configuration management with engineered solutions	Customization	Standard off-the-shelf product
RoHS 5/6 or 6/6, conformal coating, epoxy staking, and more	Solder Compliance and Ruggedization	RoHS 6/6, no clean flux

Road to 100Gbps and Beyond

Reliable lasers at 25Gbps or 50Gbps over temp. to get to 100 or 200Gbps means parallel architecture or **W**ave **D**ivision **M**ultiplexing



Parallel

- ✓ 4, 8, or 12 channels, one controller chip, Multimode only, complex structures
- ✓ MT Connector, ribbon fiber, IEC commercial standardized
- ✓ Higher aggregate data rates with potentially lower link budget
- ✓ Smaller packages than pluggables and high-density electrical interconnect

WDM

- ✓ Two channels on single fiber or up to 16 channels for single or duplex fiber runs
- ✓ M29504, ARINC 801, or LC, simplex or duplex, Military, Commercial standardized
- ✓ Very high link budget, Single or Multimode fiber with optical muxes
- ✓ Using Mil spec fiber also enables highspeed through slip rings

2024 Roadmap



2024 PRODUCT ROADMAP

Opto-Electronic | Interconnect | OSA | Test

Q1 2024

Opto-Electronic

- SFP+10G-LR/SR
- QSFP 28G

Interconnect

- SpliceWORKS (Rugged Mechanical Splice)
- Potted Pluggable Assemblies

Optical Sub-Assembly

- Custom
- SWDM TOSA 28G

Test

- OIT Platform
- Interposer Boards

Q2 2024

Opto-Electronic

- ESL-10G-TX2/RX2
- ESL-10G-DX
- SFB-G-BX10

Interconnect

- POF-M29504
- Lightly

Optical Sub-Assembly

- 850 PIN ROSA 5pins

Test

- OIT Platform Upgrade 1

Q3 2024

Opto-Electronic

- ESL-28G-SR
- Parallel: Option 1
- RCP-10G-LR-TX/RX/DX
- RCP-28G

Interconnect

- Rugged Test Probe
- Potted Rugged Connectors

Optical Sub-Assembly

- 1310 DFB TOSA

Test

Q4 2024

Opto-Electronic

- ESL-10G-BiDi
- SFS
- Parallel: Option 2

Interconnect

- Mechanical Splice Field Kits
- Expanded Beam MT Cable Assembly

Optical Sub-Assembly

Test

- OptoCube Upgrade 10G

For more information about COTSWORKS products, please contact our sales support team.

• Americas & Asia/Pacific | 440-446-8800 | sales@cotsworks.com

• EMEA | +49(0) 661 9786 9200 | EMEAsales@cotsworks.com

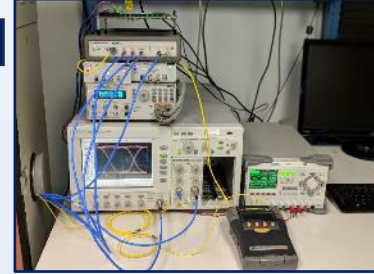
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Facility

Facility Overview

- ISO 9001:2015, AS9100:D, JEDEC and IEC certified products
- State of the art with modern power and services for secure operation
- In-house failure analysis rework and repair capabilities
- Production test racks include automated BERTs, optical & electrical scopes, spectrum & protocol analyzers, power meters, light sources with NATA/NIST traceability, high resolution OTDRs, advanced imaging systems, mechanical property analysis, and more



Transceiver Production

- Opto-electronic assembly/test/rework stations: industry leading manufacturer equipment & custom-built stations
- All test data is recorded and readily retrievable by barcode
- All parts tracked by serial ID, lot #, technician, and linked to customer from PO to shipment
- Shipment specific test data and certificates of conformance provided with every delivery



Simplex & Complex Cabling

- SIMPLEX and COMPLEX cable design/fabrication/state of the art test of optical & hybrid assemblies
- Terminates/polishes to customer specified or industry standards: every cable/termini are inspected visually & with an interferometer ensuring they meet or exceed specifications
- IL test data provided with every cable. Screen shots of test measurements available upon request



FORCE

- Fiber Optic Research Center of Excellence (FORCE) packages optical ICs utilizing optical bench design, submounts, enclosures, fiber guides unique packages, optical filters and more
- Lens design, light path analysis, splitter/combiner, laser diode package, and fiber ferrule design



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COTSWORKS' Manufacturer Representative and Resellers





COTSWORKS®

Company History

- ✈ COTSWORKS, INC. is an innovative designer, developer and manufacturer of fiber optic transceivers, cables, complex cable assemblies, and optical test equipment for aerospace, defense, oil and gas, and other rugged industrial environments.
- ✈ Commercial-Off-The-Shelf components are integrated across multiple engineering disciplines to WORK in the most consistent and highest quality, performance, and cost-effective ways
- ✈ Our products are designed for commercial and military aerospace, military tactical, industrial & energy, rugged networking & sensor markets.



100+
Employees

30,000
SQ FT high
tech facility

*21%
Annual
Growth

100,000+
Parts shipped
annually

**Excluding Pandemic Years*

Year	Event
2006	WDM transceivers and passives ruggedized for Mil/Aero applications
2007	COTSWORKS founded in Cleveland, Ohio USA
2008	COTSWORKS expands mfg facility with advanced ESD implementation
2009	COTSWORKS achieves ATEX certification for Oil & Gas product applications.
2010	Enhanced RJ Transceiver released, supporting digital diagnostics, 5Gbps, and SM fiber
2011	COTSWORKS achieves ISO 9001 certification for design and manufacturing of opto-electronic devices.
2012	RCP is upgraded for new radar applications, offering 15dB of link budget at 10Gbps
2013	COTSWORKS achieves ISO 9001 certification for design and manufacturing
2014	COTSWORKS named one of the top 100 fastest growing companies in Northeast Ohio
2015	The RCP product platform is expanded to include quad Tx or Rx configurations in addition to standard duplex.
2016	AS9100C certification achieved with production capacity exceeding 250,000 units/year
2017	New production and engineering areas added to support growth of complex cable assembly offerings
2018	COTSWORKS creates GmbH in Fulda, Germany to support rapid growth of EMEA market.
2019	Multi-year product development road-maps released publicly, demonstrating alignment with growing mil/aero market needs. AS9100:D certification achieved.
2020	COTSWORKS receives R&D grant to build FORCE, a Fiber Optic Research Center of Excellence, in Ohio
2021	COTSWORKS celebrates 15th anniversary with >\$100M in generated revenue & 600,000+ units delivered across 20k shipments to customers around the world.
2022	COTSWORKS celebrates 5-years at its GmbH office in Fulda, Germany. Phase II Update of FORCE to include single-mode assemblies & DFB lasers.
2023	Rugged Mechanical Splice and POF termini released. COTSWORKS CEO accepts chair position at SAE AS-3 Fiber Optics & Applied Photonics Committee.

Company Information

Quality System:

ISO 9001:2015 + AS9100:D CERT-0136100

ATEX Compliant, OP IS

S20.20 ESD program

J Standard electronic parts work

Compliant to FAR 52.204-2, DFARS 252:204-7012

NIST 800-171 Compliance in process



Aerospace and Electronics
Industry Quality Standards



FDA/CDRH Laser Safety Test
and Manufacturing Support



International Traffic in
Arms Regulations



ESD handling and Facility Testing,
Operation, and Certification



Harsh environments including
Oil and Gas compliance



Foreign Object Debris Procedures,
Auditing, and Training

Company Information:

EIN/Tax ID: 20-4055028

Vendor License: 18-90016

CAGE Code: 49T62

ECCN: EAR99

ITAR: M37737

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COTSWORKS®