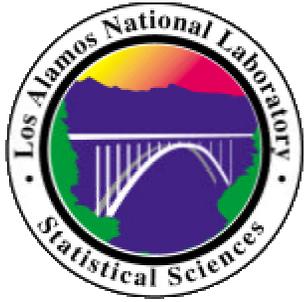


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# INTRODUCTION TO KNOWLEDGE SYSTEMS



# INTRODUCTION

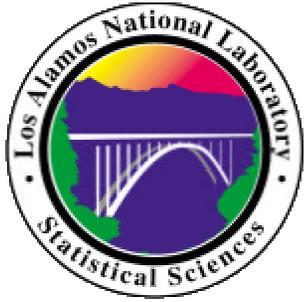
---

## **Purpose:**

Describe prototype Knowledge Systems (KS) that build on expertise and expert judgment.

## **Overview:**

- Definitions of Information Integration Technologies ( $I^2$ ) and Knowledge Systems.
- Descriptions of the range of Knowledge Systems.



# INTRODUCTION

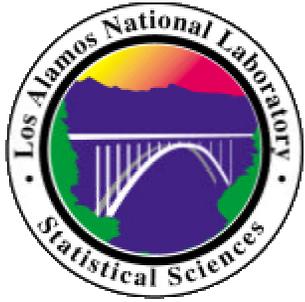
---

## Why Build a Knowledge System?

### **We've developed:**

- representations of the system,
- diagrams of the problem-solving methods,
- models for the data, elicitation tools,
- quantifications of expert judgment,
- methods to combine diverse information sources, and
- what-if questions.

**How are we going to organize and keep track of all of this?**



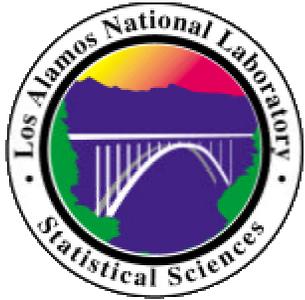
# INTRODUCTION

---

## Why Build a Knowledge System?

To provide distributed communities with electronic access to the information, methods and tools they seek to perform their problem solving/decision making.

To rapidly evolve knowledge in dynamic Science and Technology (S &T) environments



# **THESE KNOWLEDGE SYSTEMS**

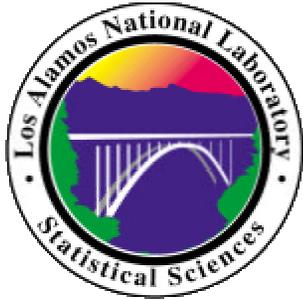
---

## **Are not your typical web page:**

- Customized to experts'/communities' cognition and culture.
- Focused on a particular problem.
- For eliciting expertise and expert judgment.

## **Are not your typical IM/KM for business:**

- Adapted to dynamic, evolving S & T environments.
- Collaboratively designed or designed by users for themselves using our guidance, methods, and tools.



# WHAT ARE KNOWLEDGE SYSTEMS?

## **Information Integration Technology:**

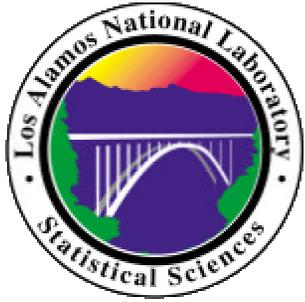
Tools, systems, methods, and guidelines for integrating data and knowledge to support problem solving and decision making.

## **A Knowledge System is an example of I<sup>2</sup> Technology:**

- a web-based electronic repository that has been customized to the cognition and culture of technical communities
- to bring together their data and knowledge
- in structured, quantitative ways, and may include
- the methods and tools that they need to solve problems and make decisions.

- [Really Deadly Missile System](#)
- [Archive Prototype](#)
- [Problem Solving Prototype](#)

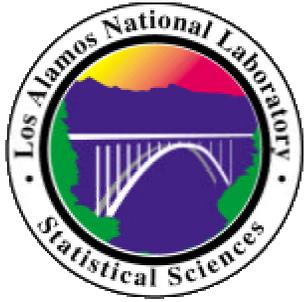




# WHAT IS INTEGRATED?

## Data, Information, and Knowledge

- **Explicit to Tacit Knowledge (Expertise)**
  - Explicit – already codified and stored, e.g. electronic archives.
  - Implicit (tacit) – embedded in practice and mental models of individual and communities of practice. Typically communicated interpersonally.
- Sources – simulations, experiments, observations, and expert judgment
- Judgments of experts or communities of practice
- Time – past, present, future (“what ifs”)
- Types and Levels of Representation – data, meta data; component, subsystem, and system
- Qualitative, quantitative, and degrees of uncertainty



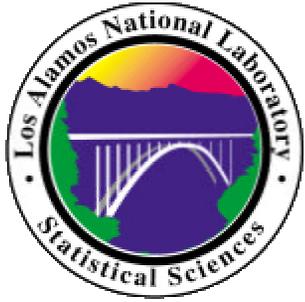
## HOW IS IT INTEGRATED?

---

Mechanisms for integration:

- structural
- quantification and statistical analyses

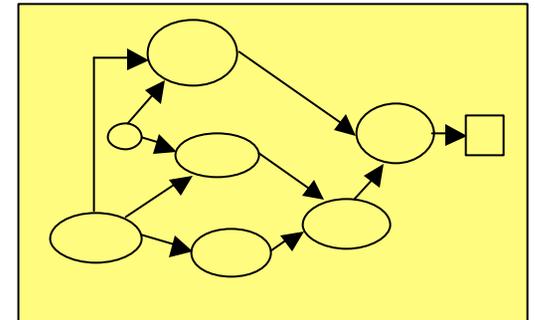
Roles of expertise, expert judgment and other sources of data.



# ROLE OF EXPERTISE AND EXPERT JUDGMENT

*Expertise, a model, representation of the problem or problem-solving process,*

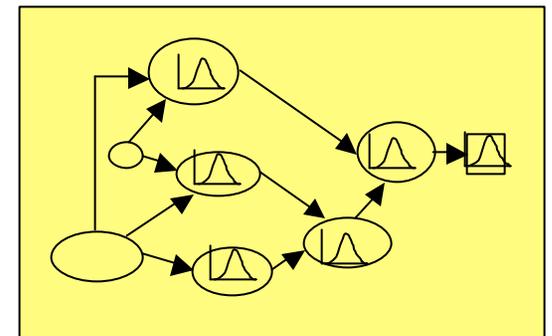
- becomes the structure of the Knowledge System.

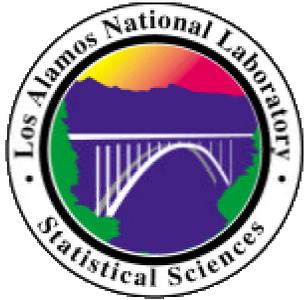


*Expert Judgment, expert's estimates in response to a problem,*

- becomes the content of the structure.

Minimum \_\_\_\_\_ 0.1 IPTV  
Expected \_\_\_\_\_ 0.5 IPTV  
Worst \_\_\_\_\_ 1.0 IPTV





# RANGE OF KNOWLEDGE SYSTEMS

---

## **Vary on degree of integration:**

- sources and types of information.

*Examples: All data is integrated.*

*All sources and types of information are integrated.*

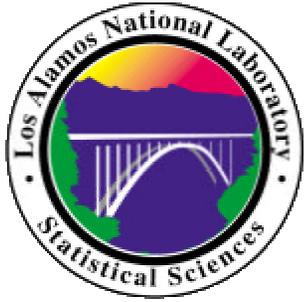
- location of tools, methods, and guidelines for performing analysis and decision making on the information.

*Examples: Tool, methods, and guidelines are offline.*

*Tools, methods, and guidelines are integral part of the Knowledge System.*

# EVOLUTION OF INFORMATION INTEGRATION TECHNOLOGIES



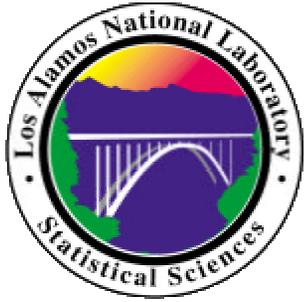


# RANGE OF KNOWLEDGE SYSTEMS

---

## **Vary according to:**

- their focus (archival or problem-solving processes).
- who elicits the expertise and expert judgment, analysts or users themselves.
- range of explicit to tacit knowledge captured.
- whether the KS (content and structure) is static or revised continuously on line.
- degree of automation of processes, such as analysis.



# RANGE OF KNOWLEDGE SYSTEMS

---

## Example: Archival Focus

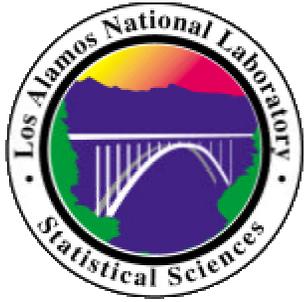
Slapper Detonator Knowledge Base

For: the DoD, Army, Navy, Air Force.

Purpose: To electronically gather the knowledge from the DOE weapon labs for the DoD.

Repository for static, archival information.

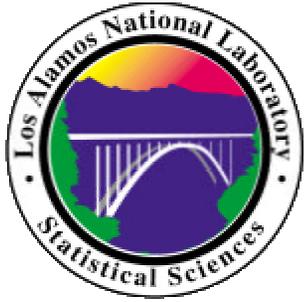
Decision making occurs mainly outside the KS.



# ARCHIVAL KNOWLEDGE SYSTEM

---

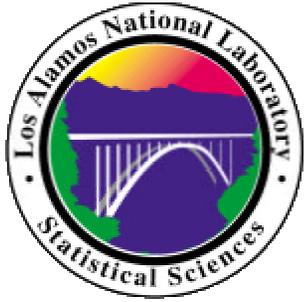
**The following are unclassified, sanitized snapshots of screens from the classified Slapper Detonator Knowledge System.**



# SNAPSHOT OF ARCHIVE

---

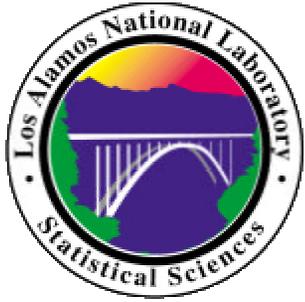
**Home page and user responsibilities**



# SNAPSHOT OF ARCHIVE

---

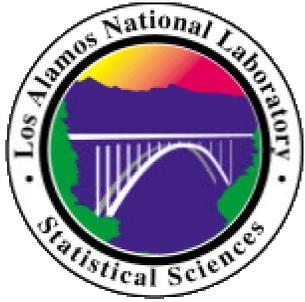
## Definition & Organizing Structure



# SNAPSHOT OF ARCHIVE

---

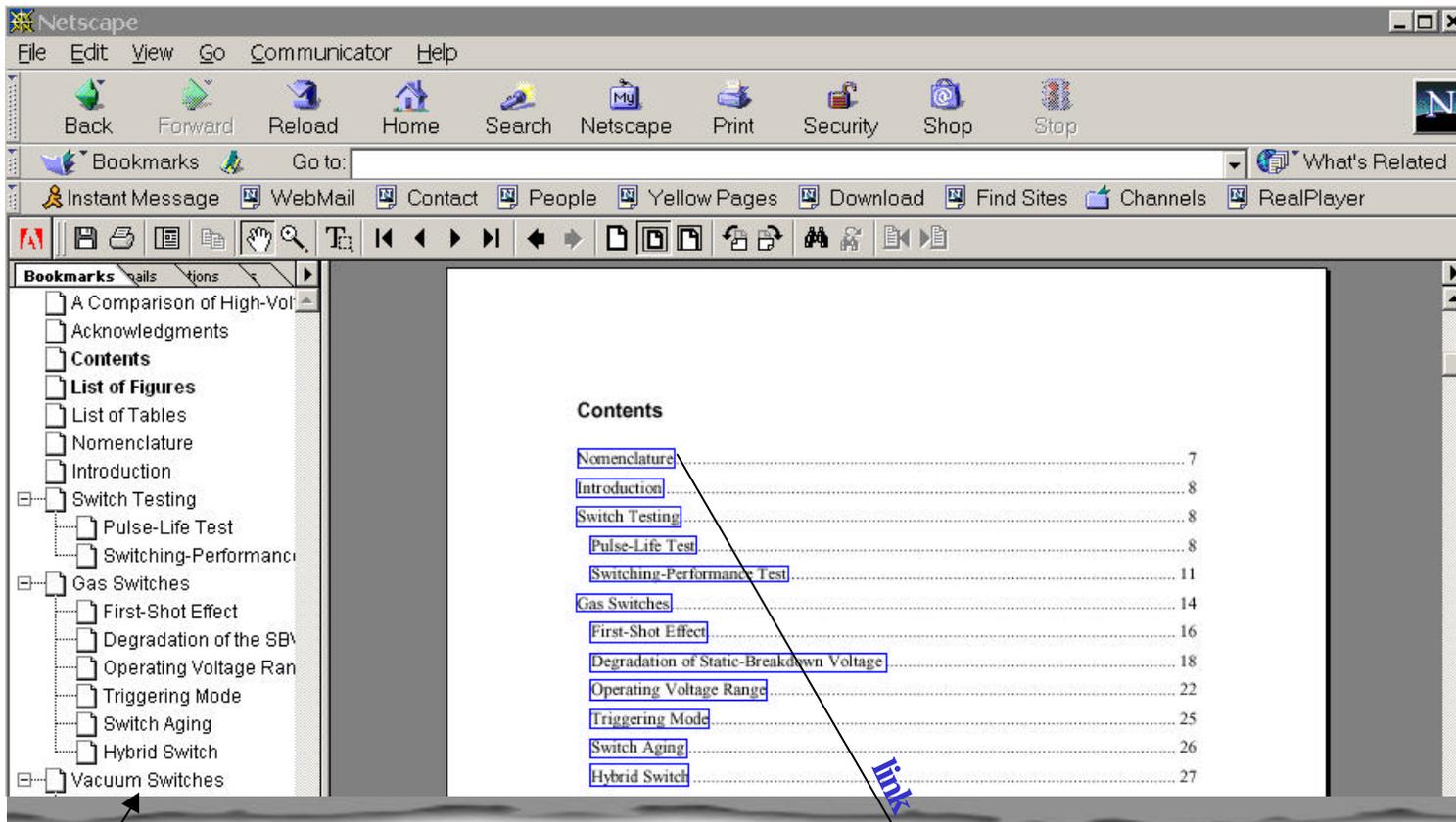
## Switches and Capacitors Holding Bin



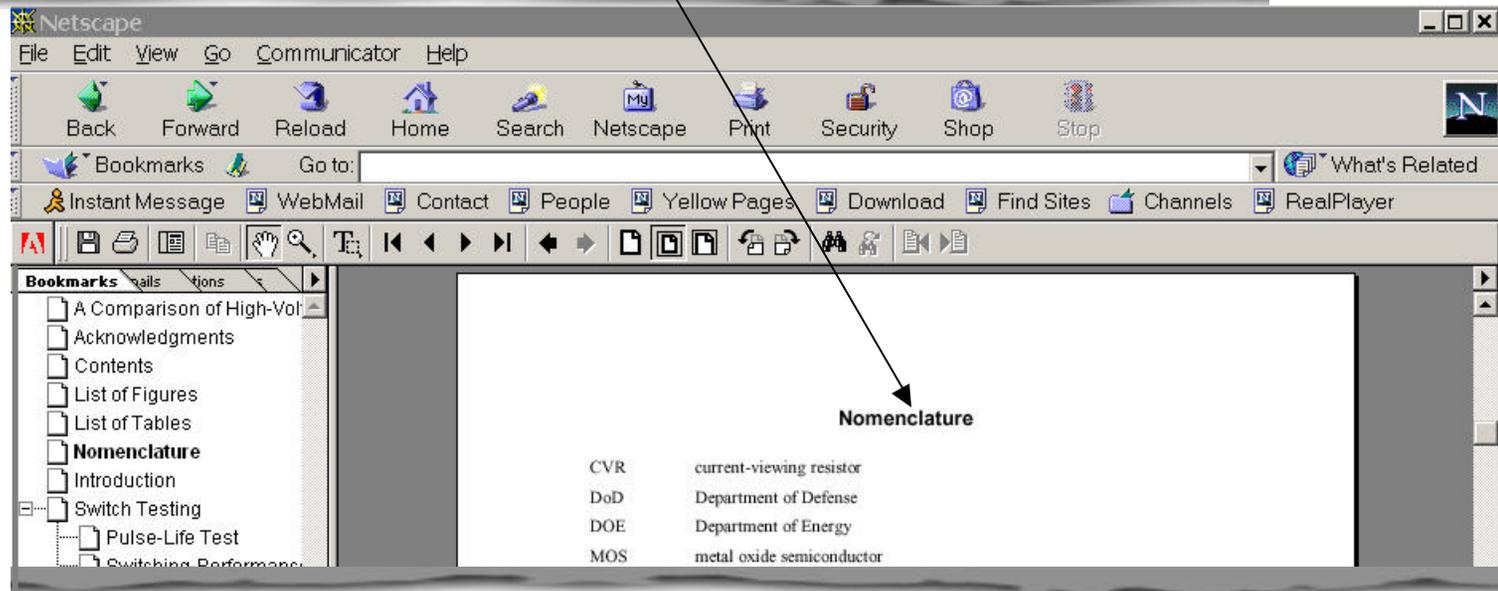
# SNAPSHOT OF ARCHIVE

---

## Technical Coordinating Group Meetings

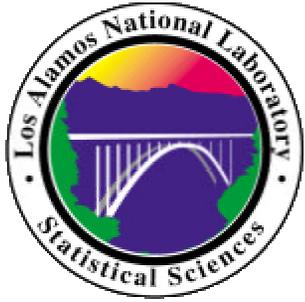


**Bookmarks  
in sample  
report**



Thumbnails  
in sample  
presentation

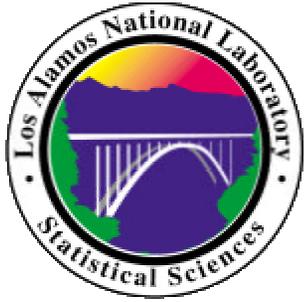
The screenshot shows a Netscape browser window displaying a presentation slide. The browser's address bar is empty, and the menu bar includes File, Edit, View, Go, Communicator, and Help. The toolbar contains icons for Back, Forward, Reload, Home, Search, Netscape, Print, Security, Shop, and Stop. Below the toolbar is a bookmarks bar with icons for Instant Message, WebMail, Contact, People, Yellow Pages, Download, Find Sites, Channels, and RealPlayer. The presentation slide is titled "Advanced Initiation Systems" and "DoD Applications of In-line ESAF Technology". It features a diagram with a legend: Army (green), Navy (blue), Air Force (cyan), Development (oval), and Production (rectangle). The diagram shows various shapes representing these categories, with some boxes having a drop shadow. A red text box at the bottom right of the slide states: "Los Alamos has been involved in programs with shadowed boxes." The footer of the slide includes "Dynamic eXperimentation" and "Los Alamos". On the left side of the browser window, there is a "Thumbnails" sidebar with five numbered thumbnails (1-5) representing different slides from the presentation.



# ARCHIVAL KNOWLEDGE SYSTEM

---

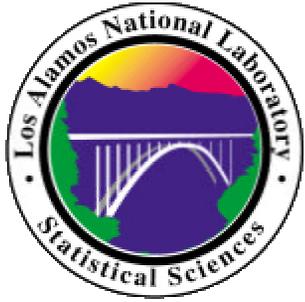
This viewgraph is deliberately left blank. Course attendees will be shown an unclassified snapshot of the interface to the executable slapper simulation code.



# ARCHIVAL KNOWLEDGE SYSTEM

---

- **Who elicits expertise** – advisor expert and analysts during biannual meetings.
- **Explicit (archival) knowledge** – ranging from formal reports to informal presentations.
- **KS contents are static** – revised biannually and disseminated by CD via classified mail channels.
- **Little automation of processes** – except for new interface to executable slapper simulation code.



# RANGE OF KNOWLEDGE SYSTEMS

---

## Example: Problem-Solving Focus

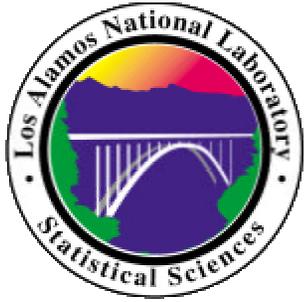
### **Automotive Logbook**

**For:** a multi-national automotive company.

**Purpose:** To bring together the information and elicitation instruments for predicting engine-system reliability.

Integrates a wide variety of evolving information.

Problem solving/decision making will occur within the KS, when it is a production version.



# PROBLEM-SOLVING KNOWLEDGE SYSTEM

---

- **Who elicits expertise and judgments** – experts themselves.
- **Explicit to implicit knowledge** – expert judgment to test data, warranty data as available.
- **KS is dynamic** – contents and structure revised continuously on-line by experts themselves.
- **Automation of processes** – underway, analytical tools in a separate but integrated knowledge system. Will pull information for running analytical tools.



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- ▼ Logbooks
  - [Engine Knowledge System](#)
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  - ▶ [Account Management](#)
  - ▶ [Really Deadly Missile System](#)

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## Engine Knowledge System

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**Subject Author Composed**

#### INFORMATION

- ▶ [010. Cover Memo](#)
- ▶ [020. Subject Matter Expert Teams](#)
- ▶ [030. Reliability Logic Flow Diagram](#)
- ▶ [040. Work Sheets](#)
- ▶ [050. Summary Spreadsheets](#)
- ▶ [060. Failure Mode Summary](#)
- ▶ [070. LANL Reliability Characterization](#)
- ▶ [080. Reliability Growth Plan](#)

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[Delete](#)

## Log Entry

**General**

[Attachment](#)

[URL](#)

[Archive](#)

[Access Control](#)

**Subject:**

**Composed:**

at

**by:**

**Category:**

None  
INFORMATION010. Cover Memo  
INFORMATION020. Subject Matter Expert Teams

**New Cat:**

Use the \ to

Engine Knowledge System - Netscape  
 File Edit View Go Communicator Help

Los Alamos National Laboratory Lab Home | Phone | Search

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### Engine Knowledge System

Logbook ▾

▼ [All Documents By](#)

- [Category](#)
- [Author](#)
- [Date](#)

▼ [Selected Docs](#)

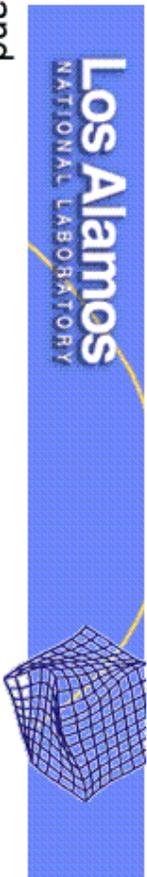
- [Log Entries](#)
- [Email](#)

▼ **Wilson, Gregory**

10/04/2000		<a href="#">New Fuel Pump Cover Memo</a>
10/04/2000	28	<a href="#">New Sensor A</a>
10/04/2000		<a href="#">New Sensor A Reliability Graph</a>
10/04/2000		<a href="#">New Sensor A Failure Mode Summary</a>
10/04/2000		<a href="#">New Sensor A Summary Spreadsheet - Design</a>
10/04/2000		<a href="#">FlexTech Worksheet</a>
10/04/2000		<a href="#">Connector Worksheet</a>
10/04/2000		<a href="#">Component Work Sheet</a>
10/04/2000		<a href="#">New Sensor A Subject Matter Expert Team</a>
10/04/2000		<a href="#">Fuel System Subject Matter Expert Team</a>
10/04/2000		<a href="#">Fuel Injection Subject Matter Expert Team</a>
10/04/2000		<a href="#">New Injection Subject Matter Expert Team</a>
10/04/2000		<a href="#">New Sensor B Subject Matter Expert Team</a>

# Snapshot of Automation Prototype

File Applications IDL Help



and

## **ENGINE SYSTEMS COMPANY**

### Prototype to Automate

Performance & Reliability Evaluation and  
Design by Information Combination & Tracking

### Engine Systems

- FUEL SYSTEM
- FUEL INJECTOR
- NEW SENSOR A
- NEW FUEL INJECTOR
- NEW SENSOR B
- NEW FUEL SYSTEM
- ACCESS KNOWLEDGE BASE
- OVERVIEW
- USERS GUIDE
- QUIT



Welcome to Prototype ... Messages ...

# Snapshot of Automation Prototype

File Applications IDL Help



and

## ENGINE SYSTEMS COMPANY

Prototype to Automate

Performance & Reliability Evaluation and  
Design by Information Combination & Tracking

### Engine Systems

FUEL SYSTEM

FUEL INJECTOR

NEW SENSOR A

NEW FUEL INJECTOR

NEW SENSOR B

NEW FUEL SYSTEM

OVERVIEW

USERS GUIDE

QUIT

ACCESS KNOWLEDGE BASE



Welcome to Prototype ...Messages...

# Snapshot of Automation Prototype

File Applications IDL Help

## New Sensor A

TEAM IDENTIFICATION

RELIABILITY BLOCK DIAGRAM

Select Update

WORKSHEET

Select Update R0

DESIGN

Select Update R1

MANUFACTURING

Select Update R2

ELICITATIONS

Select Update R3

WARRANTY DATA FITS

Select Update R4

TIME-MILES CONVERSIONS

Select Update R5

PREPARATION for SIMULATION

Select Update R6

DESIGN

Select Update R7

MANUFACTURING

Select Update R8

EXPERT ESTIMATES GRAPHS

Select Update R9

SIMULATION

Select Update R10

DESIGN

Select Update R11

MANUFACTURING

PREPARATION of RESULTS

PRESENTATION of RESULTS

RELIABILITY GROWTH

WHAT IF

UPDATE RELIABILITY GROWTH

Return to Main Screen

QUIT

Welcome to Prototype ...Messages...

# Snapshot of Automation Prototype

File Applications IDL Help

## New Sensor A

TEAM IDENTIFICATION

RELIABILITY BLOCK DIAGRAM

Select Update

WORKSHEET

DESIGN

Select Update R0

MANUFACTURING

Select Update R1

Select Update R2

ELICITATIONS

Select Update R3

WARRANTY DATA FITS

Select Update R4

TIME-MILES CONVERSIONS

Select Update R5

PREPARATION for SIMULATION

Select Update R6

DESIGN

Select Update R7

MANUFACTURING

Select Update R8

EXPERT ESTIMATES GRAPHS

Select Update R9

SIMULATION

Select Update R10

DESIGN

Select Update R11

MANUFACTURING

PREPARATION of RESULTS

PRESENTATION of RESULTS

RELIABILITY GROWTH

WHAT IF

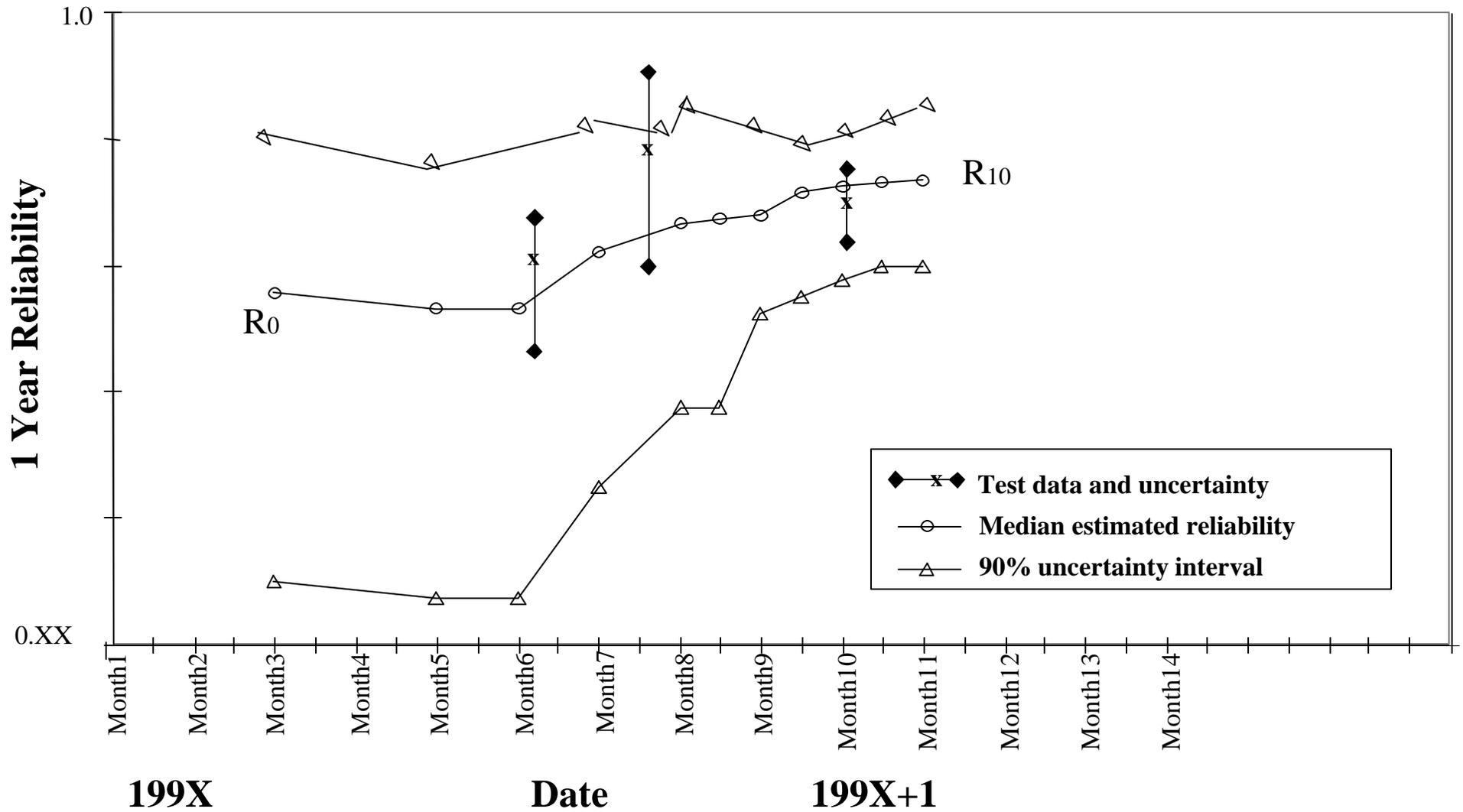
UPDATE RELIABILITY GROWTH

Return to Main Screen

QUIT

Welcome to Prototype ...Messages...

# New Sensor Reliability Tracking



# Snapshot of Automation Prototype

File

About

COMPUTE GAMMA PARAMETERS ALPHA & THETA

PLOT GAMMA FITS - MULTIPAGE - SIX PER PAGE

CLOSE PLOT WINDOWS

PLOT GAMMA FITS - ONE PAGE - COLOR OVERLAY

INPUT PERCENTILE VALUES

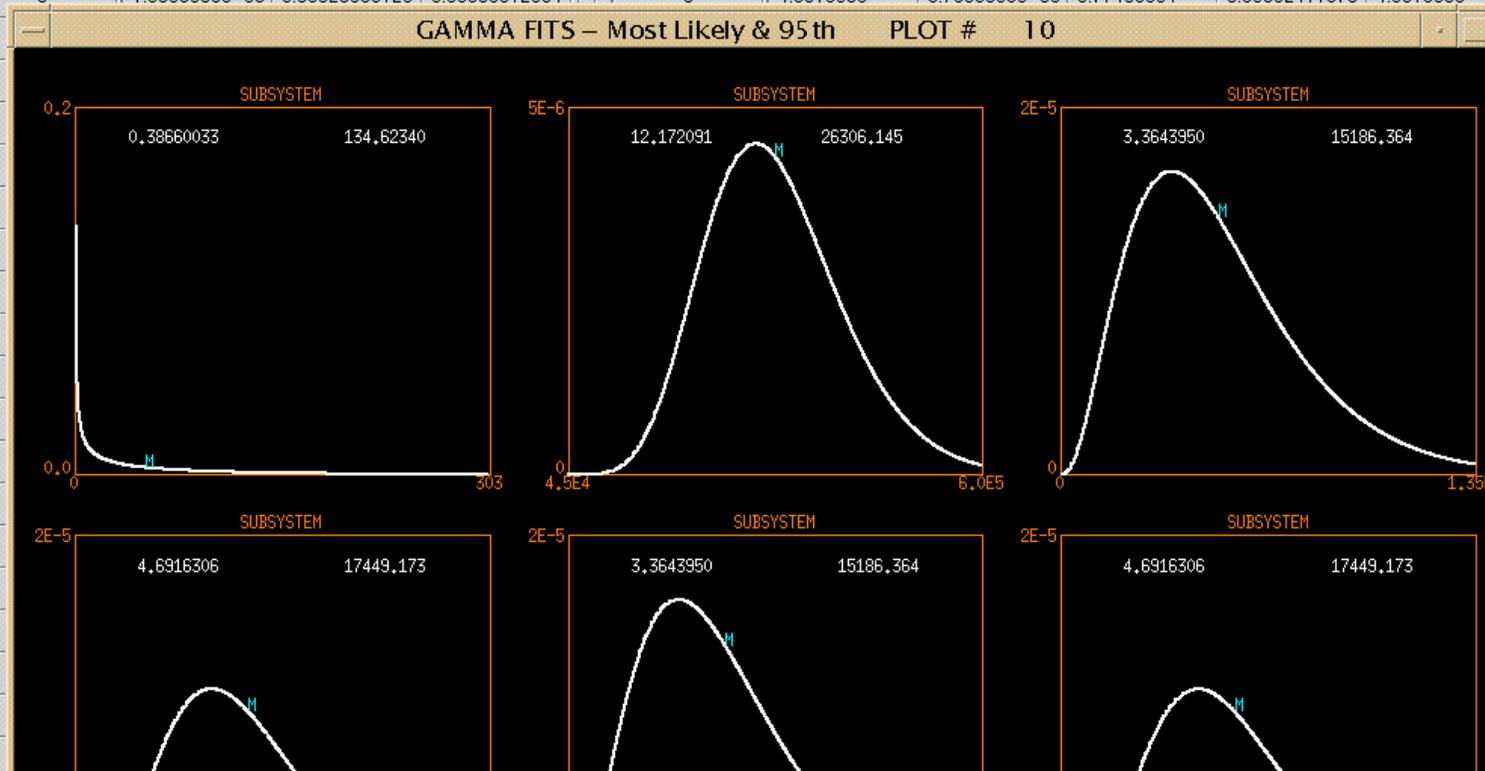
GAMMA FIT VALUES

Median & 95th

Median & 5th

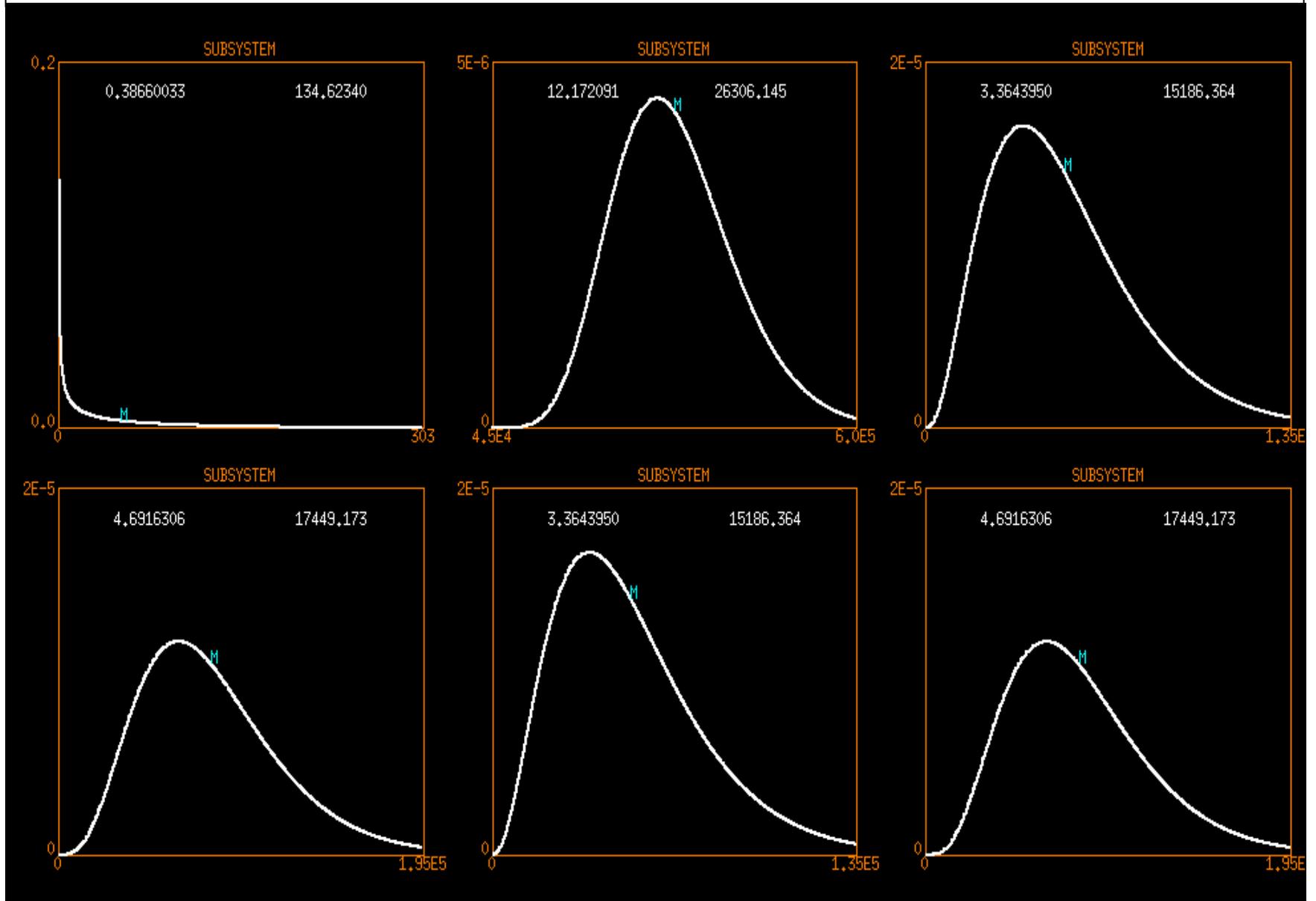
Plot Parameters

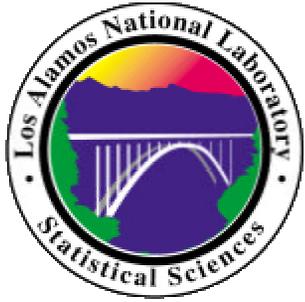
	INPUT PERCENTILE VALUES			GAMMA FIT VALUES			Median & 95th		Median & 5th		Plot Parameters	
	5th	median	95th		alpha	theta	alpha	theta	alpha	1/theta		
0	5.0001250e-05	0.0010005003	0.012072581	0	0.38660033	0.0074281294	0.84289499	0.0018455275	0.38660033	134.62340		
1	0.00010000500	0.00045010126	0.00070024511	1	12.172091	3.8013932e-05	2.0936627	0.00025409413	12.172091	26306.145		
2	1.0000050e-05	0.00020002000	0.00045010128	2	3.3643950	6.5848546e-05	0.84301686	0.00036887832	3.3643950	15186.364		
3	1.0000050e-05	0.00025003126	0.00050012504	3	4.6916306	5.7309306e-05	0.77430964	0.00052411076	4.6916306	17449.173		



15186.364
17449.173
175.46594
175.46343
1765.9462
39356.472
51479.976
6684.4892
2754933.4
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8719.8518
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17449.173
50235.347
8719.9058
17449.173

# Snapshot of Automation Prototype



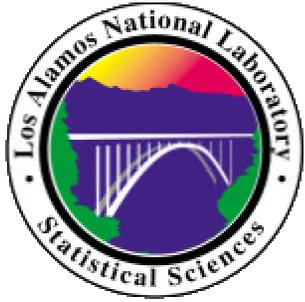


# SUMMARY

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## Knowledge Systems:

- are web-based electronic repositories that have been customized, cognitively and culturally, to the technical communities to bring together their data and knowledge.
- are created from the expertise, expert judgment and other data.
- integrate data to knowledge by structural and analytical means.
- reflect the decision making needs of user and the state of their knowledge.
- range from Archival to Problem-Solving foci.



---

To be continued  
after lunch

“Creating Knowledge Systems”