

ExactSpace

AI for Safe & Reliable Power

Assets

Digital solutions for improved Performance and Reliability of Power Plant Fleets & Switchyards



- 1 Introduction (5 minutes)
- 2 ExactSpace and Pulse Overview (25 minutes)

3

- Demo (1 hour)
- 4 Case Studies (15 minutes)
- 5 Q&A (15 minutes)

How it began – Turbine Failure Prediction

Helped avoid 4 days downtime of a 60 MW Turbine by predicting failure



Discovering the Unknown

- Early prediction of issue
- Diagnosis was not part of OEM Fault Diagnostics manual



High level of correlation and causality of Vibration with LP Heater level

ExactSpace – Introduction



With *Pulse*, your assets will reach out to you with specific insights when they need your attention.

We leverage advanced AI technologies and a wealth of available data to help run the industrial world with **ZERO unplanned downtime**, **highest possible performance** and **utmost safety**.



Reduced Downtime and Maintenance Costs

PLANT BENEFITS



Improved Asset Performance



ExactSpace

Maintenance Workforce Empowerment

Team – where Power and AI meet



Boben Anto Co-founder, Technical (30 years – ED STEAG, COO Uniper, NTPC)



Arun Jose Co-founder, Technology and AI (13 years – Analytics Product Head at Altiux)



Rahul Raghunathan

Co-founder, Business and Strategy (12 years – Analytics and Sales Leadership at Target, Altiux)



Dilleep Chandran

Director, Sales and Commercial (25 years – Technical expertise in Gas Turbine NTPC; Sales Leadership GE, Schneider)

Team Size

16

Team Structure

- Mechanical Engg Post Graduates
- Data Science Post Graduates
- Experienced Big Data Engineers

Global names that trust ExactSpace



- Global Industrial automation supplier
- Enabling predictive maintenance at their **Power and Steel customers**



- Power Gen OEM 55% of India Power capacity
- Enabling their LTSA business



ADITYA BIRLA GROUP

- \$40 Bn Industrial Group
- Operate **40+ captive** plants
- Enabling **Fleet reliability** and monitoring



- Largest **Real-time optimization** provider in Australia region
- Providing AI capability for their Combined cycle and Coal Power customers

Recognized and Funded by Government as High Impact Startup in Energy



Challenges of deploying AI in Power



ExactSpace

pulse - Our Industrial AI Engine



Distributed architecture with streaming analytics capability

Semantic Reasoning + Asset Library



2 Knowledge Base – Learning from the past

- An evolving document store of all Asset and Plant specific information
- Used by the higher level AI models to 'learn' and 'develop' deep knowledge of a specific asset



Design Data – This is critical information that helps map the Asset model to expected functionality of an asset

> **Process Flow** – This is specifically useful to understand the physical connectedness of various assets within a system





Maintenance Records – Knowledge of the existing maintenance process, history of issues/breakdowns and expert comments

Historic Data – This is the most critical piece of information used by the machine learning models to understand and benchmark an asset's performance



Learn about individual assets

Two assets designed with identical specifications still have their own individual characteristics. A thermodynamics-only approach cannot handle this variance accurately.





3 Video Analytics – Rotary Equipment

We augment sensor data with periodic analysis of **video+audio** grabs of rotary equipment to discover issues and avoid major damages.







ExactSpace



4 User Applications

Designed for a Fleet

Monitor and enhance performance of a fleet of plants with a single web application

Leverage Experts remotely

Enable remote experts and field teams to collaboratively resolve issues quickly



Full suite of Digital Applications

Move beyond Thermodynamic solutions. Empower customers with new-age digital solutions: *** Failure prediction * Diagnostics * DIY Modeling * Spares Management**





Why ExactSpace

Designed for Fleet of Plants Pre-built Asset Models will deliver value from day 1



80

New Revenues, Lower Costs Generate new 'Digital' revenue; Cut cost of service delivery to customers

AI + Thermodynamics Use a single platform for all monitoring and analytic needs





User-friendly Your engineers can add analytics modules as per their needs



Questions

Thank You!

Reach out to us for more details and solution demo.

Boben Anto Chemmannoor Rahul Raghunathan | Co-founder rahul@exactspace.co boben@exactspace.co +91 99165 23232 +91 9051219801



Case Studies

i. Unsupervised learning for Failure prediction and RCA ii. Boiler Tube leak detection



Machine learning to identify root cause in Steel Mill failures

Predicting failures in Steel plant

Customer Background:

- 1 million tons per annum Integrated Steel Plant
- 'Cobble' events lead to ~12% of productivity loss each month

Objective:

- Accelerate root cause analysis using machine learning
- Utilize past data and experience to predict and prevent cobbles

Challenges

- Multiple sources of information High dimensionality
- Discrete nature of process Time sequencing events
- High frequency Millisecond resolution
- Dynamic system Change is constant, heuristics break down

Data studied	180 sources of data across 18 locations
Data points	~ 4.5 billion data points per month
Cobble events (Failures)	48
Average downtime per cobble	106 minutes
Total downtime in 1 month	11.36% (81.8/720 hours)

Prediction of Failure



Prediction of Failure





Boiler stress evolution before Boiler Tube Leak

Boiler Stress evolution

Customer Background:

Coal-based 180 MW Power plant

Issue:

Frequent boiler tube leaks

- Unable to detect the onset of tube leak early enough to control the damage
- Cyclic (flexible) operations makes detection of signals more challenging
- Demand for Plant availability makes taking preventive shutdowns difficult

Steam profile changes

Analytics and Outcome:

- Studied patterns of data and changes in relationships between various tags
- Comparison of steam profile in a 15 days period leading upto a tube leak
- Able to detect minor changes in boiler operations close to 8 days before actual tube leak incident and observe the progression of the issue



Feedwater profile change



8 days before Tube Leak

Flue Gas profile changes

AAIN STEAM FLOW



8 days before Tube Leak

These are early indicators of an upcoming leak event.

Progression of issue



Gradual change in model relationship from 8 days before a Tube Leak indicating significant change in Flue Gas profile as a possible early indicator.

Outcome

The solution

- Real-time Pattern Recognition and relationship co-relation helps monitor asset stress
- Solution inherently tuned for flexible operations and compares with best known historic operations
- Relationship changes between multiple tags and predictive models help accurately detect component level degradation

Outcome

- Providing a predictive score (probability index) helps plant modify operations to reduce stress on boiler or plan well for an unavoidable shutdown
- Real-time monitoring also enables operations at peak performance