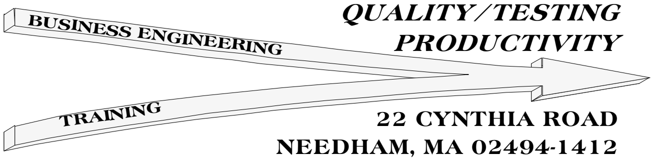
Testing Whether Requirements Are Right

Robin F. Goldsmith, JD
GO PRO MANAGEMENT, INC.

SYSTEM ACQUISITION & DEVELOPMENT



QUALITY/TESTING
PRODUCTIVITY

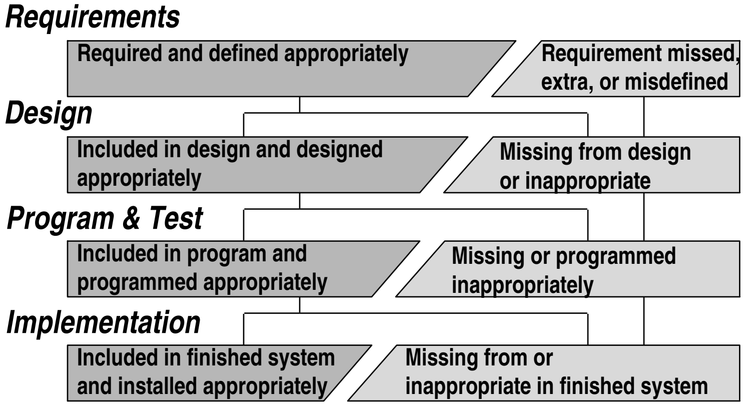
22 CYNTHIA ROAD
NEEDHAM, MA 02494-1412
INFO@GOPROMANAGEMENT.COM
WWW.GOPROMANAGEMENT.COM
(781) 444-5753 *VOICE/FAX*

Objectives

- Identify how creep and resulting budget/schedule overruns are largely due to (often unrecognized) inadequate definition of requirements
- Explain why requirements are seldom tested effectively for accuracy and completeness
- Introduce more than 21 methods for testing that requirements are right:
  - Form (including testability and clarity)
  - Finding overlooked requirements
  - Detecting incorrect requirements

Error Sources by Phase

Phase | **Portion of System Correct** | **Portion of System In Error**

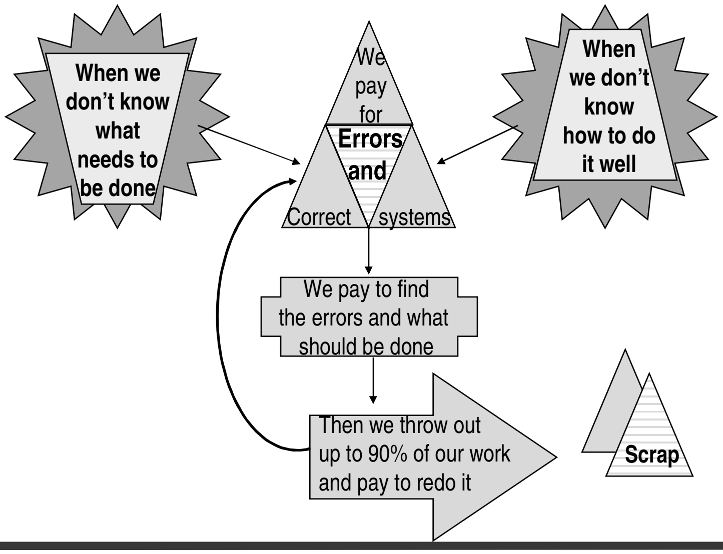

Requirements
Required and defined appropriately
Requirement missed, extra, or misdefined
Design
Included in design and designed appropriately
Missing from design or inappropriate
Program & Test
Included in program and programmed appropriately
Missing or programmed inappropriately
Implementation
Included in finished system and installed appropriately
Missing from or inappropriate in finished system

Quality Assurance Economics

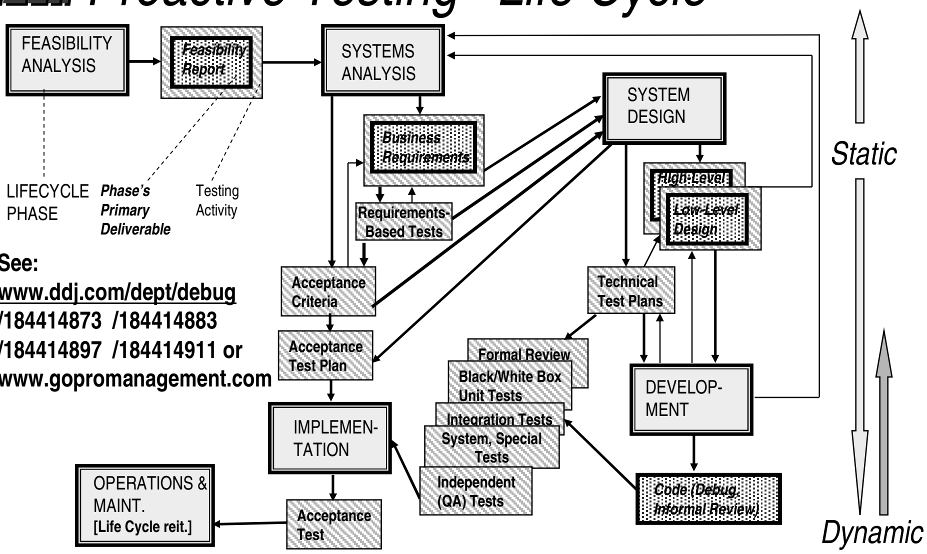
- Maintenance is 66-90% of system cost
- Maintenance is mainly completion/ correction of development
- 2/3 of finished system errors are requirements and design errors
- Fixing a requirements error will cost
  - 10X+ during programming
  - 75X-1000X+ after installation (maintenance)

Does your organization routinely and reliably know these measures?

What Development Dollars Buy


When we don’t know what needs to be done
We pay for
Errors and
Correct systems
When we don’t know how to do it well
We pay to find the errors and what should be done
Then we throw out up to 90% of our work and pay to redo it
Scrap

Proactive Testing™ Life Cycle



See:
www.ddj.com/dept/debug
/184414873 /184414883
/184414897 /184414911 or
www.gopromanagement.com

Keys to Effective Testing

- ➢ **Define correctness independently of actual results**
- ➢ **You must know what the “right answer” is**
- ➢ **Follow independent guidelines to be more thorough**
- ➢ **Systematically compare actual to expected results**

Test Input	**Actual Results**	**Expected Results**
Cust. #123	John P. Jones	Jones, John P.
New Cust’s name,address	Redisplays screen with fields cleared	“Added”
10 Widgets	$14.99	$14.99 $ .75 tax

Why Up-Front Testing Usually Is So Weak

- Unaware it can be done or how to do it
- No definition of “right answer”
- Person who defined it “tests” it
- Use limited or weak review methods
- Confuse design with requirements
- Don’t manage overall software process
  - – cost/consequences not measured/matched
  - – activity and deadline driven

The "Regular Way"

✪ User review

✪ Management review

✪ Supervisory review

✪ Peer review

✪ QA Group review

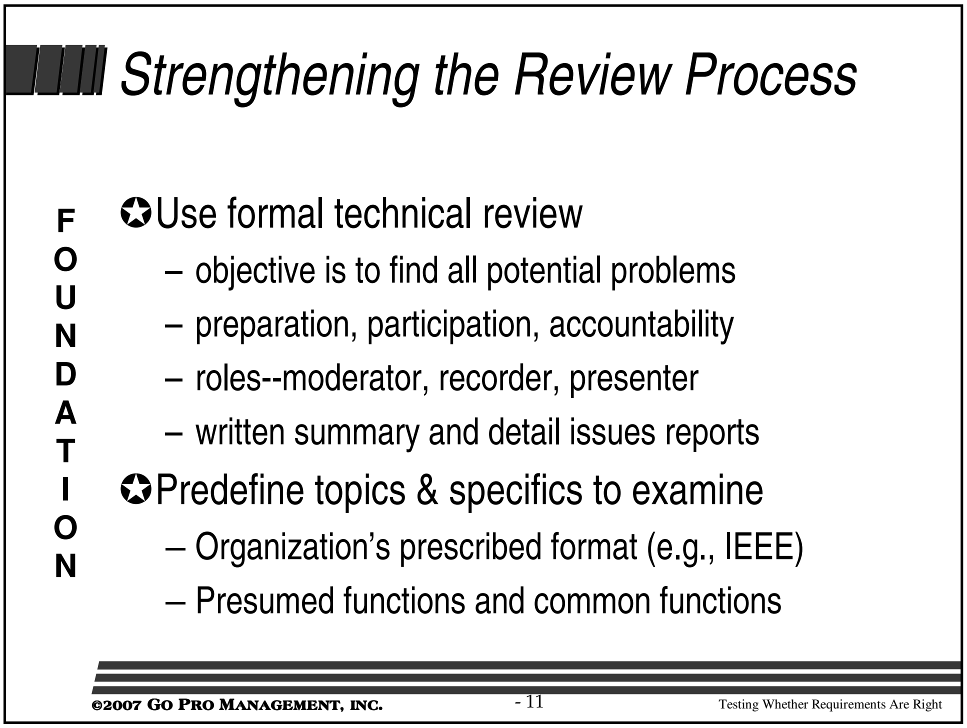
Did you know:
What to do?
How to do it?
How to tell if you'd done it well?
How confident were you that you had done it well?

Think of how your organization used these techniques

Much weaker than recognized passive review on which most organizations unwittingly over-rely

What Limits the "Regular Way"

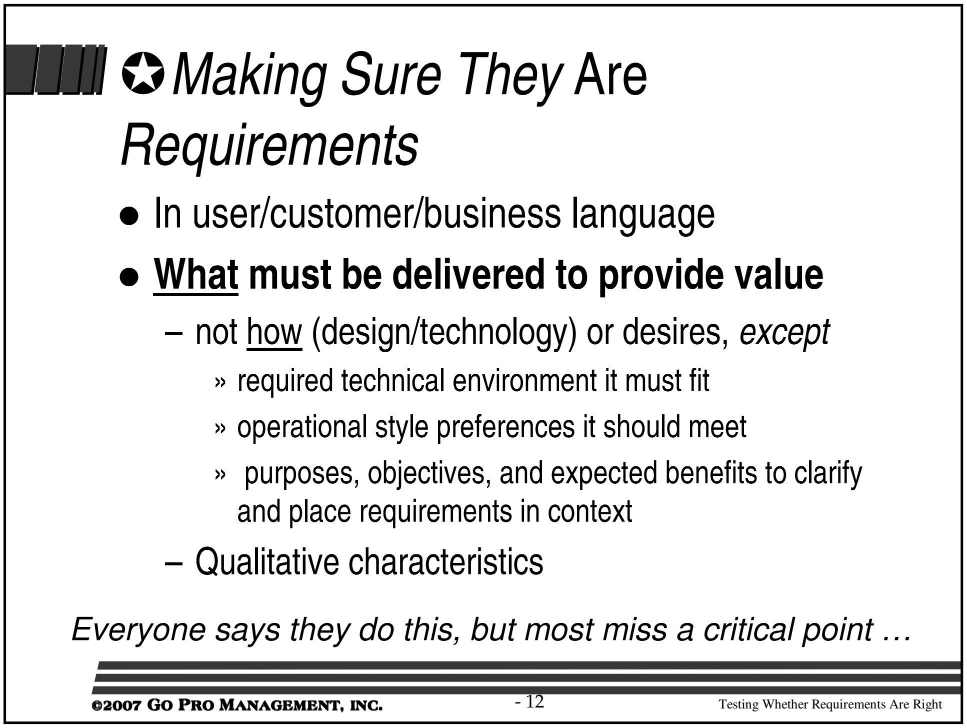
- Illusory presumption of assuring correctness
  - Based on what was said, not what should have been said (dictation vs. content)
  - Weak passive static review by people with insufficient knowledge of subject area
  - Easily overlooks things due to no systematic procedure to guide the review, not sure what to look for or how to do the review
- Inadequate feedback to guide improvements ("Do it over. Do it better.")



Strengthening the Review Process

FOUNDATION

- ✪Use formal technical review
  - – objective is to find all potential problems
  - – preparation, participation, accountability
  - – roles--moderator, recorder, presenter
  - – written summary and detail issues reports
- ✪Predefine topics & specifics to examine
  - – Organization’s prescribed format (e.g., IEEE)
  - – Presumed functions and common functions



✪*Making Sure They* Are *Requirements*

- ● In user/customer/business language
- ● **<u>What</u> must be delivered to provide value**
  - – not <u>how</u> (design/technology) or desires, *except*
    - » required technical environment it must fit
    - » operational style preferences it should meet
    - » purposes, objectives, and expected benefits to clarify and place requirements in context
  - – Qualitative characteristics

Everyone says they do this, but most miss a critical point …

➲Two Types of Requirements:

Business/User

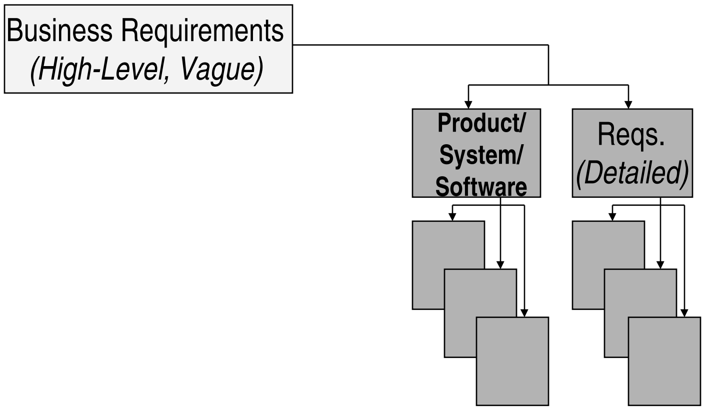
- Business/user language & view, conceptual; *exists* within the business environment
- Serves business objectives
- ***What*** business results must be delivered to solve a business need (problem, opportunity, or challenge) and provide value when delivered/satisfied/met

Many possible ways to accomplish

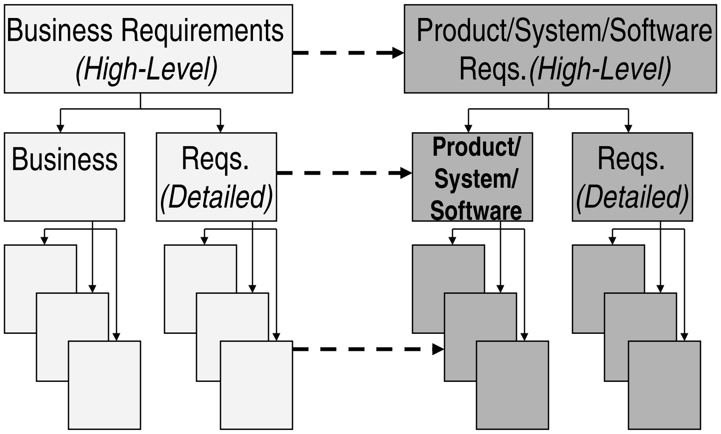
Product/System/Software

- Language & view of a *human-defined product/system*
- **One of the possible ways** ***How*** (design) presumably to accomplish the presumed business requirements
- Often phrased in terms of external functions each piece of the product/system must perform to work as designed (Functional Specifications)

Even Requirements "Experts" Think the Difference is Detail



When Business/User Requirements Are Detailed First, Creep Is Reduced



Other Tests of Requirements Form

- Deliverable, attainable in the world (not a budget issue)
- Testable (write test cases)
- Reviewable
- Reasonably understandable in the business community
- Clear and structurally complete
  - Stated as positive (can't prove absence of a negative)
  - Terms: known meaning, identifiable, consistent
  - Assumptions documented
  - Stand on own without internal contradictions, logic flaws, or vagueness/ambiguities
- Consistent with (suitable) objectives
- Identifies major functions, limits
- Alternative consequences defined
- [In prescribed format, e.g., IEEE Std. 830-1998 for Software Requirements Specifications, use cases]
- [Magic words--must, shall, will (no TBD)]
- Hierarchical itemized business deliverable whats, traceable

✪ Use Cases Can Be, But Seldom Are, Business Requirements

“Two-Column” Use Case Example

U1.	Enter Vendor Number	R1.1	Display vendor name, address
		R1.2.	Vendor not found
U2.	Enter vendor name	R2.	Display list of vendors by name
U3.	Scroll list and select	R3.	Display selected vendor’s info
U4.	Exit name search	R4.	Switch to Vendor Add mode
U5.	Enter vendor info	R5.	Add vendor to database

Often considered “user” requirements, but really usually *usage* requirements for the product/system to be created

These, or Just a Subset (e.g., Testability or Use Cases), Are All Most “Experts” Address

- Often resisted as nitpicking
- Still can miss important form issues, even with checklists and procedural rigor
- Contrary to presumptions, unlikely to spot *content* issues
  - Overlooked requirements
  - Incorrect requirements

Tests of form can be performed by people with minimal subject area knowledge, e.g., many of US

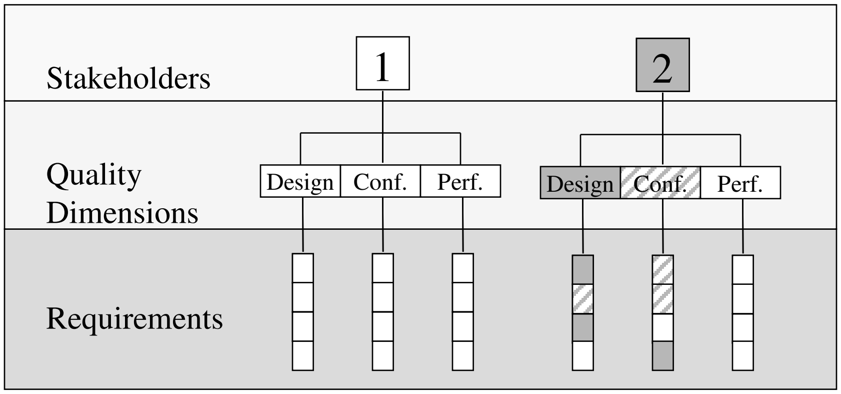
Greater Knowledge and Added Methods Are Needed to Find Missed Requirements

- Focusing on what *has been defined* actually makes it harder to realize what's been overlooked
- Typically find *groups* of requirements of which we were unaware
- Quickest way to gain support for requirements review

When There's No Definition of "Right," Create a "Strawman"

- Reasonable guess of what requirements might be--no assurance they are right
- Match to what has been defined
  - Reasonably present confirms it has been addressed, assume appropriately
  - Not reasonably present indicates need to examine more fully
  - Sample: One problem may signal more
- Forcing concrete examples challenges assumptions that we've addressed them

How Requirements Get Missed



Stakeholders

1

2

Quality Dimensions

Design Conf. Perf.

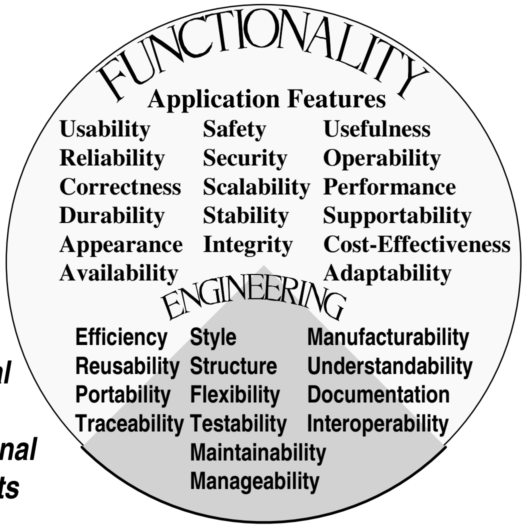
Design Conf. Perf.

Requirements

☐ Overlooked
▨ Misdefined
■ Defined Correctly

✪ What are business and temporal event triggers?

✪ Addressing Quality Factors



FUNCTIONALITY

Application Features

Usability	Safety	Usefulness
Reliability	Security	Operability
Correctness	Scalability	Performance
Durability	Stability	Supportability
Appearance	Integrity	Cost-Effectiveness
Availability		Adaptability

ENGINEERING

Efficiency	Style	Manufacturability
Reusability	Structure	Understandability
Portability	Flexibility	Documentation
Traceability	Testability	Interoperability
	Maintainability	
	Manageability	

Beware Conventional Wisdom's Non-Functional Requirements Nonsense

Additional Strawmen

- ✪ Commonly-overlooked deliverables
  - – Backup and recovery
  - – Distribution, Installation
  - – Training, Help
- ✪ Environments—cultural, physical, technological
- ✪ Origin—strategic, tactical, operational
- ✪ Interfaces with other systems
- ✪ Special capabilities and calculations
- ✪ 3rd-party access and auditing
- ✪ Conformance to laws and regulations

Greatest Knowledge and Structure Are Needed to Detect Wrong Requirements

- ● Like a strawman in identifying the likely “right answers” to compare to
- ● Structured methods focus knowledge on important and error-prone areas
- ● Unlike strawman, informed judgments do evaluate correctness

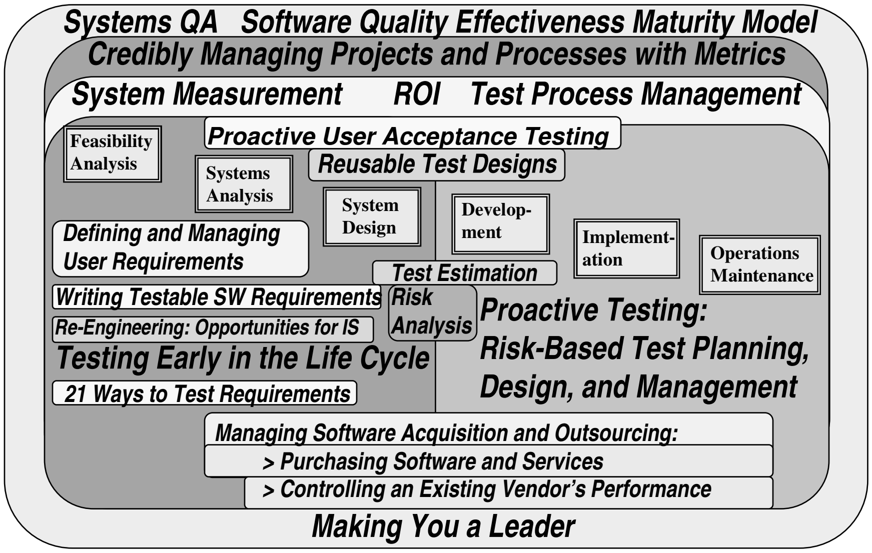
Some Methods for Testing Accuracy

- Application feature Engineered Deliverable Quality™
- Cross-application
  - Guidelines & conventions
  - Engineering standards
- Conflicts and tradeoffs
- Working out implications
- Prototyping & simulation
- Walkthroughs
- Joint Application Development (JAD)
- Defining acceptance criteria
- Mini-definitions and “canned” requirements
- Expert review
- Two independent reviews

Summary

- Requirements creep mainly because system/software requirements (functional specification) and use cases for the expected *product* don’t meet the REAL, business/user requirements--*whats* that provide value when delivered.
- Requirements are hard to test because there is no prior definition of “right” to compare to
- There are 21+ ways to test that requirements are right
  - Tests of form, including testability, clarity, and prescribed formats, are all that most people know about, easiest, and weakest
  - Finding overlooked requirements takes more knowledge
  - Identifying requirements errors takes most knowledge/structure

Go Pro Management, Inc. Seminars--Relation to Life Cycle



Systems QA   Software Quality Effectiveness Maturity Model

Credibly Managing Projects and Processes with Metrics

System Measurement   ROI   Test Process Management

Feasibility Analysis

Proactive User Acceptance Testing

Systems Analysis

Reusable Test Designs

System Design

Develop-ment

Defining and Managing User Requirements

Implement-ation

Operations Maintenance

Test Estimation

Writing Testable SW Requirements

Risk Analysis

Re-Engineering: Opportunities for IS

Proactive Testing: Risk-Based Test Planning, Design, and Management

Testing Early in the Life Cycle

21 Ways to Test Requirements

Managing Software Acquisition and Outsourcing:

> Purchasing Software and Services

> Controlling an Existing Vendor's Performance

Making You a Leader

Robin F. Goldsmith, JD

robin@gopromanagement.com (781) 444-5753

www.gopromanagement.com

- President of Go Pro Management, Inc. consultancy since 1982, working directly with and training professionals in business engineering, requirements analysis, software acquisition, project management, quality and testing.
- Previously a developer, systems programmer/DBA/QA, and project leader with the City of Cleveland, leading financial institutions, and a "Big 4" consulting firm.
- Degrees: Kenyon College, A.B.; Pennsylvania State University, M.S. in Psychology; Suffolk University, J.D.; Boston University, LL.M. in Tax Law.
- Published author and frequent speaker at leading professional conferences.
- Formerly International Vice President of the Association for Systems Management and Executive Editor of the *Journal of Systems Management*.
- Founding Chairman of the New England Center for Organizational Effectiveness.
- Member of the Boston SPIN and SEPG'95 Planning and Program Committees.
- Chair of BOSCON 2000 and 2001, ASQ Boston Section's Annual Quality Conferences.
- Member ASQ Software Division Methods Committee.
- Member IEEE Std. 829 for Software Test Documentation Standard Revision Committee
- Admitted to the Massachusetts Bar and licensed to practice law in Massachusetts.
- Author of book: ***Discovering REAL Business Requirements for Software Project Success***