A Strategy for Improved System Assurance

June 20, 2007

Kristen Baldwin
Deputy Director,
Software Engineering and System Assurance
Office of the Under Secretary of Defense
Acquisition, Technology and Logistics

System Assurance

- **We continue to be concerned with assurance of our critical DoD assets:**
  - Critical information
  - Critical technologies
  - Critical systems
- **Observations:**
  - Increasing numbers of network attacks (internal and external to DoD)
  - Broader attack space
- **Trends that exacerbate our concerns:**
  - Globalization of our contracts, expanding the number of international participants in our system developments
  - Complex contracting arrangements that further decrease transparency below prime, and visibility into individual components

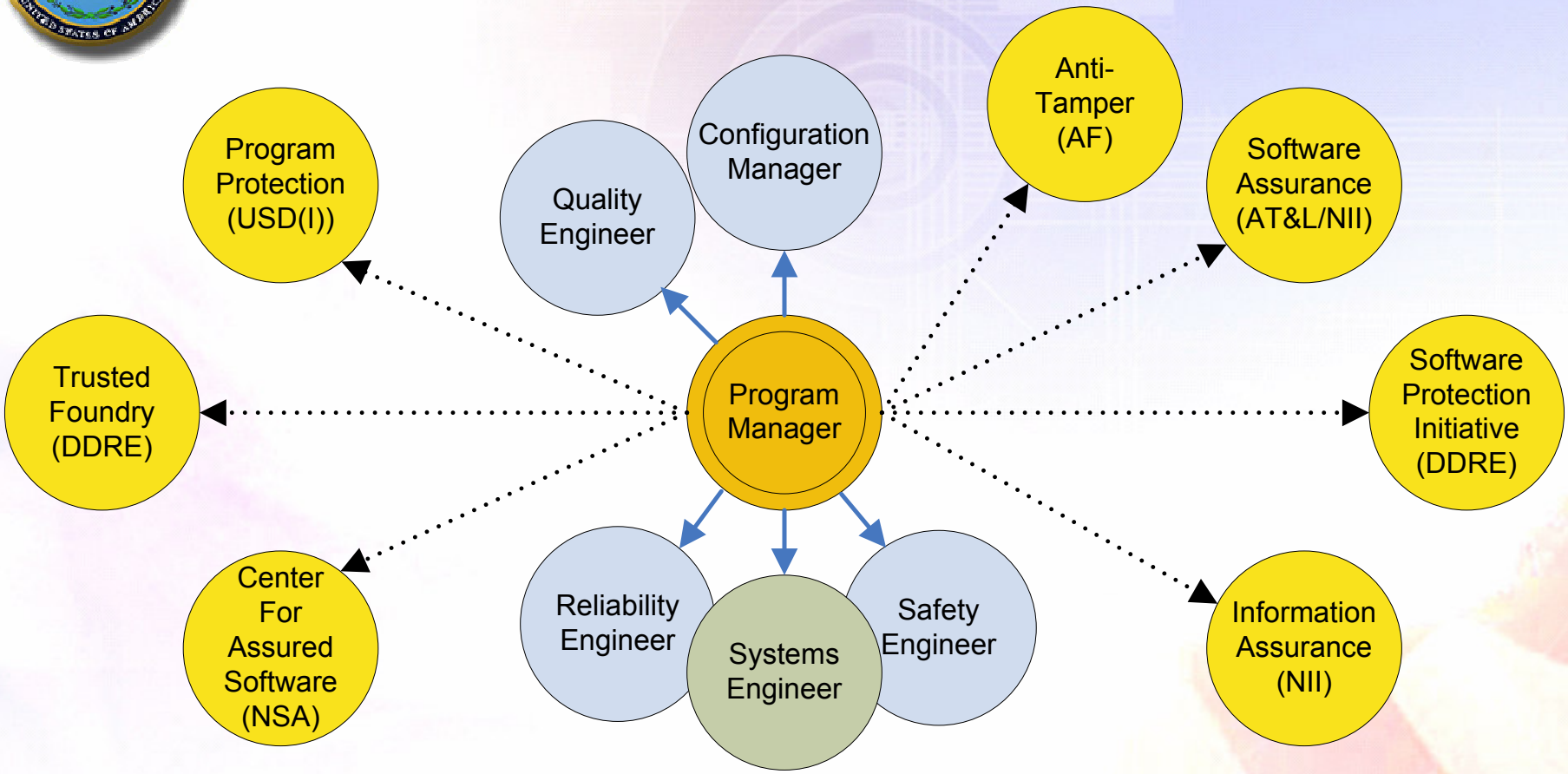
These trends increase the opportunity for access to our critical assets, and for tampering

Top Software Issues*

1. The impact of requirements upon software is not consistently quantified and managed in development or sustainment.
2. Fundamental system engineering decisions are made without full participation of software engineering.
3. Software life-cycle planning and management by acquirers and suppliers is ineffective.
4. The quantity and quality of software engineering expertise is insufficient to meet the demands of government and the defense industry.
5. Traditional software verification techniques are costly and ineffective for dealing with the scale and complexity of modern systems.
6. There is a failure to assure correct, predictable, safe, secure execution of complex software in distributed environments.
7. Inadequate attention is given to total lifecycle issues for COTS/NDI impacts on lifecycle cost and risk.

*NDIA Top Software Issues Workshop August 2006

System Assurance Context for the PM



System Assurance – Working Definition

Level of confidence that a system functions as intended, is free of exploitable vulnerabilities, and protects critical program information

Consequences of Fragmented Systems Assurance Initiatives

- Lack of Coherent Direction for PMs, and others acquiring systems
  - Numerous, uncoordinated initiatives
  - Multiple constraints for PMs, sometimes conflicting
  - Loss of time and money and lack of focus on applying the most appropriate engineering for systems assurance for each system
- Synergy of Policy – Multiple ownership
  - Failure to capitalize on common methods, instruction among initiatives
- DoD Risk Exposure
  - Lack of total life cycle view
  - Lack of a focal point to endorse system assurance, resolve issues, advocate PM attention
  - Lack of system-of-systems, architecture perspective on system assurance
  - Potential for gaps in systems assurance protection

Path Forward

- **Create a 'framework' to integrate multiple security disciplines and policies**
  - Leverage 5200.39: expand CPI definition to include system assurance and total life cycle
- **Use the Program Protection Plan (PPP) to identify CPI and address assurance for the program**
  - Link plans (e.g., Anti-Tamper, Software Protection, System Engineering, Assurance Case)
- **Modify Acquisition and System Engineering guidance to integrate system assurance across the lifecycle**
  - Milestone Decision Authority visibility
  - Guidebook on Engineering for Assurance for program managers/engineers

Raise the bar:	
Awareness	- Knowledge of the supply chain - Who has access to our critical assets
Protection	- Protect critical assets through security practices - Engineer our systems for assurance

Policy Roadmap for System Assurance

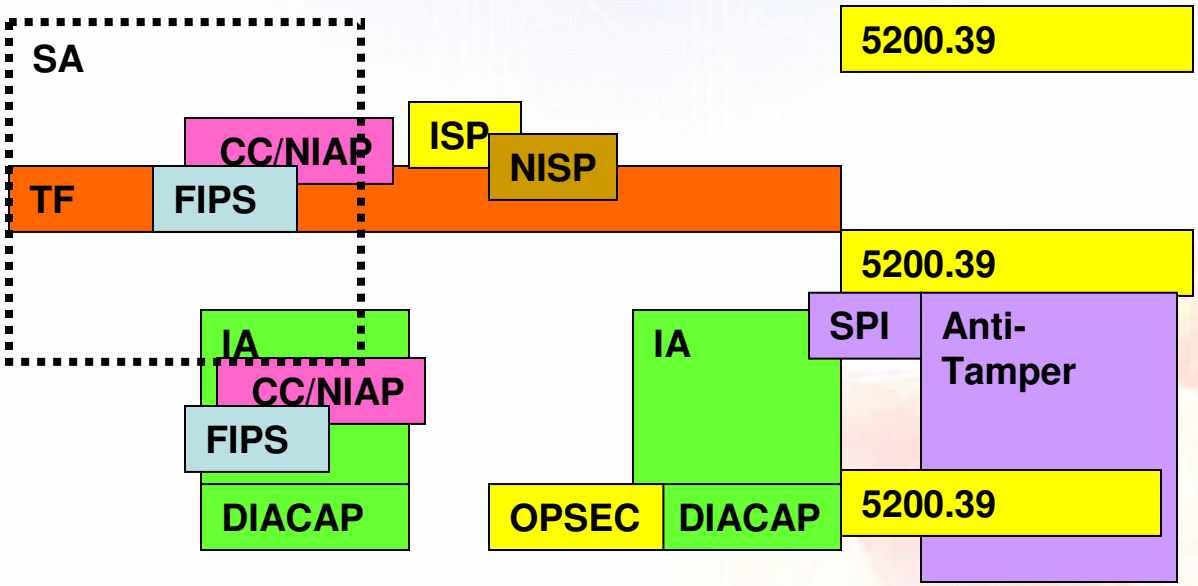
Current Systems Security Policies

Defense-In-Depth

- **Intelligence**
- **Supply Chain**
- **Engineering**
- **Certification**
- **Documented Plan**

Component Protection Sought

Critical Functionality		Critical Information		Critical Technology	
Non-Security	Security	Classified	Un-Classified	Software	Hardware/ Firmware



Policy Ownership	DoD - CIO/DSS	DoD – AT&L
DoD – AT&L/S&T	DoD - CIO/DISA	CC/NSA
DoD – NSA	DoD - USD(I)	NIST

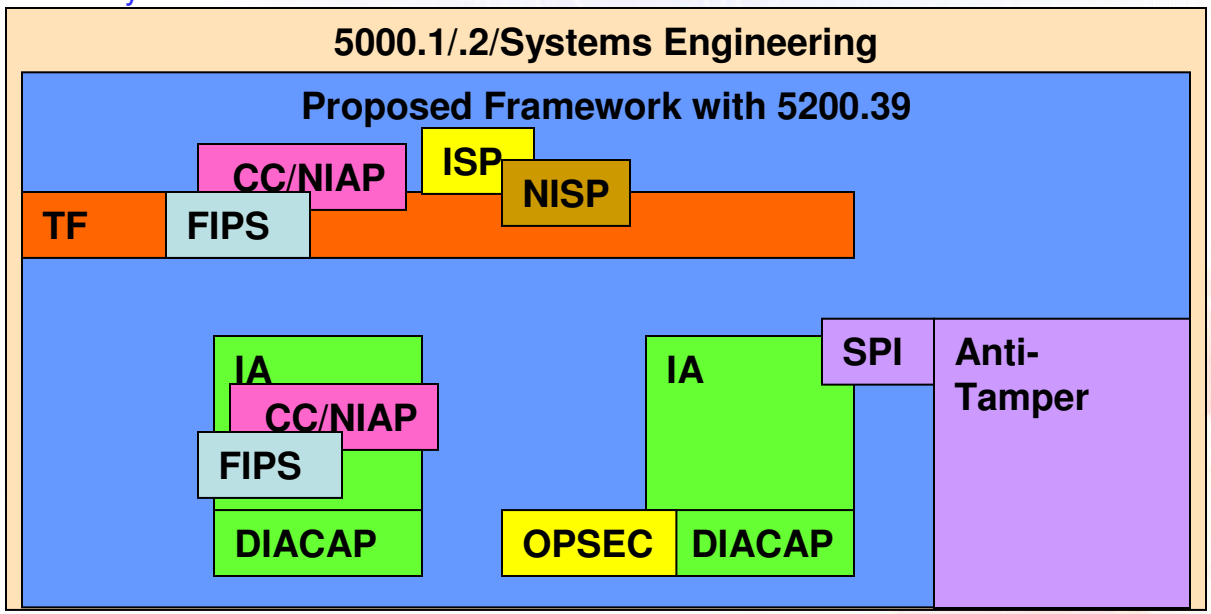
Proposed Framework for Security Policies

Defense-In-Depth

- **Intelligence**
- **Supply Chain**
- **Engineering**
- **Certification**
- **Documented Plan**

Component Protection Sought

Critical Functionality		Critical Information		Critical Technology	
Non-Security	Security	Classified	Un-Classified	Software	Hardware/ Firmware



Policy Ownership	DoD - CIO/DSS	DoD – AT&L
DoD – AT&L/S&T	DoD - CIO/DISA	CC/NSA
DoD – NSA	DoD - USD(I)	NIST

Critical Program Information

New Definition - Draft DoDI 5200.39:

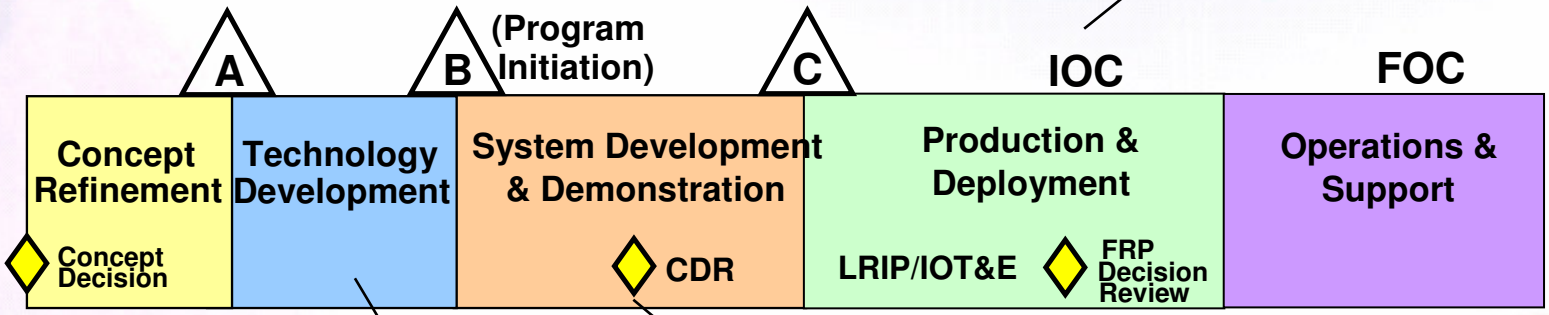
- E3.6. Critical Program Information (CPI). Elements or components of an RDA program that if compromised, could cause significant degradation in mission effectiveness, shorten the expected combat-effective life of the system, reduce technological overmatch, significantly alter program direction, or enable an adversary to counter, copy, or reverse engineer the technology or capability.
- E3.6.1. **Technologies** become eligible for CPI selection when a DoD Agency or military component invests resources to demonstrate an application for the technology in an operational setting, or in support of a transition agreement with a Program Manager.
- E3.6.2. Includes **information** about applications, capabilities, processes, and end-items.
- E3.6.3. Includes **elements or components** critical to a military system or network mission effectiveness.

Notional Assurance Implementation

- Identify CPI in PPP
- Identify threats
- Develop Plans (AT, SEP, TES)

- Approved SEP with details on Assurance
- Milestone Decision approves plans, sets SDD criteria

- Sustainment security plans in place
- Maintenance providers meet security practice
- Upgraded HW/SW configuration managed, validated and verified



- Source selection consideration of supplier FOCI and security practices
- Technology Readiness Assessment
- Sensitivity Analysis
- CPI enter Horizontal Protection Database

- Final AT Plan
- Designs meet assurance plans
- Initial verification and validation of critical components

Total Lifecycle Approach to Assured Systems

Guidebook on Engineering for System Assurance

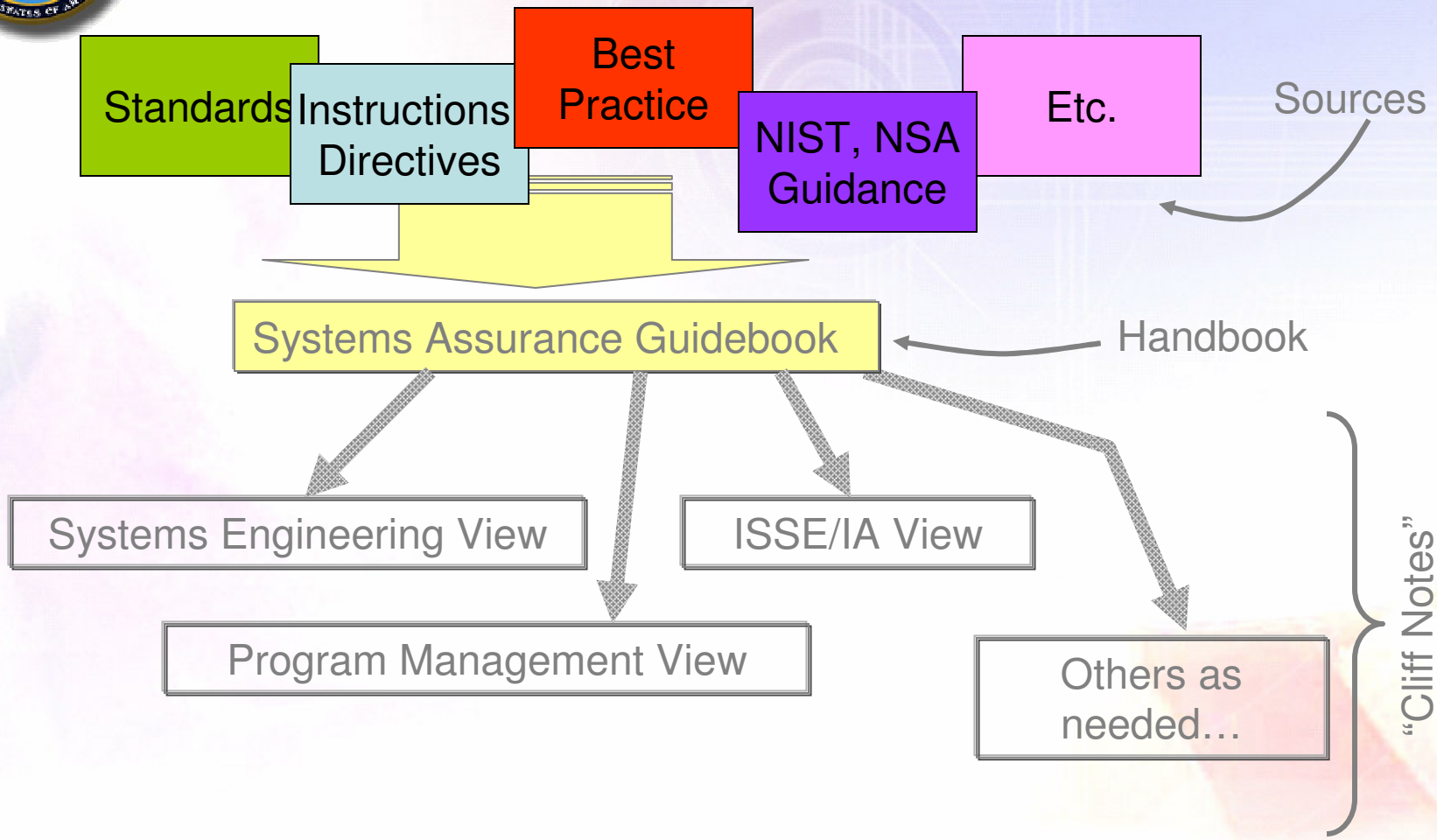
SA Guidebook Intent

- **Intent:**
  - Provide *practical guidance* on augmenting systems engineering practice for system assurance
  - Synthesize existing knowledge from organizations, standards and best practices
  - Recap concepts from standards
- **Implementation:**
  - Iterative releases with updates as new knowledge is gained and applied
  - Multiple Views for information dissemination
    - Technical Project Manager
    - System Engineer
    - Subject Matter Expert Detail

SA Guidebook – Engineering-in-Depth

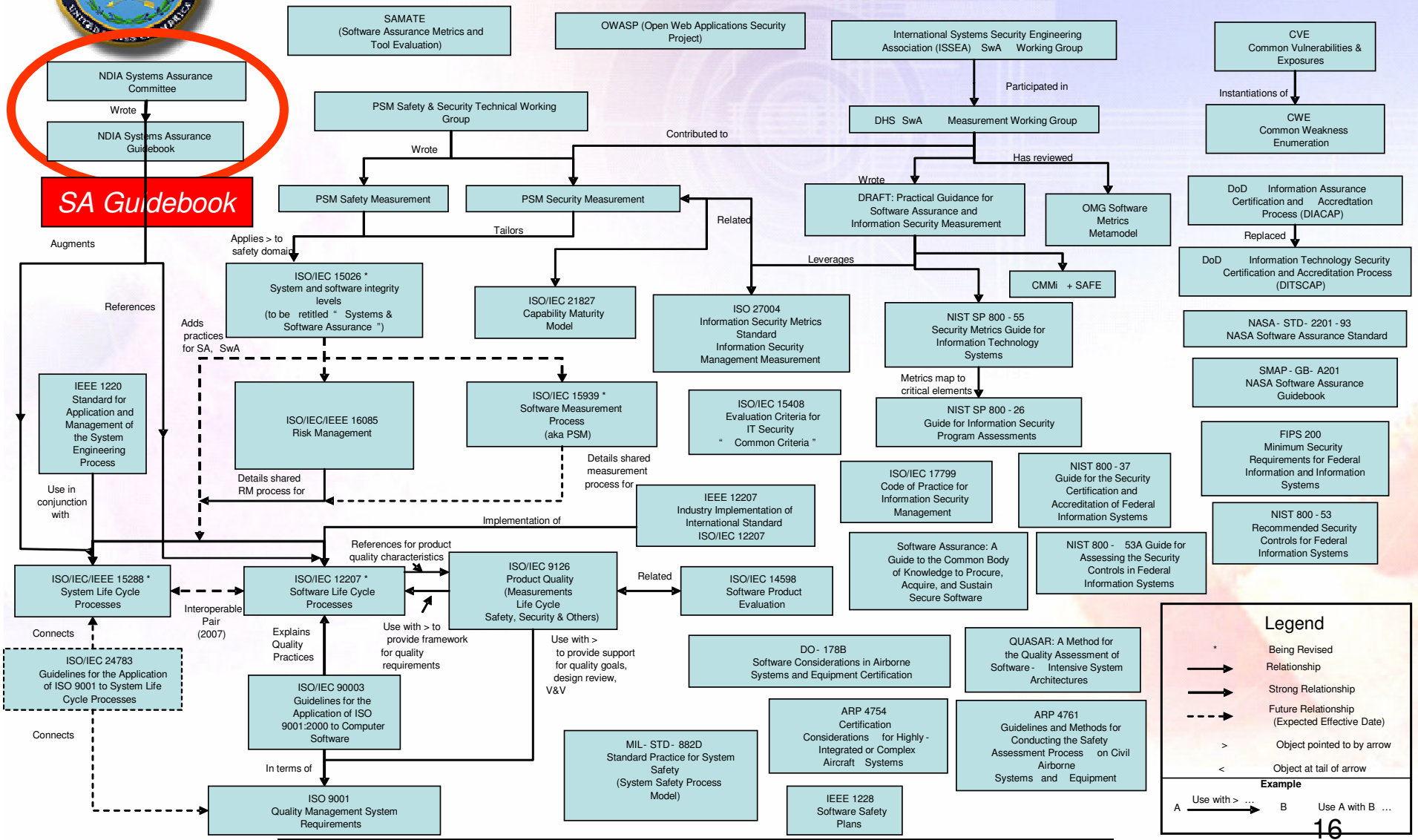
- **Augments SE from documentation through engineering processes and technical reviews**
  - Introduced as early as possible - Where there is the greatest impact
  - Continue through the life cycle
- **Consistent with international standard and current best practices**
  - E.g., Guidebook approach, presentation of process / procedure consistent with ISO/IEC 15288 standard for System Engineering
  - Integrates consideration and leverages numerous existing program protection or security disciplines (e.g., IA, AT, SwA, SPI, PPP)
  - Existing information security / assurance material is summarized, and leveraged by reference, not repeated
    - Test & Evaluation; Center for Assured Software (CAS)
    - Enhanced vulnerability detection techniques
    - SwA Body of Knowledge
- **Intent is to yield assured program / system with demonstrable evidence of assurance**

Guidebook Strategy



Future: Link to Acquisition Guidance, Evolve/Implement into training, education

Why this is hard…



Related Standards, Efforts, and Working Groups…

Contributors

- NDIA
- INCOSE
- MITRE
- IDA
- SEI
- OSD, Joint Staff, Services
- Contractor community
- Academe

Milestones & Plan

- **Complete the Guidebook**
  - Increment versions through Summer, 2007
  - Focus: “Get the content right”…worry format and organization later
- **Stakeholder Review**
  - From the larger community, different perspectives
- **Pilots**
  - Systems Assurance innovators and areas where comprehensive expertise in one or more relevant domains exists
  - Starting Summer, 2007
- **Write SE, PM, ISSE/IA Views**
  - Focus: Derived from the Guidebook, “get the right content” (by audience)
- **Release version 0.9 by 30 September**

Contact us to participate in stakeholder review

Community Site

http://www.ndia.org/Content/ContentGroups/Divisions1/Systems_Engineering/Systems_Assurance_Committee.htm

http://tinyurl.com/222hvq

Committee Links

Past meetings

Systems Assurance Guidebook Project

Guidebook Authors Guide

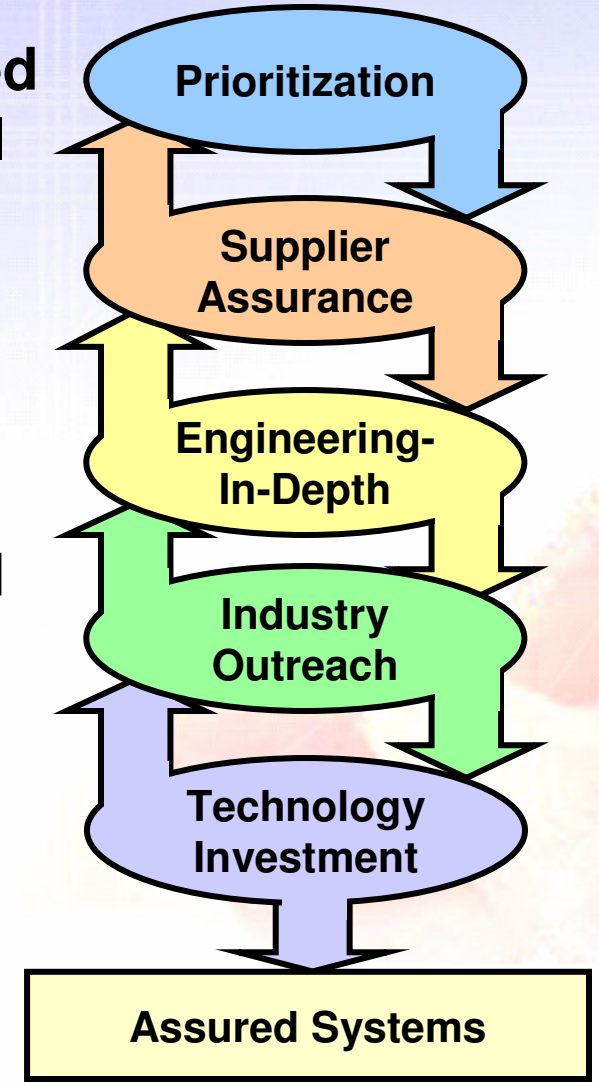
Guidebook Assignments

Guidebook Status

Systems Assurance White Paper Project

System Assurance: What does success look like?

- The requirement for assurance is allocated among the right systems and their critical components
- DoD understands its supply chain risks
- DoD systems are designed and sustained at a known level of assurance
- Commercial sector shares ownership and builds assured products
- Technology investment transforms the ability to detect and mitigate system vulnerabilities



Backups

Fragmented Systems Security Policies

Each policy:

- **Affects different parts of the life cycle**
  - R&D, acquisition, foreign ownership
- **Applies to a different subset of DoD systems**
  - NSS, IT, MDA, ACAT 1C, etc.
- **Assures different 'type' of components**
  - information, leading technology, functionality
- **Mandates a different set of defense tactics**
  - intelligence, engineering, documented plan, certification & accreditation

- **CC – Common Criteria**
- **DIACAP – DoD Certification & Accreditation**
- **FIPS – Federal Information Processing Standards**
- **ITAR – International Traffic in Arms Regulation**
- **IA – Information Assurance**
- **ISP – Information Security Program**
- **NIAP - National Information Assurance Partnership**
- **NISP – National Industrial Security Program**
- **OPSEC – Operational Security**
- **5200.39 – DODD 5200.39 Security, Intelligence, and Counterintelligence Support to Acquisition Program Protection**
- **SA – System Assurance**
- **SPI – Software Protection Initiative**
- **TF - Trusted Foundry**

Current approach does not have systems-of-systems perspective