



# Data-driven Decisions using Artificial Intelligence/Machine Learning

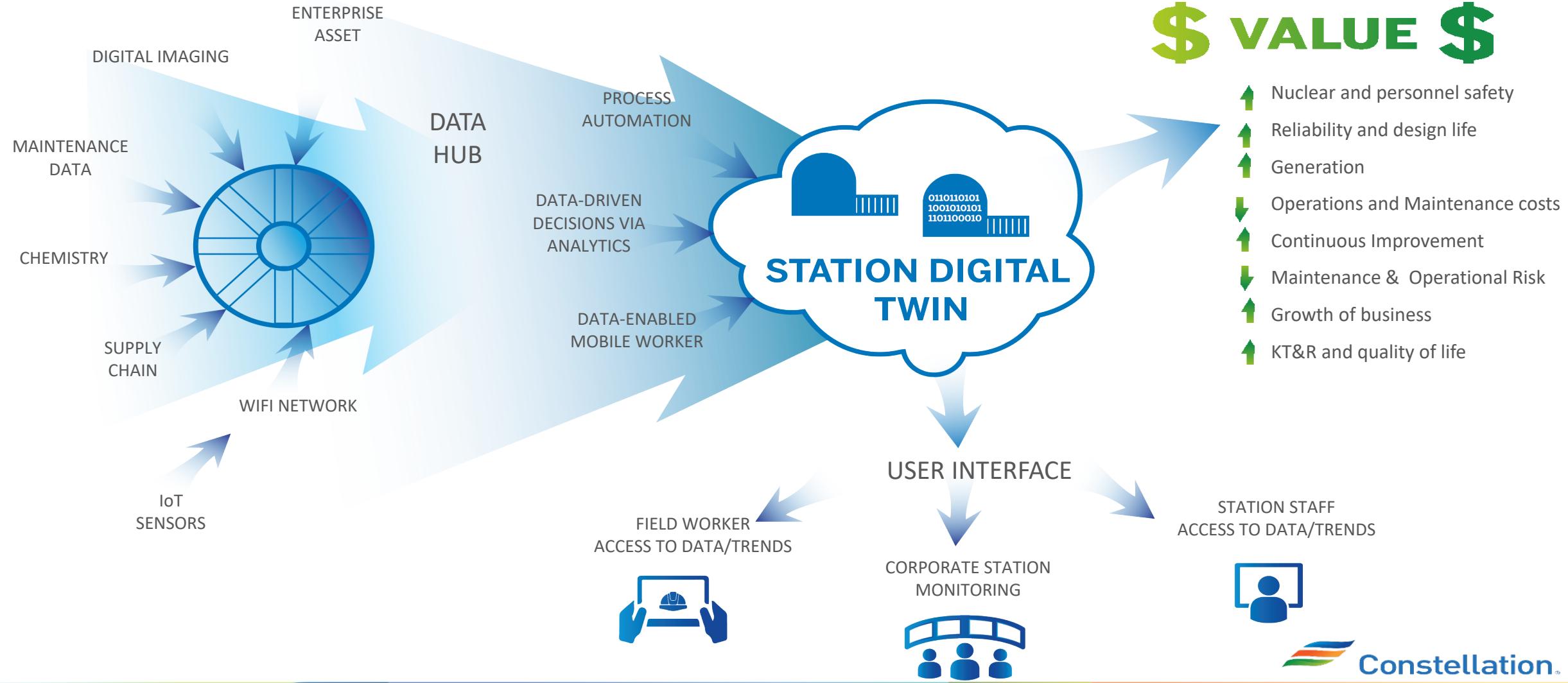
Regulatory Information Conference  
March 14, 2023

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# Vision for a Digital Generation Business

	<b>Automated Work Processes</b>	Streamlined workforce
	<b>Smart Processes</b>	Electronic procedures/work instructions
	<b>Decision making through analytics/AI</b>	Faster, more accurate decisions by right level
	<b>Field workers instant access to information</b>	No time wasted, improved HU
	<b>In-field training through virtual reality and video</b>	More wrench time
	<b>Predictive plant performance</b>	Zero transients/trips
	<b>Centralized information backbone</b>	Ability to leverage additional technologies
	<b>Innovative culture embedded</b>	Workers continuously improving

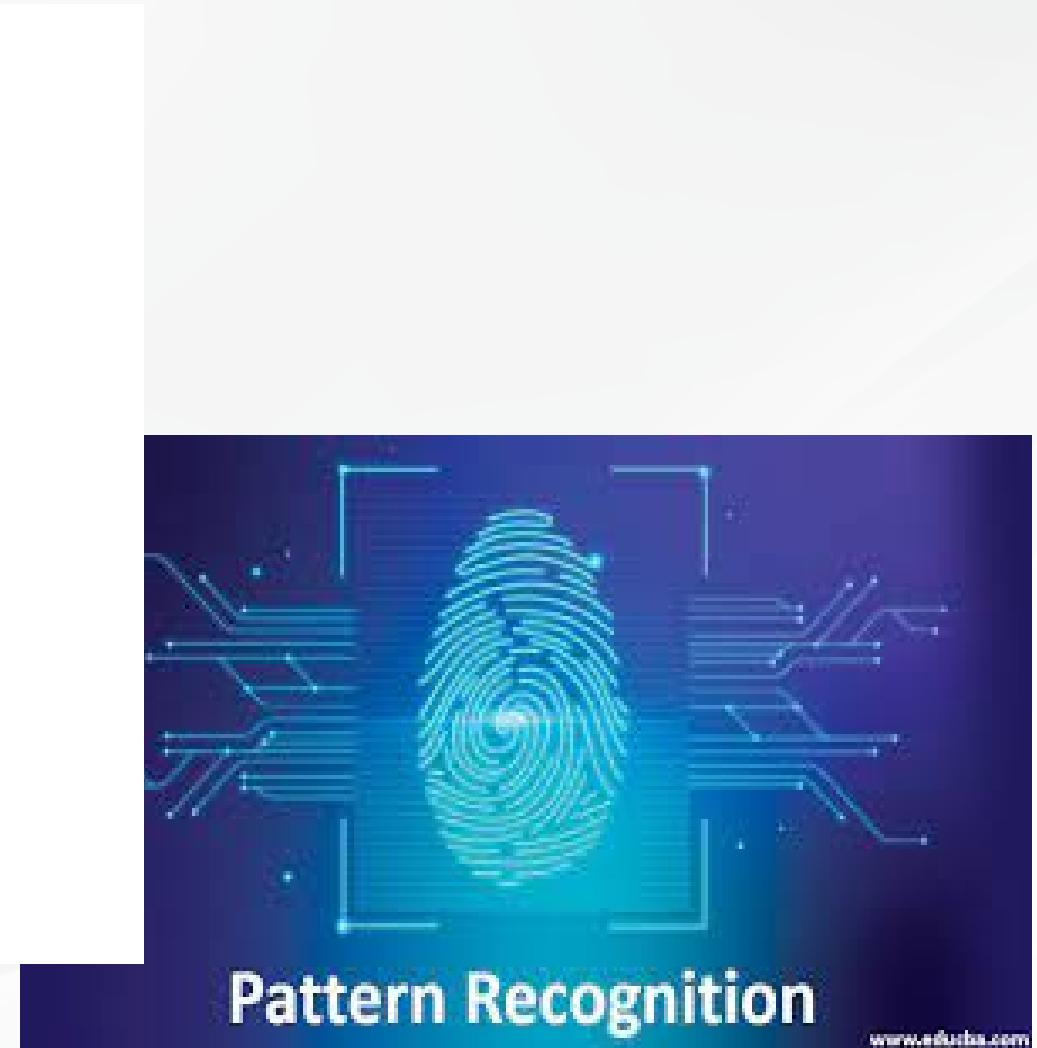
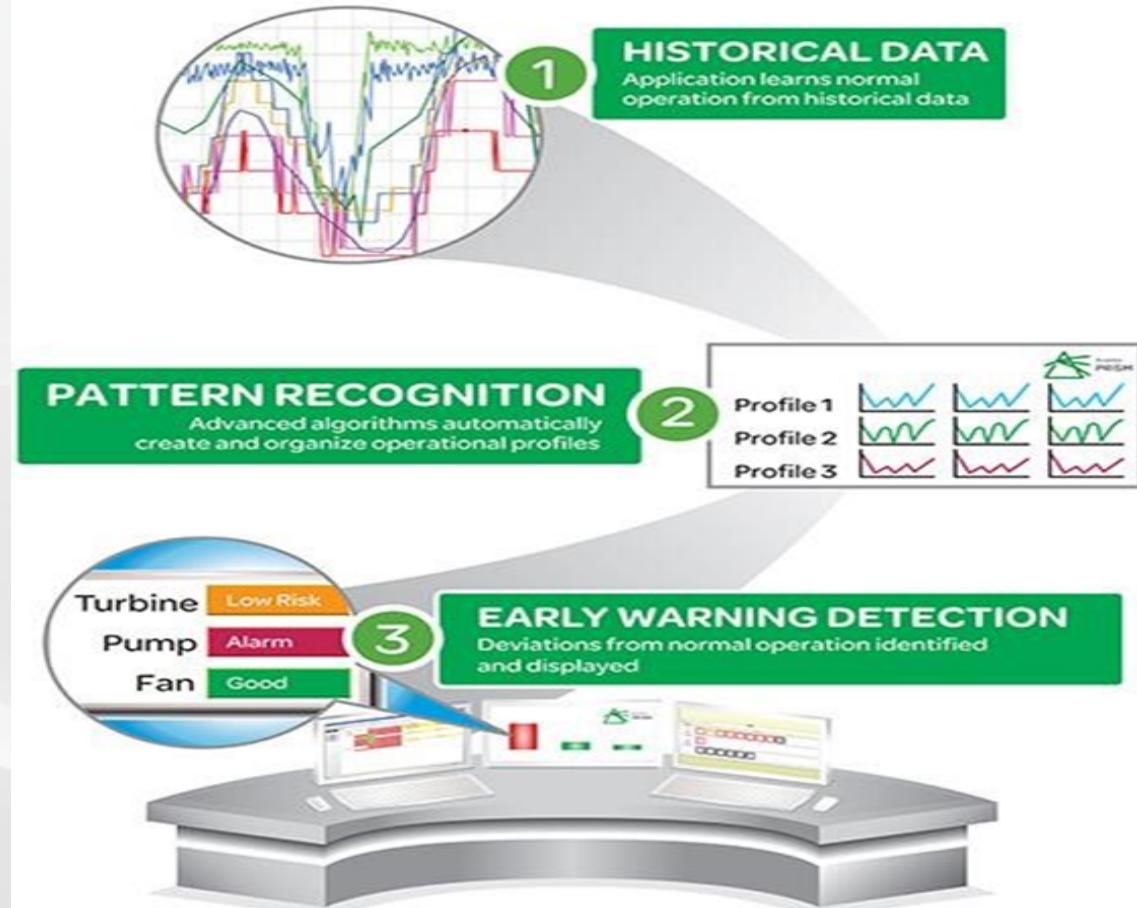
# CONSTELLATION NUCLEAR DIGITAL TRANSFORMATION



# Current Analytics Examples

- Advance Pattern Recognition (APR) – *averts equipment failures*
- Initial License Training analytic – *improves student pass rates*
- Maintenance Rule Functional Failure analytic – *streamlines categorization*
- New Work Screening analytic – *streamlines condition report screening*
- License Extension reviews – *automates data collection*
- Preventive Maintenance Optimization – *optimizes maintenance frequencies*
- Work Order optimization – *automates work order process*

# Equipment Reliability – Advanced Pattern Recognition to Avert Failure



# Initial License Training Student Performance

Constellation - DEV

HOME ACTIONS REPORTS HELP EDIT DASHBOARD

Exam Risks +

NO SAVED FILTERS

NO FILTERS APPLIED

Student Risks

Student	Max of Risk - Exam Cumulative Risk Score
Ashley Ken...	~1
Brady Nixon	~5
David Snyder	~1
Diane Johnson	~1
Franklin Marco	~1
James Suarez	~1
Janet Ballad	~1
Jeb Thompson	~10
Jim Williams	~1
Joan Carson	~2
Joseph Williams	~1
June Appleby	~1
Mary Owens	~3
Michael Stewart	~5
Peter Mars	~2
Phillip Cole	~15
Robert Fields	~3
Sarah Johnsdotter	~3
Spencer Rogers	~15
Steven Holmes	~3
Thomas Blanc	~1
Timothy Cane	~1
Tony Sheppard	~3
Washington Jasper	~5
Wayne Kauffmann	~3
Wendell Short	~2

Max of Risk - Exam Cumulative Risk Score

Gaps Grid

Search Gaps Syncs

Gap - ID	Gap - Gaptopic	Gap - Examid	Gap - NRC Reference	Gap - Score	Gap - Station Reference	Gap - Student ID	Gap - Type	Person - First Name	Person - Last Name
1	High Pressure Coolant Injection	355363	201001.A1.07	5	DRE203LN001	5	Current	Louis	Armstrong
2	Turbine Trip	355363	201001.A1.08	4	DRE262LN007	5	Current	Louis	Armstrong
3	Recirculating Pump Trips	355363	201001.A1.09	4	DRE262LN003	5	Predicted	Louis	Armstrong

# Maintenance Rule Functional Failure Analyzer

- In place successfully for two years
- The software is *not* making failure determinations ... it is pre-screening/flagging potential functional failure CR's for human review
- Biased towards high safety-significant component failures
- Equipment monitoring still occurs (i.e., human element backstopped)
- Confidence in results is gained through continuous feedback

# Issue Report Screening Analytic

Displays the “why”

- Summarize data for user review
- Provide users detailed insights into how the predictions were made
- Indicate potentially similar IRs to the one being reviewed
- Orange means over the threshold for review; blue wouldn't trigger the need for a review

DataAdvisr

Home Analysis Results Admin ▾ Logout

Select Model ▾

### IR 48 - CAQ

Flagged for Review: Yes

DataAdvisr has identified this IR as a potential Significant Condition Adverse to Quality.

Last Processed On: 6-Sep-2022

Location: Plant BWR1 | Unit: 2

Metrics Exceeded ?

1. At least one text field was highly indicative of the identified class.  
2. The majority of text fields were more indicative of the identified class.  
3. The combination of binary, numeric, and textual data had a high confidence.

Binary Field Triggers ?

### Highlighted Text Fields ?

Subject

trip of 2B / 2C Circ Water Pumps

IR Body

At 05:15, the 2B Circ Water Pump tripped along with the 2C Circ Water Pump. Reactor power was immediately reduced by Reactor Operator due to condenser vacuum issues. Investigation of breaker shows no flags.

Body

Immediate Actions Taken

Recommended Actions

Operable Basis

Reportable Basis

Functional Basis

### Confidence Values ?

Metric	Value
Max Confidence	84
All Text Confidence	69
Subject Confidence	71
Body Confidence	68
Imm. Act. Taken Confidence	82
Rec. Actions Confidence	84
Operable Basis Confidence	50
Reportable Basis Confidence	50
Functional Basis Confidence	50
Reviewer Comments Confidence	50
Median Confidence	71
Network Confidence	99

### Phrases ?

Phrases Indicative that IR is CAQ ?

1. trip (8.55e-3)
2. water (3.94e-3)
3. pumps (4.05e-4)
4. shows no (3.79e-4)
5. water pump (3.71e-4)
6. circulation water (1.62e-4)
7. reactor power (1.48e-4)
8. pump tripped (1.09e-4)
9. circulation water pump (1.04e-4)
10. condenser vacuum (8.70e-5)

Phrases Indicative that IR is NOT CAQ ?

1. water (5.52e-3)
2. trip (1.29e-3)
3. shows no (5.39e-4)
4. water pump (3.50e-4)
5. pumps (2.99e-4)
6. circulation water (2.15e-4)
7. circulation water pump (1.21e-4)
8. circ (6.01e-5)

# Future Analytics

- **Predictive analytics** – *Work Order generation*
- **Corrective Action Program** – *Predictive trending to avert operational challenges*
- **Advanced equipment performance analytics** – *avert equipment failure and operational risk*
- **Outage schedule predictions** – *improve outage schedule adherence*
- **No intent to apply artificial intelligence to control the plant**

# Summary

- **Constellation continues to explore and deploy artificial intelligence (AI) that can improve or streamline business processes and data-driven decision-making**
- **Constellation considers AI to be useful as a decision support tool, not as a replacement for human judgment**
- **Constellation AI applications are designed to keep subject matter experts fully engaged in the decision-making process**
- **Current projects are giving Constellation experience with AI to inform future decisions on the potential value of AI in other areas**