HONEYWELL'S VISION ON THE FUTURE OF MEASUREMENT
Topic for Today

• Short Introduction to ´Elster Precision Solutions´
• Industry Trends
• History of Diagnostics
• From Diagnostics to Operational Excellence
• Honeywell´s Vision on the Future of Metering
• When does the Future Start?
Elster Precision Solutions – Skid and Stations for Gas & Liquids

Gas & Liquid Metering Skids

Skid mounted fiscal metering systems for:
- LNG metering
- Border stations
- City gas distribution
- UGS systems
- Industrial client connections
- Calibration Facilities
- Power plant metering skids

PRMS – Biogas - CNG Station

Pre-packaged metering & pressure regulation stations:
- Fiscal metering skids
- CNG filling installations
- Fuel Gas Conditioning Systems for power plants
- Bio Methane grid injection systems

Loading and Blending Skids for Terminals

Products and systems for tank terminal operations:
- Volume provers
- Blending systems
- Loading systems
- Additive injection
- Tank gauging
- Sampling solutions
- Custody transfer management
- Terminal management system

Advanced Applications

Smart solutions for optimizing process and enterprise Processes
- Advanced alarm management
- Advanced Process control
- Asset management solutions
- Batch Automation
- Blending and movement
- Operations & production man.
- Uniformance PHD
Comprehensive Portfolio

Controllers, PLC, RTU, Safety Shutdown systems

Loading gantries, skids & controllers

Engineering & Support Services

Flow computing and analysers

Meter prover, valves sensing, corrosion

Oil & Gas Suite:

Process Safety
- Alarm Management
- Shut-Down Analysis
- Safety Valve Analysis
- Barrier Testing

Equipment Effectiveness
- Equipment Integrity
- Transmitter Monitoring
- Control Valve Performance
- Corrosion Prediction

Production Excellence
- Operations Management
- Integrated Planning
- Production Management
- Operator Competency
- Process Control & Optimization

Operational Data
- Process History & Analytics

Production Surveillance
- Well Test Validation
- Well Surveillance
- Well Test Management

Operational Performance
- Enterprise Collaboration
- Performance Management

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02 Industry Trends
Oil & gas pipelines
What is driving the Industry?

Increase in global demand for affordable energy
- North America business readiness for rising Middle class
- Demand from China, India & Middle East
- Changing Energy mix and global supply & demand

Increase focus on capital & operational costs
- Real time performance
- Pressure on Efficiency and Reliability
- Better use of resources -- Collaboration
- Aging Assets
- Systems Complex
  - Databases growing at astronomical rate
- Capital & Operating Costs per unit rising quickly

Shrinking Pool of Subject Matter Experts
- Retiring experience
- GAP in industry experience & knowledge – Asset Management & Industry Processes

Increasing government regulations
- Focus on SAFETY- No lost time, no pollution, no loss of lives
- Regulatory Pressures – governments respond to recent events & new technologies

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Changing Roles in the Organization

Changing Role of the Operator

<table>
<thead>
<tr>
<th>Current</th>
<th>Future</th>
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<tbody>
<tr>
<td>On-line Quality Control</td>
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<td>On-line Cost Control</td>
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<td>Product Change-overs</td>
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<td>Response to Process Upsets</td>
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<tr>
<td>Response to Quality Upsets</td>
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<tr>
<td>Process Monitoring</td>
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<td>Definition of Operating Parameters</td>
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<tr>
<td>Manipulation of Non-automated</td>
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<tr>
<td>Logging/Reporting</td>
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Maintenance

<table>
<thead>
<tr>
<th>Current</th>
<th>Future</th>
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<tbody>
<tr>
<td>Analyze Production Problems with Op. and Product Eng. (FMEA)</td>
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<tr>
<td>Fix Failed Components</td>
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<tr>
<td>Training</td>
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<td>Predictive Maintenance</td>
<td></td>
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<td>Preventative Maintenance</td>
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<tr>
<td>Process Design Modifications for Improvement</td>
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<tr>
<td>Interact with Design Engineering (RCFA)</td>
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Change Management must also be considered!
History of Diagnostics
## Metering Principles in Oil & Gas Industry

<table>
<thead>
<tr>
<th>Differential Pressure</th>
<th>Positive Displacement</th>
<th>Turbine</th>
<th>Ultrasonic Metering</th>
<th>Coriolis</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Orifice &amp; Venturi</td>
<td>• Rotary meters</td>
<td>• Off-line remote diagnostics available from Elster Turbinscope®</td>
<td>• On-line, real-time diagnostics available • Condition-based monitoring is a key driver</td>
<td>• Emerson released diagnostic tool for the Micro-Motion meter</td>
</tr>
</tbody>
</table>
Evolution of USM Diagnostics

Traditional analog diagnostics with oscilloscope and multi-meter.

Digital diagnostics with meter dashboards like ‘Sonic Explorer’, and many other meter diagnostic packages.

Integrated system diagnostics. The Total Energy Measurement concept is Extended Data Mining

Meascon: Continuous meter diagnostic software running locally – accessible via Internet

Meascon: Continuous diagnostic software running in the Cloud
From diagnostics to operational excellence
Where is My Information?

Valuable information is all around in your plant and compartmentalized
- On-board meter diagnostics
- Process instrument diagnostics
- Flow computers
- Metering supervisory computers
- Process information

Compare with a MIS
- Consolidate all available information
- Valuable insights on how to optimize business
- Impossible when looking at individual bits of information
The Metering Community Changes

- Metering guru
- Lifetime employee
- Experienced
- Plant or remote-office based
- Solid & reliable
The Metering Community Changes

- More likely to work from a local support office close to site though able to support from remote locations
- A champion of new technology
- Systems / control engineer capable of using standard interfaces and supporting the platform rather than the device

Now
What if you Could?

- Overcome the challenge of remote operations and limited expertise?
- Promote optimal operations while at the same time protecting your people, the environment, and your reputation?
- Overcome ‘analysis paralysis’ and start making the right decisions at the right time?
- Unleash the knowledge tied up in all your metering and control components?

Operate in your ‘sweet spot,’ all the time?
Honeywell´s Vision on the Future of Measurement
Impact of new IT Trends

Mobility

- Enhancing the Connection of People to Assets

Analytics

- More efficient business
- Less interfaces
- Better Inventory control
- Better measurement accuracy
- Better Integrity management
- Easier overall business control

Cloud

- Enterprise Scalability and Data Fusion

iiOT

- Less interfaces
- Common display mechanisms
- Cheaper communications
- Better measurement accuracy
- Better Integrity management

Enhancing the Connection of People to Assets

Enabling New Ways to Serve
The Industrial Internet of Things (IIOT)

"The Industrial Internet of Things is a network of networks that uses the internet to connect people, processes and assets enabling a new way to optimize business results."

…it leverages smart connected assets, enterprise integrated automation, secured cloud-based data, and advanced analytics.
Creating new value with data

Data sources
- External data on trade prices, weather, inventory
- Smart Connected products data on location, condition, use, metering parameters
- Enterprise data on service histories, warranty Status etc.

Data Lake
- Aggregated Raw Data in Multiple formats

Analytics
- Descriptive
- Diagnostic
- Predictive
- Prescriptive

Control and optimization e.g. software updates to improve products performance

Basic insights

Source: "How the internet of things transforms companies" study from Harvard University - by Michael E. Porter and James E. Heppelmann
Practical Example 1: Cloud Based Total Energy Metering

**Metering information:**
- \( \text{Amb. T and P} \)
- Weather forecast
- Upstream gas composition
- Downstream gas composition
- Upstream HC-dew point
- Upstream water dew point
- \( X \)
- \( Y \)

**External information:**
- Amb. T and P
- Weather forecast
- Upstream gas composition
- Downstream gas composition
- Upstream HC-dew point
- Upstream water dew point
- \( X \)
- \( Y \)

**Enterprise information:**
- Spare parts availability
- Consumables availability
- Maintenance contract info
- Gas price
- Custody transfer contract data
- Maintenance history
- \( X \)
- \( Y \)

**Set of subscriptions:**
- Asset management
- AGA flow calc.
- Consumables management
- Pipeline management
- Prev. maintenance
- LAUF prevention
- \( X, Y, Z \)

**Real time remote alerts**

**Automated PO generation for service or consumables**

**Automated work order generation**

**Assets overview on collaboration station**

**SAP**
Practical Example 2: In Line Meter Validation with Digital Twin

Current metering data

External data:
- Installation conditions
- Installation design
- Ambient conditions
- X, Y, Z

UFM Finger print data at calibration facility

UFM Finger print data at Site acceptance test

Predict Behavior:
- Over time
- At changing condition
- At combination of events
  → Predictive maintenance

Digital Twin

Predict Behavior:
- Predictive maintenance

Simulate situations:
- Simulate cal. lab. conditions and predict performance
  → limit/eliminate need for physical calibration

Optimize product:
- Design improvement
- Software corrections
- Reduce sensitivity to changing condition
  → Better products

Improve collaboration:
- Engineers/R&D work remotely on digital twin
  → Cost saving
  → Reduce errors
  → Less trial and error
When does the Future begin?
DCS Integrated Approach

Cost Saving Simplification of System Architecture
DCS Integrated Flow Computation

MeterSuite™ is fully:

- MID approved
- OIML R117 Approved
- ERCB Directive 017 compliant

All Calculations Meet

API Standards
ISO Standards
AGA Standards
Tools and Infrastructure

Pulse

Cloud IIoT platform

Collaboration Station

Asset management tool - Sentinel
Conclusions

• Combination of all available data properly analyzed can create a wealth of added value

• Products will change
  - More sensors
  - Less on board software (→ moves to cloud)

• Enormous cost reductions / process optimizations can be achieved

• Technologies are available

• Acceptance of (metering) data in the Cloud is key to this development
  → Cyber security is crucial