AI/ML Applications in aviation : GE Aviation's experience

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Operating Aircraft is a Complex Endeavor

Complex Asset
and about 39000 commercial A/C in the market

3.9%
expected growth in the industry

Utilization
directly impacted by unplanned maintenance

$25Bn
unplanned maintenance cost at about 33% of total maintenance cost of $78Bn in 2018

Passenger
experience affected by unplanned maintenance events

Powering the world's airline fleets with 38,000 engines

0:02

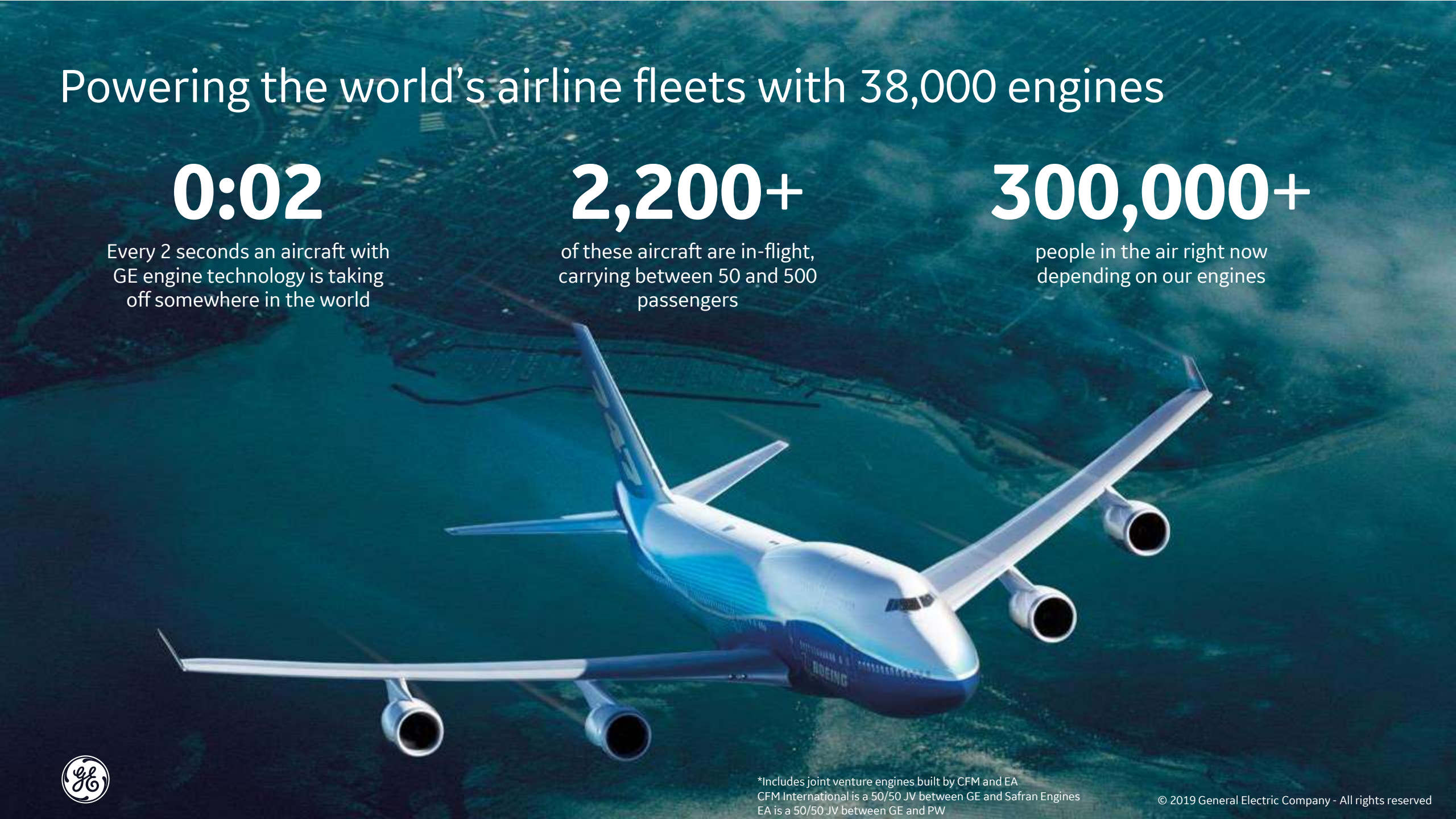
Every 2 seconds an aircraft with GE engine technology is taking off somewhere in the world

2,200+

of these aircraft are in-flight, carrying between 50 and 500 passengers

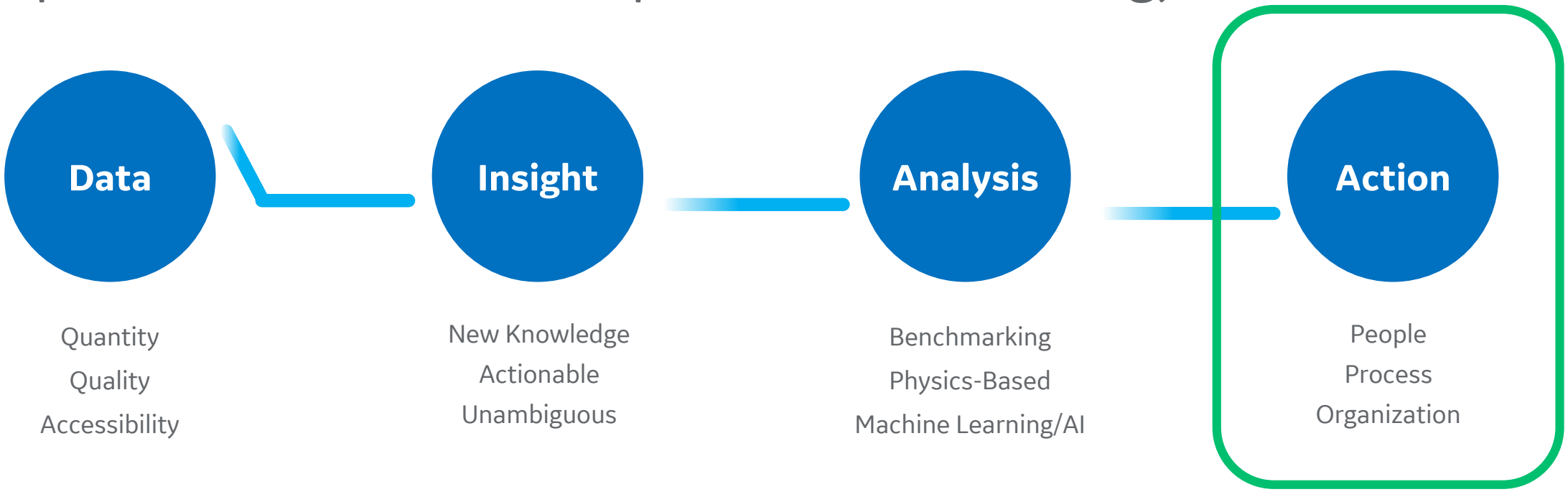
300,000+

people in the air right now depending on our engines



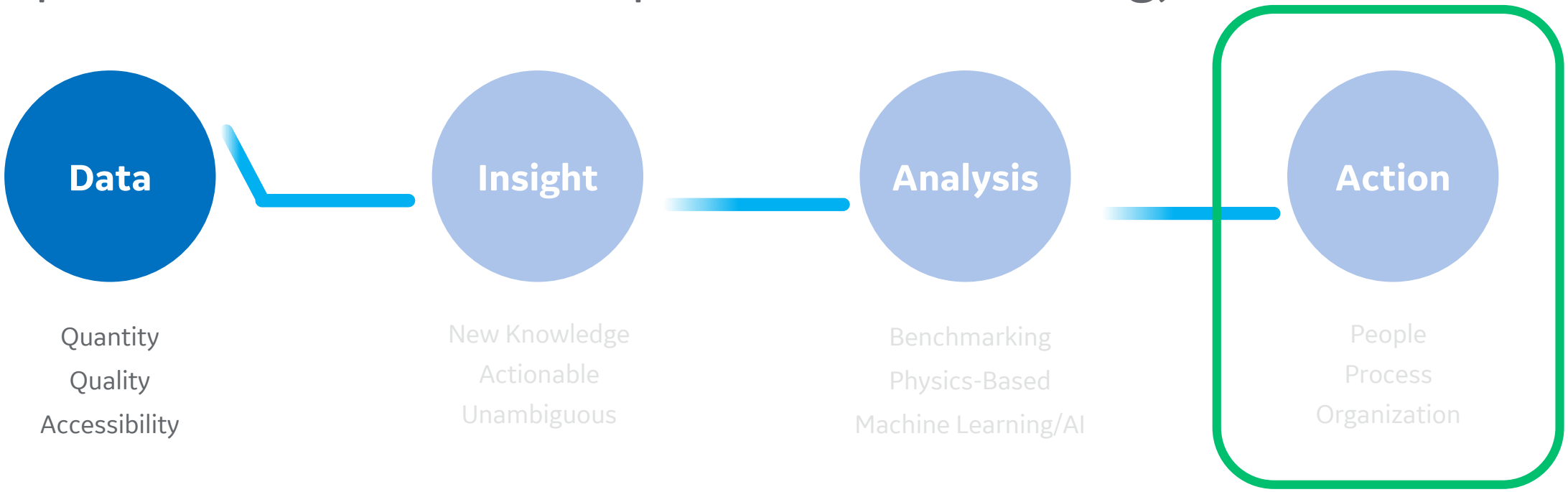
*Includes joint venture engines built by CFM and EA
CFM International is a 50/50 JV between GE and Safran Engines
EA is a 50/50 JV between GE and PW

Adoption is the critical end point...not technology



Instead of managing this as an technology gap, manage it as a (digital) transformation opportunity

Adoption is the critical end point…not technology



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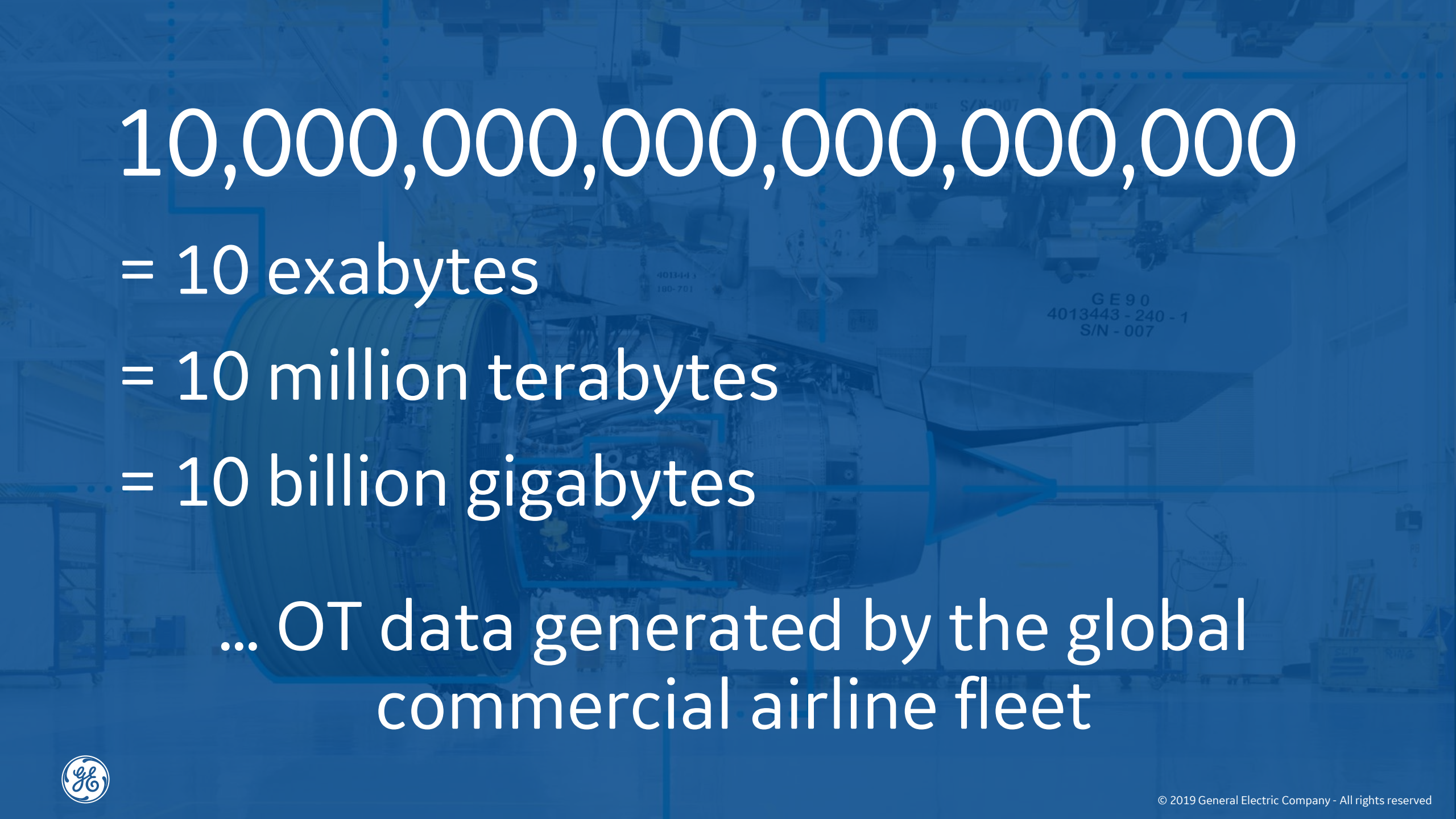
Based on Data



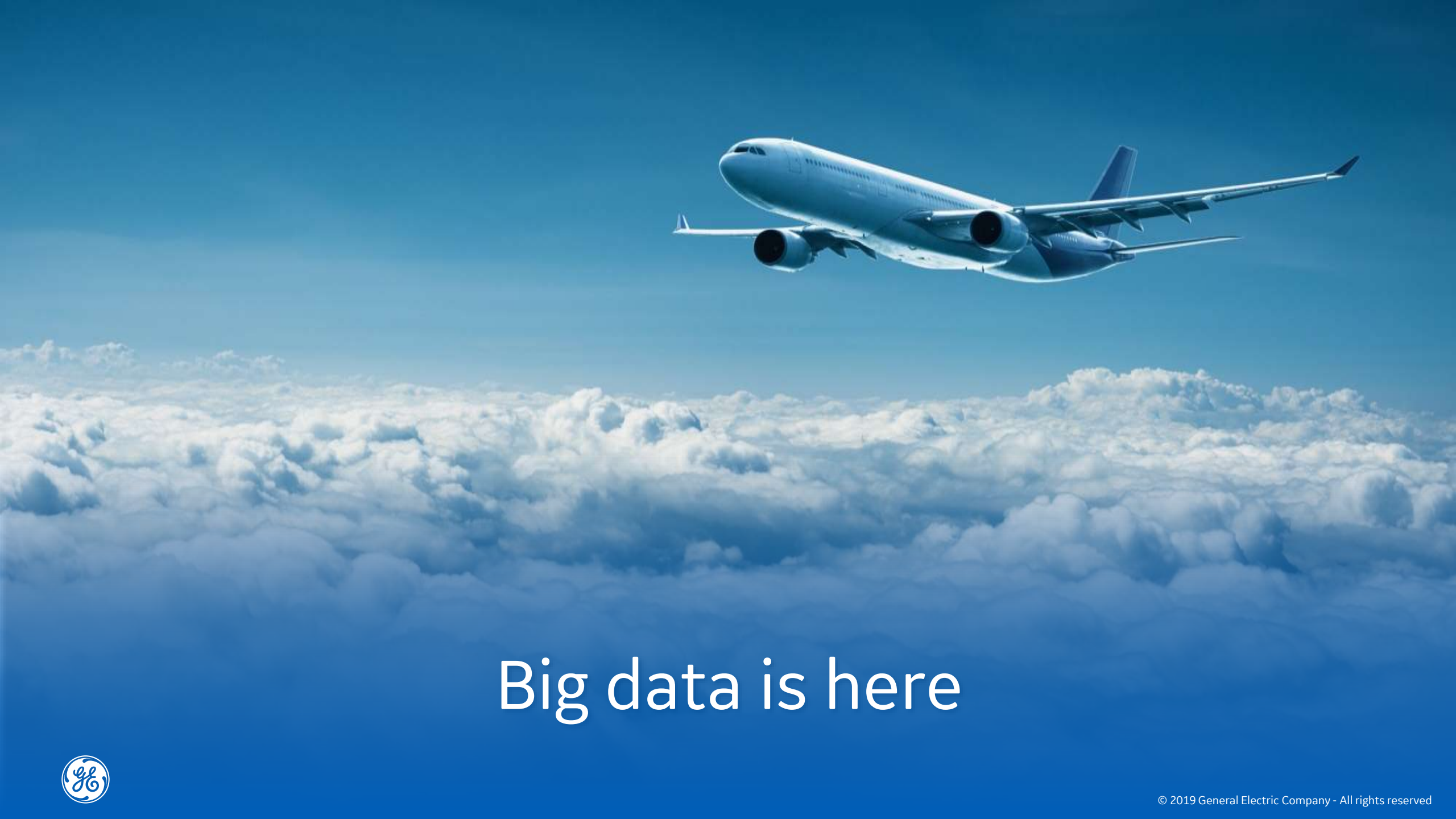
10,000,000,000,000,000,000

= 10 exabytes

= 10 million terabytes

= 10 billion gigabytes

… OT data generated by the global commercial airline fleet

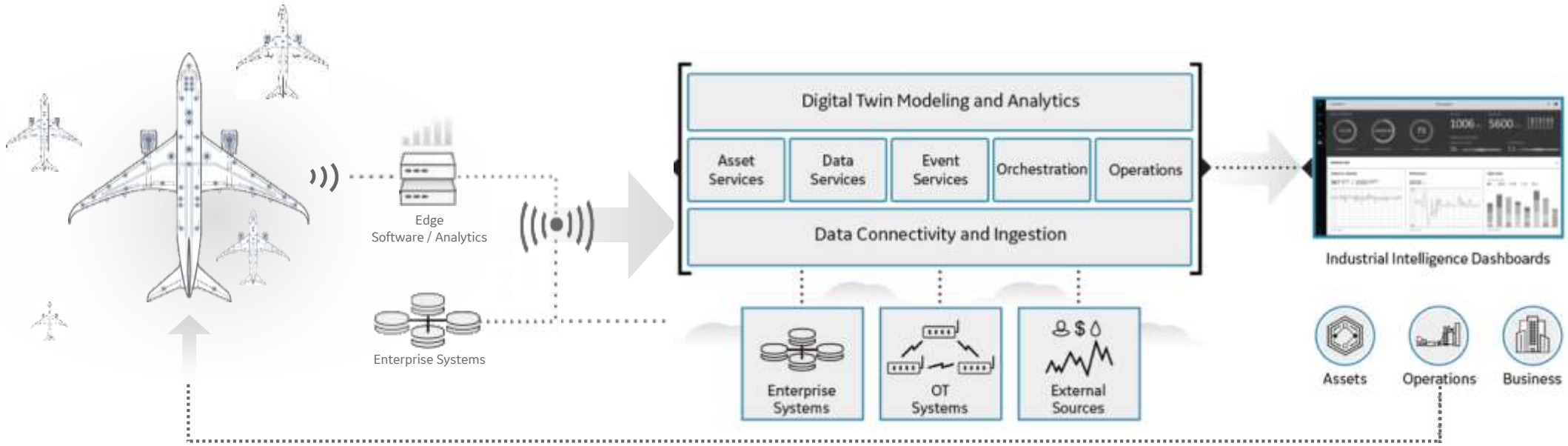


Edge-to-Cloud … platform-as-a-service

EDGE Connected assets. Edge appliances. Edge Analytics.

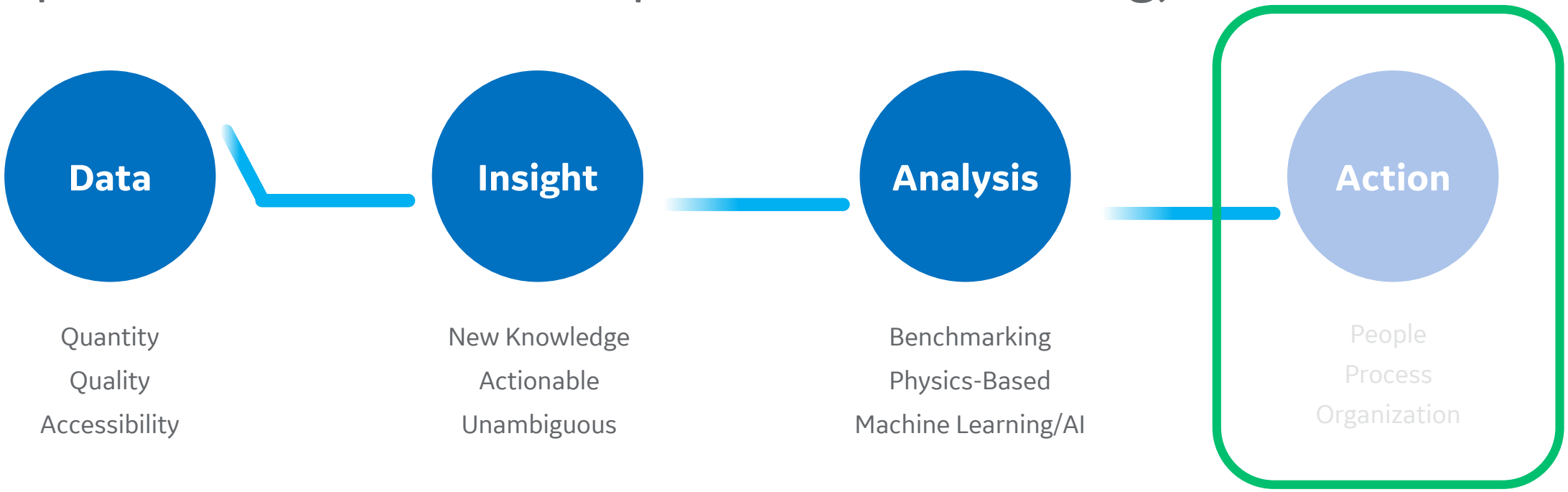
CLOUD Connect industrial assets with people through data and analytics.

APPLICATIONS Visibility and insights for better business outcomes.



GET CONNECTED | **GET INSIGHTS** | **GET OPTIMIZED**

Adoption is the critical end point…not technology



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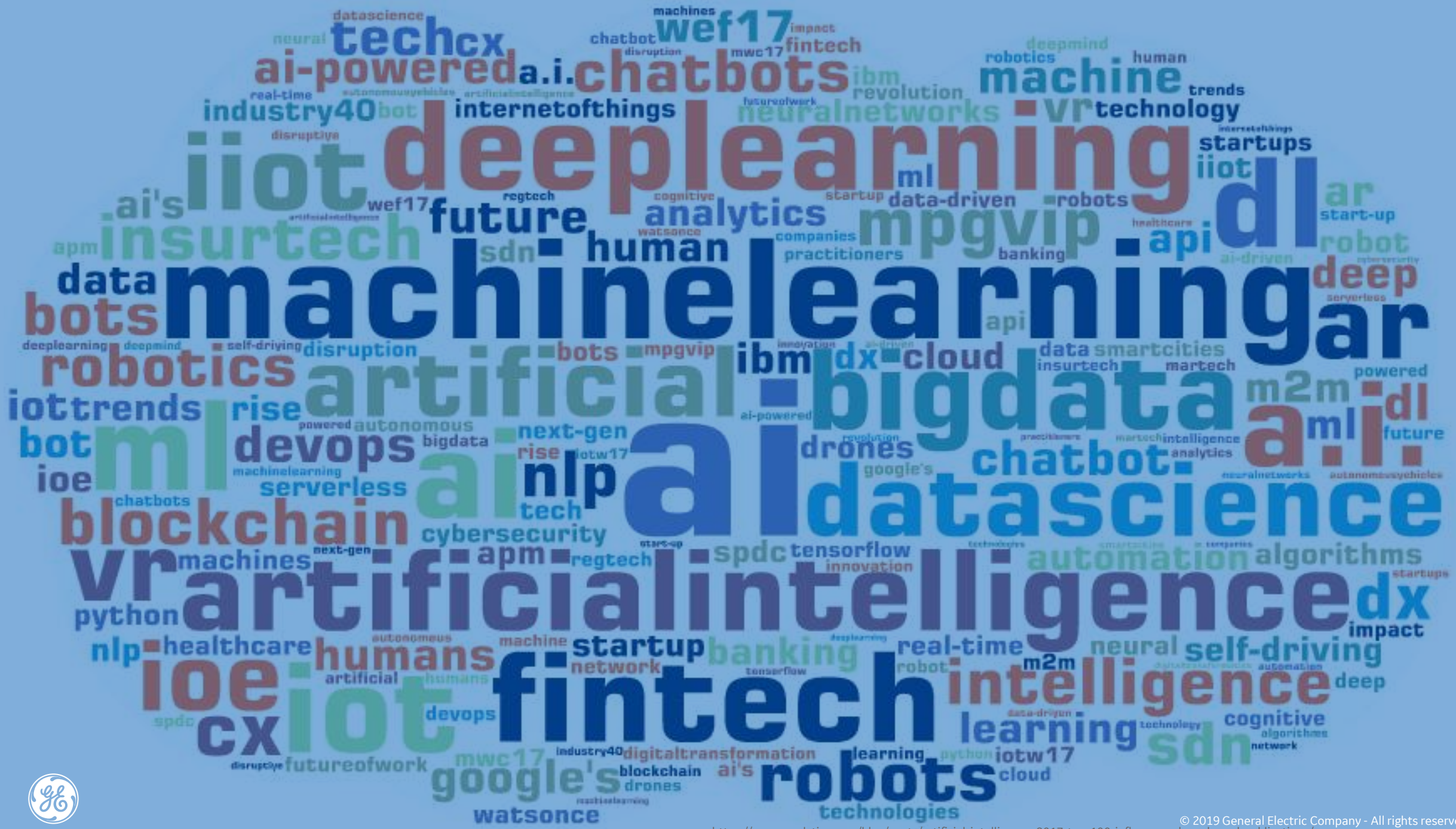
Based on Data and Specific Analytics

What does “first” come to your mind when you hear the word “Artificial Intelligence”



https://www.onalytica.com/blog/posts/artificial-intelligence-2017-top-100-influencers-brands-and-publications/

More Than 100 Years of Aviation Expertise

175 Million
flights analyzed

46,689 Years
of flight data under management

25 years
Digital Services

GE Aviation

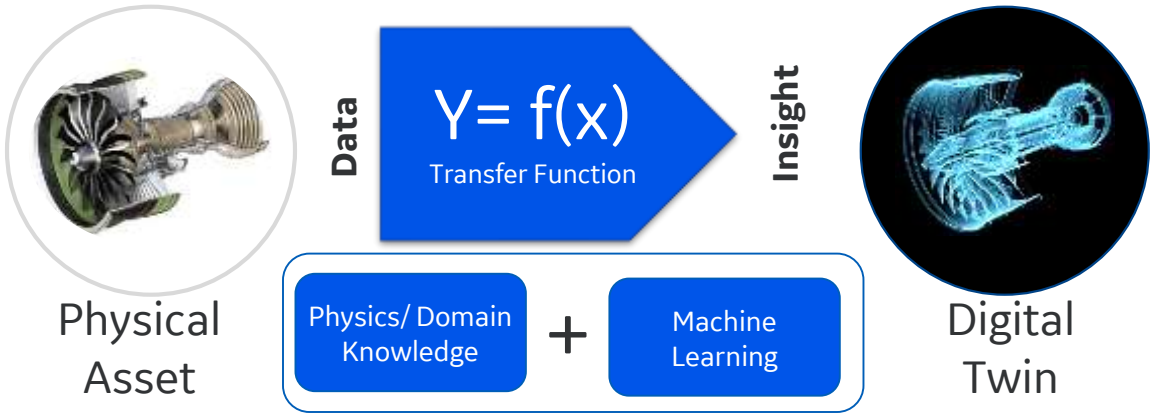
38,000 installed engines … in a world of variation

Operations

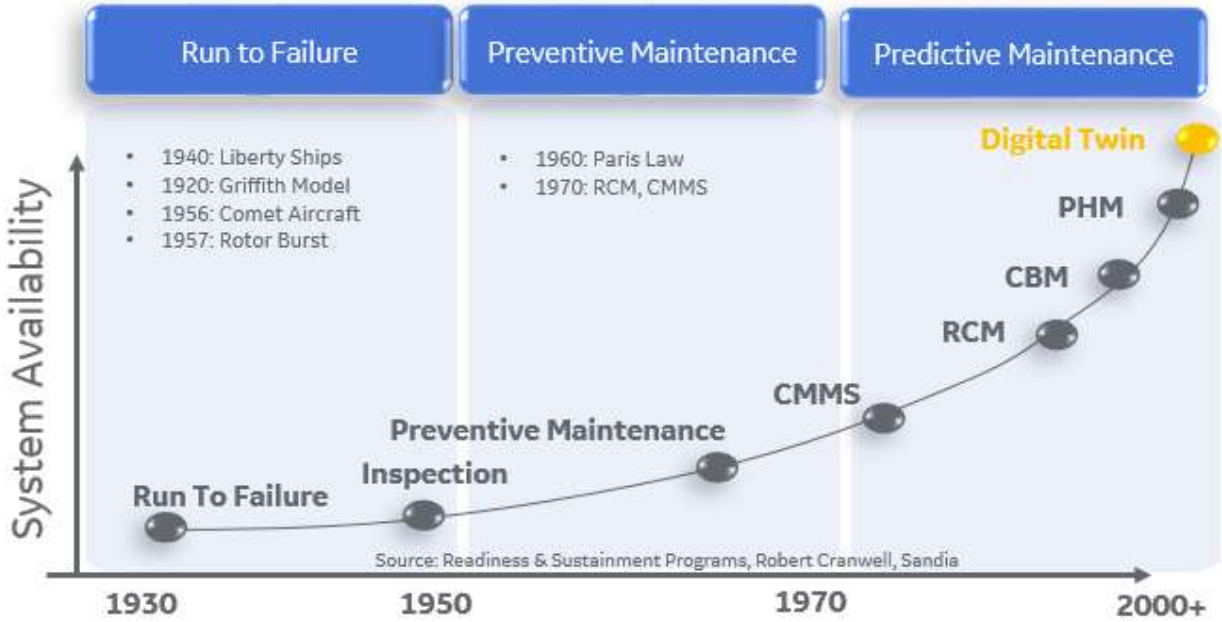
Environmental

The Digital Twin: A Personalized, Learning Digital Model

1. **Business Outcome**
2. **Adaptable**
3. **Per Asset/System Model**
4. **Scalable**
5. **Continuously Learns**



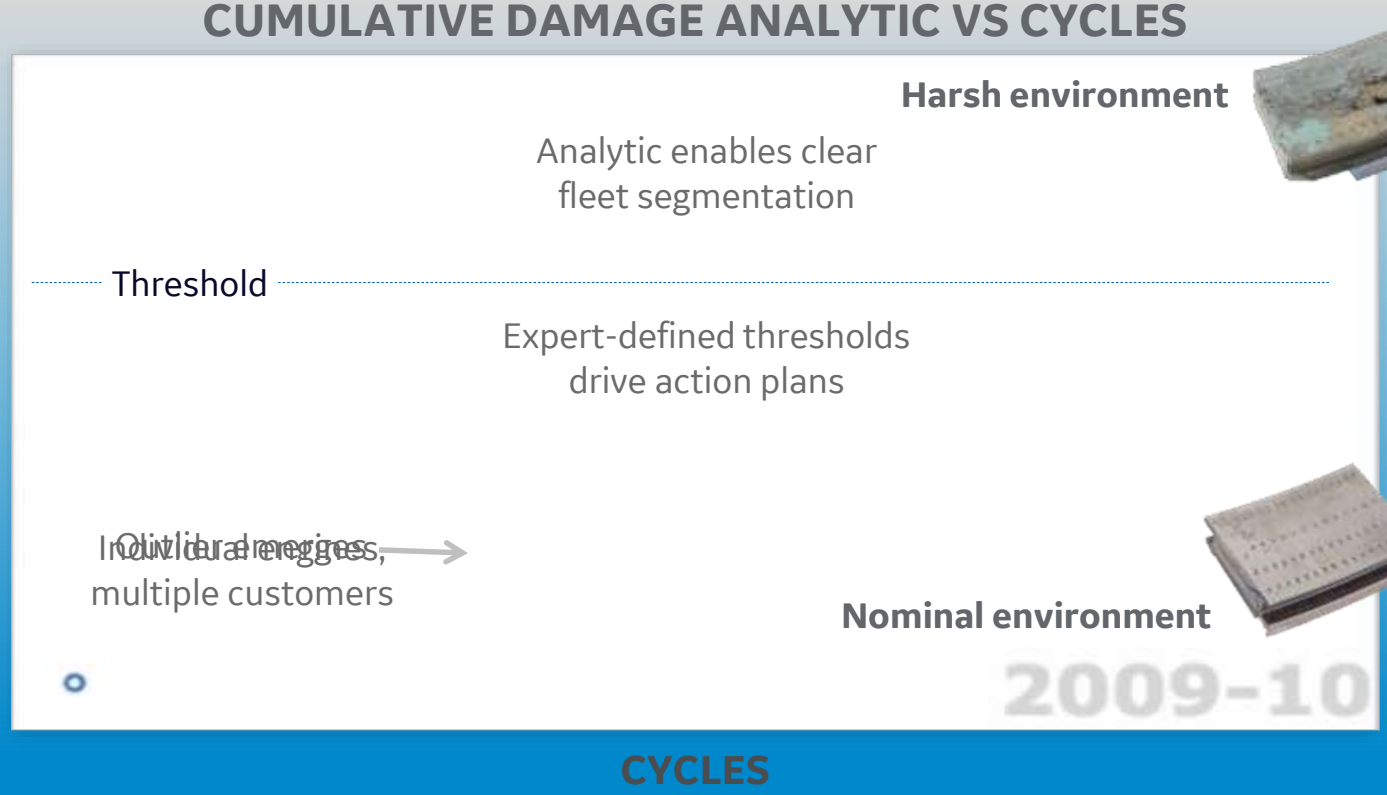
Evolution of Analytics and Maintenance Practices



Digital Twins are Learning Physics Models Running at Scale

Digital Twin … 21st Century Fleet Management - Engine

Customer outcomes … reactive to proactive



Outcomes

Major International carrier … better predictability

56% decrease in disruptions[-a)]

15% decrease in overhauls[-b)]

12 additional days of utilization[-c)]

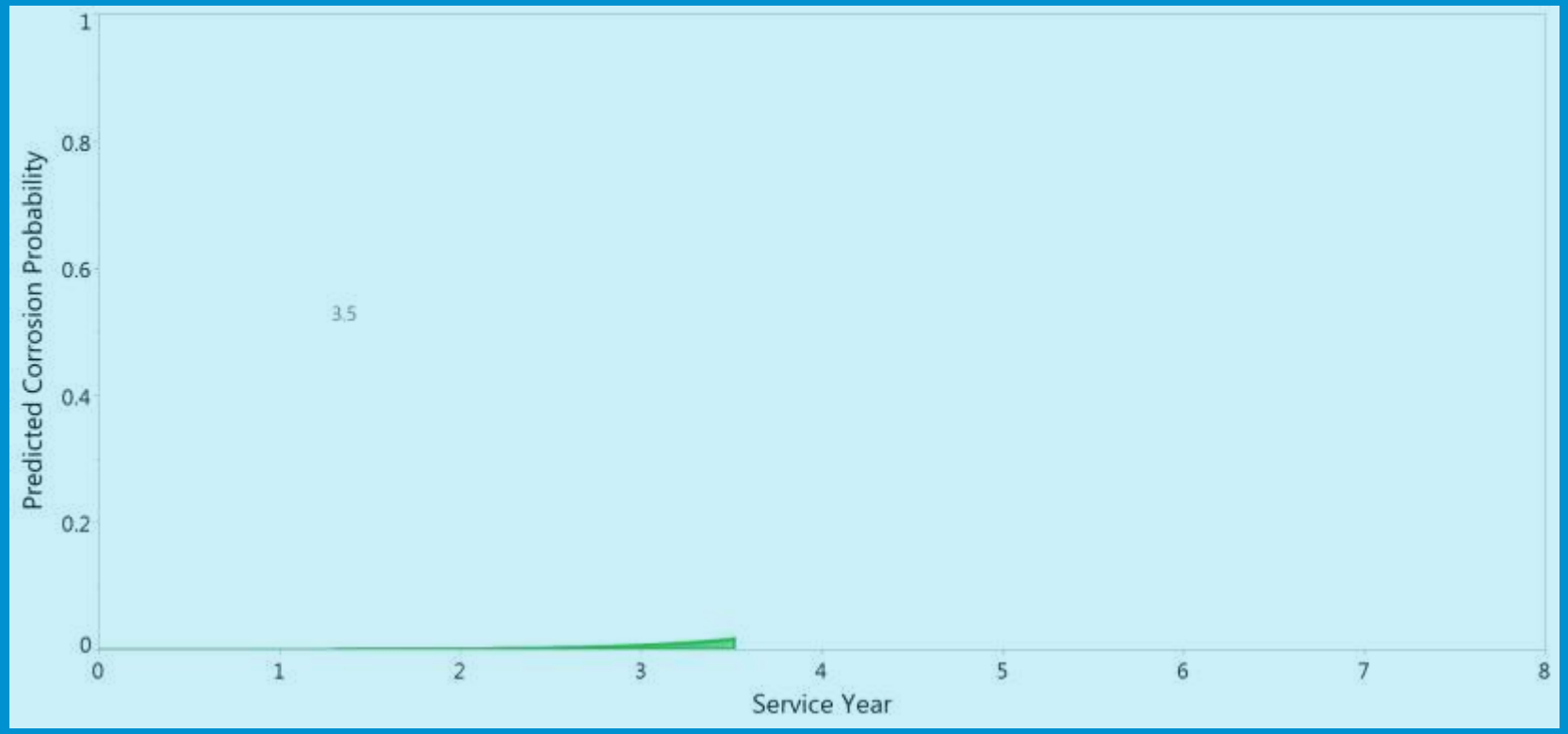
(a- Unscheduled engine removals 1H2016
(b- Forecasted reduction in performance shop visits FY17-18
(c- Customer estimate

Reduced maintenance burden = removals ↓ disruptions ↓ inspections ↓

Digital Twin … 21st Century Fleet Management - Aircraft

Customer outcomes … reactive to proactive

Aircraft corrosion prediction

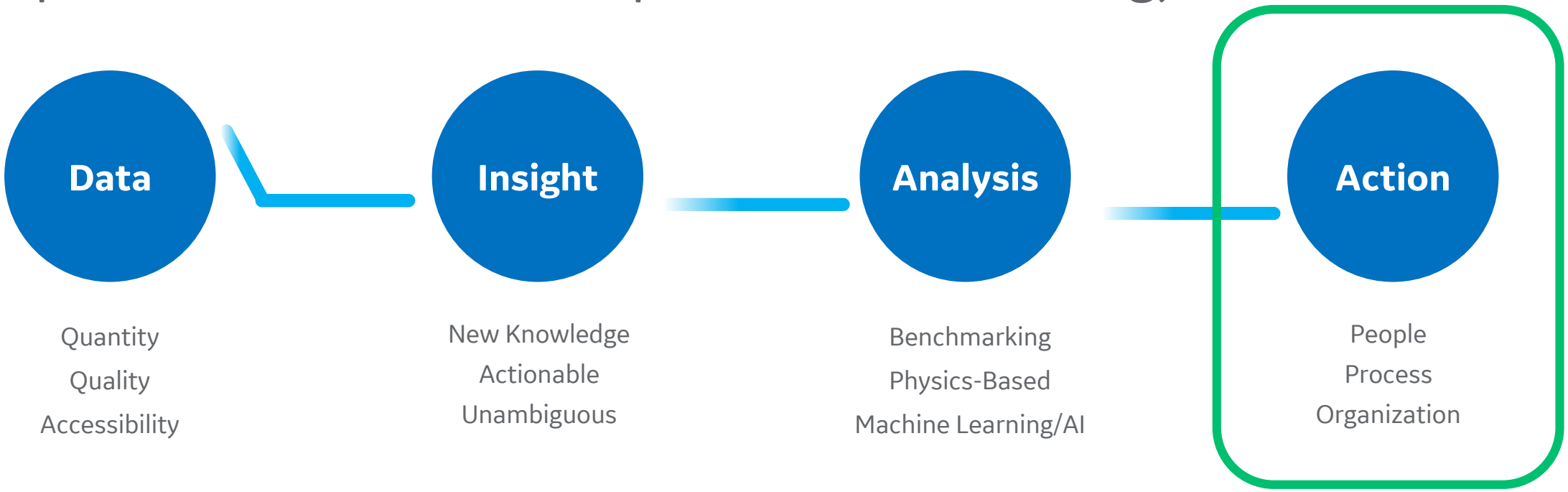


Network Routing

Global Environmental Data

(atmospheric sea salt concentration, for example)

Adoption is the critical end point...not technology



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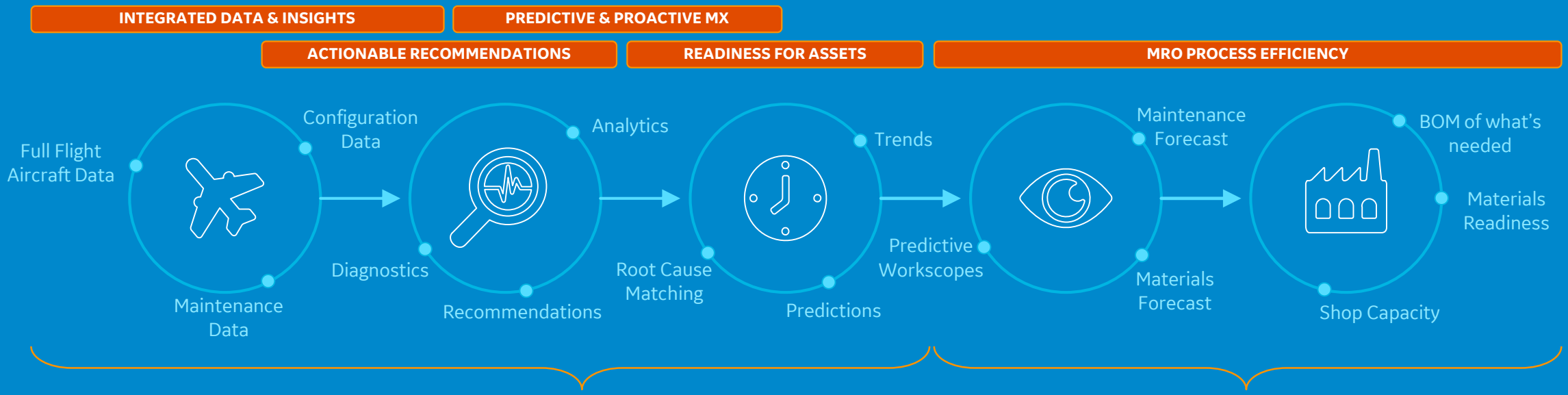
Life of an Asset | APM & dMRO

Driven by Customer Experience Value Mapping



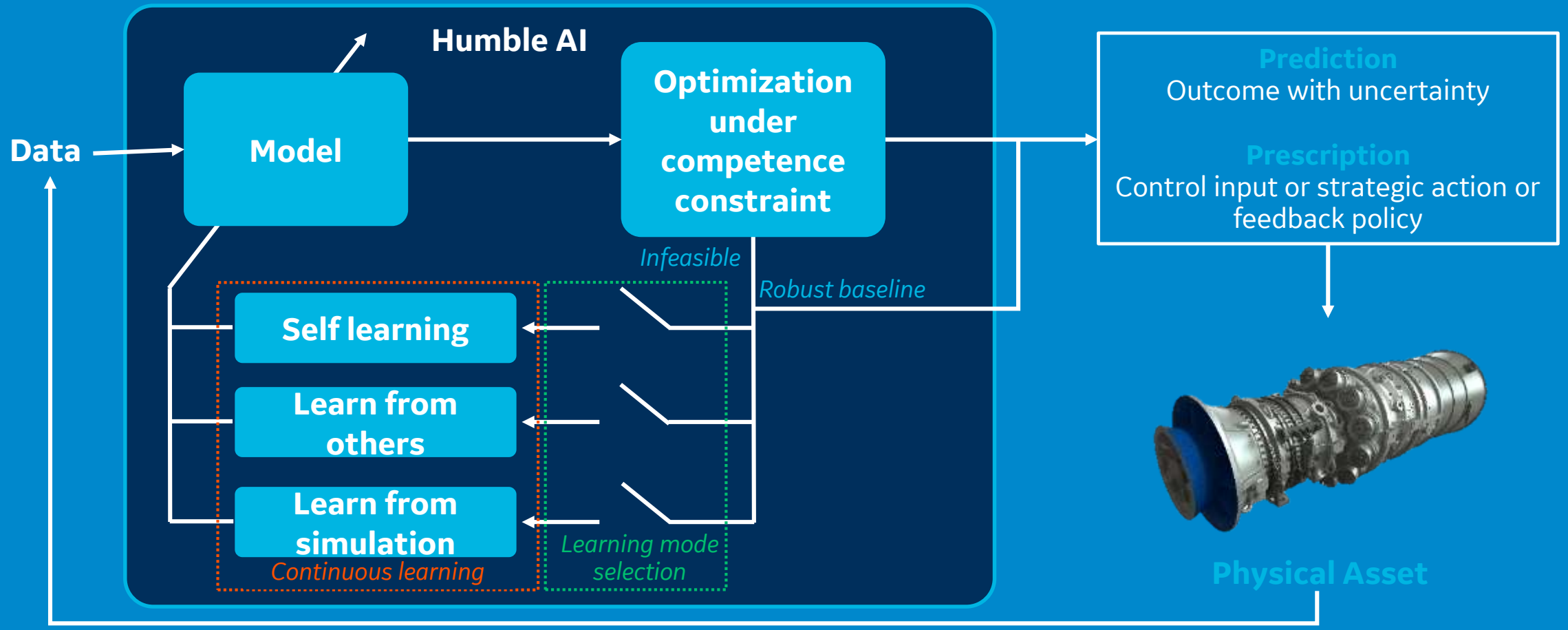
Asset Performance Management
(Asset Management, Fix Effectiveness, Strategy Optimization)

Maintenance, Repair, Overhaul
(Input, Workscope, WIP, Output)

Humble AI

Maximizing value in safety critical manner

Humble AI
Become aware of model competence



Tech Stack

MODEL COMPETENCE MONITORING

CONTINUOUS LEARNING

UNCERTAINTY QUANTIFICATION

Outcomes … productivity ‘inside’ GE Aviation

30% ↑
fidelity with engine digital twin

15% ↑
yield at GE’s MRO shop with Digital MRO (dMRO) solution

6 Weeks
advance component-level BOM prediction for engine shop visit

14% ↑
accuracy with engine digital twin

25% ↑
detection rate with engine digital twin

Significant productivity across GE Aviation

AI/ML invention to production journey……

1| Analytics Exploration

- Type of problems
  a. When will my part fail
  b. Where is the "strain" in ops
  c. What is the expected cash flow
- Form a "right" team
- Define "catching" org./application
- Required fidelity for ACTION

2| Migrating analytics into Production

- Outcome decides type of production
  a. On-line
  b. Off-line
- Type of analytics decides platform
- Capable of identifying analytic "degradation" with time

3| Things to consider

- Data availability in production
- PoC and Production tech sync-up
- Right balance of the team :
  - Data scientists
  - Software engineers
  - Subject matter expert
  - Business owner

Thank you !