Concepts NREC
EXPERTS IN TURBOMACHINERY

RBTS

ROTORDYNAMICS & BEARING TECHNOLOGIES SPRING SEMINAR

MAY 4-7, 2026

ONLINE OR IN PERSON, VERMONT, USA

WHO SHOULD ATTEND

This course is designed for engineers and technical managers who are involved in rotating machinery design, operation, maintenance, diagnostics, and troubleshooting, with emphasis on bearings and bearings systems, machinery rotor dynamics, and drive train torsional vibration.

WHAT WILL YOU LEARN

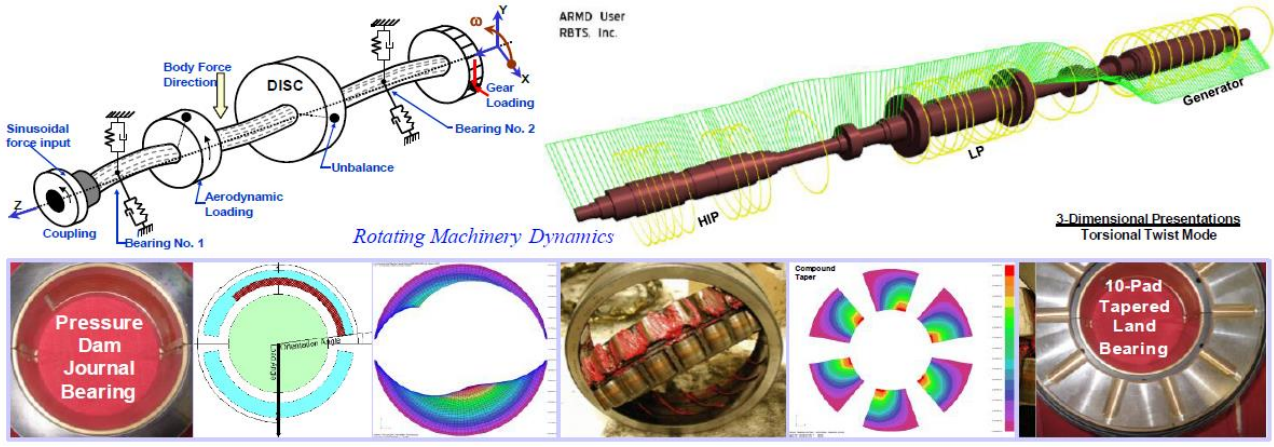
This seminar provides detailed coverage of the field of fluid-film bearings and rotor dynamics including the presentation of case histories and the application of advanced software for modeling, analyses, and troubleshooting real-life bearing systems and vibration problems encountered in rotating equipment.

FLEXIBLE REGISTRATION

DAY 1	**MON**	**MAY 4, 2026**	**FLUID-FILM BEARINGS**
DAY 2	**TUES**	**MAY 5, 2026**	**ROTOR DYNAMICS LATERAL VIBRATION**
DAY 3	**WED**	**MAY 6, 2026**	**TORSIONAL VIBRATION**
DAY 4	**THU**	**MAY 7, 2026**	**SOFTWARE WORKSHOP AND APPLIED EXAMPLES OF REAL-WORLD APPLICATIONS** **ARMD™ software demonstration, training, and application to bearings, bearing systems, rotor dynamics, and torsional vibration modeling, analyses, and interpretation of generated results.**

No previous experience is required.

Each student will receive a certification of completion reflecting earned CEU.



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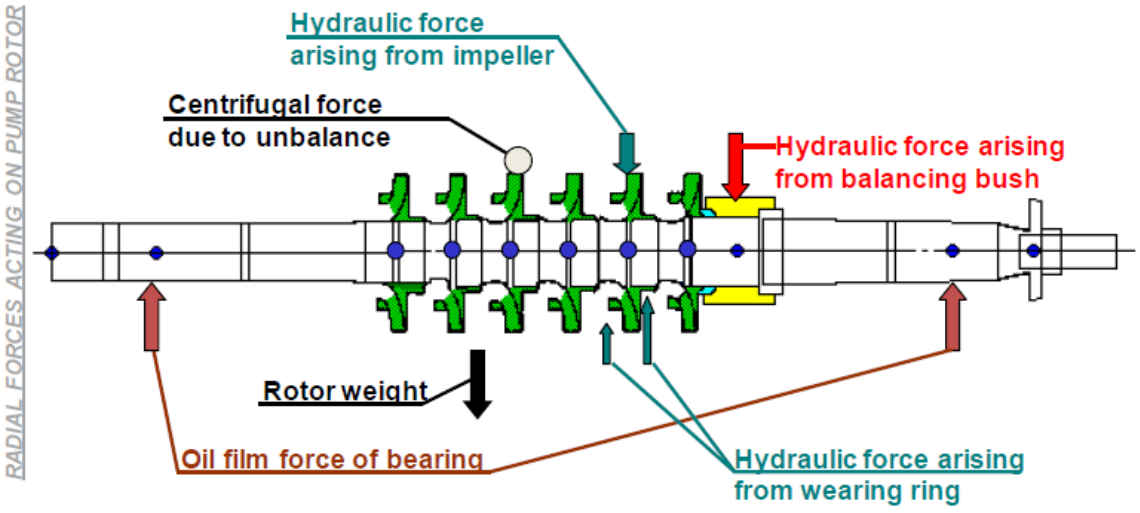
ABOUT THE COURSE

This course is designed for engineers and technical managers who are involved in rotating machinery design, operation, maintenance, diagnostics, and troubleshooting, with emphasis on bearings and bearings systems, machinery rotor dynamics, and drive train torsional vibration.

The first session will focus on FLUID-FILM BEARINGS, the vital tribological element of rotating machinery, beginning with their fundamental principles of operation through computer-implemented evaluations of their operational performance characteristics and limitations. Design considerations and applications of fluid-film bearings will be discussed along with the presentation of numerous real-life case histories to illustrate the technology and its application to rotating machinery failure analysis and troubleshooting of common as well as unique vibration problems. An introduction to rolling element bearings will be presented to illustrate their various applications and effects on system rotor dynamics.

The second and third sessions focus on ROTOR DYNAMICS LATERAL VIBRATION & TORSIONAL VIBRATION. The interacting influence of bearings on the dynamic behavior of rotating machinery will be reviewed and illustrated by the construction of analytical models and evaluated by computerized solutions. Participants are encouraged to present problems to be discussed. Informal technical sessions and workshops are intended to provide participants with adequate time to describe problems they have encountered in bearings, bearing systems, rotor dynamics, and torsional vibration.

The fourth session is a hands-on SOFTWARE WORKSHOP AND APPLIED EXAMPLES OF REAL-WORLD APPLICATIONS. Participants will have access to the Advanced Rotating Machinery Dynamics software package ARMD™, as well as in-depth demonstration, training, and application to bearings, bearing systems, rotor dynamics, and torsional vibration modeling, analyses, and interpretation of generated results. state-of-the-art computer-aided engineering of bearings and rotor dynamics.



Representative rotating assembly illustrating various applied radial forces

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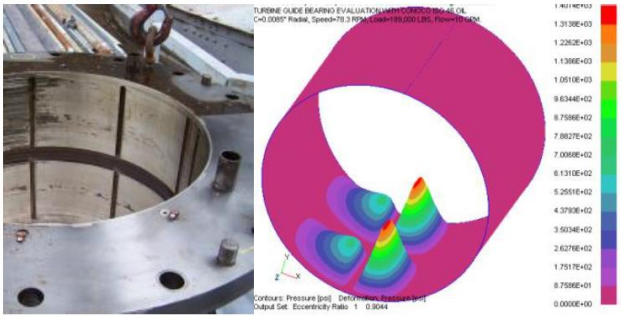
DAY 1 FLUID-FILM BEARINGS

This session is presented in a simple way to understand the technology of sliding surface bearings so that participants with or without previous knowledge benefit from the presentation and can apply it immediately in their profession.

The session is a full coverage of fluid-film bearings (the vital tribological elements of rotating machinery that support, guide, and locate the rotating assembly) beginning with their fundamental principles of operation through computer-implemented evaluations of their operational performance characteristics and limitations. Design considerations and applications of sliding surface bearings with emphasis on hydrodynamically lubricated fluid-film bearings will be discussed along with presentations of practical examples and case histories.

INTRODUCTION TO BEARINGS

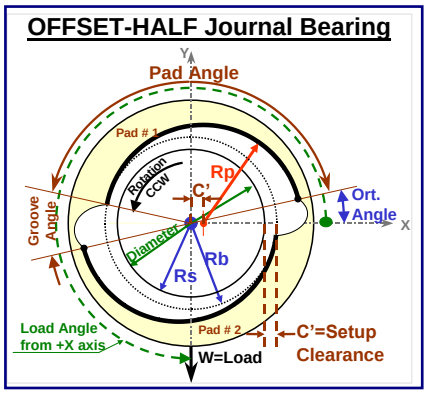
- **Functional roll**
- **The two primary classes**
- **Noteworthy differences between classes of bearings**



Hydro-turbine guide bearing & oil pressure model

SLIDING SURFACE BEARINGS

- **Fundamentals**
- **Types and definitions**
- **Load support mechanisms**
- **Modes of lubrication**
- **Frictional response characteristics**
- **Terms and concepts of hydrodynamic lubrication and its requirements**
- **Terms and concepts of hydrostatic-hybrid lubrication and its requirements**
- **Lubricant temperature/viscosity-dependent properties and heat balance effects**
- **Turbomachinery hydrodynamic bearing types, performance, and dynamic characteristics**
- **Oil whirl/whip**
- **Advantages/disadvantages**
- **Costs**



FLUID-FILM BEARING TYPES AND APPLICATIONS

- **Fixed and tilting pad geometries**
- **Journal, thrust and conical**

BEARINGS STATE-OF-THE-ART TECHNOLOGY

- **Advanced technology presentation & demonstration**
- **Summary of course content and application of bearings technologies**

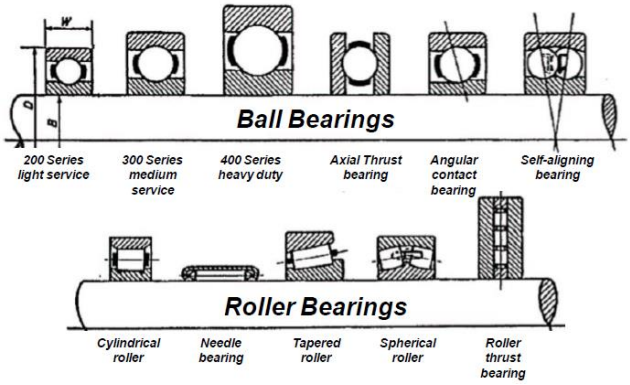
WORKSHOP

- **Participants' systems, group discussion, course summary**

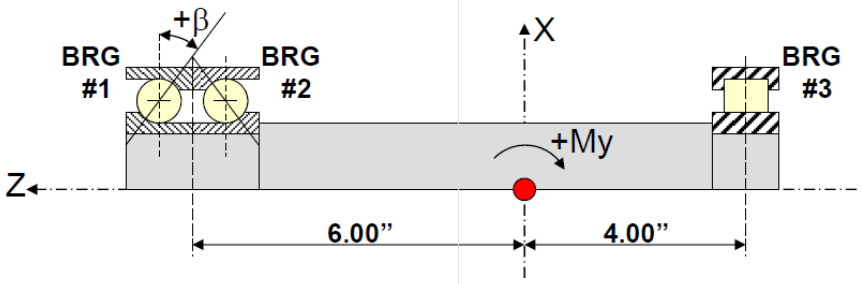
DAY 2 ROLLING ELEMENT BEARINGS

A brief introduction to Rolling Element Bearings (REB) is presented in a 2-hour session.

Topics include REB types, geometries, applications, and Standards. Failure modes, bearing stress, and fatigue life are addressed, followed by lubrication, kinematics, and multi-bearing systems. Modeling and analysis of a rolling element-bearing sample is presented and results discussed.



ROLLING ELEMENT BEARING ANALYSIS SAMPLE PROBLEM



Bearing System:

Fan shaft with impeller loads

Fixed Bearing:
Back-to-Back duplex angular contact ball
80mmx140mmx52mm per row
15 – ¾ inch balls per row
25 degree contact angle
Zero operating end play

Conditions:

1500	RPM shaft speed
2000	(lbs) radial load downward (-)
1000	(lbs) thrust load to the left (+)
500	(in-lb) moment clockwise (+)

Radial Bearing:
Cylindrical roller bearing
100mmx150mmx24mm per row
24 – 14mm diameter x 16mm long rollers
0.0010" operating IDC (diametral clearance)

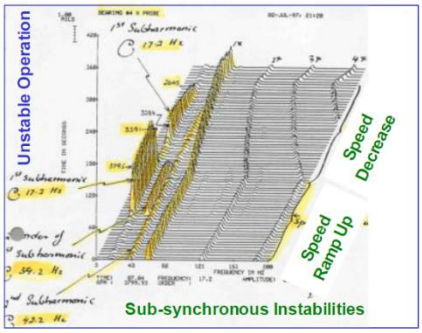
DAYS 2 & 3 ROTOR DYNAMICS & TORSIONAL VIBRATION

These sessions present rotordynamics in a simple way so that participants with or without previous knowledge benefit from the presentation and can apply it immediately in their profession. Commonly used terminology in the industry such as lateral and torsional critical speeds, mode shapes (rigid body and bending), stability, bearing whirl/whip, phase angle, critical damping, gyroscopic effects, unbalance, API amplification factors and required separation margins, etc. will be discussed and illustrated throughout the course by the presentation of practical examples and case histories. The course handout includes sufficient details to be used as a reference including a tutorial section on rotor dynamic fundamentals and terminology. Topics include:

INTRODUCTION & OVERVIEW *(includes the presentation of a real-life vibration problem and cost/time-effective corrective actions taken as a solution)*

BASICS OF MACHINERY VIBRATION – Introduction

- Vibration theory – single mass system, planar vibration
- Response and shaft dynamics – displacement, velocity and acceleration amplitude and phase
- Forces in rotating equipment – bearings, cavitation, imbalance, hydraulic, aerodynamic



ROTOR DYNAMICS & TORSIONAL VIBRATION – Basics

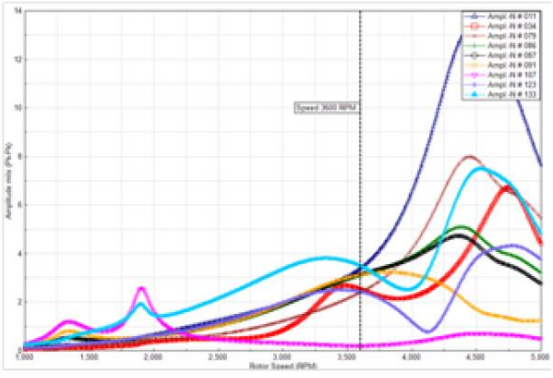
- Introduction and application
- Parameters of interests
- Vibration analysis types - lateral, torsional, and axial
- Stability and response

ROTOR DYNAMICS – Theory

- Rigid rotor – one degree of freedom free & forces vibration
- Simplified rotor system behavior – dynamic vectors (displacement and force), critical speed, phase angle, stability parameter, and the effects of system mass, stiffness, and damping
- Flexible rotor – multi-degree-of-freedom system

ROTOR DYNAMICS – Advanced

- Synchronous steady-state response
- Non-synchronous time-transient response
- Balancing grades and guidelines
- API standards and guidelines - amplification factor, critical response envelope. Required separation margins for operation below and above critical speed, shaft vibration orbit properties



Response amplitude vs. speed

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REQUIREMENTS FOR ROTOR DYNAMIC ANALYSES

MODELING

- **Shafting**
- **Disks – impellers, couplings, thrust collars, blades, balanced pistons, etc**
- **Bearings – fluid-film and rolling element**
- **Seals, wear-rings, labrynth**
- **Housing/pedestal**
- **Aerodynamic, steam whirl, hydraulic effects**
- **External excitations**
- **Gyroscopic effects**

ANALYSIS

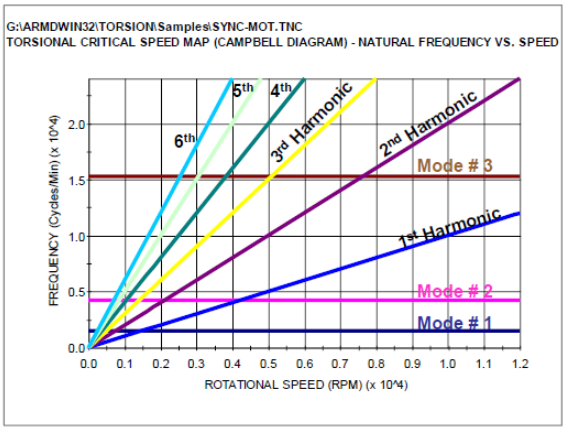
- **Damped and undamped rotor stability, natural frequencies, mode shapes**
- **Stability and critical speed maps and response**

ROTOR DYNAMICS DETAILED CASE HISTORY

- **Step-by-step rotor-bearing system modeling, analysis, and problem solution by the introduction of rotor dynamics software and its application to a rotor-bearing system**
- **Bearing interaction with the rotating assembly, oil-whirl/whip phenomena, rotor-bearing response, and stability illustrations**

TORSIONAL VIBRATION – ADVANCED

- **Modeling considerations – shaft, inertia, coupling, bearings, damping, etc.**
- **Analysis types and generated results interpretation**



TORSIONAL VIBRATION DETAILED CASE HISTORIES

- **Simple two-disk system**
- **Direct drive fixed speed – 75kw electric motor driven 4-stage gas booster centrifugal compressor**
- **Synchronous motor–gearbox–compressor drive train start-up simulation**
- **Failure analysis of 2000hp electric motor driving a 4-throw reciprocating compressor and cost-effective solution**

STATE-OF-THE-ART TECHNOLOGY PRESENTATION & DEMONSTRATION

- **Advanced technology presentation & demonstration**
- **Summary of course content and application of rotating machinery dynamics technologies**

WORKSHOP

- **Participants' systems, group discussion**

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DAY 4 ARMD™ SOFTWARE WORKSHOP AND APPLIED EXAMPLES OF REAL-WORLD APPLICATIONS

This workshop is planned for participants who are interested in the detailed modeling and analysis of bearings and rotor/bearing systems utilizing the ARMD software. Participants can bring their rotating machinery and bearings problems to be presented and discussed in an open session, watch a problem development and solution, or use the software and create their own models and perform the analysis of their interest. Time will be allocated to discuss FAQs and details of the ARMD software. The workshop will cover the following subjects:

MODEL GENERATION

- **Introduction and problem description**
- **Getting the "right" parameters**
- **Dividing the rotating machine into Components for modeling and integration**
- **Verification of constructed models**

ROTOR/BEARING SIMULATION

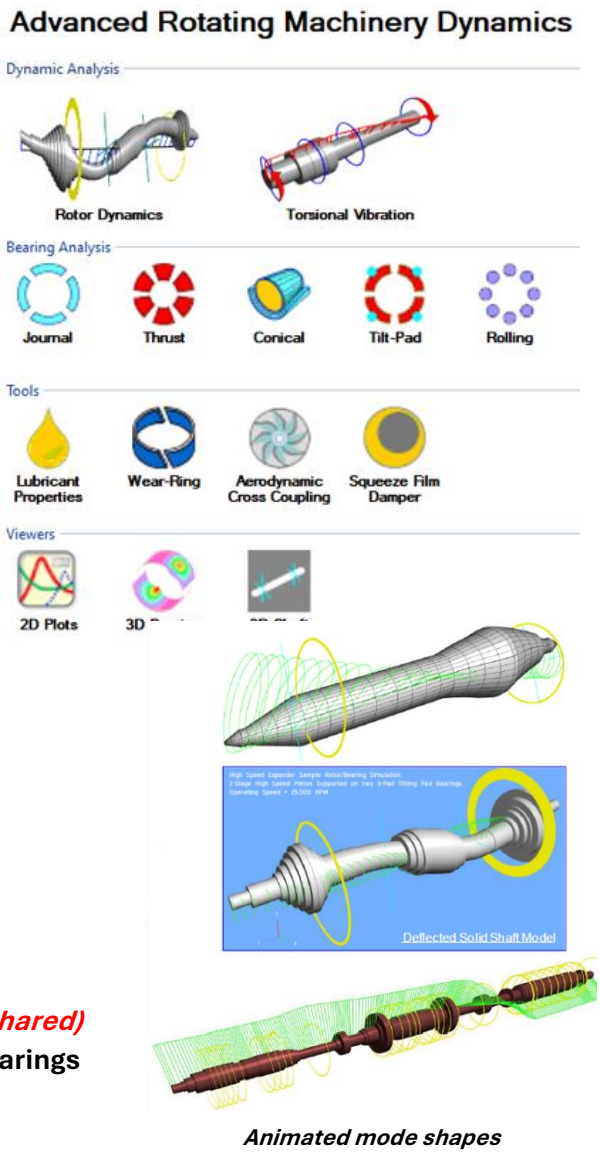
- **Deflection and load calculations**
- **Bearing performance and the generation of dynamic coefficients**
- **System natural frequency, mode shapes and stability calculations**
- **Critical speed map generation**
- **Stability map (CAMPBELL diagram)**
- **Synchronous unbalance response**
- **Non-synchronous time transient response**

INTERPRETATION OF RESULTS

- **Acceptable bearing performance**
- **Rotating machinery dynamic performance and cost-effective corrective action**
- **Comparison/correlation of calculated and measured machinery dynamic performance**

APPLICATIONS

- **Participants' problems *(if available and can be shared)***
- **Fixed and tilting-pad fluid-film journal/thrust bearings**
- **Lateral/torsional rotor dynamics**



Animated mode shapes

During the sessions, numerous real-life case histories will be presented to illustrate the technology and its application to rotating machinery failure analysis and troubleshooting of common, as well as unique, vibration problems.

ABOUT YOUR INSTRUCTORS

VICTOR K. OBEID has over 35 years of experience in the fields of rotor dynamics, fluid-film and rolling-element bearings, machinery vibration, failure analysis, and troubleshooting.

He is a pioneer in the development and application of PC-based state-of-the-art computer-aided design software for predicting the dynamics of complex rotor-bearing systems. A former Staff Engineer at the Franklin Institute Research Laboratories and a technical leader at *RBTS*, he directs government and industry-sponsored projects involving the design, analysis, and troubleshooting of rotating machinery systems and their components. He has been instrumental in teaching and training in the fields of bearings and rotor dynamics, and their application to common as well as unique equipment design, operation, and failure analysis. He taught seminars and training sessions worldwide at rotating equipment OEM, end users, packagers, government agencies, and open seminars to machinery engineers.

Mr. Obeid holds a Bachelor's degree from Drexel University and a Master of Science degree from Penn State University, both in Mechanical Engineering, as well as numerous US & Canadian patents on bearing designs & machinery elements.

CHARLES W. YEISER has over 30 years of experience in the technical evaluation of structural and rotating machinery dynamics that encompasses application, design, software development, systems evaluation, failure analysis, and troubleshooting.

He has extensive experience in developing linear and non-linear finite element and specialized fluid-film/rolling-element bearing applications, which included structural deformation and heat transfer. For more than 20 years he has developed and successfully applied advanced computational techniques to evaluate torsional vibrations in hundreds of mechanical drive systems.

Mr. Yeiser holds a Bachelor of Arts in Physics from Franklin & Marshall College, as well as Bachelor and Master of Science degrees in Engineering from the University of Pennsylvania.

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ABOUT THE SEMINAR VENUE

CONCEPTS NREC CORPORATE HEADQUARTERS AND PRODUCT CENTER
217 Billings Farm Road, White River Junction, Vermont

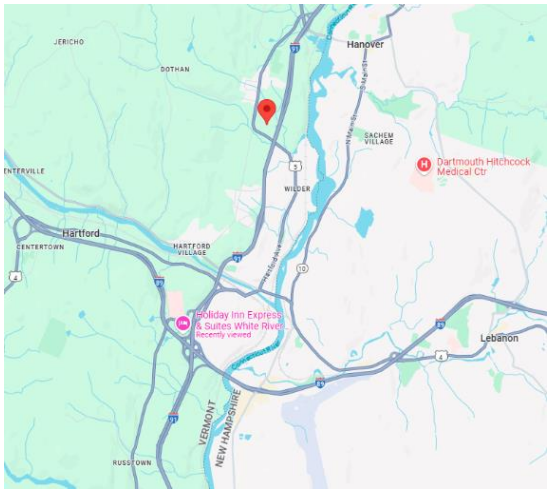
Concepts NREC's Headquarters is home to our state-of-the-art manufacturing center featuring 3- and 5-axis milling machines, horizontal and vertical numerical controlled lathes, and high-end inspection equipment. Facility tours, networking opportunities, and group dinners are significant benefits of attending in-person.

DISCOUNTED ACCOMMODATIONS

HOLIDAY INN EXPRESS & SUITES
121 Ballardvale Drive, White River Junction, Vermont

Call +1 (802) 299-2700 to make your reservation, and use the word CONCEPTS to confirm your discounted rate at the Holiday Inn Express & Suites.

The hotel is located less than 10-minute drive from the Concepts NREC headquarters. Rooms feature air conditioning, refrigerator, microwave, 36“ flat screen TV. A breakfast buffet is available daily from 6:30am-9:30am. The property also includes free WiFi, a fitness area, and free parking.



Concepts NREC's Headquarters and Product Center is positioned in a quiet, rural setting between Norwich, Vermont, and Hanover, New Hampshire, near the intersection of I-91 and I-89. The location is well connected with several major airports, and rural highways that offer relaxed driving.

The regional airport in West Lebanon, NH, is eight miles from the facility. Airports in Burlington, VT and Manchester, NH are approximately a 1-hour drive, and the Boston, MA, and Hartford, CT airports are approximately a 2-hour drive.