The Use of AI and Big Data Analytics

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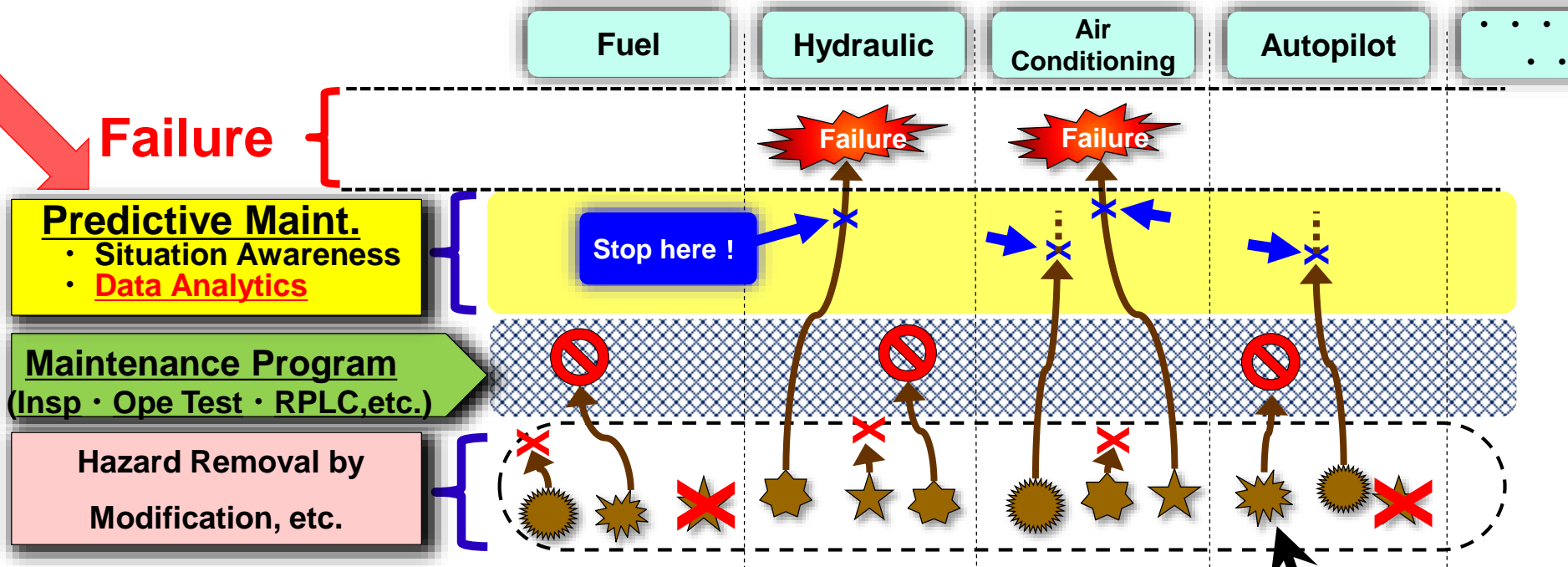**JAPAN AIRLINES**

JAPAN AIRLINES

To shift from "repair" to "prevent" , we set the ultimate target of safety and satisfaction that we provide to our customers
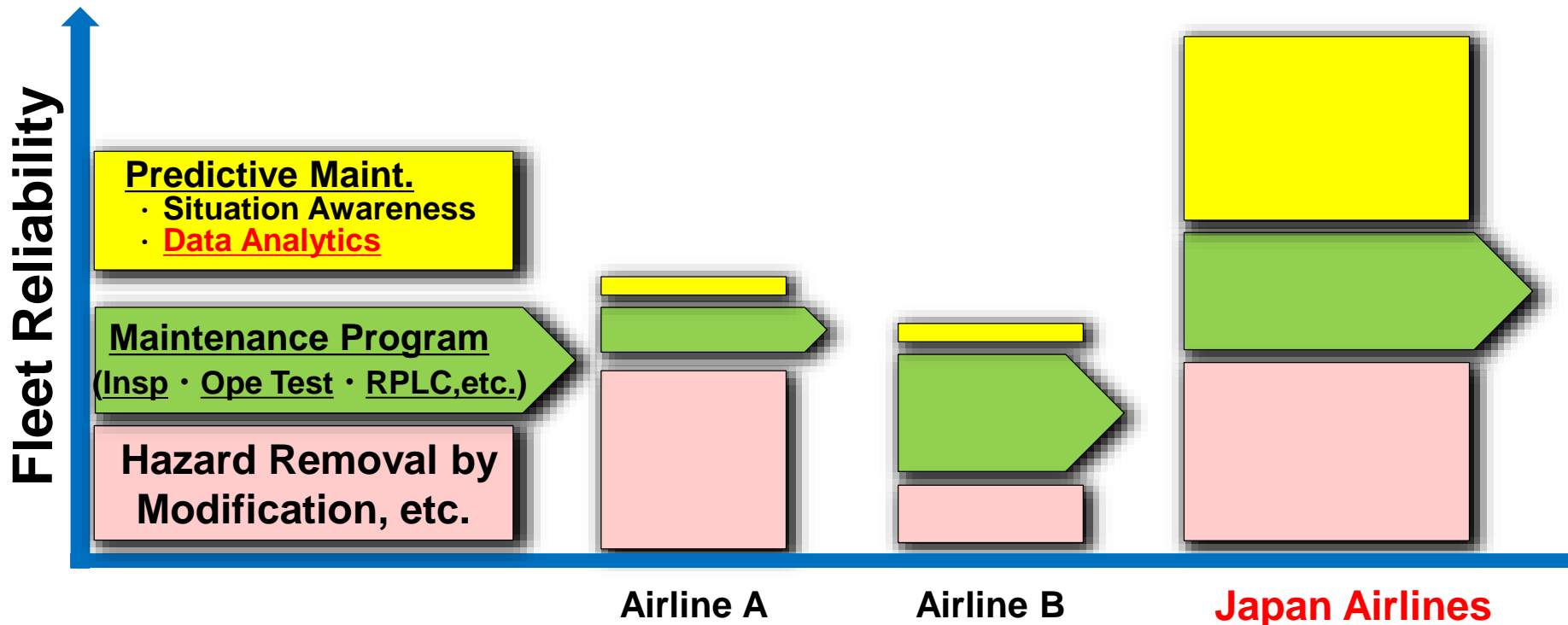
"Zero Zero 100"

➢ **Irregular Operations, IFSD   Zero**
➢ **Flight Defect   Zero**
➢ **On-time Departure   100 %**

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| Fuel | Hydraulic | Air Conditioning | Autopilot | ・・・ ・・ |

Failure

Predictive Maint.
・ **Situation Awareness**
・ **Data Analytics**

Stop here !

Maintenance Program
(Insp・Ope Test・RPLC,etc.)

Hazard Removal by

Modification, etc.

Seed of Failure = Hazard

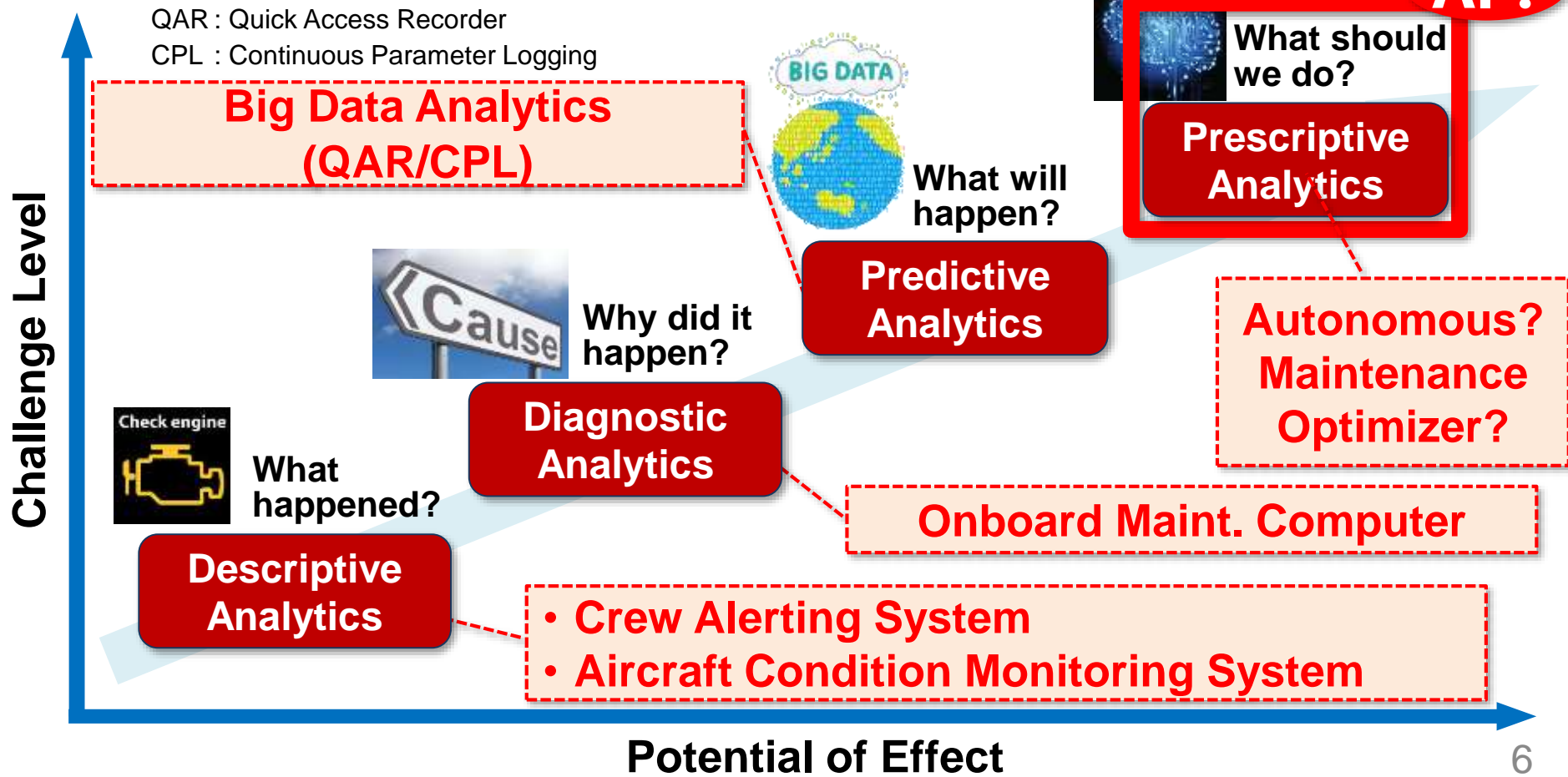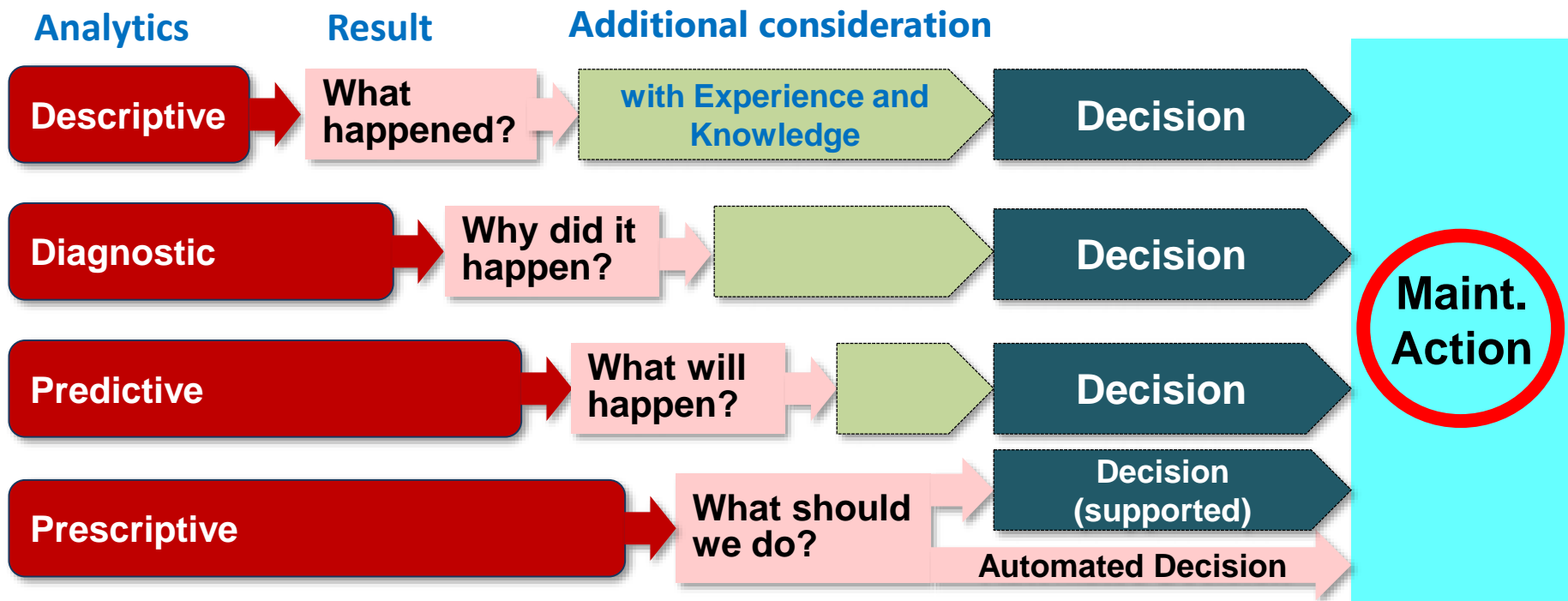- **Predictive maintenance by Data Analytics is advancing rapidly. Technician's experience and situation awareness play key rolls to monitor the conditions of aircrafts physically.**
- **Also, incorporation of Service Bulletin and execution of maintenance program are important**

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Fleet Reliability

Predictive Maint.
· **Situation Awareness**
· **Data Analytics**

Maintenance Program
(Insp · Ope Test · RPLC,etc.)

Hazard Removal by Modification, etc.

Airline A   **Airline B**   **Japan Airlines**

In parallel with maximizing the effect of modification and maintenance program, JAL will strive for predictive maintenance toward "0-0-100".

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QAR : Quick Access Recorder
CPL : Continuous Parameter Logging

AI ?

**Big Data Analytics
(QAR/CPL)**

BIG DATA

**What should
we do?**

**Prescriptive
Analytics**

**What will
happen?**

**Predictive
Analytics**

**Why did it
happen?**

**Autonomous?
Maintenance
Optimizer?**

**Diagnostic
Analytics**

**What
happened?**

Onboard Maint. Computer

**Descriptive
Analytics**

- **Crew Alerting System**
- **Aircraft Condition Monitoring System**

Challenge Level

Potential of Effect

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Data Analytics and Aircraft Maintenance

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Analytics | **Result** | **Additional consideration**

Descriptive	What happened?	with Experience and Knowledge	Decision
Diagnostic	Why did it happen?		Decision
Predictive	What will happen?		Decision
Prescriptive	What should we do?		Decision (supported) / Automated Decision

Maint. Action

Furthermore, some may be automated decision support.

However, technicians are still essential for accomplishing and confirming actual maintenance actions.

Collaboration of AI and Maintenance Personnel

Expectation for AI and Prescriptive Analytics

1. **Bring the maintenance level up without depending on each person's expertise and skill.**
2. **Decrease the human error in decision.**
3. **Accelerate the process for decision making.**

Even AI can propose the desirable solution, it is necessary to monitor and approve the proposal since the allowance for any error in the aircraft maintenance is minimal.

- AI needs to propose the solution in a manner that maintenance personnel can determine whether the proposal is appropriate or not.
- Also, maintenance personnel are required to keep/improve the knowledge and skill for evaluating the proposal by AI.

**Toward the ultimate goal of "0-0-100",
Building a "Proud and Confident" maintenance team
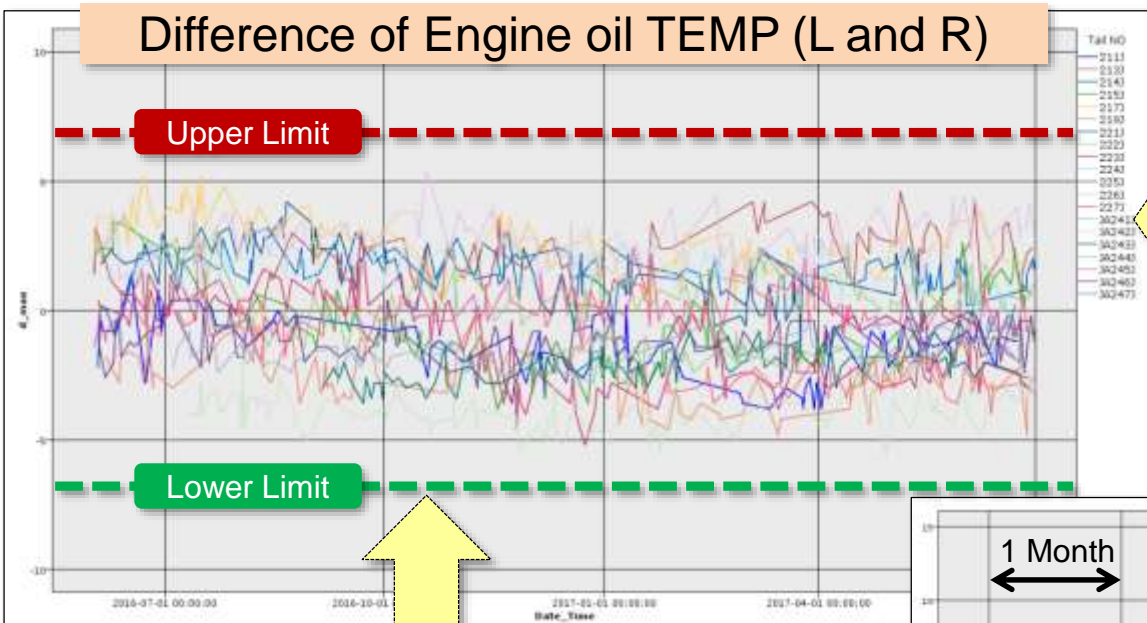with the collaboration of AI is the key**

Thank you

Example of Big Data analytics (ERJ ENG oil TEMP sensor)

Difference of Engine oil TEMP (L and R)

Upper Limit

Lower Limit

- E-170/190 (20 airplanes)
- Used data for one year
  - 68,000 flights
  - 62,000 flight HRs
  - 12 parameters/sec
  - 15.4 GB data size

Using standard deviation, normal range was defined.

If the data deviates from the normal range, degradation of the oil TEMP sensor is suspected.

1 Month

Replaced oil TEMP sensor