



Phone: 770-252-5692  
FAX: 770-252-6256  
Email: [info@bengalresources.com](mailto:info@bengalresources.com)

### Bengal Resources, Inc. Rates

Rates available upon request via FAX or Email.

#### Key Contacts

Steven Perry,  
Field Service Manager  
E-mail: [steven@bengalresources.com](mailto:steven@bengalresources.com)

M.P. Draughon,  
Sales  
Email: [mallory@bengalresources.com](mailto:mallory@bengalresources.com)

Sample consultation reports and technical papers  
available [upon request.](#)

#### Table of Contents

<a href="#">Introduction</a>	Page 2
<a href="#">About Our Company</a>	Page 3
<a href="#">Laser Shaft Alignment</a>	Pages 4 – 5
<a href="#">Positional Change Monitoring with Lasers</a>	Pages 5 - 7
<a href="#">Internals Alignment</a>	Pages 7 & 8
<a href="#">Field Balancing, Vibration Analysis, and Data Collection</a>	Pages 9 & 10
<a href="#">Plant-Wide Alignment Management Information Systems (MIS) Consulting</a>	Pages 11 & 12
<a href="#">Laser Alignment Training</a>	Page 13
<a href="#">Sales &amp; Links</a>	Page 14

# Bengal Resources, Inc.

**Bengal Resources, Inc. is a comprehensive industrial service group offering an array of solutions for industrial alignment, balancing, and vibration measurement applications.**



**Steam Turbine Internals Alignment**

- Conveniently located near Atlanta's Hartsfield International airport,
- Our people are on a 24-hour call and ready to provide decades of field experience for your outage and downtime needs.
- In most cases, we can have experienced personnel enroute to your location **WORLDWIDE** within 24 hours.
- Bengal Resources frequently provides same day service within the continental United States

<b>Industries</b>	<b>Equipment</b>	<b>Applications</b>
Utilities	Cooling Towers Gas/Steam Turbomachinery Feedwater Pumps	Shaft Alignment, Machine Train Alignment, Thermal Growth, Steam Turbine Internals Alignment, Casing and Bearing Housing Distortion measurement
Petrochemical	Compressors, Centrifuges, Motors, Blowers, Pumps, skid mounted equipment, Intrinsically safe environments	Shaft Alignment, Balancing, Vibration Analysis, Thermal Growth measurement, leveling-machinery installation
Paper	Bull Gear Drives, Motors, Blowers, Pumps	Shaft Alignment, Balancing, Vibration Analysis, Thermal Growth measurement, leveling-machinery installation
Marine/Oil	Diesel & Turbine Driven Shafting, Gearboxes, Stern Tubes	Bore Alignment, Shaft Alignment, Hull Distortion measurement



Laser shaft alignment  
of a feed water pump

## About Our Company

Bengal Resources, Inc. was founded in 1999 with its primary focus to support general industry maintenance needs. The unprecedented growth in the application of digital technology to solve everyday maintenance problems has itself, created a problem. General Industry, in its effort to apply cutting edge technology in the maintenance arena, is increasingly hard pressed to provide qualified personnel to the job site.

Bengal Resources stands by ready to provide decades of experience for your outage and downtime needs in the fields of alignment and balancing. Whether your workforce has been diminished through downsizing or you simply have lost qualified personnel through attrition, Bengal Resources can provide competent manpower in breaking technologies for all your alignment and field balancing requirements.

---

## Staff

### Steven Perry; Field Service Manager

**Steven Perry** formed Bengal Resources and has worked in the area of **predictive/preventive maintenance** at corporate OEM, Distributor, and field service capacities **since 1981**. Specifically, duties over the **past 22 years** have included consulting, applications, and sales of **laser measuring systems, hard/soft bearing balancing machines and all types of industrial vibration measuring devices**. Upon earning his engineering degree from Louisiana State University in 1981, Mr. Perry worked as a field engineer in the petroleum drilling industry for three years.

### Keith Bond; Senior Field Technician

Keith Bond has over **25 years of experience**, predominately with Dow Chemical in the Freeport, TX Rotating Equipment Group. During this time, Mr. Bond specialized in advanced alignment techniques involving **optics and lasers**. He has had long term exposure to high-end applications involving **turbomachinery shaft and internals alignment, precision leveling and problem solving with motors, pumps and compressors**

## LASER SHAFT ALIGNMENT SERVICE

On-call for YOUR plant's specific alignment needs.

Bengal Resources, Inc. specializes in both high end and standard shaft alignment applications.

Some of these high-end applications are:

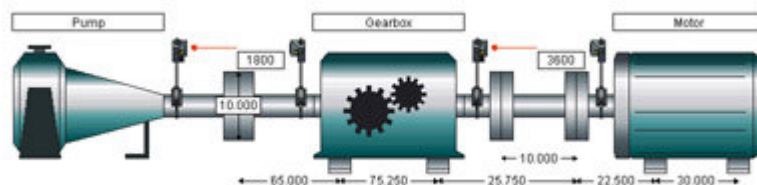
### UTILITIES; Motor/Turbine driven feedwater pumps

Frequently, these applications require the movement of piped machinery. Bengal Resources has the experience to reliably adjust piped machines in as little as two moves within tolerances of 1 to 2 mils.



## MACHINE TRAIN ALIGNMENT

A systematic approach must be taken to efficiently tackle a series of machines with multiple couplings and coupling types. Bengal Resources consistently aligns these applications, sometimes cutting days off the alignment process.



### PETROCHEMICAL INDUSTRY; Compressors, Centrifuges, Motors-Blowers

From turbine driven Chlorine gas compressors to cryogenic applications, Bengal Resources has the experience to solve difficult thermal growth issues. Executing difficult alignments under poor conditions to exacting tolerances is what we have come to expect.

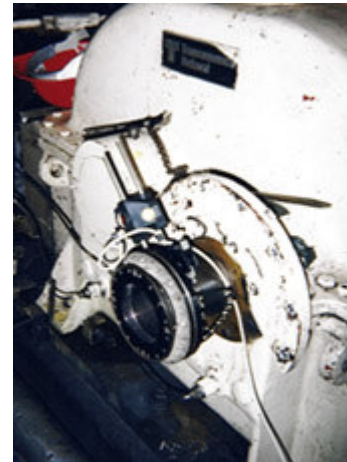


### **PAPER INDUSTRY; Bull Gear Drives and Cooling Towers**

Severely misaligned gear driven equipment separated by spacer shafts from drive motors can be aligned with unsurpassed speed by using instrumentation permitting "Dynamic Range Extension". Bengal Resources provides personal experienced with range extension techniques and graphing.

### **MARINE; Diesel and Turbine driven Prop Shafts and Gearboxes**

Marine applications often present unique alignment problems. Limitations in shaft rotation, obstructions to line of sight, and difficulty with rotating shafts hamper alignment data accuracy. Bengal Resources employs advanced 5 axis measuring technology to overcome these pitfalls.



Optalign Standard, Optalign V, Optalign Plus Turbalign 1.5, Turbalign Centralign, Boralign, Rotalign, Rotalign Pro, rotalign Pro Straightness, and Permalign are registered trademarks of Pruftechnik AG; Ismaning, Germany. Exclusive distributor for North America, Carribbean, and Venezuela-Ludeca, Inc., Miami, FL.

### **POSITIONAL CHANGE MONITORING WITH LASERS**

The fact that machinery moves during operation is established and well documented. Many manufacturers of rotating equipment provide expansion data for their products derived from theoretical calculations. It is Bengal Resources' position that no matter how painstakingly careful one is in approaching these calculations, and no matter how sophisticated the mathematical approach, unavoidable limitations are encountered when applying pure theory to field situations. Further, thermal growth is not the only contributor to positional change of on-line machinery.

Some variables posing problems to theoretical growth calculations for alignment are:

- Piping size and length
- Downstream temperature variations ( and their effect on piping)
- Variations in load
- Machine frame distortion due to torque
- Non-homogeneous materials composition
- Non-uniform machinery cross-sections
- Uneven heating of material
- Foundation problems
- Frequent and significant changes in ambient temperature
- Process effects (changes in operating pressure, temperature)

- Mechanical looseness
- Oil film thickness

A good alignment target takes all significant factors into account. The objective is to deliberately misalign the machine assembly off-line so that it runs into a "straight line" when activated. Occasionally, the solution to thermal growth problems require expansion joints or additional securing of pipes. Nevertheless, the problem with on-line monitoring is: "How do I get realistic data"?

The approach to positional change measurement employed by Bengal Resources is to apply several methods of measurement (i.e. **laser, optical, theoretical calculations of temperature gradients, strain gauges, and accelerometers**) at a reasonable cost. Our goal is to learn more about the physical behavior of a machine assembly so that we may intelligently recommend a course of action to eliminate poor machinery performance. Frequently, that course of action is a recommended cold alignment target. Sometimes a change in piping may be required. On occasion, the source of alignment problems is foundation movement. Regardless of the causal nature of a movement problem, Bengal Resources has the necessary equipment and expertise to confirm positional change.



Permalign and Rotalign  
Pro M3 system measuring thermal growth;  
Agricultural Products Manufacturer in Nebraska.



Optical and Laser Measurement;  
Compressor Thermal Growth;  
Gas Transition Facility, Minnesota



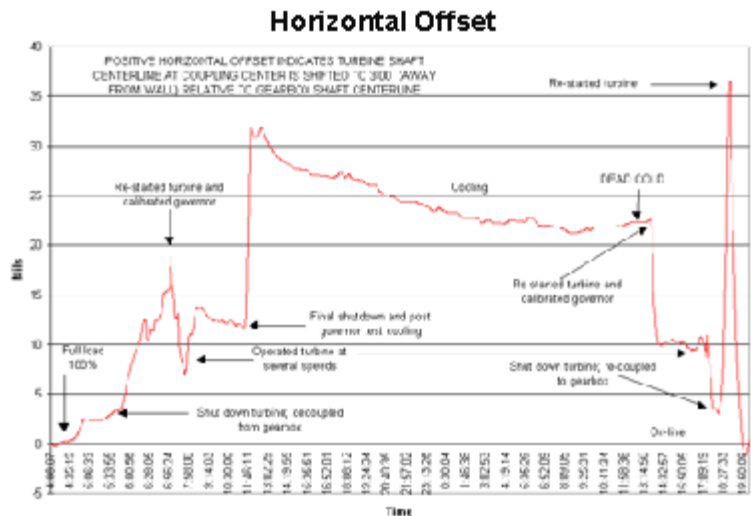
Optical measurement of thermal growth  
using a precision level



Laser and Strain gauge measurement of  
steam turbine foundation pedestal movement in Ohio.



Casing Distortion Measurement on Steam Turbine



## INTERNALS ALIGNMENT

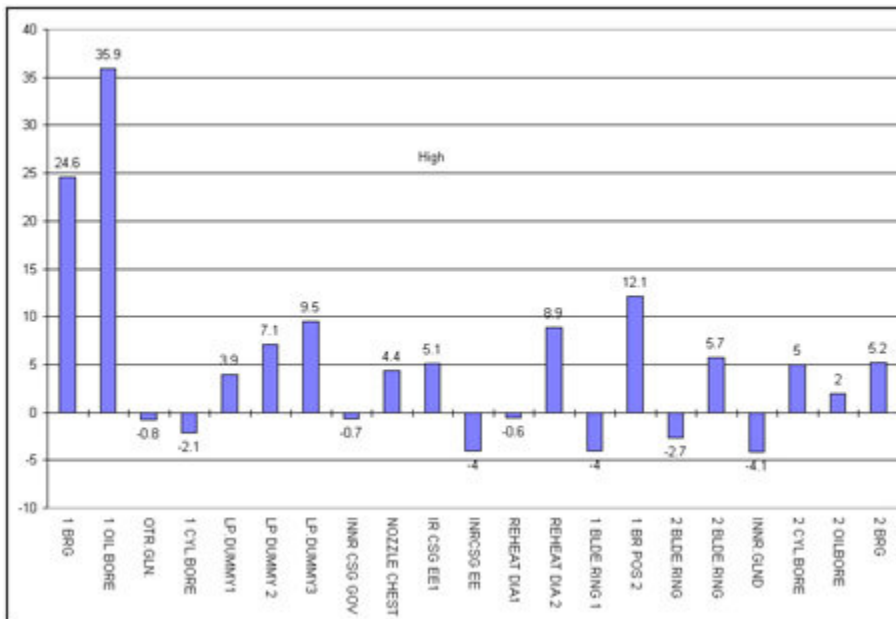
### For Steam/Gas Turbines, Compressors, Stern Tubes

Traditional methods of gathering bore alignment data (piano wire and acoustic micrometer) require inordinate attention to ambient temperature conditions, wire sag, and operator involvement in the data collection process. Furthermore, once the data is gathered, it must be manually processed to account for positional presets (catenary curves) and/or shaft to bore disassembly readings. Such labor intensive gathering and manipulation of data increase the chance for systematic errors.

Breakthroughs in stabilizing laser behavior over long distances have produced a measuring system capable of consistently generating accurate bore position data. Repeatability is achieved independent of the technician collecting the data. ISO 9000 standardization guarantees uniformity in the application of presets across the entire measurement string.

For compressor applications, crosshead alignment requires days of downtime for disassembly and removal of the connecting rod to facilitate piano wire set-up...an unnecessary step with lasers.

Whether your application is short range (under 27 feet) or long range (up to 157 feet), Bengal Resources can deliver accurate data at a cost effective price.



**Applications:**

- Steam turbine internals (ex: GE, A/C, Westinghouse)
- Gas turbine internals (ex: GE, ABB)
- Compressors (ex: Ingersol)
- Stern tubes (ex:NASSCO)



**Crankcase Bore Alignment  
of a Reciprocating Compressor**

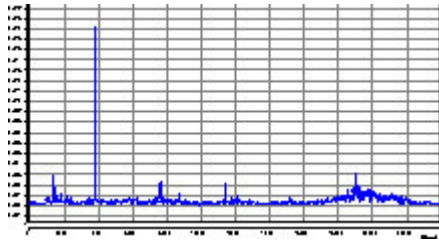


**Steam Turbine Internals Alignment**

## FIELD BALANCING, VIBRATION ANALYSIS, AND DATA COLLECTION

### Vibration analyzer and field balancer

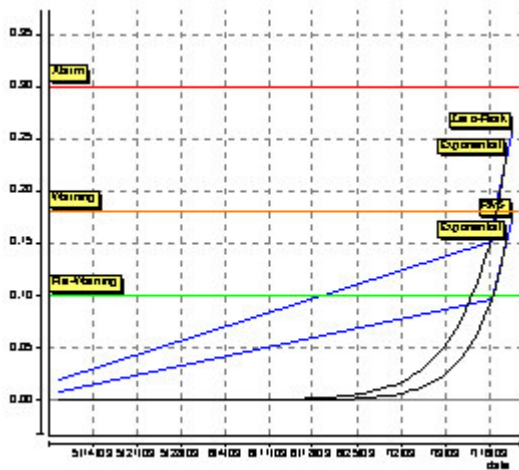
#### Gearbox Vibration Signature



Click on image for larger view.

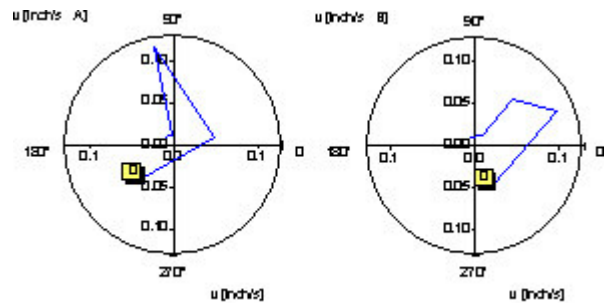


#### Overall vibration Trend Chart approaching Alarm



Click on image for larger view.

#### Balancing Vector Diagram



Click on image for larger view.

Periodic in-situ balancing offers a simple method to improve the running condition of your machinery. As with alignment, Bengal Resources utilizes the most sophisticated and field proven technology available in the world. When you call Bengal Resources, you can rest assured that we will bring the proper equipment to the job site.

Instrumentation must be sensitive to balance PC hard drives with corrections significantly less than one gram, but also rugged enough to handle forced draft fans at power plants. We have extensive experience with uncommon applications and are dedicated to providing a cost-effective data bank of experience to industry. Some areas of high end application experience are: High speed textile winders, rigid and flexible rotor balancing of paper machine rolls, bowl and scroll centrifuges, high speed cooling fans (22,000 rpm), trim balancing of turbines, aircraft propellers, and high speed hammer mills. Bengal Resources also offers consulting for variable speed machinery operating above and below various critical speeds.

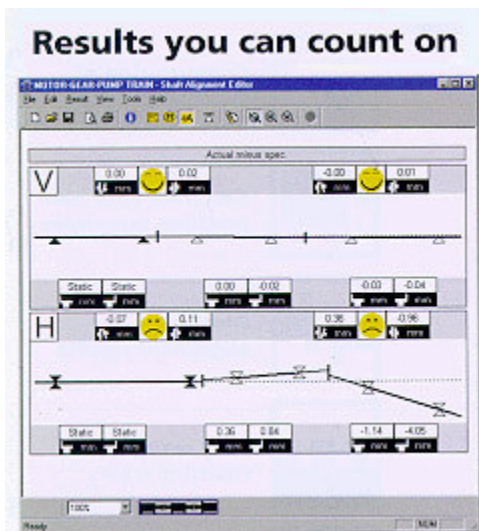


### **Vibration Analysis**

Bengal Resources provides complementary vibration data for alignment consulting projects on request. Typically, before and after alignment data are obtained (overall/spectral). When determining whether thermal growth is an issue, vibration signatures provide useful indications of worsening alignment during the startup process. We can also provide long term trending of overalls and bearing shock pulse values to provide early warning to our customers of impending problems with their machinery.

## PLANT-WIDE ALIGNMENT MANAGEMENT INFORMATION SYSTEMS (MIS) CONSULTING

Many companies have no problem with alignment tasks, but sometimes lack the time or expertise to properly establish a comprehensive alignment program. Proper creation and management of an alignment database can have a tremendous impact on your plant's operating costs.



Less successful alignment programs often err in their devotion to putting out fires instead of preventing them. Bengal Resources can organize your alignment program to increase plant-wide machinery availability. Eliminating unscheduled alignment related downtime is achievable only through efficient use of alignment tracking software. Bengal Resources stands ready to provide assistance in this endeavor.

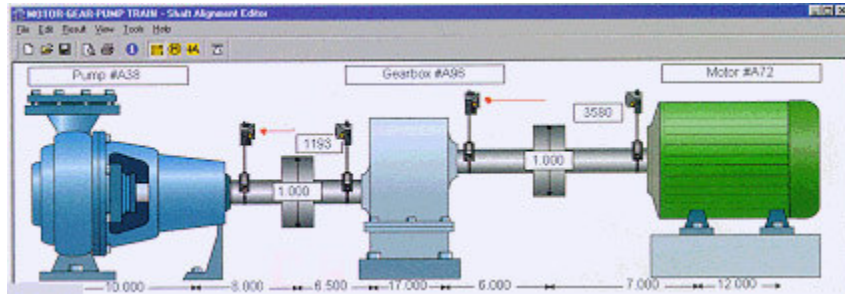
**Alignment Commander**

**Taking command of shaft alignment**

The Alignment Commander acts as the communication center of the entire program: use it to view alignment and soft foot measurements, tolerance tables and predefined machine templates, all displayed in a clear tree-type structure and listed according to file type and operator name. Copy files between the ROTALIGN PRO instrument and the PC with drag-and-drop convenience, and simply click onto any entry to load it into its corresponding Commander module.

ROTALIGN PRO

Device	User	File
Centrifugal Blower	Anne McGeehan	400.txt
Centrifugal Blower	John Miller	440.txt
Centrifugal Blower	Anne McGeehan	321.txt
Steam Evaporator	Anne McGeehan	444.txt
Generator	John Miller	300.txt
Generator	John Miller	437.txt
Generator	John Miller	425.txt
Steam Turbine	Anne McGeehan	445.txt



Rotalign Pro and Pro Commander are registered trademarks of Prüftechnik AG of Ismaning, Germany.  
Exclusive USA Distributor is Ludeca, Inc. of Miami, FL

## Laser Alignment Training



Bengal Resources provides introductory, intermediate, and advanced training through Ludeca, Inc. of Miami, FL and their independent sales force for the following products:

<b>Optalign® Standard</b>	<b>Laser Shaft Alignment System</b>
<b>Optalign V®</b>	<b>Laser Shaft Alignment System</b>
<b>Optalign Plus®</b>	<b>Laser Shaft Alignment System</b>
<b>Turbalign 1.5®</b>	<b>Laser Shaft Alignment System</b>
<b>Turbalign®</b>	<b>Laser Shaft Alignment System</b>
<b>Centralign®</b>	<b>Long/Short Range Bore Alignment System</b>
<b>Boralign®</b>	<b>Short Range Bore Alignment System</b>
<b>Rotalign</b>	<b>Laser Shaft Alignment System</b>
<b>Rotalign Pro</b>	<b>Laser Shaft Alignment System</b>
<b>Rotalign Pro Straightness</b>	<b>Laser Straightness Measuring Program</b>
<b>Permalign</b>	<b>Laser Measuring System for Positional Change</b>

Specific course syllabus information is available upon request. Video Aids to be furnished by the customer are: overhead projector, LCD projection device for a personal computer, flip chart or marker board or chalk board. One alignment simulator will be provided for each class. Limit: 8 people. It is strongly recommended additional simulators be rented or made available for advanced classes involving more than 4 people.

Optalign Standard, Optalign V, Optalign Plus Turbalign 1.5, Turbalign Centralign, Boralign, Rotalign, Rotalign Pro, rotalign Pro Straightness, and Permalign are registered trademarks of Pruftechnik AG; Ismaning, Germany. Exclusive distributor for North America, Carribbean, and Venezuela-Ludeca, Inc., Miami, FL.

## Bengal Resources, Inc. Sales

Bengal Resources Inc. is an exclusive sales representative for Ludeca Incorporated. We provide sales and general support to the Condition Monitoring product line in the Carolinas, Georgia, and East Tennessee.



## Links



<http://www.ludeca.com>



<http://www.heartlandsolutions.com>

*Voelzow & Company, Inc.*



<http://www.laseralignment.net>