



Defense Information Systems Agency

Department of Defense

A Strategy for Program Success: Leading Indicators for Early Warning

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25 October 2006

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Agenda

- **Context**
- **Purpose of Briefing**
- **A Framework for Indicators**
- **Typical Indicators of Success and Problems**
- **Leading Indicators and What They Offer**
 - **Some Examples**
- **Case Studies**
- **Future Work**



If only we had known in advance...



Context - 2

- **DISA's systems engineering & acquisition foci have driven this research**
 - **Communications systems and managed services acquisition**
 - **Information systems infrastructure development and managed services acquisition**
 - **Information systems C2 applications development and managed services acquisition**
- **Other organizations' systems engineering & acquisition environments may require different or additional leading indicators**
 - **Weapons platform hardware development**
 - **Weapons subsystem hardware development**
 - **Aerospace platform hardware development**
 - **Aerospace subsystem hardware development**
 - **Hard-real-time software development**



Purpose

- **Track major programs from acquisition & systems engineering perspectives as part of responsible technical and program management**
 - Using conventional metrics
 - Often lagging indicators
 - Using unconventional indicators
 - Early warning system
- **Assess indicators over time to capture lessons and refine indicators for early warning of problems**



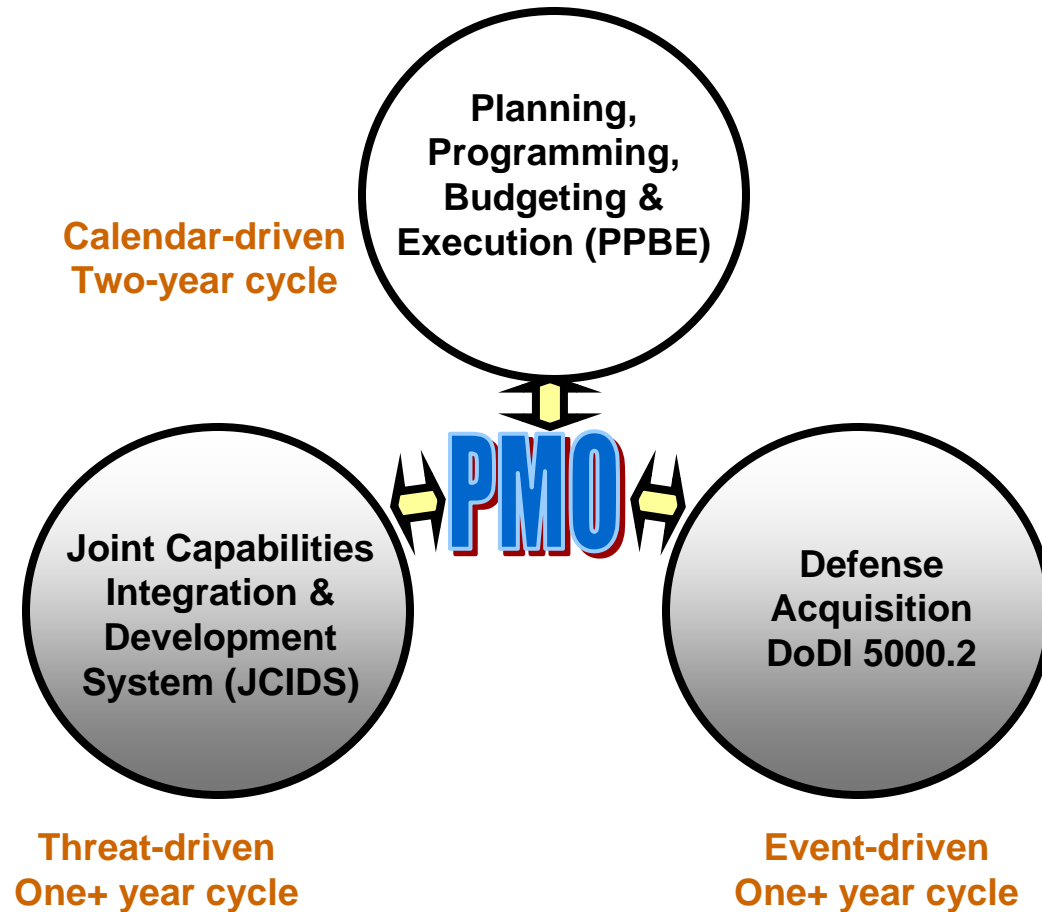
About Leading Indicators

- **Leading indicators give a sense of problems downstream in a system or service acquisition or development**
- **These indicators help a program manager or chief engineer identify potential problems earlier than otherwise**
- **Once identified, problems may be amenable to more traditional risk management and remediation**
- **Leading Indicators may first appear subtly rather than as a waving red flag**

DISA Tenets about Leading Indicators

- **Indicators need to identify problems that have tractable solutions**
 - **Confirming a future wreck that cannot be avoided is only so valuable**
- **Indicators should not require yet another data call**
 - **If a simple “yes,” “no,” or “the answer off the top of my head is 6” response to a simple question isn’t possible without gathering further data, then we have the wrong indicator**
- **Indicators should be readily understandable by all**
 - **If it needs an explanation, it’s a complex metric, not an indicator**

DISA The Program Manager's Challenge



Source: NDIA-NAU Course in Defense Systems Acquisition Management

**These DoD processes should interact & overlap.
The program manager must orchestrate across all three.**



A Framework for Indicators

Program Factors	Examples of Indicators
Program Management	Degree of commitment to program from other relevant organizations Degree of program management engagement in the program
Communications	Cordiality, frequency of communications between program personnel and stakeholders Speed of stakeholder issues resolution
Fiscal Issues	Degree of agreement among stakeholders on funding approach & commitments Fiscal unanimity among key organizations (e.g., Congress, OSD, Military Services)
Requirements	Stability of requirements Realism of requirements versus maturity of technology to meet them
Schedule	Schedule stability Evidence of unrealistic scheduling
Staffing	Government / contractor management stability, lack of gaps in management Key government / contractor staff stability
Technology	Technology readiness to be employed in DoD systems Technological skills available in government and contractor base

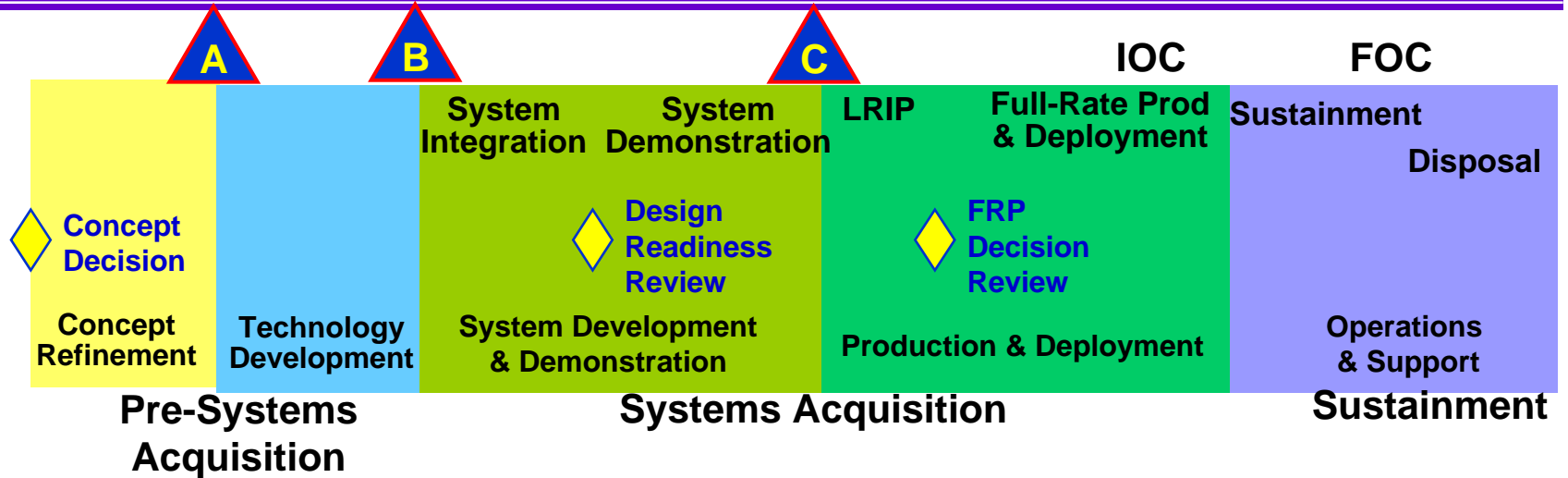


Framework (concluded)

- **Dimensions of the indicator framework**
 - **Stage in the system or service life cycle**
 - Some indicators are more significant for some milestones than others
 - E.g., technology can be less mature prior to Milestone A than prior to Milestone C
 - **Duration of an indicator problem**
 - Some indicators show more sensitivity to duration of an indicated problem than others
 - E.g., a gap in a key government management position of any duration can portend downstream problems in a program



Indicators & Their Relevance in the System or Service Life Cycle



Prgm Factrs	Representative Indicators Associated with Milestones
Program Management	Degree of PM engagement with staff
Communication	Reduction in face to face communication with stakeholder
Fiscal Issues	Disagreement among stakeholders on program funding
Requirements	Lack of realism
Requirements	Scope Creep
Schedule	Unrealistic Schedule
Staffing	High Turnover in Contractor Staffing
Technology	Moderate-to-High Technology Readiness Risk



What Indicators Can Indicate

<u>Indicator</u>	<u>Possible Consequences</u>
Reduction in face-to-face communications	Can result in failure to resolve stakeholder issues that can get pushed aside and reappear later in the process when correction costs more. In extreme cases, can lead to funding cuts through lack of advocacy by key stakeholders.
Lack of realism regarding financial constraints	Most likely will result in significant cost overruns if the parties do not understand the nature of contract funding. Can result in IG and GAO involvement for significant overrun.
Requirements scope creep	Generally will result in cost overruns or incomplete capability being delivered, and will also cause issues regarding contract compliance between government and contractor. Can also result in IG and GAO oversight for significant overrun.
Unrealistic schedule	Most likely will result in a program off the critical path from the start. Can affect other programs under development (via dependencies). Can affect costs if the contractor has to add more personnel to try to get a program back on track. Quality of delivered product or service may be reduced while trying to meet schedule.
Technology not yet ready	Can result in failure to deliver required product or service, or at least will result in delayed delivery.



Correcting the Problem

Indicator

Possible Solutions

Reduction in face to face communications

Primary solution is to identify the cause of the reduction in communications. If necessary set mandatory meetings with posted agenda. Have senior management attend the meetings to oversee interaction between parties.

Lack of realism regarding financial constraints

Proper training can usually correct this problem. A closer scrutiny of spending and program budget may be required by senior management. Have PM explain 5% or great variance.

Requirements scope creep

A watchful contracting officer should help significantly to reduce requirements creep. Educating the COTR can also aid in reducing creep.

Unrealistic Schedule

This problem is easier to prevent than correct. Upon identification, meet with team to define realistic schedule and re-baseline to that schedule. Costs may be affected.

Technology not yet ready

Identify less risky technology, experiment with it, pilot it, demonstrate how well it scales. Alternatively, pilot the riskier technology, work out the bugs and deliver in smaller increments, if feasible. Either solution results in schedule delays, possible capability reduction.

DISA Case Study 1: The Problems

- **Context: complex suite of information services; many diverse users, DoD-wide; some applications services, some infrastructure services**
- **Leading indicators getting to Milestones A & B**
 - ✓ **Program management, Staffing**
 - Leadership (government, contractor) absence, turnover, weak leadership
 - Key technical staff (government, contractor) absence, turnover
 - ✓ **Communication**
 - Turnover of key stakeholder caused schedule slip while working to win over the replacement stakeholder
 - ✓ **Fiscal issues**
 - Disagreement among stakeholders on program funding
 - OK** **Requirements**
 - ✓ **Schedule**
 - Realistic until personnel churn caused program to lose focus
 - ✓ **Technology maturity, skills to use**
 - Technology not yet widely used in commercial world
 - Lack of available skills in government, among government contractors

DISA Case Study 1: The Resolution*

- **Context:** complex suite of information services; many diverse users, DoD-wide; some applications services, some infrastructure services
- **Leading indicators getting to Milestones A & B**
 - ✓ **Program management, Staffing**
 - Leadership (government, contractor) – **gained longer-term commitments from new talent, stabilized situation**
 - Key technical staff (government, contractor) – **attracted talented new players with commitment to complete the first spiral at least**
 - ✓ **Communication**
 - Turnover of key stakeholder – **still building trust via intensive communication campaign**
 - ✓ **Fiscal issues**
 - Disagreement among stakeholders – **still a challenge**
 - OK **Requirements -**
 - ✓ **Schedule**
 - Realistic until personnel churn – **working hard but with possible slip**
 - ✓ **Technology maturity, skills to use**
 - Technology not yet widely used – **still experimenting; outcome not clear**
 - Lack of skills on program – **OJT, experience building but likely schedule slips downstream**

*So far ...

DISA Case Study 2: The Problems

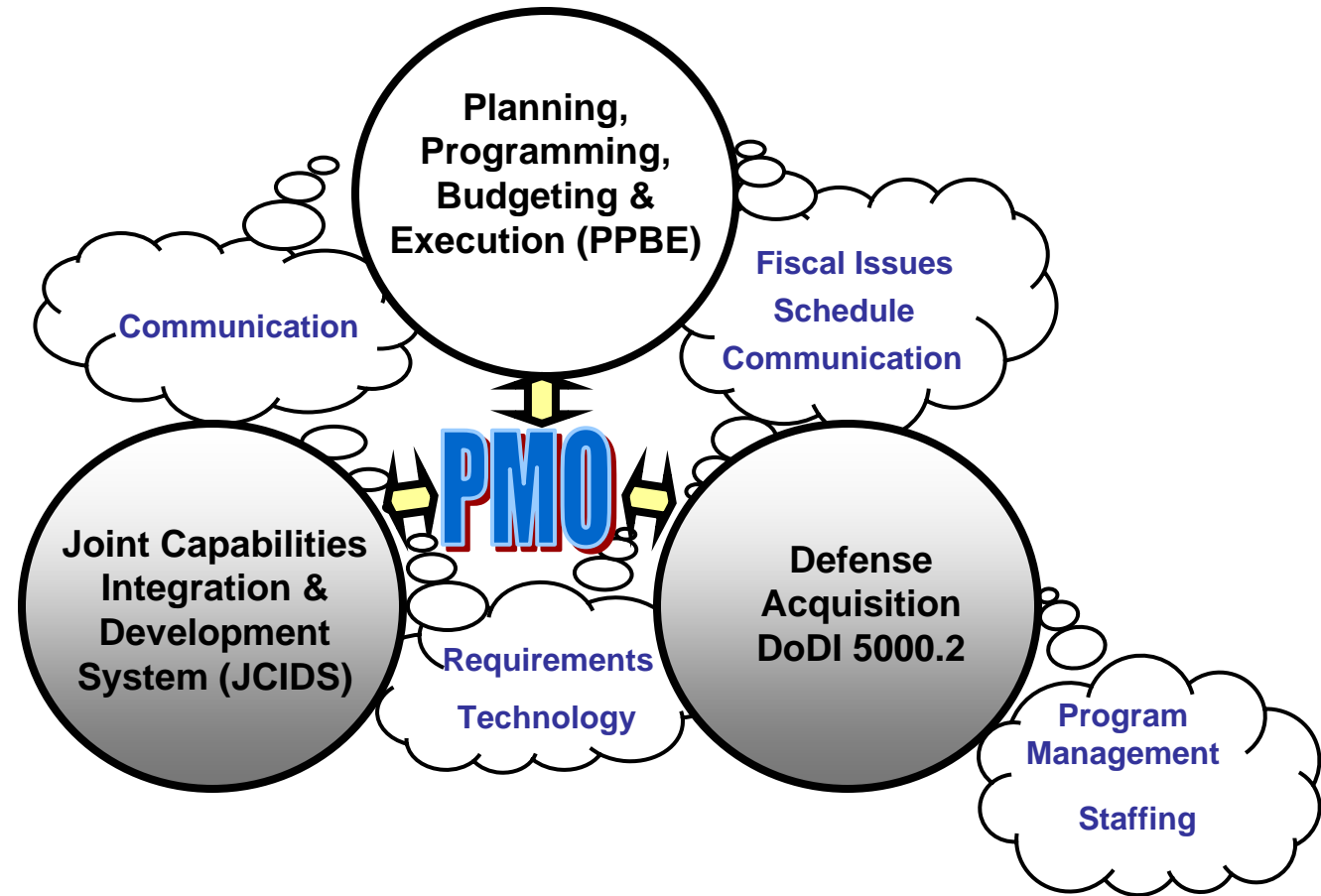
- **Context: worldwide communications system ground-based infrastructure, being developed & fielded in multiple spirals**
- **Leading indicators getting to MSs A & B of Spiral N**
 - OK** Program management, Staffing
 - ✓ **Communication**
 - Multiple Military Service stakeholders have proven challenging for a small-staff PMO
 - OK** Fiscal issues
 - ✓ **Requirements**
 - One key requirement dependent on immature technology
 - ✓ **Schedule**
 - Realistic except for immature technology, errant stakeholders
 - ✓ **Technology maturity**
 - One key product still in development
 - Reliant on multiple stakeholders for agreement on technological way-ahead

DISA Case Study 2: The Resolution*

- **Context: worldwide communications system ground-based infrastructure, being developed & fielded in multiple spirals**
- **Leading indicators getting to MSs A & B of Spiral N**
 - OK** Program management, Staffing
 - ✓ **Communication**
 - **Multiple Military Service stakeholders – focused on most challenging player(s)**
 - OK** ✓ **Fiscal issues – cost increase due to delayed requirement**
 - ✓ **Requirements**
 - **Dependent on immature technology – delaying fielding of new technology; extending life of older technology by two years**
 - ✓ **Schedule**
 - **Immature technology, errant stakeholders – generally acceptable schedule slip accorded to technology problem**
 - ✓ **Technology maturity**
 - **Key product in development – too early to tell if new schedule realistic**
 - **Reliant on multiple stakeholders for agreement – achieved grudging agreement**

*So far ...

Summary



Source: NDIA-NAU Course in Defense Systems Acquisition Management

Most of the leading indicators address Defense Acquisition, but without acting to correct indicated problems, damaging effects can occur in all three domains



Future Work

- **Refine number and variety of leading indicators**
 - Most significant effects likely on program
 - Modest data collection demands
- **Gather data across a greater variety of programs**
 - Hardware-intensive
 - Software-intensive
 - Leading-edge technology application
 - Complex dependencies on programs inside, outside the Agency
- **Analyze results**
- **Refine indicators**
- **Define dashboard with watch list of indicators**



Questions?



Backup Slides

DISA Candidate Early Warning Indicators - 1

Program Advocacy

- **Weak/Ineffective Program Manager**
- **Lack of Management Continuity and Oversight**
- **Lack of Involvement from Stakeholders (contracting officers, COTRs, OSD, etc.)**
- **Reluctant or ambiguous statements from public officials**
- **Programs not clearly specified in budget submissions, FYDP, Program Element Descriptions Summary (PEDS), etc.**

Communications

- **Principals do not attend regular meetings and do not send an alternate**
- **Reduction in face-to-face communications**
- **Inadequate resolution of issues**
- **Prime contractor not engaged**
- **Lack of proactive stakeholder communication**
- **Lack of information sharing**
- **Lack of visibility on executive status or priority list**

DISA Candidate Early Warning Indicators - 2

Fiscal Issues

- **Inability to tie performance to well articulated payoff**
- **Lack of realism regarding fiscal constraints at time of contract award**
- **Submission of multiple engineering change proposals (ECPs)**
- **Large underruns or overruns inconsistent with contractor proposal within three months of award**
- **Military Services/Components disagreeing on funding approach or commitments**
- **Contractor proposal estimates significantly exceed IGCE**

DISA Candidate Early Warning Indicators - 3

Requirements

- **Ambiguity of requirements**
- **Unrealistic requirements**
- **Requirements not testable**
- **Scope creep**
- **Mission needs/requirements not adequately defined in Statement of Work**
- **Key DoD 5000 requirements documents not developed, approved, or updated**

DISA Candidate Early Warning Indicators - 4

Schedule

- **Unrealistic schedules**
- **Unilaterally set schedules**
- **Frequent schedule slips – especially w/in first 3-6 months**
- **Poor or no design/test schedules**
- **Integrated Master Schedule not linked with contractual delivery schedule**

Staffing

- **Turnover ratios greater than 5%, especially among staff with scarce skills**
- **Changes to contractor staffing within first six months not identified in contractor proposal**
- **Change in program management of contractor or government**
- **Time gaps between managers**
- **Oversight officials lacking proper certification**
- **Contracting officer not assigned or insufficient contracting office support**

DISA Candidate Early Warning Indicators - 5

Technology

- **Proposed technology is below Technology Readiness Level of 6 at Milestone B**
- **Technology has not been or has been only rarely demonstrated successfully in commercial world**
- **Skills among government and contractor teams insufficient to apply chosen technology**

Other?

- **Program dependencies – on other programs; others dependent on it; on outside-the-Agency organizations**

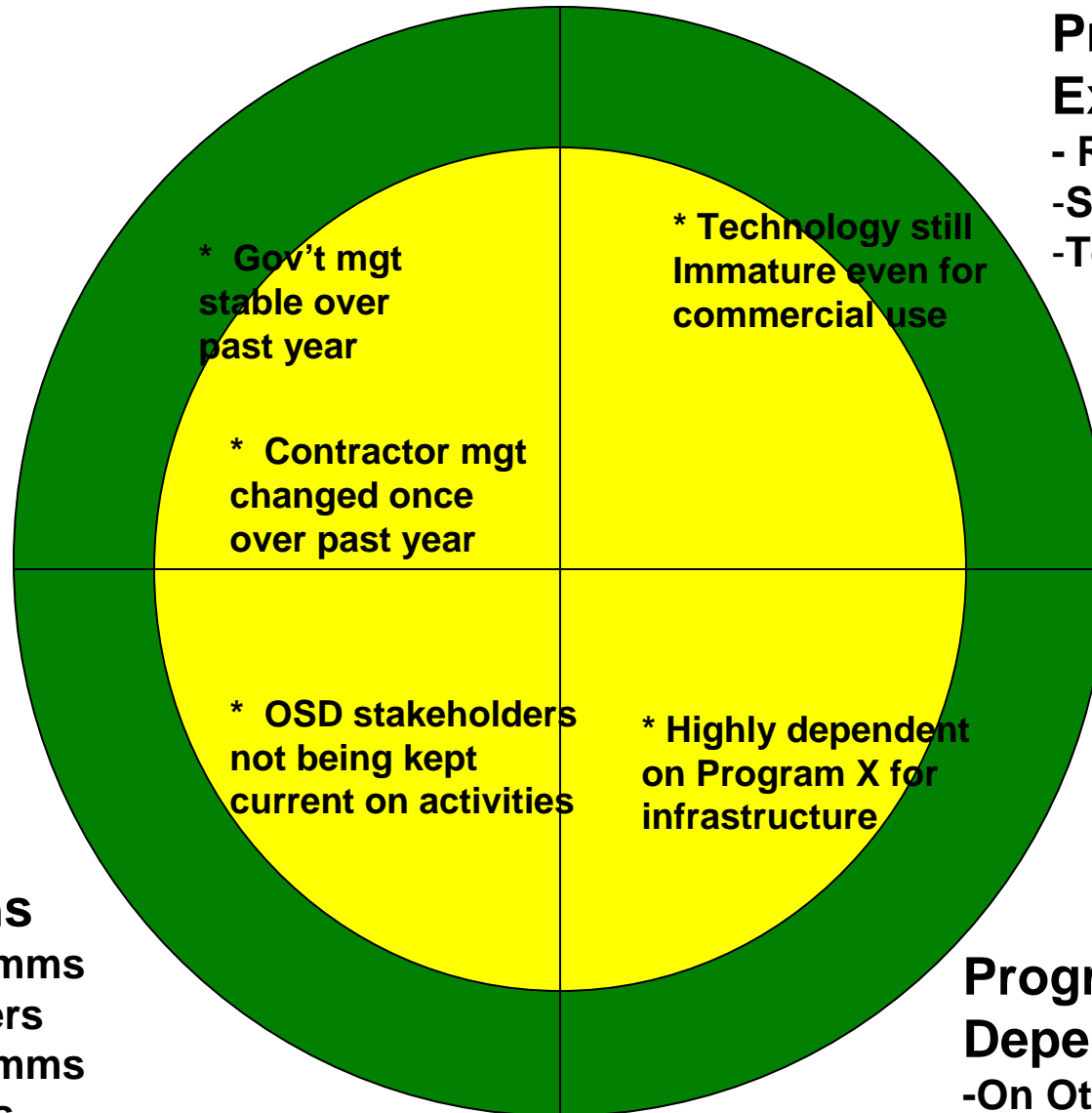
DISA A Framework for Indicators(1)

Program Resources

- Stability of Mgrs
- Stability of Staff
- Financial Status

Program Execution

- Requirements
- Schedule
- Technical Maturity



- Watch/
Take action
- Neutral/
No action required

Program Communications

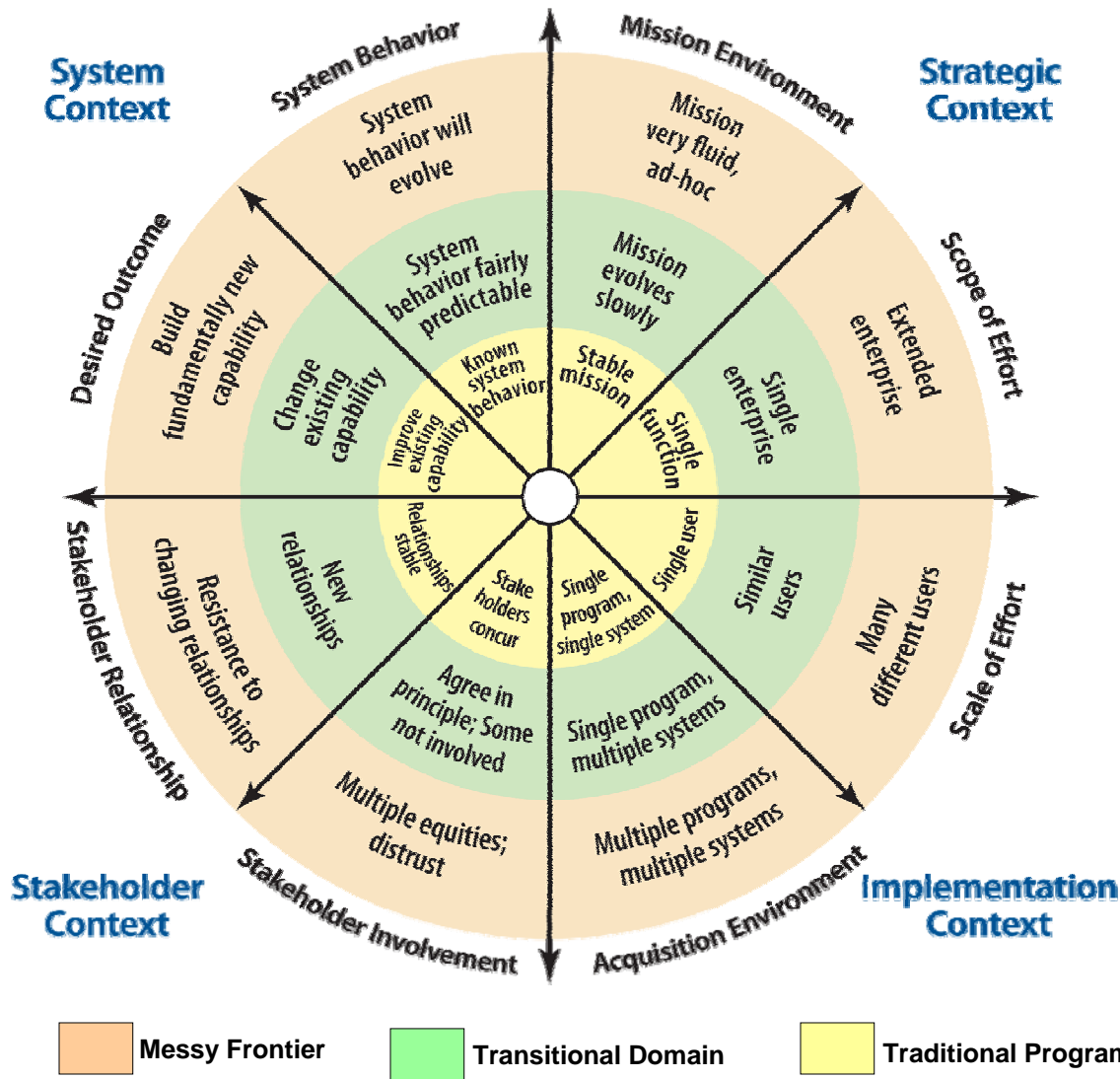
- Degree of open comms with key stakeholders
- Degree of open comms with internal players

Program Dependencies

- On Other Programs
- On Other Organizations



A Framework for Indicators(2): Enterprise Systems Engineering Profiler™



Sector	Indicators
Mission Environment	Requirements Stability Schedule Realism
Scope of Effort	Requirements Realism
Scale of Effort	Technology Readiness?
Acq. Environment	System Dependencies Organizational Dependencies
Stakeholder Involvement	Communication w/Stakeholders - Degree of Agreement, Advocacy - Frequency of Communication
Stakeholder Rel'nship	Communication w/Stakeholders - Cordiality
Desired Outcome	Technology Readiness
System Behavior	Technology Readiness?

Important Indicators not Fitting Framework

- Management Stability
- Government
- Contractor
- Staff Stability
- Government
- Contractor
- Fiscal Unity?



Bibliography

- “Defense Acquisition Performance Assessment” Report, Lt.Gen. Ronald Kadish, USAF (Ret) Panel Chairman, January 2006
- MITRE Enterprise Systems Engineering studies
- DAU course materials at www.acc.dau.mil
- “Acquisition – System Engineering Planning for the Ballistic Missile Defense System (D-2006-060)”, Department of Defense Office of Inspector General, 2 March 2006
- “The Federal Bureau of Investigation's Management of the Trilogy Information Technology Modernization Project” Audit Report No. 05-07, Office of the Inspector General, February 2005
- “Analyses Of A Sampling Of Major Acquisition Systems How A Definite Linkage Between Escalating Costs And The Ineffective Applications Of Systems Engineering”, Michael W. Wayne & Mark D. Schaeffer. March – April issue of Defense AT&L
- Department of Defense Instruction 5000.2
- Department of Defense Directive 5000.1 and 5010.38
- “A Model for Leading Change: Making Acquisition Reform Work” Defense Systems Management College, Lt. Col. Charles L. Beck, Jr., USAF, Lt. Col. Nina Lynn Brokaw, USA, Commander Brian A. Kelmar, USN
- “Chapter 4, Systems Engineering,” Defense Acquisition Guidebook
- “Executability Metrics for SMC Programs” (Version 3.0), P.L. Smith and P.G. Cheng, G. S. Arnold. Aerospace Report No. TOR-2004(8583)-3470 under contract no. FA8802-04-C-0001, 15 June 2004.
- General Accounting Office, *BUSINESS MODERNIZATION NASA's Integrated Financial Management Program Does Not Fully Address Agency's External Reporting Issues*, November 2003, GAO-04-151
- “DOD Acquisitions Contracting for Better Outcomes”, General Accounting Office, Statement of David M. Walker, Comptroller General of the United States, 7 September 2006
- “Defense Acquisitions Restructured JTRS Program Reduces Risk, but Significant Challenges Remain”, General Accounting Office, Report to Congressional Committees, September 2006