Digital Transformation Helping Your Safety Case

Jonas Berge

Emerson Automation Solutions

Safety Case Symposium 2018 Singapore

Topics Covered

- Making the safety case
- Digital transformation of work practices
- New digital measures

Making the Safety Case

Challenging Safety Requirements Brought About by The Safety Case Regime

- Increased emphasis on training and assessment
- Detect loss of containment, releases, and flammable or toxic gas
- More frequent inspection
- Easy access for inspection and testing
- Increased monitoring
- Appropriate maintenance regime; equipment condition monitoring
- Headcount roll call and search and rescue arrangement
- Reporting incidents and near misses
- Mobilize monitoring during an incident
- Minimize the risk of human failure
- etc.

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Digital Transformation of Work Practices

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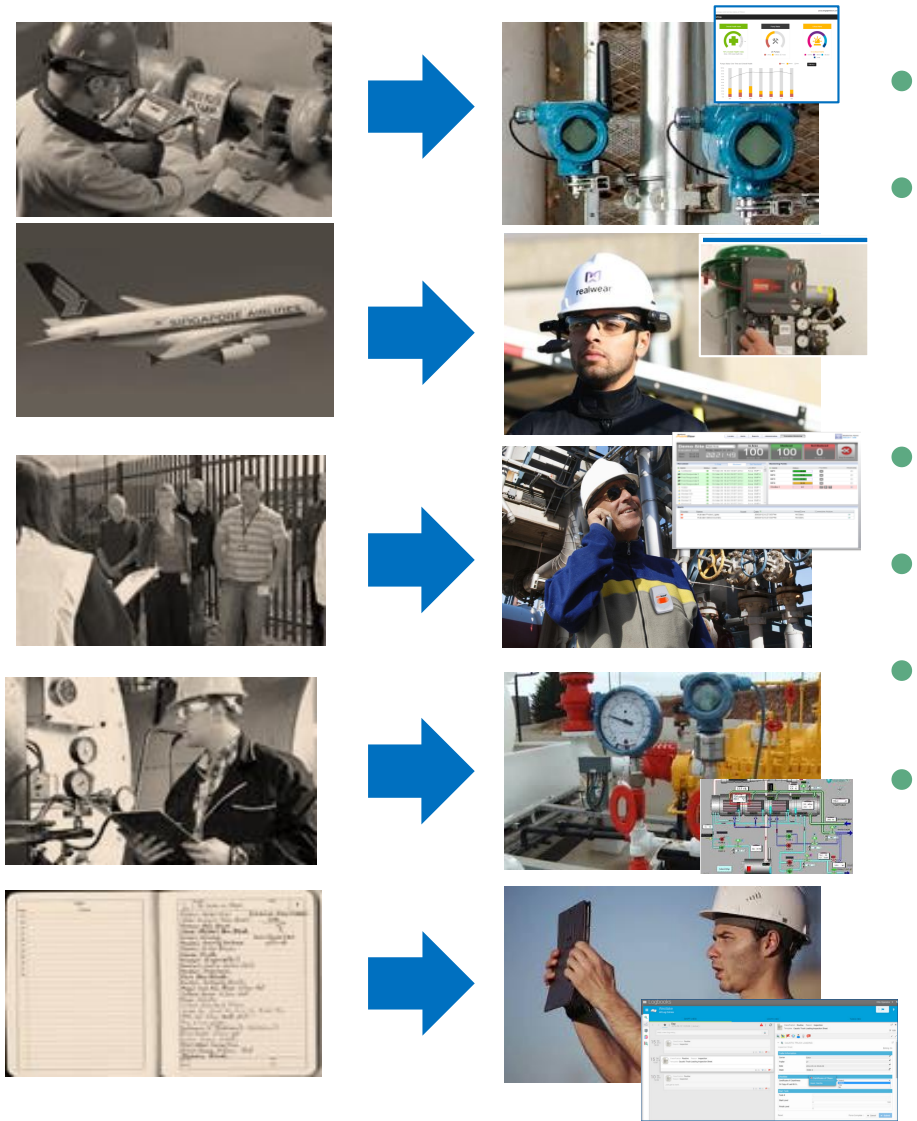
Digital Transformation (DX) of how the plant is run and maintained

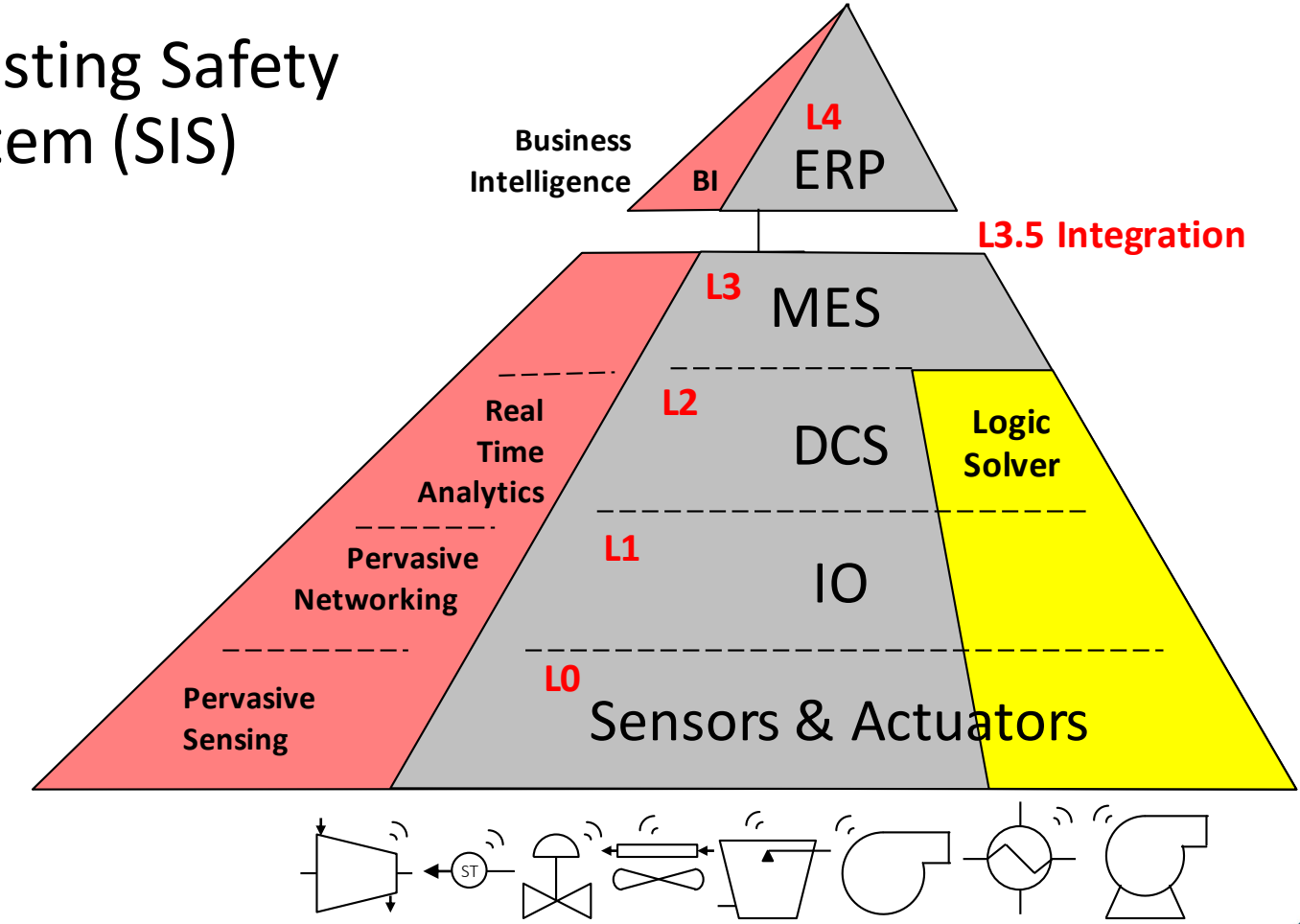


- Automatic data collection and interpretation
- Condition monitoring for predictive condition-based maintenance management of equipment
- Digital reporting
- Digital distress calls
- Digital personnel locating
- Digital twin simulation training for control room operators and field operations

New Digital Measures

Second Layer of Automation Beyond the P&ID

- In parallel with existing Safety Instrumented System (SIS)



Training and Assessment

- Challenge
  - Some safety measures relies on manual operation
  - Cannot practice manual tasks in actual plant
- Solution
  - Virtual Reality (VR)
  - Digital field operator learning and assessment
  - Practice manual tasks in a classroom; startup, shutdown, loading, offloading, and abnormal situation etc.
  - Immersive and realistic environment
- Result
  - Higher field operator performance

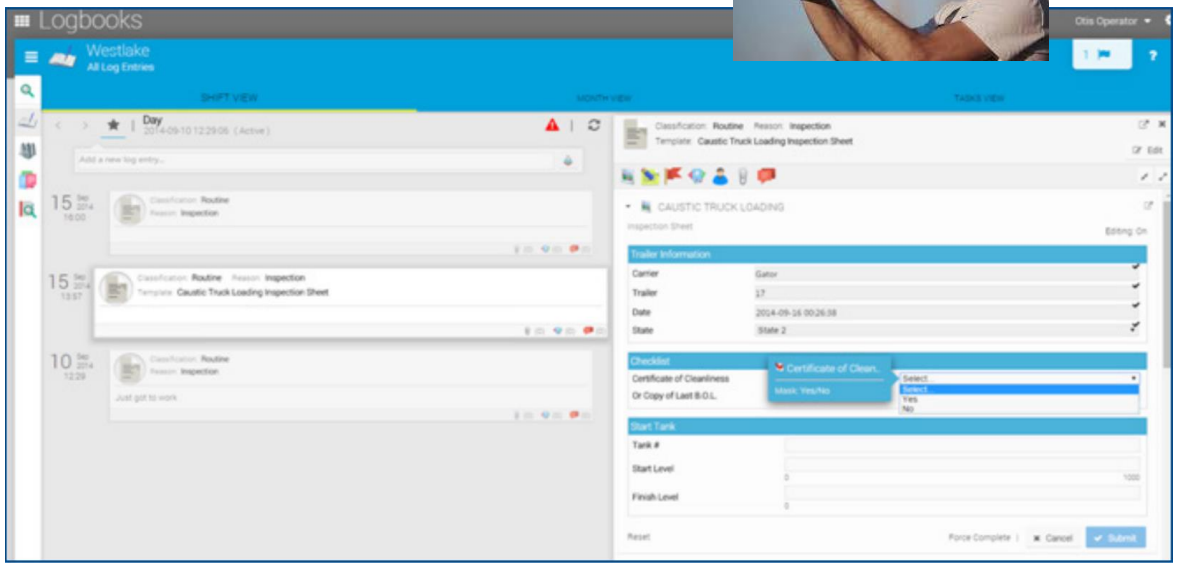
- Vessels and piping
- Walking the floors and catwalks, climbing monkey ladders and stairs
- Reading gauges and operating valves etc.

Inspection and testing

- Challenge
  - Lots of inspection
    - Prevent loss of containment (LOC)
    - If the plant is based on out-of-date standards
    - When operating facilities beyond its expected life
    - Equipment of high safety concern
    - Fire-fighting equipment
  - Manual inspection of all this may not be practical
  - Must be easy to access
- Solution
  - Monitoring using wireless sensors
- Result
  - Reduced inspection burden on personnel

Digital Logbook

- Challenge
  - Must report incidents, near misses, and faults
  - Paper notebooks notes trapped on paper
  - Must remember to transcribe and share
- Solution
  - Digital photo and notes using tablet
  - Puts the report on the server
  - Share it with those concerned
- Result
  - Better reporting and tracking
  - Searchable records
  - Constant improvement



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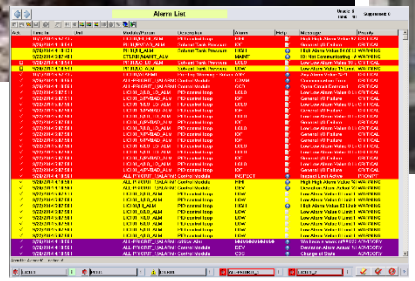
Modernization of Out-of-Date Standards - Example API standard 682 for Mechanical Seals

- Challenge
  - The earlier editions call for use of level and pressure switches
  - 2014 edition instead calls for use of level and pressure transmitters
- Solution
  - Wireless transmitters
- Result
  - Easy upgrade without having to bother with control system I/O cards and marshalling.

Detection

- Challenge
  - There has to be measures to detect a LOC
- Solution
  - Deploy wireless sensors
    - Level monitoring
    - Loss of pressure
    - Toxic and flammable gas detection
    - Leak detection
    - Discharge into water
- Result
  - Easy to deploy
  - Early detection



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Condition Monitoring

- Challenge
  - An appropriate maintenance regime has to be established for safety critical equipment
    - E.g. some pumps
- Solution
  - Predictive analytics condition monitoring software
  - Wireless sensors; vibration, temperature, etc.
- Result
  - Maintenance more predictive, less reactive, less preventive

Corrosion and Erosion Monitoring

- Challenge
  - The continuing integrity of the containment has to be monitored
  - Causes of failure include corrosion and erosion
  - Manual inspection may not be practical
- Solution
  - Wireless corrosion and erosion sensors
  - Analytics software
- Result
  - Reduced burden on inspection team
  - More accurate determination of corrosion rate

Monitoring of Integrity of Containment and Discharges to Water

- Challenge
  - Requires monitoring equipment for toxic gas, discharges to water, and combustible gas
- Solution
  - Wireless sensors
    - Hydrocarbons and other liquids
    - H2S gas detectors
    - Combustible gas
- Result
  - Easy to deploy
  - Meets the requirement

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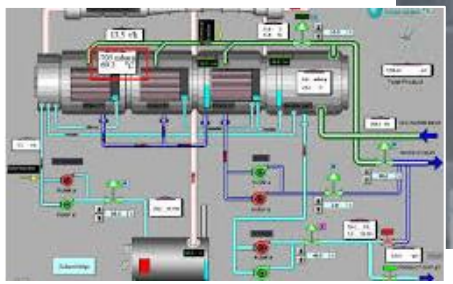
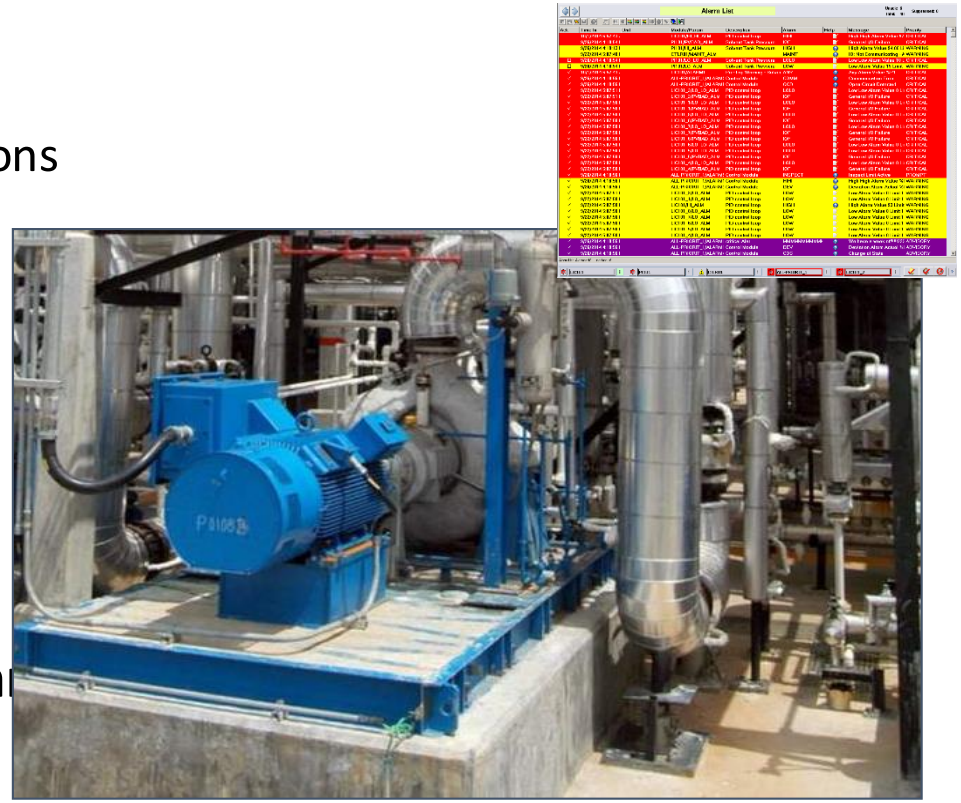
Wind Speed and Direction Monitoring

- Challenge
  - Wind speed and direction has to be monitored
- Solution
  - Anemometer wired to a wireless adapter
  - Local power
- Result
  - Requirement met
  - Easy deployment signal wiring is not needed
  - Signal interface is simplified



Monitoring Flammable Fluids and Ignition Sources

- Challenge
  - There has to suitable inspection and testing to detect;
    - Presence of flammable substances
    - Potential ignition sources like overheating or fault conditions
  - Manual inspection may not be practical
- Solution
  - Wireless gas and liquid hydrocarbon leak sensors
  - Wireless temperature sensors
    - Monitor motor winding temperature etc.
- Result
  - Reduce the inspection burden on maintenance personn
  - Faster detection



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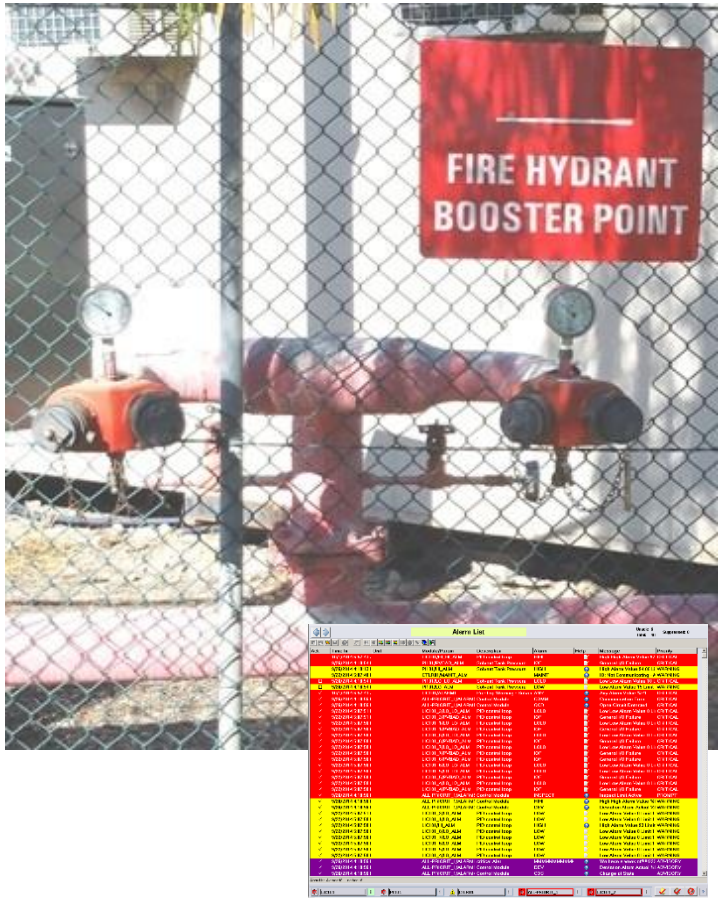
Monitoring Utilities Used for Safety

- Challenge
  - Must ensure utilities like firewater and electrical power will be available when required
  - Manually inspecting may become too much of a burden
- Solution
  - Wireless pressure sensors
  - Wireless temperature sensors on switchgear
- Result
  - Reduced inspection burden

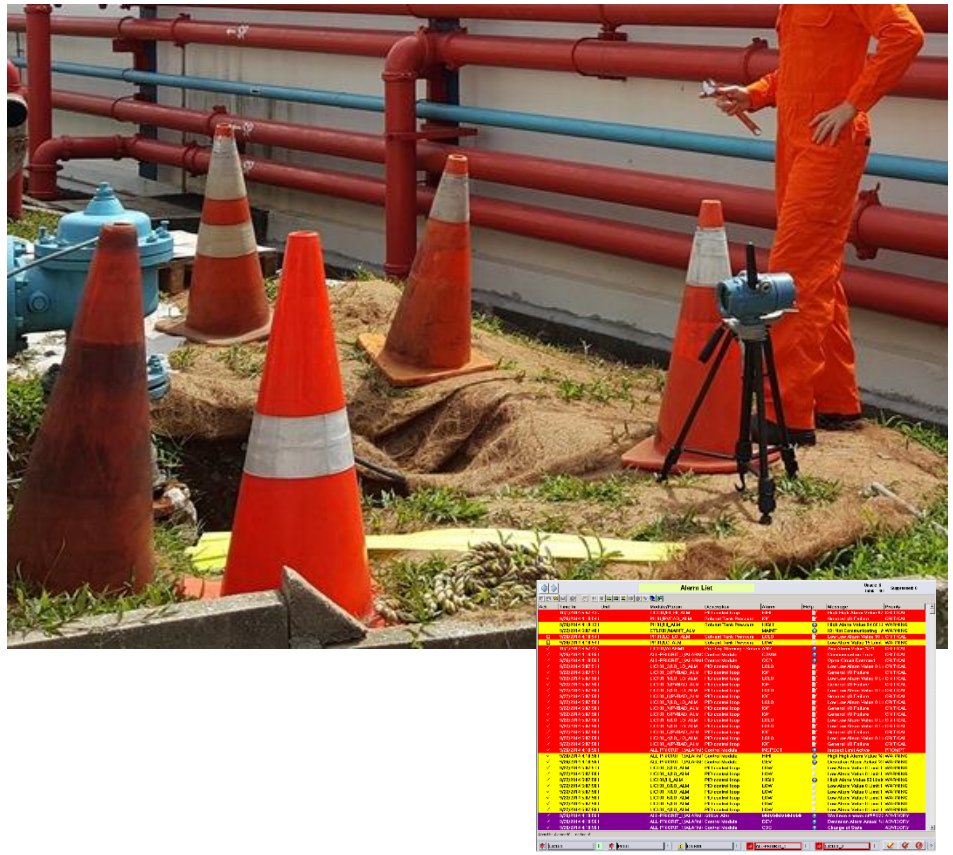


Digital Mustering and Rescue

- Challenge
  - Manual headcount roll call, headcount cards
    - Employees, visitors, and contractors
  - Time consuming and labor intensive search and rescue
- Solution
  - Real Time Locating Service (RTLS) software and tags
    - Automatic headcount at the mustering points
    - Person's location indicated on a plot plan
    - Alarm on entry to unauthorized areas
    - Man-down detection and manual distress call button
  - Wearable toxic and flammable gas detector
- Result
  - Faster and more accurate headcount
  - Minimal rescue team

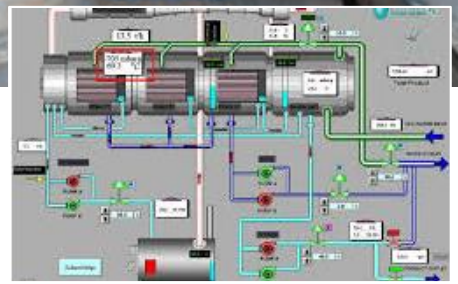
Monitoring During Incident

- Challenge
  - Monitoring to be mobilized in the event of an accident
    - Combustible gas, toxic gas, and spills into water and the ground
- Solution
  - Wireless sensors lend themselves very well to such temporary deployment
- Result
  - Quick to deploy



Measures to Minimize Risk of Human Failure

- Challenge
  - Minimize human error such as overfilling
  - Minimize mistakes with manual valves
- Solution
  - Wireless secondary level sensors
  - Wireless position feedback
    - Manual bypass, isolation, and transfer valves.
- Result
  - Greater situational awareness
  - Reduced burden for manual confirmation and checks



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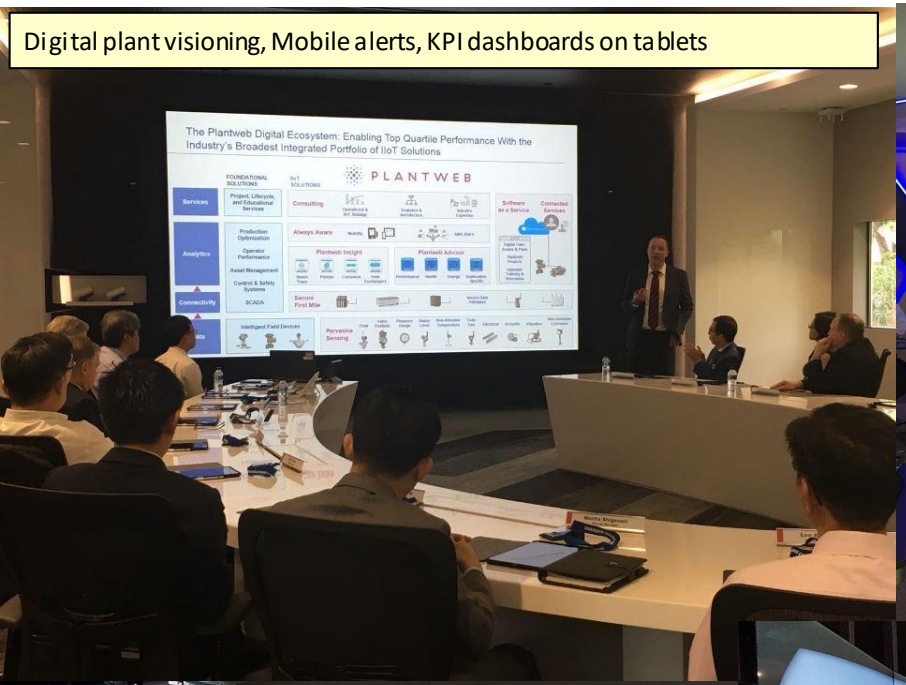
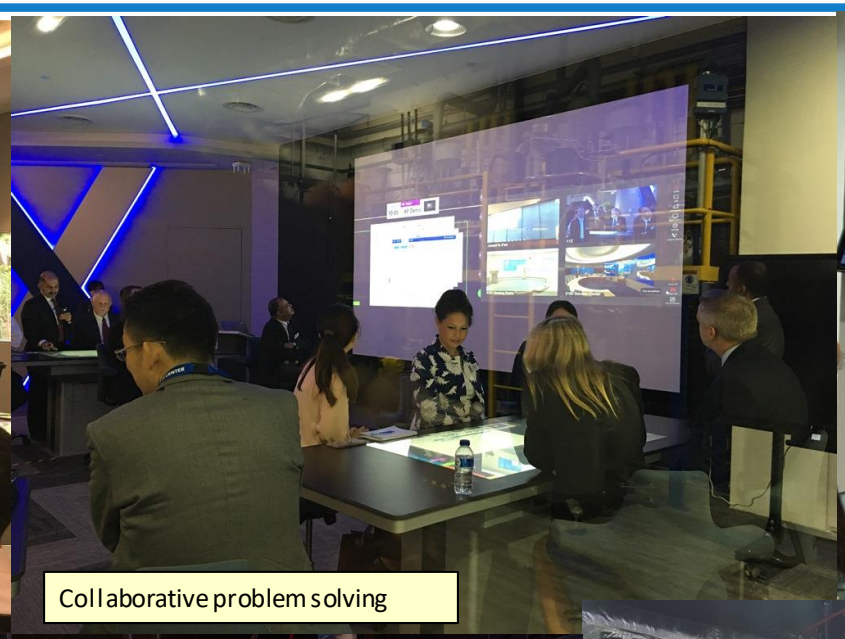
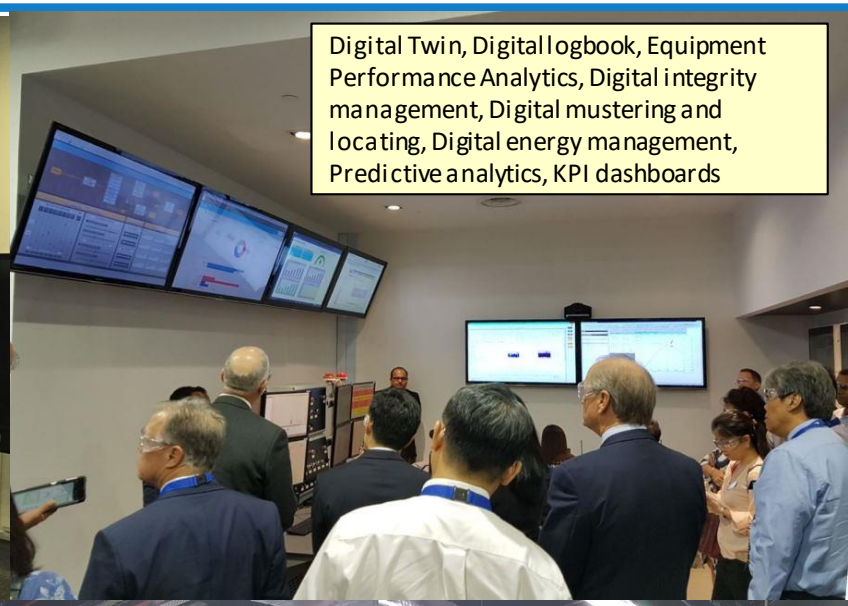
Conclusion

New Best Practice

Digital Transformation: Experience the New Way of Working At Emerson Solutions Center in Singapore







New Best Practice

- Plant Safety Challenge
- Digital Transformation of Work Practices
- New Digital Measures

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Jonas Berge

Senior Director, Applied Technology

Emerson Automation Solutions

jonas.berge@emerson.com

http://www.linkedin.com/in/smartdigital

https://www.emersonexchange365.com/members/jonas.berge

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