



47TH TURBOMACHINERY & 34TH PUMP SYMPOSIA
HOUSTON, TEXAS | SEPTEMBER 17-20, 2018
GEORGE R. BROWN CONVENTION CENTER

Centrifugal Compressors 101 Part 1

Mark J. Kuzdzal

Head, Advanced Components and Methods

Jay Koch

**Product Line Management Single Shaft
Compressors**

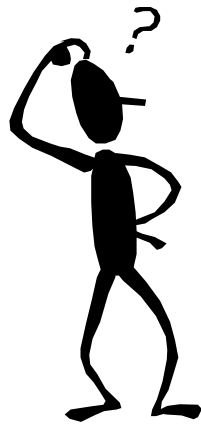
DRESSER-RAND
A Siemens Business

ATM | TEXAS A&M
UNIVERSITY



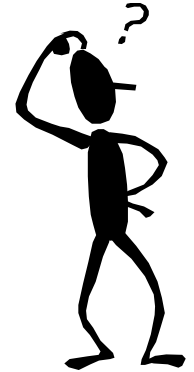
TURBOMACHINERY LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

Who Are We???



- **Jay Koch**
- **Graduate of Iowa State University (BS Aerospace Eng.)**
- **Joined Dresser-Rand in 1991**
- **Worked for Allied Signal Aerospace before joining D-R**
- **Aero Dynamics group, NPD team, Datum Development Team, Manager Aero/Thermo Design Engineering, R & D Manager, Principal Engineering Lead, Product Line Management Single Shaft Compressors**
- **Current Responsibilities include:**
 - **Development Portfolio management for centrifugal compressors**
 - **Interface between clients, sales, service and R&D organization**
- **Previous Responsibilities:**
 - **Design, development, analysis of aero components of centrifugal compressors**
 - **Development of software used to select and predict compressor performance.**

Who Are We???



- **Mark J. Kuzdzal**
- **1988 Graduate of University of Buffalo (BSME)**
- **Joined Dresser-Rand in 1988**
- **Texas A&M Advisory Committee Member Since 2004**
- **Penn State Advisory Committee Member Since 2004**
- **RotorDynamics group, NPD team, Datum Development Team, Development Manager, Core Tech. Manager, Business Development Director, Head of Advanced Components and Methods organization**
- **Current Responsibilities include:**
 - **Development of Advanced Components and Methods to improve product portfolio**
 - **Favorite work-related topics: aero-mechanical excitation (SSV), & Acoustics**

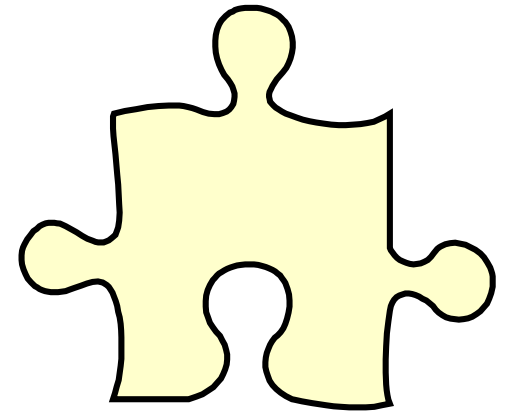
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Agenda

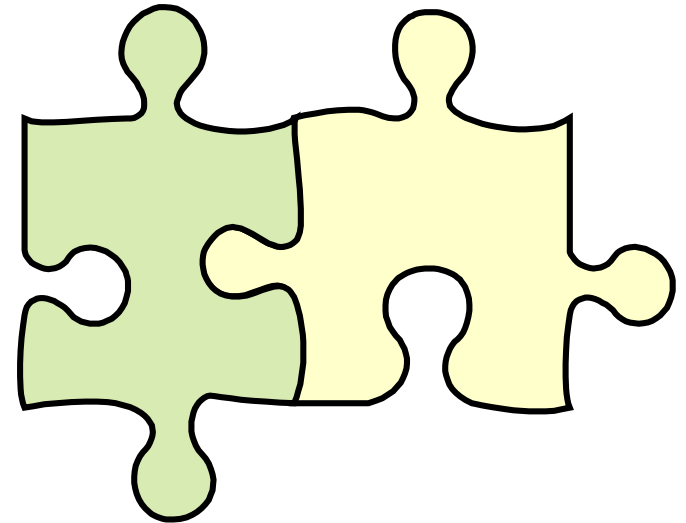
- Reciprocating and centrifugal compressor similarities/ differences
- How do they work? (Potential Energy, Kinetic Energy, PE, KE, ...)
- History of compressors
 - Timeline, major advances
 - Configurations, straight-through, back-to-back, compound, side streams, double-flow
- Markets served
- Pressure containment
 - Case
 - Nozzles and flanges



Mark

Agenda Continued

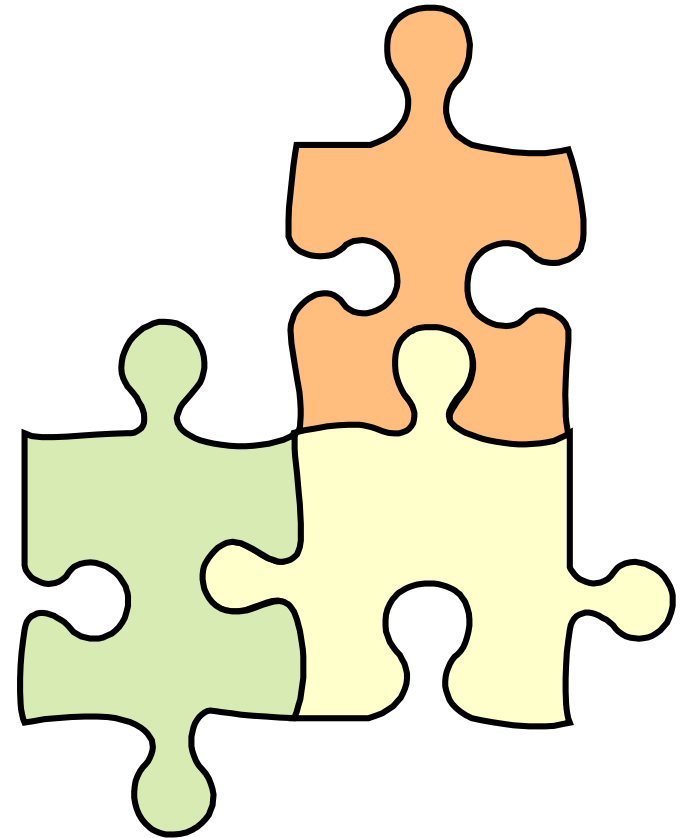
- Selection Process
 - Aerodynamic Selection
 - Mechanical Design
 - Rotordynamic Design
- Impellers
 - Design Basics
- Stationary Aero Components
 - Inlet, inlet guide
 - Diffuser, vaned and vaneless, LSD
 - Volute and collector
 - Return bend / Return channel
- Compressor Performance
 - Nomenclature
 - Impact of Operating Conditions
 - Internal Leakage
 - Surge Control



Jay

Agenda Continued

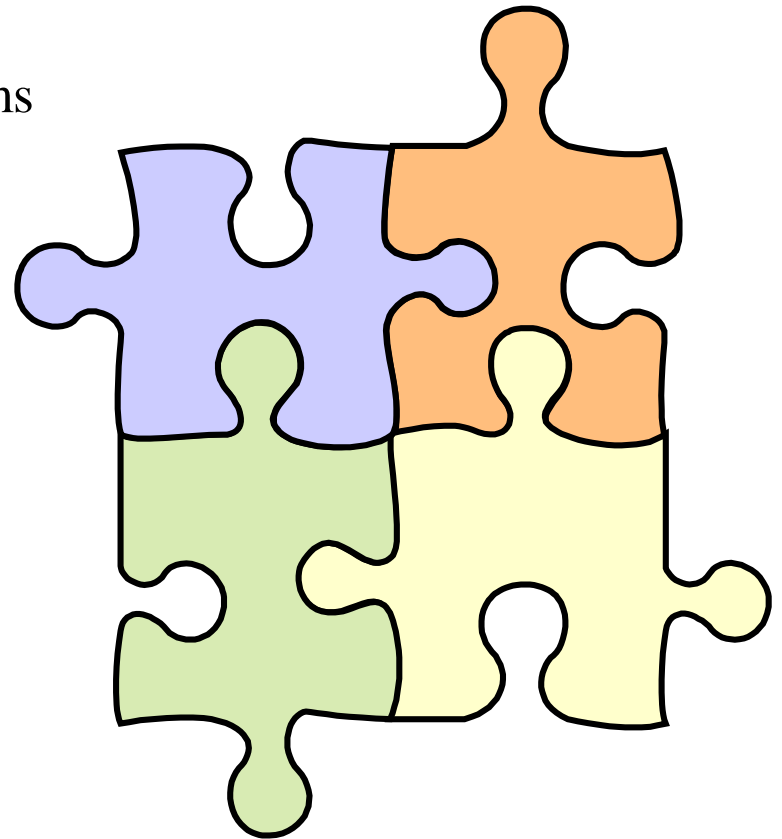
- Rotordynamics
 - Critical speed maps
 - Synchronous unbalance response
 - Stability, log decrement
 - Damper seals
 - Bearings, seals
 - TP, Sleeve, magnetic
 - Squeeze film damper
 - Steady state and transient torsional
- Stress analysis
 - Impeller dynamics
- Acoustics
- Seals
 - Gas seals
 - Oil film seals
 - Laby



Mark

Agenda Continued

- Testing
 - Type 2 and Type 1, Performance testing
 - Mechanical testing
- Vibration signatures of classic problems
 - Rotor Instability
 - Surge and stall - forced vibration
- Materials considerations
 - NACE
 - Typical compressor materials
 - Effects of blockage and fouling
- Adjourn



Jay