



INDUSTRIAL SCIENCE AND OPERATIONS DEPARTMENT

Preparing for the Great Crew Change – Industrial Maintenance Training Challenges

MBAA Meeting
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Objectives for Tonight

- Why is there an Industrial Science and Operations program at Red Rocks CC?
- What is the Industrial Science and Operations program?
- Focus on Industrial Maintenance
- Skill Areas and Competencies
- Program Design Approach
- What challenges lie ahead?
- Wrap-up and Discussion
- Contact Information



So What is the Business Case...??

Growing Shortage of Qualified Technical Workers

- The demand for a well educated technical workforce is beginning to outstrip the available supply.
- At its worst, in 2000, there were 4.7 million more jobs than people to fill them.
- By 2010, there will be 10 million more jobs than people to fill them.
- Companies in Colorado are not exempt; they are facing critical shortages in their technical workforce in the next ten years and beyond.
- The energy sector estimates 75% of their workforce is retirement eligible within the next ten years.

Quotes from Dr Cozzens, Colorado Institute of Technology, 9News, November 2005



So What is the Business Case...??

National Association of Manufacturers (NAM) 2005 Skills Gap Report - A Survey of the American Manufacturing Workforce.

- Today's skill shortages are extremely broad and deep, cutting across industry sectors and impacting more than 80 percent of the companies surveyed.
- Skills shortages are having a widespread impact on manufacturers' abilities to achieve production levels, increase productivity and meet customer demands.
- High performance workforce requirements have significantly increased as a result of the skills gap shortage and the challenge of competing in a global market.

"Union Pacific RR to hire 5000".
Denver Post, May 7, 2006



Where does Red Rocks Community College Fit?

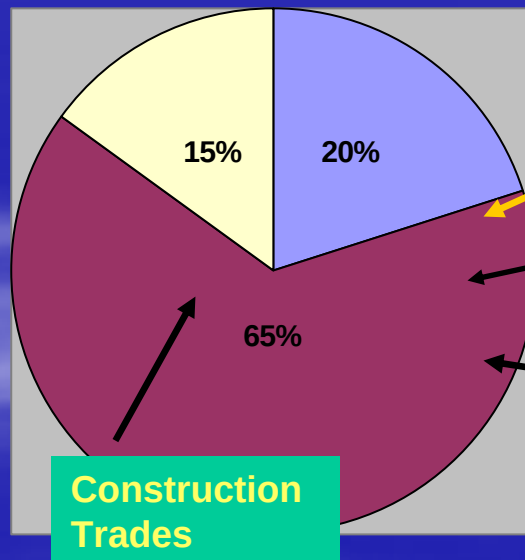
2000

20% Professional

65% Skilled

15% Un-Skilled

2000



Industrial Science and Operations Dept.

Process Technology

Power Plant Technology

Industrial Maintenance Technology

Construction Trades

Broad Industry Support and Interest

- ISOD currently sponsored and actively supported by key major Colorado Industries including:
 - **Denver Metro Waste Water Reclamation District**
 - **Suncor Energy** (Operator of the Denver area refinery)
 - **BP Colorado** (Oil and gas production)
 - **Lakewood Brick and Tile** (structural/architectural building products)
 - **Molson-Coors Brewing Company** (Brewing and Packaging)
 - **Xcel Energy** (Energy generation and transmission)
 - **Trigen** (Energy generation and transport)
 - **Encana** (Natural Gas Producers)
 - **Jacobs Engineering** (JE Merit) (major contractor for many partner industries)
 - **Shell Oil** (potential oil shale operation)
 - **Nestle-Purina** (pet foods)
 - **Platte River Power Authority** (Energy generation and transmission)
 - **Kinder-Morgan** (energy resources transport)
 - **Halliburton** (oil and gas field services and production)
 - **Schlumberger** (oil and gas field services and production)



■ Industrial Maintenance

- New program combining existing RRCC courses and new courses
- Industry driven content
- Innovative use of “industry based” professional training programs
- Will baseline and share with sister college industrial maintenance programs
- Technology driven, electrical and mechanical skills.





Building a New Industrial Maintenance Program

- Maintenance Program value-added = Skills + Competency
- Maintenance Goals
 - Maximize the Available Production Time for Capital Assets
 - Maximize the Output of the Capital Assets
 - Maximize the Quality of the product produced by the Capital Assets



Building a New Industrial Maintenance Program

- SKILLS IDENTIFICATION
 - Great work by the combined maintenance teams at Molson-Coors (Hank Ward, et al)
 - 33 Major Mechanical, Electrical and Admin skill areas were identified
 - Over 194 specific competencies identified
 - [Mtce Matrix Survey Results Summary rev02.xls](#)



Building a New Industrial Maintenance Program

- Industry Survey (in January)
 - Molson-Coors
 - Suncor
 - Nestle-Purina
 - Denver Metro Waste Water District
 - Jacobs Engineering (JEM)
- Skill Survey Criteria
 - 1 = Marginal or No Importance to the Business
 - 2 = Important to the Business
 - 3 = Mission Critical to the Business
- Maintenance Skill Areas were prioritized





Building a New Industrial Maintenance Program

Skill Survey Results

Skill Area	Average Rating
<u>ELECTICAL THEORY FUNDAMENTALS</u>	3.00
<u>PIPING SYSTEMS</u>	2.96
<u>PROGRAMMABLE CONTROLLERS</u>	2.89
<u>BEARINGS</u>	2.85
<u>HYDRAULIC SYSTEMS</u>	2.77
<u>LUBRICATION</u>	2.75
<u>MACHINING SKILLS</u>	2.74
<u>ELECTRICAL TROUBLE SHOOTING TOOLS</u>	2.73
<u>WELDING AND CUTTING</u>	2.70
<u>POWER TRANSMISSION EQUIPMENT</u>	2.70
<u>DRAWINGS AND PRINT READING</u>	2.70
<u>SEALING AND GASKET SYSTEMS</u>	2.68
<u>RIGGING AND LIFT SYSTEMS</u>	2.60
<u>PLANT SAFETY PRACTICES</u>	2.59
<u>MACHINE BALANCING</u>	2.57
<u>MAINTENANCE MANAGEMENT SYSTEMS</u>	2.56
<u>INSTRUMENTATION FUNDAMENTALS</u>	2.55
<u>PREVENTATIVE MAINTENANCE PRINCIPLES</u>	2.54
<u>ELECTRICAL CONSTRUCTION SKILLS</u>	2.52
<u>FUNDAMENTAL TOOL USAGE AND CARE</u>	2.46
<u>MACHINE ALIGNMENT</u>	2.34
<u>MEASUREMENT</u>	2.30
<u>BASIC PHYSICS</u>	2.30
<u>DISTRIBUTED CONTROL SYSTEMS</u>	2.27
<u>QUALITY CONTROL SYSTEMS</u>	2.20
<u>ETHERNET AND DATA TRANSMISSION SYSTEMS</u>	2.06
<u>TROUBLESHOOTING (ROOT CAUSE ANALYSIS)</u>	2.01
<u>CONVEYING SYSTEMS</u>	1.91
<u>SPECIAL DEVICES</u>	1.67



Building a New Industrial Maintenance Program

Skill Area
<u>ELECTICAL THEORY FUNDAMENTALS</u>
<u>PIPING SYSTEMS</u>
<u>PROGRAMMABLE CONTROLLERS</u>
<u>BEARINGS</u>
<u>HYDRAULIC SYSTEMS</u>
<u>LUBRICATION</u>

Basic Understanding of Electrical Theory

Basic understanding of electrical theory (Ohm's Law, Electrical Components, Schematics and symbology, AC/DC Circuits, conductors, NEC Standards, Coors Standards, Local or State codes, Electrical Safety/Hazards, Grounding/Grids)

<u>RIGGING AND LIFT SYSTEMS</u>
<u>PLANT SAFETY PRACTICES.</u>
<u>MACHINE BALANCING</u>
<u>MAINTENANCE MANAGEMENT SYSTEMS</u>
<u>INSTRUMENTATION FUNDAMENTALS</u>
<u>PREVENTATIVE MAINTENANCE PRINCIPLES</u>
<u>ELECTRICAL CONSTRUCTION SKILLS</u>
<u>FUNDAMENTAL TOOL USAGE AND CARE</u>
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<u>SPECIAL DEVICES</u>

Building a New Industrial Maintenance Program

Skill Area
<u>ELECTICAL THEORY FUNDAMENTALS</u>
<u>PIPING SYSTEMS</u>
<u>PROGRAMMABLE CONTROLLERS</u>
<u>BEARINGS</u>
<u>HYDRAULIC SYSTEMS</u>
<u>LUBRICATION</u>
<u>MACHINING SKILLS</u>
<u>ELECTRICAL TROUBLE SHOOTING TOOLS</u>
<u>WELDING AND CUTTING</u>

Basic Bearing Knowledge (should this include B5?)	Basic Bearing Knowledge including: Dry versus Lubricated, Bearing identification and application, bearing heaters, lubrication specifications.
TS / R Rolling Element Brgs	Troubleshoot/Repair/Replace Rolling Element Bearings.
TS / R Journal Brgs (duplicate of B7?)	Troubleshoot/Repair/Replace Journal Bearings.
Special Brgs	Troubleshoot/Repair/Replace Special Bearings (ceramic, cam follower, linear, plastic, injector, etc.).
Handling / Storage / Transportation of Bearings (should this be included in B1?)	Perform Handling/Storage/Transportation of Bearings.
Bearing Failure Analysis	Perform Bearing Failure Analysis (related to each specific Bearing type).
TS / R Sleeves and Bushings (duplicate of B3?)	Troubleshoot/Repair/Replace Sleeves and Bushings.

<u>QUALITY CONTROL SYSTEMS</u>
<u>ETHERNET AND DATA TRANSMISSION SYSTEMS</u>
<u>TROUBLESHOOTING (ROOT CAUSE ANALYSIS)</u>
<u>CONVEYING SYSTEMS</u>
<u>SPECIAL DEVICES</u>



Building a New Industrial Maintenance Program

- Program/Curriculum Development – New Approach
 - **Course selection**
 - Industry versus existing RRCC course
 - Industry provider open to creating a college course?
 - Existing RRCC course close to skill set?
 - **Course Evaluation**
 - Relevant to the Colorado Industry base
 - Experienced team of 16 Mechanics and Electricians (approx 400 yrs exp)
 - Interactive (web chat site) and tested process (pre/post testing)
 - Longer term retention and results

Lubrication Class Results



Building a New Industrial Maintenance Program

- Program/Curriculum Development – New Approach
 - **Implementation and Support**
 - Flex training schedule
 - College Business Needs and Industry needs
 - Laboratory for HANDS-ON Learning
 - **Degrees and Certificates**
 - Incumbent workers
 - Multi-craft interest
 - New workers entering the field
 - RCM, TPM, TQM, SMRP
 - **Employment Candidate Evaluation Program**
 - Skill and Knowledge assessment
 - Recommended training/course program

- **QUESTIONS/COMMENTS**

- **CONTACT INFORMATION**
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