

Digital Transformation Helping Your Safety Case

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Safety Case
Symposium 2018
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Topics Covered

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



Making the Safety Case

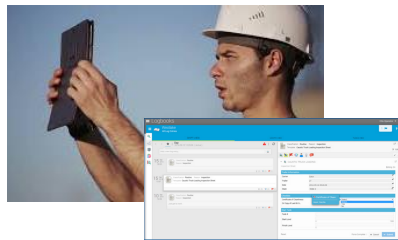
Challenging Safety Requirements Brought About by The Safety Case Regime

- 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.



Digital Transformation of Work Practices

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

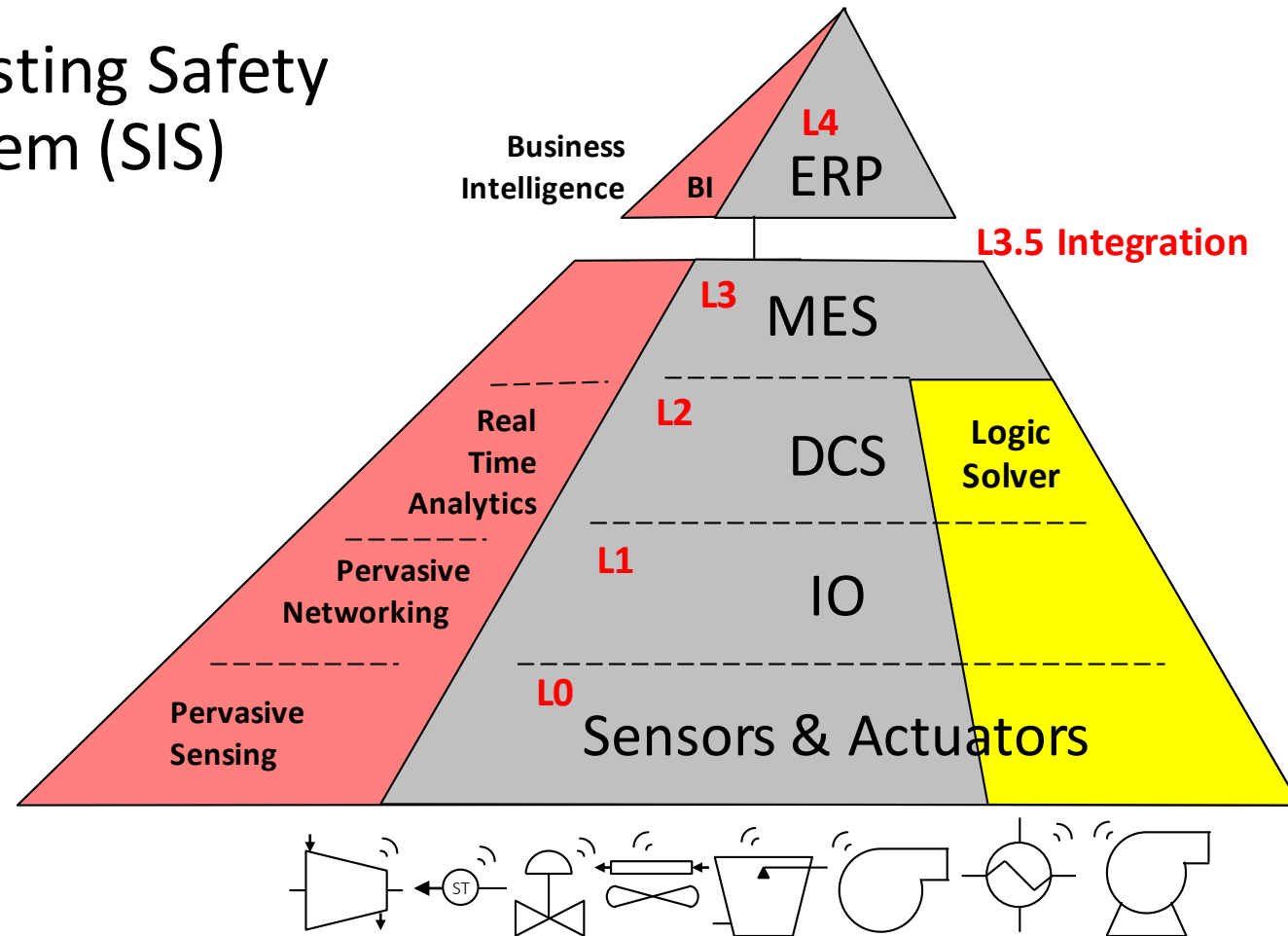


- Automatic data collection and interpretation
- Condition monitoring for predictive condition-based maintenance management of equipment
- Digital reporting
- Digital distress calls
- Digital personnel locating
- Digital twin simulation training for control room operators and field operations

New Digital Measures

Second Layer of Automation Beyond the P&ID

- In parallel with existing Safety Instrumented System (SIS)



Training and Assessment

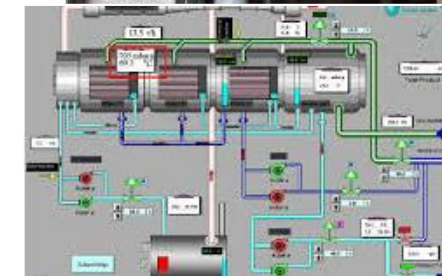
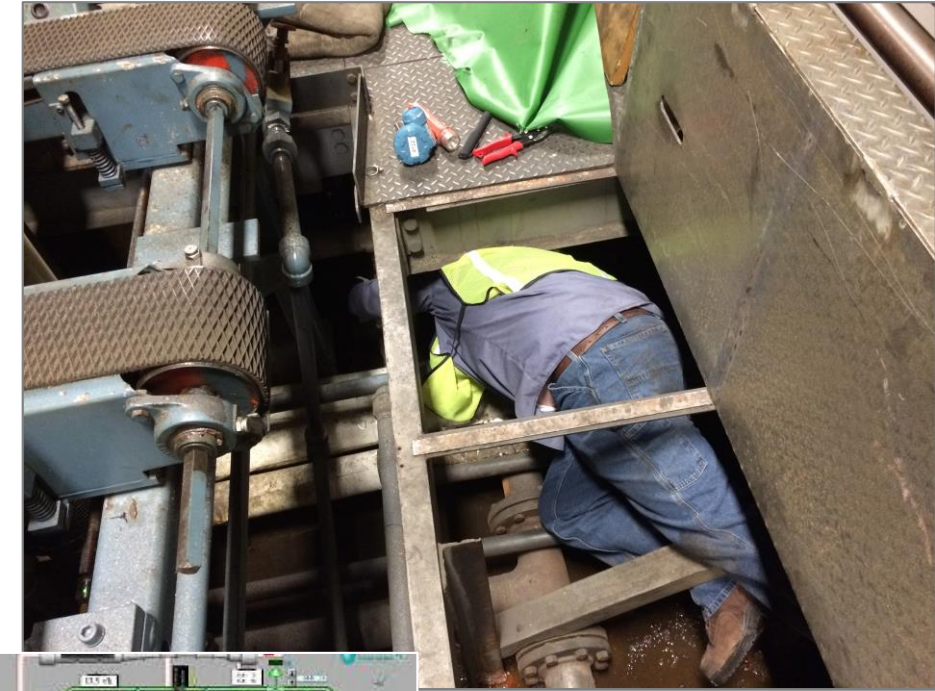
- Challenge
 - Some safety measures relies on manual operation
 - Cannot practice manual tasks in actual plant
- Solution
 - Virtual Reality (VR)
 - Digital field operator learning and assessment
 - Practice manual tasks in a classroom; startup, shutdown, loading, offloading, and abnormal situation etc.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



Logbooks

Westlake
All Log Entries

Day
2014-09-10 12:29:06 (Active)

Add a new log entry...

15 Sep 2014 18:00
Classification: Routine Reason: Inspection

15 Sep 2014 13:57
Classification: Routine Reason: Inspection
Template: Caustic Truck Loading Inspection Sheet

10 Sep 2014 12:29
Classification: Routine Reason: Inspection
Just got to work

Classification: Routine Reason: Inspection
Template: Caustic Truck Loading Inspection Sheet

CAUSTIC TRUCK LOADING

Inspection Sheet Editing On

Trailer Information

Carrier	Gator
Trailer	37
Date	2014-09-18 00:26:38
State	State 2

Checklist

Certificate of Cleanliness
Or Copy of Last S.O.L.

▼ Certificate of Cleanliness
Select
Yes
No

Start Task

Task #	
Start Level	0
Finish Level	0

Reset Force Complete Cancel Submit

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

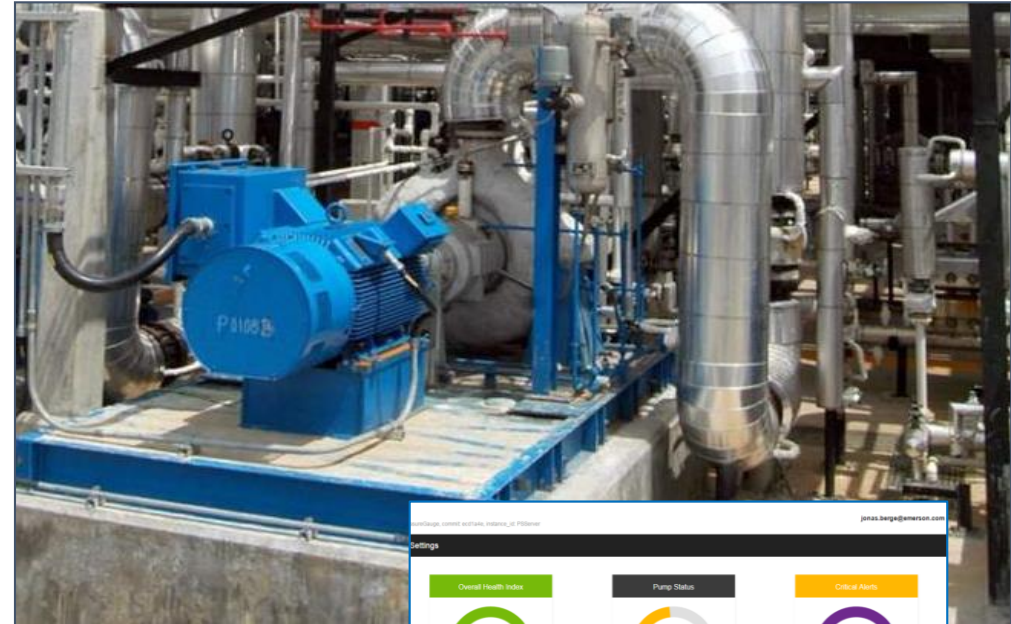
- Challenge
 - There has to be measures to detect a LOC
- Solution
 - Deploy wireless sensors
 - Level monitoring
 - Loss of pressure
 - Toxic and flammable gas detection
 - Leak detection
 - Discharge into water
- Result
 - Easy to deploy
 - Early detection



Alarm ID	Alarm Name	Severity	Priority	Alarm Type	Alarm Status	Alarm Time	Alarm Location
W00000001	High Pressure Alarm	High	1	Pressure	Active	2018-08-01 10:00:00	Process Unit 1
W00000002	Low Pressure Alarm	High	1	Pressure	Active	2018-08-01 10:00:00	Process Unit 1
W00000003	High Temperature Alarm	High	1	Temperature	Active	2018-08-01 10:00:00	Process Unit 1
W00000004	Low Temperature Alarm	High	1	Temperature	Active	2018-08-01 10:00:00	Process Unit 1
W00000005	High Flow Alarm	High	1	Flow	Active	2018-08-01 10:00:00	Process Unit 1
W00000006	Low Flow Alarm	High	1	Flow	Active	2018-08-01 10:00:00	Process Unit 1
W00000007	High Level Alarm	High	1	Level	Active	2018-08-01 10:00:00	Process Unit 1
W00000008	Low Level Alarm	High	1	Level	Active	2018-08-01 10:00:00	Process Unit 1
W00000009	High Vibration Alarm	High	1	Vibration	Active	2018-08-01 10:00:00	Process Unit 1
W00000010	Low Vibration Alarm	High	1	Vibration	Active	2018-08-01 10:00:00	Process Unit 1
W00000011	High Gas Alarm	High	1	Gas	Active	2018-08-01 10:00:00	Process Unit 1
W00000012	Low Gas Alarm	High	1	Gas	Active	2018-08-01 10:00:00	Process Unit 1
W00000013	High Leak Alarm	High	1	Leak	Active	2018-08-01 10:00:00	Process Unit 1
W00000014	Low Leak Alarm	High	1	Leak	Active	2018-08-01 10:00:00	Process Unit 1
W00000015	High Discharge Alarm	High	1	Discharge	Active	2018-08-01 10:00:00	Process Unit 1
W00000016	Low Discharge Alarm	High	1	Discharge	Active	2018-08-01 10:00:00	Process Unit 1
W00000017	High Water Alarm	High	1	Water	Active	2018-08-01 10:00:00	Process Unit 1
W00000018	Low Water Alarm	High	1	Water	Active	2018-08-01 10:00:00	Process Unit 1
W00000019	High pH Alarm	High	1	pH	Active	2018-08-01 10:00:00	Process Unit 1
W00000020	Low pH Alarm	High	1	pH	Active	2018-08-01 10:00:00	Process Unit 1

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



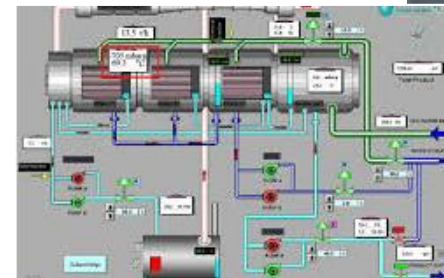
Monitoring of Integrity of Containment and Discharges to Water

- 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



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 be 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 personnel
- Faster detection



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



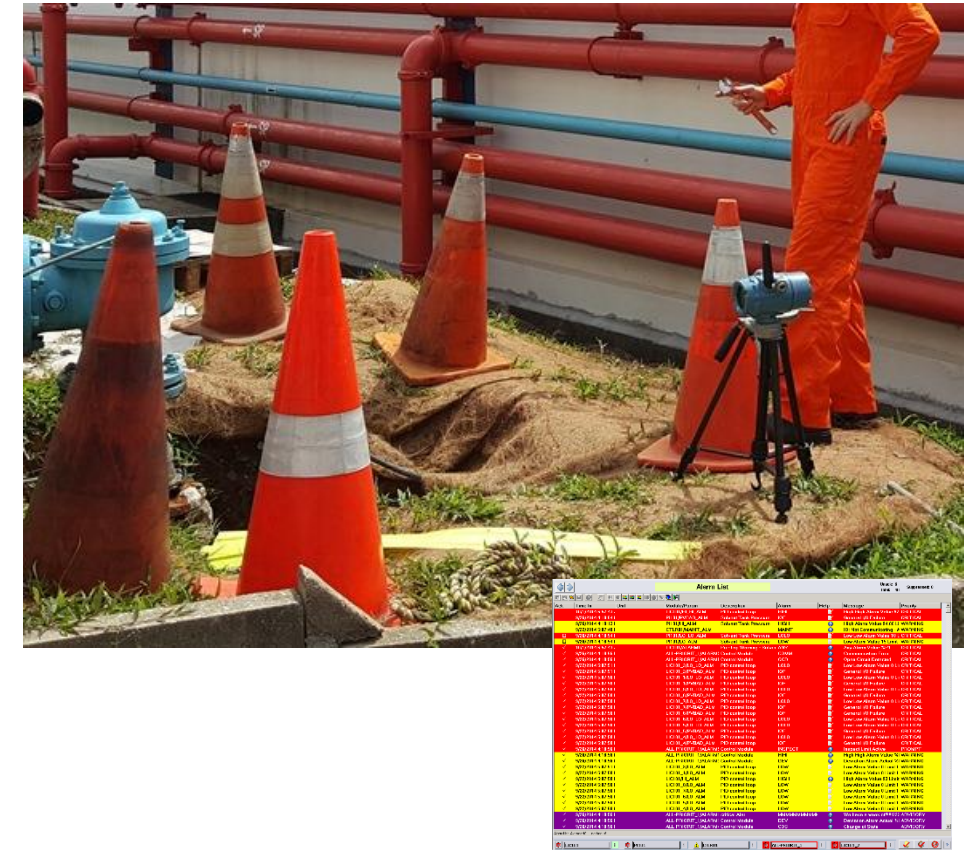
Digital Mustering and Rescue

- 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



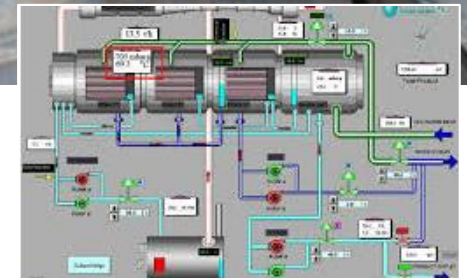
Monitoring During Incident

- 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

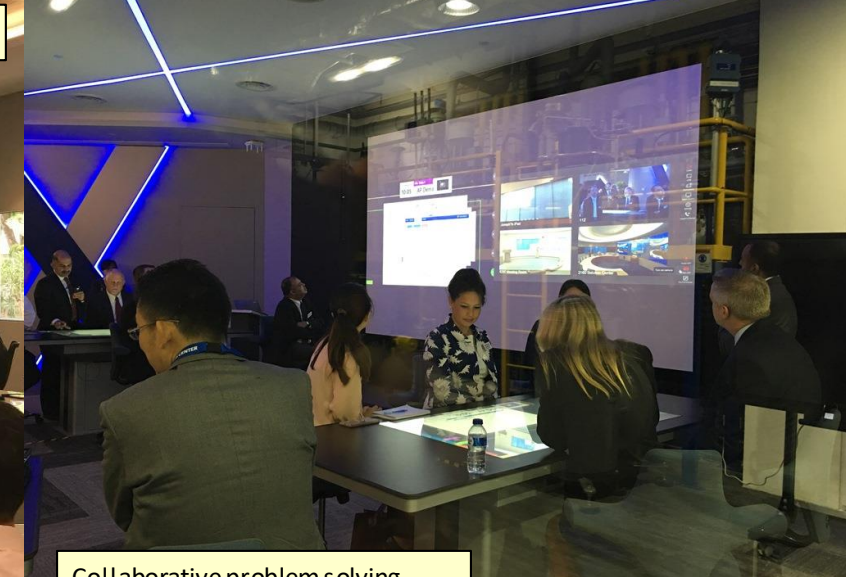
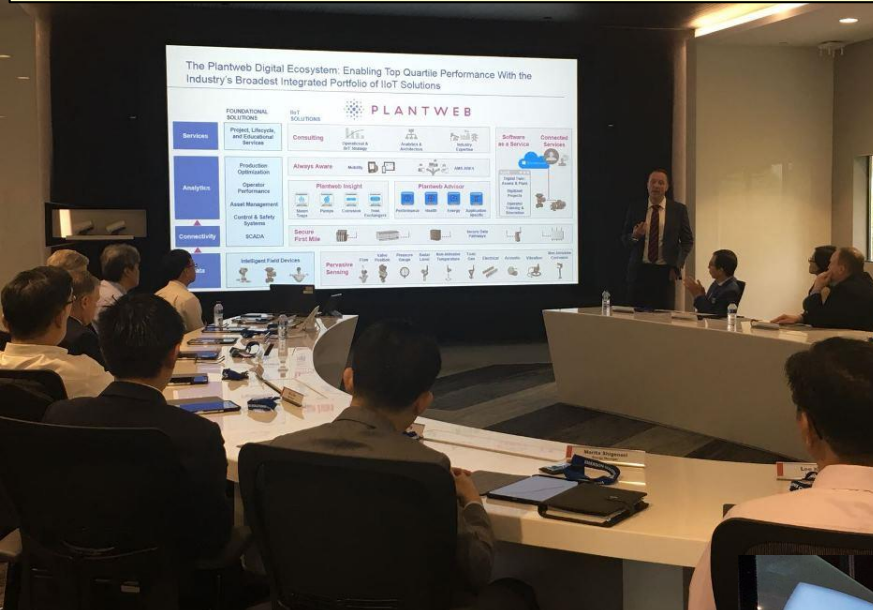


Conclusion

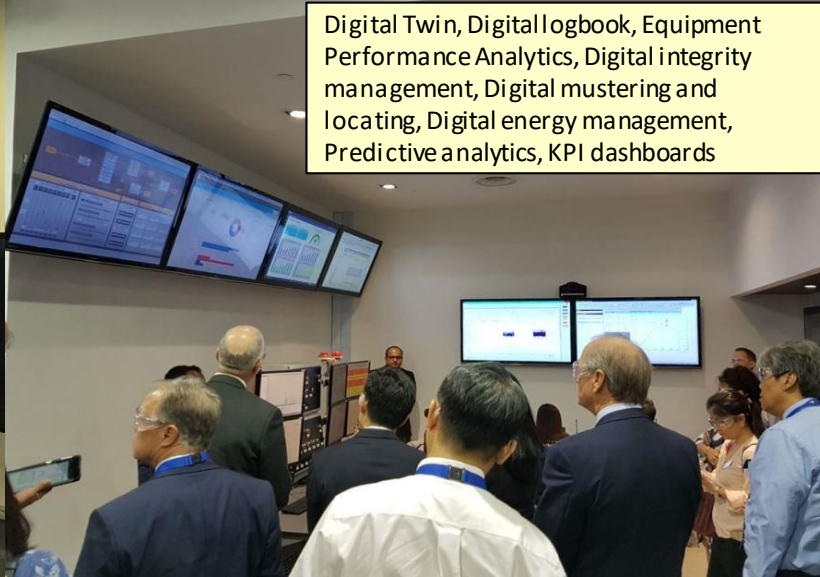
New Best Practice

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

Digital plant visioning, Mobile alerts, KPI dashboards on tablets



Collaborative problem solving



Digital Twin, Digital logbook, Equipment Performance Analytics, Digital integrity management, Digital mustering and locating, Digital energy management, Predictive analytics, KPI dashboards



Operational Certainty Discovery Session



Virtual Reality (VR), Success sharing



Digital reporting, Digital inspection, Mobile operator, RFID, Wearable video conferencing, Augmented Reality (AR)

New Best Practice

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



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