

# GE Global Research

## Stifel 2015 Industrials Conference



Mark Little  
June 16, 2015

### Forward-Looking Statements:

This document contains "forward-looking statements" – that is, statements related to future, not past, events. In this context, forward-looking statements often address our expected future business and financial performance and financial condition, and often contain words such as "expect," "anticipate," "intend," "plan," "believe," "seek," "see," "will," "would," or "target." Forward-looking statements by their nature address matters that are, to different degrees, uncertain, such as statements about our announced plan to reduce the size of our financial services businesses, including expected cash and non-cash charges associated with this plan; expected income; earnings per share; revenues; organic growth; margins; cost structure; restructuring charges; cash flows; return on capital; capital expenditures, capital allocation or capital structure; dividends; and the split between Industrial and GE Capital earnings. For us, particular uncertainties that could cause our actual results to be materially different than those expressed in our forward-looking statements include: obtaining (or the timing of obtaining) any required regulatory reviews or approvals or any other consents or approvals associated with our announced plan to reduce the size of our financial services businesses; our ability to complete incremental asset sales as part of this plan in a timely manner (or at all) and at the prices we have assumed; changes in law, economic and financial conditions, including interest and exchange rate volatility, commodity and equity prices and the value of financial assets, including the impact of these conditions on our ability to sell or the value of incremental assets to be sold as part of this plan as well as other aspects of this plan; the impact of conditions in the financial and credit markets on the availability and cost of GECC's funding, and GECC's exposure to counterparties; the impact of conditions in the housing market and unemployment rates on the level of commercial and consumer credit defaults; pending and future mortgage loan repurchase claims and other litigation claims in connection with WMC, which may affect our estimates of liability, including possible loss estimates; our ability to maintain our current credit rating and the impact on our funding costs and competitive position if we do not do so; the adequacy of our cash flows and earnings and other conditions which may affect our ability to pay our quarterly dividend at the planned level or to repurchase shares at planned levels; GECC's ability to pay dividends to GE at the planned level, which may be affected by GECC's cash flows and earnings, financial services regulation and oversight, and other factors; our ability to convert pre-order commitments/wins into orders; the price we realize on orders since commitments/wins are stated at list prices; customer actions or developments such as early aircraft retirements or reduced energy demand and other factors that may affect the level of demand and financial performance of the major industries and customers we serve; the effectiveness of our risk management framework; the impact of regulation and regulatory, investigative and legal proceedings and legal compliance risks, including the impact of financial services regulation and litigation; adverse market conditions, timing of and ability to obtain required bank regulatory approvals, or other factors relating to us or Synchrony Financial that could prevent us from completing the Synchrony Financial split-off as planned; our capital allocation plans, as such plans may change including with respect to the timing and size of share repurchases, acquisitions, joint ventures, dispositions and other strategic actions; our success in completing, including obtaining regulatory approvals and the specifics of any approvals for announced transactions, such as the proposed transactions and alliances with Alstom, Appliances and Real Estate, and our ability to realize anticipated earnings and savings; our success in integrating acquired businesses and operating joint ventures; the impact of potential information technology or data security breaches; and the other factors that are described in "Risk Factors" in our Annual Report on Form 10-K for the year ended December 31, 2014. These or other uncertainties may cause our actual future results to be materially different than those expressed in our forward-looking statements. We do not undertake to update our forward-looking statements.

This document includes certain forward-looking projected financial information that is based on current estimates and forecasts. Actual results could differ materially.

This document also contains non-GAAP financial information. Management uses this information in its internal analysis of results and believes that this information may be informative to investors in gauging the quality of our financial performance, identifying trends in our results and providing meaningful period-to-period comparisons. For a reconciliation of non-GAAP measures presented in this document, see the accompanying supplemental information posted to the investor relations section of our website at [www.ge.com](http://www.ge.com).

In this document, "GE" refers to the Industrial businesses of the Company including GECC on an equity basis. GE Capital or GECC refers to the financial services businesses of the company. "GE (ex-GECC)" and/or "Industrial" refer to GE excluding Financial Services."

GE's Investor Relations website at [www.ge.com/investor](http://www.ge.com/investor) and our corporate blog at [www.gereports.com](http://www.gereports.com), as well as GE's Facebook page and Twitter accounts, contain a significant amount of information about GE, including financial and other information for investors. GE encourages investors to visit these websites from time to time, as information is updated and new information is posted.

**Imagination at work.**

# GE businesses



**Spending = \$5+B/year**



# GE Global Research

## THE TECHNOLOGY DEVELOPMENT ARM FOR GE

- First U.S. industrial lab
- Market-focused R&D
- One of the world's most diversified industrial research organizations
- Leading a team of ~50K world-class engineers

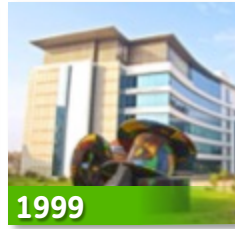




# GLOBAL RESEARCH NETWORK ... ALWAYS ON



**1900**  
Global Research Headquarters  
Niskayuna, NY



**1999**  
Welch Technology Center  
Bangalore, India



**2000**  
China Technology Center  
Shanghai, China  
**+ 3 Customer Innovation Centers**



**2004**  
Global Research Europe  
Munich, Germany  
**2X Size + Customer Innovation Center**



**2009**  
Advanced Manufacturing and Software Technology Center  
Detroit, MI



**2010**  
Brazil Technology Center, Customer focused R&D  
Rio de Janeiro, Brazil



**2011**  
Software CoE  
San Ramon, CA



**2012**  
Israel Technology Center  
Tirat Carmel, Israel



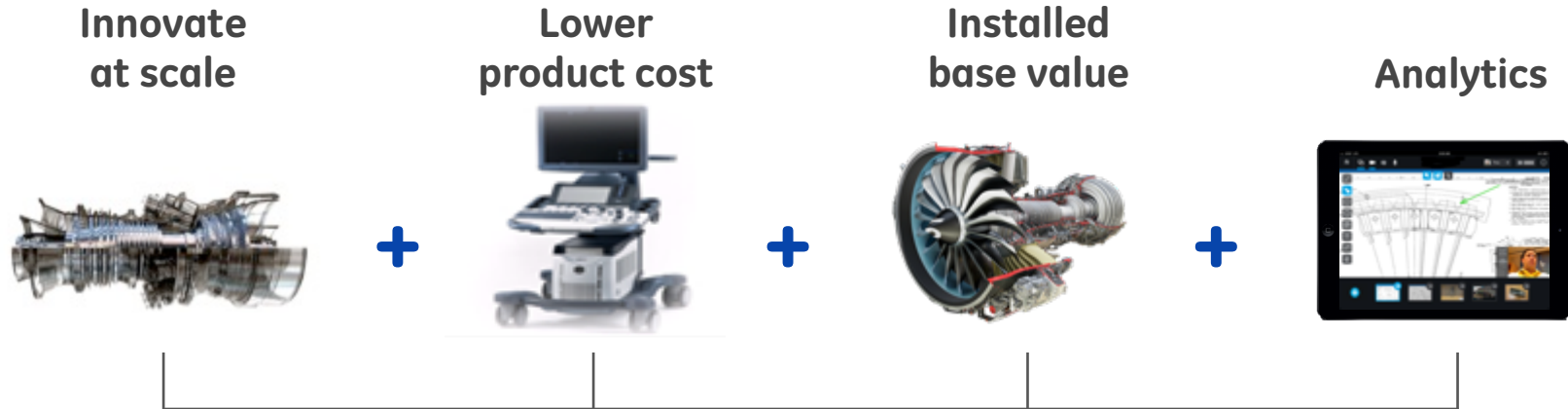
**2013**  
O&G Tech Center  
Oklahoma City, OK





# Win with Technology

## Business model



### Gain share

- LEAP ... 79%<sup>(a)</sup> share, +15% efficiency
- H-turbine ... world's largest & most efficient gas turbine; 15 in backlog + 30 technical selections
- Tier 4 ... 1,355 locos ordered in '14<sup>(b)</sup>; only qualified product

### Improve margins

- Advanced manufacturing ... CMCs, 3D, service value
- Design & testing ... Greenville test stand
- Vertical integration ... ↑ GE content, ↓ sole source
- Brilliant Factory

### Grow services

- ↑ \$/IB ... targeting growth of 3-5%/year
- Predictivity™ revenue of \$1.4B in '14
- Increasing global presence & value in the aged fleet
- '14 Services Op profit ~32%

## How Technology wins ... GE Advantage



(a- 79% market share to date: 55% on A320neo & 100% for 737MAX;  
LEAP is a trademark of CFM International a 50/50 JV between GE & SNECMA.

(b- Tier 4 compliant orders

# The GE Store for Technology

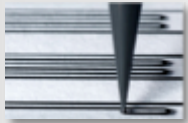


**DRIVING TECHNOLOGY ADVANTAGE ACROSS OUR BUSINESSES**

# GRC role in GE Store

## Invest in foundation

### Advanced manufacturing



### Controls



- ✓ Materials
- ✓ Combustion
- ✓ High-performance computing
- ✓ Thermo systems

## Spread ideas

### CMC



### Inspection



- ✓ Additive manufacturing
- ✓ Repairs
- ✓ Design tools
- ✓ Aerodynamics

## Value in acquisitions

### Oil & Gas



### Life Sciences



### Power Conversion



- ✓ Systems thinking
- ✓ Bio-inspired materials
- ✓ Electrification

## Nurture innovation

- ✓ Solid oxide fuel cell
- ✓ Silicon carbide
- ✓ Cell therapy
- ✓ Brain imaging
- ✓ Robotics/AI
- ✓ Multi-phase flow meter

## Digital at scale

### Software COE



- ✓ Analytics
- ✓ Big data
- ✓ Physical + Digital

## Develop engineering community

~50K



Engineers

- ✓ Best practices
- ✓ Tools
- ✓ Careers
- ✓ Leadership development



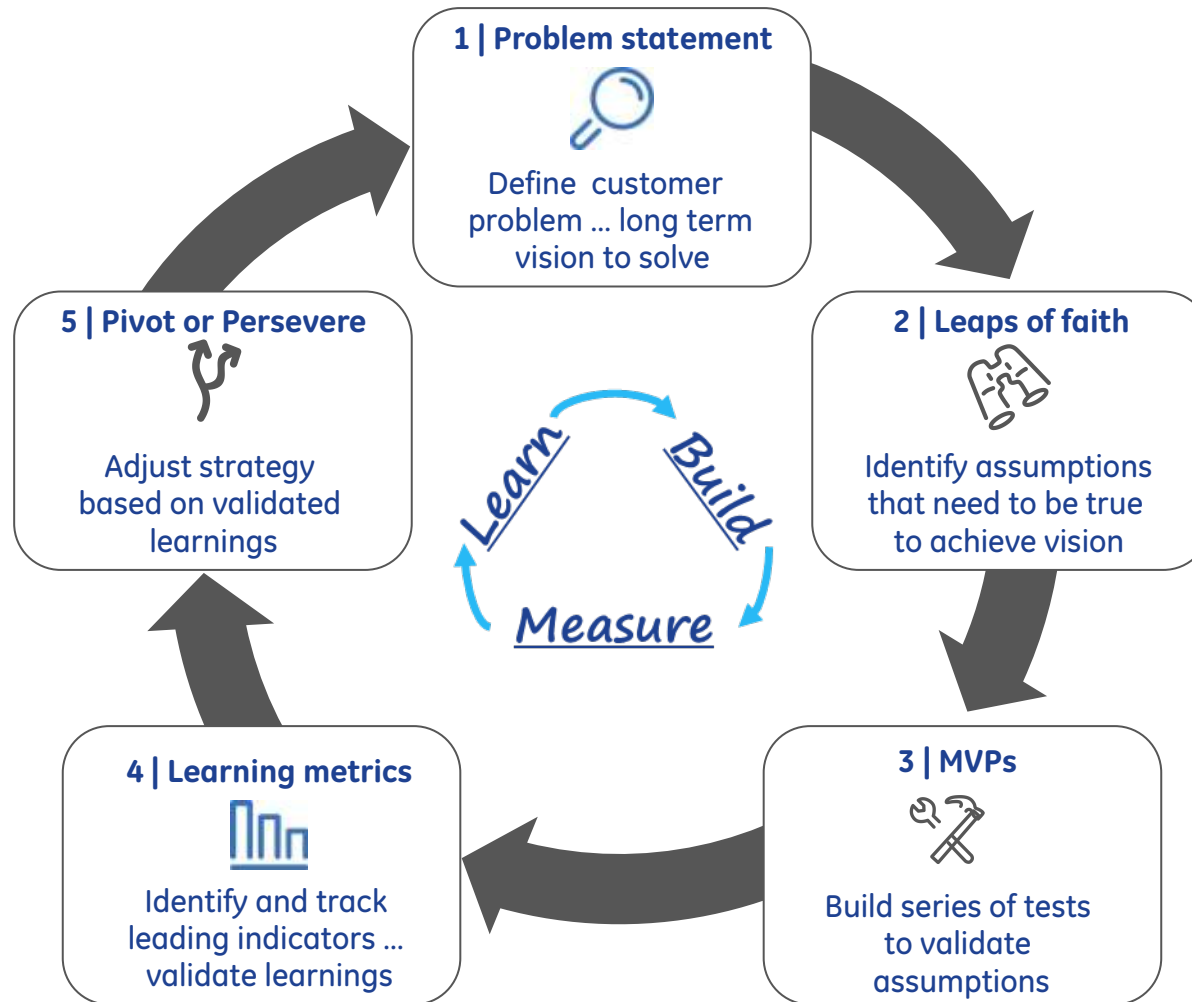


# Accelerating innovation through collaboration



# The FastWorks Framework

## EXPERIMENT... LEARN... ITERATE



# What's Next

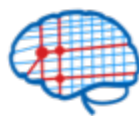
## *Six areas of research that will ignite the future*



EXTREME  
MACHINES



SUPER  
MATERIALS



MAPPED  
MINDS



ENERGY  
EVERYWHERE



BRILLIANT  
FACTORIES



INTELLIGENT  
INTERNET





# \*CFM LEAP...not just any new product introduction

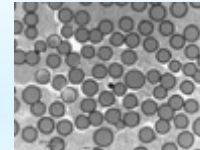
- First engine fired two days ahead of schedule
- Achieved max thrust
- 15,000 parts...3,000° F temps
- Composites, ceramics, super alloys
- 3D printed fuel nozzles
- Clearances  $\frac{1}{4}$  thickness of a human hair



\*CFM is a 50/50 JV between GE and Safran.

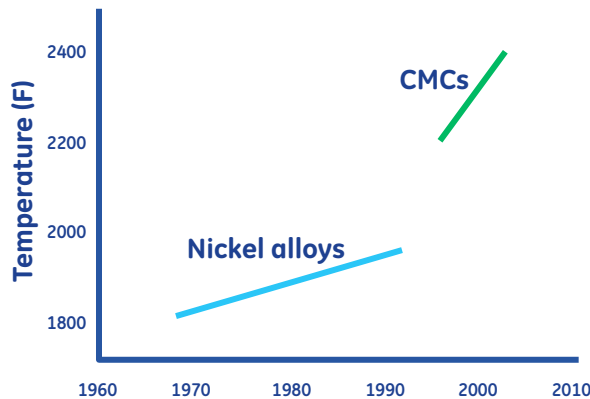
# Super materials ... ceramic-matrix composites

CMCs are silicon carbide fibers in a silicon carbide matrix

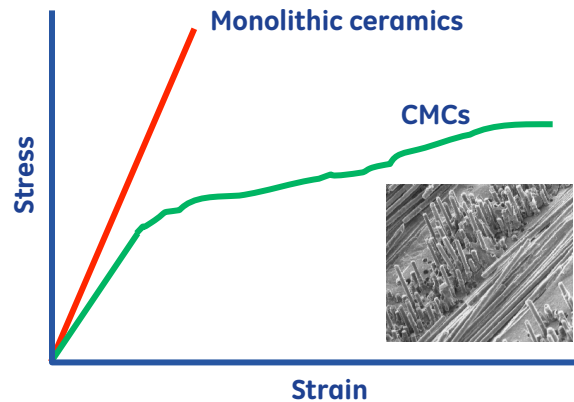


● Diameter of a human hair

## High-temperature



## Not brittle



$$+500^{\circ}\text{F} + \frac{1}{3} \text{ weight of metal} = 1.5\% \text{ Fuel efficiency}$$

# Extreme machines: GE “store” for subsea

## SOFTWARE CENTER

Smart BOP and advanced controls



## MEASUREMENT & CONTROL

Leak detection and multiphase flow measurement

## POWER & WATER

Water injection and processing

## TURBO MACHINERY

Pumps and compressor technology

## ENERGY MANAGEMENT

Power transmission and distribution

## AVIATION

Valve coatings and advanced materials

## HEALTHCARE

Diagnostic software imaging

## GLOBAL RESEARCH CENTER

Flow assurance and advanced riser technology

## SUBSEA SYSTEMS

Subsea production equipment and services



USING THE ENTIRE COMPANY TOOLKIT ...  
SOLUTIONS FOR CUSTOMERS



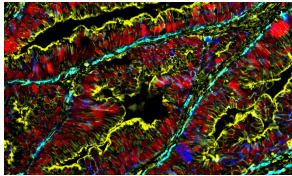
# Mapped minds: Brain health

## Trends

### Normative Science

Understanding the brain at multiple scales

Multi-scale data integration and analytics

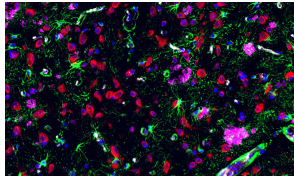


Scale of the human genome project

### Disease Understanding

Common disease mechanisms and pathways

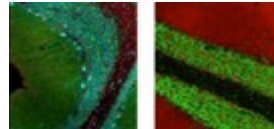
Brain stimulation and implants



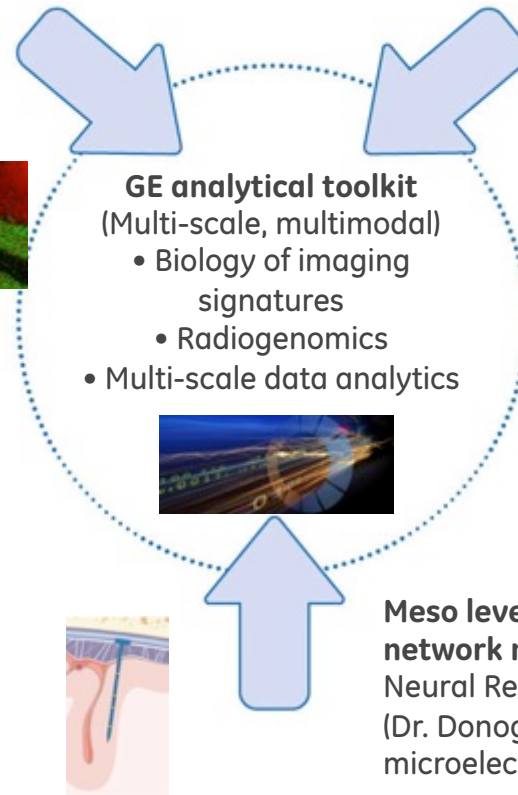
Common solutions for TBI, AD, PD, etc.

## Research ecosystem

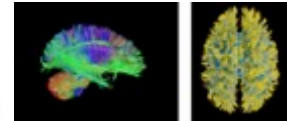
Micro level cell classification and disease pathways



*Common disease solutions*



Macro level brain structure and function



*Advanced human imaging*

Meso level brain network mapping  
Neural Recording  
(Dr. Donoghue) GRC  
microelectronics technologies



*Collaborative ecosystem is key to finding a cure*



# Life Sciences: a biological factory

## INDUSTRIALIZED AND AUTOMATED FOR CELL THERAPIES

### QUALITY ASSURANCE/QUALITY CONTROL

Source/donor

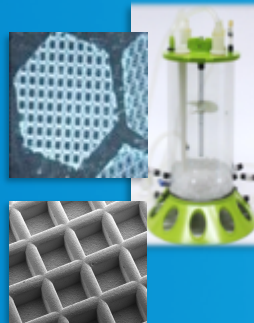


Processing/enrichment



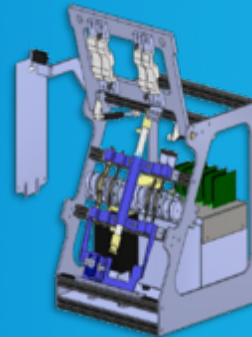
Separation  
technology

Expansion



Expansion

Harvesting/washing



Harvesting and QC

Formulation



Delivery



ADVANCED MANUFACTURING FOR HEALTHCARE  
ENABLES WIDESPREAD ADOPTION OF CELL THERAPIES



# Revolution™ CT – Platform for the future with uncompromised clinical performance



## KEY GLOBAL RESEARCH TECHNOLOGIES

### Image reconstruction:

- SnapShot Freeze™

### Spectral imaging:

- Gemstone™ Detector



## CLINICAL/PATIENT VALUE

### Safety:

- Routine low radiation dose

### Improved outcomes:

- 1-beat cardiac
- Tissue characterization



# Energy everywhere

Growth in emerging countries



Need for cleaner energy



Investments in O&G industry



Increased gas availability



Need for fast, scalable & financeable solutions



# Power & Water: HA turbine technology

Lower  
OPEX

Industry-leading efficiency & maintenance costs

Lower  
CAPEX

Largest turbines with lowest \$/kW through economies of scale

Simpler

No complexity and cost of steam cooling... and designed for plant constructability

Most  
Flexible

Industry-leading operating flexibility... start times, ramp rates, operating range



5% lower lifecycle cost of electricity ...  
significant customer validation, building the HA order book



# Distributed Power

## GE – FUEL CELLS ... OUR NEWEST “START-UP”

### DISRUPTIVE TECHNOLOGY FOR POWER GENERATION

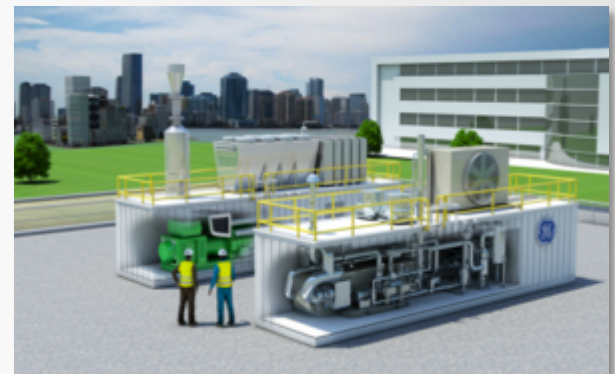
- 65% efficiency, 1-10MW Distributed Power solution ... *best-in-any-class*
- Clean energy ... *Low GHG Emissions*
- Hybrid solution ... *65% SOFC fuel cell, 35% GE Jenbacher*

### MARKET OPPORTUNITIES ... DELIVER POWER WHERE IT'S NEEDED

- Developing nations, remote communities
- Utility substations
- Industrial/Commercial centers (factories, data centers)
- Retrofit for customers with gas engines



Opened new pilot development facility in Aug. 2014



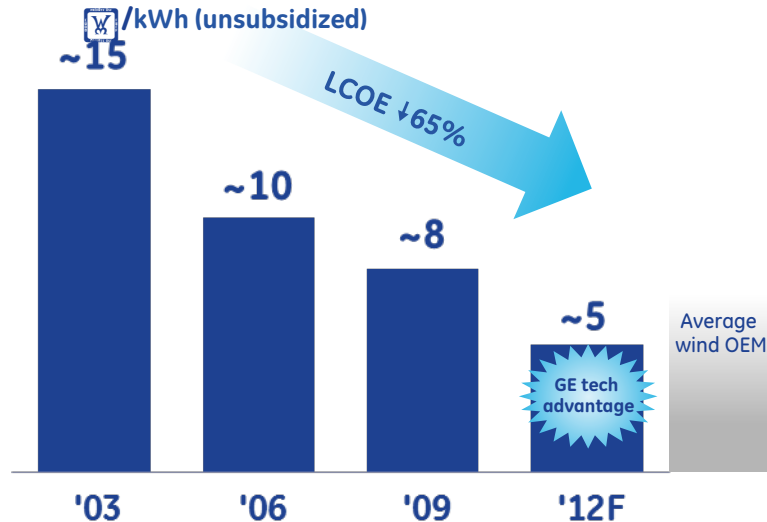
GE's Hybrid SOFC system



# Renewables going mainstream

## Competitive today

### Wind Cost of Electricity (LCOE)



### GE product advancements ...

- Turbine performance ↑50%
- Efficiency ↑35%+
- Availability ↑13 pts

Source: GE Marketing, Lazard

## More competitive tomorrow



### GRC technologies ...

- Controls to better manage performance... 5% LCOE
- Improved blade aero/manage noise
- More efficient drivetrain and power electronics

**Technology making wind more economic than ever**

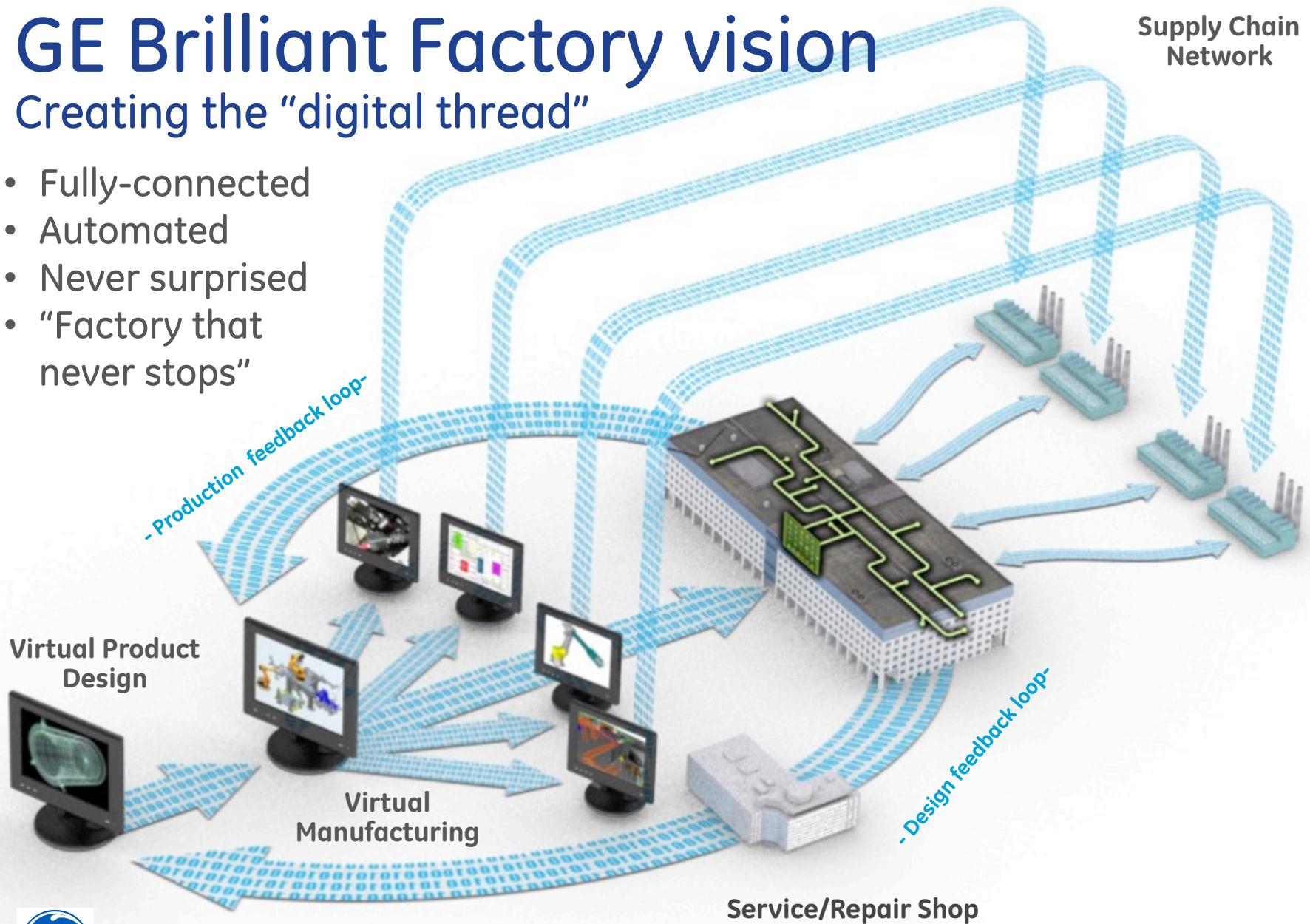


# GE Brilliant Factory vision

Creating the “digital thread”

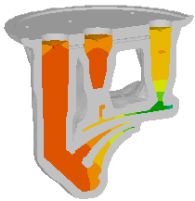
Supply Chain  
Network

- Fully-connected
- Automated
- Never surprised
- “Factory that never stops”

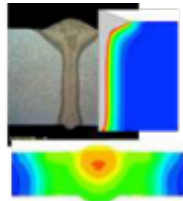


# Virtual Manufacturing

## Process Modeling



Solidification

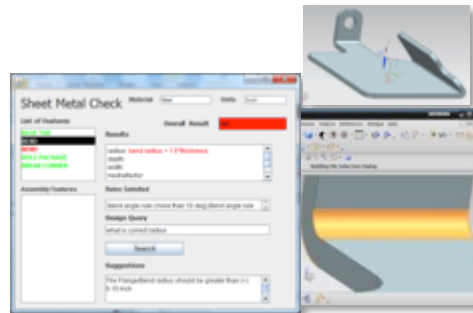


Welding

- Broaden supply base, design space
- Shorten NPI cycle time
- Quality... yield increase
- Cost reduction

## Manufacturing Producibility

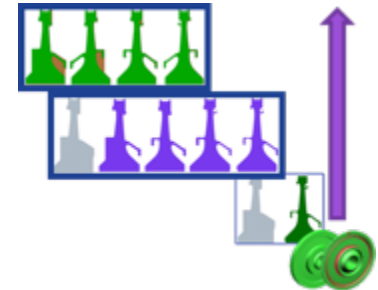
- Advisor tool *during* design
- - Producibility, cost, capability
- Enables Design for Manufacturing
- Drives faster NPI
- Opens supply base



Design Producibility Advisors

## Model-Based Manufacturing

- Engineering data to mfg. model  
Today:
  - ✓ Significant manual work
  - ✓ Long time to adapt NC to new part
- In-process models for machining
- Linked to engineering models
- Reusable libraries

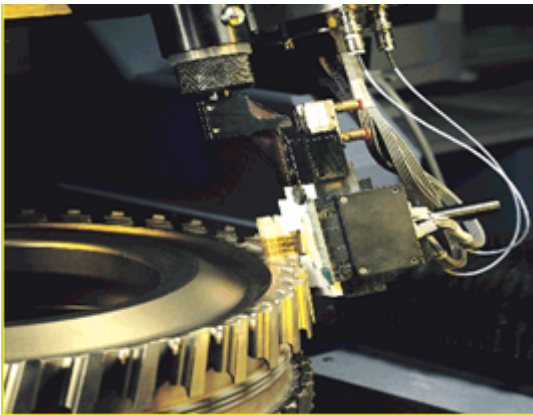
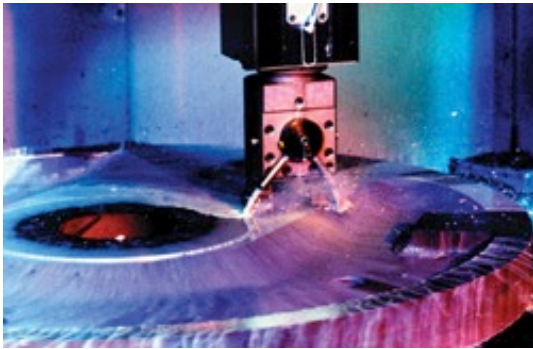


In Process Models

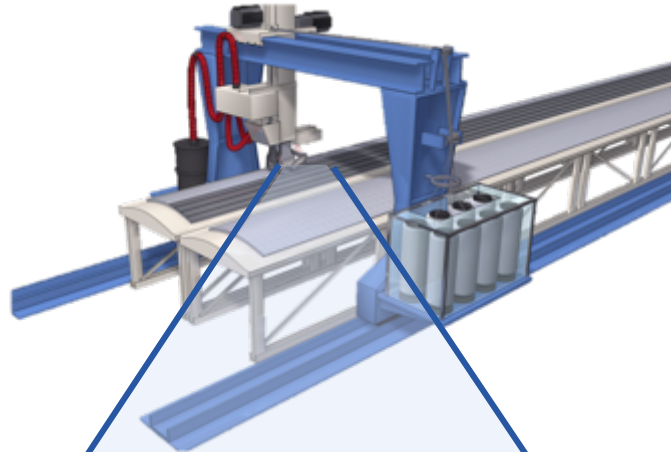
# Inspection Technologies...Factory

Real-time Adaptive Process Control & Feedback to Design on Part Cost & Quality

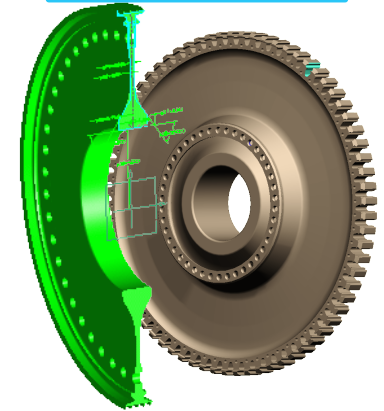
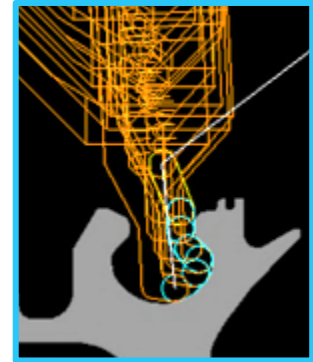
## Inspection-Guided Manufacturing



## Real-time Adaptive Process Control

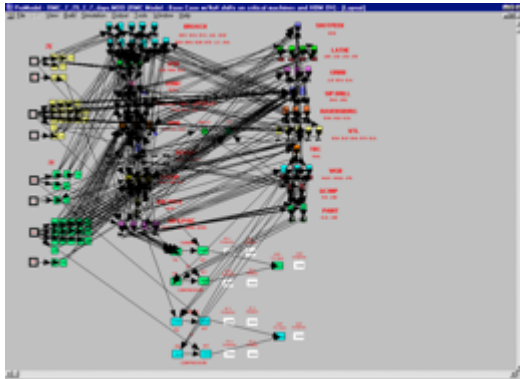


## Part Quality & Cost Feedback



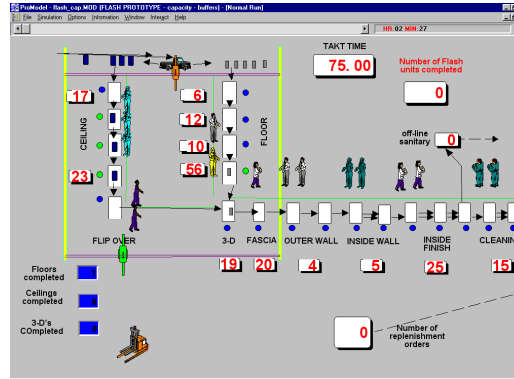


# Factory & Demand-Side Analytics and Optimization



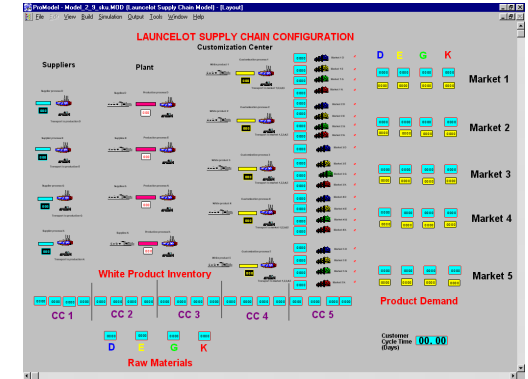
## Throughput, Expense, Fulfillment Capability

Design & Decision Support for reliable capacity to meet demand and ID cost/quality opportunities



## Inventory, WIP

Optimized material & labor at each process – throughput & timing as function of variation and interdependencies

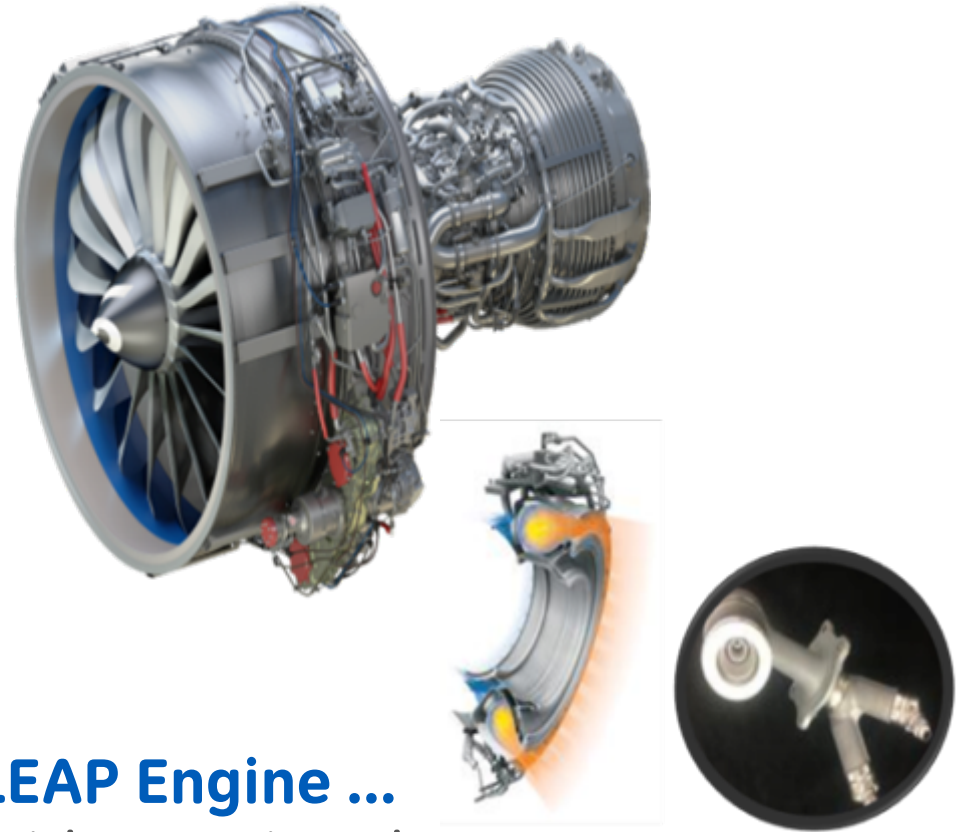


## Value Chain

Determine make/buy, plant locations, late point customization, inventory/delivery to fulfill demand and lower cost

# 3D printing ... complexity is free

- 300+ 3D printing machines in use across the company
- Developing parts for Aviation, Oil & Gas, Healthcare, Power & Water and other GE businesses
- Will print more than 100,000 parts for Aviation by 2020



**\*CFM's LEAP Engine ...**  
1st jet engine with 3D printed parts

World largest user of additive technologies for metal



# INDUSTRIAL INTERNET





# What happened when 1B people became connected?

[ Social marketing emerged ]

[ Communications mobilized ]

Consumer Internet

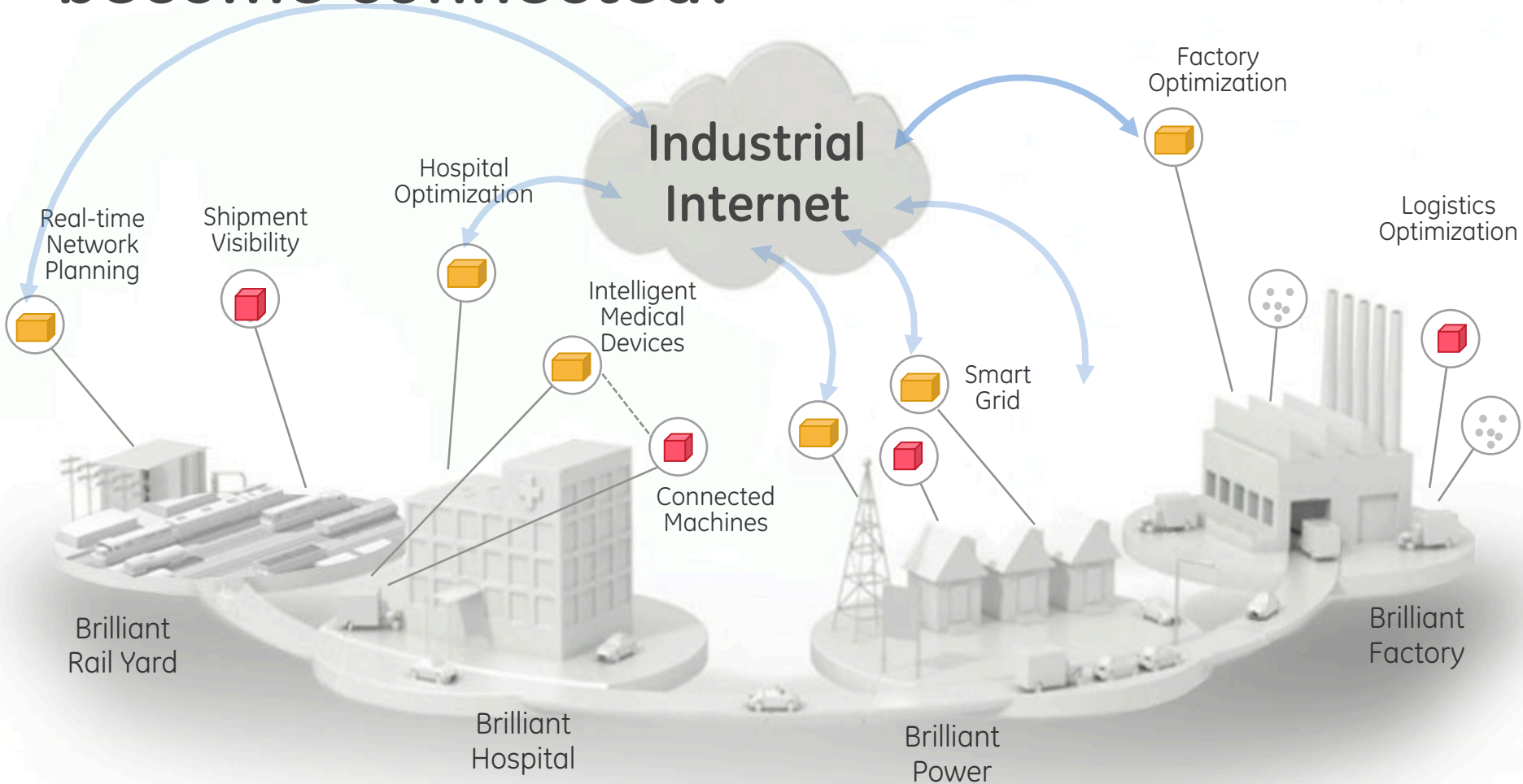
[ IT architecture virtualized ]

[ Retail & ad transformed ]

[ Entertainment is digitized ]



# What happens when 50B Machines become connected?



OT is virtualized ..... Analytics become predictive ..... Employees increase productivity  
Machines are self healing & automated ..... Monitoring and maintenance is mobilized



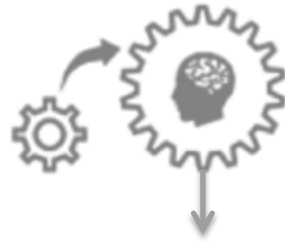
# Physical + digital

*These drivers are a doorway to endless outcomes*



## Software & Analytics

Combining the power of physics-based analytics, predictive algorithms & deep domain expertise



## Intelligent Machines

Increasing system intelligence through embedded software to connect facilities, fleets & networks



## Big Data

Generating data-driven insights & enhancing asset performance



## People at Work

Connecting people to support more intelligent operations, maintenance & safety



# The Industrial Internet

*The merging of the physical and digital worlds enables machines talk to machines, systems and people so that they can perform better, faster, safer, and more reliably.*

Factories grow progressively more efficient their manufacturing by collecting analyzing and applying production data

**40% ↓**

Manufacturing value by optimizing supply chain

City's interconnectivity among lighting fixtures can optimize transportation by collecting and analyzing information about vehicles, traffic, work zones, & roadways.

**\$1B**

Industry value by reducing inefficiencies

Hospitals know and serve their patients better by equipping them with RFID wristbands that enable the full view of their medical history.

**\$63B**

Industry value by reducing process inefficiency

Fleets will tell maintenance crews which parts are needed to be replaced & when, helping aircraft operators to predict future downtime, before it occurs.

**\$30B**

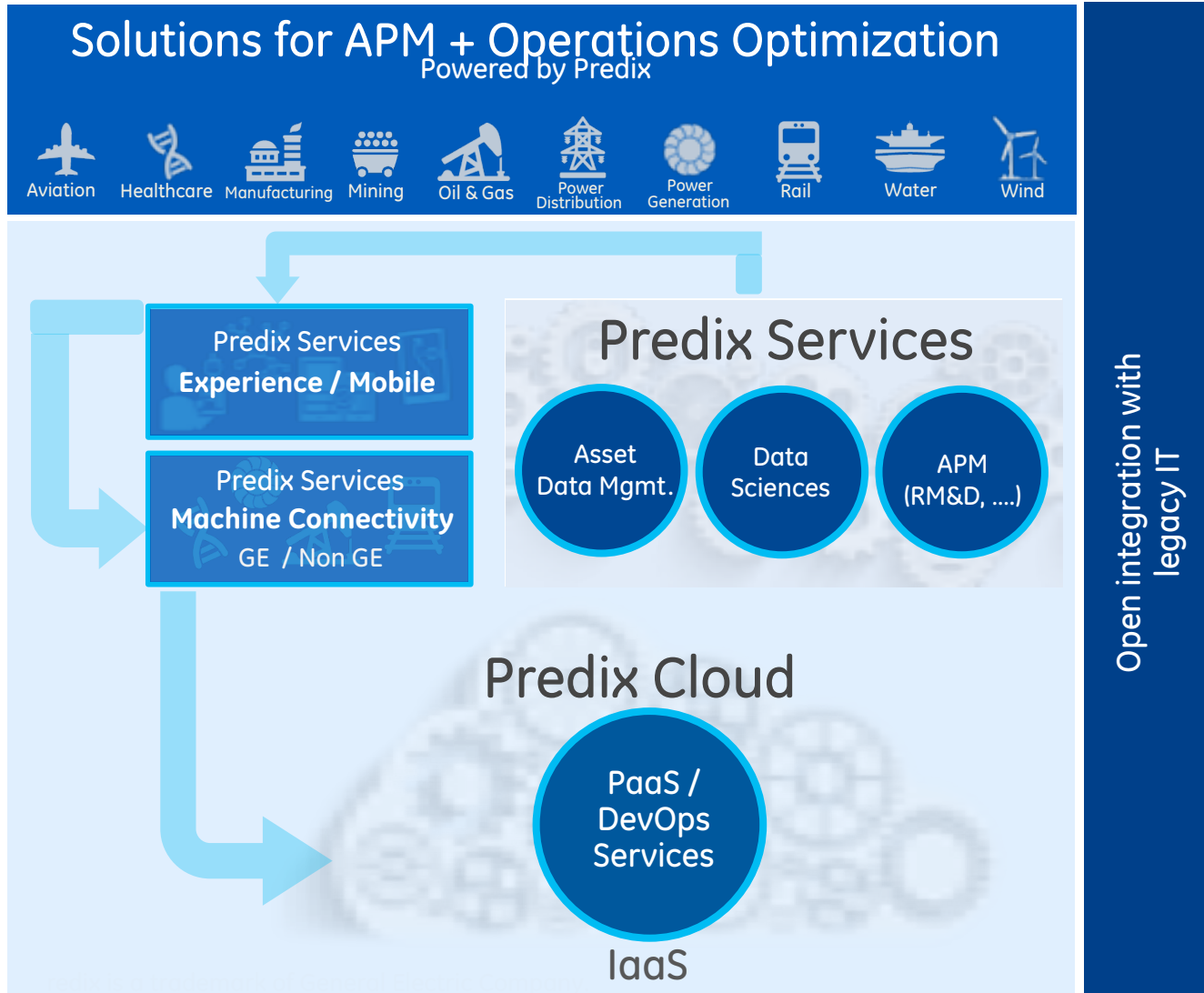
Industry value by increasing fuel savings





# Predix\*

*A developer-centric platform for the Industrial Internet*

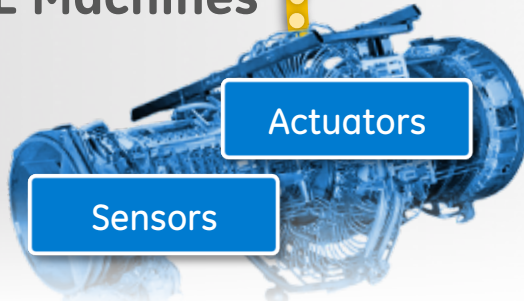


# GE Industrial Internet Controls System

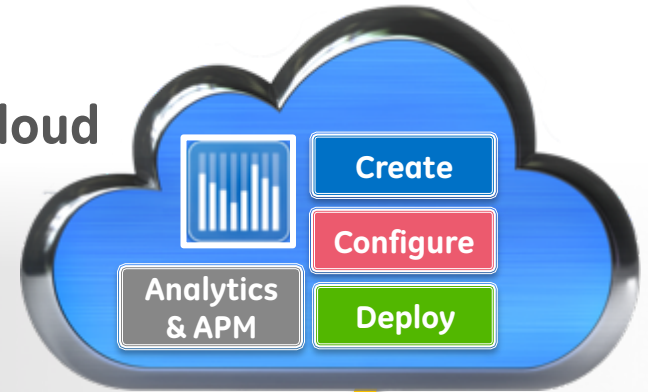
Driven by safety, reliability and performance

1. Controls asset behavior
2. Provides safety & security
3. Bridges digital & physical
4. Hosts critical control apps

GE Machines



GE Cloud



1. Cloud gateway
2. User experience gateway
3. Security & SW upgrades
4. Hosts fleet level, non-critical apps

Brings scale of GE capability

Predix-ready platform



# Predictivity + aviation

## Impact of Unplanned Downtime



Air turnbacks are costly

Airline industry maintenance cost for delays & cancellations



Decrease in workforce productivity



Added maintenance costs

**\$45MM per day**

Loss per cancellation or diversion

**\$25K - \$100K**

Loss per delay

**\$6K - \$8K**

## Benefits of Predictive Maintenance



Effective workforce & reduced maintenance costs



On-time performance



Customer satisfaction

# Technology leadership

(\$ in billions)

## Investment



R&D  
(% revenue)

~5%

~5%

- R&D ramp starting in '10
- Key investments made ... product + software
- Executed well ... FastWorks, Analytics, GE Store

## Key launches

LEAP



H gas turbine



Tier 4



PET/MR



Predix

