



Smart Ports: Innovating with Digital Twins & IOT

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Declining productivity requires a new approach




Industrial Productivity had been in Decline



Drivers for Industrial Productivity



Digital leaders own asset productivity

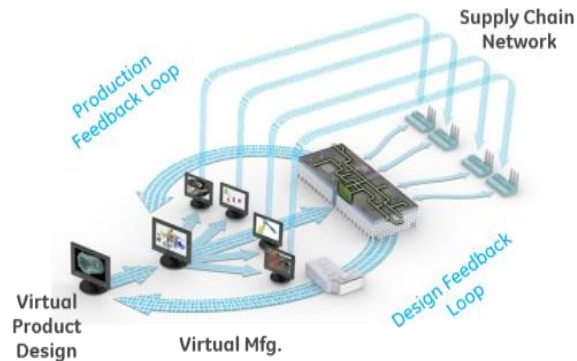
	Owns no real-estate
	Creates a few apps
	Owns no vehicles

Success Defined

- Assets are significantly more efficient
- Create a compelling user experience
- Develops a robust ecosystem
- The software is a vehicle for value creation

GE: Digital Industrial Blueprint

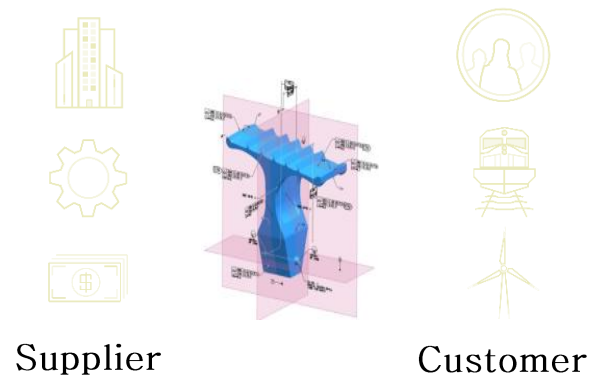
GE for GE



Productivity

- Digital thread
- Predix + data
- Digital twin
- Services Transformation

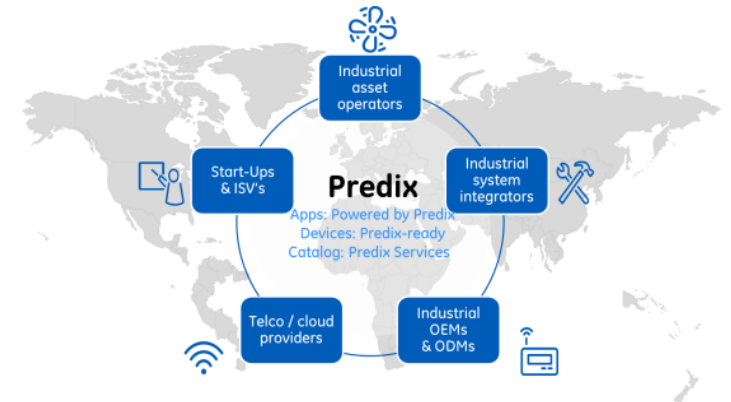
GE for Customers



Apps

- Outcomes for customers
- Optimize GE machines
- Industrial apps portfolio

GE for World



Platform

- Enable industrial companies
- Predix industrial operating system
- Industrial-focused security



Asset Performance Management



Some causes of unplanned downtime and excessive maintenance



Data isn't easily accessible and isn't proactively analyzed



Reactive or Break-Fix maintenance culture



Operations Maintenance, and Engineering often working in silos



Organizational Knowledge loss due to aging / departing workforce



GE Digital APM Solution

Increase asset reliability and availability while reducing cost and risk in operations



Reliability Management

Less unplanned downtime by predicting equipment issues before they occur.

- Predictive analytics
- Case and collaboration management
- Knowledge management
- Root cause analysis
- Reliability analysis



Compliance and Integrity Management

Ensure asset integrity by analyzing changing risk conditions and regulations.

- Risk based inspection management
- Safety lifecycle management
- Hazard analysis
- Inspection management
- Thickness monitoring



Asset Strategy Optimization

Optimize across availability, reliability, risk, and costs through intelligent asset strategies.

- Reliability centered maintenance/failure mode effects analysis
- Lifecycle cost analysis
- Asset strategy management
- Financially optimized asset strategy



Machine and Equipment Health

Anytime, anywhere, unified view of your assets' current state, and health.

- Connectivity
- Condition monitoring
- Event management
- Data management
- Data analysis & visualization
- Recommendation management









Customers will have access to APM Content Catalog (Ex. Blueprints, regulations, etc.)

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Condition-Based Maintenance

- **Nearly 90%** of failures are independent of time
- Excess maintenance wastes money and can increase the chance of equipment failure

Source: Enterprise Reliability: Changing the Game
Authors: Robert DiStefano Management Resource Group
Larry Covino (GE)

Table 2 – Modern View of Asset Wear		
Description	Graphical Representation	% of Assets
A. Traditional View Random failure, then wear out zone		2%
B. Bathtub Curve High infant mortality, then a low level of random failure, then a wear out zone		4%
C. Slow Aging Steady increase in the probability of failure		5%
D. Best New Sharp increase in the probability of failure, then random failure		7%
E. Constant Random Failure Truly random with no age-related failure pattern		14%
F. Worst New High infant mortality and then random failure		68%
		11% (primarily time-based wear)
		89% (primarily random wear)

Staying Ahead of the Game

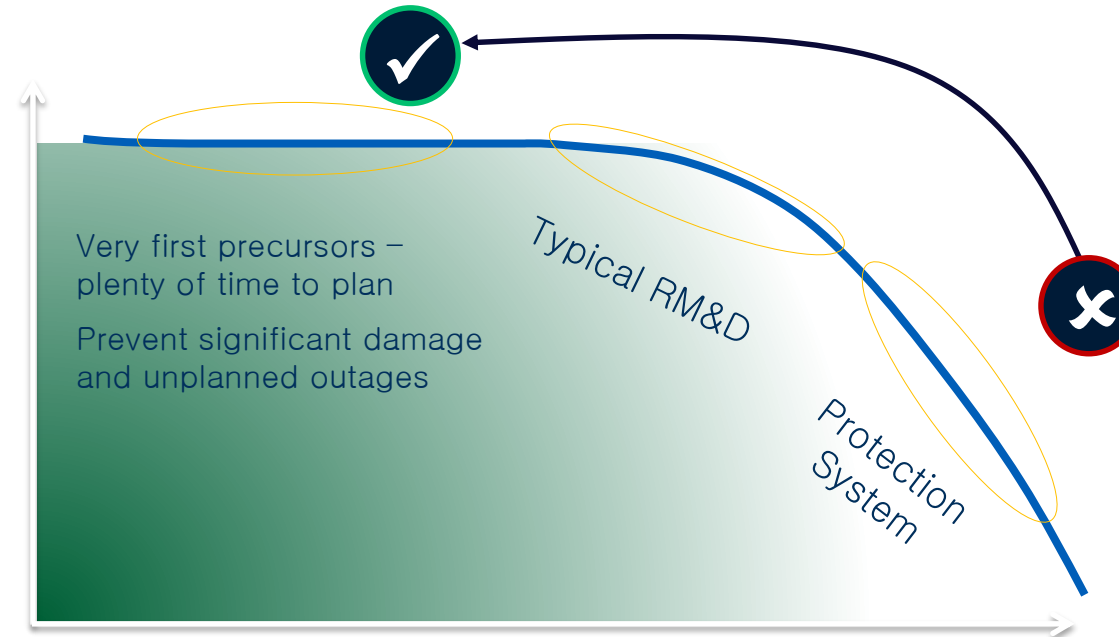
Customer Pain Point

- Reactive Scramble
- Unplanned downtime
- Cost of major repairs and throughput loss

Reliability Management

- Anticipate machine failure
- Minimize damage and unplanned outages
- Replace unplanned downtime with planned outages

PF Curve – Time to Prevent and Plan

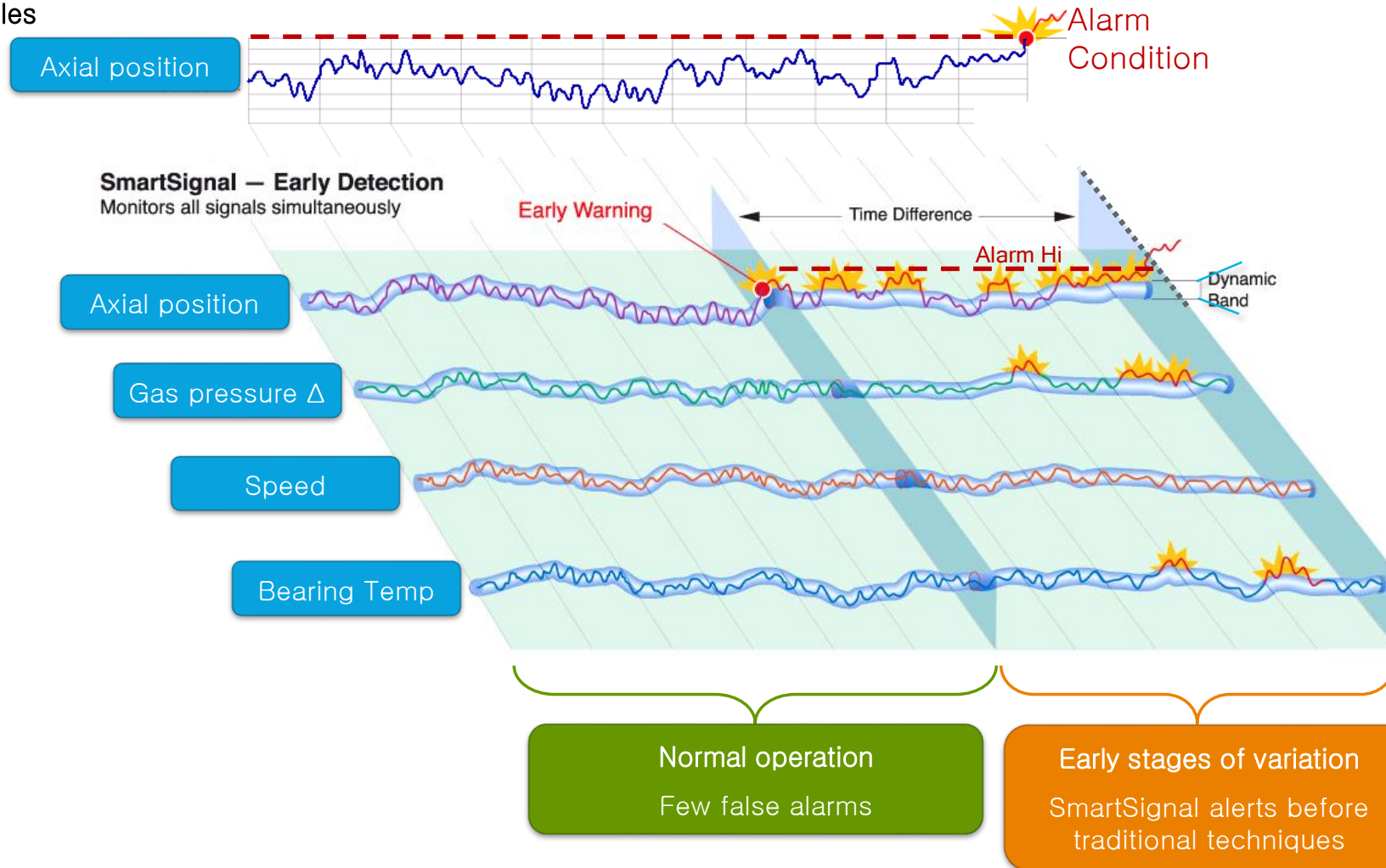


Easily observed effects. Failure might already be in progress.
More damage, higher O&M, more downtime

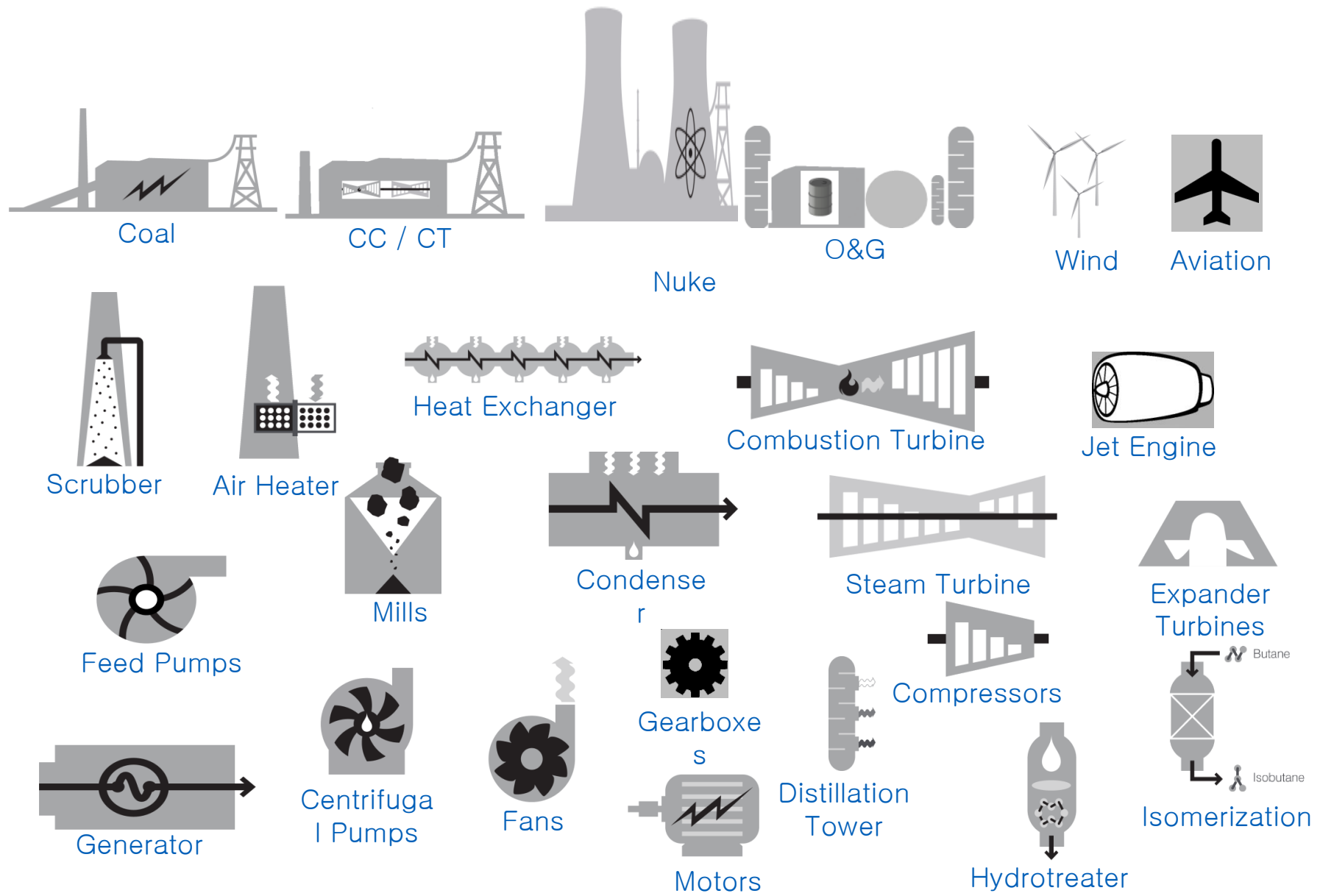


This means earlier detection, and fewer false alarms

Single-sensor analysis or equation based models using traditional thresholds & rules



Some of Assets we manage.. GE & non-GE



APM Digital Twin models cover over 125 Asset Classes



Example IPRC “Catch of the Week”



Detection of increased fan bearing temperature on a combustion fan at a steel plant saves nearly 72 hours of downtime and ~ \$864,000*

What did GE Digital’ s software find?

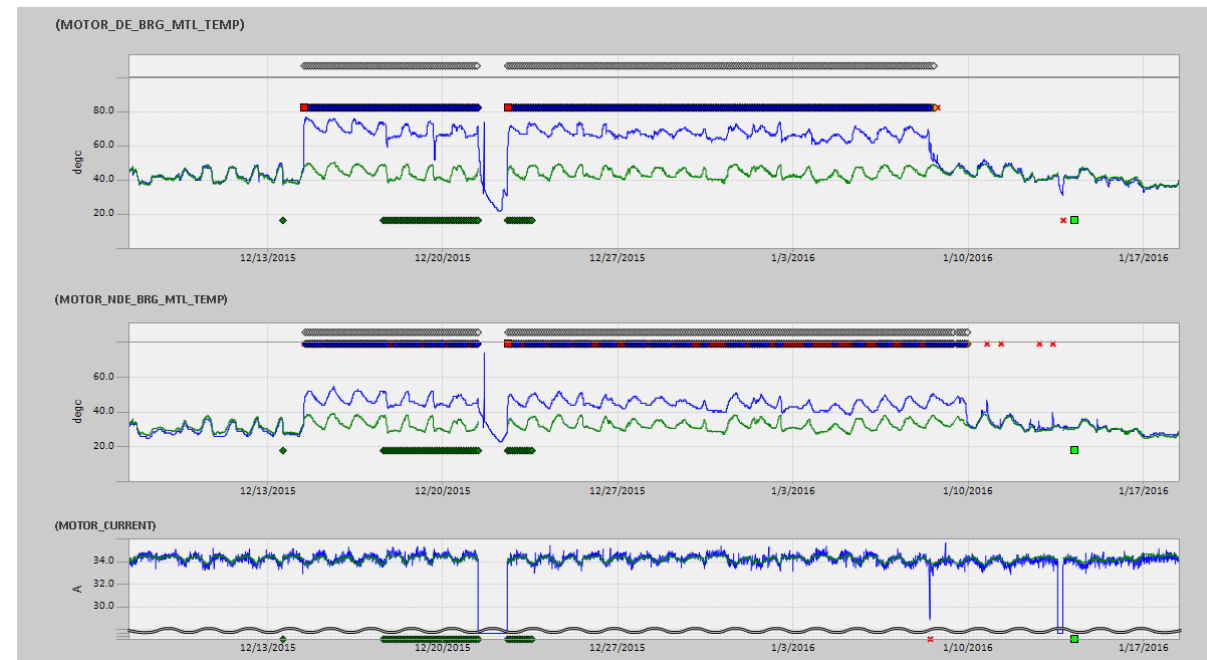
In January, GE’s Asset Performance Management detected an increase in fan bearing temperatures on a furnace combustion fan at a steel steckel mill. The fan drive end bearing temperature increased up to 85°C (185°F) and the fan non-drive end bearing temperature increased up to 94°C (201°F). GE’s Industrial Performance & Reliability Center (IPRC) sent a notification to the customer through the Rapid Response process for further discussion with the customer on the weekly call.

What was the underlying cause?

After the alert from the IPRC, the customer discovered that the fan bearings were being over-greased.

What was the value to the customer?

Due to the early notification from the IPRC, the customer was able to correct the bearing lubrication issue and avoid a fan bearing failure. This failure would have required 72 hours of non-scheduled maintenance to repair and would have cost approximately \$864,000* in lost production. The customer’s engineering team also performed further analysis and recommended the use of an automatic lubrication system to prevent this problem in the future. *Avoided costs are based on an assumed \$12,000/hr. North American average production value.



Subscribe @ <http://www.geautomation.com/catch-of-the-week>



