Honeywell Users Group 2011

Where Technology Shapes Solutions.

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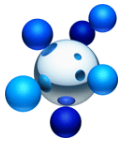
ASM Compliant HMI Graphics Design

Honeywell

Introduction



SASOL
reaching new frontiers

- Integrated oil and gas company with substantial chemical interests in Africa, Europe, Asia & North America
- Member of the ASM® Consortium
- World leader in Fischer-Tropsch expertise
  - Complemented by interests in technology development and oil and gas exploration and production
- Major production facility in Secunda, South Africa

Human Centered Solutions

Helping People Perform

- Human Factors design company
  - Provides comprehensive Human Factors designs & products to improve Operator Effectiveness
- Member of the ASM® Consortium

Team

- Hardie Voges
  - Chief Technologist, Sasol Synfuels
  - Degree in Computer Science (B.SC. Hon IT)
  - 15 years instrumentation and control experience
- Mischa Tolsma
  - Engineering Manager, Sasol Synfuels
  - MSc and PhD in Applied Physics
  - Interests include Abnormal Situation Management, Real-Time Dynamic Optimization and Work Process Design
- Jamie Errington
  - Senior Partner, Human Centred Solutions
  - Degree in Chemical Engineering
  - 25 years process control and project engineering experience

Introduction

- Outline
  - DCS replacement project Rectisol
  - Replacing all TDC technology with Experion C300
  - Designing a new Human Machine Interface according to the Abnormal Solutions Management (ASM) guidelines.
  - What is ASM?
  - Design approach
  - Challenges and mitigation plans
  - Successes achieved
  - Other changes
  - Path forward
  - Conclusion

Rectisol DCS Project

- TDC 2000 replacement Rectisol West
  - TDC was installed in 1978, it did exceptionally well **but**:
    - Bathtub curve effect – increasing failure rate
    - Spares availability – some spares no longer available
    - Ability to maintain – resources
    - Available spare capacity - Limited to no capacity for expansion
    - Lack in functionality – need more advance functions
- In 2008 Sasol decided to replace the TDC 2000 system with Experion C300 DCS system

Rectisol DCS Project

- The hardware replacement was relatively easy.
  - The complete hardware change over was done during a two week shutdown – September 2009
- The challenge faced was the HMI

What to do?

Abnormal Situation Management®

A Joint Research and Development Consortium

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.

www.asmconsortium.org

Sasol joined ASM in 2006

bp

ConocoPhillips

ExxonMobil

SASOL
reaching new frontiers

Shell

TOTAL

UOP
A Honeywell Company

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Human Centered Solutions
Helping People Perform

Mary Kay O'Connor PROCESS SAFETY CENTER

NANYANG TECHNOLOGICAL UNIVERSITY

PENNSTATE

UCLA

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.

An Abnormal Situation Impacts Process Safety

ASM in relation to Process Safety Mgt.

Safety Pyramid Illustration

Process Safety Incidents

Abnormal Situation Incidents

Ineffective Operations Practices

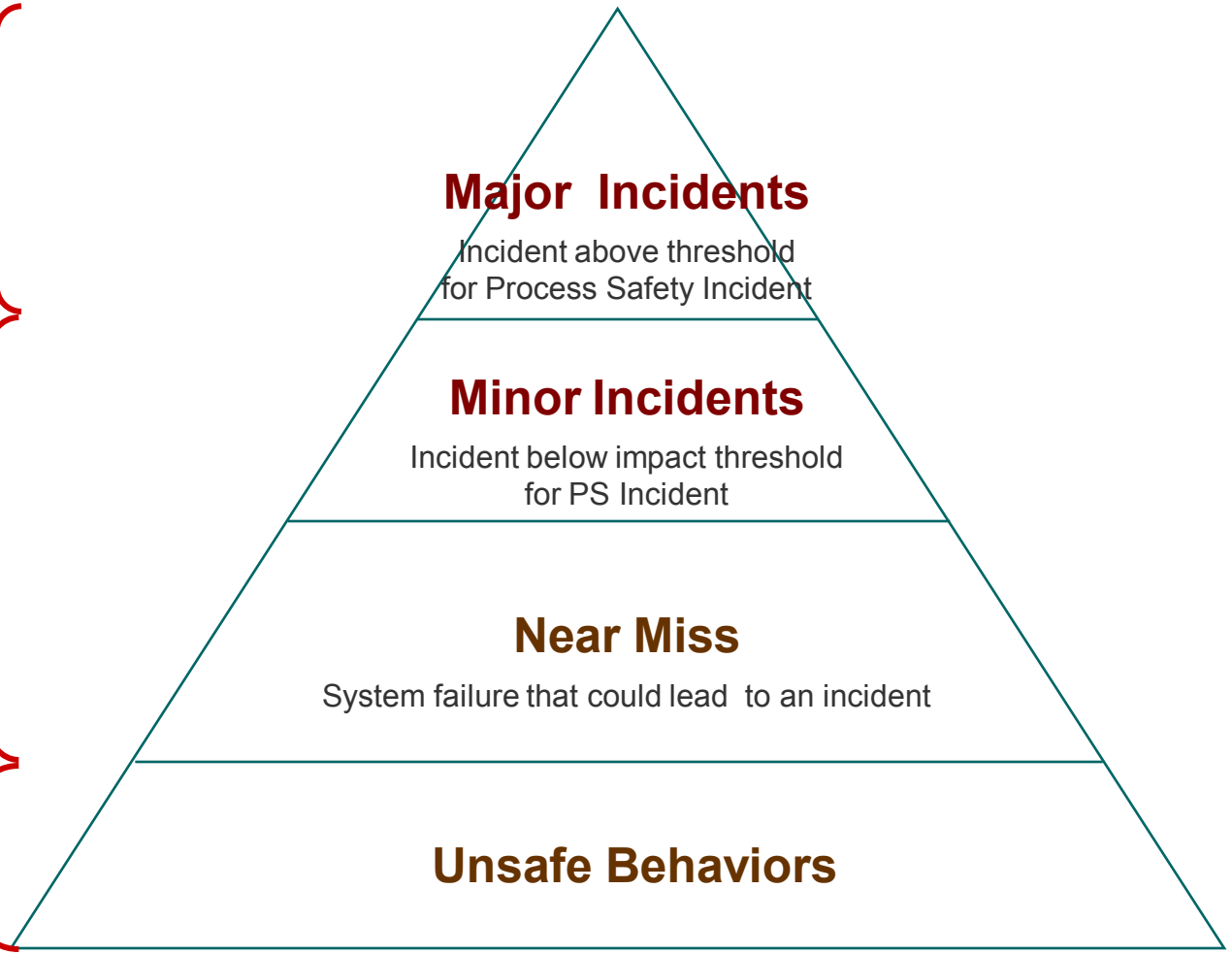
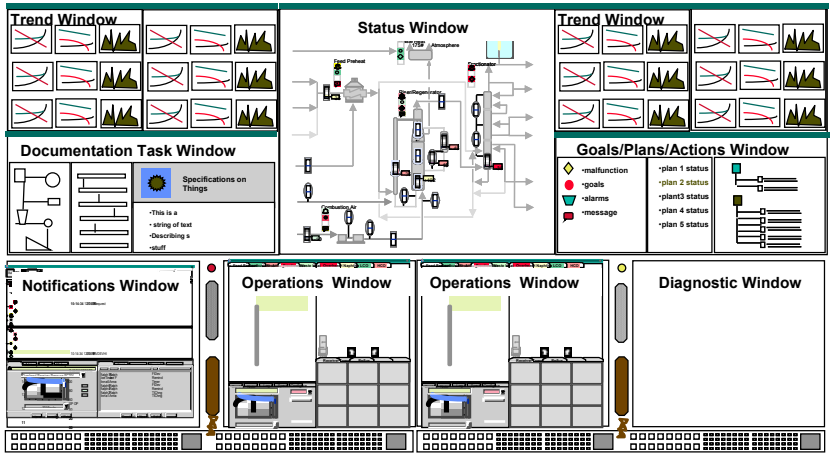


Illustration based on: CCPS *Process Safety Leading and Lagging Metrics.*

ASM® Consortium Guidelines

- Initial ASM® Research
  - Started in 1994 with multiple site-assessments
    - Determined breadth of the ASM problem
  - AEGIS (Abnormal Event Guidance and Information System)
    - Developed prototype of technologies that could avoid abnormal situations or manage improved response
- Site Assessments and Research
  - Led to the development of ASM® Effective Practice G/Ls
    - Effective Operations Practices
    - Effective Operator Display Design
    - Effective Alarm Management Practices
    - Effective Procedural Practices
  - Initially internal documents – now three are published

ASM Initial ASM Operator Interface Concepts



Objective

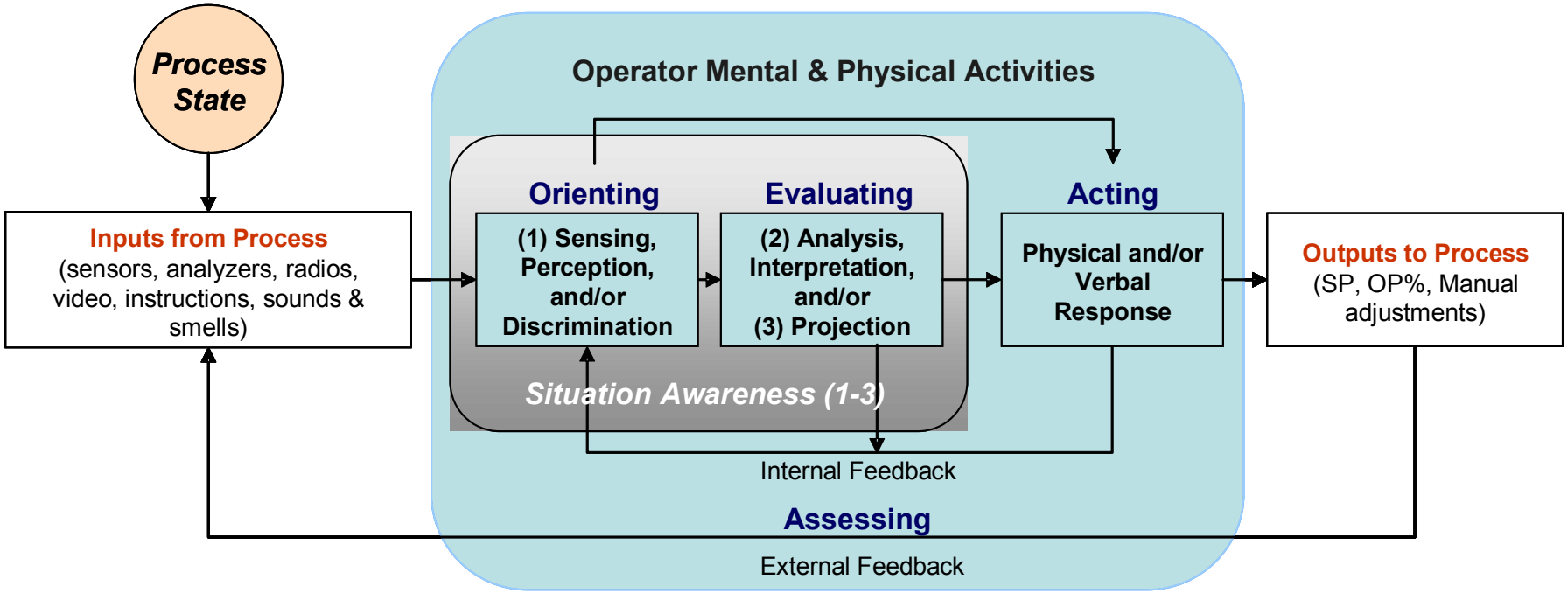
- Define concepts and features that **improve usability and effectiveness of the human-machine interactions** in the process control operations environment

Key Solution Concepts & Innovations

- Single, Integrated View of Multi-Level Hierarchy
- Mixed Initiative Approach
- Effective Window Management and Layout
- Effective Navigation Scheme
- Visual Coding Scheme
- Interaction Objects
- Contextual Menus & Information Presentation
- Task View Organization

ASM Supervisory Control Model

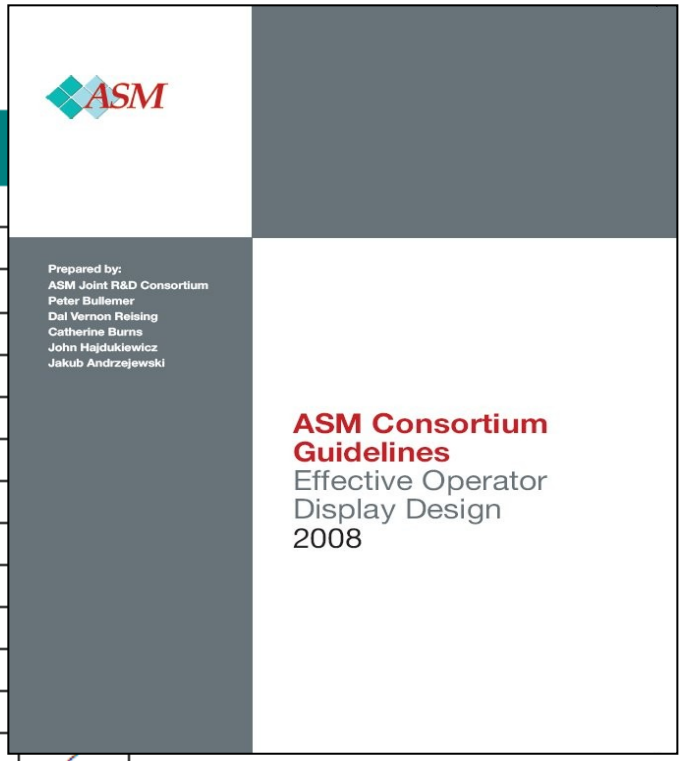
- Based on Human Information Processing model
- Includes Psychological stages of Situation Awareness



Effective Operator Display Design

6.1	**Use a minimum of color display hierarchy levels**
Why?	Consistent, distinguishab and the meaning behind t
How it Works	The number of colors use seven or less, and be cor number of items that can and Hollands, 1999). The other information separat unacknowledged, high ala which is distinct from an a less saturated yellow. Th red color-coded emergen saturated depending on th In general, color coding to recommended in normal c attention away from more lines colored based on material they contain, then colors should be implemented such that they can be toggled on and off (or show this representation in a view generated by the IT system supporting the plant).

Categories	
1: Display Types	
2: Display Content	
3: Display Style	
4: Display Layout	
5: Navigation	
6: Color	
7: Symbols and Process Connections	
8: Text and Numbers	
9: Interactions and Displays	
10: Alarm Configuration Scheme	
11: Audible Annunciation of Alarms	
12: Visual Annunciation of Alarms	
13: Training Program	
14: Online user assistance	2
15: Design Methodology	5
16: Management of Change	2
Total	**81**

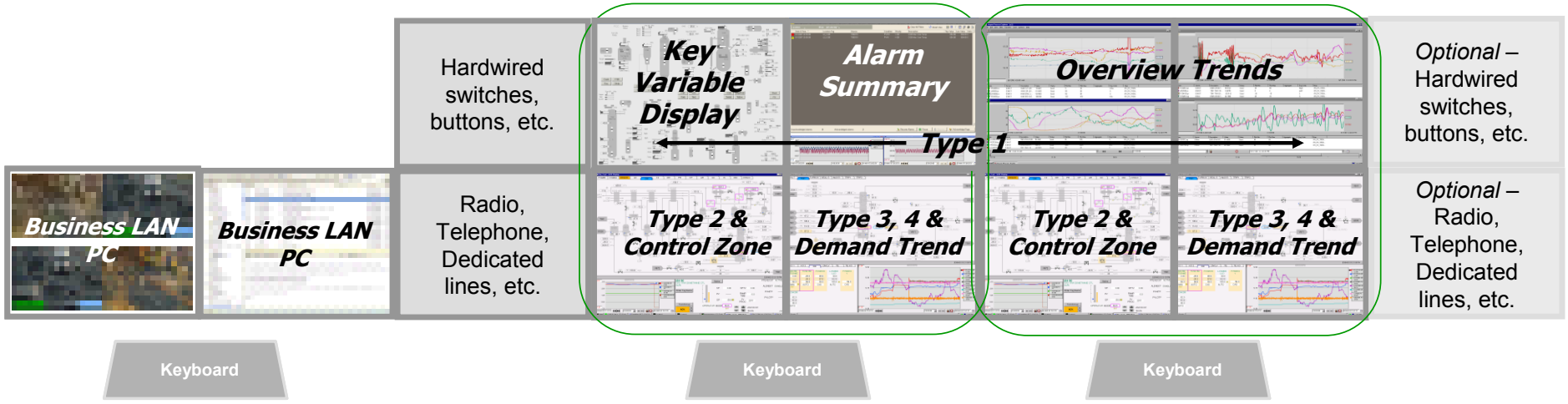


What Makes an Operator Interface ASM Compliant?

- It is much **more** than a display with a **grey background**!
- Sasol implementation meets over **90%** of the ASM® Consortium's 81 Effective Operator Display Design Guidelines
- "Cherry picking" select Guidelines may not lead to an effective interface

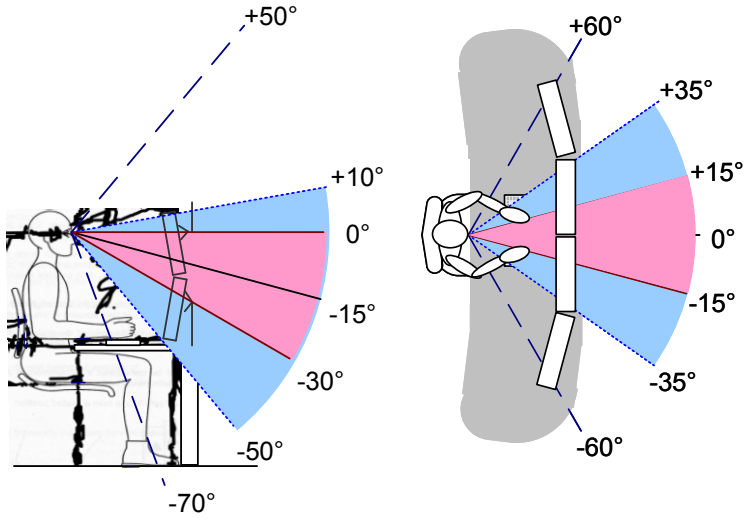
Categories	No. of G/Ls	Compliance %	Exceptions to the G/Ls
1: Display Types	7	100	
2: Display Content	7	89	Interlock / permissive status
3: Display Style	6	100	
4: Display Layout	5	100	
5: Navigation	6	83	Soft key navigation – replaced w/ tabs
6: Color	8	100	
7: Symbols and Process Connections	4	100	
8: Text and Numbers	6	83	Mixed case messages
9: Interactions and Displays	8	75	2 G/Ls on field devices n/a
10: Alarm Configuration Scheme	5	96	No dedicated display for alarm inhibits
11: Audible Annunciation of Alarms	5	80	1 G/L on field annunciation n/a
12: Visual Annunciation of Alarms	2	100	
13: Training Program	3	100	
14: Online user assistance	2	100	
15: Design Methodology	5	100	
16: Management of Change	2	100	
Total	**81**	**92.5**	**Includes 3 G/Ls n/a**

Sasol Required an Operator Interface:

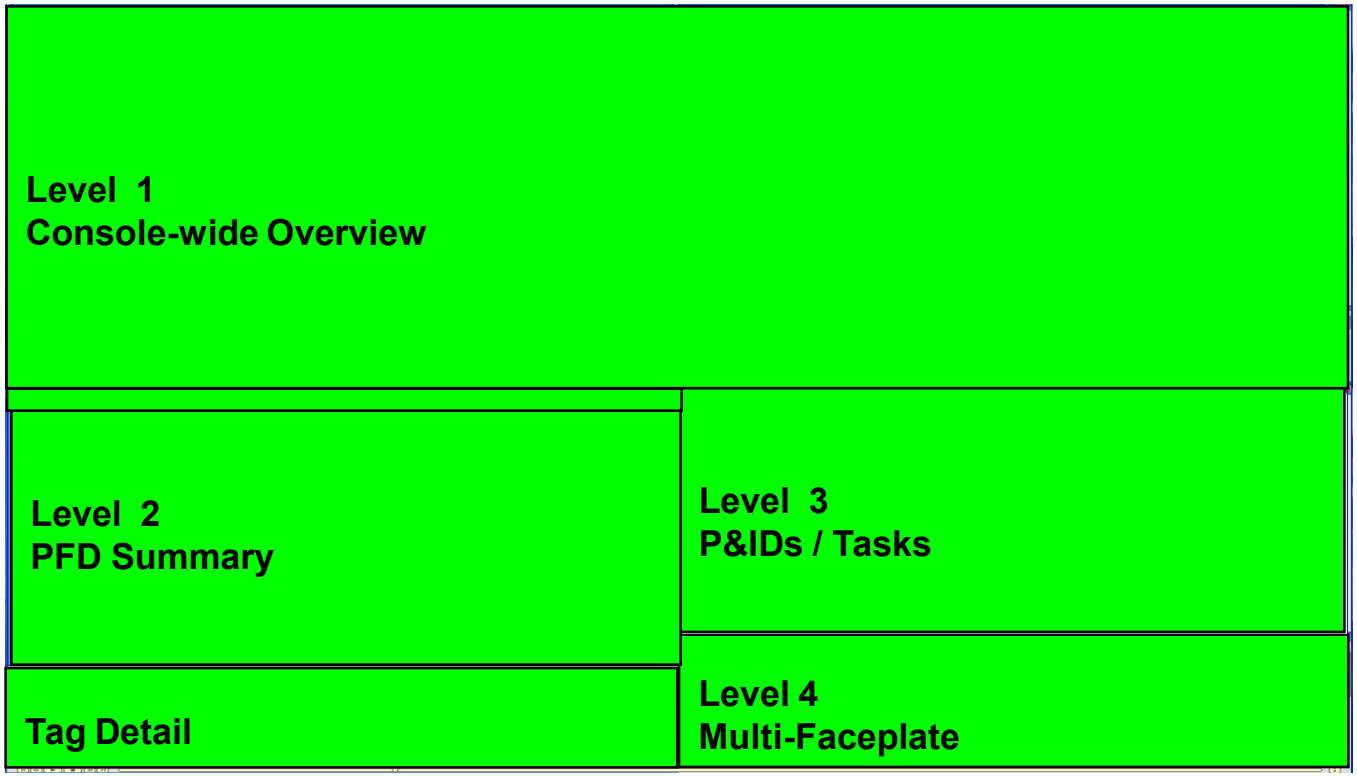


Designed for the Console Operator:

- View Angles
- Secondary support position
- Ancillary equipment



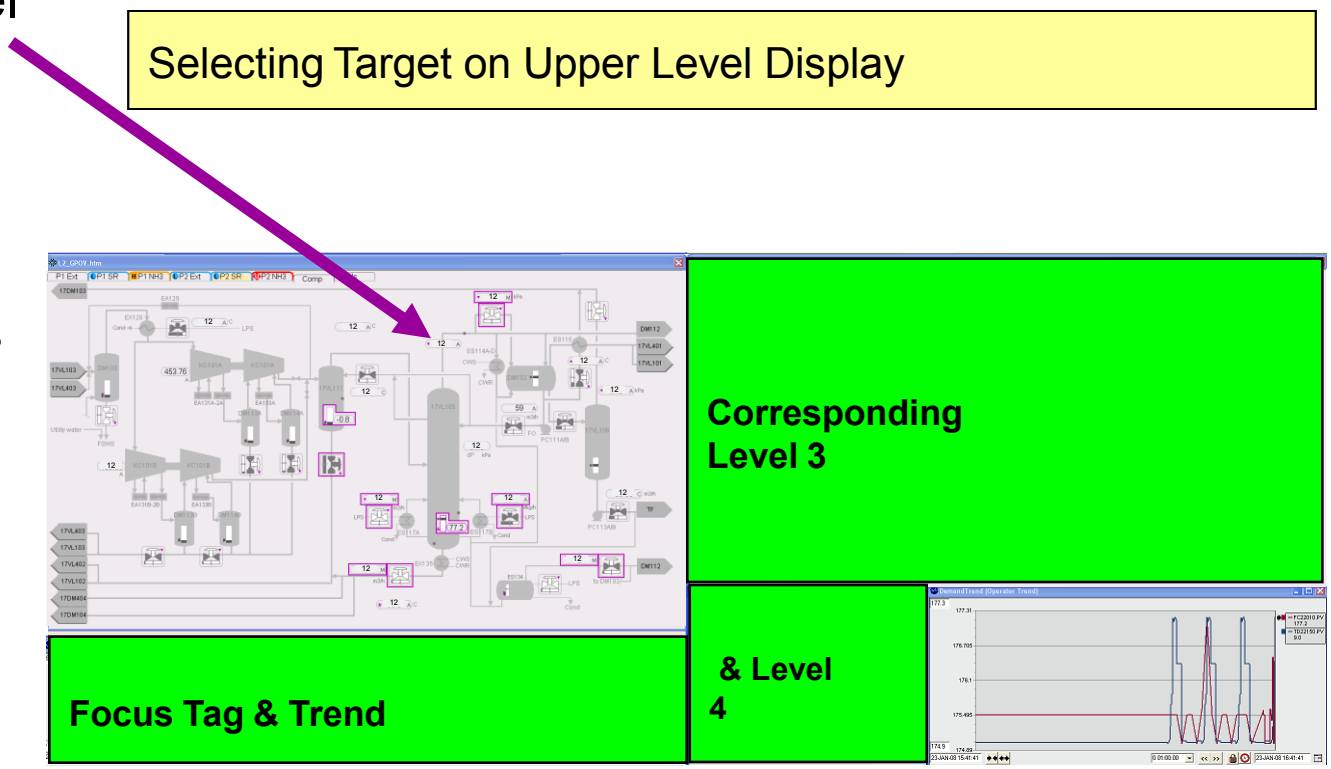
Multi-Window Operator Interface



- Tag Detail – Custom Faceplate
  - Focus Tag details with “strip-chart” trend

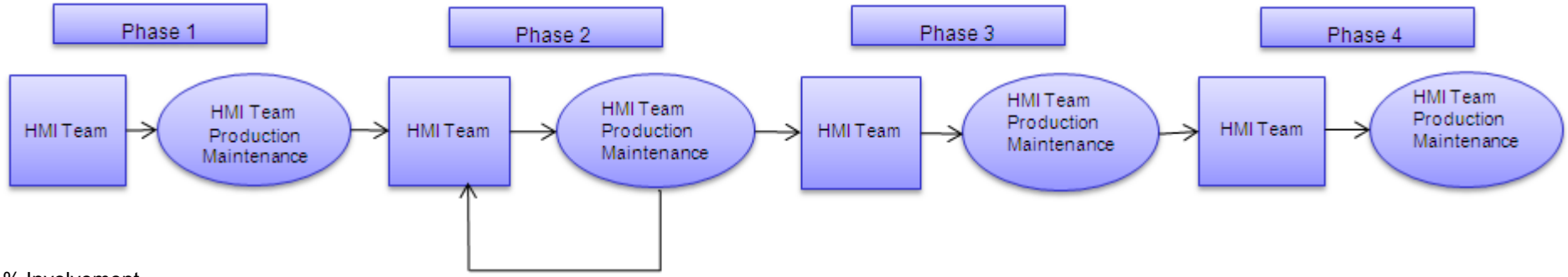
Display Coordination

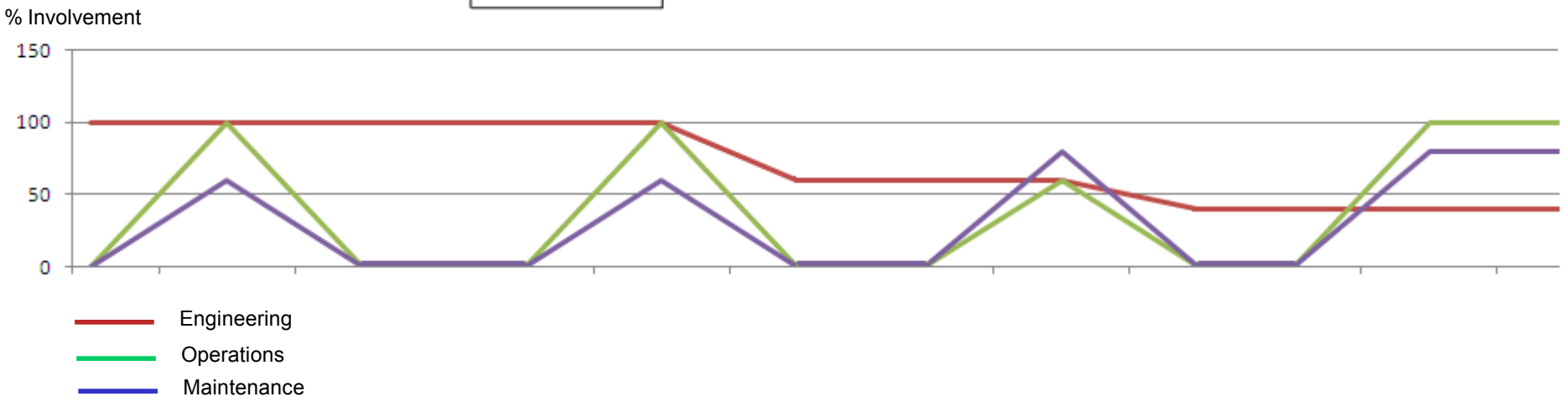
- Linked Displays
  - Selecting a target on an upper level display
  - Automatically opens more corresponding detailed displays
- Selected tag is put in Focus
  - Opens new Faceplate
  - Detail Trend



HMI Design Methods

- The design process consisted of four phases.





HMI Design Methods

- Phase 1 Process
  - Collects information, MFD's
  - Arrange meeting with operations management to discuss process. Establish team.
  - Arrange first workshop with operations and maintenance
  - Explain design process, Level 1,2,3,4
  - Compile MFD's into process flow hierarchy

- Phase 2 Process
  - Build graphics using process flow hierarchy starting at level 3
  - Arrange review session and correct deviations.
  - This phase should not take more that four sessions
  - Graphics must be design to cater for needs not wants

HMI Design Methods

- Phase 3 Process
  - Finalize graphics
  - Train maintenance and build in all the links
  - Arrange review session with production
  - Maintenance to lead review session and test all links on graphics
  - Maintenance to correct minor deviations

- Phase 4 Process
  - Load graphics on system to be CFAT
  - All deviations must be recorded
  - Maintenance to correct deviations and production to sign off graphics for operation

Obstacles Encountered

- The HMI design was not without problems.
- Obstacles
  - Operator resistance to change
  - Operator lack of participation in the design process
  - Operator lack of participation in the CFAT
- Operator perception
  - Paradigm shift to control via graphics instead of groups
  - Navigation between four screens on quad will be a problem
  - Grey color scheme will not make operating easier

Overcoming Obstacles

- The HMI team tried to overcome the problems by.
- Overcoming obstacles
  - Making the operators part of the change, giving them ownership
  - Negotiating overtime for operators partaking in the design and CFAT process
  - Taking the workshop offsite to limit distractions
- Overcoming operator perception
  - Giving the operators extensive training on the navigation of the graphics and the colors used
  - Incorporating the old groups into the level 4 graphics

Benefits of New HMI

- Some benefits achieved
  - Newer operators more relaxed, no need to remember group numbers
  - Training time for new DCS operators has been reduced, due to existing plant knowledge
  - After shutdown Rectisol started up first time
  - Operator more attentive to color changes
  - Tab navigation makes it easy to navigate to problem area
  - Improved fault finding capabilities for maintenance personnel

Other Changes

- New console design
  - Designed a new console with adjustable work areas to cater for all operators
  - Incorporate other interfaces into new console (fire and gas, Moore PLC, personal computer, Vibration monitoring)
- Control room.
  - Upgrade lighting for optimum working conditions
- Alarming
  - Implemented a distinctive alarm sound for each console and each alarm priority (critical, high and low)
  - Followed a alarm rationalization process to optimized the alarms and reduce nuisance alarms

Secunda Path Forward

- Implementation completed at 3 other plant
- Future plan to roll out process to rest of Sasol Synfuels
- To upgrade control rooms
- To upgrade consoles
- Build new centralizes control rooms
- Upgrade from TDC to Experion

Project Summary

- The project has succeeded in:
  - Manage a successful changeover from TDC to Experion
  - Manage a successful HMI design approach with operations
  - Manage a successful implementation of the new HMI
  - Manage a successful startup with a totally new system
  - Manage to create a improved training environment for new DCS operators
- But you can’t win all:
  - Alternative plan required for personnel close to retirement