



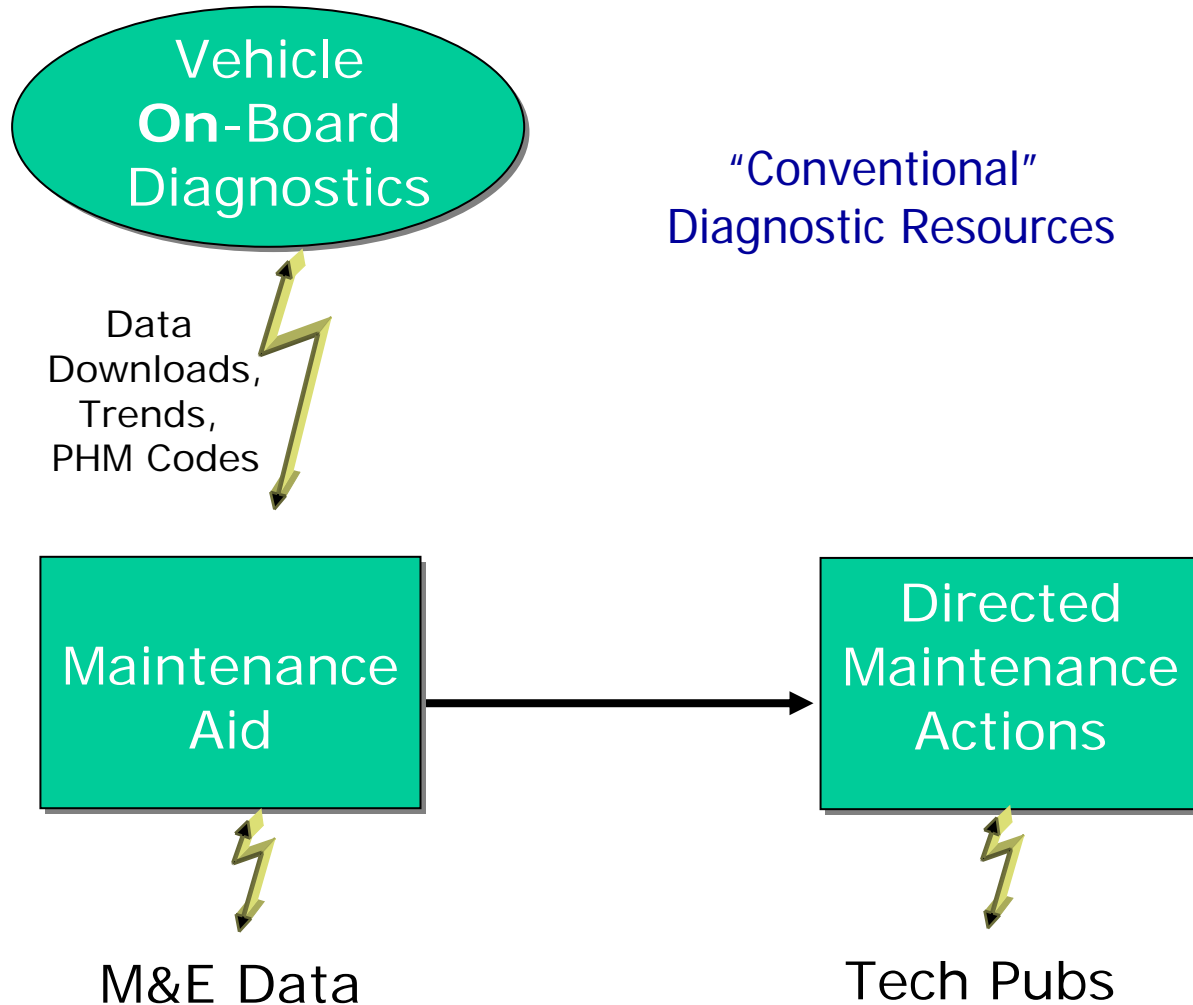
Closing the Gap on First-Time-Fix

Integrating "Field Experience" with Sensor-Based DPHM

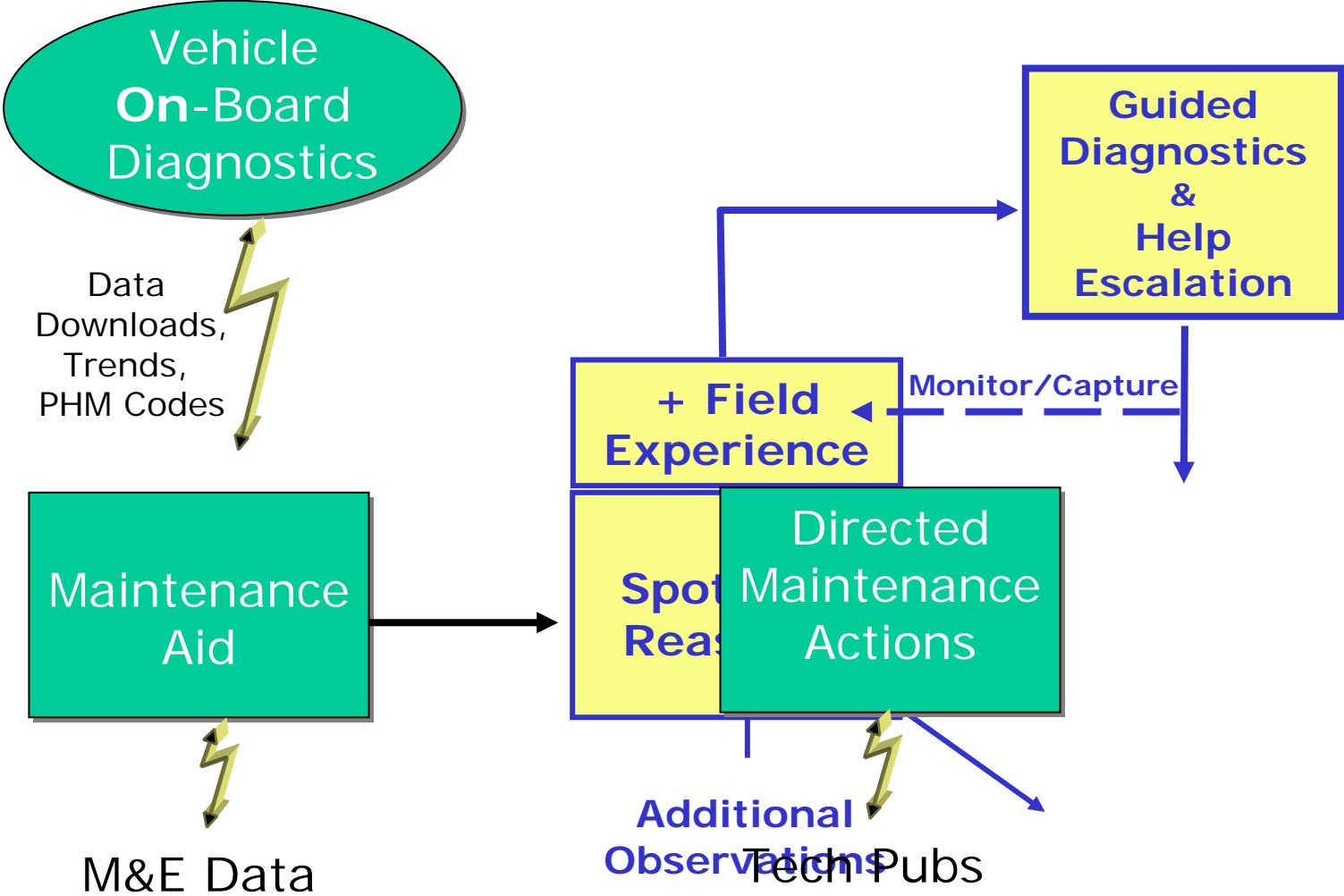


Mr. Phil D'Eon, CEO
CaseBank Technologies, Inc.

A Quick Synopsis . . .



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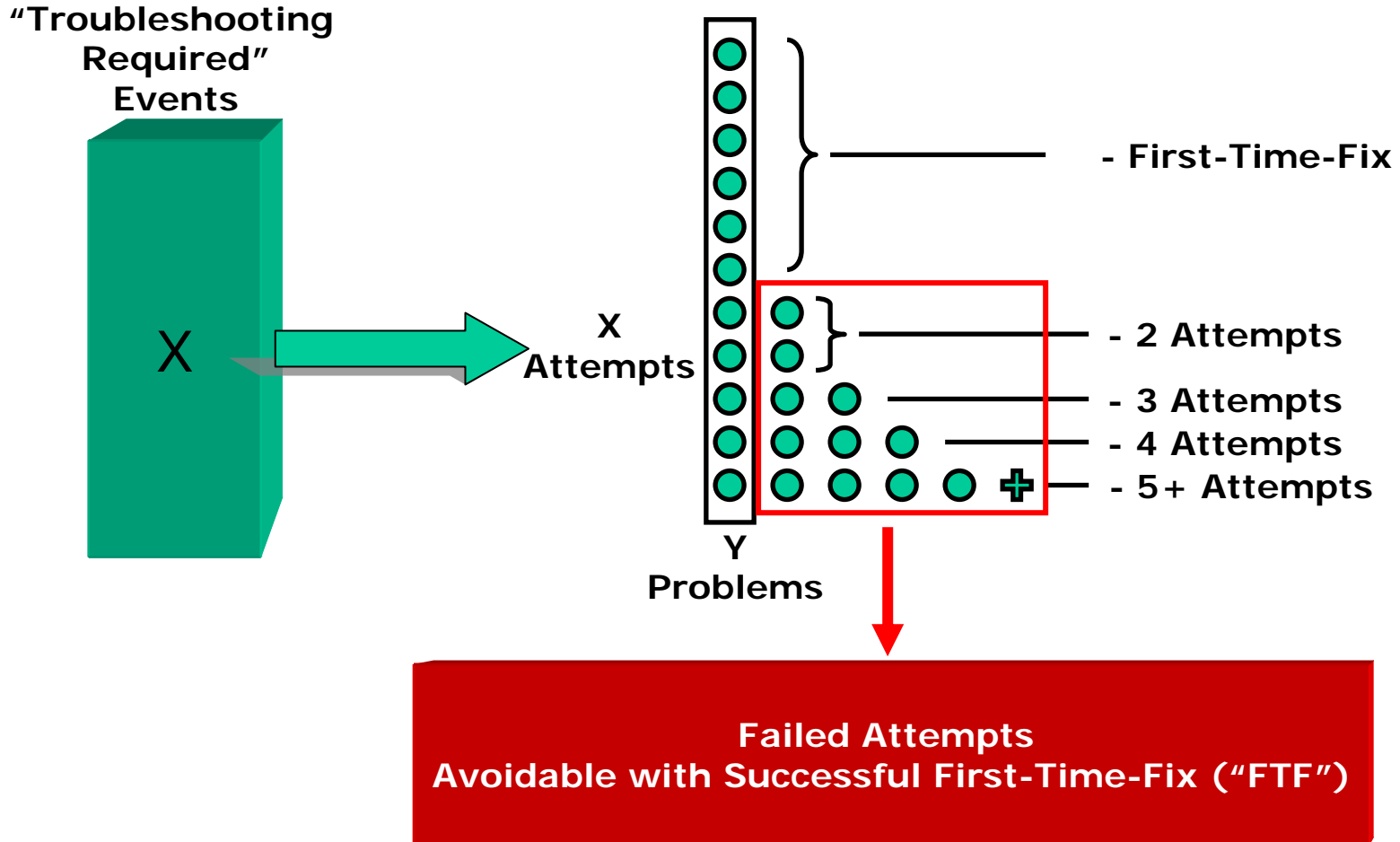


Goal: Improved First-Time-Fix

- Given today's equipment and best practices . . .

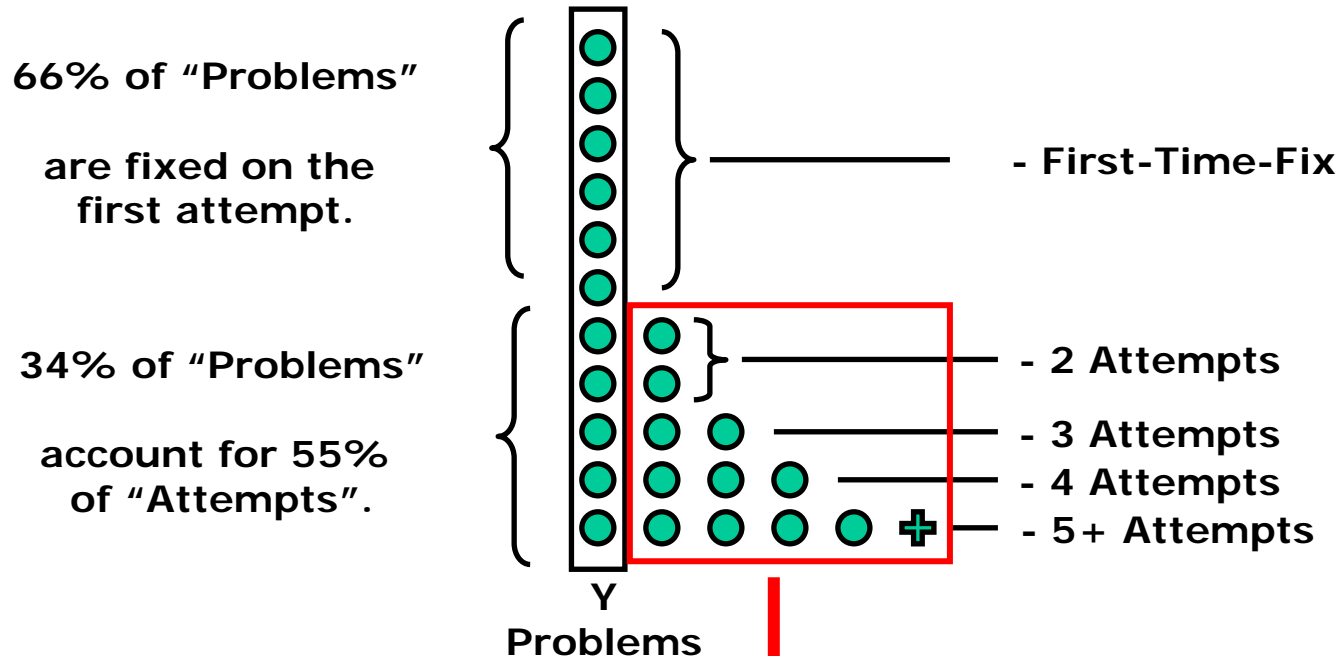
*What is current performance on
First-Time-Fix?*

First-Time-Fix Analysis



First-Time-Fix Analysis

Large Regional Airlines



47% of Troubleshooting "Attempts" Failed

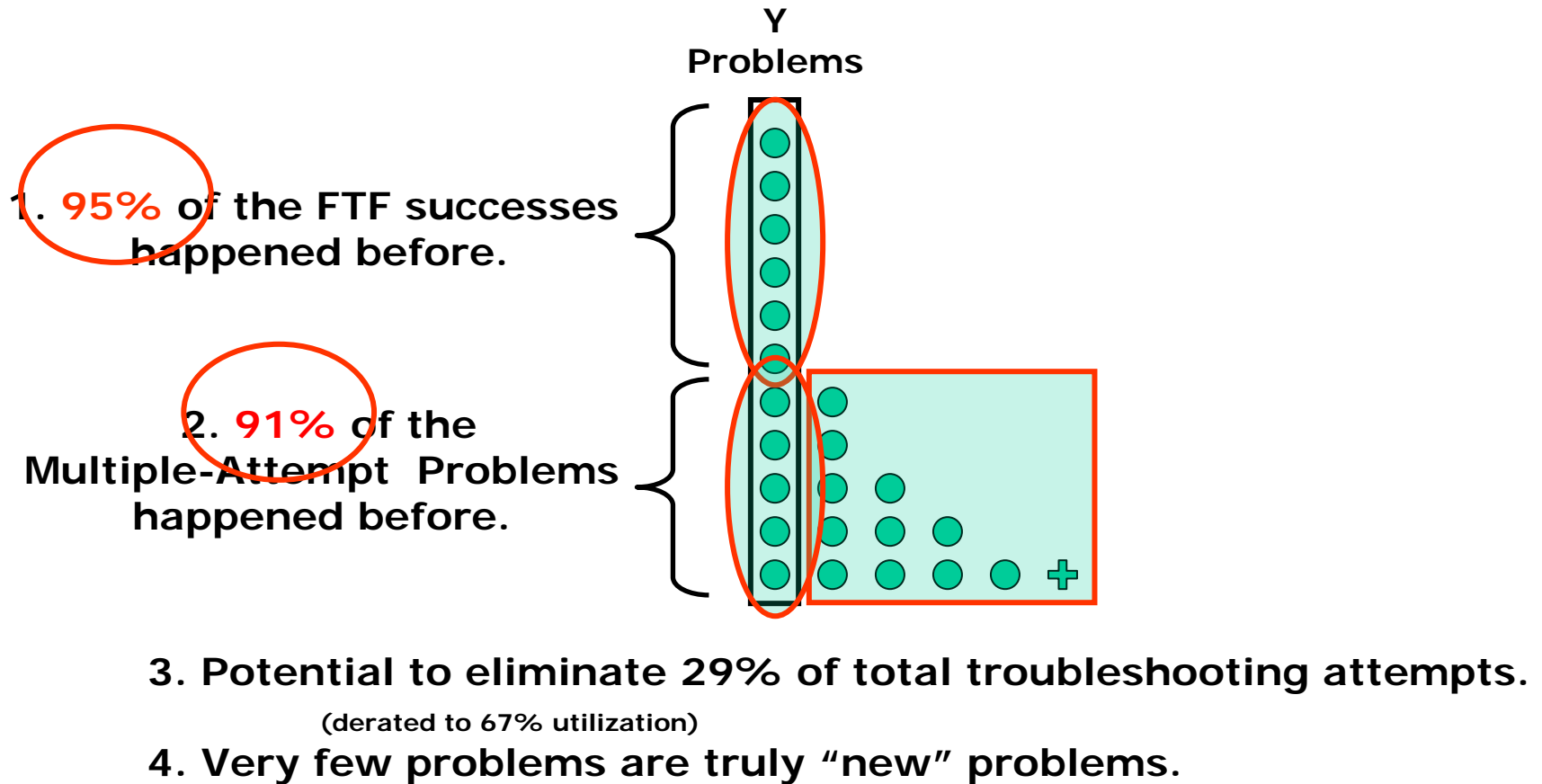
Cost Impact \$35K-\$52K per year per aircraft

+

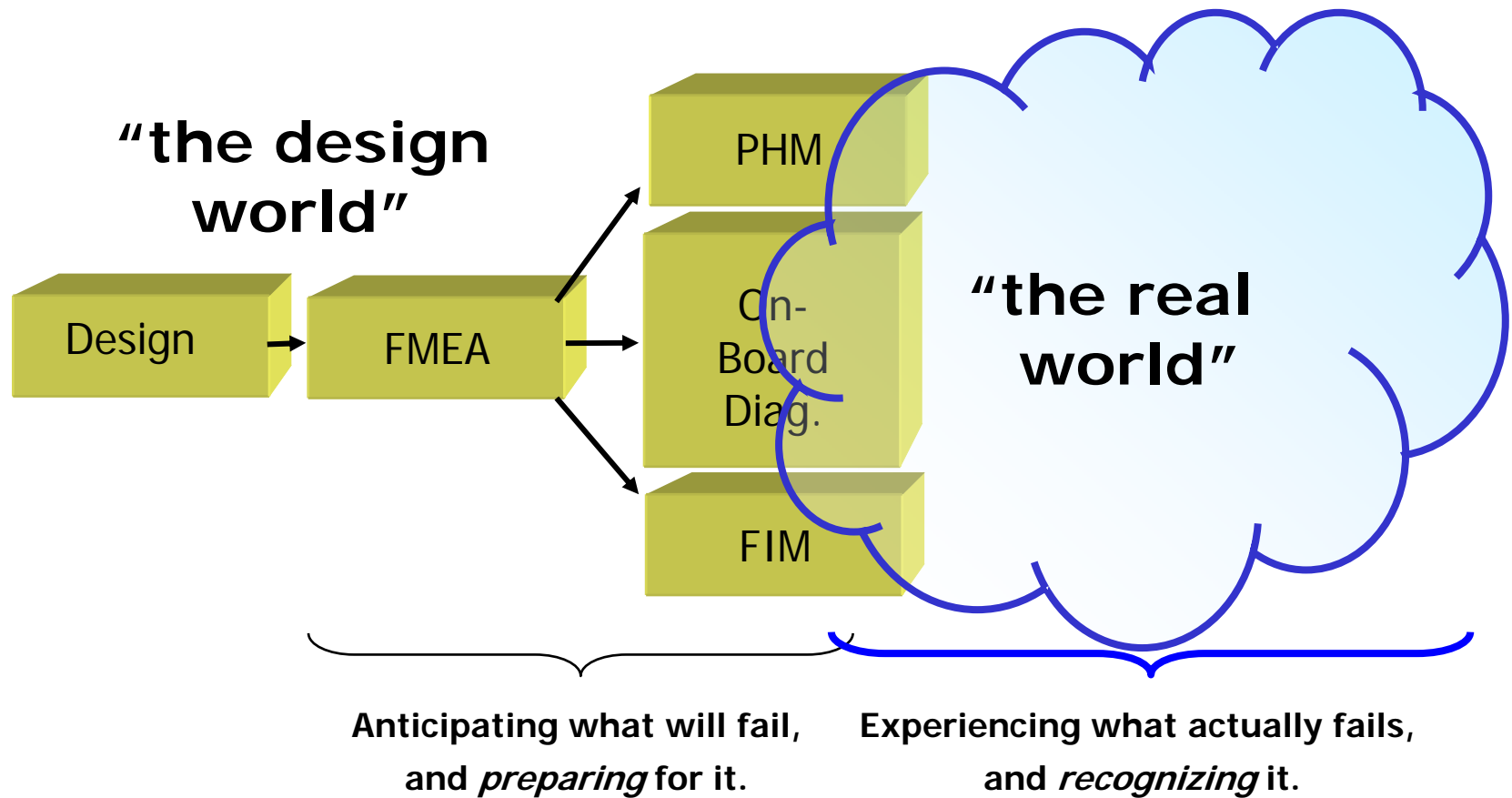
Dispatch reliability reduced by 0.2 to 0.4% (98% usual)

How Relevant Is Past Experience?

(Compared to the accumulated operator experience for these aircraft captured previously in a SpotLight knowledgebase.)



The Core Problem: Anticipated vs. Actual Experience



“Recognizing” Problems

- “Differential” Diagnosis
 - Candidate Solutions
 - Seek evidence to confirm or refute candidates
 - Reason with time, cost, frequency
 - Constantly re-assess with added evidence
 - *Guided* Diagnostics
- Symptoms . . .
 - Operator complaints
 - Health (fault) codes
 - Environment
 - Sound, smell, feel
 - Maintenance history
 - *Anything relevant*

Pilot Report: *"STEERING INOP" message*

Initial symptom:

Discriminating Questions:

- What is the problem with the steering?
- Was the hand-wheel moved before touchdown?
- Any MDC fault message codes?
- Can the message be cleared with a Reset?
- Is WOW INPUT message also shown?
- What is the hydraulic quantity?
- Is hydraulic pressure at the selector valve OK?
- Fault clear if you change the Selector Valve?

"STEERING INOP shown"

*Inoperative
No
NWS EHSV FAIL
Cannot be reset
No*

Experience Suggests:

- Loose/ disconnected torque links
- Hand-wheel moved in flight
- LVDT or connector
- Swivel valve
- Landing Gear Selector valve
- Balanced Relief Valve

ID# **Cas-MDP-0024**

STEERING INOP: Shown - 5/17/2004

Open

Casebase CRJ700-900

Aircraft ID: Test

Casebase Search

- [Event Details](#)
- [Symptom List](#)
- [Suggested Questions](#)
- [Problem Notes](#)

Answer one or more questions about the problem

- Is the caution message STEERING INOP shown on EICAS? [More details...](#)
- What is the problem with the nosewheel steering? [More details...](#)
- Which MDC message(s) are shown for 32-51 - NOSEWHEEL STEERING?
- Is the caution message WOW INPUT shown on EICAS? [More details...](#)
- Is there hydraulic pressure present at the selector valve?
- Is an unusual noise heard?
- What is the condition of the nose gear torque links?
- Has the Goodrich Service Bulletin 53340-32-12 been incorporated to the landing gear selector valve?
- [More details...](#)
- What is the condition of the selector valve extend solenoid? [More details...](#)
- What is the hydraulic quantity indication on the HYDRAULIC synoptic page? [More details...](#)
- Is the nosewheel steering electrically and mechanically centered? [More details...](#)
- Was the steering handwheel moved prior to complete aircraft touchdown?
- Is the status message STEERING DEGRADED shown on EICAS? [More details...](#)
- What is the condition of the steering actuator piping assemblies?
- Is there evidence of a hydraulic leak?

Shown

No response to steering input

[NWS MANIFOLD / NWS HSV FAIL;](#)

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18 possible solution(s) found:

	Similarity
STEERING INOP Caution message due to a malfunctioning No.3 system Balanced Relief Valve	
STEERING INOP Caution with multiple MDC messages due to malfunctioning No.3 Balanced Relief Valve	
STEERING INOP and WOW INPUT Caution messages due to Disconnected Nose Landing Gear Torque Links	
STEERING INOP Caution message and Nosewheel Shimmy due to loose Torque Links Pins	
STEERING INOP Caution message due to a malfunctioning Landing Gear Selector Valve	
FIM - EICAS - STEERING INOP (Caution)	

ID# Cas-PDe-0002

STEERING INOP: Shown - 2/16/2004

Open

Casebase CRJ - 700

Serial Number: Test

View solution details

Solution # 366: STEERING INOP Caution message due to a malfunctioning No.3 system Balanced Relief Valve

The malfunctioning no.3 system balanced relief valve in line to the selector valve was obstructing the flow of hydraulic fluid.

One balanced relief valve is installed in the reservoir bootstrap circuit and closes off flow to the hydraulic system users when pressure falls below 2200 psi (15170 kPa). This allows the accumulator to maintain bootstrap pressure at the reservoir. A second balanced relief valve is installed between the pressure manifold and the landing gear, nose wheel steering and inboard brakes. This valve closes when supply pressure drops to 2200 psig.



References

The no.3 hydraulic system balanced relief valve was replaced:

- [AIPC 29-12-05](#) - Balanced Relief Valve
- [AMM 29-12-05-04](#) - Removal/Installation of the System No.3 Balanced Relief Valve

Lessons

To help determine which LRU is defective, verification of the hydraulic pressure should be done with a suitable pressure gauge [0-3500psi (0-20 954 kPa) pressure range] to ensure that the steering manifold and steering swivel valves are getting hydraulic pressure.

Obey all safety precautions set forth in [AMM Task 29-00-00-910-802](#) - hydraulic technical precautions.

Note: It is normal with the Nose Wheel Steering (NWS) selected to 'OFF', torque link disconnected and the hydraulic system number 3 selected to 'ON' that any pressure difference caused by a lateral force input or angle off center will result in the steering collar to turn. With the NWS selected to 'OFF' and hydraulic system number 3 pressurized there is approximately 60 psi within the steering manifold assembly. Taking into consideration that with the torque link disconnected there is little (negligible) friction on the steering collar, any pressure difference applied to the steering actuators will cause the steering collar to continue turning.

Capturing Field Experience



4 Knowledgebase is then updated



1 Knowledgebase Administrator reviews sessions saved by users.

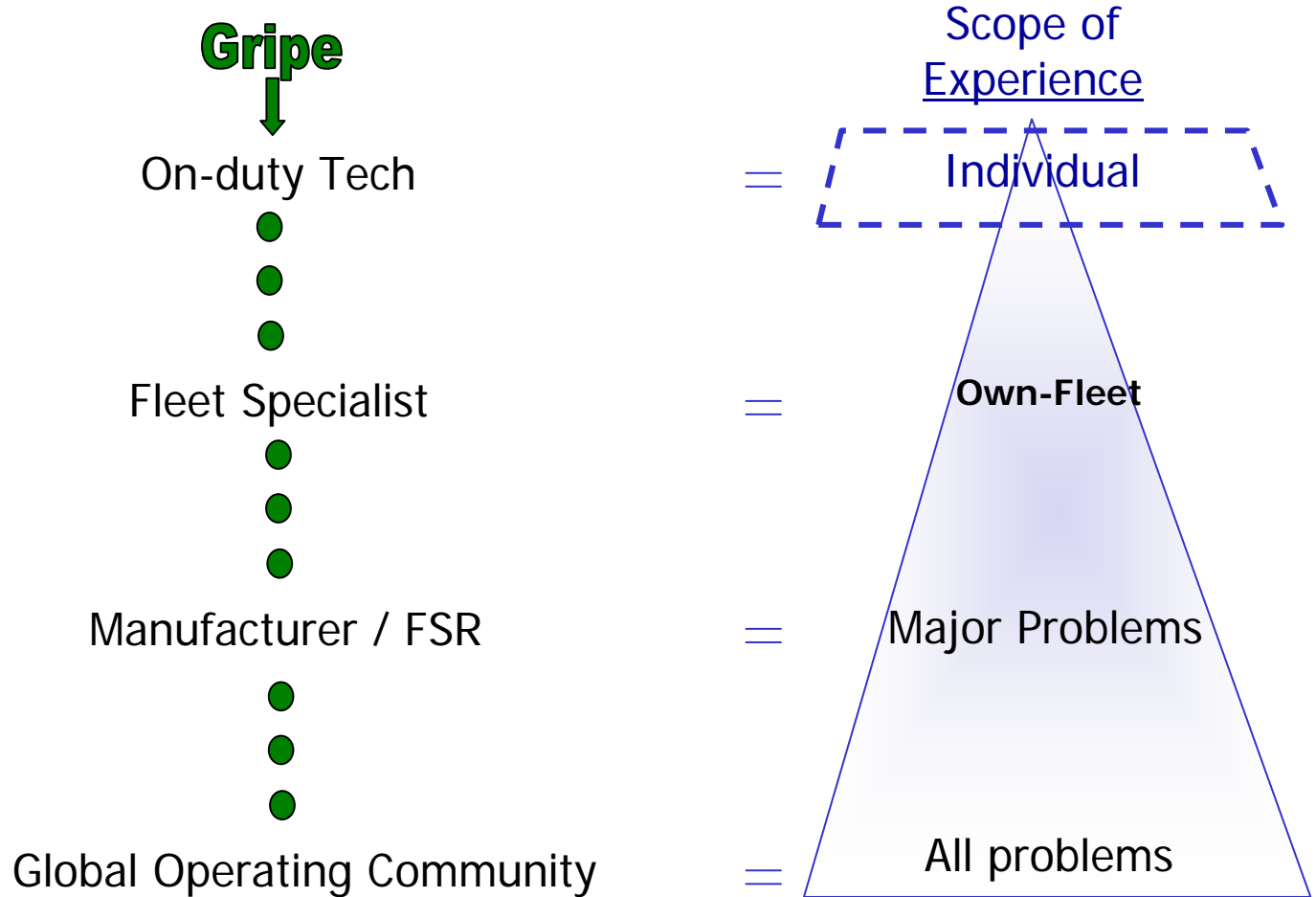


2 Knowledgebase Developers (SMEs) prepare new solutions.

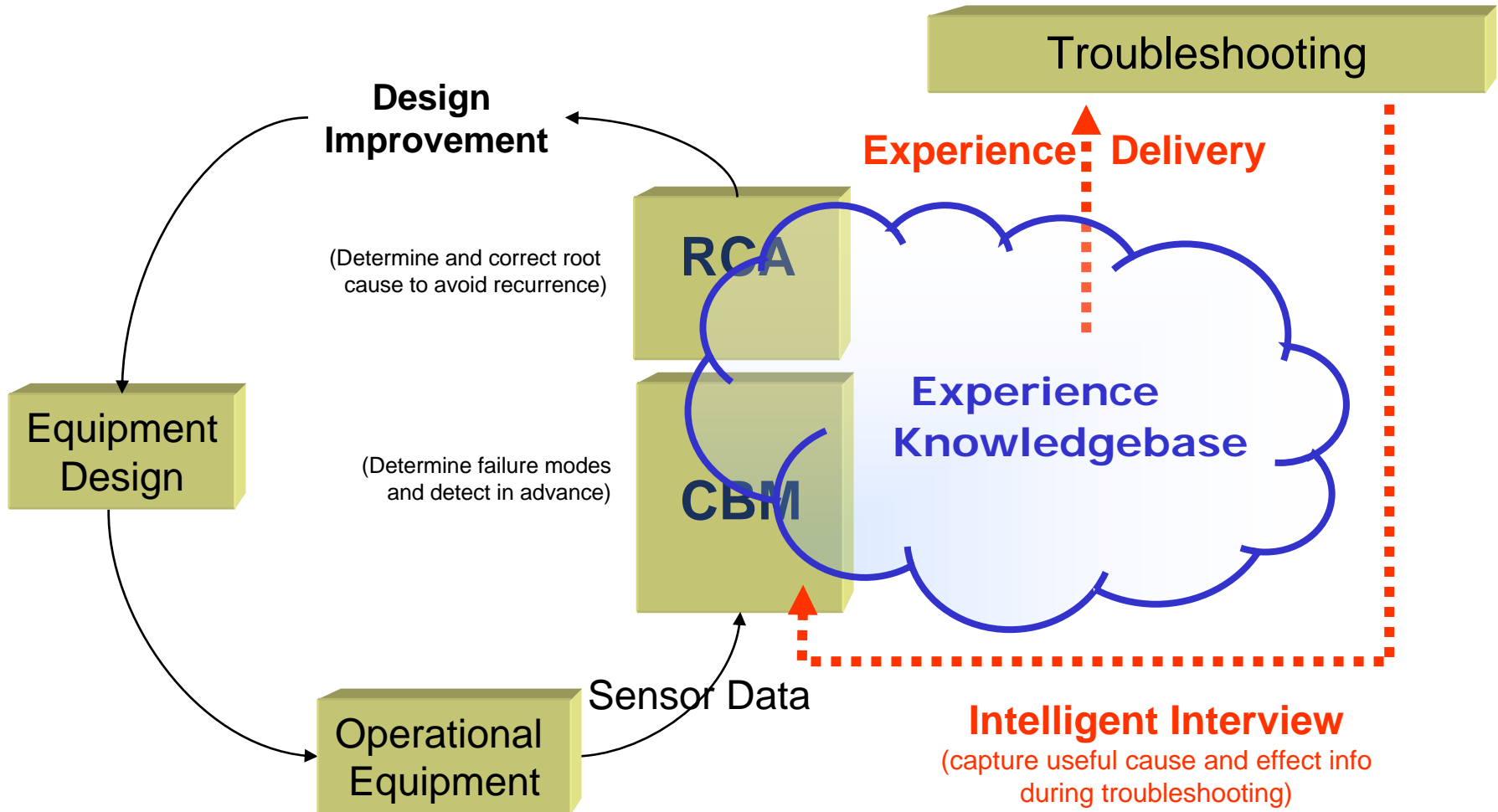


3 Independent review of new solutions.

Where Is The Experience?

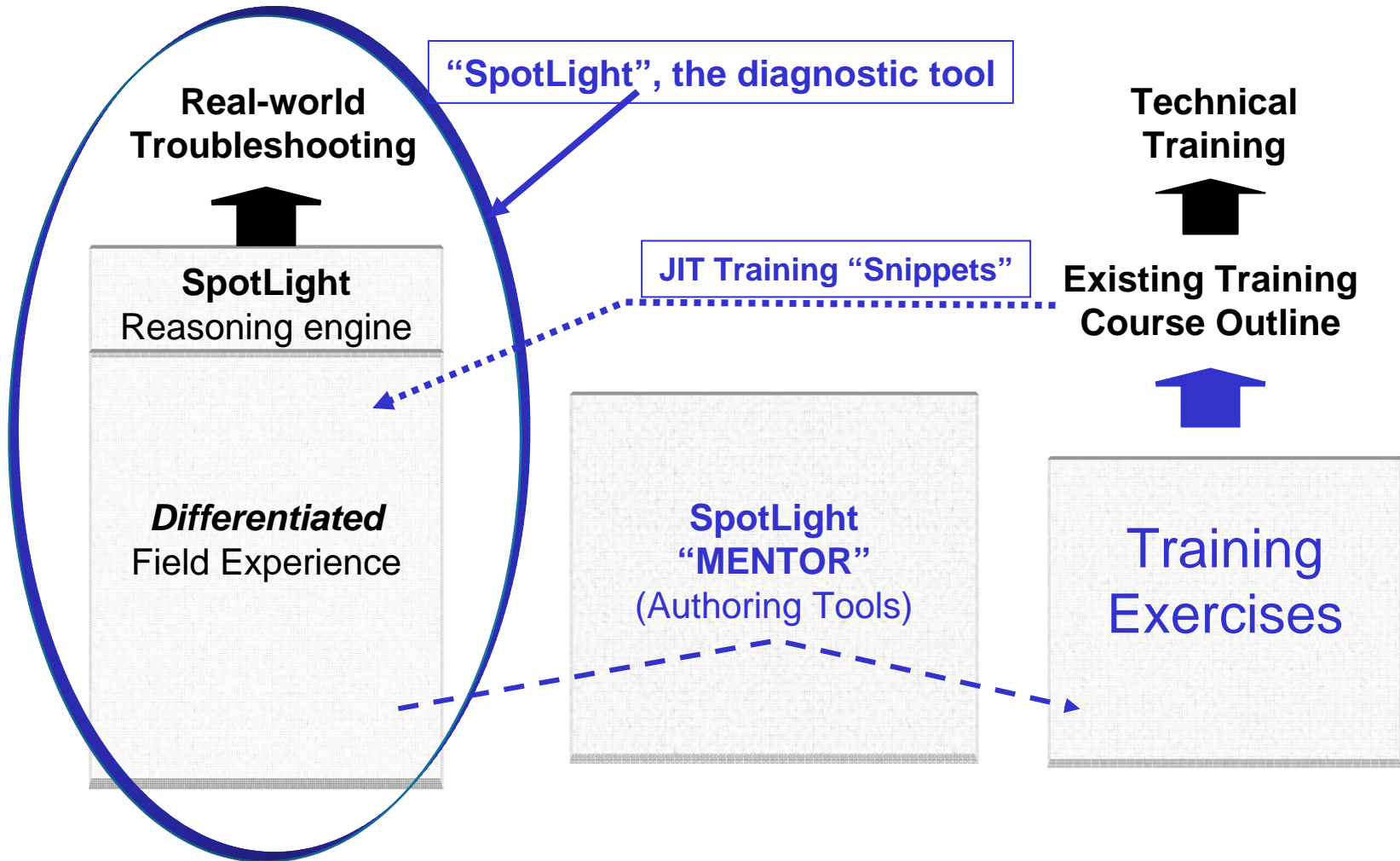


Role of SpotLight with CBM and RCA



RCA = Root Cause Analysis
CBM = Condition Based Maintenance

Field Experience Used in Training



Summary

- Field Experience improves FTF performance
 - IF applied during the diagnostic process
- Field Experience can be delivered as guided diagnostics
 - Integrated with other diagnostic resources
- Powerful side benefits
 - Activity monitoring and collaboration
 - Intelligent knowledge capture for CBM and RCA
 - Training



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