

OZ Optics Limited

CORPORATE OVERVIEW

FIBER OPTIC SENSORS

November 2016

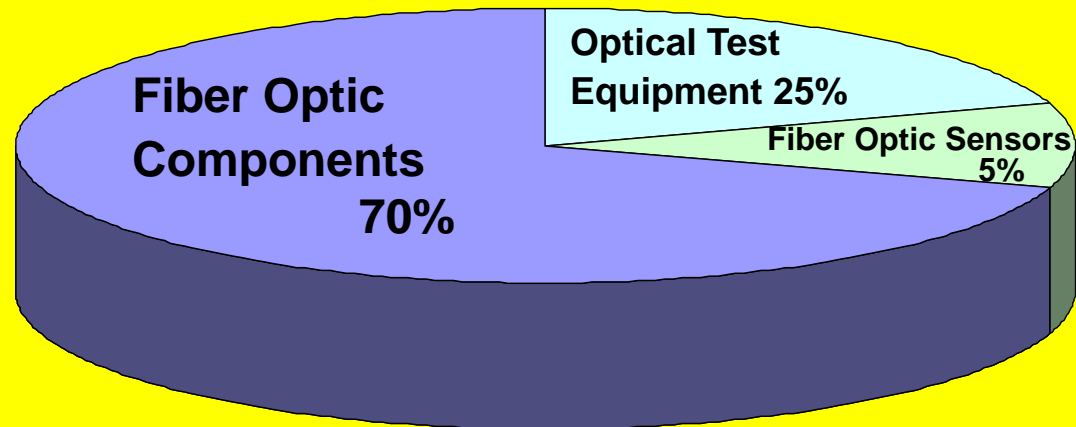
Company Profile

- Company founded in 1985
- Corporate headquarters located in Ottawa, Canada
- Manufacturing facility in Ottawa/Canada, Izmir/Turkey, and Jiaxing/China
- Seven Product Groups: **Laser-to-Fiber Delivery Systems, High Power Fiber Optic Components, Polarization Maintaining Products, Attenuators, Opto-Electronic Packaging, Test Equipment, Fiber Optic Sensor Systems**
- Sales offices in Canada, USA, Turkey and China



Company Profile

➤ Three Product Groups:



- Over 1,000 products
- Leading Edge R&D

OZ Optics Products



OZ Optics
shop.ozoptics.com
www.ozoptics.com

Global Leader in Fiber Optic Products since 1985

Polarization Maintaining Fiber Optic Components

Patent Numbers: USA 7058275, 7095931, 7295731, China 1672073



Polarization Maintaining Connectors / Patchcords

Polarization Maintaining and Polarizing Splitters / Combiners / Fused Couplers / Switches

All Fiber Manual and Electrically Driven Polarization Controllers / Scramblers

PM Fiber Directional Taps / Power Monitors

Manual / Electrically Controlled PM Fiber Pigtailed Variable Attenuators

PLC Splitters

Fiber Pigtailed Polarizers

PM Fiber Pigtailed Circulators



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High Power Fiber Optic Components

Patent Numbers: Canada 2494133, USA 7058275, 7095931, 7295731, China 1672073



High Power/Temperature Connectors & Patchcords

High Power Isolators

High Power Laser to Fiber Couplers / Collimators / Focusers

High Power Mode Field Adapters

High Power Optical Taps / Power Monitors

CO₂ Cleaning for High Power Components

High Power Splitters / WDM's

Shutters / Receptacles / Sleeve Thru Adapters with Sensors



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Fiber Optic Attenuators for SM, PM, and MM Fibers

| | | |
|---|---|---|
| <p>Digital Variable Attenuators</p>  <ul style="list-style-type: none"> • 0.01dB Resolution, Fast Response • 200dB to 1000 dB Extinction Range • 100mW Max | <p>Electrically Controlled Variable Attenuators</p>  <ul style="list-style-type: none"> • 0.01dB to 100dB Attenuation Range • Up to 2 Watts Power Handling • PC Based, Analog and Digital Control | <p>MEMS Variable Attenuators</p>  <ul style="list-style-type: none"> • 0.01dB to 40dB Attenuation Range • Small Size, Low Cost, Low Power Consumption • Low Wavelength Resonance, Low Crosstalk |
| <p>SM / PM / MM Fiber Pigtailed Inline Variable Attenuators</p>  <ul style="list-style-type: none"> • 0.01dB to 100dB Attenuation Range • 500mW Power, 200mW Maximum Response • 0.01dB PC, 0.01dB Tolerance Specifications | <p>Single/Multi Channel Miniature Variable Attenuators</p>  <ul style="list-style-type: none"> • Compact, Less Than 5mm Spacing Between Fibers • Designed for Multiple Fiber Arrays • PC Based, Monolithic | <p>Reflective Style Variable Attenuators</p>  <ul style="list-style-type: none"> • 0.01dB to 60dB Attenuation Range • 0.1dB Resolution • 40W, 400W, 400W Backreflection |
| <p>Air Gap Variable Attenuators</p>  <ul style="list-style-type: none"> • 0.1dB Resolution • Fast Power Response • Fiber, PC and ST Connector Styles | <p>Plug Type Fixed Attenuators</p>  <ul style="list-style-type: none"> • Low Insertion Loss • High Reliability • Available in Multiple Fiber Arrays | <p>Attenuating Fiber Patchcords</p>  <ul style="list-style-type: none"> • Available in a wide range of fiber types • 0.1dB to 100dB Attenuation Range • All Fiber Attenuation, Low Back Reflection • High Reliability and Long Lifetime |

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Laser & Laser Diode to Fiber Delivery Systems

| | | |
|--|---|---|
| <p>Laser to Fiber Couplers</p>  | <p>Bare Fiber Adaptors with Magnetic Clips</p>  | <p>Bulkhead Receptacles</p>  |
| <p>Pigtail/Receptacle Style High/Low Power Collimators/Focusers</p>  | <p>High/Low Power Patchcords</p>  | <p>WDM/RGB Combiners</p>  |
| <p>OCT Modules and 2 micron Components</p>  | <p>OEM Laser Diode to Fiber Couplers</p>  | <p>Turnkey, Ultra Stable Laser Modules</p>  |


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OZ Optics Products



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Fiber Optic Components for Optoelectronic Packaging

Hermetically Sealable Patchcords with Glass or Metal Solder



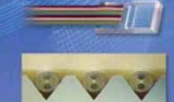
Single Channel



Multi Channel




Metalized Fibers



PM/SM/MM Fiber Pigtailed V-Groove Arrays




Polarization Measurement System for V-Grooves



Tapered / Lensed Fiber Polished / Laser Shaped




Glass Solder Preforms




Fiber Optic Ferrules



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Fiber Optic Test Equipment



Polarization Extinction Ratio Measurement Systems



Power Meters with Smart Detector Heads



Broadband Digital Variable Attenuators



Optical Fiber Length Meters



High Power Visual Fault Locators Fiber Optic Stable Sources



Inline Optical Power Monitors/Meters



Laser Diode Sources Single/Multiwavelength



Fiber Optic Smart Patchcords



Fiber Optic Fault Finders



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Product Innovation



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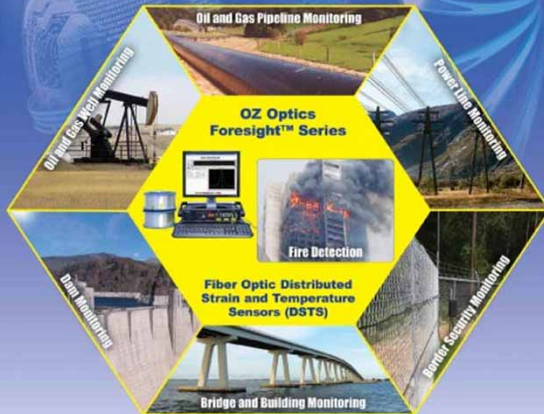


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Fiber Optic Distributed Strain and Temperature Sensors

USA Patent Numbers: 7499151, 7599047

- BOTDA only, BOTDR only, or both BOTDA and BOTDR modules in one unit
- Simultaneous measurement of strain and temperature
- Fast, dynamic measurement of strain and/or temperature up to 100 km sensing range
- Uses standard telecommunication fiber to minimize costs



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Fiber Optic Fault Finder for Optical Network Safeguard™

- Monitors and reports network health status in real time, 24 hours/day, 365 days/year
- Lowers network operating and maintenance expenses
- Reduces revenue loss due to fiber plant outages
- User friendly interface via various wireless interfaces (Wi-Fi, GPRS), USB, or RS-232
- Reports fault location, giving GPS coordinates with time stamp
- Early alert and outage reports via cellular phone, email, IM, SMS, or text messaging



OZ Guard Automated Test Solution



Remote Monitoring a WDM Network



Remotely Accessible/Wireless Fault Finders



GPS Locator



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Product Innovation



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2 micron Fiber Optic Components for PM and SM Fibers



Fiber Optic Patchcords



Fused Couplers / Taps /
Beam Splitters / Combiners



Fiber Pigtailed
Laser Diode Sources



Pigtail / Receptacle Style
Collimators / Focusers



Polarizers



Manual / Electrically Controlled
Variable Attenuators



Isolators

| | | | |
|--|---|---|---|
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|--|---|---|---|



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Fiber Optic Products for OCT Applications



OCT Modules



Manual / Electrically Controlled
Broadband Variable Attenuators



Manual / Electrically Controlled
Fiber Optic Delay Lines



Manual / Electrically Controlled
Polarization Controllers



Fiber Pigtailed
Broadband SLED Sources



Fiber Collimators / Focusers



Broadband Fused Couplers

| | | | |
|--|---|---|---|
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|--|---|---|---|

Company Profile

Over 470 employees worldwide:

- 260 in Ottawa and US
- 50 in Turkey
- 160 in China

OZ Canada



OZ China



OZ Turkey

Company Profile

OZ Optics is lead by an experienced team:

- **Ömür Sezerman, Chairman, President & CEO**
 - Founder and CEO since inception (31 years)
- **Zahide Sezerman, VP of Human Resources**
 - With OZ Optics since inception (31 years)
- **Garland Best, VP of Components Division**
 - 24 years at OZ Optics
- **Gordon Youle, VP of Test Equipment Division**
 - 17 years at OZ Optics
- **Martin Powell, Operation Manager**
 - 12 years at OZ Optics
- **Sarah Miller, Controller**
 - 3 years at OZ Optics
- **Metin Sezerman, General Manager of OZ Turkey**
 - 15 years at OZ Optics
- **Bing Li, General Manager of OZ Optics China**
 - 12 years at OZ Optics

PRIVATE AND CONFIDENTIAL

Company Profile

- ISO9001:2008 certified
- Broad patent portfolio
- Advanced proprietary processing technology



Company Profile

➤ *Using our strong direct sales and distributors, we address the following markets:*



Company Profile

➤ *OZ Optics has resellers and distributors in over 30 Countries & Regions and over 10,000 customers globally:*



Australia



France



Japan



Spain



Austria



Germany



Netherlands



Switzerland



Belgium



Greece



Luxembourg



Sweden



Brazil



Hong Kong



Norway



Taiwan



Canada



India



Poland



Thailand



China



Ireland



Portugal



Turkey



Czech Rep.



Israel



Singapore



United Kingdom



Denmark



Italy



South Korea



United States

In-House Production Capabilities

- Experienced and well-trained staff in following fields:
 - optical, mechanical, electronics & software

CNC Machine Shop



AR Coating



Femtosecond Laser Lab



Clean Room



Laser Conditioning/Cleaving



PRIVATE AND CONFIDENTIAL

Branch Network

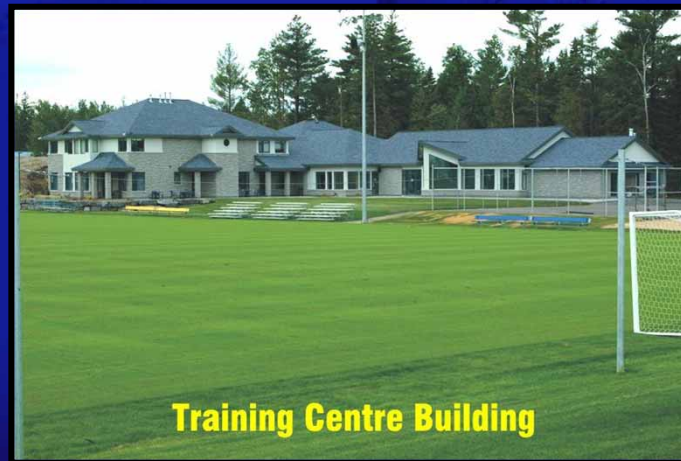


Facility – Ottawa Headquarters

- 60,000 sq ft. – Manufacturing and R&D Facilities
- 15,000 sq ft. – Admin, Sales and Marketing
- 15,000 sq ft. – Training and Fitness Facility
- R&D, Product Design, Engineering, Final Assembly & QA



Facility – Ottawa Headquarters



OZ Optics – Turkey Factory

- Operational since 2000
- 33,000 sq ft. Manufacturing Facility
- Located in Free Trade Zone
- Low Tax Rates
- Sub Component Parts Manufacturing
- Cost Effective Manufacturing
- High Quality Labor



OZ Optics China

- Operational since 2009
- Wholly Foreign Owned Enterprise
- Subcomponent Parts Manufacturing
- Cost Effective Manufacturing
- High Quality Labor
- Extensive Training
(3-6 months in OZ Canada)



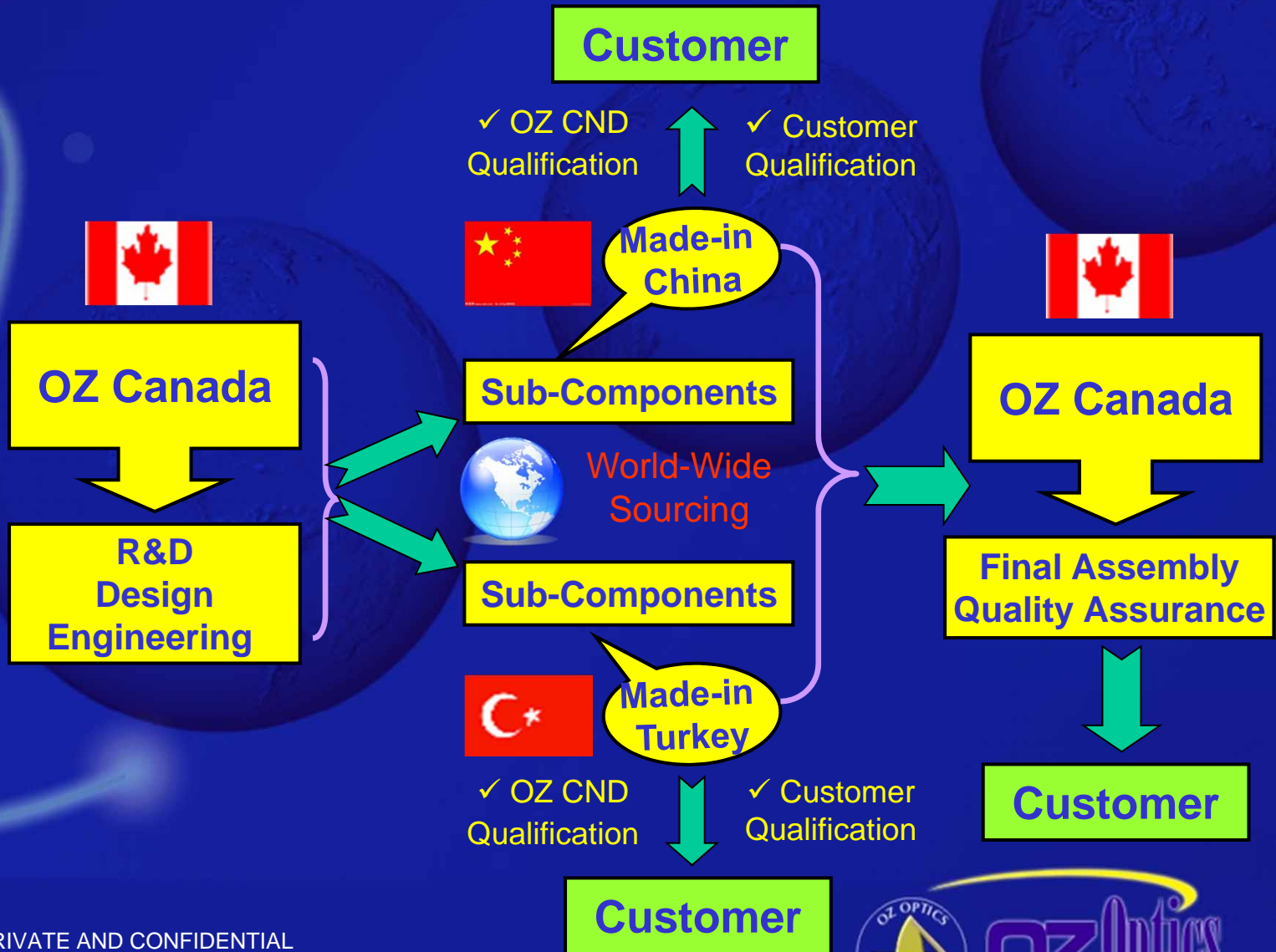
OZ China Facility

Jiaxing, China

- Located in Economic Development Zone
- 500 sq meters – Admin, Sales and Marketing
- 1500 sq meters – Manufacturing Area
 - 100 sq meters – Class 10,000 Clean Room
 - 100 sq meters – ESD Working Area



Manufacturing Strategy



Industry Standards

All products manufactured are in strict accordance with international industry standards:

➤ *Telecordia Compliance*



➤ *CE Compliance*



➤ *RoHS Compliance*



➤ *ISO 9001:2008 Certified (China, Turkey and Canada)*

➤ *Controlled Goods Directorate Registered*

Core Competencies

- Pioneer in Polarization Maintaining (PM) Components
- Leader in Wavelength Flattened, High Power & Low PDL Components
- Leader in High Power Fiber Optic Delivery Systems
- Custom Test Equipment, Including Polarization Test Equipment and FTTH Equipment
- Widest Range in Attenuator Product Offering
- Fiber Optic Distributed Strain and Temperature Sensors
- Complete product line for OCT applications & 2 Micron

Leading Technology

- **High Power Isolators**
 - power handling > 50W
 - low loss, low cost turnkey solution



High Power Free Space and Pigtailed Isolators

- **Pioneer in Polarization Maintaining (PM) Components**
 - wavelength flattened
 - high power & low PDL
 - PM test equipment



Polarization Maintaining Patchcords

Distributed Strain and Temperature Sensors



- **Fiber Optic Sensor**
 - fast and simultaneous measurement of strain & temp
 - large structure health monitoring

High Power Collimators/Focusers



- **Leader in High Power Fiber Optic Delivery Systems**
 - specializes in custom design



OUR VISION

- Be the preferred Supplier of choice
- Capture and expand market share
- Maximize shareholder value

OUR MISSION

- To become the leading provider of innovative optical products to telecom and non-telecom sectors

OUR CORE VALUES

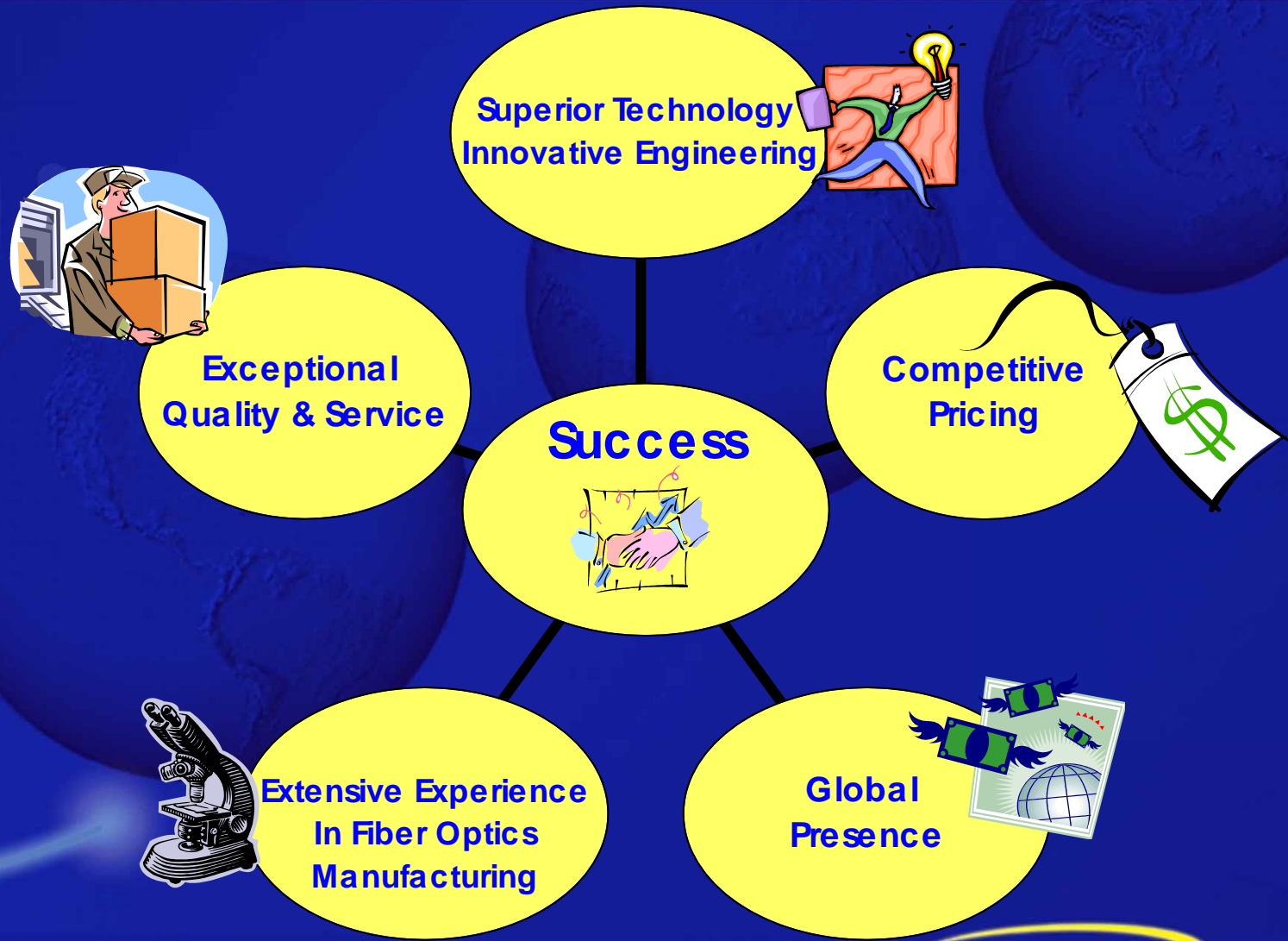
- Leadership
- Teamwork
- Boldness
- Commitment
- Innovation
- Rewards

OUR QUALITY POLICY

- Provide our Customers with a competitive advantage, leveraging performance, price and delivery, through a continuous process of Quality advancement in all areas of our Company
- Communicate effectively to our Customers, Suppliers and Shareholders our commitment to Quality and continuous improvement
- Promote opportunities of professional development for all members of our Company through education, training and personal challenge

Ömür Sezerman
President

Competitive Advantage



Foresight™ DSTS Awards & Patents

USA Patent # 7499151 on March 3, 2009

USA Patent # 7599047 on October 6, 2009



Applications – Innovative Solutions



Oil and Gas Pipeline Monitoring



Dam Monitoring



Oil and Gas Well Monitoring



Bridge and Building Monitoring



Power Line Monitoring



Border Security Monitoring

Fiber Optic Distributed Strain and Temperature Sensor (DSTS)

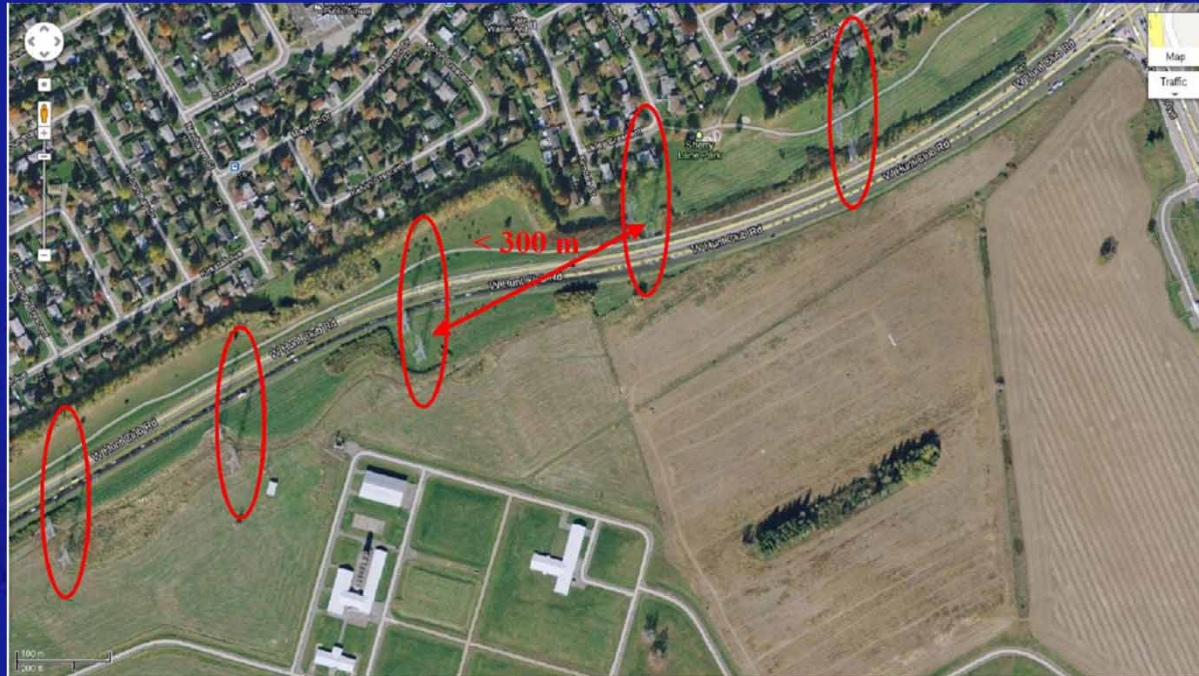


Innovative and Complete Solution for Monitoring Tiny Cracks

OPGW Monitoring

- **Monitoring the working status of OPGW**
- **Abnormal event found and located**
- **Event caused by broken strand, lightning, frost covering, change of strain, etc..**

OPGW Status Monitoring



- The OPGW is located from Smith Falls to Merivale-Ottawa, Ontario, Canada.
- The total fiber length was close to 140 km.
- The BOTDA located in Merivale-Ottawa made measurements as often as once every 60 minutes starting in June 2012 and continuing till July 2013.

The Costs of Catastrophic Failure

- **Example: Druzhba Pipeline July 2006**
- **Small 50 cubic meter leak results in:**
 - Interruption of \$100M/day pipeline
 - Global spike in oil prices
 - Report of environmental catastrophe
 - Months of investigation and ecological monitoring
- **Single point of failure in 3000 km pipeline**

OZ Optics Foresight™ DSTS Benefits

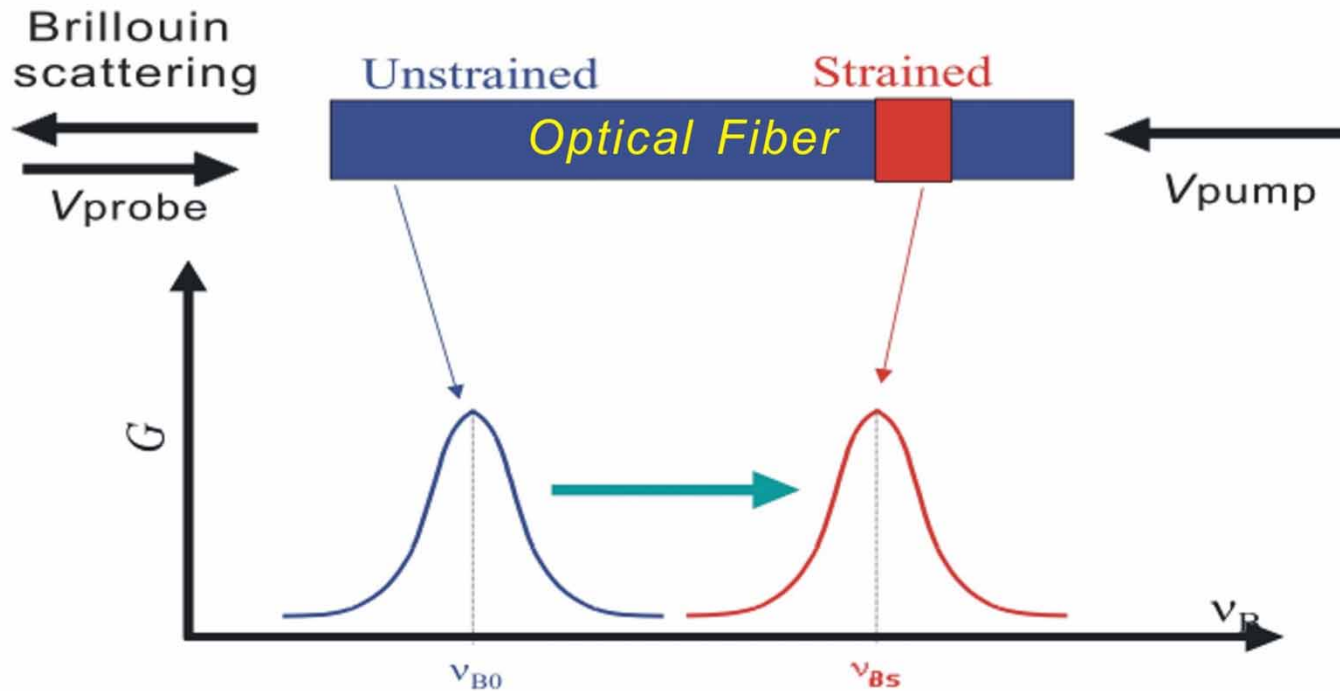
Total System Solution Provides

- **Reduced Operating Expenses**
 - Centralized monitoring
- **Reduced Danger of Catastrophic Failure**
 - Real-time continuous monitoring
 - Corrosion and leak detection
- **Optimized Field Engineering Resources**
 - Automated dispatch with GPS coordinates

OZ Optics Foresight™ DSTS Features

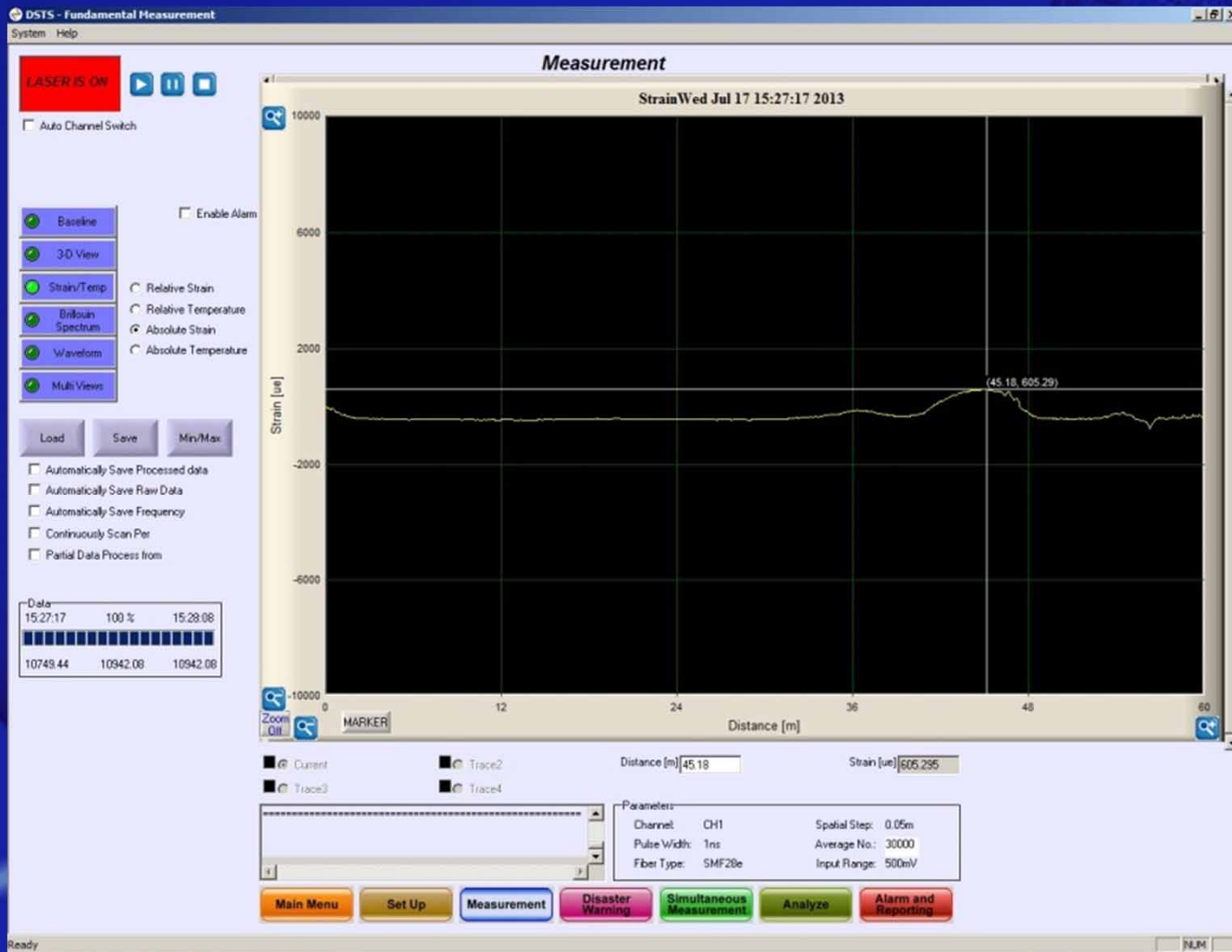
- Temperature and strain in a single telecom fiber
- High resolution over lengths up to 100 km/sensor
- Sends time and location stamped alerts
- Escalates alarms until problem solved

Working Principle — BOTDA




$$\nu_B = \nu_{B0} + C_T (T - T_0) + C_\epsilon (\epsilon - \epsilon_0)$$

OZ Software Translates Raw Data...



...Into Service Calls

Distributed Strain and Temperature Sensors

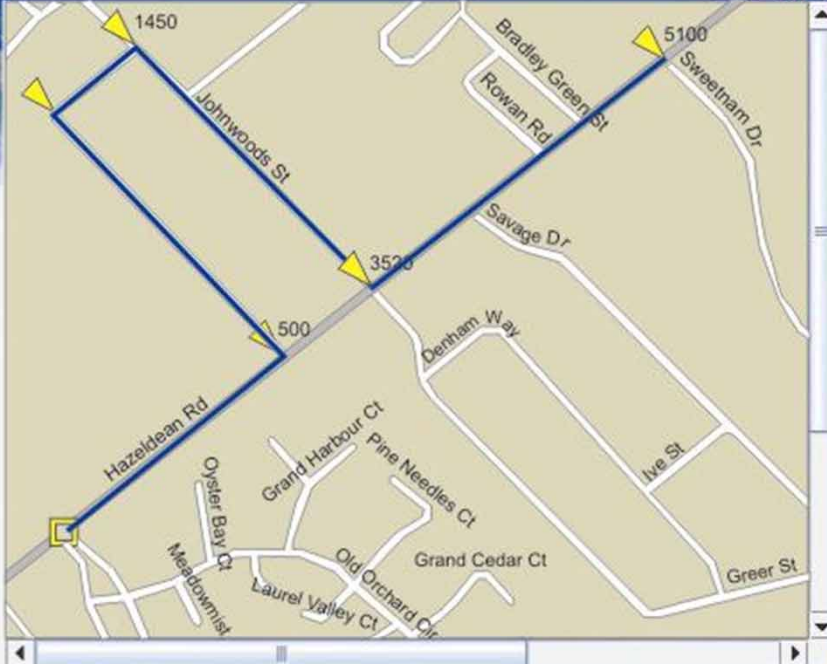


Repair Archive Tree

- DSTS ID:1002
 - 06-16 13:23 ID:103 - 1416M - R
 - 06-16 13:24 ID:104 - 3420M - R
 - 06-06 11:40 ID:101 - 1329M - R
 - 06-06 11:45 ID:102 - 2762M - R

Connect
Settings
Exit
Clear DB

All Repairs (4 repair/s)

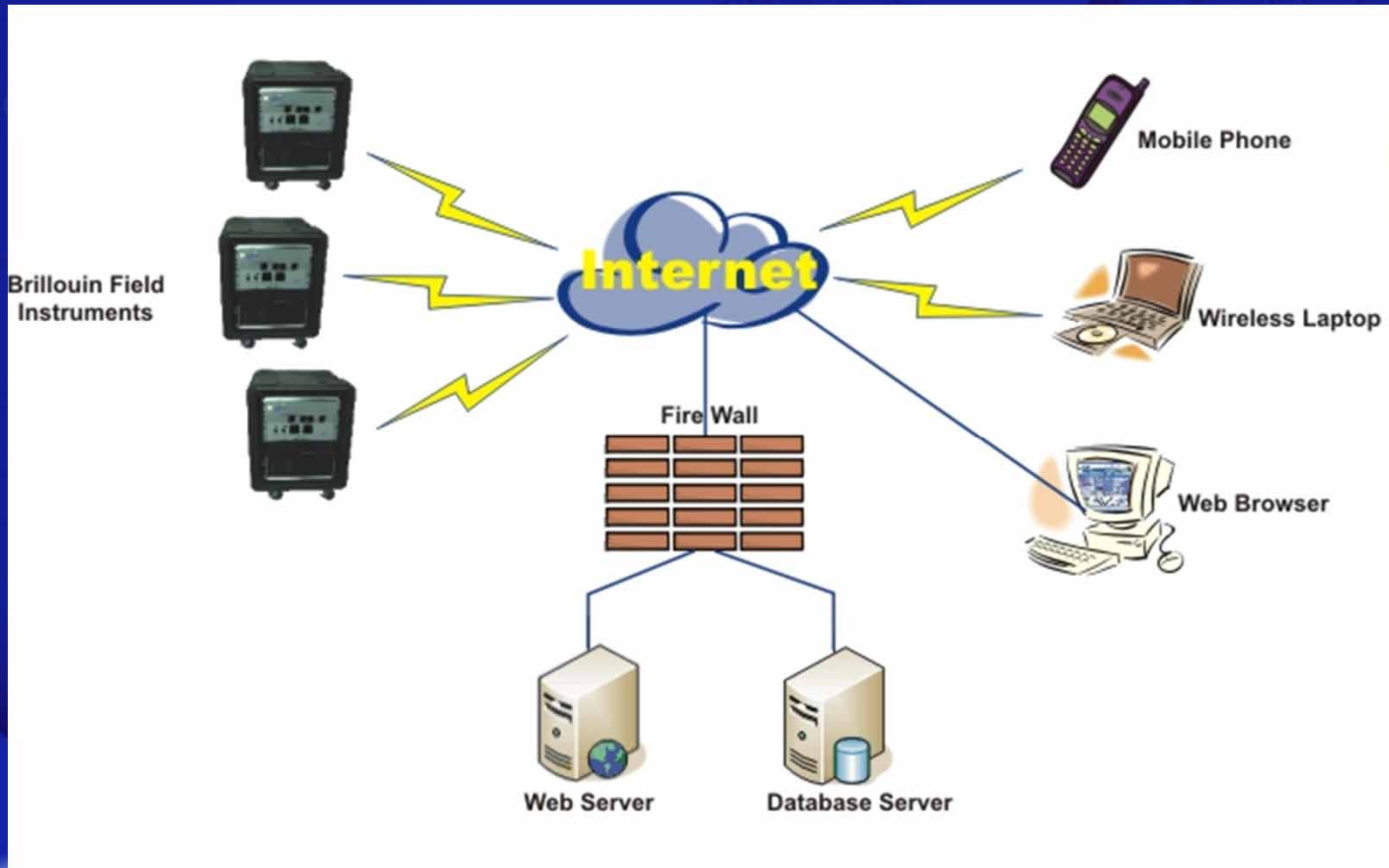


Repairs Bulletin Board

| Event | | Status | | | Repair | | |
|-----------|-----------------|-----------------------|----------------------|------------|--------|------|--------|
| Repair ID | Occurrence Time | Detail | Action | Elapsed | Person | Time | Report |
| 103 | 06-16 13:23 | DSTS:1002 - 1416m - R | Sent 4 service calls | 0h-02':50" | | | |
| 104 | 06-16 13:24 | DSTS:1002 - 3420m - R | Sent 2 service calls | 0h-01':55" | | | |

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OZ Monitoring System Architecture



Compact 2UR1US Model Package



Available Rack Mountable Package



Quantifiable Value Proposition (QVP)

- **Example 1: Druzhba Pipeline**
- **10 hour service interruption = \$43M**
- **Clean-up, repair & site surveys = \$3M**
- **Fines and penalties (Unknown)**
- **Brillouin installation < \$2/meter**
- **Single 50 cubic meter spill costs much more than sensor installation.**

QVP Continued

- **Example 2: Nigerian Pipeline July 2006**
- **Accidental leak**
- **180,000 barrels / day shutdown**
- **180,000 * \$74 = \$13M per day**
- **10-day shutdown = \$130M**
- **Brillouin operation << \$1/m/year**
- **Single production shutdown far exceeds lifetime sensor operating costs.**

Getting Started with DSTS

- **Review OZ Optics reference material**
- **Contact OZ with your needs**
- **Consult with OZ on system design**
- **Request customized QVP estimate**
- **Receive OZ system quotation**

The OZ Optics Commitment

OZ Optics is committed to providing a complete solution, lab evaluation, and field trial to meet your structural health monitoring requirements.

OZ Optics Limited

Your solution provider for existing and next generation fiber optic components, test equipment, and sensor systems...

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613-831-0981 x 3370 or 1-800-361-5415

or email us at:

Sales@ozoptics.com