ASM Overview

EPRI Meeting

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ASM Consortium Vision

• The ASM improves the safety, reliability and efficiency of process plants by
  – Sharing in investments to lower cost
  – Non-competitive collaboration
  – Bridging research into development and deployment of solutions for plant operations

Leading and influencing industry
Founded in 1994

Creating a new paradigm for the operation of complex industrial plants, with solution concepts that improve Operations’ ability to prevent and respond to abnormal situations.

ASM Principles

1. Not by technology alone
2. People play a major role in avoiding or mitigating plant upsets
3. Systems should be designed for the abnormal not just normal
4. Systems should be designed for adaptation

www.asmconsortium.org
Early Findings

• Initial studies showed that improvement opportunities are wide ranging
  – Management policies and practices
  – Operator capabilities and training
  – Equipment design and maintenance
  – Control system capabilities, design and maintenance
  – Control room design
  – Intra/inter team collaboration
  – Operating procedures
  – Operating within limits

No one company can solve it all, need a holistic approach
Industry Challenges

Safety
Protect People, Assets and Process
Billions lost per year in Petrochem Industry

Reliability
Improve Availability
Reduce Downtime
Millions lost per year due to unplanned production losses

Efficiency
Improve Productivity
Reduce Cost
Fewer people can make better decisions, faster
What is an Abnormal Situation?

- An industrial process is being disturbed and the automated control system can not cope...
- Consequently, the operations team must intervene to supplement the control system.
- Impacts profitability in multiple ways:

Product Quality

Personal Injury

Loss of Life

Job Satisfaction

Equipment Damage

Public Relations

Product Throughput

Environmental Release

Public Relations
The Paradox of Automation…

- Better automation leads to more sophisticated processes
- More sophisticated processes leads to more opportunities for error
- We “fix” the increasing errors with still more automation

When things go wrong, people have difficulty intervening to correct the problem!

Poor User Centered Automation!
Unexpected Events Cost 3-8% Capacity

Source: ASM Consortium Research

Summarized Production Data

Plant Operating Target

Operational Constraints

Optimization efforts

Plant Capacity Limit

Days per Year

< 60%

Daily Production Level

95%

100%

Unexpected Events Cost 3-8% Capacity

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Moving Forward ....
How Important is the Problem?
15th Body Pulled from Refinery Rubble
By KEVIN MORAN
Copyright 2005 Houston Chronicle

TEXAS CITY - The only worker still missing after the explosion of BP's Texas City refinery was found dead in the plant's rubble today, bringing the death toll to 15. At least seven other blast victims, meanwhile, are fighting for their lives in hospitals.

The report identified numerous failings in equipment, risk management, staff management, working culture at the site, maintenance and inspection and general health and safety assessments.
The Pembroke Accident

An HSE report quotes:

- **275 alarms** in the **11 minutes** before the explosion
- “... warnings of the developing problem were lost in the plethora of instrument alarms triggered in the control room, many of which were unnecessary and registering with increasing frequency, so operators were unable to appreciate what was actually happening …”

Too Many Alarms Can Contribute to Incidents
Human Factors are at the core…

• 42% of Abnormal Situations People Related

ASM Consortium Research

- People & Work Context: 42%
- Equipment: 36%
- Process: 22%

The average percentages shown had the following:
• People and Work Context Factors: 35% - 58%
• Equipment Factors: 30% - 45%
• Process Factors: 3% - 35%

“In systems where a high degree of hardware redundancy minimizes the consequences of single component failures, human errors may comprise over 90% of the system failure probability.”


• “Human failures are responsible for up to 80% of all types of accident”

UK Health & Safety Executive (HSE) Human Factors Briefing Note No. 1 Introducing Human Factors
Tendency to ‘Blame’ The Operator

To help the Operator – you need to understand the problem!
Humans and Computers

“Blink”

Humans are good at:
• “Recognition”
• Pattern recognition
• Troubleshooting
• New situations

“Think”

Computers are good at:
• “Cognition”
• Vigilance tasks
• Repetitive tasks
• Fast response to defined situations
• Automated procedures
Factors in Complacency

- Discounting risk
- Over-relying on redundancy
- Unrealistic risk assessment
- Ignoring low-probability, high-consequence events
- Assuming risk decreases over time
- Ignoring warning signs

Learn from past incidents…. Don’t make the same mistakes…
Management Responsibility

• Most mistakes are committed by skilled, careful, productive, well-meaning employees.

• Rather than blaming the individual involved attempt to identify the root causes of the error in the work situation and implement appropriate corrective actions.”


Operators need better tools, training and leadership!
Expertise is **critical** when automation fails

For more information: hilburn@nlr.nl
ASM Consortium – Organization Structure

- **Leadership**
  - Strategy, investments, Consortium operations
- **Research**
  - Linked with Academia and Honeywell Labs, plan and execute research initiatives
- **Development and Deployment**
  - Linked with Honeywell Process Solutions, direct funding, provide feedback, test and deploy product solutions
- **Communications**
  - Create, publish and deliver internal and external resources and tools to further the ASM Consortium goals

~$2.5 M invested by members 2009
>$50M invested over life of Consortium
Structure

All ASM Information Available to Members

Leadership

ASM Member Sharing $ and In-kind hours

Some information Public

Research

Development

ASM Information and Reports Available to Members
<table>
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<th>ASM Seven Practice Areas</th>
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<tr>
<td>• Abnormal Situation Understanding</td>
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<tr>
<td>• Management Structure &amp; Policy</td>
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<tr>
<td>• Training and Skill Development</td>
</tr>
<tr>
<td>• Communications</td>
</tr>
<tr>
<td>• Procedures</td>
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<tr>
<td>• Control Room and Field Environment</td>
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<tr>
<td>• Monitoring, Control and Support Applications</td>
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</tbody>
</table>

ASM = Prevention, Detection, Mitigation of Abnormal Situations
ASM Consortium - Improving Safety

Safety
Protect People, Assets and Process

Billions lost per year in Petrochem Industry

- **Addressing Alarm Flooding**
  - Purpose: Design and evaluated new displays for operators during alarm flood situations
  - IP Generated: Two patent applications filed based on 2007/2008 display designs
  - Product Implications: Productization in Experion will start in 2009; technology transfer started in Q4 2008

- **Root Causes of Abnormal Situations**
  - Purpose: Identify common failures and causes of abnormal situations
  - IP Generated: One disclosure filed covering analysis method and work process
  - Product Implications: Supports need for products like UniSim (training, leadership), Operations Management (task communication, coordination), ProcOps (procedure enforcement), ASM guidelines

ASM Research Project Examples
ASM Consortium  - Improving Reliability

Reliability

- Improve Availability
- Reduce Downtime

Millions lost per year due to unplanned production losses

  - Purpose: Quantify benefit of structured approach to shift handover
  - IP Generated: None yet (likely in 2009)
  - Product Implications (in 2009): Requirements and electronic checklist design for Operator Logbook

  - Purpose: Quantify value of interaction requirements methodologies/overview displays
  - IP Generated: None yet (likely in 2009)
  - Product Implications (in 2009/2010): No direct product implications but provides projects/services organization input on the value of using interaction requirements during operator display design projects

ASM Research Project Examples
ASM Consortium  - Improving Efficiency

**Efficiency**
- Improve Productivity
- Reduce Cost

Fewer people can make better decisions, faster

- **Low vs. High Fidelity Simulators**
  - Purpose: Investigate the value of low/high fidelity simulators for process control training
  - IP Generated: None
  - Product Implications: Provides use cases, requirements, and information on value proposition for UniSim

- **Case Studies**

*ASM Research Project Examples*
Other ASM Research Program Activity

- **ASM Research Roadmap**
- **ASM Research History**
  - Over 200 projects completed over life of ASMC
  - Results members can use now and implement for advantage
- **2009 Funded Projects**
  - *Interaction Requirements and Effective Display Design (2008 project continuation)*
  - *Operator Evaluation of Visual Thesaurus Objects*
  - *Evaluation of Structured Shift Handover*
  - *Addressing Alarm Flooding*
  - *Interactive Analysis of Alarm System Improvements*
  - *Effective Operations Team Leadership*
  - *Procedure Execution Failures During Abnormal Situations*
  - *ASM Research Test Bed*
ASM Product Development & Deployment

- Procedural Operations
- Early Event Detection
- Human Machine Interface DCS Improvements
- Alarm Management Tools
- Asset Management Tools
- Operator Station Furniture
- Scouts
- Handheld Mobile Tools
- Shape Library - Solution Pack
- Process Optimization Software
- Operator Simulation Training
- Project/Solutions Deployment Improvements
- ASM Analysis Audit, Site Studies, Benchmarking

Honeywell invests in and develops products based on ASM input!
ASM Communication

• Maintain a public website – www.asmconsortium.org
• Develop Operation Outreach activities
  – Webinars, training and events to improve ASM Learning's
• Publish papers at relevant conferences
• Maintain, publish and sell guideline books:
  – Effective Operator Display Design - 2008
  – Effective Procedural Practices – 2010

ASM Changing “members only” paradigm
Expect more publically available information!
Guideline Publications

ASM Consortium Guidelines
Effective Alarm Management Practices 2009

ASM Consortium Guidelines
Effective Operator Display Design

$150 Each

Guideline Books available on Amazon.com or Createspace.com
Examples: Case Studies
Advanced Alarm Management

Why focus on alarm system?
- Allow operators to identify situations and act on them faster
- Operators can focus on more productive tasks than acknowledging nuisance alarms

EEMUA Guidelines suggest 1 alarm/10 minutes
Advanced Alarm Management

- Irving Oil – Saint John, New Brunswick

**Benefit**
- 45% decrease in average daily alarm rate
- Enhanced the refinery staff’s response time

*Improved operator productivity and safety!*
Designed for ASM® Operating Displays

• NOVA Chemicals Corporation – Joffre, Alberta
  – 6 billion lbs of ethylene annually
  – 2 billion lbs of polyethylene annually

Benefit
• Solution Time: 35 – 48% faster
• Success Rate: 25% higher
• Save $800,000 per year

Improved operator productivity and safety!
Advanced Alarm Management

• Shell Shearwater Platform – North Sea
  – 11,600,000 m³/d of gas
  – 18,400 m³/d (110,000 BPD) of condensate

Benefit
• Reduced alarms from 1,200 an hour to 288 per day
• Reduced trips – payback in one less trip per year

Improved operator productivity and safety!
Summary

• ASM is a difficult problem.
• No one company or organization can solve all the issues.
• The potential for improved plant safety, reliability and efficiency is significant
  – ASM technology and practices improve operator performance for incident avoidance in abnormal situations
• ASM Public Website
  – www.asmconsortium.org

We see synergy with our efforts, do you?