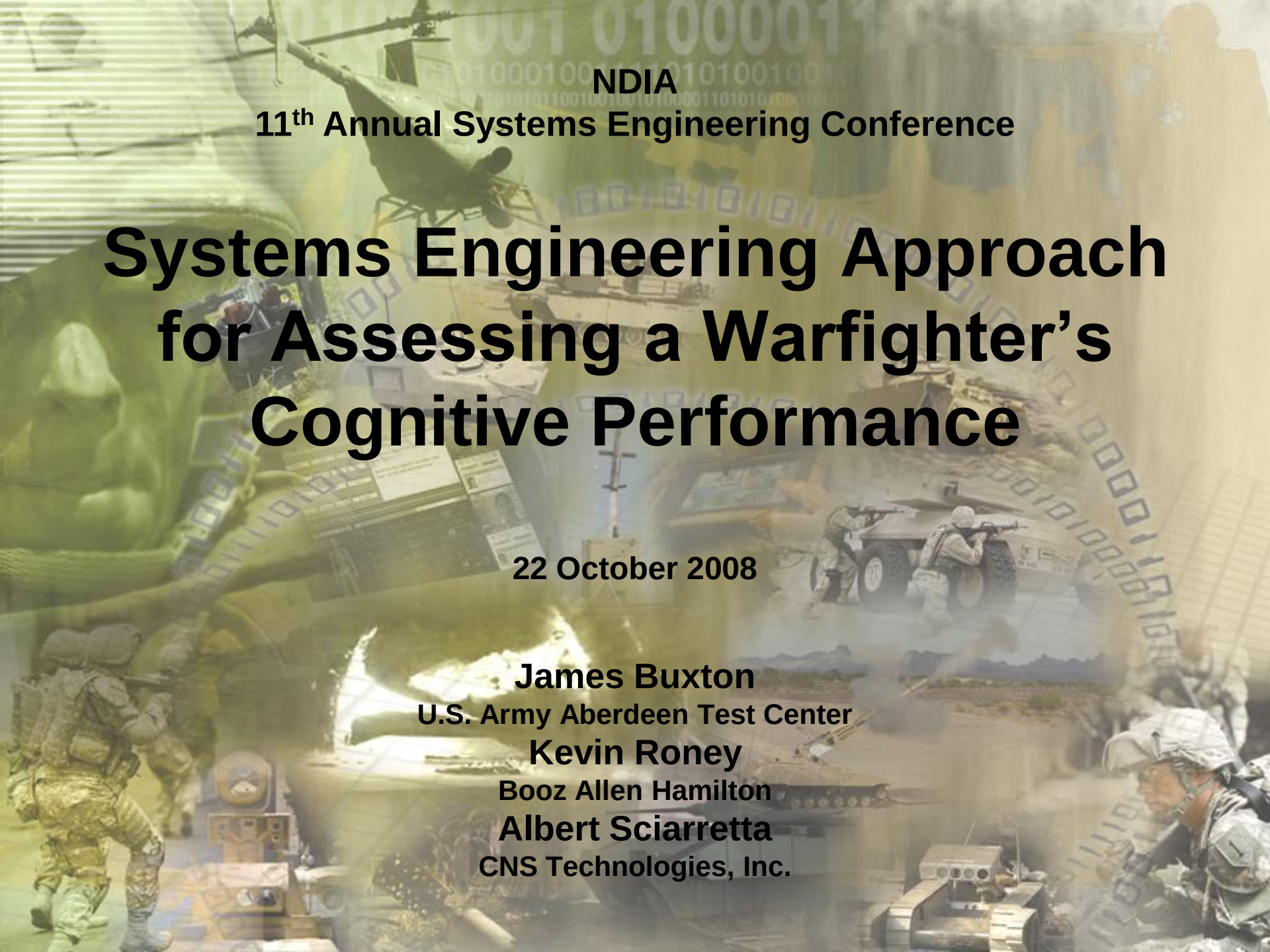

NDIA
11th Annual Systems Engineering Conference

Systems Engineering Approach for Assessing a Warfighter's Cognitive Performance

22 October 2008

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The Situation

- Historically for warfighting systems….

  System and SoS performance = f {warfighter performance}

- Future for warfighting systems….

  Complexity ↑ Dependence on Netcentric Environment ↑ Dependence on & Criticality of Warfighter Performance ↑

- Future Warfighter's performance = f {situational awareness (SA)}

- Future Warfighter's SA will be highly dependent on:

  – Sensor Input
  – Information from Other Humans
  – Information Systems Output
  – Education and Training
  – Combat Experience
  – Cognitive Capabilities
  – Others…..

The Problem

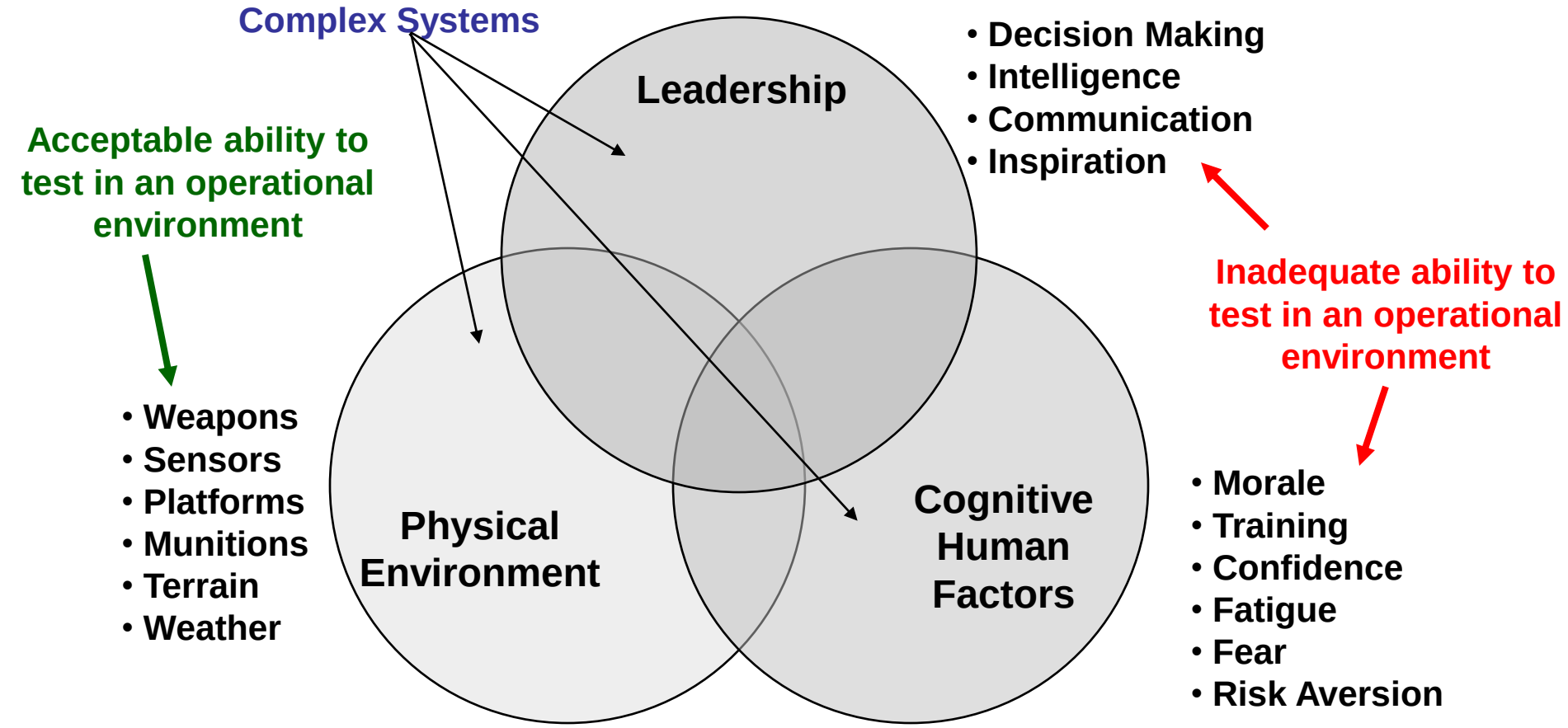
- DOD lacks capability to measure human performance
  - In an objective, quantifiable manner
  - In an operational environment – near real time
  - With statistical quality

- Significant shortcomings in measuring a warfighter's cognitive SA.
  - Much progress in measuring technical SA
    - Tracking information displayed on screens or available in a network
  - Limited success in measuring cognitive SA
    - In a laboratory environment

- **Limited technical means** for collecting **objective data** in support of **assessing cognitive SA** in an **operational environment**

As the complexity of systems and level of information flow increases, this assessment deficiency grows proportionately larger

The Problem
(Continued)



Limited ability to test all aspects of a Warfighter's combat environment

The Program

Joint Warfighter Test and Training Capability (JWTTC)

- A major US Army major instrumentation program
- Focused on measuring
  - Cognitive human performance
  - Cognitive SA
  - Physiological status
  - In an operational environment
- Will address test and evaluation (T&E) shortfalls in terms of
  - Instrumentation
  - Measurement and analysis of Warfighter performance
  - Impact of physiological and neurological stress
  - The collection and analysis of Warfighter performance data in terms of
    - SA of an individual
    - Shared SA (SSA) of teams, crews, or combined teams and crews
    - The total system performance of a single manned system or a combination of Warfighters, manned systems, and unmanned systems.

Systems Engineering (SE)

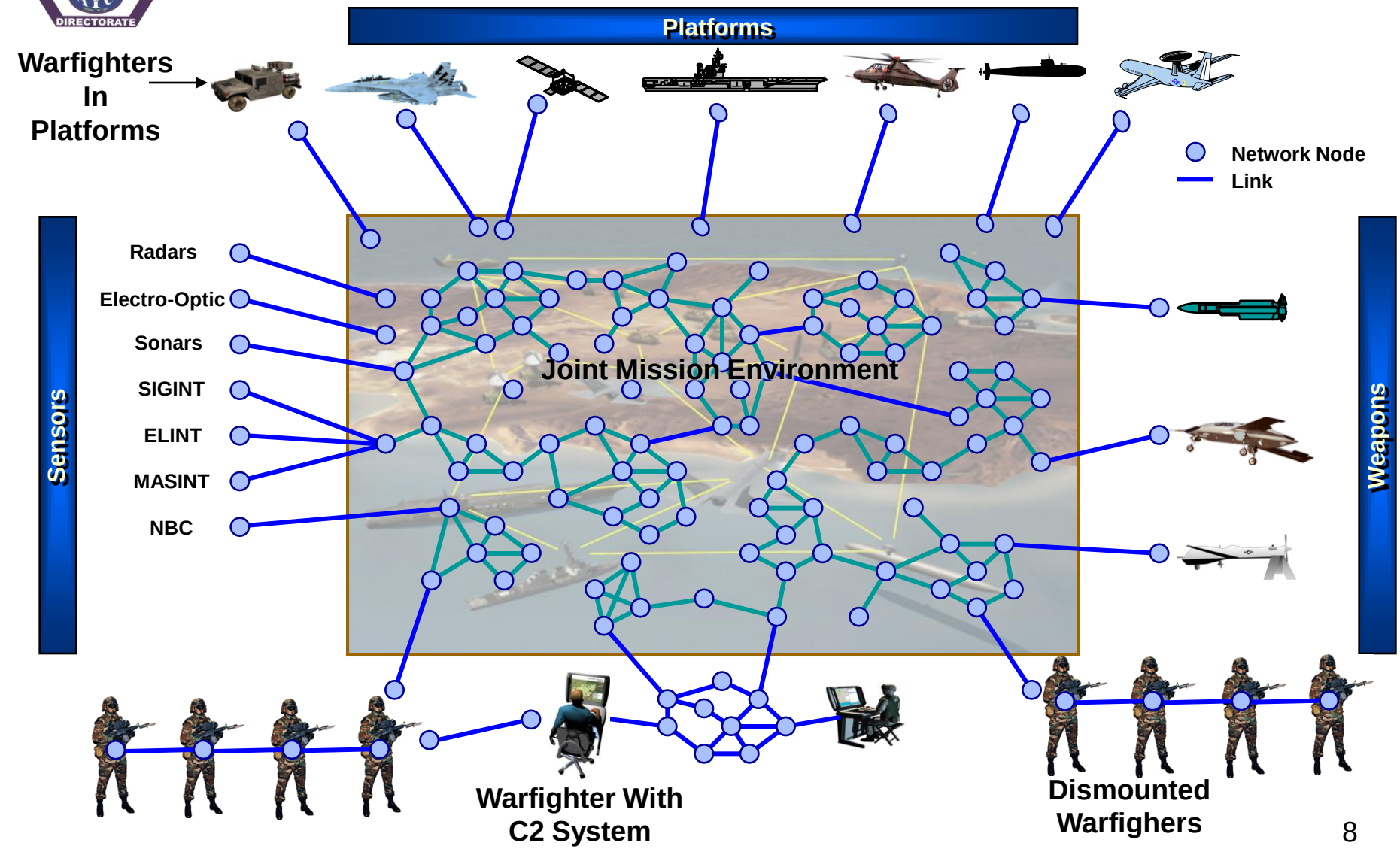
Need for JWTTC

- DOD 5000.2 requires systems engineering in a program's acquisition life cycle
- The SE describes the overall technical approach to development of an effective JWTTC product that is sustainable at an affordable cost
- Identifies how the program is structured and conducted to effectively achieve program goals and objectives
- It an instance of the technical baseline defining the architecture and design components
  - Decomposes the capabilities into logical and physical components
  - Includes technical performance measures
- Provides the road map for acquiring and integrating technologies to address the JWTTC capabilities
  - Includes a comprehensive program schedule outlining component acquisition activities, integration, test, and delivery
- A tool in managing the technical development of JWTTC System

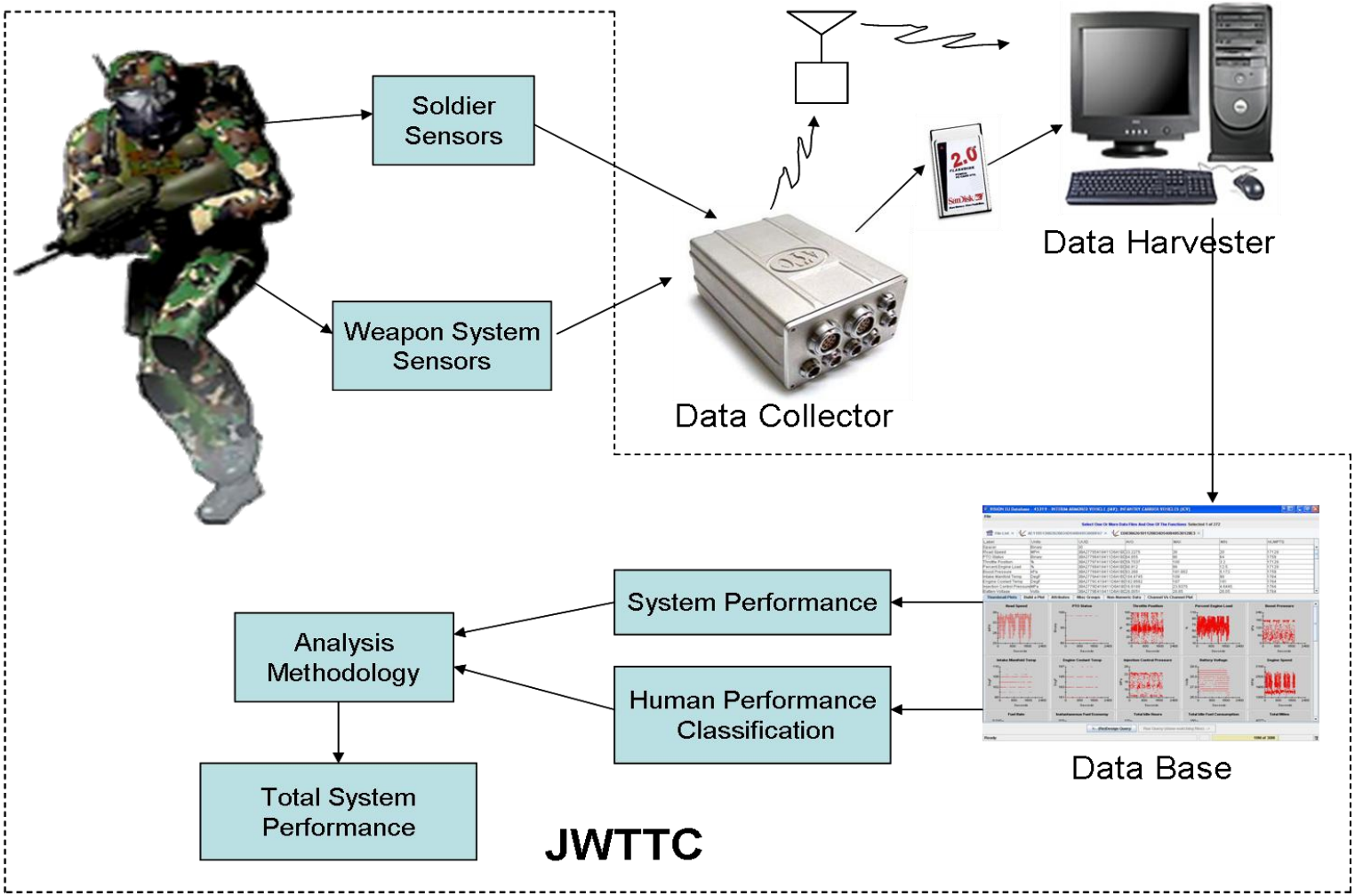
Engineering Approach for JWTTC

- Consideration in developing the JWTTC program
  - Warfighter is a system in JWTTC
  - JWTTC is a system-of-systems
- Use proven SE approaches to evaluate the systems

Warfighter as a Node in an SoS Environment



The JWTTC SoS

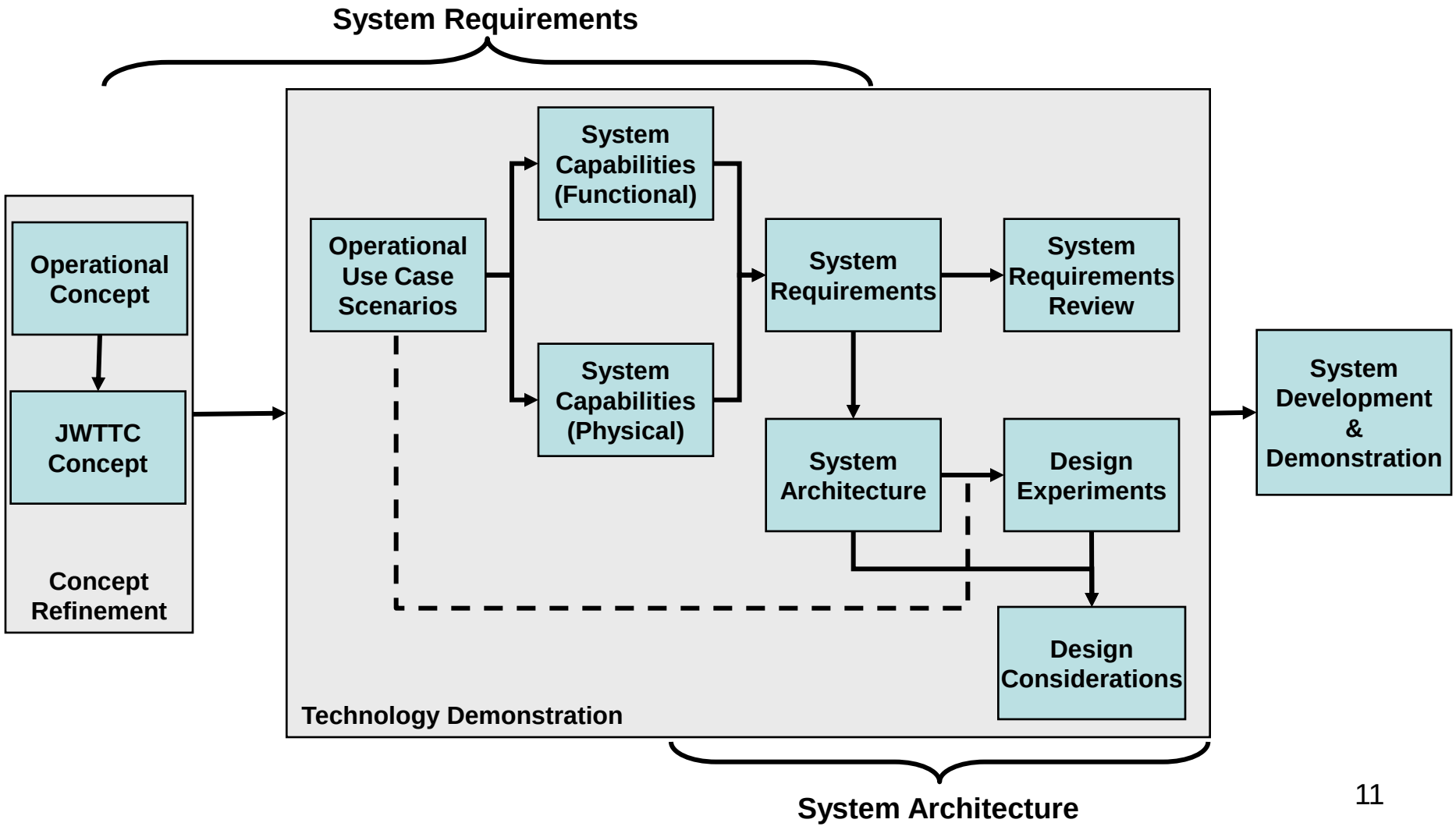


Use Proven SE Approaches

- Support the development of JWTTC
  - Use a systems approach to develop the program
  - Conduct a systems engineering analysis effort
    - To identify system requirements
      - Through Use Cases
      - Through decomposition of evaluation metrics
    - To develop a system architecture
  - Develop a Systems Engineering Plan (SEP)
  - Implementing the SE process
  - Integrate SE effort with the overall program management control efforts

The SE Effort

Systems Approach for Developing JWTTC



The SE Effort

Identifying System Requirements (Approach #1)

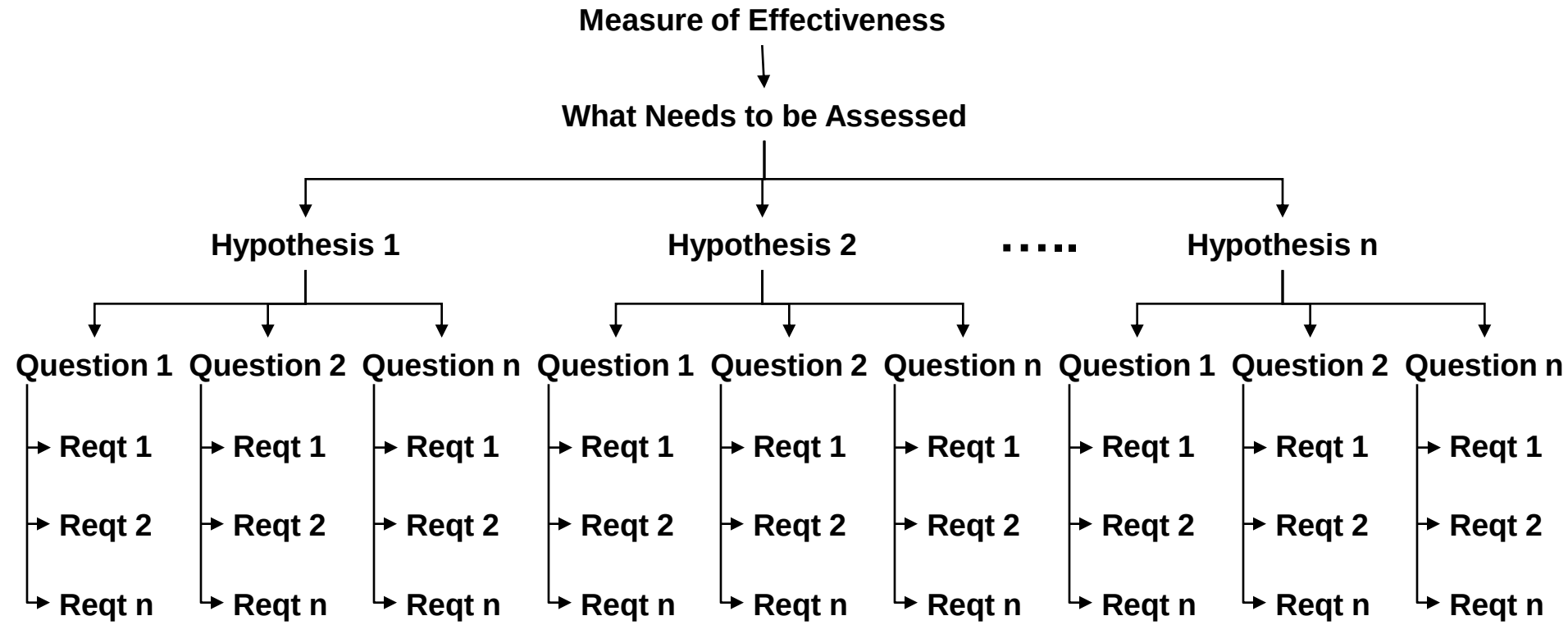
- Develop Use Cases
  - Narrative descriptions of a sequence of activities a T&E effort would undertake
  - Use cases do not identify capability needs, but rather imply them in the story it tells
  - An analyst then identifies capability needs
- Derive requirements from the capability needs

- Top Level
  - Actors
    - IT Systems
    - Warfigther
    - Test Control
    - Test Environment
  - Cases
    - Pre test
    - Test
    - Post test data collection (e.g., AAR)
    - Data Transfer
    - Post Test Analysis
    - Failure Warning

The SE Effort

Identifying System Requirements (Approach #2)

- Decompose evaluation metrics (e.g., measures of effectiveness)



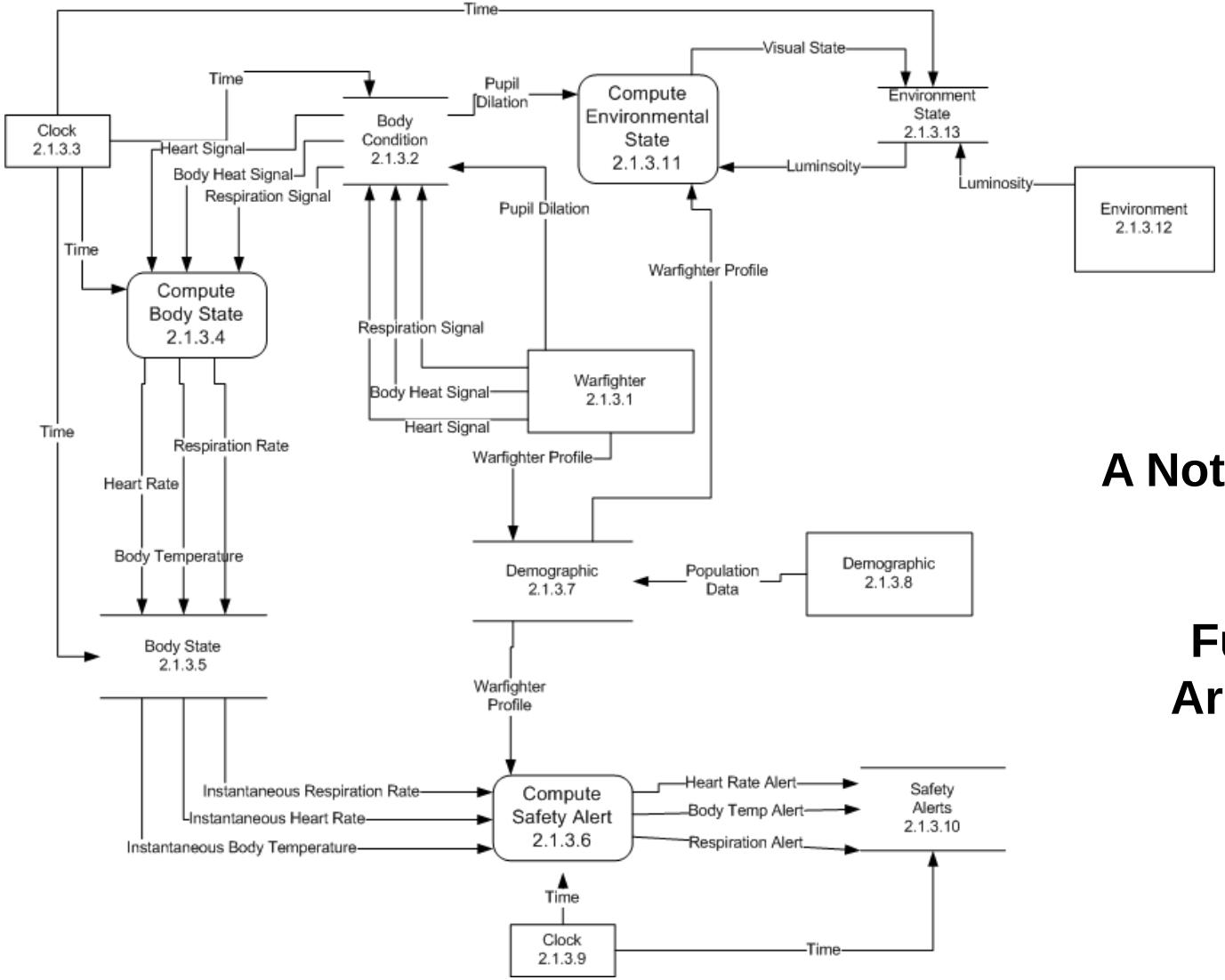
The SE Effort

Defining the System Architecture

- Once requirements are identified, design an architecture that satisfies the requirements
- Conduct experiments of the architecture design using functioning systems, prototypes, and surrogates
- Adjust the architecture as needed
- Identify areas of risk and potential mitigation efforts

The SE Effort

Defining the Functional Architecture



A Notional Design Of A JWTTC Functional Architecture

The SE Effort

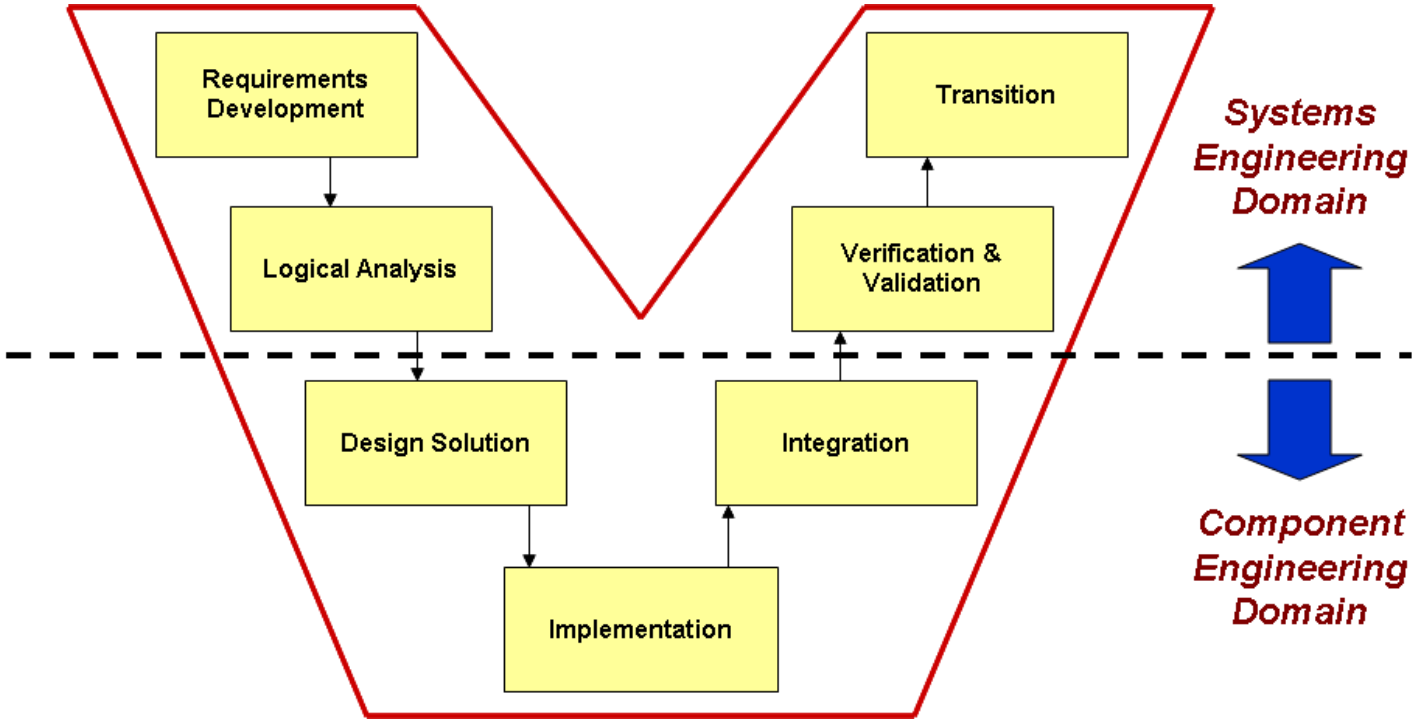
System Engineering Plan (SEP)

- The JWTTC SE methodology is tailored from the ISO/ECI 15228 four systems engineering process groups (Technical, Project, Enterprise, Agreement)
- The tailored JWTTC SE methodology includes
  - Technical processes
    - Requirements development, logical analysis, design solution, implementation, and integration
  - Parts of the project processes
    - Decision making
    - Risk, configuration, and information management
  - Enterprise environment management process groups

The SE Effort

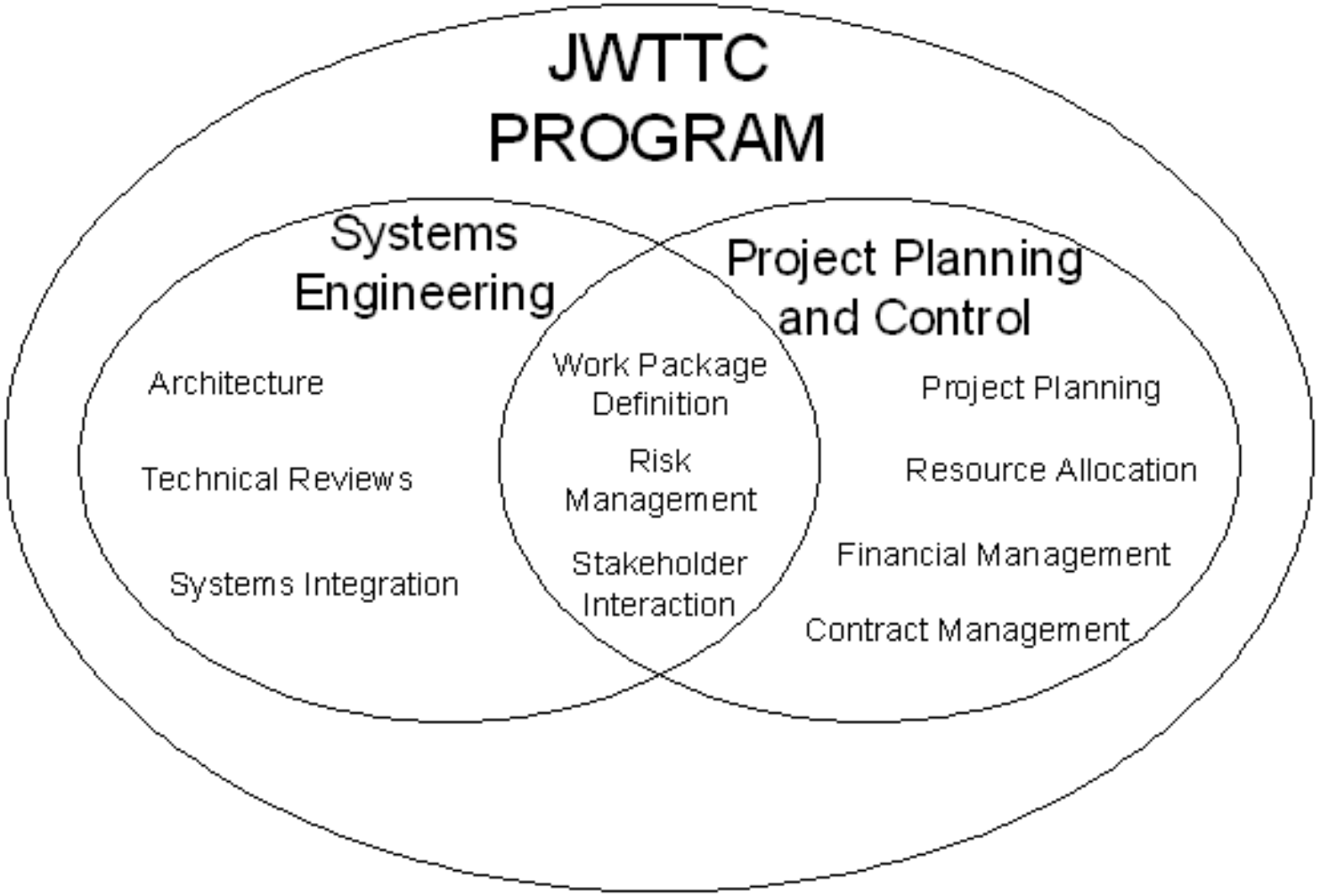
Implementing SE Processes

- As described in the SEP, the plan is to implement JWTTC SE processes using the Vee systems engineering method



The SE Effort

Integrate SE Effort with Overall Program Management Control Efforts



In Closing….

- Much of the JWTTC Systems Engineering effort is being refined
- The approach so far has been beneficial in enhancing the JWTTC program
- The effort should prove to be an effective method for reducing JWTTC program life cycle risks due to
  - Complexity of the technology
  - Unforeseen changes