



Best Manufacturing Practices Center of Excellence

Naval-Industry R&D Partnership Conference 2003

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BMPCOE ... What It Does And How It Fits

- Integral Part of ONR's Balanced Portfolio for Now and Future



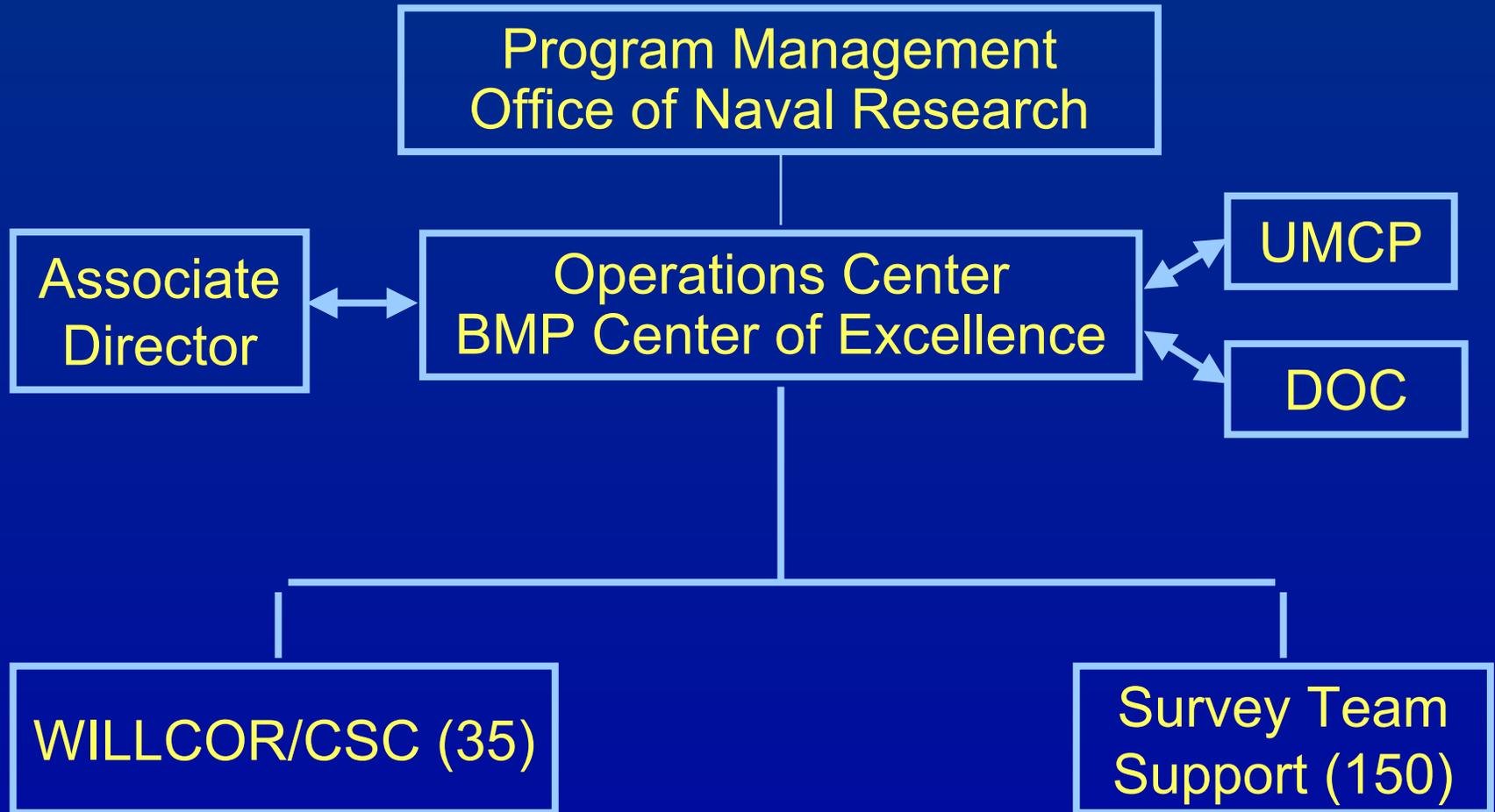
- S & T to Production / Technology Realization

From the Lab to the Fleet

- Technology Push
- Concept Pull
- Spiral Development
- Sustaining Technologies
- Maximizing Efficiencies

Organizational Structure
Technical Capabilities

Organizational Structure



Mission

Mission: To provide a national resource to foster the identification and sharing of Best Practices being used in government, industry, and academia, and to work together through a cooperative effort aimed at strengthening the U.S. industrial base and its global competitive position.

BMP Center of Excellence

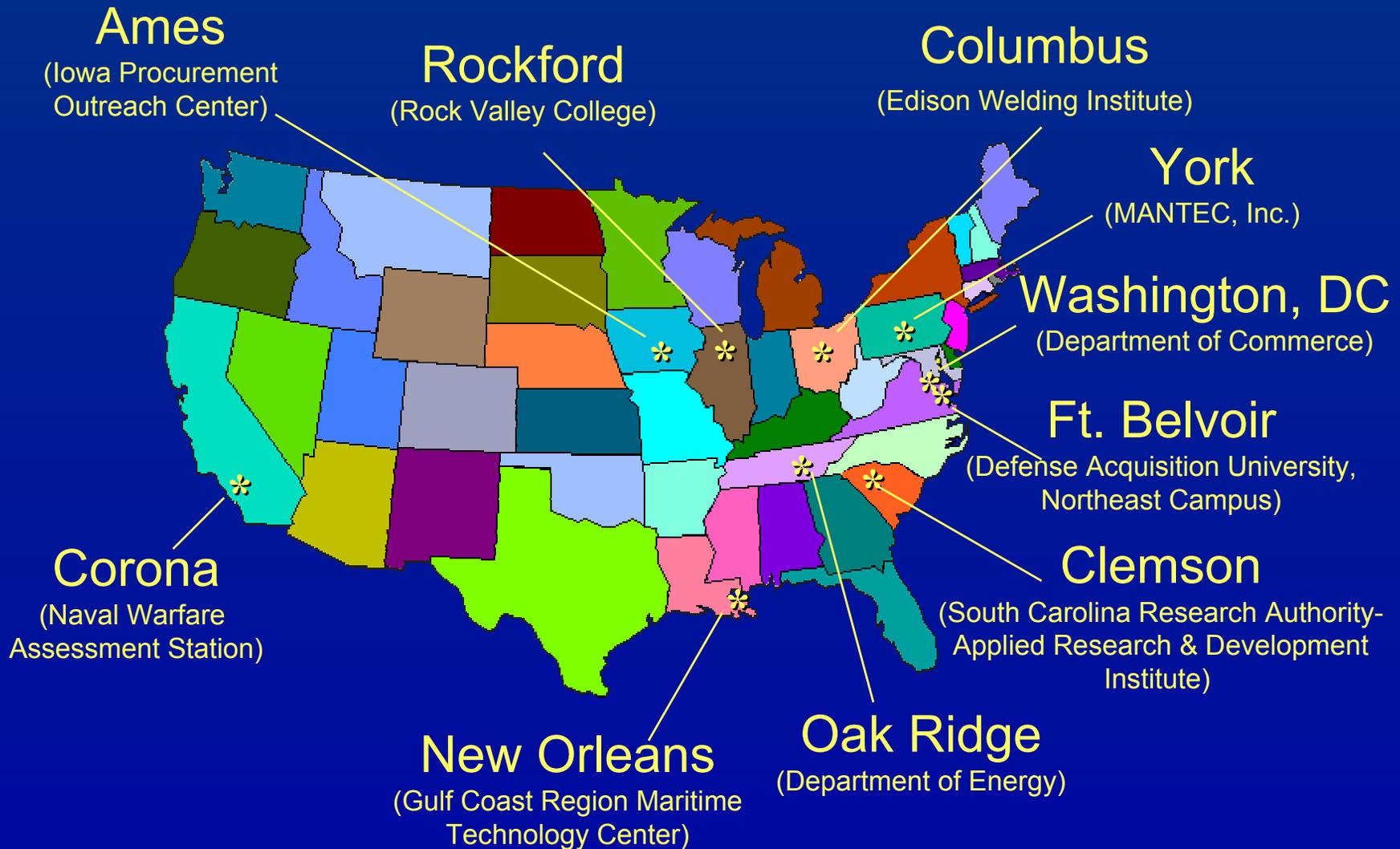
- Navy's Best Manufacturing Practices Program
 - Identify, Validate, Document, and Distribute Best Practices
- Department of Commerce
 - Deliver BMP to Small- and Medium-Sized Companies
- University of Maryland, College Park
 - Introduce BMP into College of Engineering



Since 1985 BMP Has . . .

- Conducted 135 On-site Surveys
- Documented More Than 4,000 Practices
- Developed Program Manager's WorkStation
- Developed Collaborative Work Environment
- Created BMP Center of Excellence
- Opened 10 Regional BMP Satellite Centers
- Attained National Recognition

Satellite Centers Leveraging Resources



Core Competencies

Surveys

- Technology Transfer
- Benchmarking
- Business Process Reengineering



Systems Engineering

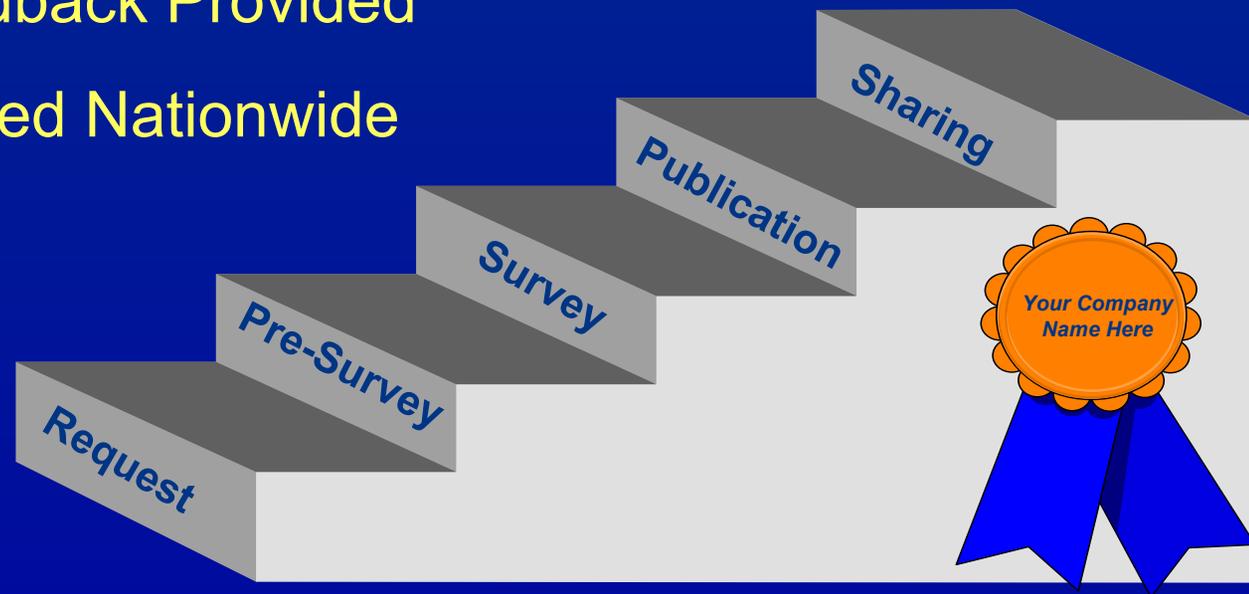
- Expert Systems
- Risk Management
- Engineering Support
- Failure Analysis

Web Technologies

- CWE
- Oracle 8i
- CORBA

Unique Survey Process – Flexible And Non-Threatening

- Company Makes Request and Controls Content
- Focus on Process — Not Product
- All Data Validated by Team of Experts
- Immediate Feedback Provided
- Report Distributed Nationwide



BMP — An Honest Broker For Technology Transfer

BMP Validated Best Practices

The BMP Program Defines a Best Practice as:



an established documented process, technique, or innovative use of equipment or resources that has a proven record of success in providing

significant improvement in cost, schedule, quality, performance, safety, environment, or other measurable factors which impact the health of a company.

The BMP Program Defines an Information Item as:

a practice that does not have a proven track record or is not significantly different from what others are doing. An Information Item could have the potential to be a best practice.

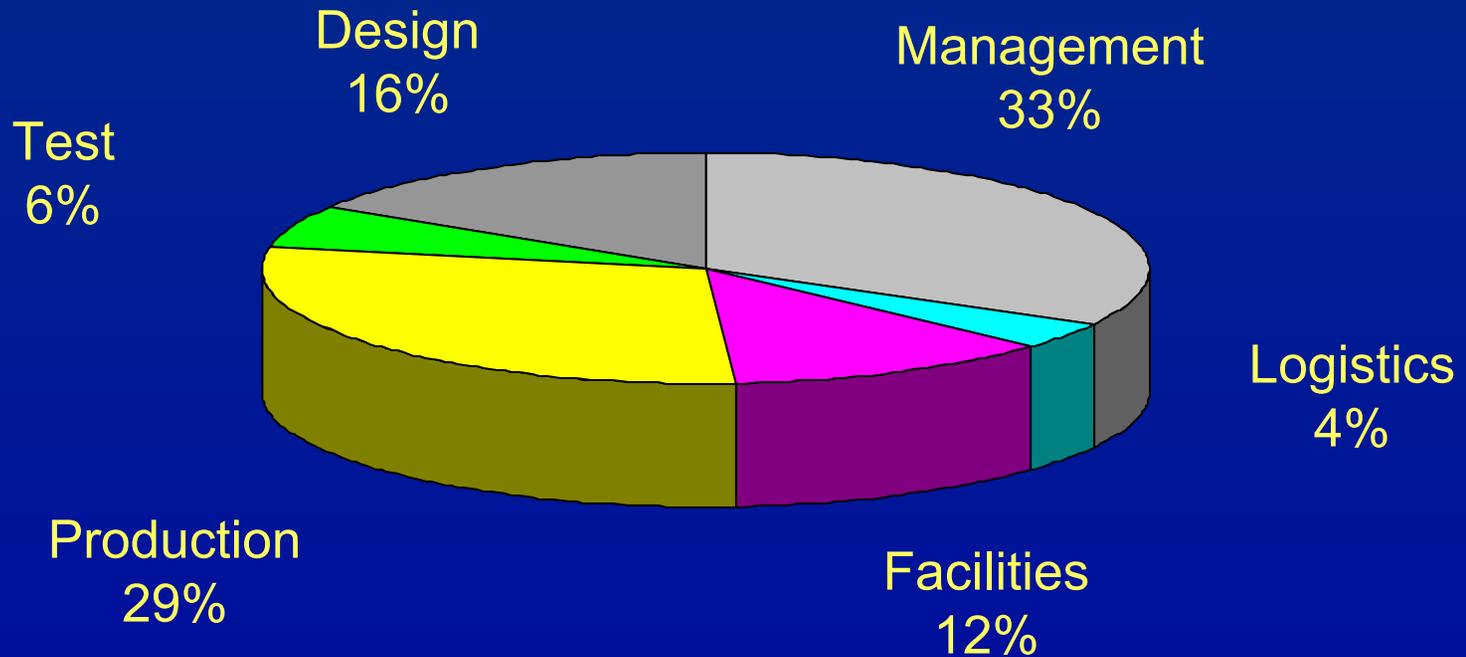
What's In It For Government And Industry

- Technology Transfer
- Benchmarking
- Promotes What the Organization Does Well
- Provides Higher Quality, More Reliable Products and Services
- No Cost Beyond the Organization's Time to Participate



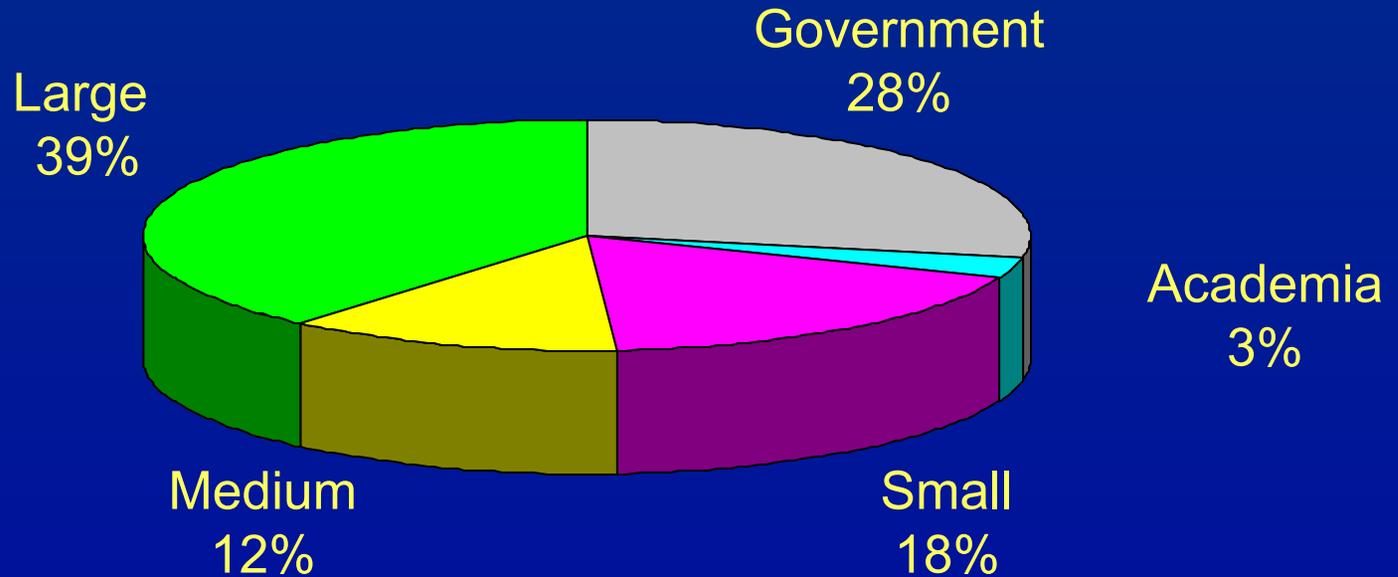
BMP Is A Win-Win Opportunity

Best Practices Break Out



More Than 4,000 Practices Documented...

BMP Survey Distribution



...Collected From 135 Surveys Since 1985

Surveyed Organizations — For Example . . .

- Large

- Lockheed Martin, Northrop Grumman, Raytheon, Rockwell Collins, Weirton Steel, JLG, Cincinnati Milacron, Texas Instruments

- Government

- NAVSEA PMS-422, USCG LANT/PAC-Maint.Fac., NASA Kennedy & Marshall, DOE-Oak Ridge, Sandia, & Livermore National Labs, NAWC-Lakehurst, NUWC-Keyport, NADEP-North Island, 8 Army Depots

- Medium

- Stryker Howmedica Osteonics, Applied Research Lab-Penn State, Kurt Manufacturing, General Dynamics Armament Systems

- Small

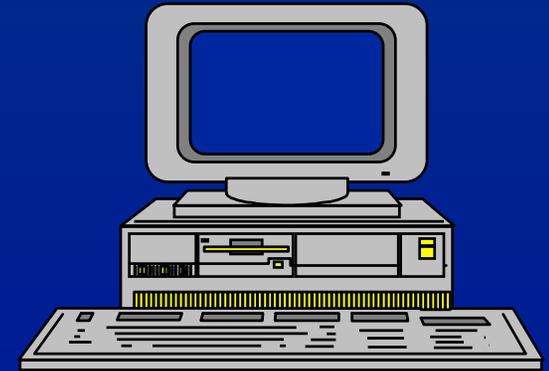
- Frontier Electronic Systems, Sharretts Plating, Thermacore, Dayton Parts, Hamilton Standard, Nascote, United Electric Controls, Wainwright Industries, and Orenda Turbines and Strite Industries (Canada)

- Focused

- Polaroid Corp., City of Chattanooga, USS Carl Vinson, Elizabethtown College, Northrop Grumman

Program Manager's WorkStation

- Reduce Risk Throughout Acquisition Process
 - KnowHow: What To Do
 - TRIMS: Keep On Track
 - Database: Where To Get Help
- Tested and Used by Government and Industry
- Taught at Defense Acquisition University and Industrial College of the Armed Forces
- OSD Deskbook Tool



Your Electronic Consultant Now And For The Future

Web Technologies

- Collaborative Work Environment
 - Integrated Windows Programs
 - Work Groups
 - Automatic Notifications
 - Calendars
 - Fully Indexed Site Allows High Speed Searches
 - Self Managing

- Additional Features for Customization
 - Chat
 - Streaming Video
 - Dial-in
 - E-Mail

Customer Usage

Web Activity — June 2003

- 1,636,813 Hits
 - 54,560 Average per Day
- 77,396 User Sessions
 - 2,579 Average per Day
- Top Downloads
 - 1,544 Systems Engineering Model
 - 1,067 Producibility Guideline Document
 - 532 Anniston Army Depot Survey Report

Sample Customers — Broad Support for BMPCOE Tools

- ASN DASN(TSC) - International ... COSIP Radar
- NAVSEA - International ... SM/053/SSTD
- NAVAIR - International ... MIDS IPO/LINK-16
- Commander MARCORSYSCOM ... Red Team Support/Dragon Eye/
LW 155/CLAWS
- DFAS ... Integrated Digital Environments
- Joint Chiefs of Staff ... Integrated Digital Environments

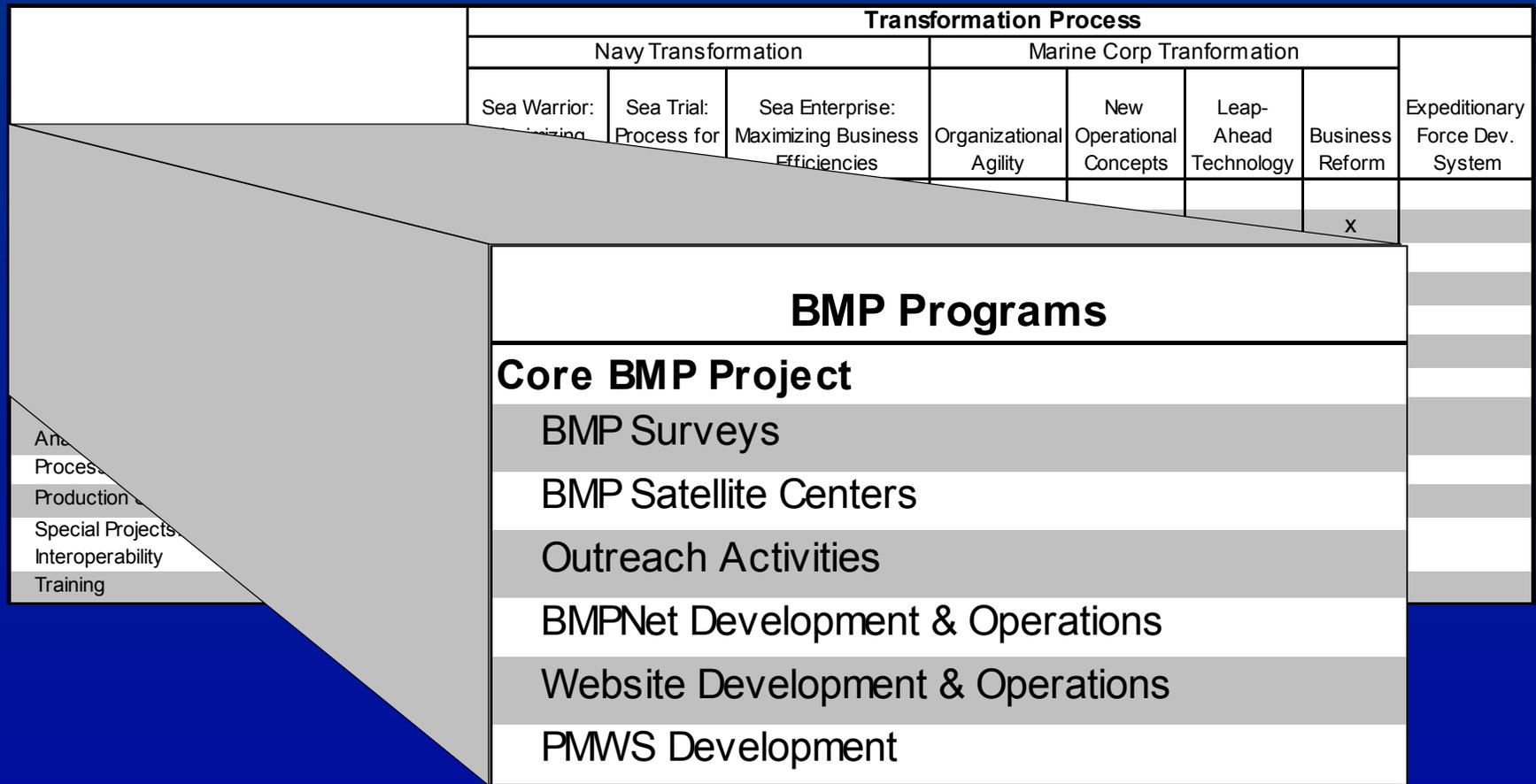
Academic Curricula Influence

- **BMP and PMWS Required in DAU Advanced Course Curriculum**
 - DAU Looks to BMP for Acquisition Reform Innovations
 - More Than 3,000 Students Exposed Yearly to BMP and PMWS
 - Many Students Become PMWS Users
 - Some Students Become Work-for-Others Customers
- **BMP and PMWS Included in ICAF Advanced Manufacturing Seminars**
- **NAVSEA PEO TSC (Theater Surface Combatant) Risk Training**
- **UMCP MTECH (MD Technology Enterprise Institute), Army Research Lab Manufacturing Management Seminars**

BMP's Current Contributions

- ***Naval Transformation Roadmap***
- ***Future Naval Capabilities (FNCs)***

How BMP Fits Into The Naval Transformation Roadmap: Processes

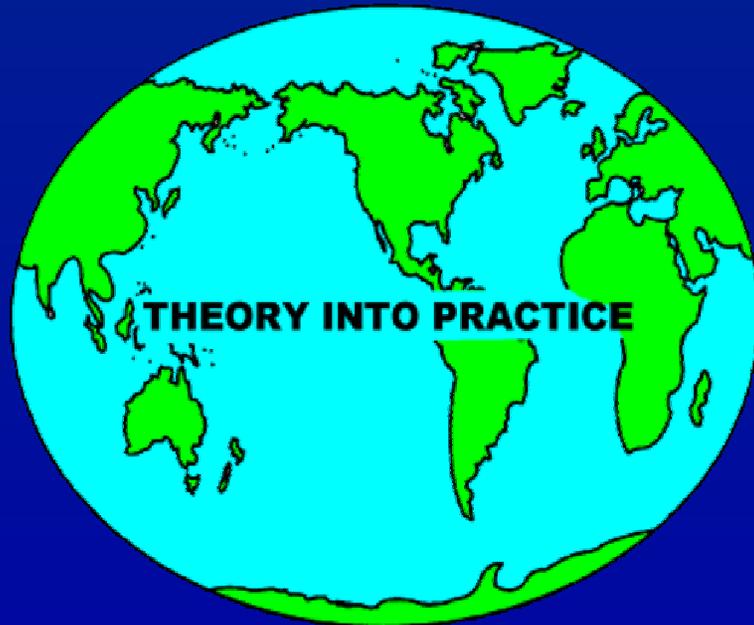


- BMP Core Program Contributes to Naval Transformation Processes
- BMP Plays an Important Role in the Marine Corp's Leap Ahead Technology Programs

BMP Ties Into ONR's Future Naval Capabilities (FNCs)

FNCs	BMP Capabilities & Experience
Autonomous Operations	Dragon Eye
Capable Manpower	PMWS & CWEs: Tools & Training
Electric Ships & Combat	NAVSEA 053
Knowledge Superiority and Assurance	TRIMS, MIDs, SIAP, Link 16, SIAMP
Littoral Antisubmarine Warfare	SSTD
Littoral Combat & Power	STANDARD Missile
Missile Defense	STANDARD Missile, AEGIS Ballistic Missile Defense, MDA
Organic Mine Countermeasures	N/A
Platform Protection	STANDARD Missile, SSTD, MK4
Time Critical Strike	STANDARD Missile, Dragon Eye, Lightweight 155mm Howitzer, MIDS
Total Ownership Cost Reduction	Reliability by Design, Producibility
Warfighter Protection	STANDARD Missile, AEGIS Ballistic Missile Defense, Dragon Eye, CLAWS, LW 155 Howitzer, MIDS, AAV, AAV, UOC, Predator

Risk Management Using The Program Manager's WorkStation (PMWS)

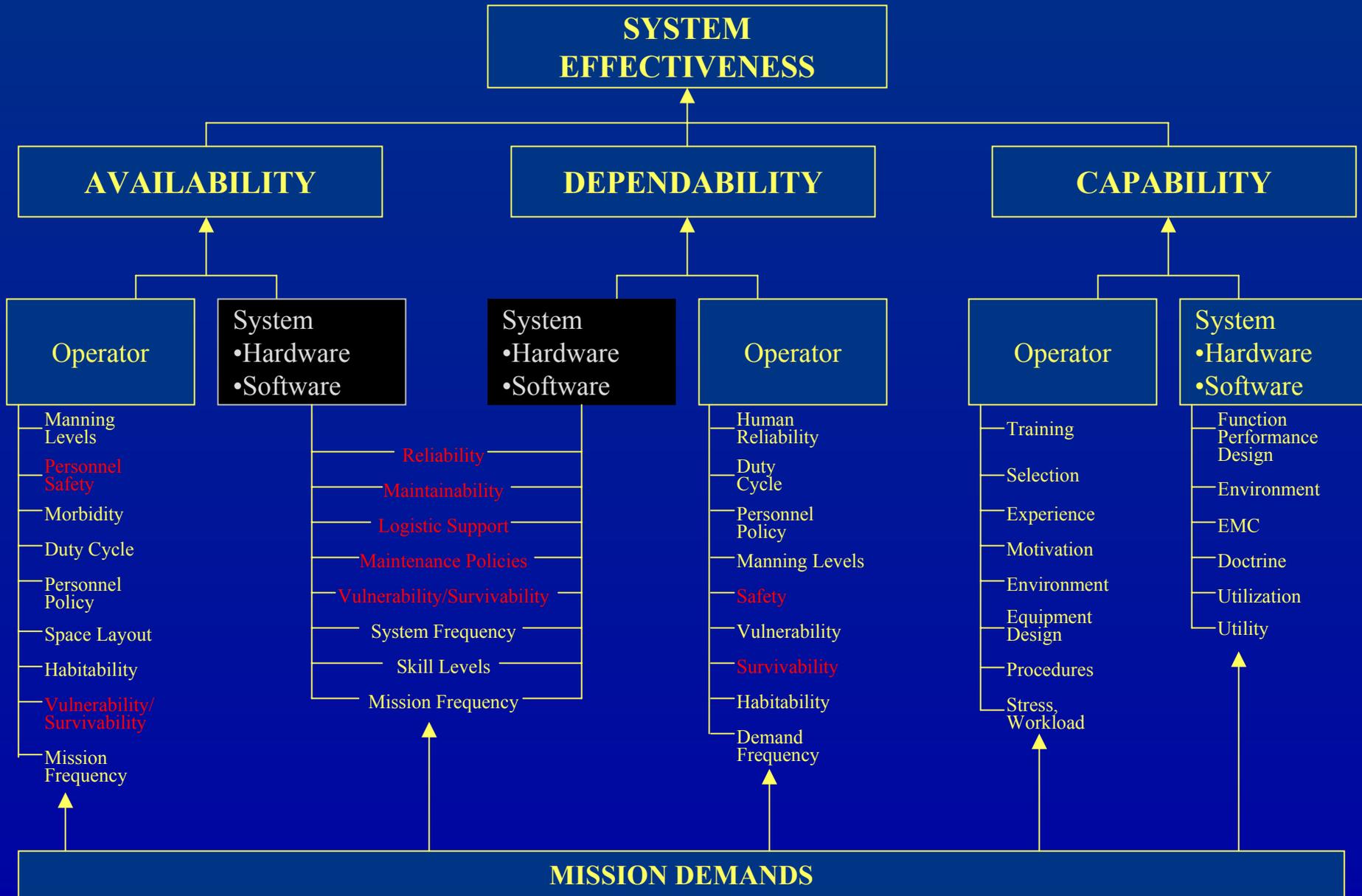


Some Facts

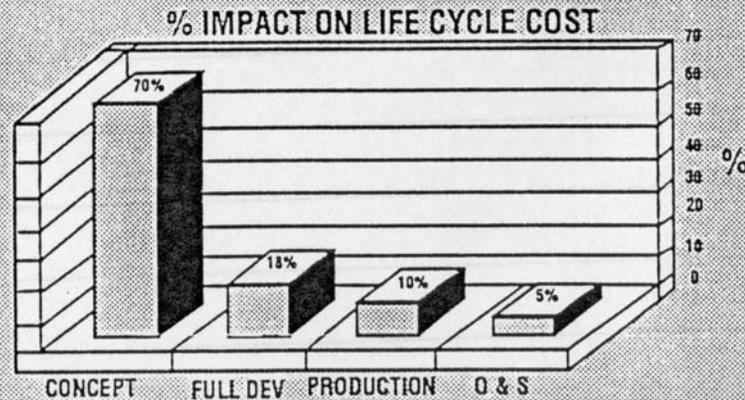
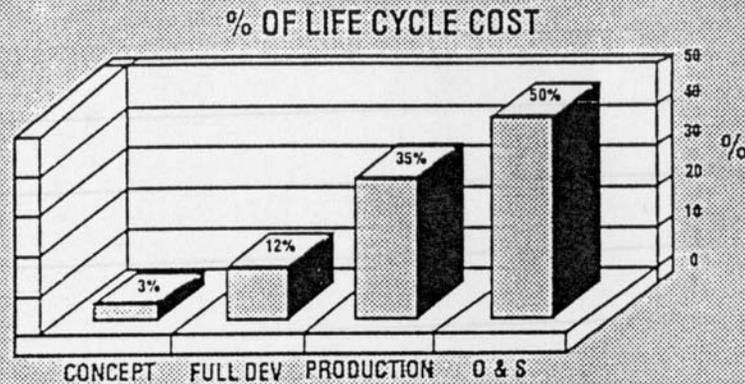
- Defense Science Board Studies Indicate that 80% of all Programs that Fail, Fail for Engineering not Technology Reasons
- Example: N43 Reports that Over 65% of all Fleet Reliability Problems are Due to Inadequate Design
- February 1998, GAO Report to the Subcommittee on Acquisition & Technology, Committee on Armed Services, U. S. Senate
 - Since 1975 Schedule Overruns Average 24%
 - Weapon Systems Overruns Cost 20% - 40%
- With Acquisition Reform and Performance Specifications, We Must Monitor the Engineering Process to Understand Program Risks

Do Not Get Technology Tunnel Vision

System Effectiveness Is No Simple Equation



To Leverage Quality Look To Design



LEVERAGE EFFECT OF QUALITY IN DESIGN PHASE ON LIFE CYCLE COSTS

Opportunities For Failure

	Vendors	Subs	Prime	Loadout
Design	Problem → ↓ ↘	Observation		
Test	Observation	Observation		
Manufacturing		<i>QA Typically Only Helps Here</i>		

**Quality Problems Usually Evidenced in
Succeeding "Phase"**

The Anatomy Of A Failure

Parts - Black Boxes - WRA - Subsystems - Systems - Products

- Unless Redundant All Must Work
- Statistics are Meaningless in a Sample Size of One
- No Such Thing as an “Electronic” Failure; All Failures are Mechanical or Chemical
- Lack of Following a Formal Systems Engineering Model (Schedule Pressure)
- Most Review Actions Actually Improve Schedules

A Proven Approach

Identify - Root Cause of Problem (Not a Fix)

→ **Analysis** - Prevent Recurrence (New Processes, etc.)

→ **Effect Change** - Where Necessary at a Time of Minimum Impact on Schedule

Not Symptoms, Guesses, Or Hopes For The Best

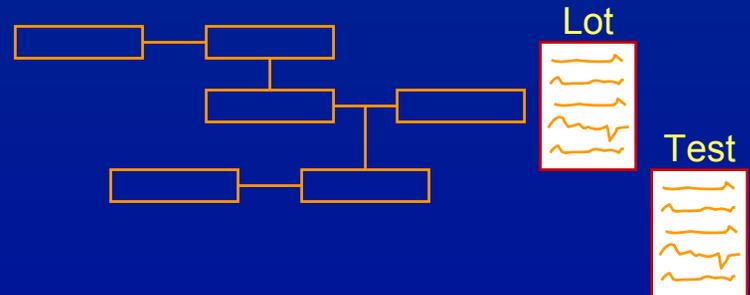
Identify

Process → TRIMS

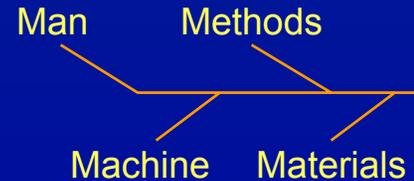
Risk Management

Design		Test	Prodn
Reference Profile	Design Requirements	Integrated Test	Manufact
Studies	Design Policy	Failure Reporting System	Quality Manufactur
Process	Design Analysis	Uniform Test Report	Piece Part
and	Software Design	Software Test	Subcontract

Parts → Pedigree



→ Root Cause



Design → Allocated Baseline



Analysis

- All Factory Assembly & Test Data / Failure, Defect Records for a Selected Period of Time
- Categories
 - Design Related (Not Derated . . .)
 - Manufacturing (Wrong / Bad Parts / Workmanship . . .)
- Review Processes Where Trends Indicate

Effect Change

- Design Review Support
- Recommendations for Change
 - Processes
 - People / IPTs / Workgroups
 - Contractual
 - Analysis / Test
- We Stay With the Program and Contractor to Review Compliance With Action Items

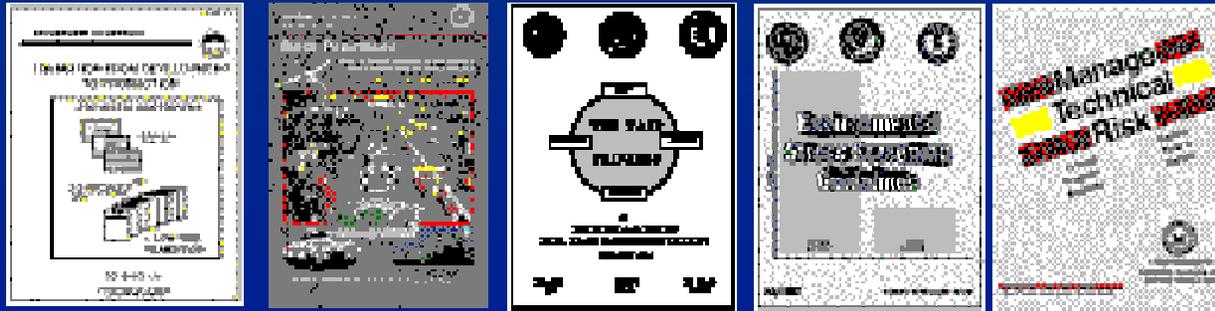
PMWS – Your Electronic Consultant

The screenshot displays the PMWS software interface, which is divided into several functional areas:

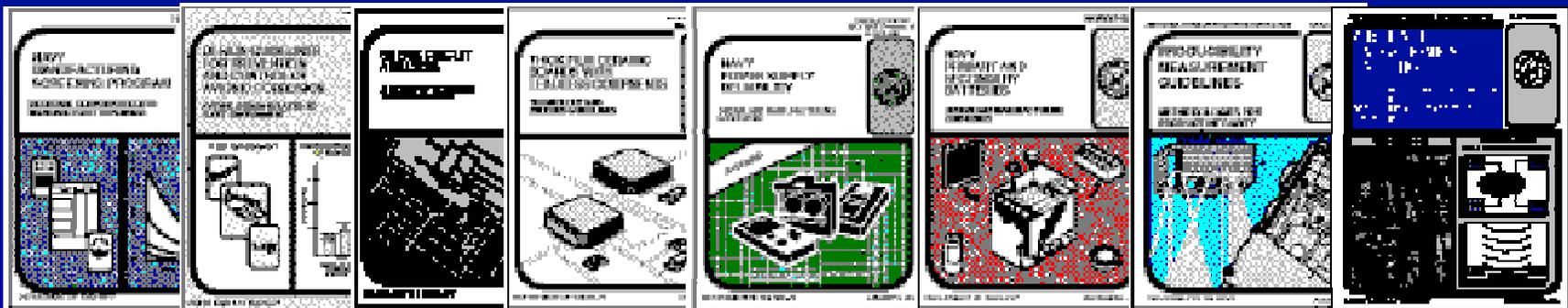
- Knowledge:** A text-based knowledge base window titled "KnowHow Book: Expert System on Systems Engineering". It contains a menu (File, Bookmark, Options, Module printing, Help) and navigation buttons (Back, Forward, Search, Copy, More). A yellow box highlights the word "Knowledge".
- Experience:** A window titled "BMP Database" with a menu (File, Filter, Help) and navigation buttons (Back, Forward, Search, Remove, Display, View). A yellow box highlights the word "Experience".
- Insight:** A window titled "TRIMS v3" with a menu (File, Baselining, Options, Reporting, Help) and navigation buttons (Summary, Detailed). A yellow box highlights the word "Insight". Below the menu is a table showing project progress across different phases.
- Graphics Viewer:** A window titled "KnowHow Graphics Viewer" showing a diagram of a process flow. A vertical label on the left reads "Milestone 0 Concept Studies Approval".
- Database List:** A central list of entries with various status indicators (Best, Info, Summ) and titles such as "Northrop Grumman, Defe...", "Orenda Turbines, Divisor", and "NASA Marshall Space Flig...".
- Text Content:** A window titled "Northrop Grumman, Defensive Systems Division - Rollin..." contains text about "Application Specific Integrated Circuit Design".

Summary	Category	4.0 Design	5.0 Test	6.0 Production
Element		[Progress Bar]	[Progress Bar]	[Progress Bar]
APM Missile Body (*)		[Progress Bar]	[Progress Bar]	[Progress Bar]
APM Missile Body		4.1 Design Reference Mission Profile	4.2 Design Requirements	5.1 Integrated Test
				6.1 Manufacturing P

Technical Guidelines Documents



Purpose:
Provide a Cost-Effective
Alternative to Government
Military Standards for Design
and Manufacturing



The screenshot shows a window titled "KnowHow Electronic Library" with a menu bar (File, Bookmark, Options, Help) and a toolbar with icons for Back, Forward, Search, Copy, Print, Export, View Image, Close Book, and an EXIT button. Below the toolbar is a "Book List" section containing a table with columns for Title, Author, Document ID, and Comment. The row for "Expert System on Systems Engineering" is highlighted. Below the table is a "Summary of Book : Expert System on Systems Engineering" section with a descriptive paragraph. The footer of the window displays "v4.03", "KnowHow Books: 31", and "[Es] - Expert System."

Title	Author	Document ID	Comment
Defense System Software Development	DOD	DOD-STD-2167	
Defense Systems Software Quality Program	DOD	DOD-STD-2168	
Dept of Defense Instruction 5000.2	Dept of Defense	DOD-5000.2	
Dept. of Defense Directive 5000.1	Department of Defense	DOD-5000.1	
Design Guidelines for Prevention and Control of Avionic Corrosion	BMP	NAVMAT P 4855-2	
EMPF Tech Brief on Connector Solderability Problem	EMPF	EMPF	
Environmental Guideline Document - How to be Green and Stay in the Black	BMPCOE	NAVSO P-3680	
Equipment Alternatives for Precision Cleaning	Martin Marietta	Precision Clean	
Expert System on Systems Engineering	BMP	Ex-SE	[Es]
Foundations for Excellence in the Chemical Process Industries	American Chem. Society	Chem Excellence	
General Requirements for Electronic Equipment Specifications	DOD	MIL-STD-2036	
More Power For The Dollar	Office of the Assistant Sec...	NAVSO P-3641A	

Summary of Book : Expert System on Systems Engineering

This Technical Reference Guide recognizes and avoids the most common traps that cause technical problems in the acquisition process. Includes complete "How-To's" on all major systems engineering processes.

v4.03 KnowHow Books: 31 [Es] - Expert System.

BMP Database

The screenshot shows the BMP Database application window. The title bar reads "BMP Database". The menu bar includes "File", "Filter", and "Help". The toolbar contains icons for "Back", "Forward", "Search", "Remove", "Display", "View", "Print", "Export", and "EXIT". Below the toolbar, the "Sort by:" dropdown is set to "Company Name" and "Number of Abstracts: 2644" is displayed. The main area contains a table with the following columns: "Company Name", "Survey Date", and "R". The table lists various companies and their survey dates, with a green checkmark in the "R" column for most entries. A footer note states: "* Note: Non-BMP surveys are not validated by the BMP program, but are included to provide additional information." The version number "v3.00" is shown in the bottom left, and a legend indicates that a green checkmark in the right column indicates a reviewed survey, with the date being the review date.

Company Name	Survey Date	R
* Company Name Cross Reference List *	09/09/1999	
Air Force Plant #44 Hughes Missile Systems Company - Tucson, AZ	11/01/1996	✓
Anniston Army Depot - Anniston, AL	04/06/1998	✓
Applied Research Laboratory, The Pennsylvania State University - State College, PA	03/08/1999	
Augusta Technical Institute - Augusta, GA	12/10/1996	✓
Bell Helicopter Textron, Inc. - Fort Worth, TX	10/14/1988	✓
Bell Helicopter Textron, Inc. - Forth Worth, TX	11/06/1996	✓
Chemeketa Community College - Salem, OR	12/13/1996	✓
Cincinnati Milacron, Inc. - Cincinnati, OH	05/12/1997	✓
City of Chattanooga - Chattanooga, TN	04/22/1996	✓
Computing Devices International (General Dynamics Information Systems) - Minneapolis, MN	10/01/1992	✓
CONAX Florida Corporation - St. Petersburg, FL	05/19/1992	✓
Corpus Christi Army Depot - Corpus Christi, TX	01/26/1998	✓
Dayton Parts, Inc. - Harrisburg, PA	06/26/1995	✓
Department of Energy, Oak Ridge Operations - Oak Ridge, TN	11/03/1996	✓
Derry Area School District - Derry, PA	10/15/1996	✓
Des Moines Area Community College - Des Moines, IA	12/19/1996	✓
Dover Air Force Base - Dover, DE	10/01/1996	✓
Electric Boat Corporation, Quonset Point Facility - North Kingstown, RI	03/22/1999	
Elizabethtown College - Elizabethtown, PA	11/17/1997	✓
Hamilton Standard Electronic Manufacturing Center - Farmington, CT	10/04/1993	✓
Harris Semiconductor (Intersil Corporation) - Palm Bay, FL	01/24/1994	✓
ITT Defense and Electronics - Mclean, VA	10/10/1996	✓

These surveys are conducted and validated by the Best Manufacturing Practices Program.

These reports are independently submitted by members of industry. (*)

* Note: Non-BMP surveys are not validated by the BMP program, but are included to provide additional information.

v3.00

✓ In right column indicates reviewed survey, date is review date.

Why TRIMS?

- Process Oriented Risk Management — Predictive
- Tailorable — Users Can Develop and Publish Their Own Baselines
- With Acquisition Reform and Performance Specifications, We Must Monitor the Engineering Process to Assess Program Risks
- Taught at DAU, Desk Book Approved Tool, Numerous Awards

In Acquisition Reform You *Only* Get The Contractor's Processes

What Is TRIMS?

- TRIMS (Technical Risk Identification & Mitigation System): A Methodology for Doing Knowledge Based Process Oriented Risk Management
- Includes Set of Software Tools to Help Implement the Methodology (Navy Owned, Fixed Revision Cycle)
- Outgrowth of DoD 4245.7-M and NAVSO P-6071 Templates
- Fully Compatible with BMPCOE Combined Government / Industry Systems Engineering Model
- Fully Supported: Training Classes, Computer-Based Training, On-line Help, 24-hour Help Desk

Process Based And Predictive

TRIMS Systems Engineering Baseline Templates



- Design Refer. Mission Profile
- Design Requirements
- Trade Studies
- Design Policy
- Design Process
- Design Analysis
- Parts & Mater. Selection
- Software
- CAD
- Design for Testing
- Built-in Test
- Configuration Control
- Design Reviews
- Design Release
- Bread Board Development
- Concept Studies & Analysis
- Brass Board Development
- Specification Dev/Allocation/ Validation
- Prototype Development & Review
- Design for Assembly

- Integrated Test
- Failure Reporting System
- Uniform Test Report
- Software Test
- Design Limit
- LIFE
- Test, Analyze & Fix (TAAF)
- Field Feedback
- Temp Development/ Execution
- Software Simulator

- Manufacturing Plan
- Qualify Manufacturing Process
- Piece Part Control
- Subcontractor Control
- Defect Control
- Tool Planning
- Special Test Equipment (STE)
- CAM
- Manufacturing Screening
- Production Fabrication
- Environmental Issues

- Modernization
- Factory Improvements
- Productivity Center
- Field Visits/Site Surveys

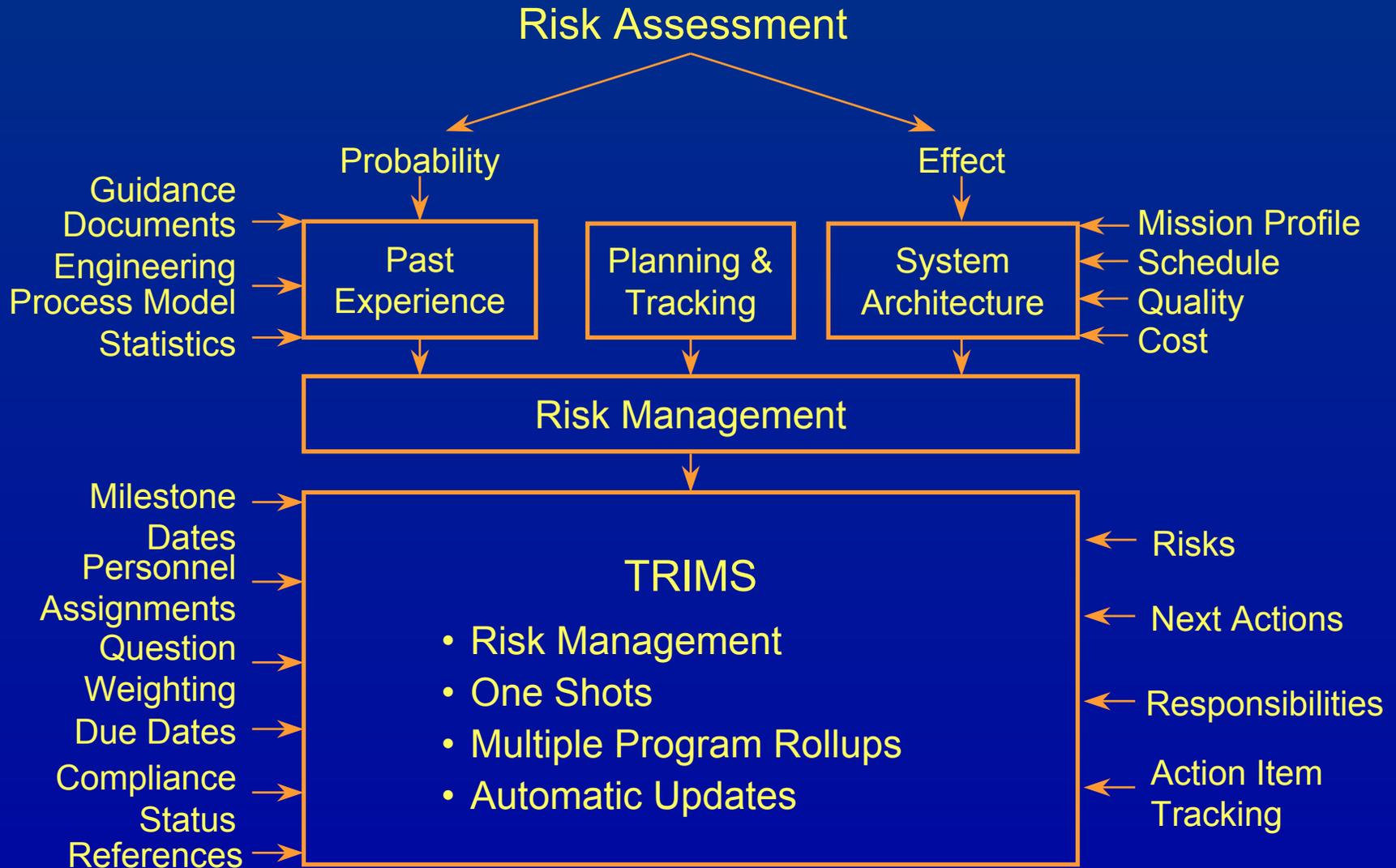
- Logistics Support Analysis
- Manpower & Personnel
- Support & Test Equipment
- Training Materials & Equipment
- Spares
- Technical Manuals
- Logistics Analysis Documentation

- Manufacturing Strategy
- Personnel Requirements
- Data Requirements
- Technical Risk Assessment
- Production Breaks
- Determining Defining Need for System
- Prepare Requirement Documents
- Quality Assurance
- Design/Milestone Review Planning
- Make or Buy Decisions

TRANSITION PLAN

New PMWS Templates

TRIMS Proactive Methodology



Understanding The Future Effects Of Today's Decisions

TRIMS - The 2nd Derivative Of Cost And Schedule

Position

^{1st}
Derivative

Velocity

^{2nd}
Derivative

Acceleration

**Schedule
Cost**

Reactive

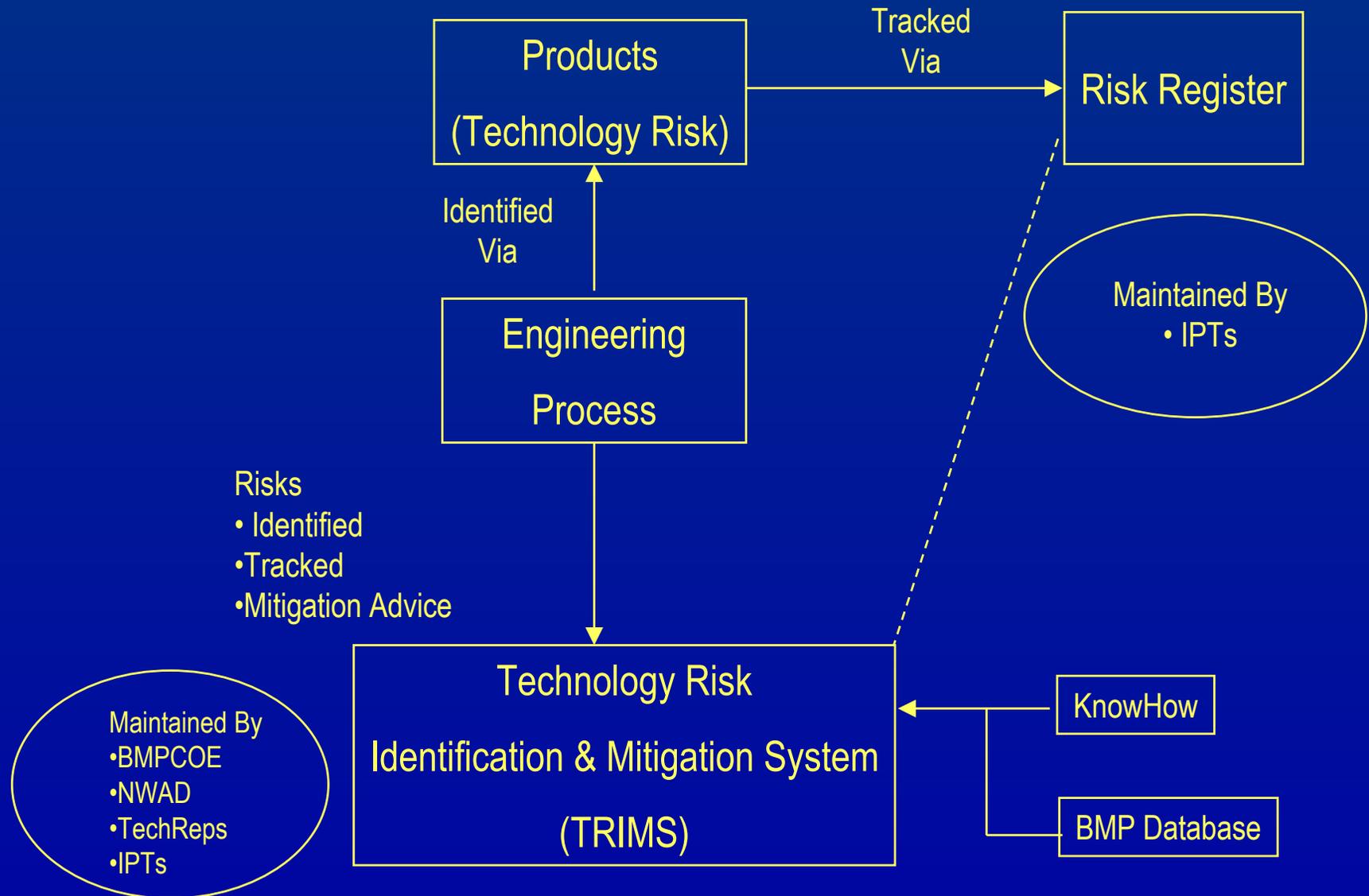
**Technical
Issues**

Proactive

**Process
Issues**

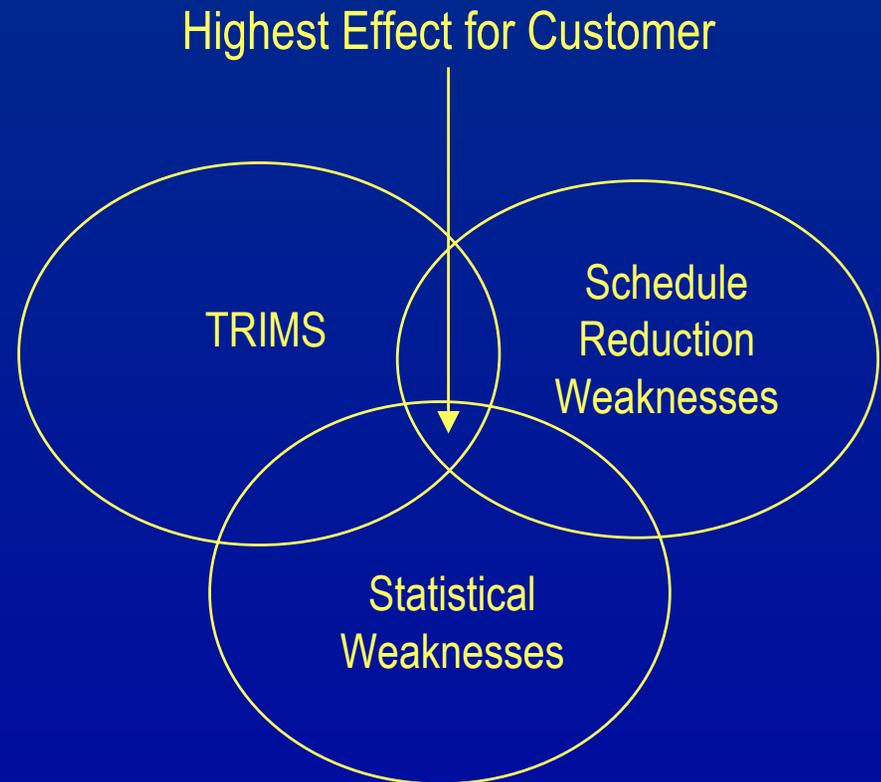
**Position Function Data Is Problem Management
For Risk Management, Derivative Data Must Be Used**

Example: Standard Missile Total Risk Management System

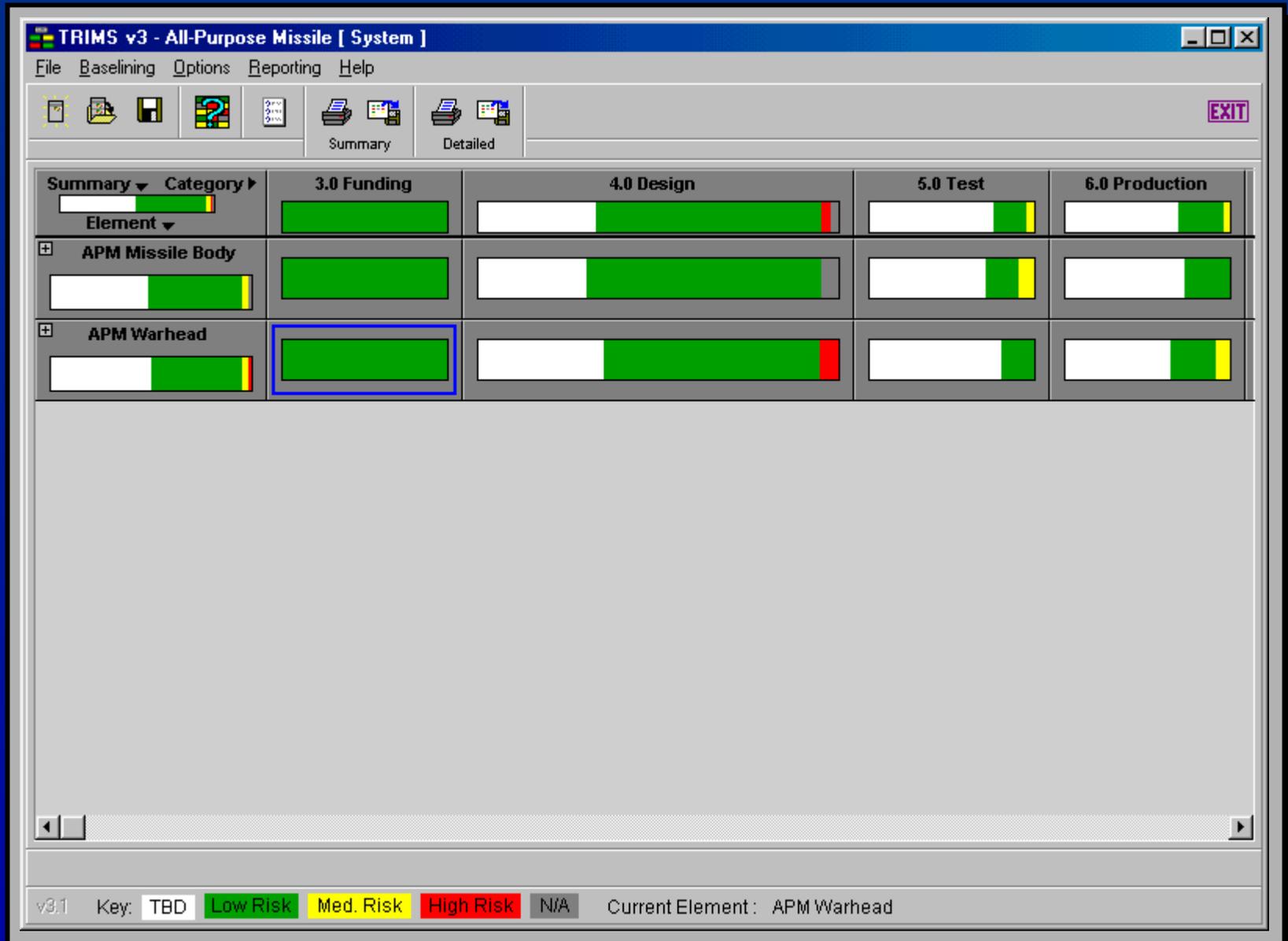


Example: TRIMS Use — How Initiatives Are Chosen

- Wide Request for Comments and Recommendations
- True “Leverage” Potential
- Intersection of:
 - BMPCOE Metric
 - Typical Schedule Driven “Skips”
 - Test Round Weaknesses From Contractor Standard Process



TRIMS - High Level (WBS) Rollups



TRIMS - Expanded View

TRIMS v3 - All-Purpose Missile [System]

File Baselining Options Reporting Help

Summary Detailed

EXIT

Summary Category	3.0 Funding	4.0 Design		5.0 Test	6.0 Production
APM Missile Body					
APM Missile Body	3.1 Money Phasing	4.1 Design Reference Mission Profile	4.2 Design Requirements	5.1 Integrated Test	6.1 Manufacturing Plan
APM Missile Body	3.2 Cost Assessment	4.3 Trade Studies	4.4 Design Policy	5.2 Failure Reporting System	6.2 Qualify Manufacturing Process
APM Missile Body		4.5 Design Process	4.6 Design Analysis	5.3 Uniform Test Report	6.3 Piece Part Control
APM Missile Body		4.7 Parts and Materials Selection	4.8 Software Design	5.4 Software Test	6.4 Subcontractor Control
APM Missile Body		4.9 Computer-Aided Design (CAD)	4.10 Design for Testing	5.5 Design Limit	6.5 Defect Control
APM Missile Body		4.11 Built-In Test (BIT)	4.12 Configuration Control	5.6 Life	6.6 Tool Planning

v3.1 Key: TBD Low Risk Med. Risk High Risk N/A Current Element : APM Missile Body

TRIMS - Primary Input Screen

Browse/Edit (APM Missile Body: Design)

4.6 Design Analysis

Assignment:

Initiate: ?

Monitor: ?

Approve: ?

Rank: 71% **Low Risk**

Last Updated: 11/24/2000

Begin Activity:

Notes:

Category (4.0) [Navigation]

Template (6 of 20) [Navigation]

4.6.1 Do the contractor's corporate standards identify design analysis as an integral part of the design process?

Question (1 of 14)

Compliant: Weight: (out of 140)

Reference:

Ref. File:

Next Action:

Due Date: (Time remaining: 442 Days)

Action list:

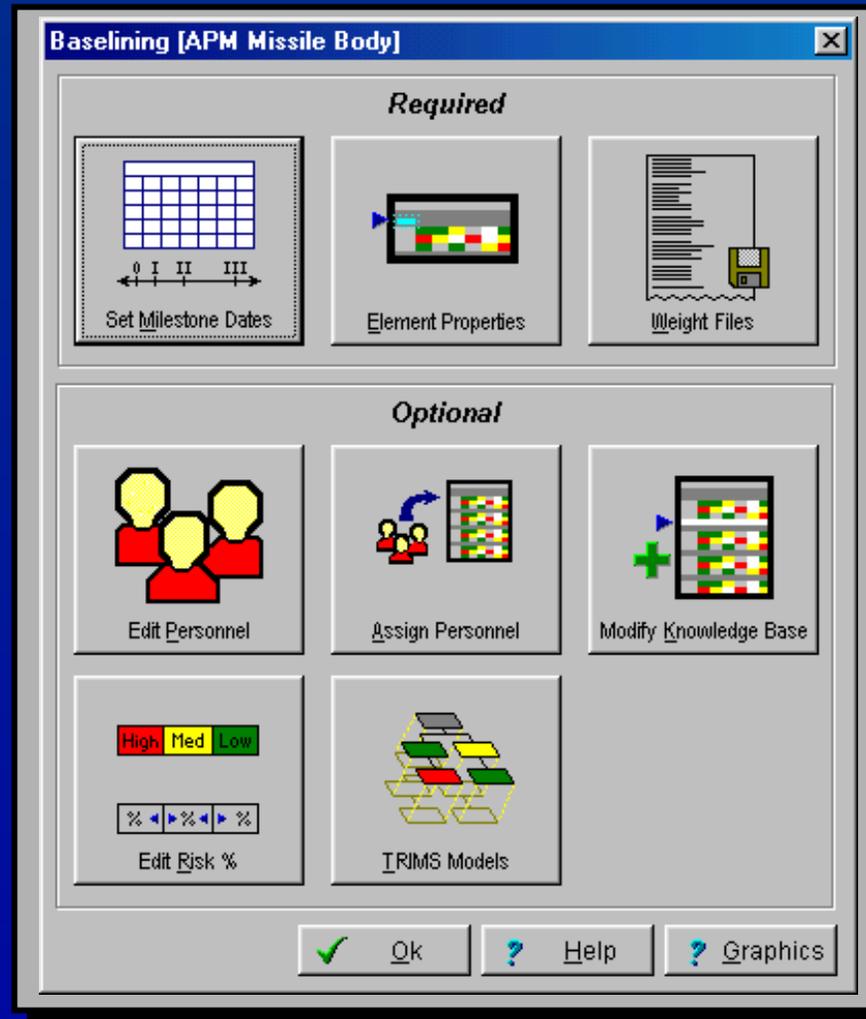
Performer: ?

Search:

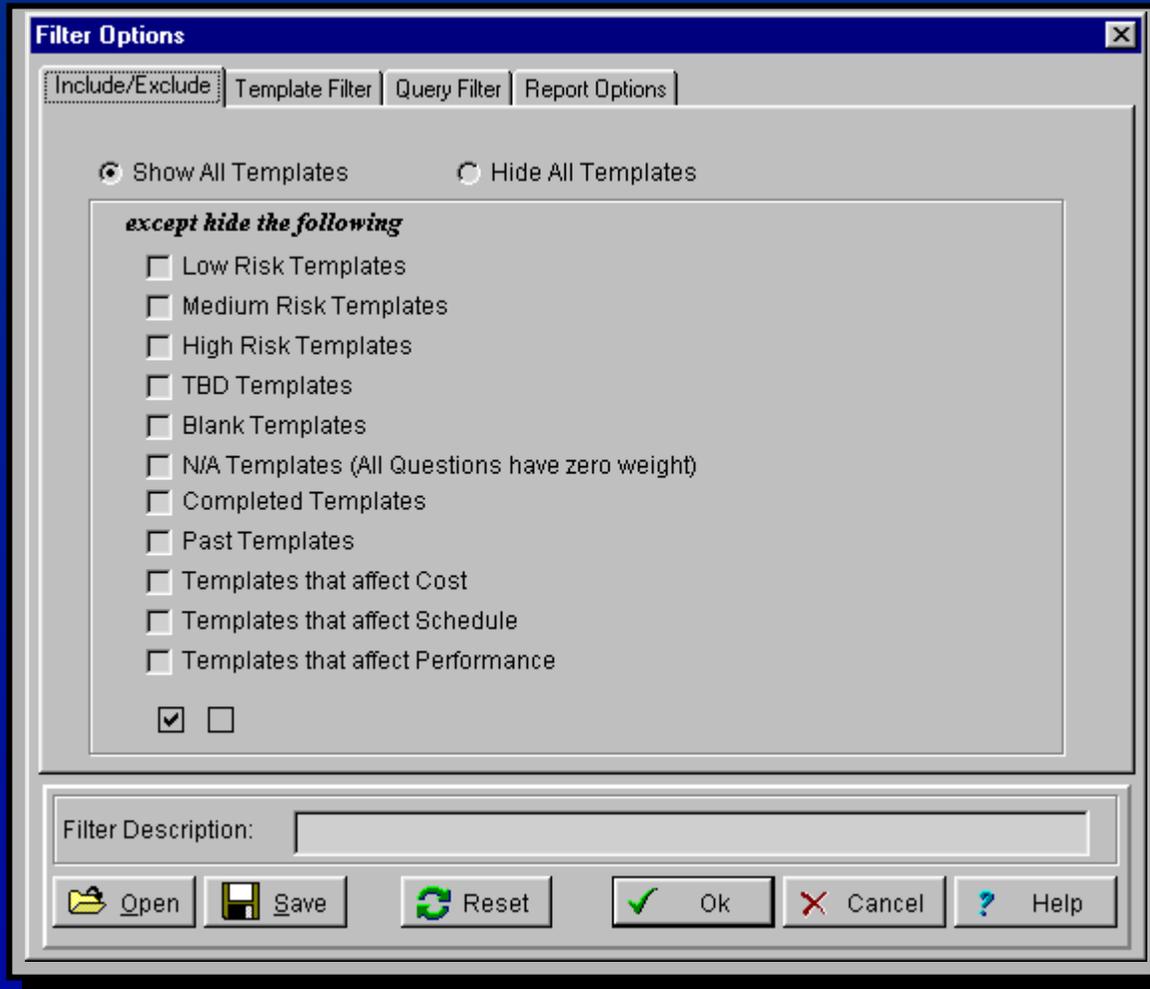
Continuous
Process
Improvement
Loop

Store
Computer
Action
Item Plans

TRIMS - Baselineing Options

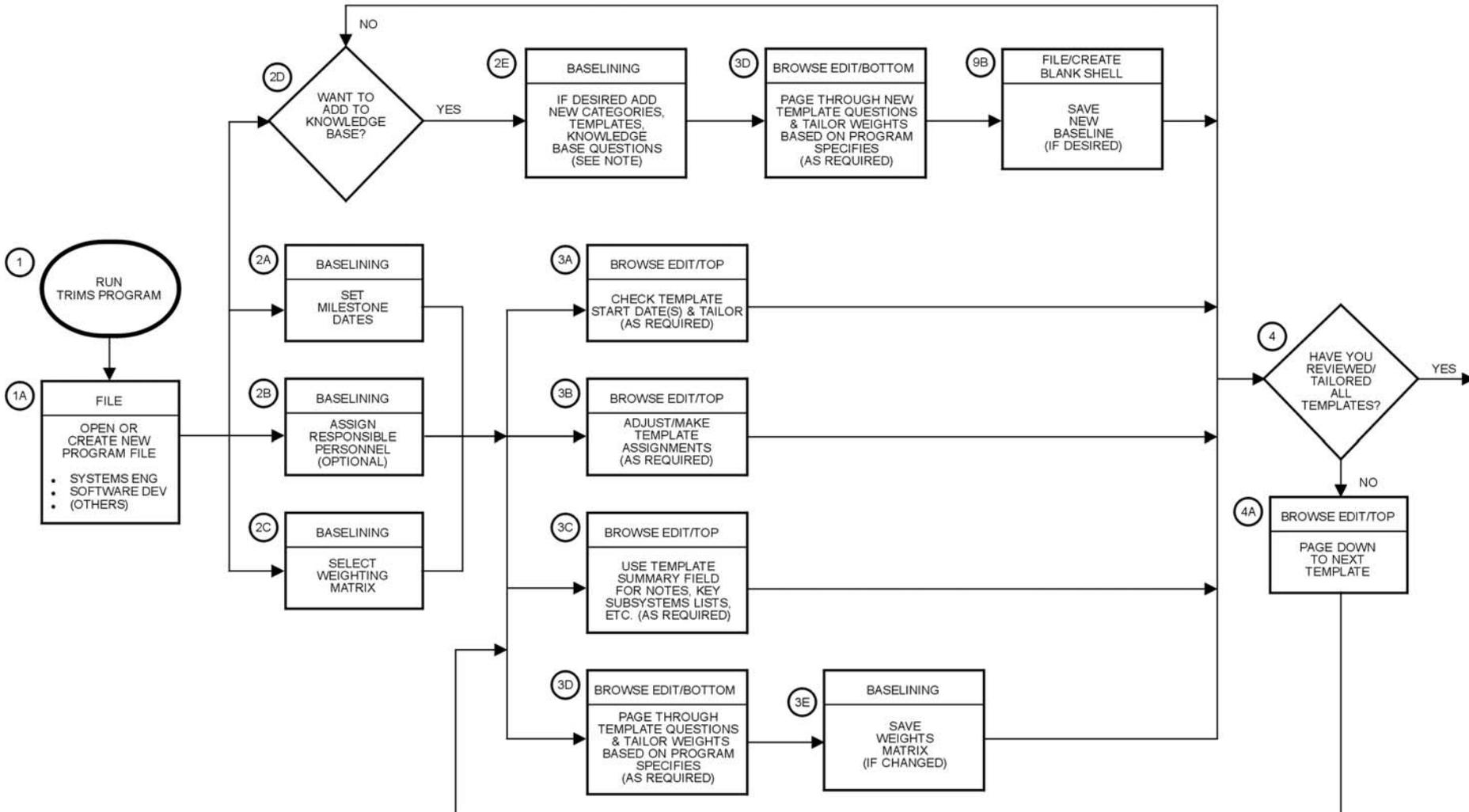


TRIMS - Fully Tailorable Screens And Reports



Risk Management Using TRIMS Program Series (Sheet 1 of 3)

BASELINING

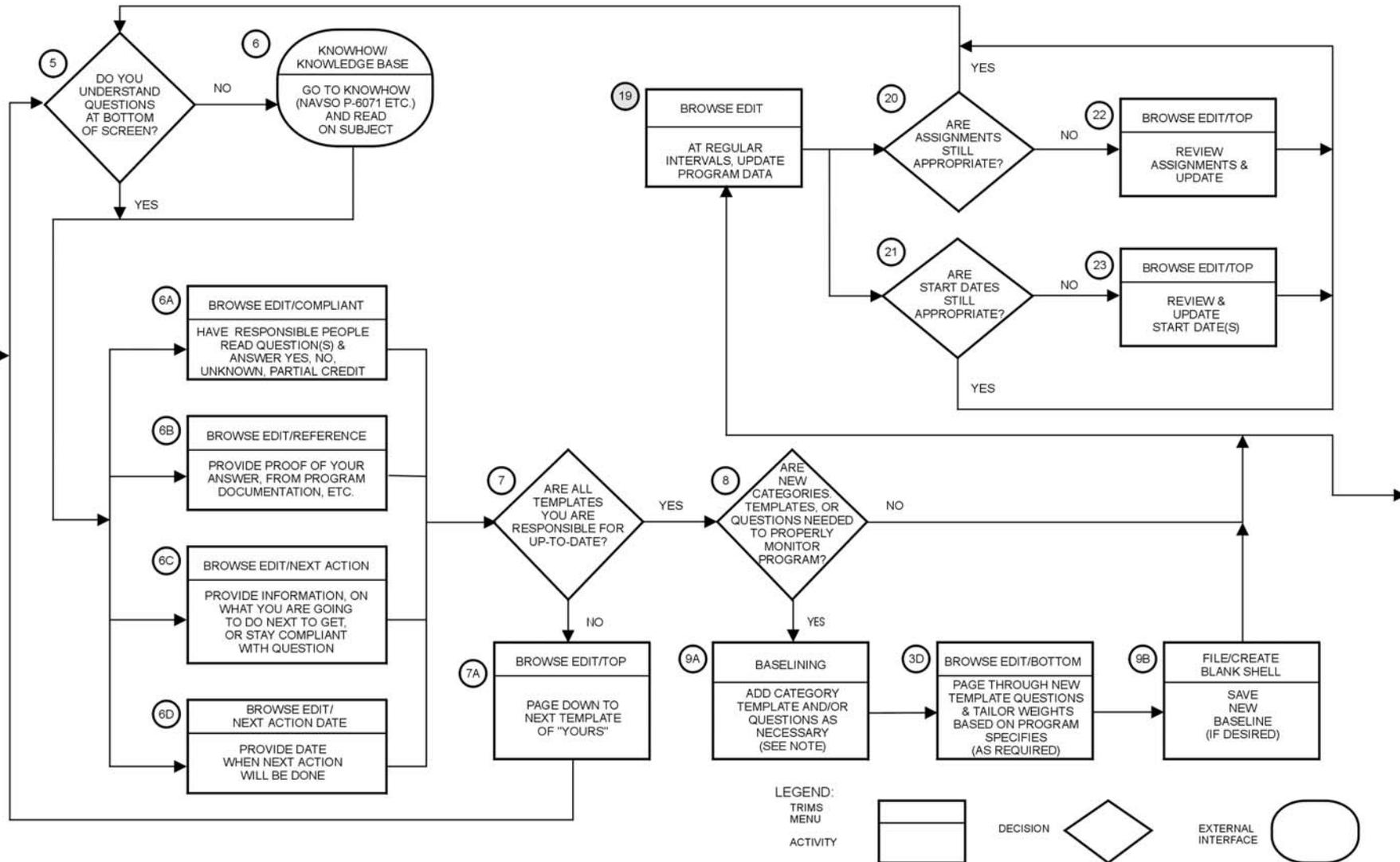


NOTE:

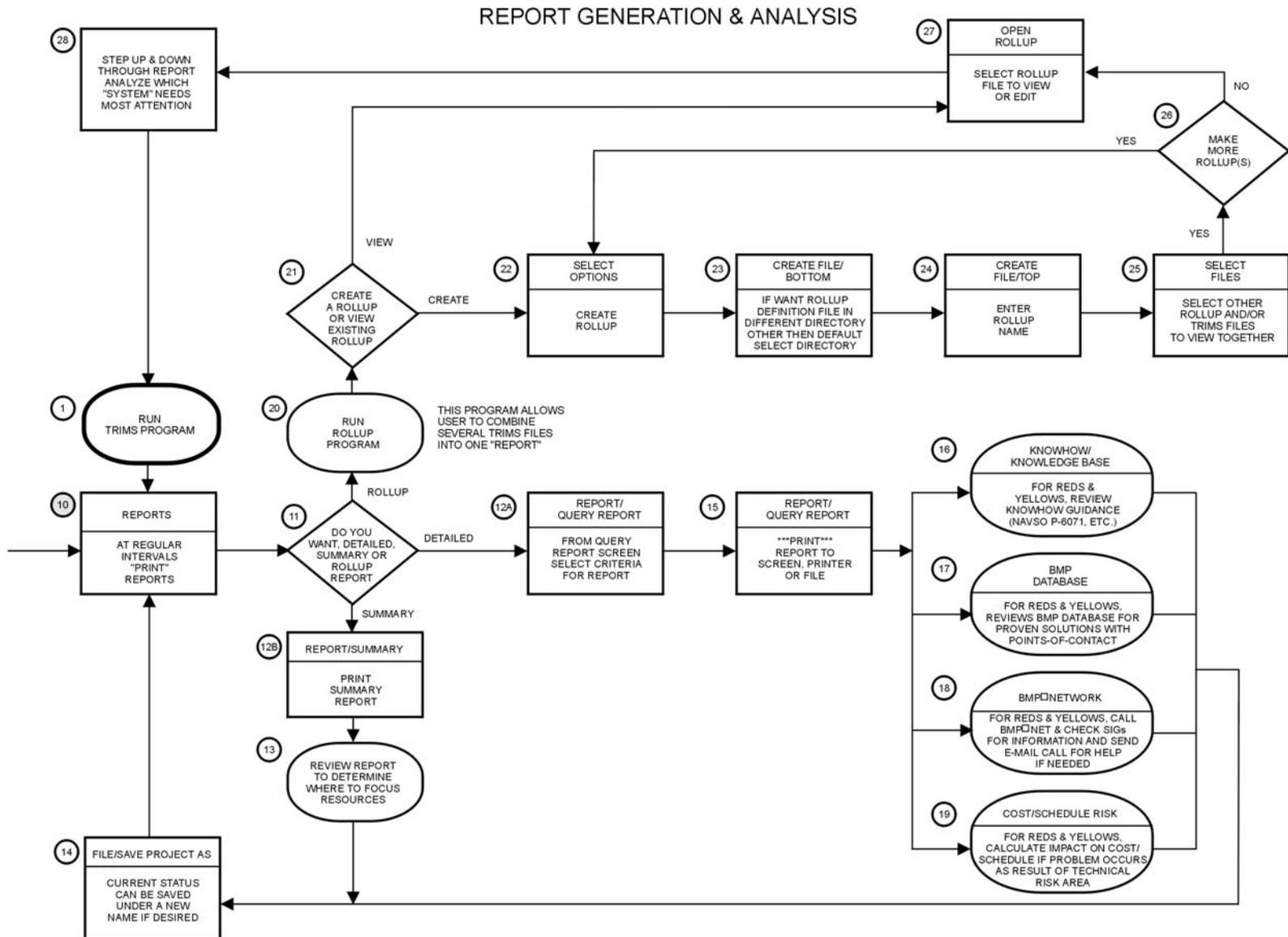
WHEN ADDING PRODUCT ORIENTED TEMPLATES (BASELINE IS PROCESS ORIENTED) SEE ADD QUESTION HELP MENU (F1) FOR GENERIC TECHNOLOGY RISK QUESTIONS. TOGETHER THESE QUESTIONS MAKE UP A SPECIFIC TECHNOLOGY RISK TEMPLATE. ADD TEMPLATES FOR ALL "RISKY" AREAS, SUBSYSTEMS OR COMPONENTS.

Risk Management Using TRIMS Program Series (Sheet 2 of 3)

DATABASE MANAGEMENT



Risk Management Using TRIMS Program Series (Sheet 3 of 3)



What Is TARs?

- TARs (TRIMS Advanced Roll-up System): A Methodology for Combining Risk Metrics From Multiple TRIMS Element or System Files Into a Single System-Level Metric
- Based on TRIMS Knowledge-Based Process-Oriented Risk Management
- Used for System-Level Risk Analysis – Identify Where the High Risk Areas Are
- Includes Comprehensive Report-Generation Capabilities

Advanced System-Level Capability

The TARs Methodology

- **Begin by Calculating Risk Percentages at the Category Level**
 - Each template is worth a certain number of “points”, depending on it’s assigned weight
 - Total the number of “points” for each risk-type: Low-Risk, Medium-Risk, High-Risk, To-Be-Determined, and Not-Applicable Templates
 - Divide each sub-total by the total number of points for the category, to convert sub-totals to weighted percentages
 - If any sub-total is non-zero before being divided by the total, the resulting percentage *must* be greater than or equal to 1% (override calculated value if necessary)
- **Combine [Weighted] Categories into Element-Level Values**
 - Repeat steps from above, using category weights and percentages
- **Combine [Weighted] Elements into Sub-Systems...**

This Method is Simple, Informative, and Repeatable!

Rolling-up System Risk Metrics

Element #1 (30) 

Element #2 (10) 

Step 1:

Combine weights into total,
and calculate percentage

Total = 30 + 10 = 40

Element #1 = 30 / 40 = 75%

Element #2 = 10 / 40 = 25%

Step 2:

"Reduce" (scale down) each
element's metrics to match it's
percentage

Element #1 (75%)

Element #2 (25%)

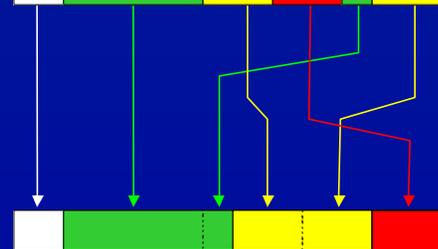


Step 3:

Combine same
type metrics...

...and done!

System:



System:



***Repeatable For As
Many System Levels
As Needed!***

Web Technologies ***(CWE)***

Web Technologies

- **Collaborative Work Environment (CWE)**

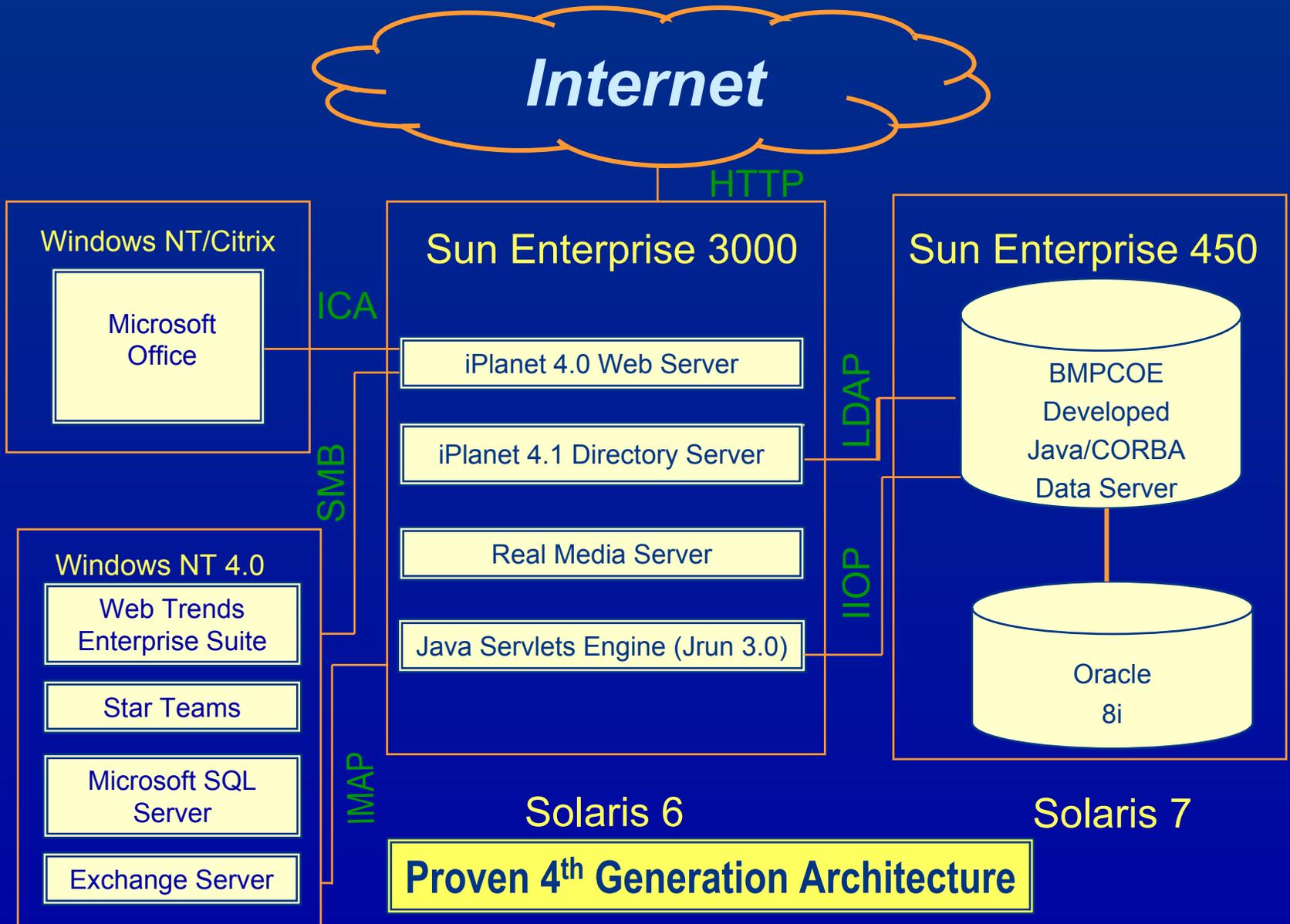
- Integrated Windows Programs
- Work Groups
- Automatic Notifications
- Calendars
- Fully Indexed Site Allows High Speed Searches
- Self Managing

- **Additional Features for Customization**

- Chat
- Streaming Video
- Dial-in
- E-Mail

Efficiency For Distributed Work Teams

CWE Architecture



Web Technologies — Unique Features

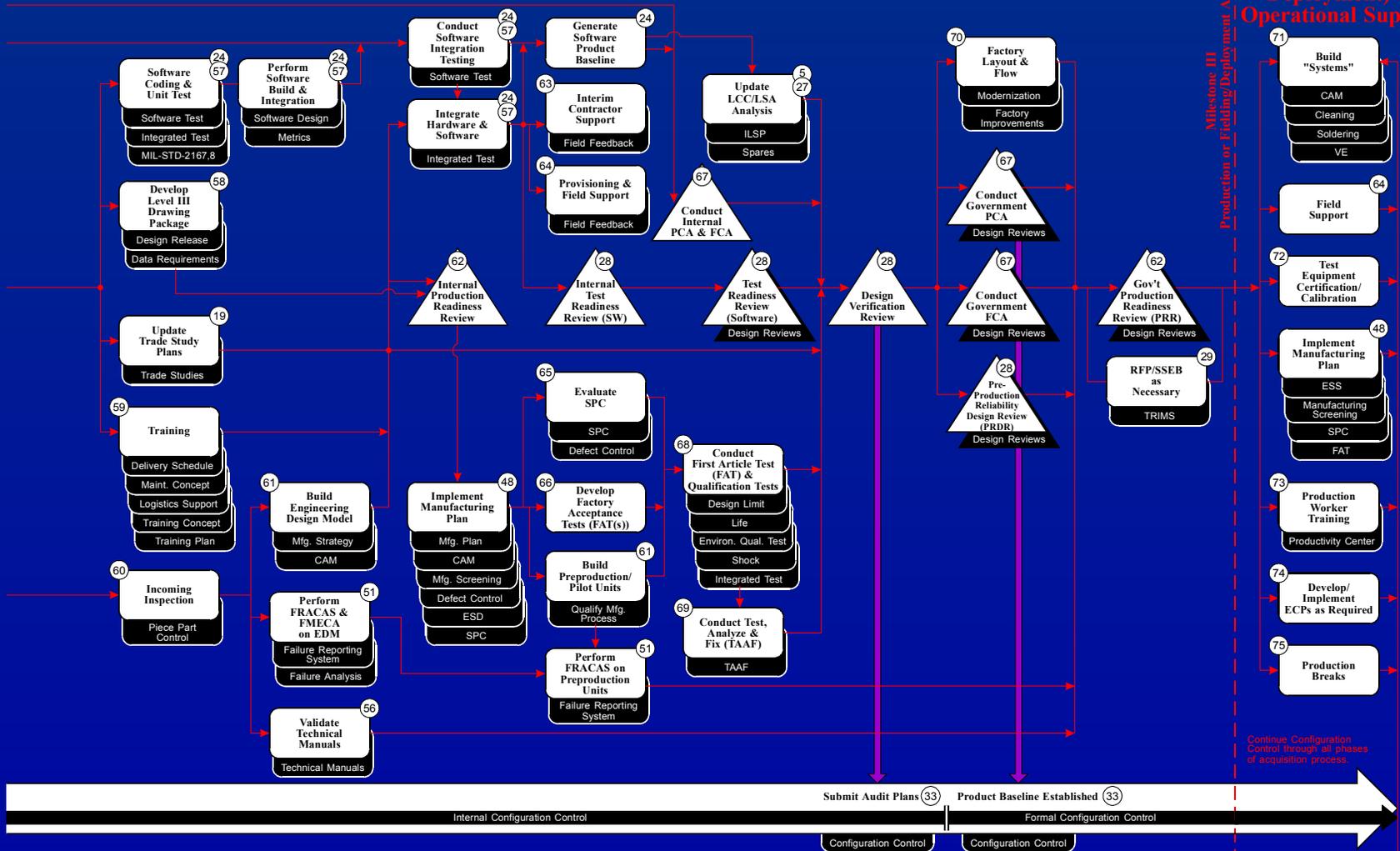
- Uploaded Document Scanner
- Seamless Windows on the Web
- Screen Saver — Push System
- Middleware Architecture
 - CORBA
 - Oracle
 - Large Database Capabilities
- Shared Business Model
 - Cost
 - Improvements
 - One Version Under Configuration Management
- Self Managing

***Sample Parts
and
Process Initiatives***

BMPCOE Concurrent Engineering Model

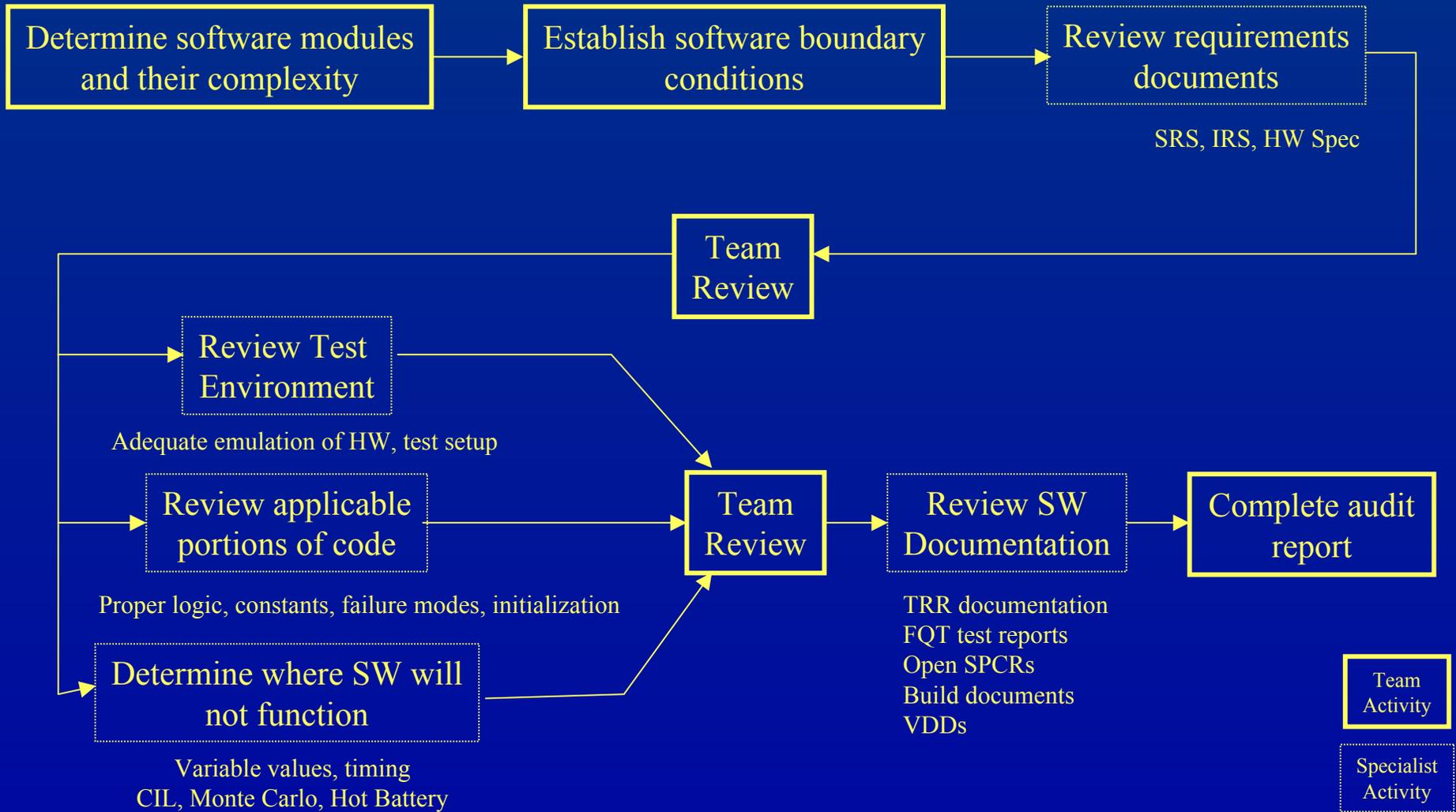
Phase 2: Engineering & Manufacturing Development (Con'td)

Begin Phase 3: Production (or Fielding/ Deployment) & Operational Support

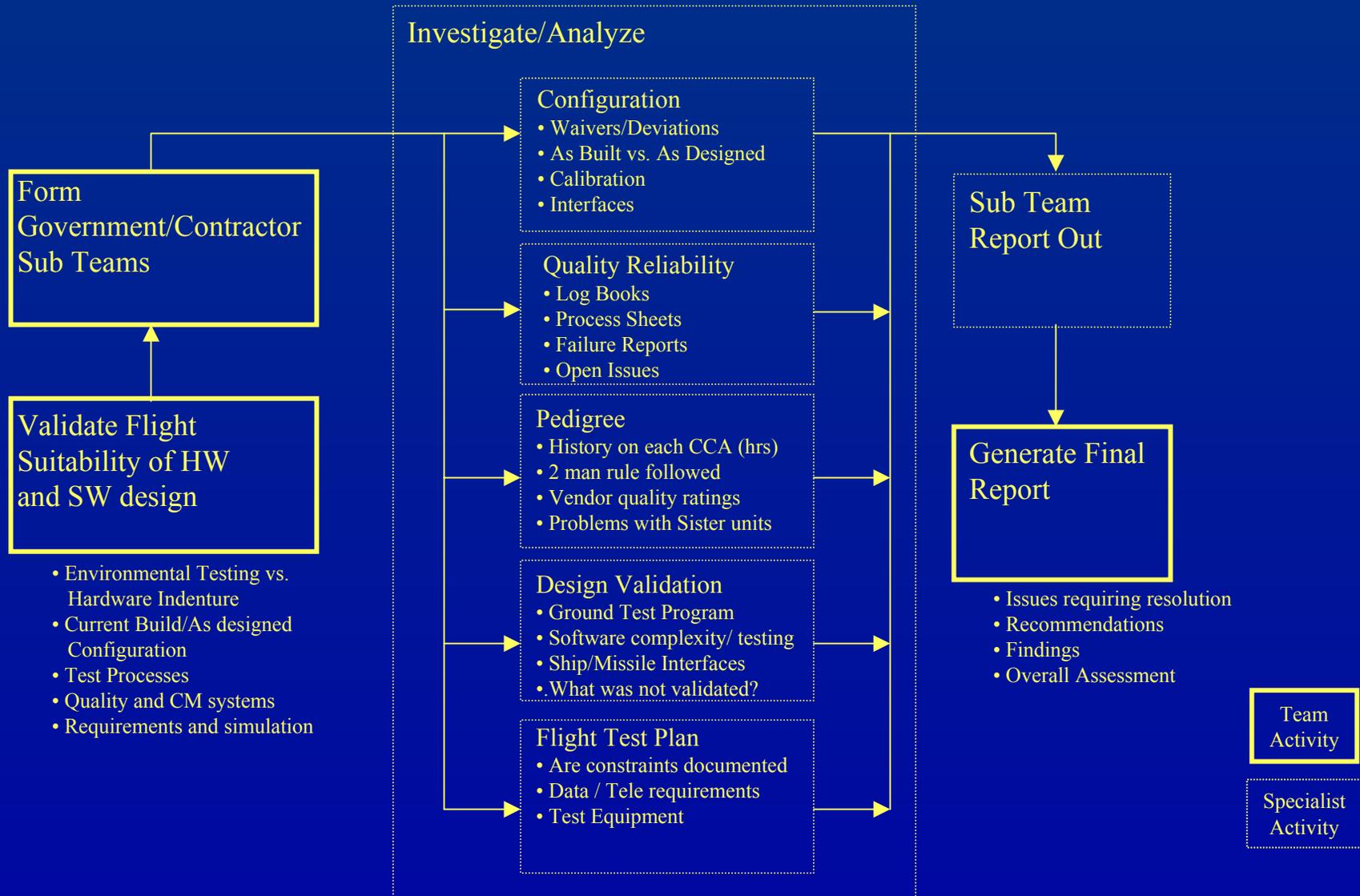


Continue Configuration Control through all phases of acquisition process.

Flight Software Audit

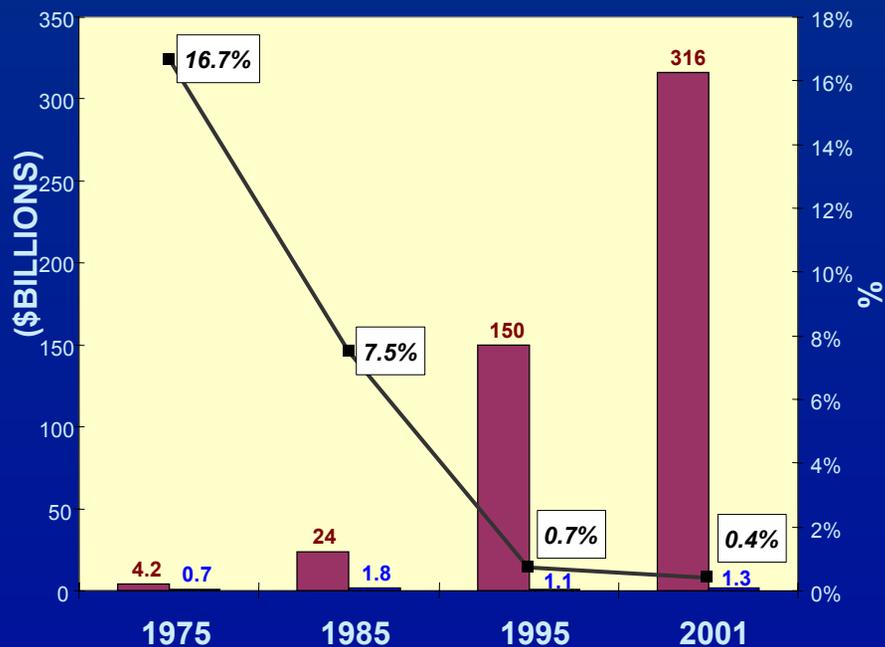


Flight Suitability Audit

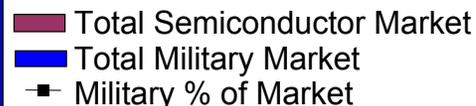


Diminished Military Influence

DECLINING MILITARY PRESENCE

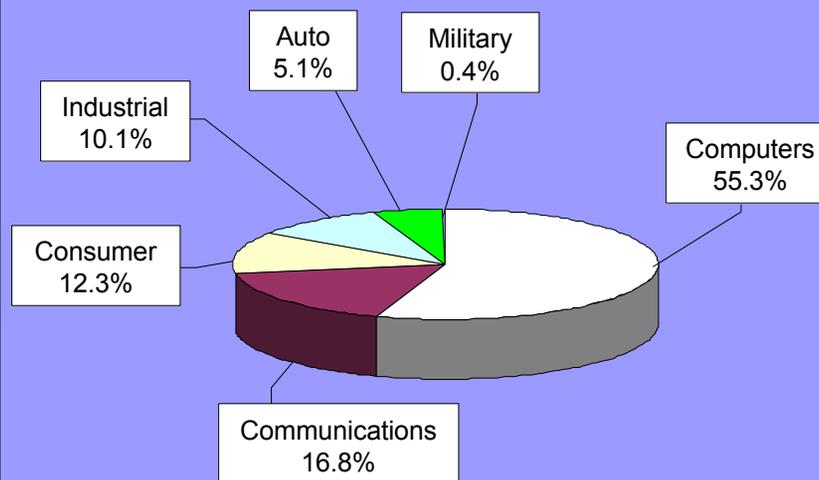


Source : ICE, "Roadmaps of Packaging Technology"



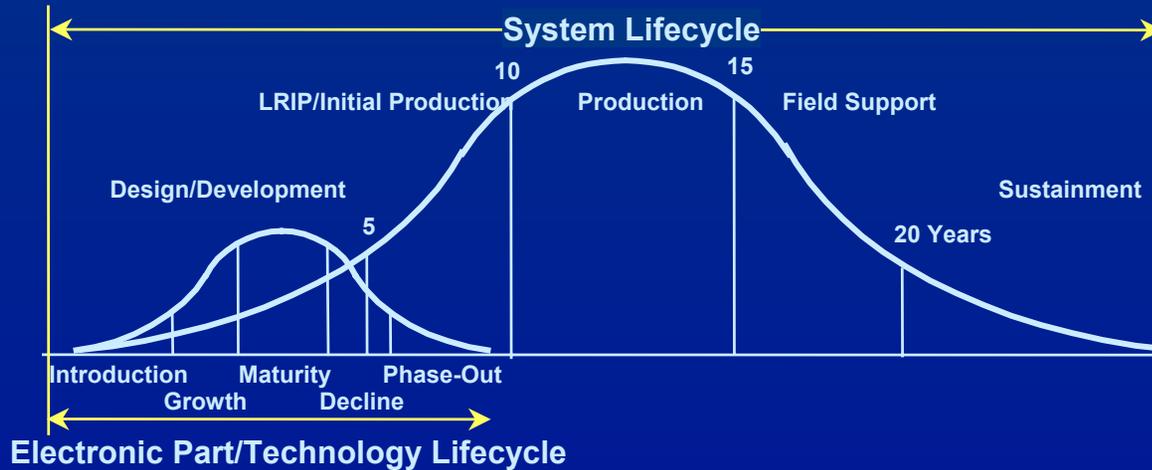
- *More Parts and Package Styles for Engineers to Choose*
- *Shorter Life Cycle of Parts*

Year 2001 Semiconductor Usage (316 Billion Dollar Market)



Followers Instead Of Leaders In Electronic Market

System vs. Technology Lifecycle Mismatch



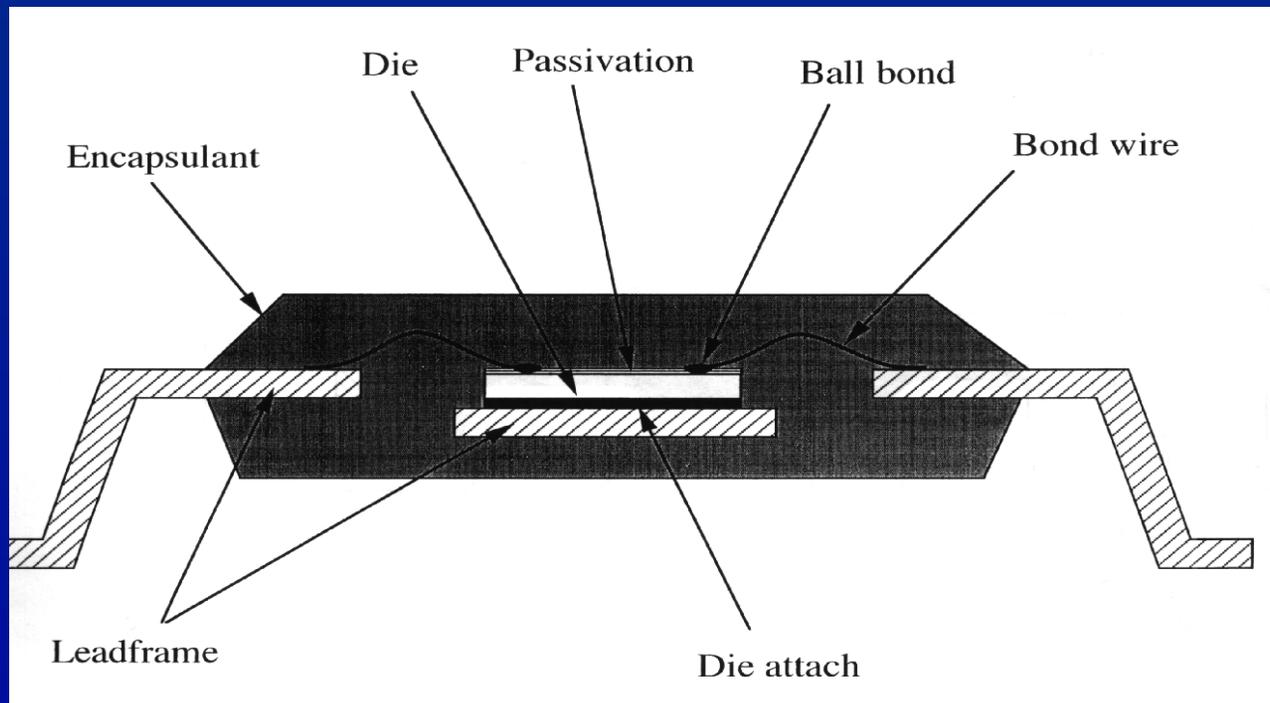
30 YEAR WEAPON SYSTEM LIFE CYCLE



SOURCE: ICE, "Status 97" & TACTech, Inc.

Note: Lifecycles could be even shorter in today's market.

PEM General Description



CHARLES BARAKAT
NAVAL AIR WARFARE CENTER CHINA LAKE

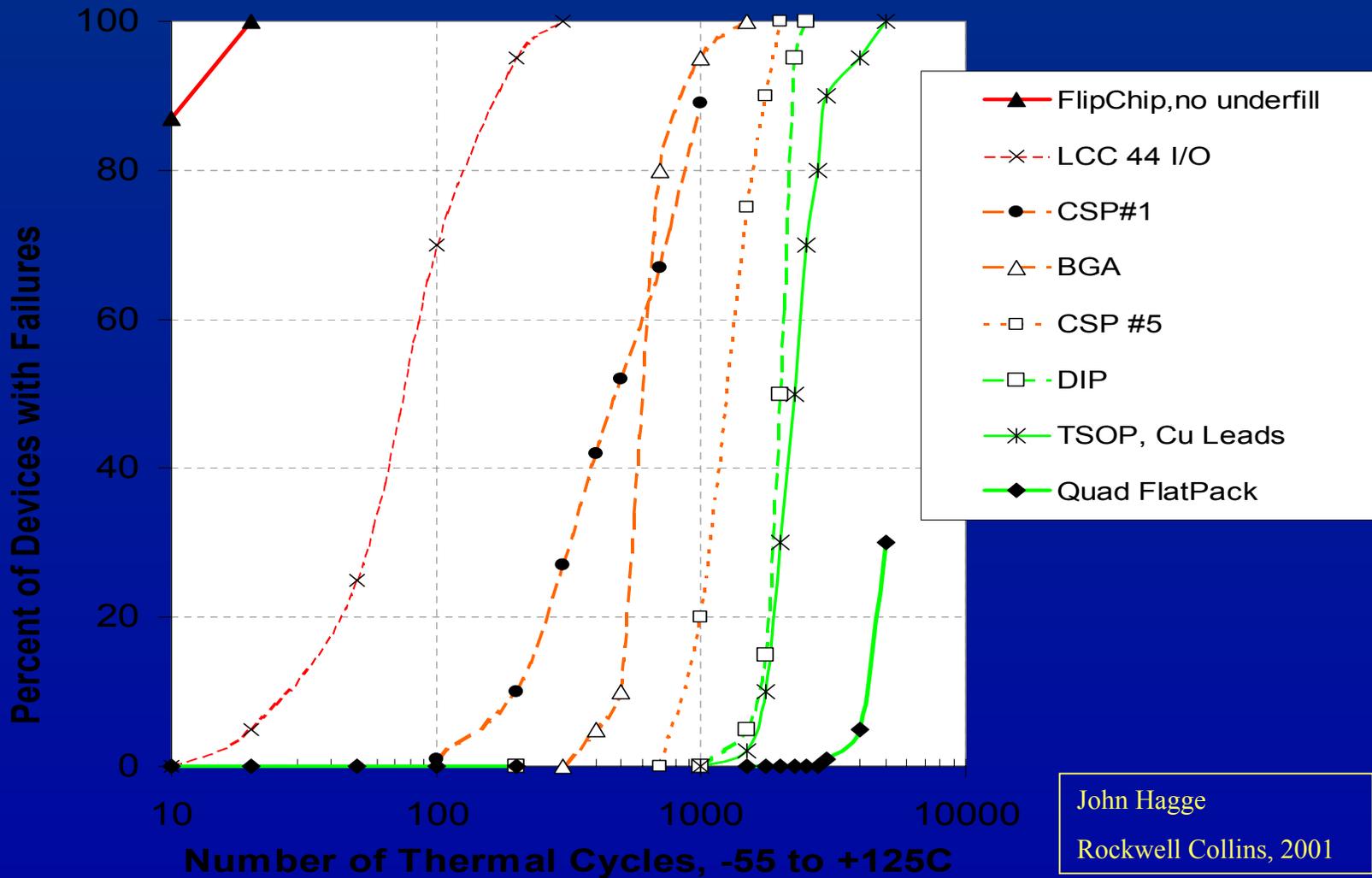
PEMs - Train Wreck Coming?

- PEMs Use in Designs Increasing (Currently Most PEMs in SM3 KW) - High Rates of Change in Altitude Not Fully Qualified
- Long Term Dormancy Issues Virtually Unknown/Proven - NMD EKV Nothing Allowed but MIL-SPEC Parts
- Government Guidelines State Not Recommended for Use in Space and Radiation Hard Applications - Army Standards More Detailed Ahead of Navy
- Army Took 76 Part Types (45 Parts per Type) From 26 Vendors Through Environmental Testing ... 20 Failed
- Manufacturing Process for BGAs, etc. Different

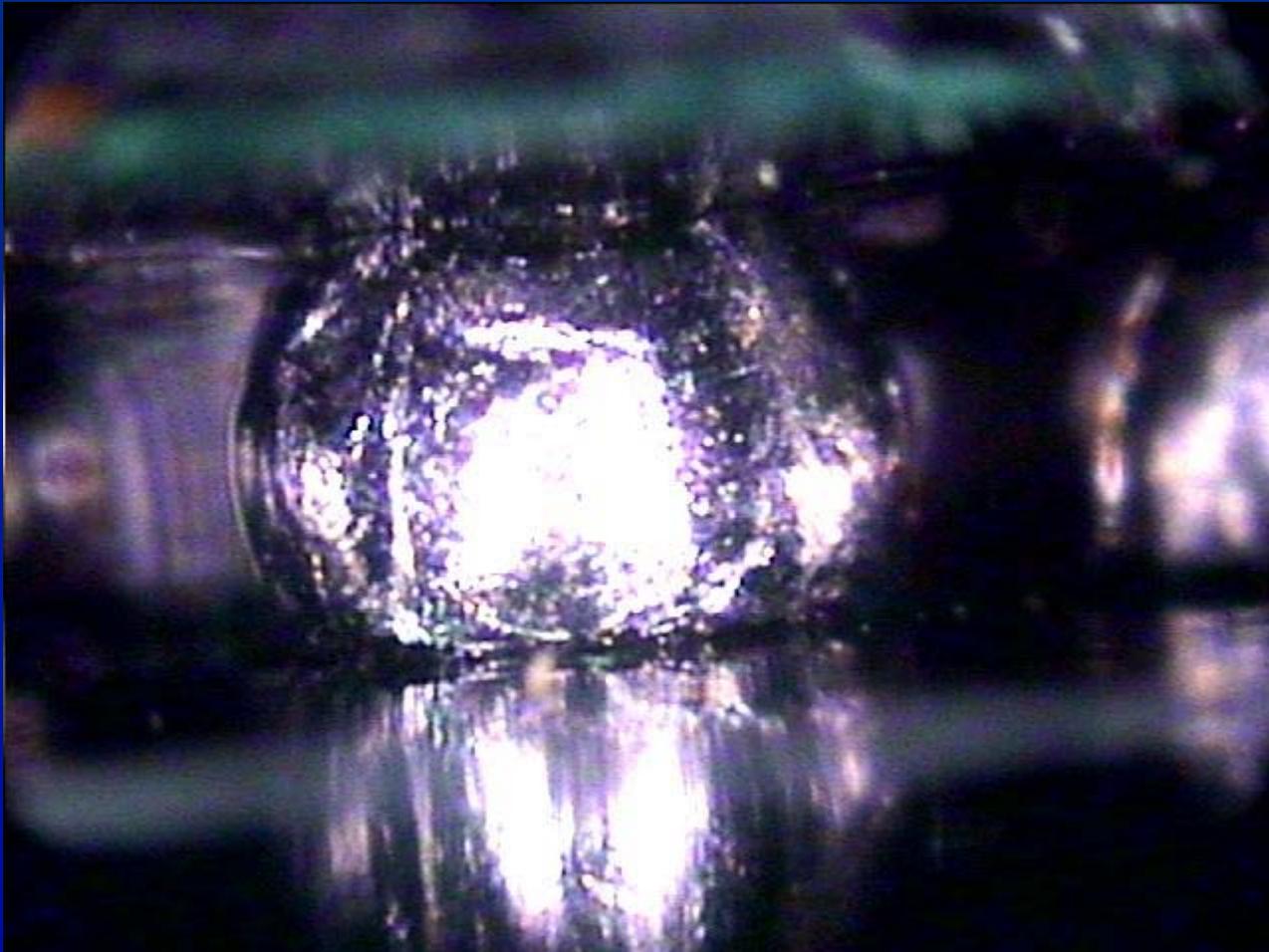
PEMs - (continued)

- High Parts Variability Seen - Must Establish a Screening Program to a Specified Quality Level
- Army Test Data Matches BMPCOE Metric of 99% to 99.9% Parts Meet Spec. Estimated 16:1 Payback From Screening
- Launcher Spec'd at 47% Relative Humidity .. What is Real World? Support World-Wide Launcher Data Collection Efforts
- We Must Commit to Using PEMs; We Also Must Commit to Characterizing Their Performance
- Recommend Development of a Plan to Characterize PEMs Life Issues, Establish Design Guidelines

Few COTS ICs As Robust In Thermal Cycling



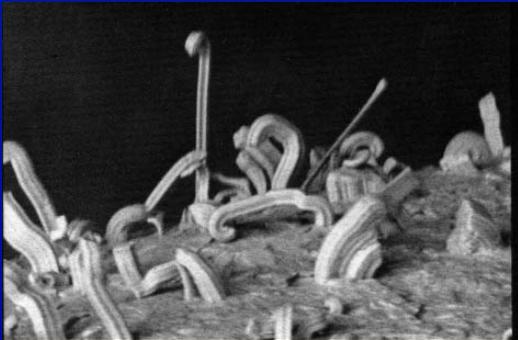
John Hagge
Rockwell Collins, 2001





What Are Tin Whiskers?

- Spontaneous, Single Crystal, Hair-Like Growths From Surfaces That Use Tin (Sn), Especially Electroplated Tin, as a Final Finish
- Electrically Conductive



Growing on capacitor



On relay hook terminal



On hybrid microcircuit lid

Failures Attributed To Whiskers

- Two Galaxy Satellites - Complete Loss of Satellite Operation Due to Whisker Short from Tin-Plated Relay
- Missiles
- F-15 Radar
- Heart Pacemaker
- Also
 - Whiskers May Be Undetectable by Untrained Person
 - NASA Scientist, Dr. Henning Leidecker, Believes Whiskers were Source of Many Past Failures Whose Root Cause was Never Found (e.g., 'Could Not Duplicate')

Program Manager's WorkStation (PMWS)

*“Knowledge, Insight, And Experience
Into The Systems Engineering Process”*

We Can Build A Tailored System



BMP COE

Partners for Transformation . . .

Accelerating Discovery to Deployment

