

**Fifth Annual PSM Users' Group Conference
“Expanding the Application of PSM”
Aspen, Colorado
July 24,2001**

**Michael C. Dyer
Corporate Fellow, SW Engineering
Lockheed Martin Corporation
michael.c.dyer@lmco.com
(315) 793-5786**

Presentation Focus

**“Excerpts From the Defense Science Board Task Force on
Defense Software with Particular Emphasis on Measurement,
Risk management and Evaluations.”**

Defense Science Board Software Task Force



May 2000

Task Force Membership

Co-Chairs

**Robert Nesbit
Marc Hansen**

**The MITRE Corporation
Lockheed Martin Corporation**

Members

Steve Cross	Software Engineering Inst.
Michael Dyer	Lockheed Martin Corporation
Cordell Green	Kestrel Institute
Brenda Goodwin	PricewaterhouseCoopers, LLP
Anita Jones	University of Virginia
Taylor Lawrence	Northrop Grumman
Mark Maybury	The MITRE Corporation
Walker Royce	Rational Software

Executive Secretary

Lt.Col. Dave Luginbuhl, USAF

DSB Secretariat

CDR Brian Hughes, USN

Government Advisors

Norm Brown, C4I Navy

Jack Ferguson, OSD

Terms of Reference

“Determine the conditions under which the procurement of defense software can appropriately use commercial practices”

- **Procurement strategy**
- **Risk management**
- **Maintenance and enhancement**
- **COTS products**
- **New tools; libraries**
- **Information security**

“This task force should not be constrained by existing DoD standards nor by current DoD procurement strategy.”

**USD A&T
24 September 1999**

Underlying Problem

Defense development and acquisition programs continue to experience “software problems” resulting in significant cost overruns, schedule slips and performance difficulties

Software Defect Reduction Top 10 List

- | **Finding and fixing a software problem after delivery is often 100 times more expensive than finding and fixing it during the requirements and design stage.**
- | **Current software projects spend about 40 to 50 percent of their time on avoidable rework.**
- | **Peer reviews catch about 60 percent of the defects.**
- | **Disciplined personal practices can reduce defect introduction rates by up to 75 percent.**
- | **About 40 to 50 percent of user programs contain non-trivial defects.**
- |
- |
- |

“Barry Boehm & Victor Basili, Computer Magazine, January 2001”

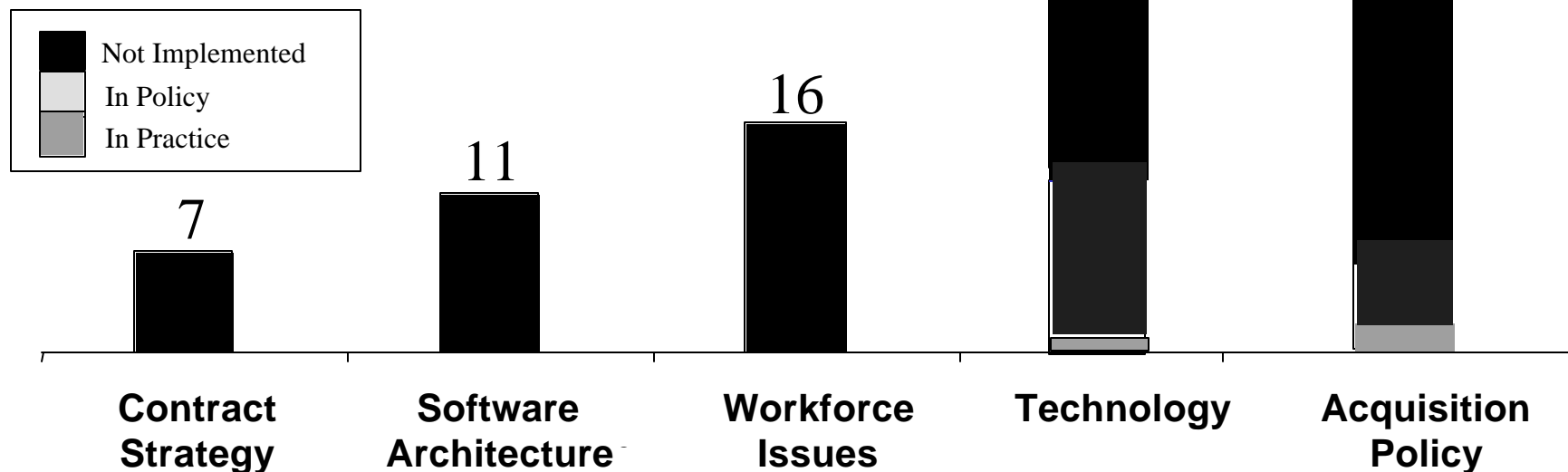
Previous DoD-Wide Software Task Forces *

- 1. Defense Science Board on Open Systems – October 1998**
- 2. Defense Science Board on Acquiring Defense Software Commercially – June 1994**
- 3. Adapting Software Development Policies to Modern Technology – July 1989**
- 4. Report of the Software Task Force – February 1989**
- 5. Research Agenda for Software Engineering – 1989**
- 6. Defense Science Board on Military Software – October 1987**

*** Many additional efforts by individual Services and Agencies**

Recommendations from Previous DoD-Wide Software Task Forces

1. Very good recommendations
2. Most still applicable today
 - except a few on Ada
3. Some Influence on DoD Policy Statements
4. Most have not been implemented



What's Different Now

The Internet Changes Everything

- Pace of tech change
- Access to information
- Influence of commercial processes, methods, tools, standards
- Personnel attraction and retention

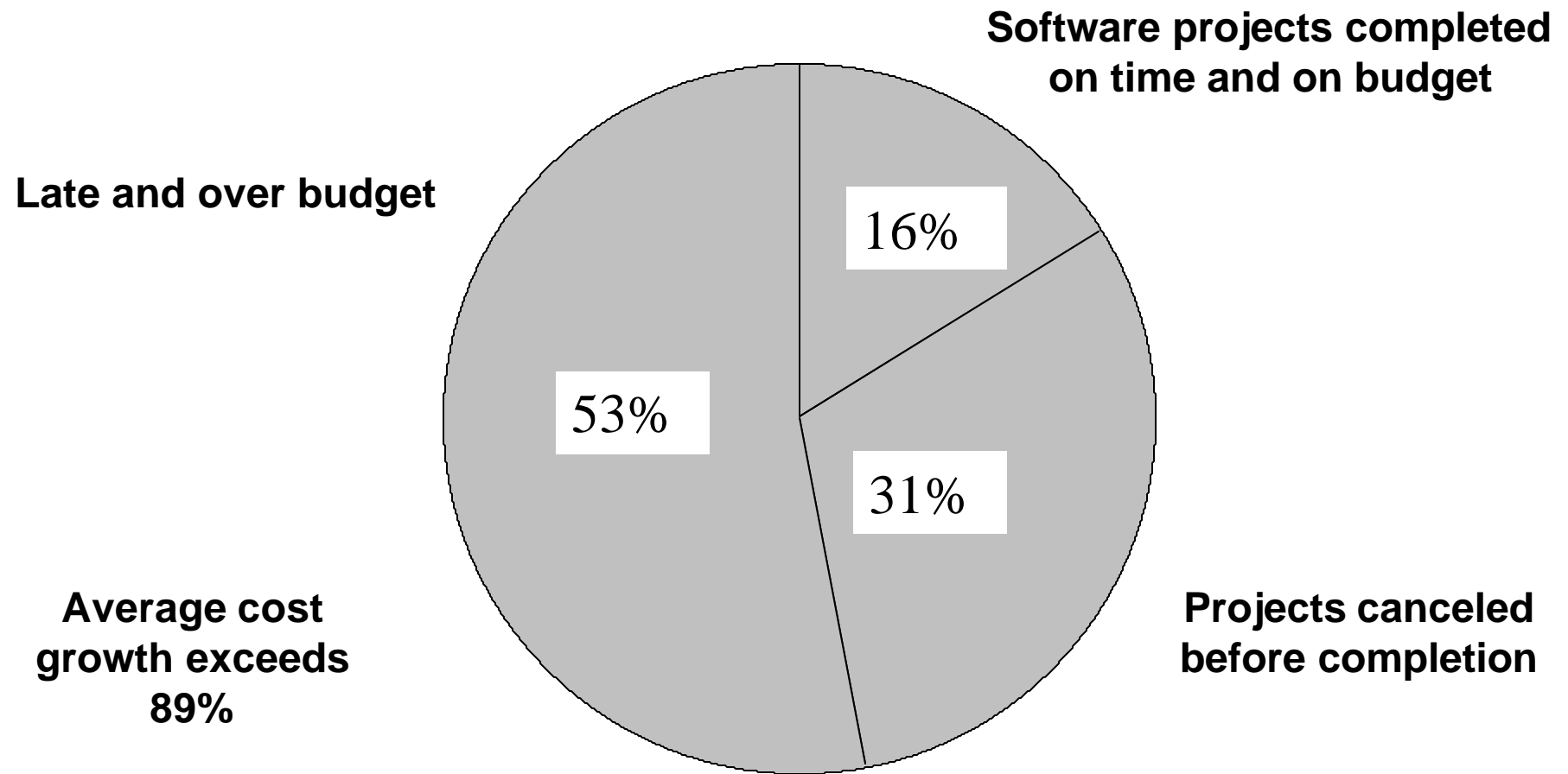
The Internet Changes Nothing

- Principles of software engineering
- Complexity of systems and software
- Software development performance
- Security issues and concerns

Enormous Opportunity

- Collaborative Engineering
- Retention and dissemination of Corporate Knowledge
- Business to business efficiencies

Commercial and Government IT Project Development

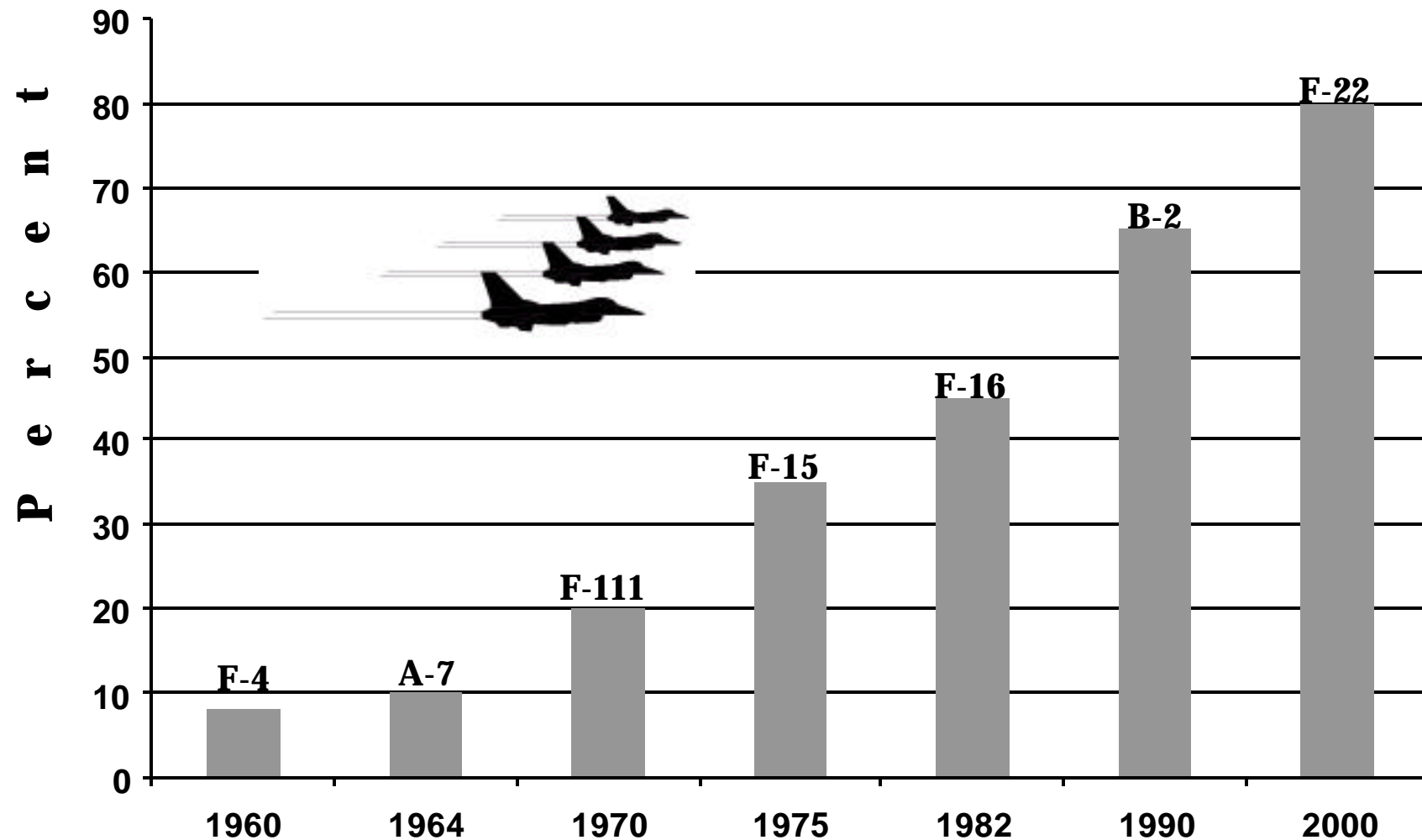


**Average cost
growth exceeds
89%**

**The average final product contains 61% of the
originally specified features**



Percent of Specification Requirements Involving Software



Ref: Lockheed-Martin Corp.

Recommendations

- ✓ 1. **Initiate independent expert reviews**
- 2. **Stress software past performance and process maturity**
- 3. **Develop serious training and education**
- ✓ 4. **Collect, disseminate and employ best practices**
- 5. **Restructure contract incentives**
- 6. **Strengthen the technology base**

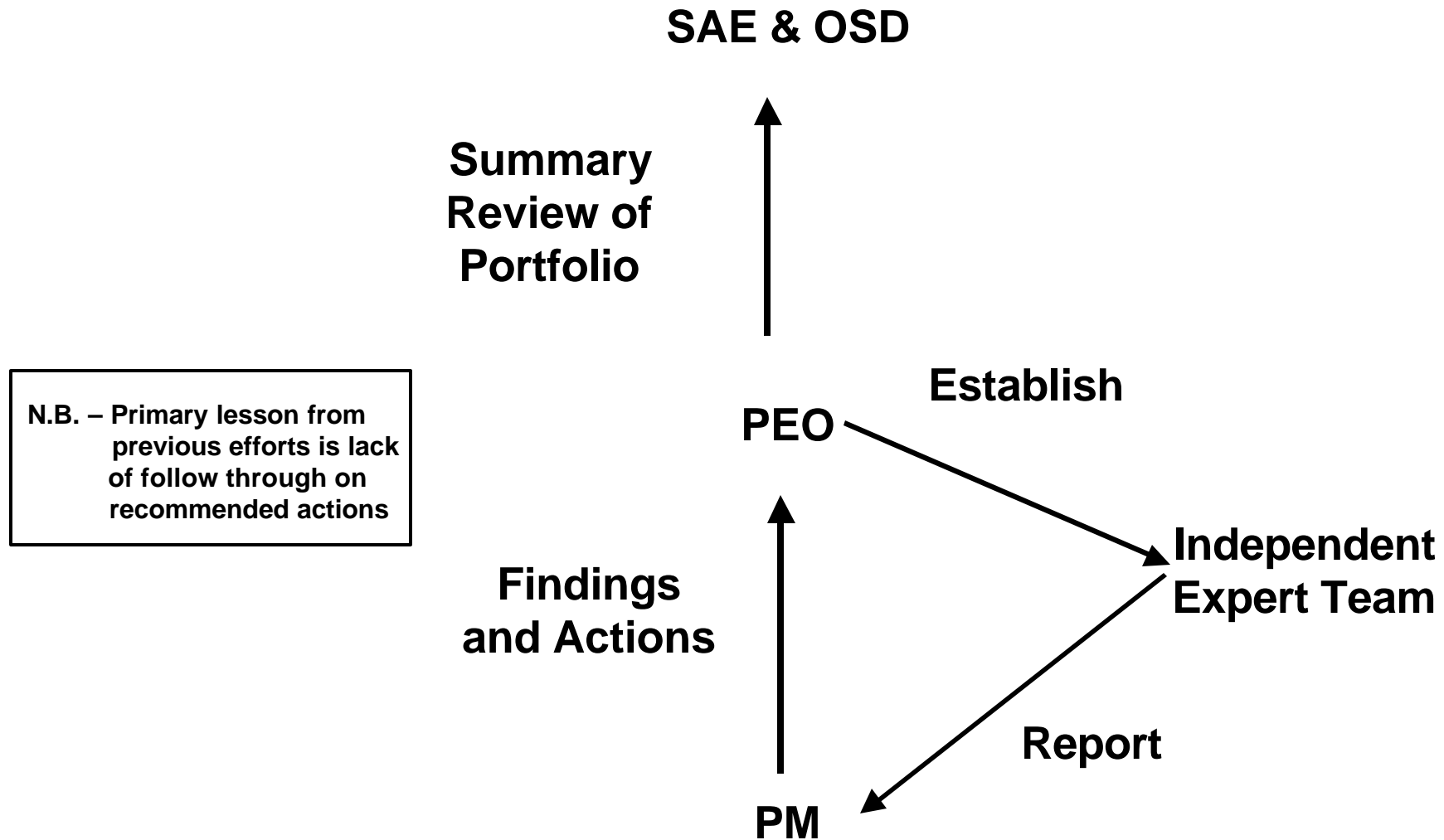
Finding 1

DoD programs with software difficulties exhibit fundamental problems that were readily identifiable . . . at least in hindsight

Recommendation 1

Institutionalize an independent expert review process of software on major development programs to provide expertise to the program manager not otherwise available

Established by PEO – Reporting to Program Manager



Review Team Composition

- **Small groups of experienced software professionals**
- **Independent of acquisition team and product development team**
- **Skilled in program management, software technology and software development**
- **External members can't be competitive with prime**
- **Can include members from government and prime contractor not involved in program**

Schedule

- **Initial review conducted prior to RFP release**
- **Subsequent reviews prior to major milestones (IBR, SDR, CDR, TRR) but at least every 6 months**
- **Review should be no longer than 1-2 days**

Items to be Considered

- **Requirements development and management; design process; system and software architecture; software practices and tools; risks and risk mitigation (Top 10); personnel and turnover; build planning; system demonstration**

Finding 2

Shortage of software skills throughout the industry make finding a qualified developer increasingly difficult

Recommendation 2

Strongly weight software past performance and development process maturity in source selection and widen the market place to find the best talent

Finding 3

Pilot training is 18 months, crypto-linguist training is 20 months, DoD program managers have a 2-week software course at DSMC (most “opt-out” of this) and one page in the program managers handbook as a guide for software development

Recommendation 3

Build a disciplined cadre of managers with technical skills and broad development perspective on software intensive systems

Finding 4

There are a number of successful examples of software development programs in both the commercial and defense areas

Recommendation 4

Best Practices should be collected, disseminated and implemented among all DoD development programs

Suggested Approach 4

- **DoD program managers must return to the basic principles of disciplined software development**
- **Should implement, starting with the Best Practices as defined by the AIRLIE Council of the Software Program Manager's Network**
- **Special emphasis should be placed on**
 - **Use of iterative development process**
 - **Development of executable architectures**
 - **Allowing program management to trade functionality for time and stability**
- **All major programs should be required to collect and report a set of core metrics as defined by DoD**

Initiate a DoD-wide annual award for the best software development program in the department

Best Practices – Modern Software Management

1. Base the process on an **architecture-first approach**
2. Establish an **iterative life-cycle process** confronting risk early
3. Transition design methods to emphasize **component-based development**
4. Establish a **change-management environment**
5. Enhance change freedom through tools that support **round-trip engineering**
6. Capture design artifacts in rigorous **model-based notation**
7. Instrument the process for **objective quality control** and progress assessment
8. Use a **demonstration-based approach** to assess intermediate artifacts
9. Plan releases in usage scenarios with **evolving levels of detail**
10. Establish a **configurable process** that is economically scalable

Best Practices – Core Metrics

1. Progress:

- Earned Value (Planned vs... Actual--CPI, SPI, TCPI)
- Milestone Slippage (Aggregate slippage against plan)
- Segment Completion against Plan

2. Staffing:

- Key Vacancies and Turnover rate

3. Requirements:

- Implementation coverage (Percent implemented in design and test)
- Volatility (Percent change over time)

4. Quality:

- Defects (open; closed; age profile)
- Testing (Planned vs. conducted vs. Passed)

5. Product Stability:

- Structured Peer Review Coverage (percent baseline products inspected)
- Rework (corrective effort on baseline product)

Finding 5

Developing complex software-based systems in very difficult work. Commercial organizations claim to have success using strong financial incentives.

Recommendation 5

The DoD should restructure and strengthen contract incentives for software development.

Finding 6

The commercial IT market is doing substantial commercial IT R&D. Much of this is short term and specific product focused. There are also areas that are priority defense areas that are not as important to commercial businesses.

Recommendation 6

Increase and ensure strong and stable support for a balanced DoD research program from 6.1 through 6.3 focusing on areas not well-covered commercially

Recommendations

- 1. Initiate independent expert reviews**
- 2. Stress software past performance and process maturity**
- 3. Develop serious training and education**
- 4. Collect, disseminate and employ best practices**
- 5. Restructure contract incentives**
- 6. Strengthen the technology base**

Defense Science Board Software Task Force

