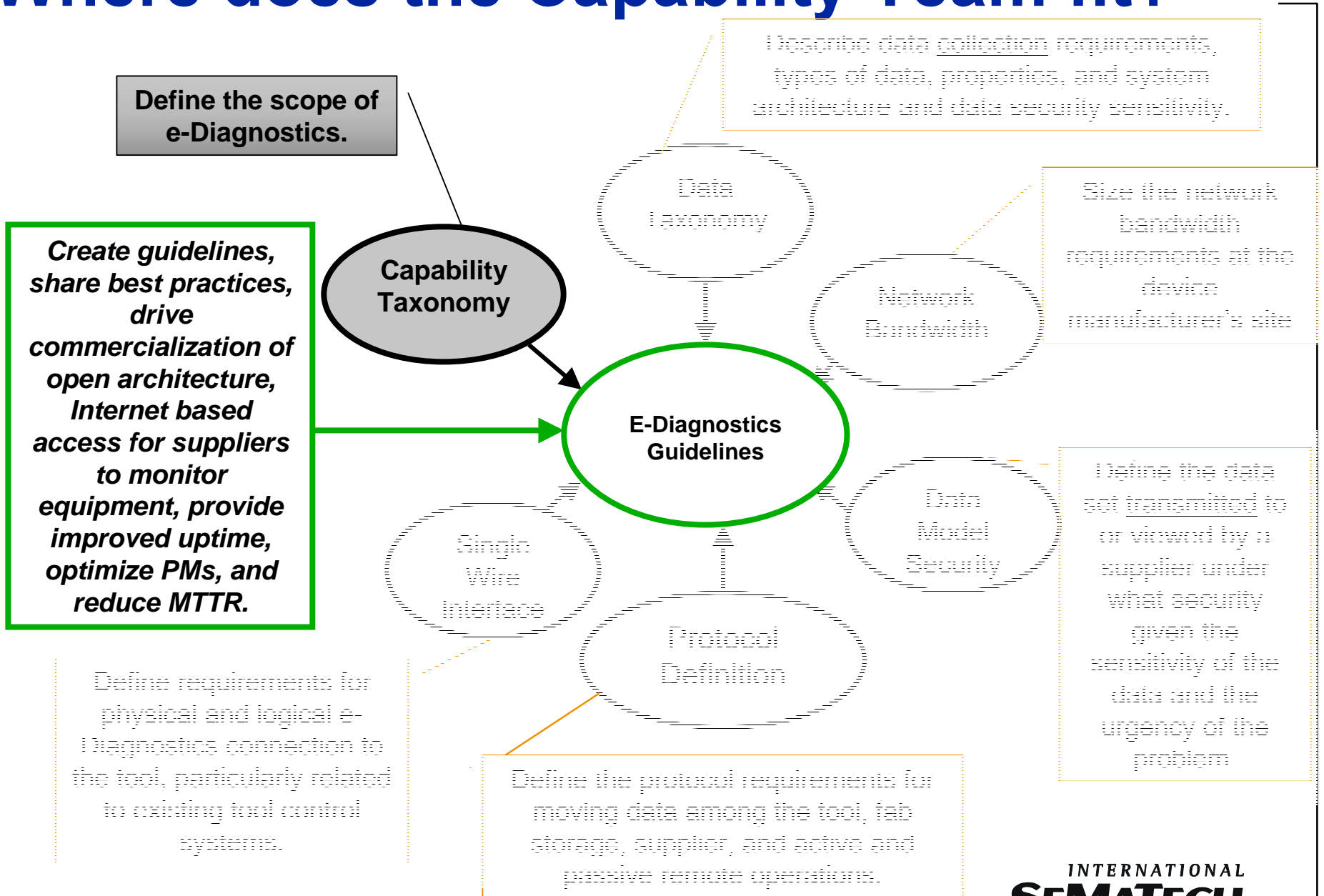


# e-Diagnostics Capability Model

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# Where does the Capability Team fit?



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- Predictive/Proactive Equipment Self-Diagnosis
- Decision Logic

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# Scope & Limitations

The goal of this document is:

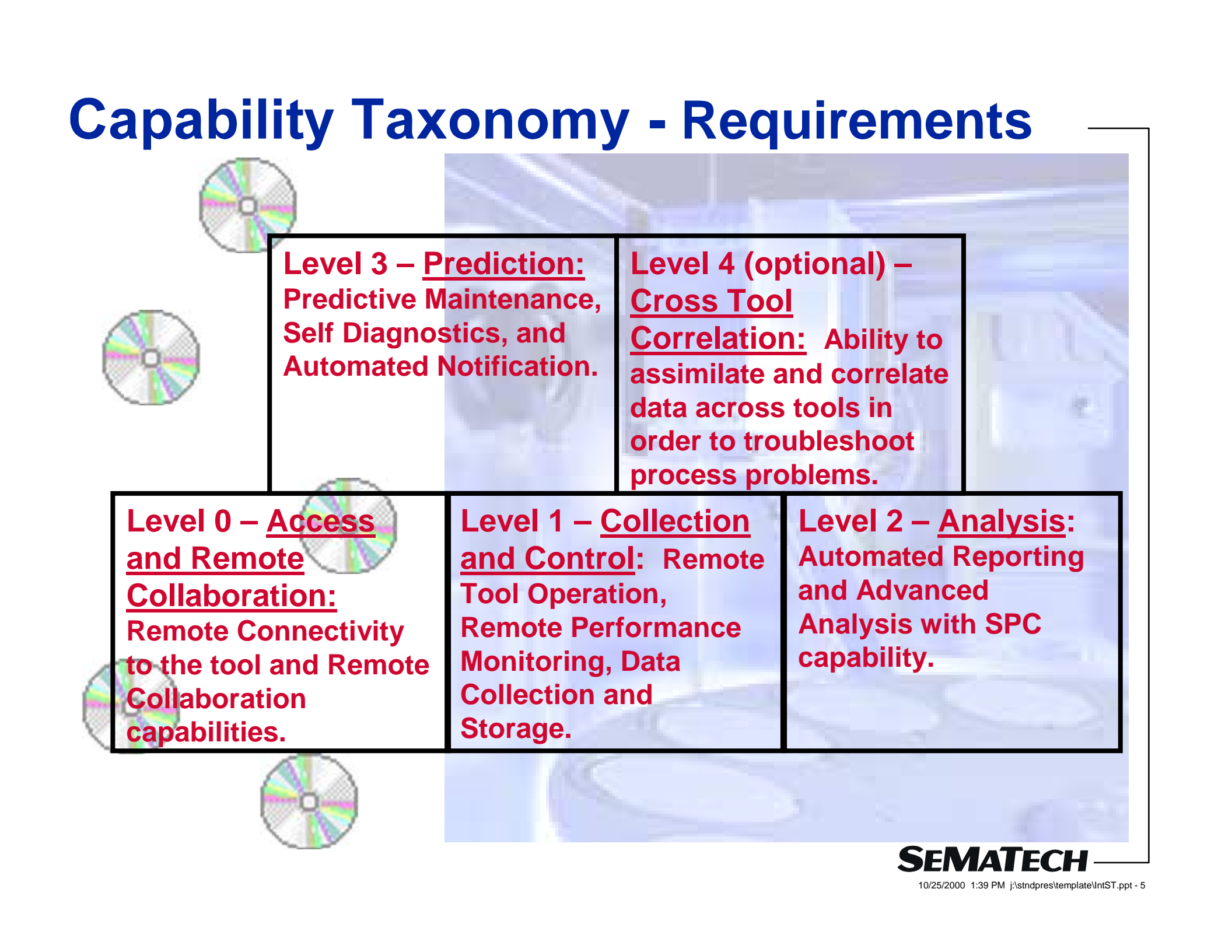
- To define multiple levels of capabilities that will improve chip makers'  
Overall Equipment Efficiency

Additional Objectives:

- To not be constrained by current practical challenges or limitations
- To implement with the best methods
- To evolve as these limitations are removed in the future

This document is not to supersede existing computer network LAN/WAN services.

# Capability Taxonomy - Requirements



**Level 3 – Prediction:**  
Predictive Maintenance,  
Self Diagnostics, and  
Automated Notification.

**Level 4 (optional) – Cross Tool Correlation:** Ability to assimilate and correlate data across tools in order to troubleshoot process problems.

**Level 0 – Access and Remote Collaboration:**  
Remote Connectivity to the tool and Remote Collaboration capabilities.

**Level 1 – Collection and Control:** Remote Tool Operation, Remote Performance Monitoring, Data Collection and Storage.

**Level 2 – Analysis:**  
Automated Reporting and Advanced Analysis with SPC capability.

# Level 0 – Access & Remote Collaboration

**Remote Connectivity to the tool and Remote Collaboration capabilities require two fundamental capabilities:**

1. Remote connectivity to the tool within the Company's environment.
2. Practical tools allowing remote collaboration sessions between the tool in the Company environment and remote experts.

## **Key Ideas:**

- Remote Connectivity
  - Fab Network/Topology/Requirements
  - LAN/WAN Management
  - Access Controls
- Remote Collaboration



# Level 1 – Collection & Control

Remote tool operation,  
remote performance monitoring,  
data collection and storage.

## Key Ideas:

- Remote Equipment Configuration
- Remote Operation of Equipment
- Real-time Remote Performance Monitoring
- Data Storage
- Data Collection



# Level 1 – Collection & Control

## Remote Equipment Configuration:

- Ability to remotely logon to a tool or tool environment to analyze and modify software aspects of the tool.
- Support must be able to manually setup, update, or upgrade tool-specific software or software that is common to a group of tools from a single Supplier.
- Must include tracking any permanent changes made via the remote connection.

# Level 1 – Collection & Control

## **Remote Equipment Operation:**

- Tool to diagnose specific tool health issues.
- View and actuate user-interface functions.
- Access, load, download, execute, and analyze results from tool diagnostics, calibrations, recipe and user programs.
- Access authorization decided by the Tool Owner.
- Must not bypass safety protections inherent in the tool or its operation.

## **Monitor Equipment Performance in Real Time:**

- Tool data available to server and Host in an "event messages" form.
- Tool shall use uniform standard formats as defined by the e-Diagnostics protocol definition sub-team.

# Level 1 – Collection & Control

## Data Storage:

- Data shall be stored in a database at the Company site.
- The database must be accessible from a remote location.
- Data must be transmitted and stored during Host control or Off-line states.
- Tools shall perform System Performance Measurement or overall (e.g., daily) QA health checks and store resultant data.

## Data Collection:

- Supplier shall collect tool data in near real-time via standard protocol using an Ethernet connection.
- Remote data collection must be possible while tool is under Host control or Off-line.

# Level 2 – Analysis

Automated Reporting  
and Advanced Analysis  
with SPC Capability.

Key Ideas:

- Automated data reporting and analysis SPC
- Data Compression



# Level 2 – Analysis

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## **Automated Data Reporting and Analysis:**

- System must have the ability to automatically produce reports.
- System shall provide several types of statistical analysis capabilities.

## **Data Compression:**

- Compression can occur by statistical techniques or via modern file compression.
- Must have associated means for conveniently “unpacking” information.

# Level 3 – Prediction

Predictive Maintenance,  
Self-Diagnostics, and  
Automated Notification.

Key Ideas:

- Predictive/Proactive Equipment Self-diagnosis
- Decision Logic
- Notification



# Level 3 – Prediction

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## **Predictive/Proactive Equipment Self-diagnosis:**

- Tool must be capable of self-diagnosis.
- System to make decisions for maintenance and repair via on-board diagnostic routines initiated by the tool, decision logic, and automated notification.

## **Decision Logic:**

- System shall provide the ability to apply logic or rules to the output from data analysis, or stored data, to make simple decisions and initiate secondary actions.

## **Notification:**

- System shall provide notification of failures, excursions, or negative trends.
- Possible tie-in to the FAB MES system should be considered.

# Level 4 – Cross Tool Correlation

**Ability to assimilate and correlate data across tools in order to troubleshoot process problems:**

- May be necessary to understand if a tool is functioning properly.
- Facilitates comparison of data and process results from multiple tools.
- Can assimilate cross-tool information by field, wafer, or lot.



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# Capability Taxonomy – Summary



**Level 4 (optional) – Cross Tool Correlation:** Ability to assimilate and correlate data across tools in order to troubleshoot process problems.



**Level 3 – Prediction:** Predictive Maintenance, Self Diagnostics, and Automated Notification.

**Level 2 – Analysis:** Automated Reporting and Advanced Analysis with SPC capability.

**Level 1 – Collection and Control:** Remote Tool Operation, Remote Performance Monitoring, Data Collection and Storage.

**Level 0 – Access and Remote Collaboration:** Remote connectivity to the tool and remote collaboration capabilities.



# Appendix A – Use Case for Remote Collaboration

<u>Actor(s):</u>	Equipment Supplier or Equipment User
<u>Preconditions:</u>	Remote Connectivity is Satisfied
<u>Postconditions (success):</u>	Equipment Supplier and Equipment User are able to jointly evaluate the tool performance while viewing or examining the same performance information
<u>Postconditions (failure):</u>	Inability to jointly evaluate tool performance
<u>Trigger:</u>	An issue, problem, concern that requires collaboration, or else routine evaluation of performance, in order to come to a joint understanding

# Appendix A – Use Case for Remote Collaboration

## Main Success Scenario

- Step 1. Acquire necessary tool information via live simultaneous interconnect or else by transferring pertinent information to all collaborators
- Step 2. Evaluate information by ad hoc or else formal methods
- Step 3. Discuss or share reports on tool performance
- Step 4. Reach a consensus and issue a report of conclusions

## Variations for Step 2

If using detailed log files for equipment performance then collaboration can be done “off-line” over a period of hours, days, or weeks.

Use of separate voice interconnects (telephone) is likely, but not discussed.

# Appendix A – Use Case for Remote Collaboration

## Non-functional Requirements:

NOTE: Collaboration requires one or both of the following depending on the e-Diagnostics interface design:

1. Detailed tool performance and operational information in the form of a transferable file that can be reviewed simultaneously at different locations.
2. Ability of the tool interface to support multiple users simultaneously so each collaborator can see the same thing at the same time.