Centrifugal Compressors 101
Part 1

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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
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
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
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
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.

- **Current Responsibilities include:**
  - Supersonic compressor product line definition and commercialization.
  - Favorite work-related topics: aero-mechanical excitation (SSV), & Acoustics
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

Responsibilities include:

- Design, development, and analysis of all aero dynamic components of centrifugal compressors
- Development of software used to select and predict compressor performance.
- Improved aero dynamics efficiency and range.
- New Product Development
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