

*An advanced, comprehensive
Testability Engineering
And Maintenance System*

TEAMS™
Tool Set

TECHNOLOGY INTRODUCTION



Who is **Qualtech Systems, Inc.** ?

Qualtech Systems, Inc.

October, 2002

- **Software Company Incorporated June 1993 in Connecticut, located in Wethersfield, CT**
 - » 14 employees and growing (SBA certified Small Disadvantaged Business (SDB))
 - » A technology leader and growing small business - Awarded Connecticut “Fast 50 Award” in Oct 2001 and September 2002
 - » Selected for NASA Space Act Award in April 2002 for *Significant Scientific and Technical Contributions*
 - » Selected for Award of Aviation Week and Space Technology - *Technical Innovations 2002*

- **QSI leaders have over 100 years of combined experience in Integrated Diagnostics/RM&T, algorithm design, implementation, and software product development - Five members of QSI staff have doctoral degrees, two of whom are IEEE Fellows - Collectively, our principals have written over 400 journal and conference papers - QSI is a recognized technology leader**

- **Key People / Recognized Experts from QSI**
 - » Dr. Krishna Pattipati - *CEO/President*
 - » Mr. Kevin Cavanaugh - *Chief Operating Officer*
 - » Dr. David Kleinman - *R&D and Business Development*
 - » Dr. Somnath Deb - *Chief Engineer*
 - » Dr. Amit Mathur - *Senior Research Scientist*
 - » Dr. Sudipto Ghoshal - *Senior Research Scientist*

- **Products and Services :**
 - » Integrated TEAMS™ Tool Set: **TEAMS™, TEAMS-RT™, TEAMATE™, TEAMS-KB™, TEAMS-RDS™**
 - » ID&T engineering, Software Design and Development, IVHM architecture, IETM reasoners, R&D, TPS Engineering, Modeling, and RM&T Engineering

Comprehensive Integrated Diagnostics and IVHM Solutions

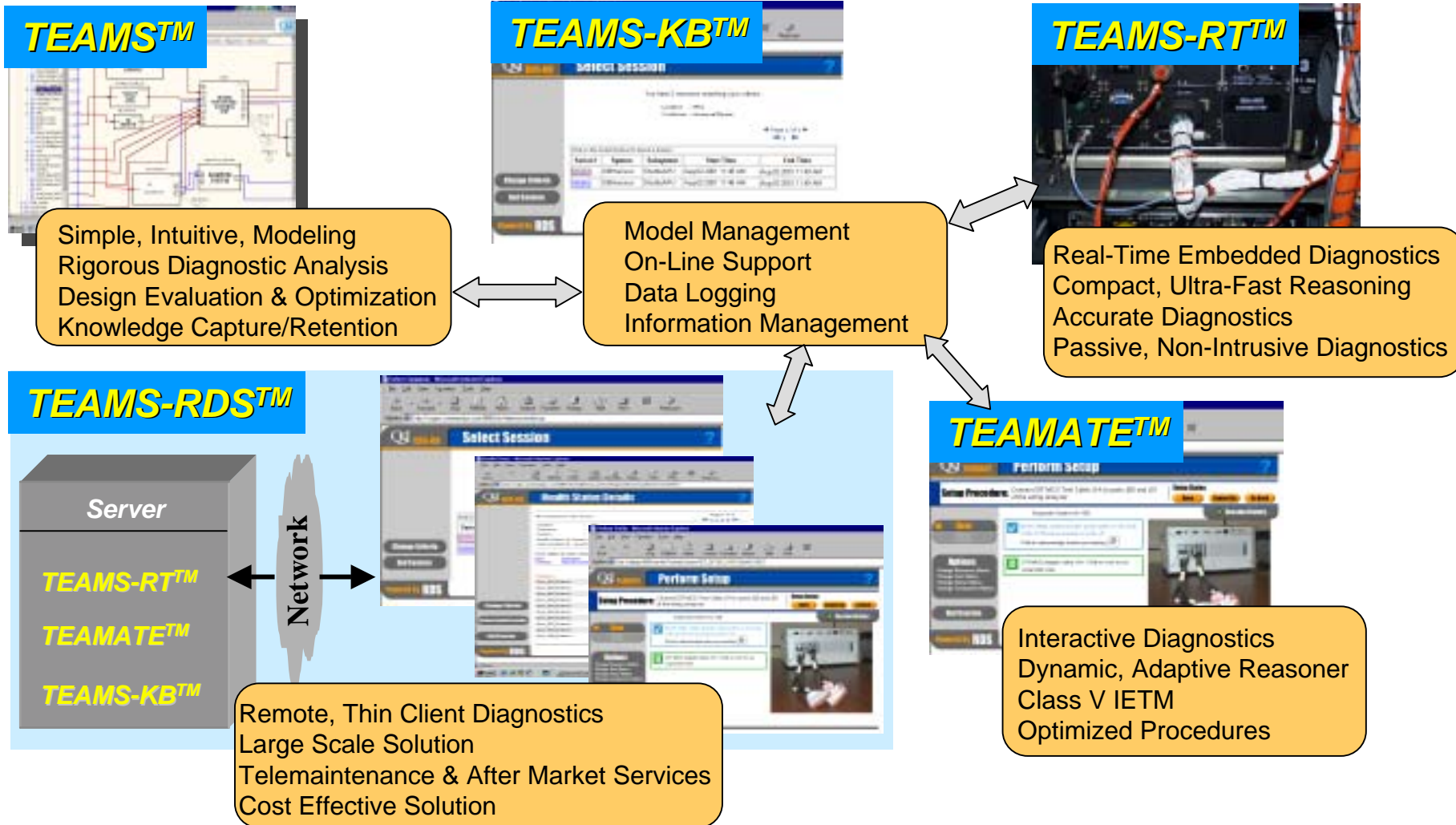


What is the **TEAMS™** Tool Set?

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A Comprehensive ("Common Model") Software Solution for Designing, Deploying, and Supporting Systems for the Entire Life Cycle

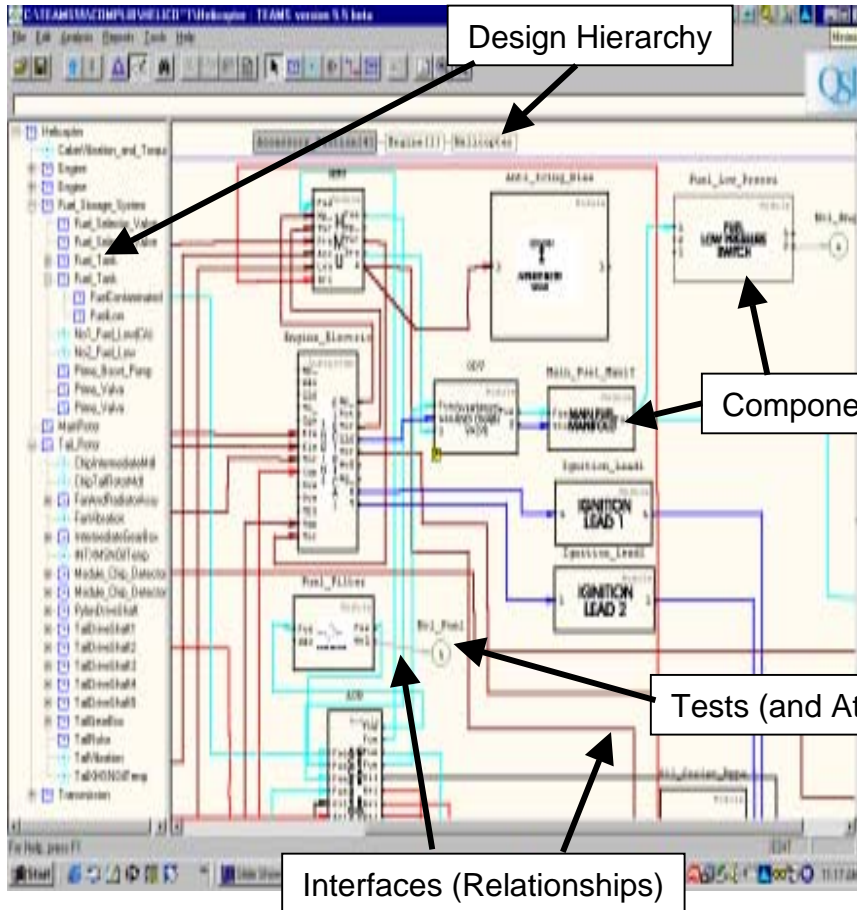




What are **TEAMS™** models?

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TEAMS™ IS NOT:

- a Simulation
- a Rule-Based Model
- a Case-Based Model
- a Statistics-Based Model

TEAMS™ IS:

- A Cause and Effect, Multi-Functional Model of the Failure Behavior of the System
- A Graphical, Understandable way of representing the RM&T aspects of the design for the Life Cycle
- A Visual model that supports V&V and Long Term Model Maintenance and Updates
- The least expensive, most cost effective modeling approach available

Most OEMs already do these “models” in their current processes Except they do not have the graphical representation, the analysis & optimization features, and the ability to implement these models in the systems!



What analysis can **TEAMS™** provide?

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Hardware Properties



Detailed Diagnostic Strategy



FMECA

Variety of Analysis Options

Testability Figures of Merit



Optimized Diagnostic Tree

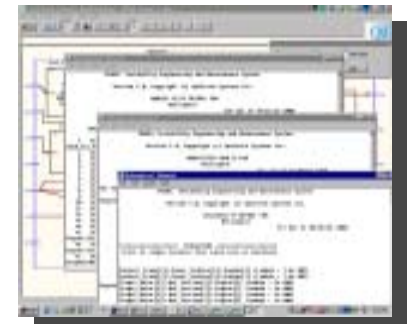
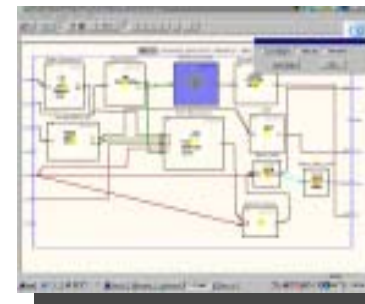


Signal Processing

Test Properties

Graphical Feedback

Variety of Text Reports





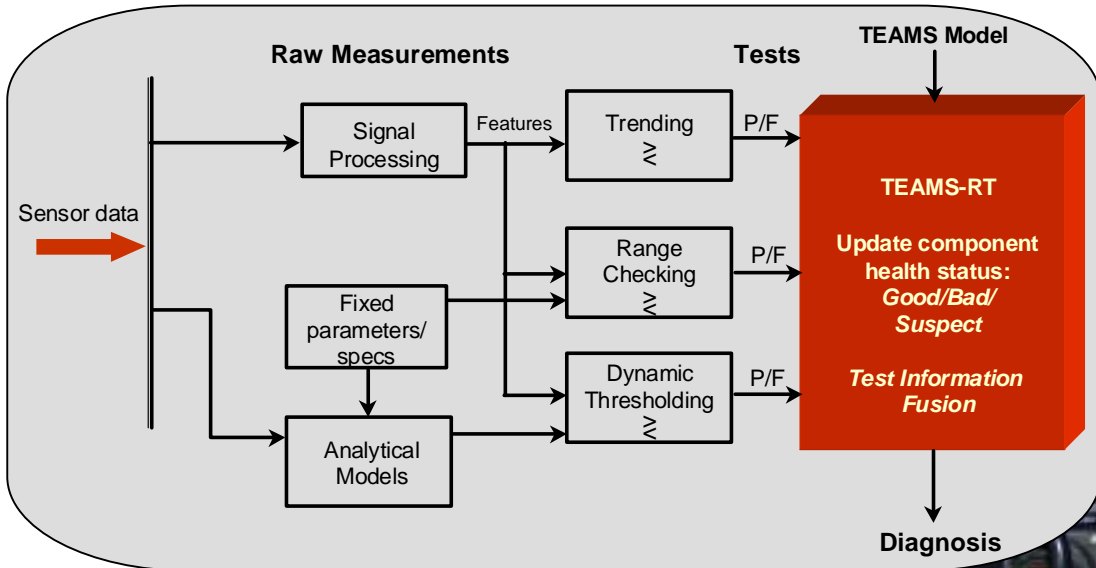
How can the

TEAMS™

Tool Set be applied?

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Example embedded application running on NASA Ames UH-60 "RASCAL" Helicopter



TEAMS-RT™

- Very Fast, Low Overhead, Model Based Real Time Reasoning Using **ALL** test results - Failed Tests, Failing Tests, and Passing Tests
- Continuous, Non-Intrusive Diagnostics
- Extracted **DIRECTLY** from the Modeling & **ANALYSIS** environment (TEAMS™)



How can the **TEAMS™** Tool Set be applied?

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TEAMATE collects/logs maintenance actions including time required and other maintenance management data



- *Dynamic Reasoner*
- *Adapt to Resources*
- *Maintenance History*
- *Collect/Time Actions*
- *Present Diagnostics*
- *Present Repair Steps*
- *Present Test Steps*

TEAMATE™

- **Extracted DIRECTLY** from the Modeling & Analysis environment (TEAMS™)
- Intelligent, Model Based, **Dynamic, Adaptive,** Maintenance Procedures



Models (Configurations)
Maintenance History
Maintenance Results

To client CMMS
and/or E-Commerce
Systems



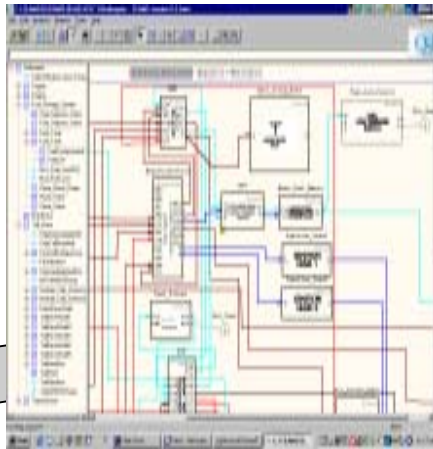
How can the **TEAMS™** Tool Set be applied?

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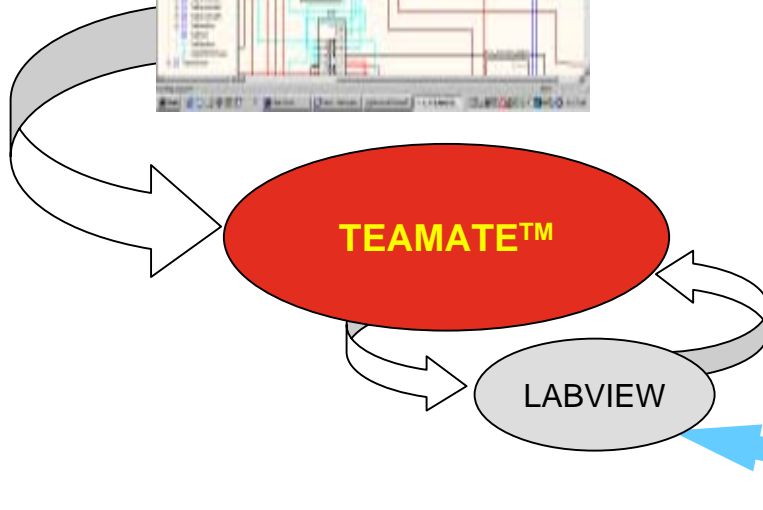
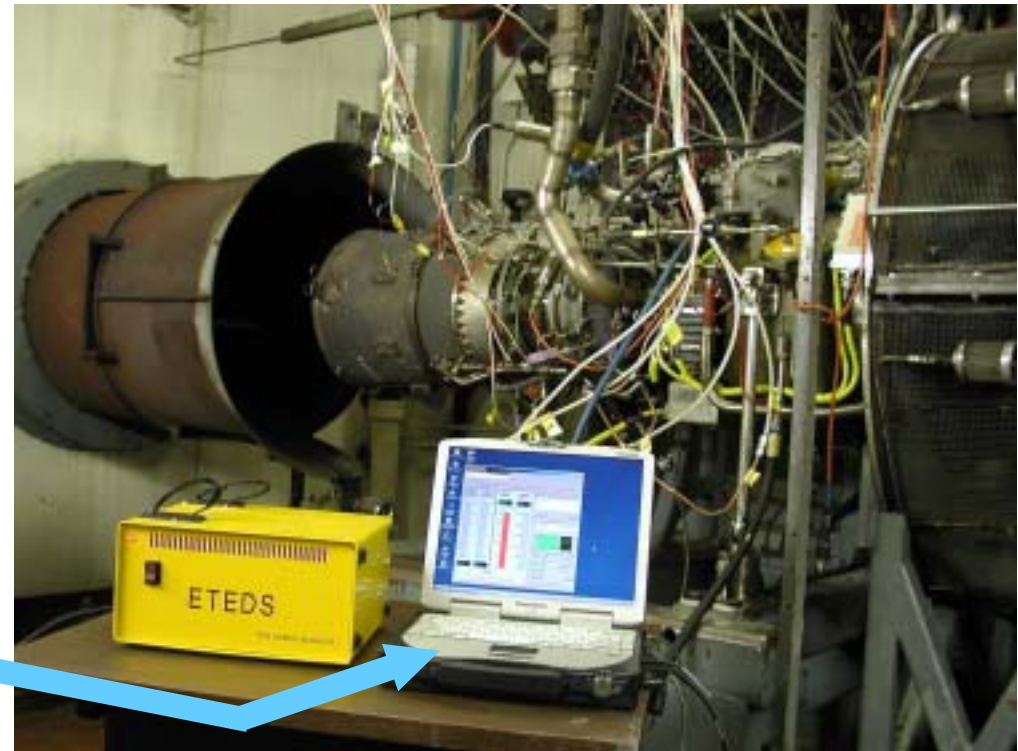
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TEAMATE™ can be used to Intelligently sequence Test Equipment - Using Knowledge from the TEAMS™ Model

TEAMS™
model of
GE T-700
Engine



**JAHUMS-ARMY: ETEDS
at the T700 Engine Test Cell,
GEAE, Lynn, 1/30/02**





How can the

TEAMS™

Tool Set be applied?

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Diagnostic Data

TEAMS-RDS™

RDS Server

TEAMS-RT™

TEAMATE™

TEAMS-KB™

Internet



Manage System Health Information



Examine Systems Health and Detailed Diagnostic Information



Perform Optimized Testing and Maintenance



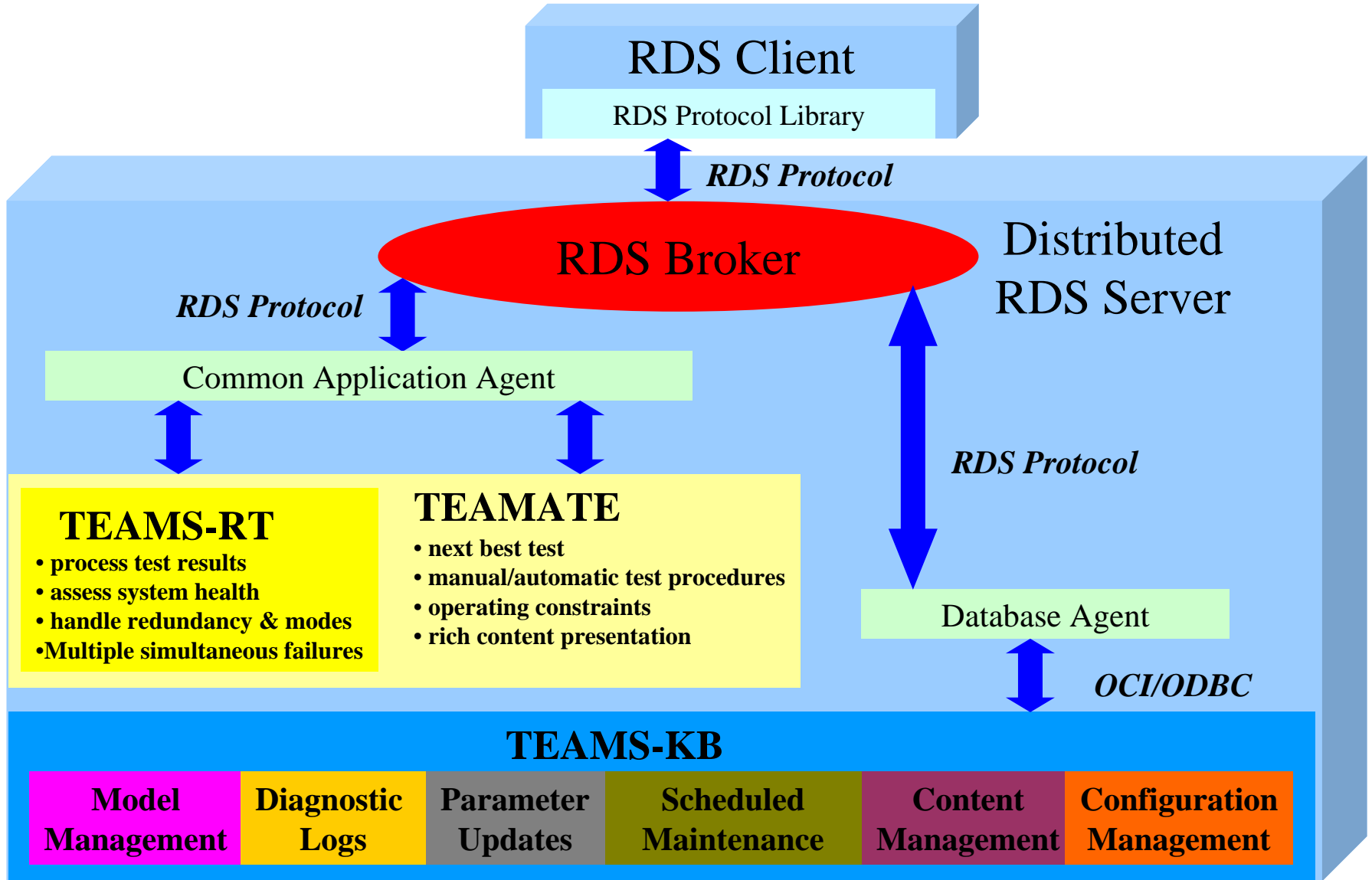
How Does

TEAMS-RDS™

Work?

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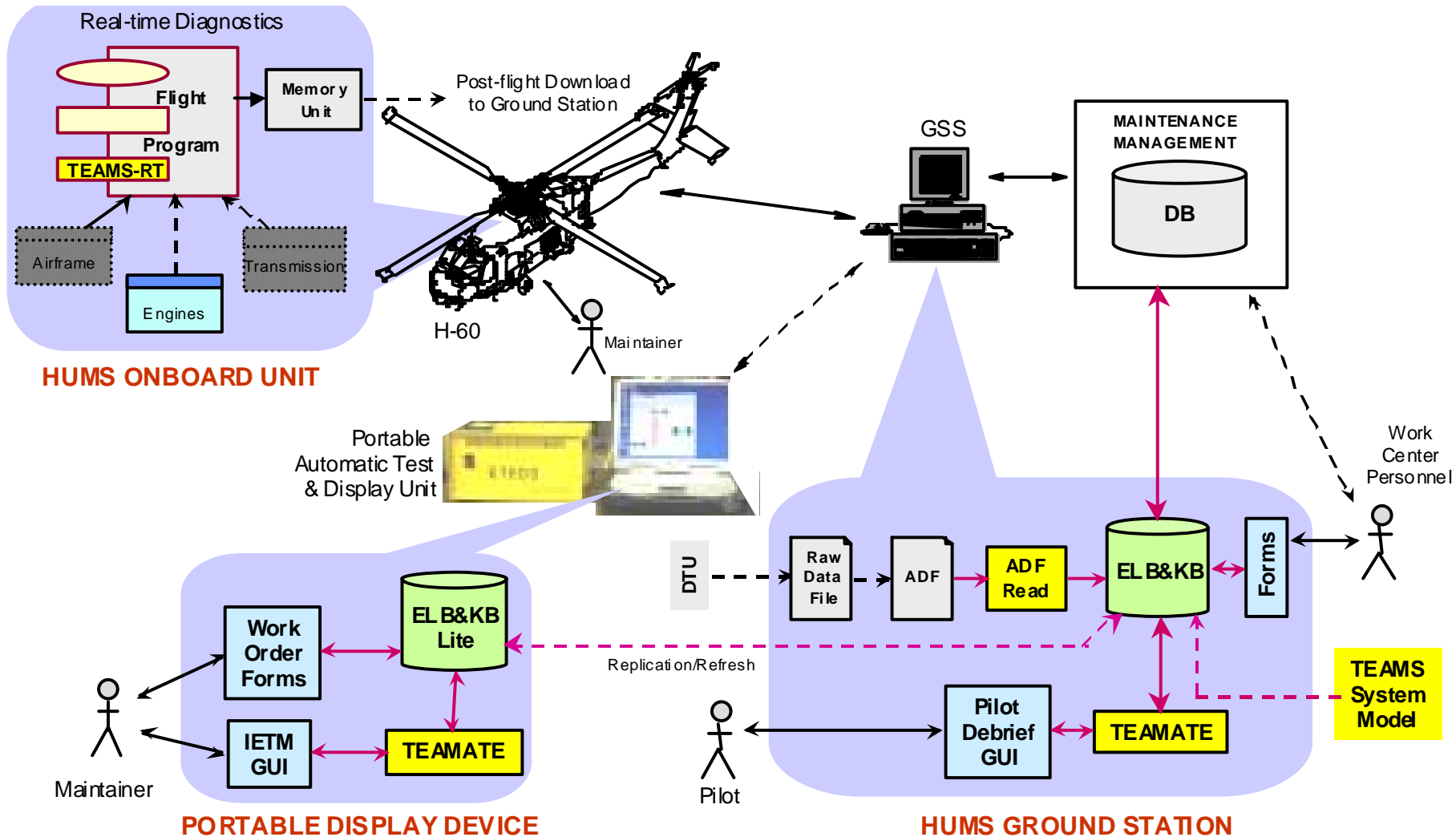




How are **TEAMS™** Tools Used in JAHUMS?

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What are the

TEAMS™

Tool Set Benefits?

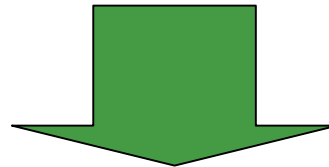
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Case History: JAHUMS (Joint Advanced Health and Usage Monitoring System) - Army and Navy Rotorcraft advanced On-board and Off-Board IVHM Solution - ROI Analysis/Study conducted by Sikorsky Aircraft for DoD ACTD using actual field data, models, and simulations

- a. **Scheduled Maintenance** reduction = **50%**
- b. **Troubleshooting time** (FI time in MTTR) reduction = **75%** using intelligent, dynamic fault isolation procedures vs standard fixed troubleshooting trees
- c. **False Removals** and Unnecessary Spares Consumption reduction = **80%** via accurate model based reasoners and cross system reasoning (IVHM function to control/isolate cascading failure)
- d. **Training Requirements** reduction = **20%** via enhanced automation and intelligent procedures
- e. **Aircraft Readiness** improvement = **38%** with fewer maintenance personnel (from 4 down to 1) via improved fault isolation performance and enhanced automation

* Data compiled for helicopter engines only based on approximately 400 operating hours per year.



Data showed approximately \$30,000 in SAVINGS per year, per engine - Helicopter Engines with 400 Operating Hours