Tri-Service Assessment Initiative Phase 2 Systemic Analysis Results

Conference on the Acquisition of Software Intensive Systems
January 28, 2003

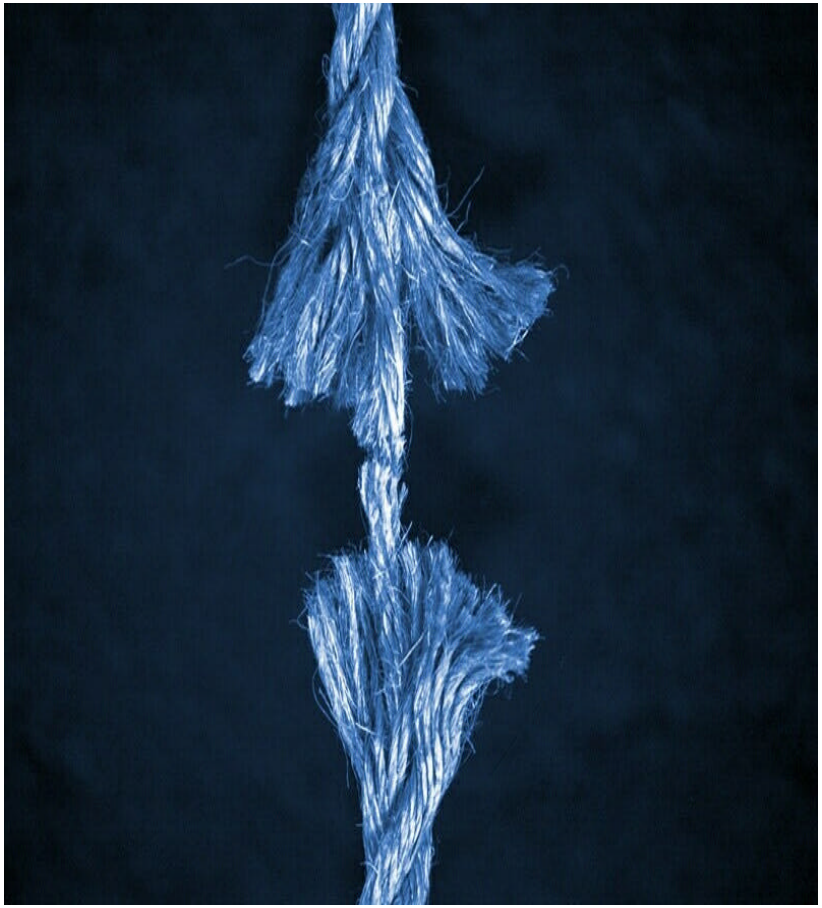
Dr. Robert Charette, ITABHI Corporation
John J. McGarry, TACOM-ARDEC
Kristen Baldwin, OUSD(AT&L) SIS

Presentation Objectives

- ***Convey what we have learned through a systemic "Cross Program" analysis of multiple DoD software intensive programs***
- ***Describe and quantify the recurring issues that impact DoD software intensive program performance***
- ***Characterize the identified DoD program performance issues in terms of cause and effect***
- ***Initiate discussion on potential corrective action strategies***

Phase 2 Overarching Conclusion

The analysis predicts an increasing gap between what is expected and what is capable of being achieved



Summary Findings

- ***Software intensive system development issues are still pervasive across DoD programs***

- ***New emerging issues reflect complex, risk-prone acquisition trends. These include:***
  - ***interoperability / family of systems***
  - ***co-dependent systems development***
  - ***"mission resilient", evolutionary system development***
  - ***direct funding - Congressional plus-ups***
  - ***expanded contractor acquisition and program management responsibilities***
  - ***acquisition policy easements***

What You Need to Know

- ***The causes of program performance shortfalls are extremely complex - improvement strategies and associated action plans must address this complexity***
- ***As an Enterprise we need to start by re-addressing the performance issues we thought we were already fixing***
- ***The longer we wait - the higher the risk***

Tri Service Assessment Initiative

Tri-Service Assessment Activities

Individual Program Assessments

- Independent Expert Program Reviews
- Single Program Focus
- Objective - Improve Program Performance
- Program Team Insight

Systemic Analysis

- Cross-Program Analysis
- Enterprise Focus
- Objective - Identify and Characterize Recurring Performance Issues
- General and Directed Analyses
- Enterprise Manager Insight

Both Activities are Based on an Integrated Assessment Architecture

Systemic Analysis Phases

Phase 1 - Complete July 2001

- Top down analysis approach
- Initial models - proof of concepts
- Assessment architecture integration
- Initial data set - 10 assessments

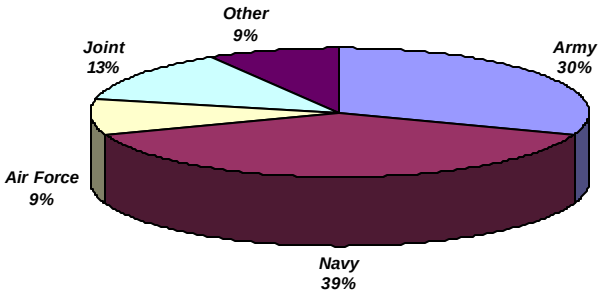
Phase 2 - Complete December 2002

- Bottom up analysis approach
- Based on quantification of recurring issues and sequences
- Information driven analysis objectives
- Systemic database
- Extended data set - 23 assessments

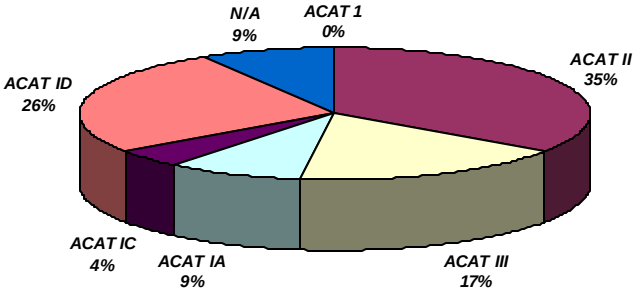
Phase 3 - Began January 2003

- Predictive issue pattern analysis
- Quantification of projected issue impacts
- Architecture and analysis process improvements
- Comprehensive transition program

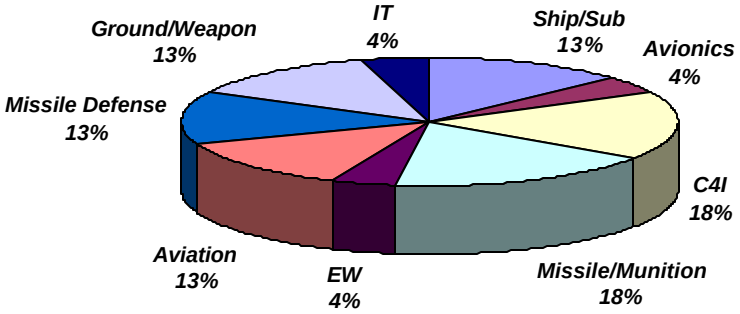
Assessment Distribution



Distribution of Assessments by Service



Distribution of Assessments by ACAT Level



Distribution of Assessments by Domain

Systemic Analysis Process

Program Assessment Results

Analyze Assessment Findings

- Systemic Peer Review
- Assessment Characterization
- Issue Identification
- Risk Typology Allocations
- Initial Cause and Effect Model

Basic Analysis

- Issue Frequency of Occurrence Analysis - Data Normalization
- Enterprise - Program Issue Responsibility Allocations
- Definition of Information Needs
- Issue Concurrency Analysis
- Issue Sequence Identification and Analysis - Interaction
- Issue Characterization - Triggers / Symptoms

Directed Analysis

- Executive Data Call
- Basic Analysis Review
- Definition - Prioritization of Information Needs
- Individual Case Analysis

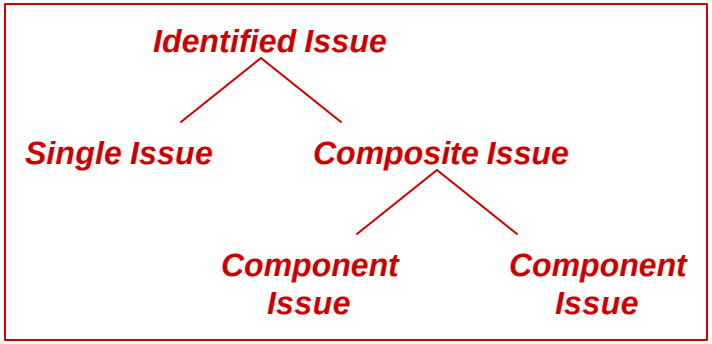
Integrated Analysis

- Issue Correlation
- Risk Analysis
- External Correlations
- Systemic Analysis Model
- Executive Level Conclusions / Summary

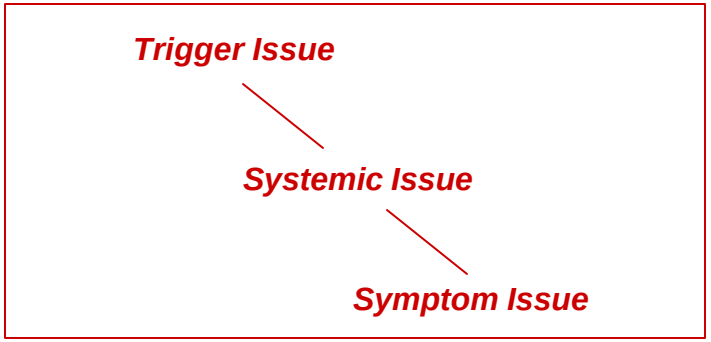
Action Plan

What Was Counted

- Identified Issues
  - single issues
  - composite issues
  - component issues
- Systemic Sequences
- Systemic Patterns
- Triggers and Symptoms



Issue Structure



Systemic Issue Pattern

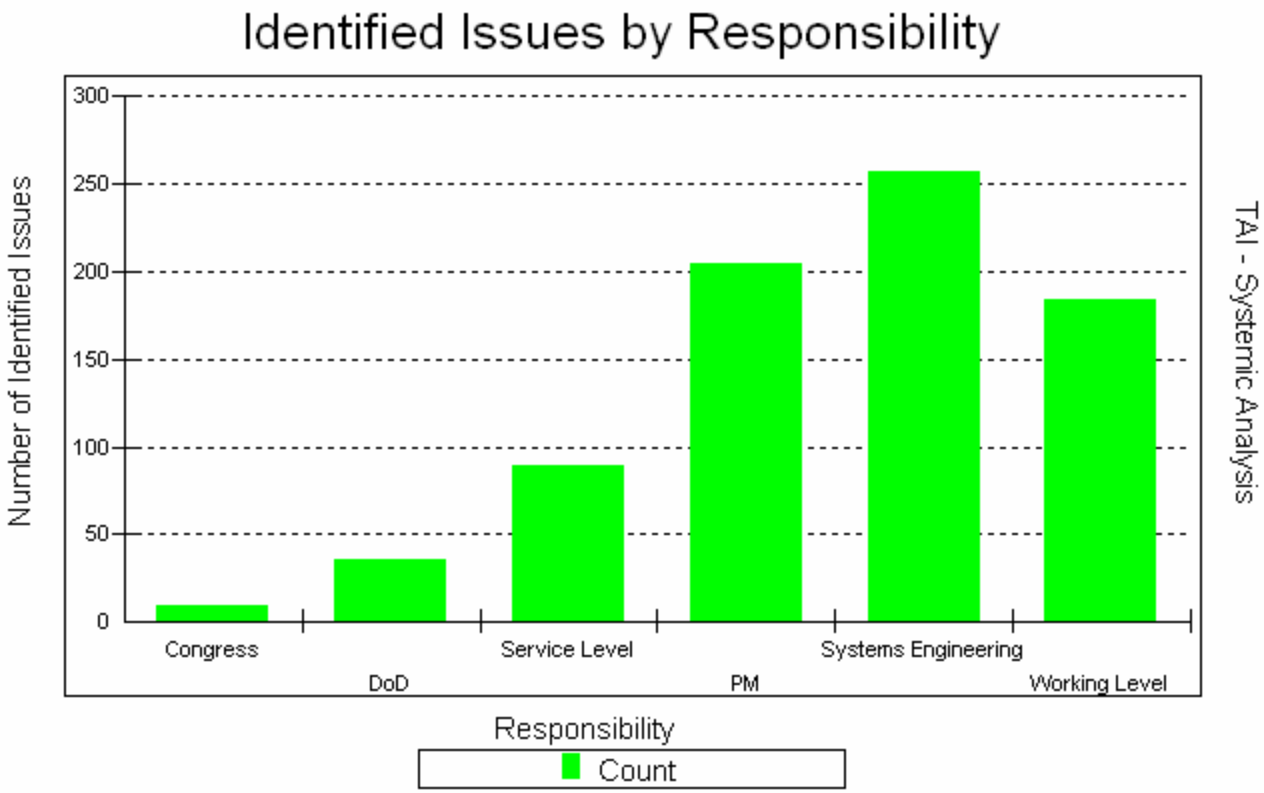
Basic Analysis

Critical program performance problems

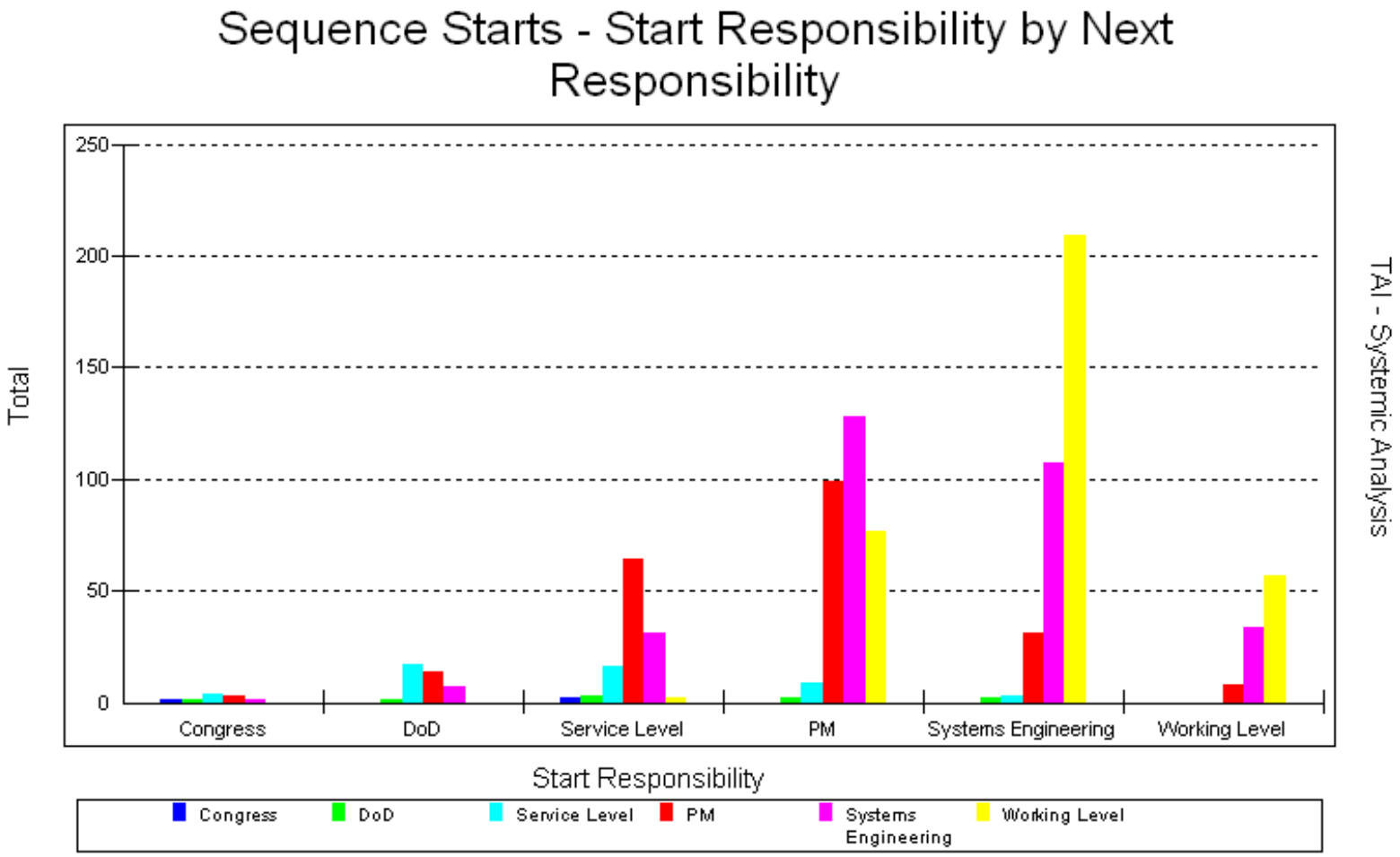
Identified Issues	Relative Occurrence
Process Capability	91 %
Organizational Management	87 %
Requirements Management	87 %
Product Testing	83 %
Program Planning	74 %
Product Quality - Rework	70 %
System Engineering	61 %
Process Compliance	52 %
Program Schedule	48 %
Interoperability	43 %
Decision Making	43 %
...	
Configuration Management	26%

Basic Analysis

Complex issues with multiple interactions across all levels of DoD management



Issue Migration



Basic Analysis

The primary causative performance issues are:

- ***Process capability shortfalls: the inability of the program team to design, integrate, and implement processes that adequately support the needs of the program***
- ***Requirements development and management shortfalls***
- ***Organizational management and communication limitations***
- ***Stakeholder agendas and related program changes***
- ***Product architecture deficiencies***

Cause and Effect Impacts

- ***Process Capability*** ***problems result in:***
  - ***Inadequate Testing***
  - ***Poor Change Management***
  - ***Poor Product Quality***
  - ***Progress Shortfalls***
- ***Requirements Management*** ***problems result in:***
  - ***Poor Product Quality***
  - ***Product Rework***
  - ***Progress Shortfalls***
- ***Organizational and Program Management*** ***problems result in:***
  - ***Inadequate Program Planning***
  - ***Responsibility Conflicts***
  - ***Poor Communications***
  - ***Product Rework***
  - ***Progress Shortfalls***

Basic Analysis

Under pressure, Program Managers make trade-off decisions that impact, in order:

- ***Development progress***
- ***Product technical performance***
- ***Product quality and rework***
- ***System usability***
- ***Cost***

Basic Analysis Summary

- ***The current DoD program issue profile shows little positive impact from past corrective actions, initiatives, and policy***
- ***The Program Manager and the Development Team must address the majority of the program issues, even if they are caused by enterprise level decisions or behaviors***
- ***Causative issues multiply downstream***
- ***The Program Team creates many of their own performance problems***
- ***There are no "single issue" program performance drivers***

Directed Analysis

- ***Software Engineering Process***
- ***Systems Engineering***
- ***Software Testing***
- ***Program Organization and Communication***

Software Engineering Process

Analysis Results

- 91% of the assessments had process capability issues (75% triggers)
- 52% of the assessments had process compliance issues (63% triggers)
- Predominant deficiencies: requirements, risk / measurement, testing, systems engineering, change management

Implications

- The performance problem extends beyond developer software process compliance
- False assumption that organizational process compliance equates to required program process capability
- Compliant organizations still have significant performance shortfalls
- Key process concerns:
    a. focus is too narrow in scope
    b. impacts of program constraints
    c. large program team process incompatibilities
    d. program teams just not good enough

Systems Engineering

Analysis Results

- 61% of the assessments had systems engineering issues (23% triggers)
- 11 of the 16 programs that have requirements issues have SE issues
- 43% of the assessments have interoperability issues (50% triggers)
- Predominant deficiencies: Non-existent SE, lack of SE expertise, poor SE implementation, dispersion of SE responsibility and authority, existing SE inadequate for program requirements

Implications

- Cost overruns, schedule slips and rework will continue to plague programs
- The most technically complex systems have the most systems engineering issues
- Interoperability of systems is in doubt
- Rapid exploitation of new/innovative technology is difficult

Systems Engineering Findings

- ***DoD programs have significant shortfalls with respect to systems engineering yet this is where most of the identified program issues exist***
- ***"Systems engineering by committee" is both common and ineffective***
- ***Programs continuously face unfunded and unplanned mandates related to family of systems management and interoperability***
- ***Trade off decisions are often extremely constrained***

Systems engineering must take a primary and renewed role in today's DoD programs

Software Testing

Analysis Results

- *83% of the assessments had testing related issues (53% triggers)*
- *Predominant deficiencies: lack of test time, facilities, testing cutbacks, poor test procedures*
- *73% of the programs with schedule problems had testing issues*
- *80% of the programs with requirements problems had testing issues*

Implications

- *Overarching testing risk - late discovery of defects (94%)*
- *Most testing issues result in quality shortfalls and rework*
- *Testing of complex systems is an emerging concern*
- *Primary causes of testing shortfalls:*
    a. *requirements (71%)*
    b. *test facilities (71%)*
    c. *test process capability (65%)*
    d. *schedule constraints (41%)*

Program Organization and Communication

Analysis Results

- *87% of the assessments had communications issues (65% triggers)*
- *Every program with IPT related issues had communications issues*
- *Predominant deficiencies: unclear roles and responsibilities, delayed decision making, conflicting decisions, proprietary information (all exacerbated by widely dispersed organizational teams and complex organizational structures not suited for traditional management approaches)*

Implications

- *IPTs appear to create more management issues than they resolve*
- *Poor implementation of IPTs: proliferation, structure, membership, authority and decision responsibility issues*

Systemic Analysis Model

ENTERPRISE LEVEL

Congress | DoD | Service

PROGRAM LEVEL

Program Manager | Systems Engineering | Working Level

Program Decision Space

Acquisition Requirements
- Process
- Politics
- Strategy
- Assumptions

Policy
Culture

Expectations
- Cost
- Schedule
- Performance
- Quality

Constraints
- Funding
- Resources
- Time
- Capability

Mission Allocation

Program Portfolio Management

Implementation Issues
- Complexity
- Capability
- Planning
- Program Trades
- Resource Allocation
- Management
- Organization
- Interoperability
- Conformance
- Leadership

Implementation Issues
- Process
- Product
- Information
- Capability
- Performance

ACQUISITION ENVIRONMENT
(Threats, Economy, Technology)

New Solution Strategy Required?

- ***Past DoD acquisition solutions (strategies, policies, and initiatives) have had only limited success in reversing poor performance trends:***
  - ***Single point solutions***
  - ***Poorly evaluated***
  - ***Focused on symptoms not causes***
  - ***Lacking in implementation guidance***
  - ***Conflicting***
  - ***Volatile***
  - ***Lack insight into solution effectiveness***
  - ***Long lasting impacts and residuals***

Key Considerations

- ***Need to establish performance parameters that can be implemented with success across the life of the program***
  - ***Feasible plan***
  - ***Understood constraints***
  - ***Change tolerance***
- ***Need to improve the capabilities of the development teams***
  - ***Real systems engineering***
  - ***Funded management and technical approaches critical to interoperability***
  - ***Foundational processes***

Key Considerations

- ***Need to ensure that all program stakeholders agree on an integrated strategy for attacking the high priority overarching program issues***
  - ***Congress and enterprise***
  - ***Program team***
  - ***Education and technology infrastructures***
- ***Need to augment recent acquisition policy changes with***
  - ***A clear understanding of the complex interactions and constraints that programs are faced with***
  - ***Adequate implementation guidance***
  - ***Directed education***

Assessment & Analysis Essentials

- Focus on performance improvement
- Enterprise performance is a composite of project performance
- Use a common architecture for project and systemic evaluation
- Address a wide scope of issues and issue sources
- Risk management and measurement processes are critical
- Flexibility is important – typology not taxonomy
- Relate subjective and quantitative information
- Information needs drive the analysis process
- Frequency of occurrence counts are just the first step
- Data integrity – data integrity – data integrity
- Consistent terminology

Tri-Service Assessment Initiative™

Kristen Baldwin
OUSD (AT&L) Software Intensive Systems
(703) 602-0851 ext. 109
kristen.baldwin@osd.mil