OCTOBER 2023

Standardising Rio Tinto Iron Ore Mine Operations

AVEVA World 2023

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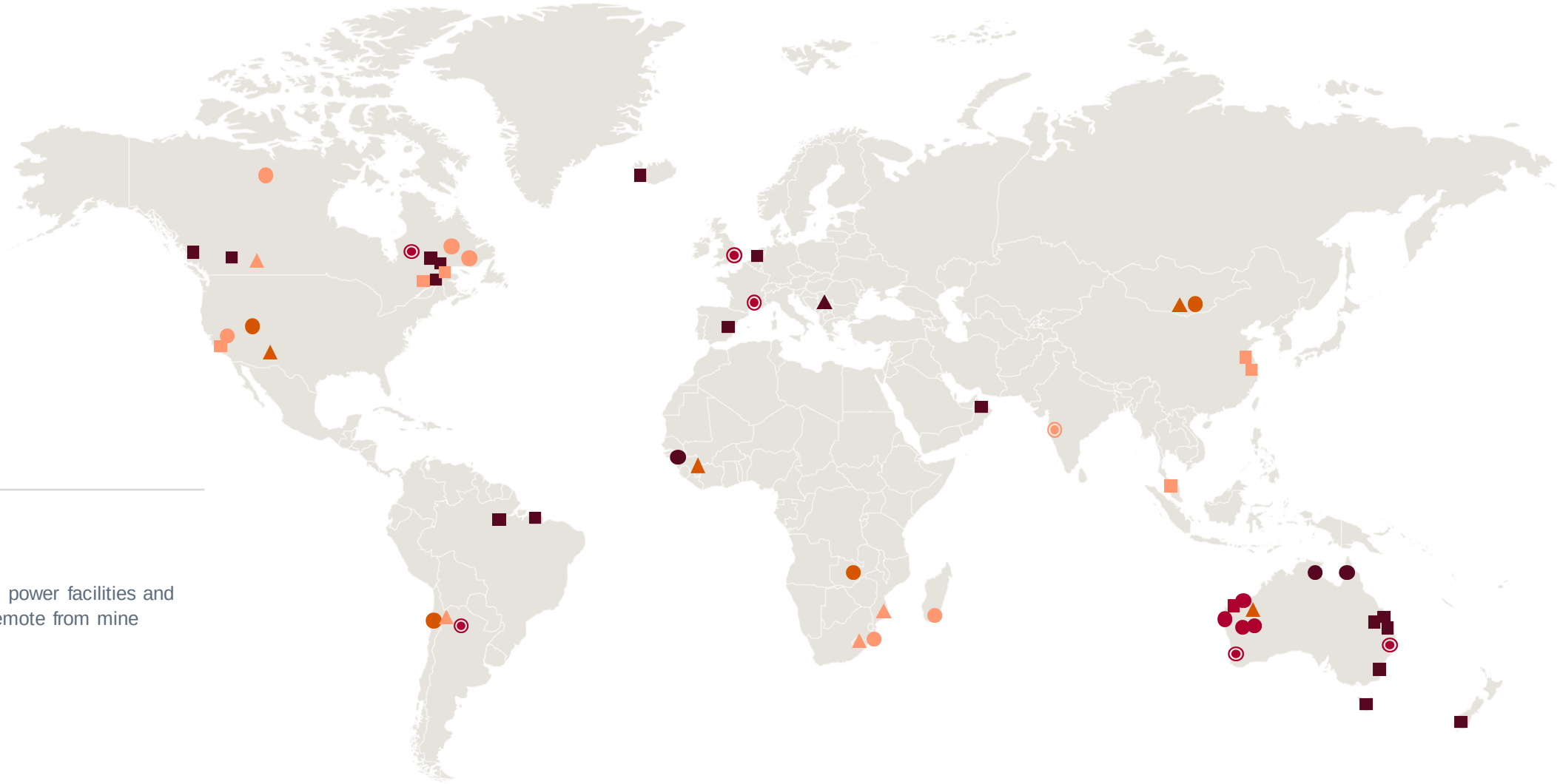
Rio Tinto Global Footprint

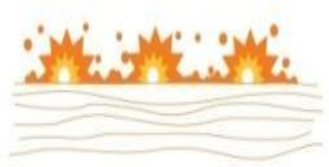
~52K employees 2023



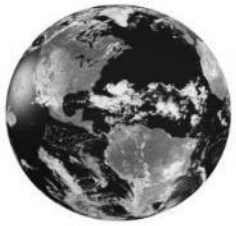
AVEVA

Large scale operation epitomises pioneering progress

1 Drill & Blast



>12,000 km drilled each year



Equivalent to the diameter of the earth

2 Load & Haul

>1 billion tonnes rock moved per year

Enough to fill OPTUS Stadium Perth 1.5 times every day

3 Process

5 gigawatt hours of electricity per day

Equivalent power for 500,000 Western Australians

4 Rail

>20,000 km rail travel per day

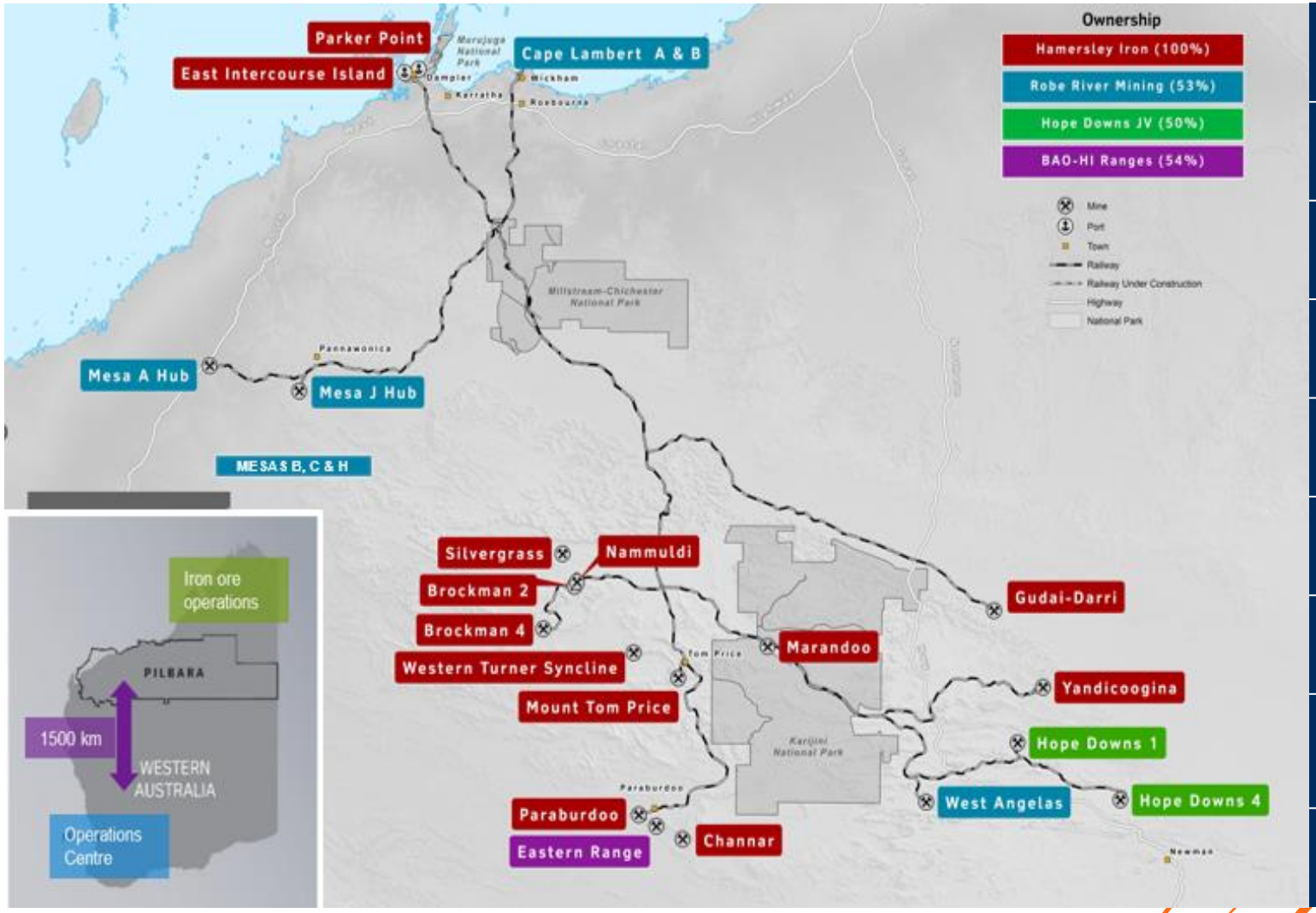
1.2 times around Australia on Highway 1

5 Ship

>320 million tonnes ore shipped annually

Build a cone >340 metres high – same height as Uluru and 25% the volume

Iron Ore assets in Western Australia

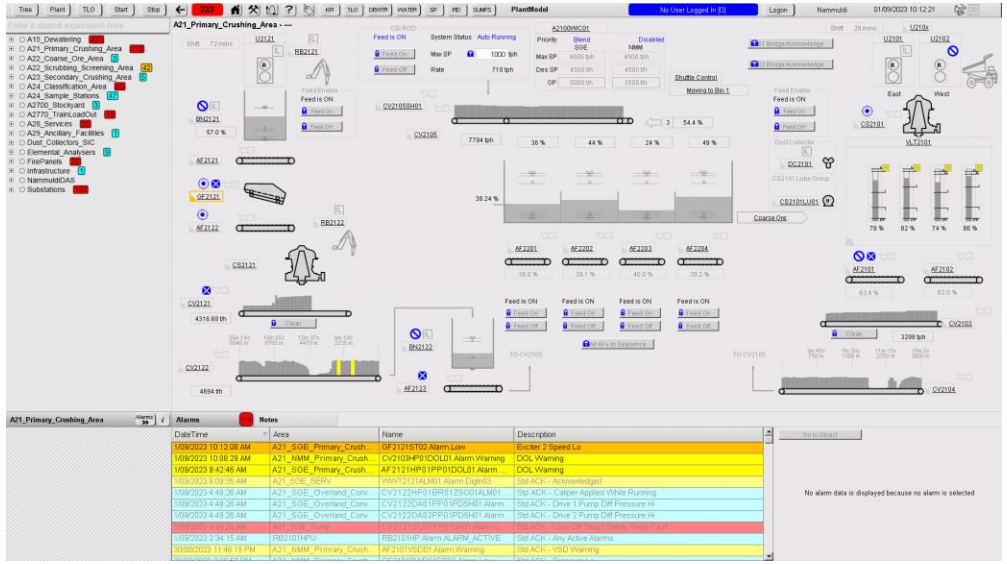


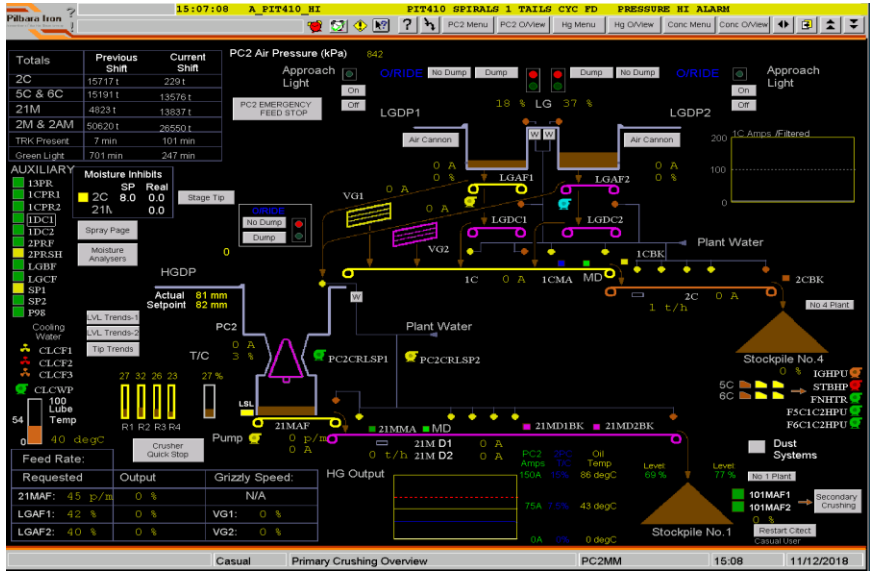
17	Mines
>1,900 km	Rail
4	Port terminals
4	Gas-fired power stations
1	Solar farm
>400	Haul trucks, ~74% automated
~60	Production drills, 33 automated
220	Locomotives pulling 13,500 wagons
> 100	Global customers

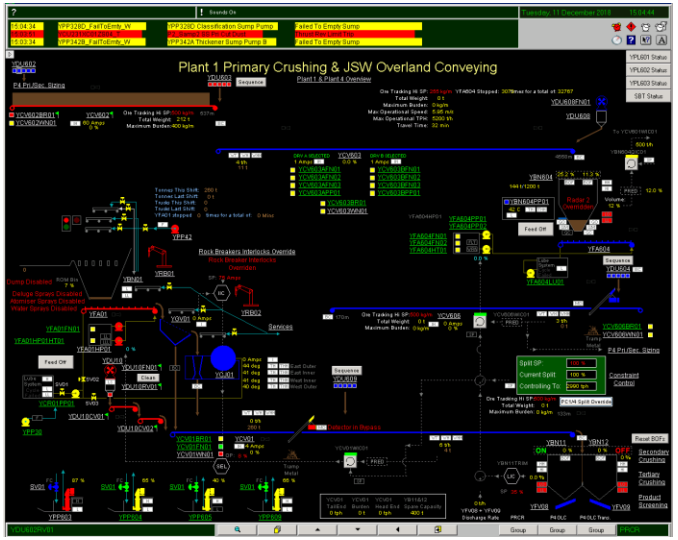
Operation Centre Control Room

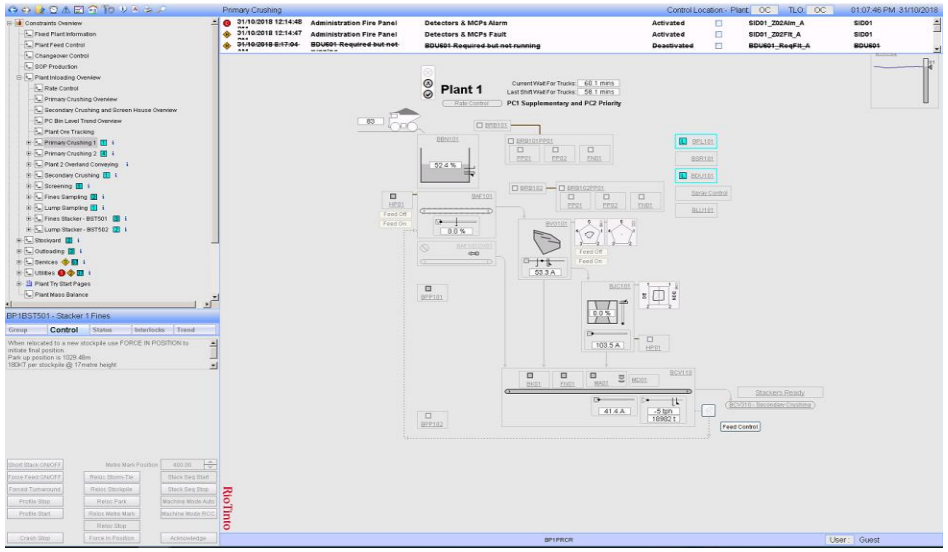
Our team provides governance and technical assurance for control systems across all sites

Mine SCADA Standardisation - Current State









Mining | Western Australia Pilbara

RTIO standardising HMI across all mine operations by 2025

Challenge

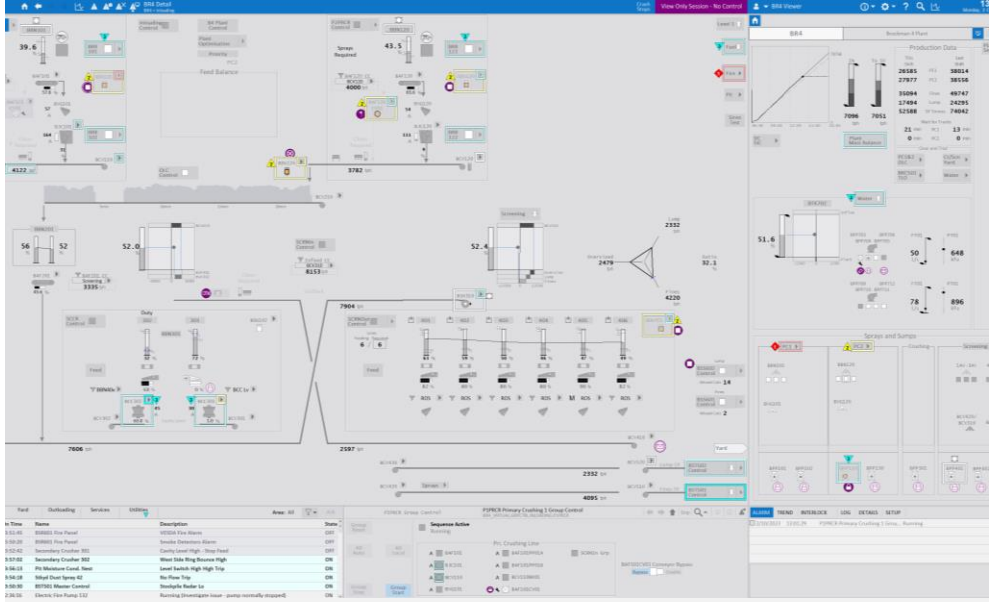
- No overarching philosophy in HMI design resulting in varying controller response to production and safety situations.
- Controllers required to learn each sites' standard which limited flexibility of controlling multiple sites and contributed to poor controller response times.
- Substandard or no Abnormal Situation (ASM) philosophy adopted.

Solution

- Plant SCADA chosen to be deployed across all mines and leverage the new tools available.
- Develop a central design employing elements of ASM and rule-based screen layouts.

Results

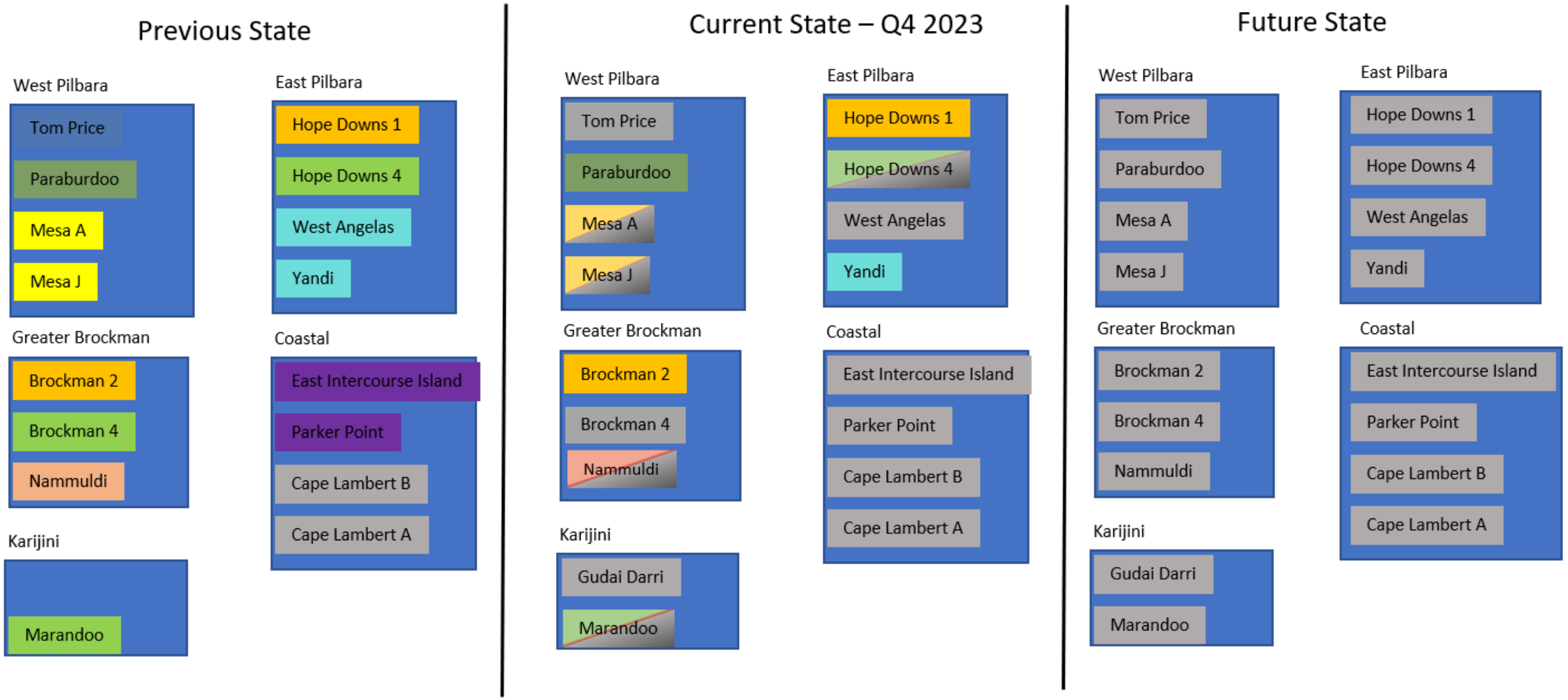
- **Unified controller experience across all sites reducing variability, improving productivity and efficiency.**
- **Removed legacy software risks within the business.**
- **Controllers empowered and able to positively influence asset performance.**
- **Different sites able to leverage each other's knowledge of similar processes and systems.**



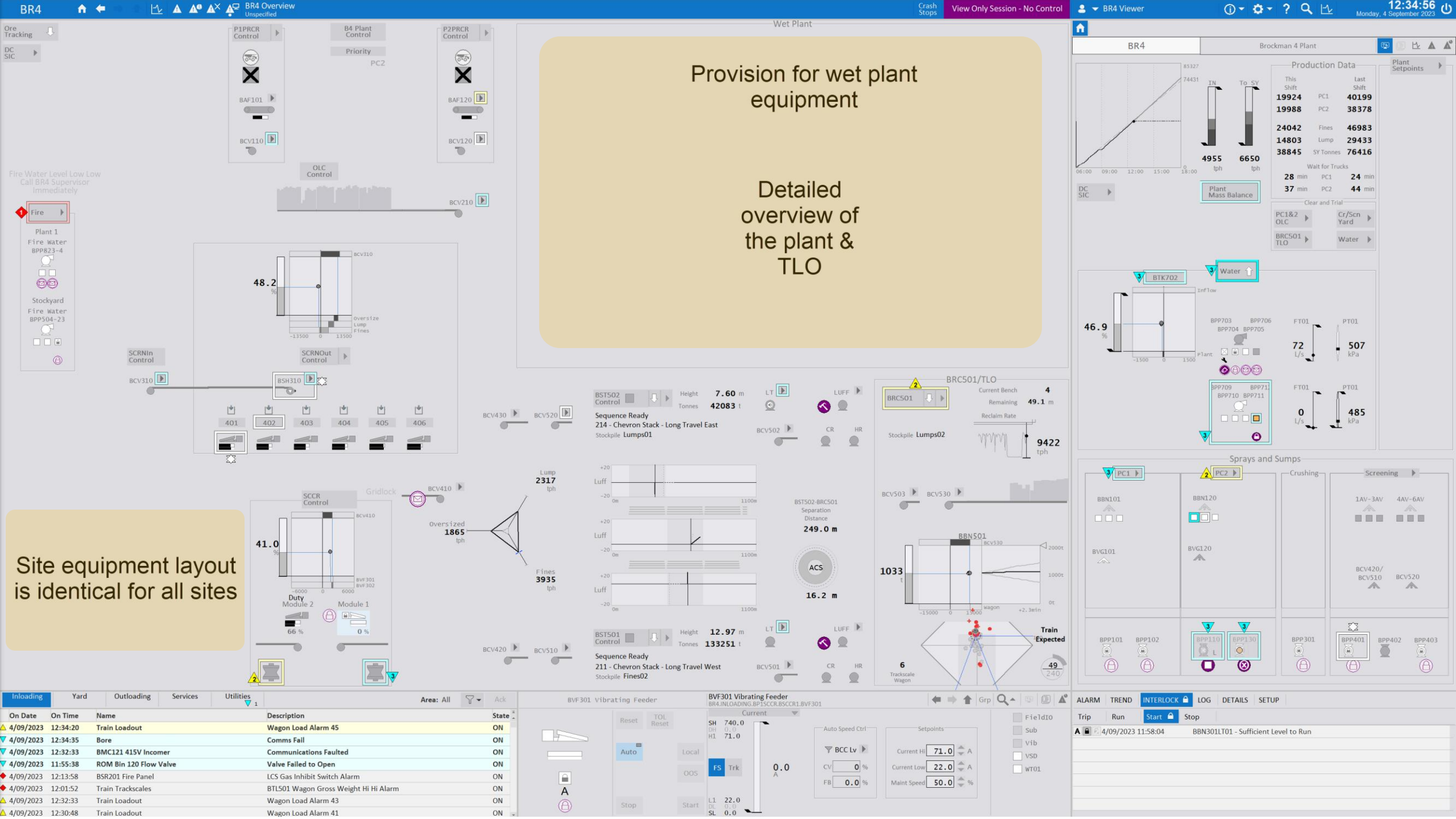
"We've been receiving positive feedback from both leadership and our operational teams regarding the Plant SCADA standardisation project. One of the highlights is that it's bridging the training gap among the controllers. This is achieved through the cross-pollination of operating systems, fostering a more versatile and skilled workforce.

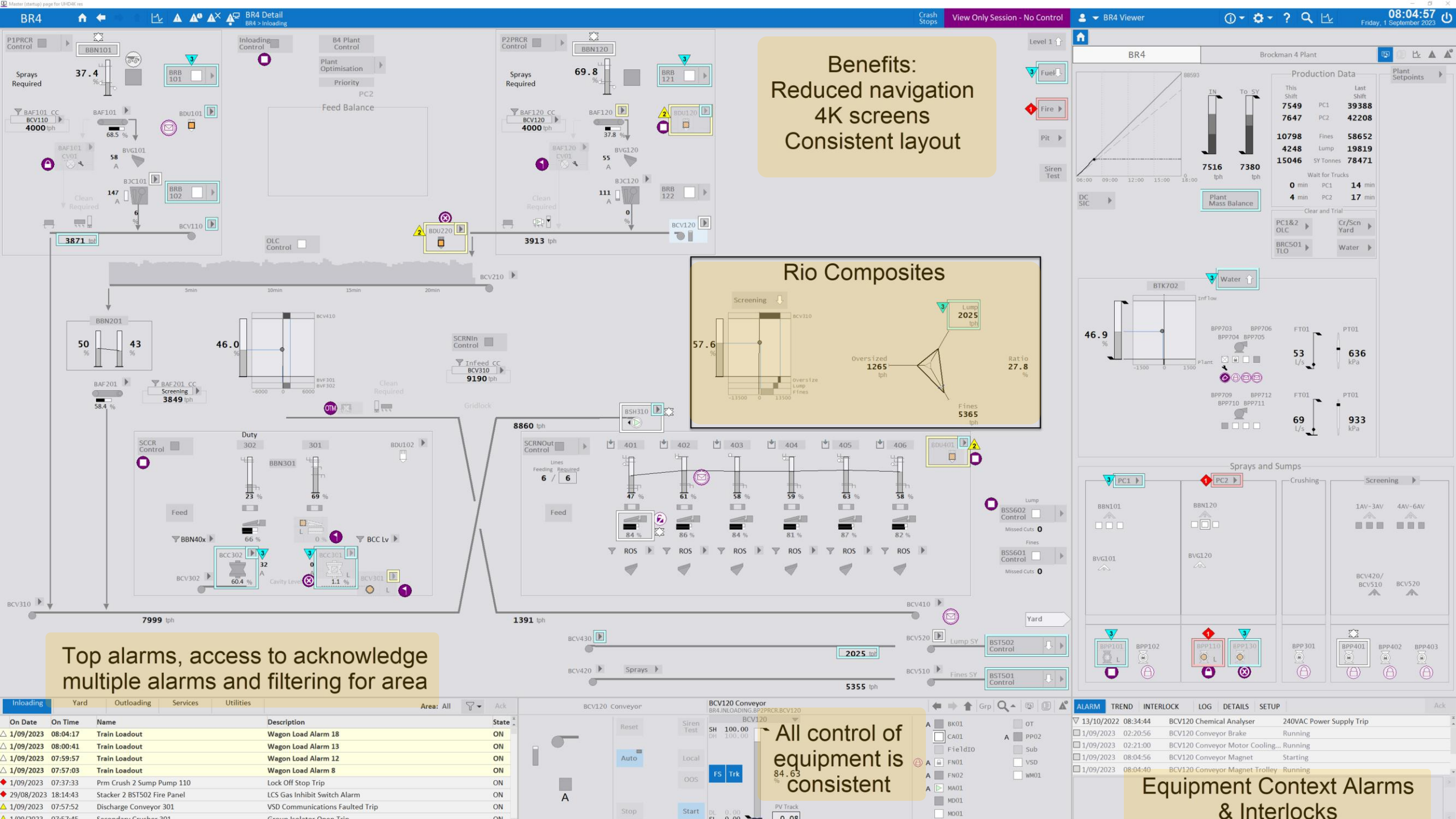
Joel Jones – Advisor Operational Readiness – Integrated Operations

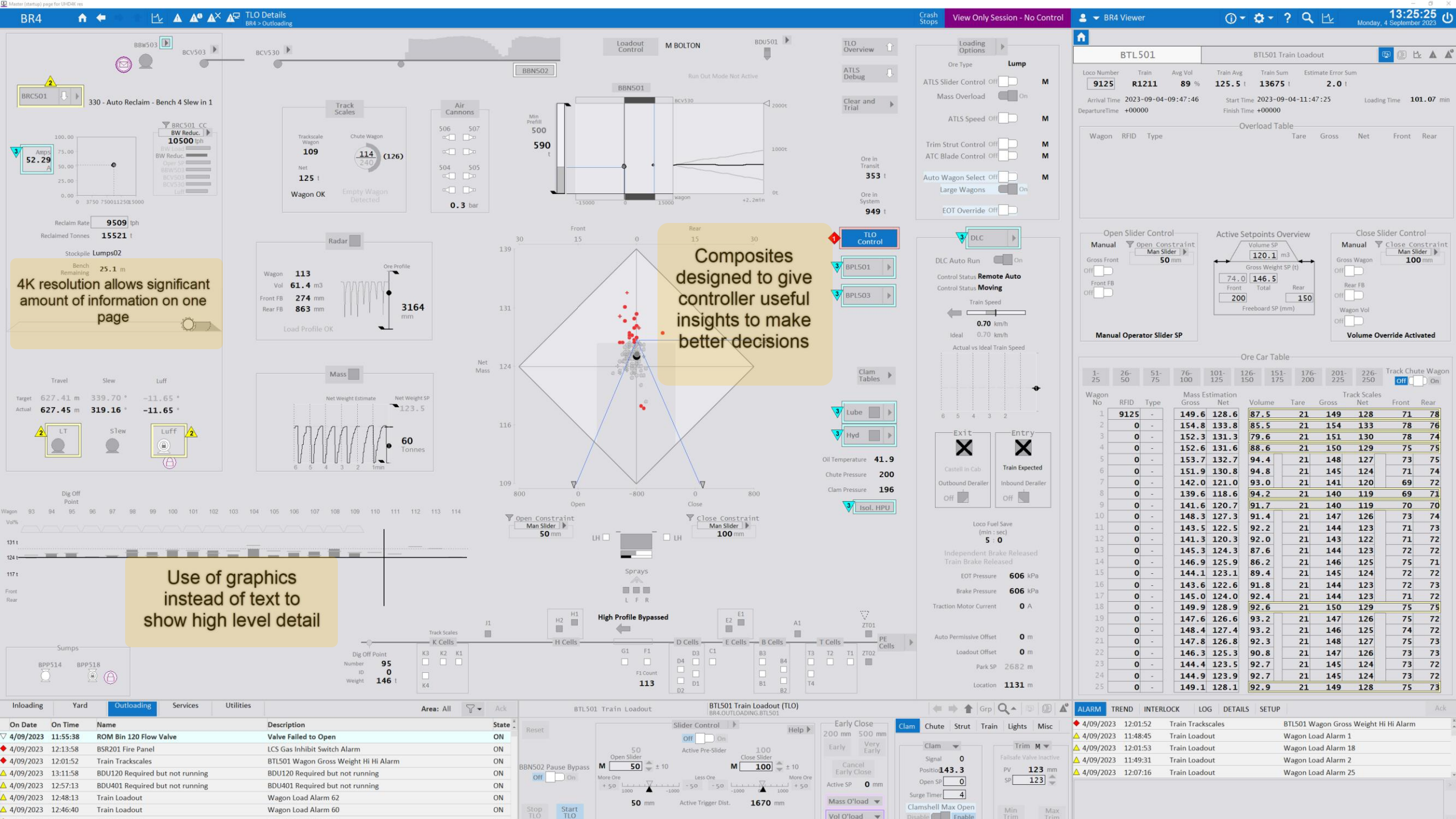
Project Timeline



= ASM Standards. Note: All other colours represent different versions of SCADA standards


BR4
BR4 Overview
Unspecified
Crash Stops
View Only Session - No Control
BR4 Viewer
12:34:56
Monday, 4 September 2023
Wet Plant
Provision for wet plant equipment
Detailed overview of the plant & TLO
Site equipment layout is identical for all sites
BR4
Brockman 4 Plant
Production Data
This Shift
Last Shift
19924 PC1 40199
19988 PC2 38378
24042 Fines 46983
14803 Lump 29433
38845 SY Tonnes 76416
Wait for Trucks
28 min PC1 24 min
37 min PC2 44 min
4955 tph
6650 tph
Plant Mass Balance
Plant Setpoints
Clear and Trial
PC1&2 OLC
Cr/Scn Yard
BRC501 TLO
Water
BTK702
46.9 %
72 L/s
507 kPa
0 L/s
485 kPa
Sprays and Sumps
Crushing
Screening
BRC501/TLO
Current Bench 4
Remaining 49.1 m
Reclaim Rate
9422 tph
Stockpile Lumps02
BST502 Control
Height 7.60 m
Tonnes 42083 t
Sequence Ready
214 - Chevron Stack - Long Travel East
Stockpile Lumps01
BST501 Control
Height 12.97 m
Tonnes 133251 t
Sequence Ready
211 - Chevron Stack - Long Travel West
Stockpile Fines02
BST502-BRC501 Separation Distance
249.0 m
16.2 m
ACS
Lump 2317 tph
Oversized 1865 tph
Fines 3935 tph
1033 t
Train Expected
6 Trackscale Wagon
Fire Water Level Low Low
Call BR4 Supervisor Immediately
Fire
Plant 1 Fire Water BPP823-4
Stockyard Fire Water BPP504-23
P1PRCR Control
P2PRCR Control
B4 Plant Control
Priority
PC2
BAF101
BAF120
BCV110
BCV120
OLC Control
BCV210
SCRNIn Control
SCRNOut Control
BCV310
BSH310
401
402
403
404
405
406
48.2 %
SCCR Control
Gridlock
BCV410
41.0 %
Duty
Module 2
Module 1
66 %
0 %
BCV430
BCV520
BCV502
BCV420
BCV510
BCV501
BCV503
BCV530
BBN501
1033 t
PC1
PC2
BBN101
BBN120
BVG101
BVG120
BCV420/ BCV510
BCV520
1AV-3AV
4AV-6AV
BPP101
BPP102
BPP110
BPP130
BPP301
BPP401
BPP402
BPP403
Inloading
Yard
Outloading
Services
Utilities
Area: All
Ack
On Date
On Time
Name
Description
State
4/09/2023 12:34:20 Train Loadout Wagon Load Alarm 45 ON
4/09/2023 12:34:35 Bore Comms Fail ON
4/09/2023 12:32:33 BMC121 415V Incomer Communications Faulted ON
4/09/2023 11:55:38 ROM Bin 120 Flow Valve Valve Failed to Open ON
4/09/2023 12:13:58 BSR201 Fire Panel LCS Gas Inhibit Switch Alarm ON
4/09/2023 12:01:52 Train Trackscales BTL501 Wagon Gross Weight Hi Hi Alarm ON
4/09/2023 12:32:33 Train Loadout Wagon Load Alarm 43 ON
4/09/2023 12:30:48 Train Loadout Wagon Load Alarm 41 ON
BVF301 Vibrating Feeder
BR4.INLOADING.BP1SCCR.BSCCR1.BVF301
Auto
Local
OOS
Stop
Start
FS
Trk
Current
0.0 A
Auto Speed Ctrl
BCC Lv
Setpoints
Current Hi 71.0 A
Current Low 22.0 A
Maint Speed 50.0 %
FieldIO
Sub
Vib
VSD
WT01
ALARM
TREND
INTERLOCK
LOG
DETAILS
SETUP
Trip
Run
Start
Stop
4/09/2023 11:58:04 BBN301LT01 - Sufficient Level to Run


BR4
BR4 Detail
BR4 > Inloading
Crash Stops
View Only Session - No Control
BR4 Viewer
08:04:57
Friday, 1 September 2023
Benefits:
Reduced navigation
4K screens
Consistent layout
Rio Composites
Top alarms, access to acknowledge multiple alarms and filtering for area
All control of equipment is consistent
Equipment Context Alarms & Interlocks
Inloading
Yard
Outloading
Services
Utilities
Area: All
Ack
On Date
On Time
Name
Description
State
1/09/2023 08:04:17 Train Loadout Wagon Load Alarm 18 ON
1/09/2023 08:00:41 Train Loadout Wagon Load Alarm 13 ON
1/09/2023 07:59:57 Train Loadout Wagon Load Alarm 12 ON
1/09/2023 07:57:03 Train Loadout Wagon Load Alarm 8 ON
1/09/2023 07:37:33 Prm Crush 2 Sump Pump 110 Lock Off Stop Trip ON
29/08/2023 18:14:43 Stacker 2 BST502 Fire Panel LCS Gas Inhibit Switch Alarm ON
1/09/2023 07:57:52 Discharge Conveyor 301 VSD Communications Faulted Trip ON
ALARM
TREND
INTERLOCK
LOG
DETAILS
SETUP
13/10/2022 08:34:44 BCV120 Chemical Analyser 240VAC Power Supply Trip
1/09/2023 02:20:56 BCV120 Conveyor Brake Running
1/09/2023 02:21:00 BCV120 Conveyor Motor Cooling... Running
1/09/2023 08:04:56 BCV120 Conveyor Magnet Starting
1/09/2023 08:04:40 BCV120 Conveyor Magnet Trolley Running


BR4
TLO Details
BR4 > Outloading
Crash Stops
View Only Session - No Control
BR4 Viewer
13:25:25
Monday, 4 September 2023
BBW503
BCV503
BCV530
BBN502
Loadout Control
M BOLTON
BDU501
TLO Overview
ATLS Debug
Clear and Trial
Loading Options
Ore Type
Lump
ATLS Slider Control
Mass Overload
ATLS Speed
Trim Strut Control
ATC Blade Control
Auto Wagon Select
Large Wagons
EOT Override
BRC501
330 - Auto Reclaim - Bench 4 Slew in 1
Amps
52.29
BRC501_CC
BW Reduc.
10500 tph
Reclaim Rate
9509 tph
Reclaimed Tonnes
15521 t
Stockpile
Lumps02
Bench Remaining
25.1 m
Track Scales
Trackscale Wagon
109
Net
125 t
Wagon OK
Chute Wagon
114
240
(126)
Empty Wagon Detected
Air Cannons
506
507
504
505
0.3 bar
BBN501
Run Out Mode Not Active
Min Prefill
500
590 t
Ore in Transit
353 t
Ore in System
949 t
Radar
Wagon
113
Vol
61.4 m3
Front FB
274 mm
Rear FB
863 mm
Load Profile OK
Ore Profile
3164 mm
Mass
Net Weight Estimate
Net Weight SP
123.5
60 Tonnes
4K resolution allows significant amount of information on one page
Composites designed to give controller useful insights to make better decisions
Use of graphics instead of text to show high level detail
TLO Control
BPL501
BPL503
Clam Tables
Lube
Hyd
Isol. HPU
Oil Temperature
41.9
Chute Pressure
200
Clam Pressure
196
DLC
DLC Auto Run
Control Status
Remote Auto
Control Status
Moving
Train Speed
0.70 km/h
Ideal
0.70 km/h
Actual vs Ideal Train Speed
Exit
Castell in Cab
Outbound Derailer
Off
Entry
Train Expected
Inbound Derailer
Off
Loco Fuel Save
(min : sec)
5 : 0
Independent Brake Released
Train Brake Released
EOT Pressure
606 kPa
Brake Pressure
606 kPa
Traction Motor Current
0 A
Auto Permissive Offset
0 m
Loadout Offset
0 m
Park SP
2682 m
Location
1131 m
Travel
Slew
Luff
Target
627.41 m
339.70 °
-11.65 °
Actual
627.45 m
319.16 °
-11.65 °
LT
Slew
Luff
Sumps
BPP514
BPP518
Dig Off Point
Number
95
ID
0
Weight
146 t
Track Scales
K Cells
H Cells
D Cells
E Cells
B Cells
T Cells
PE Cells
High Profile Bypassed
F1 Count
113
Sprays
Open Constraint
Man Slider
50 mm
Close Constraint
Man Slider
100 mm
BTL501
BTL501 Train Loadout
Loco Number
9125
Train
R1211
Avg Vol
89 %
Train Avg
125.5 t
Train Sum
13675 t
Estimate Error Sum
2.0 t
Arrival Time
2023-09-04-09:47:46
DepartureTime
+00000
Start Time
2023-09-04-11:47:25
Finish Time
+00000
Loading Time
101.07 min
Overload Table
Wagon
RFID
Type
Tare
Gross
Net
Front
Rear
Open Slider Control
Manual
Open Constraint
Man Slider
50 mm
Gross Front
Front FB
Manual Operator Slider SP
Active Setpoints Overview
Volume SP
120.1 m3
Gross Weight SP (t)
74.0
146.5
Front
Total
Rear
200
150
Freeboard SP (mm)
Close Slider Control
Manual
Close Constraint
Man Slider
100 mm
Gross Wagon
Rear FB
Wagon Vol
Volume Override Activated
Ore Car Table
Track Chute Wagon
Off
On
Wagon No
RFID
Type
Mass Estimation
Gross
Net
Volume
Track Scales
Tare
Gross
Net
Front
Rear
Inloading
Yard
Outloading
Services
Utilities
Area: All
Ack
On Date
On Time
Name
Description
State
4/09/2023 11:55:38 ROM Bin 120 Flow Valve Valve Failed to Open ON
4/09/2023 12:13:58 BSR201 Fire Panel LCS Gas Inhibit Switch Alarm ON
4/09/2023 12:01:52 Train Trackscales BTL501 Wagon Gross Weight Hi Hi Alarm ON
4/09/2023 13:11:58 BDU120 Required but not running BDU120 Required but not running ON
4/09/2023 12:57:13 BDU401 Required but not running BDU401 Required but not running ON
4/09/2023 12:48:13 Train Loadout Wagon Load Alarm 62 ON
4/09/2023 12:46:40 Train Loadout Wagon Load Alarm 60 ON
BTL501 Train Loadout
BTL501 Train Loadout (TLO)
BR4.OUTLOADING.BTL501
Reset
Slider Control
Help
Open Slider
Close Slider
Active Pre-Slider
BBN502 Pause Bypass
Early Close
Cancel Early Close
Active SP
Mass O'load
Vol O'load
Active Trigger Dist.
1670 mm
Stop TLO
Start TLO
Clam
Chute
Strut
Train
Lights
Misc
Signal
Position
143.3
Open SP
Surge Timer
Clamshell Max Open
Trim
Failsafe Valve Inactive
PV
SP
ALARM
TREND
INTERLOCK
LOG
DETAILS
SETUP
4/09/2023 12:01:52 Train Trackscales BTL501 Wagon Gross Weight Hi Hi Alarm
4/09/2023 11:48:45 Train Loadout Wagon Load Alarm 1
4/09/2023 12:01:53 Train Loadout Wagon Load Alarm 18
4/09/2023 11:49:31 Train Loadout Wagon Load Alarm 2
4/09/2023 12:07:16 Train Loadout Wagon Load Alarm 25

Standard Governance

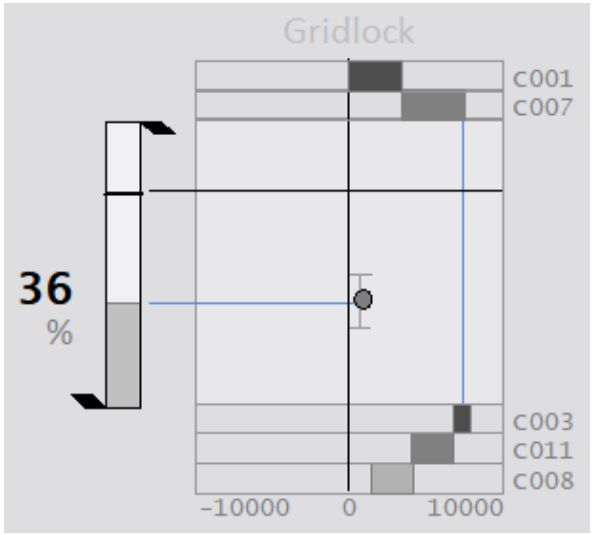
Rio Composites and Kernel projects have been internally developed and deployed across upgraded sites

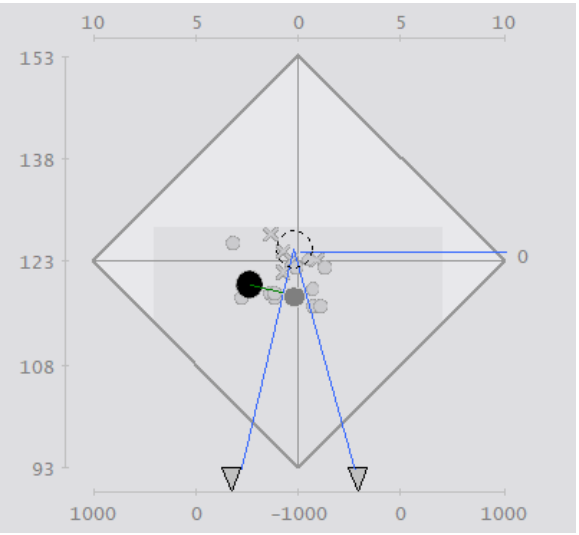
Aim:

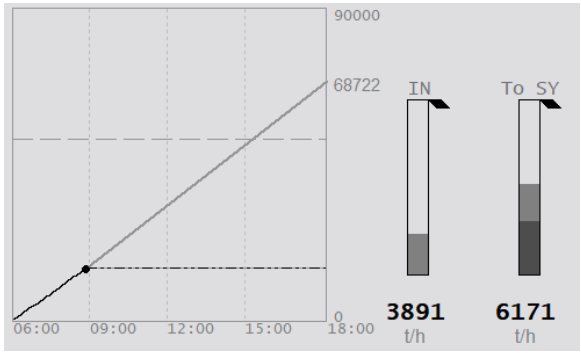
- All shapes and graphics developed are identical across every site
- Composite configuration and user interaction with equipment is standardised
- Improvements and fixes are carefully tested prior to deploying

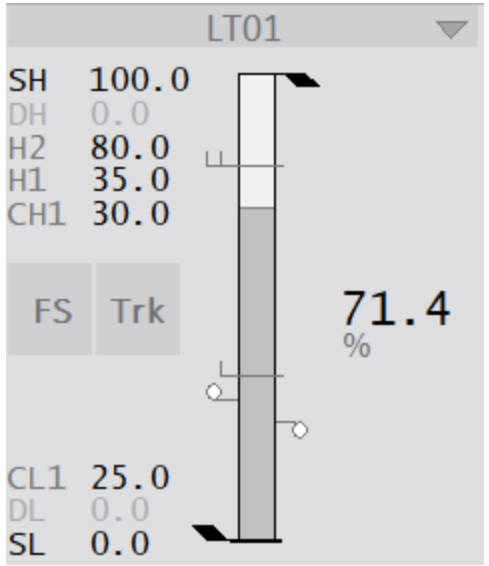
Why?

- Allows for improvements and fixes to be easily applied across sites
- Ensures all operations continue to adhere to the new standard
- Clear management of change process for updates and improvements
- Assists with ongoing consistent page layout and design

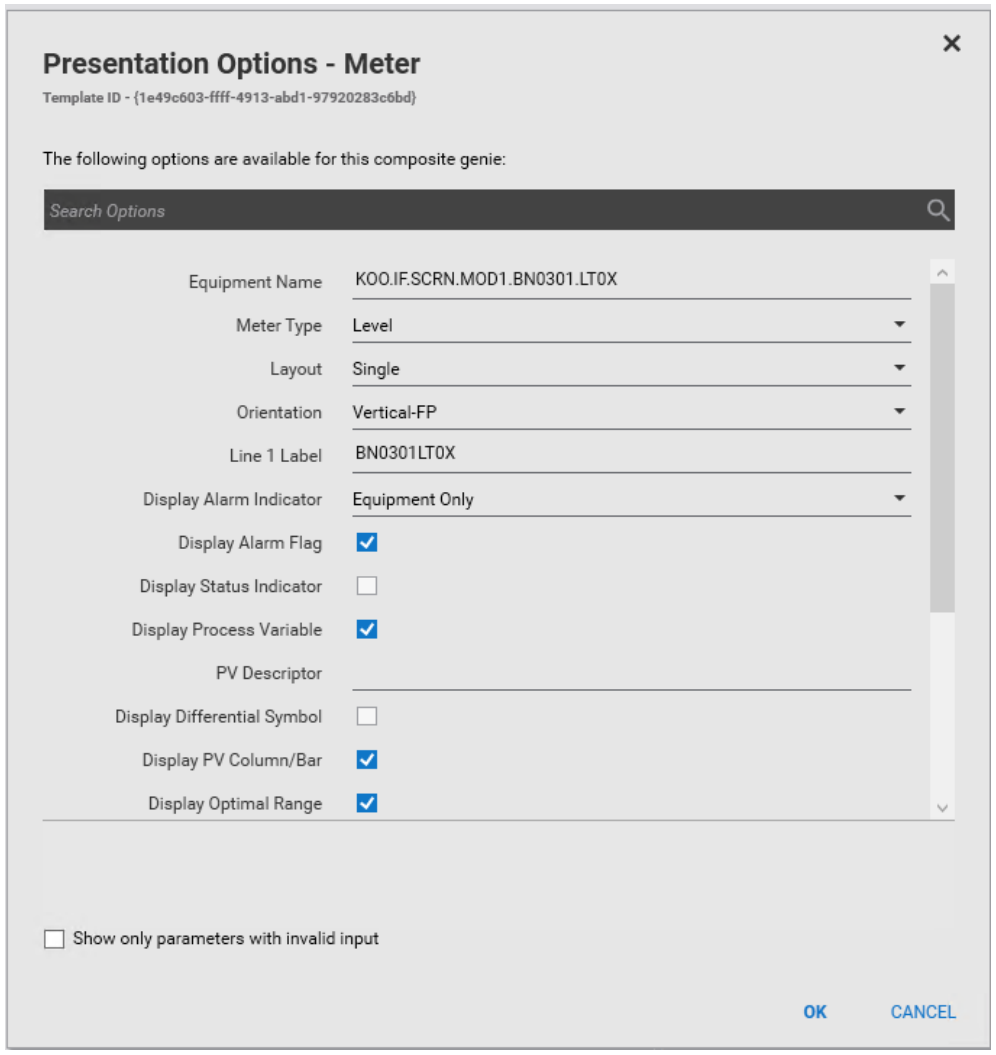


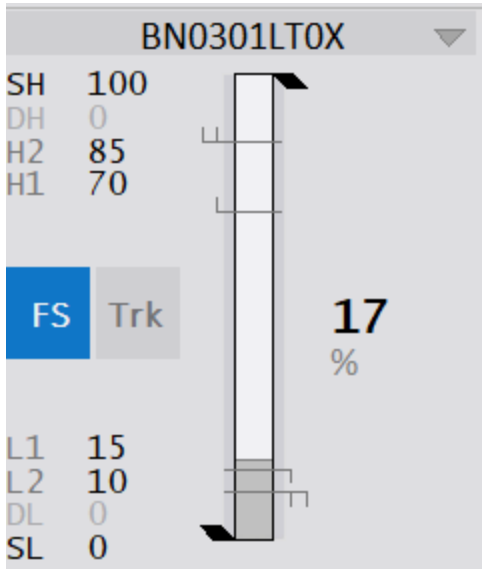






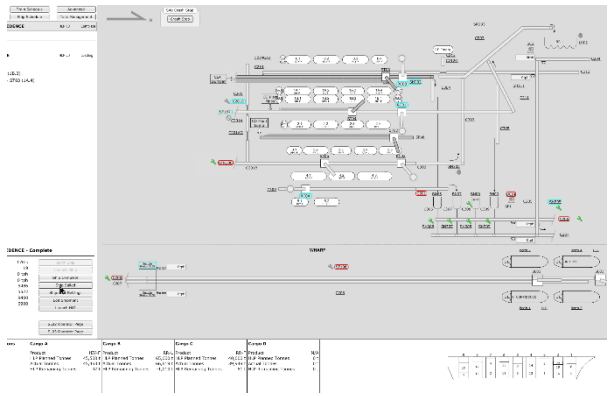
Composite Configuration



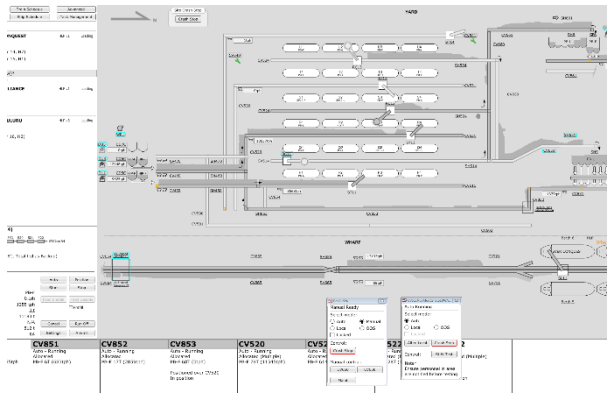


Port Controller Pages – Consistent Interface

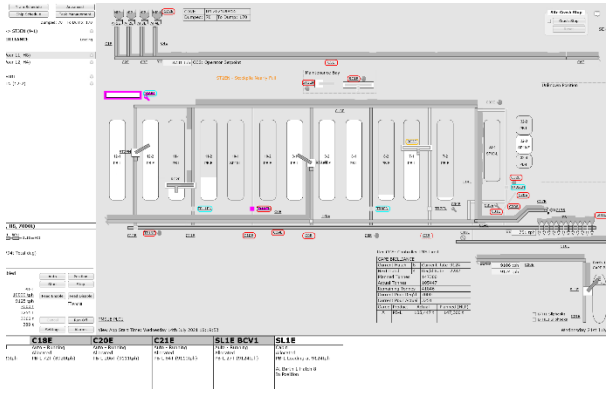
Cape Lambert A Outload

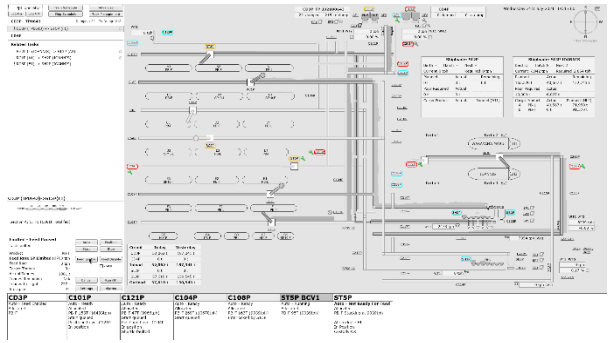


Cape Lambert B Outload

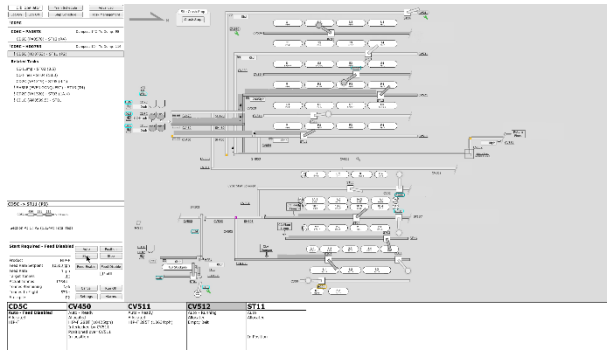


East Intercourse Island

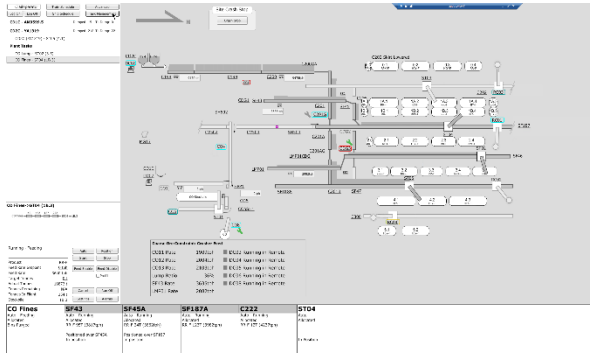




Parker Point



Cape Lambert B Inload



Cape Lambert A Inload

Lessons Learned

- Collaboration with AVEVA is essential
  - Getting support & raising product bugs or issues
  - Escalation of significant defects
  - Raising product feature requests
- Developing the Rio Composites library
  - Allowing for both new and legacy assets
  - Difficulty in modifying the library once deployed
  - Incorporating feedback to continuously improve the standard
  - Early stakeholder engagement
- Managing product updates for a 24/7 operation business
- Careful planning around major site upgrade works

Questions?

Please wait for the microphone.

State your name and company.

Please remember to…

Navigate to this session in the mobile app to complete the survey.

Thank you!

This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

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ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

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