Headquarters U.S. Air Force

Integrity - Service - Excellence

PSM ERP Workshop: Discussing Estimator's Toolkit and MIL-STD AIS WBS Initiatives

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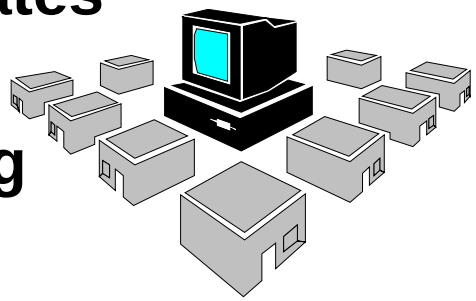
Overview: What is an ERP?

- Enterprise Resource Planning (ERP) software
- An <u>enterprise</u> software application that
  - Has a <u>single, integrated database</u>
  - Integrates multiple business functions across an organization onto a <u>single computer system</u> that serves everyone's needs
  - Eases the exchange of data and facilitates communication among departments
- Each module works separately performing specific data-processing
- Typically enabled by Commercial-Off-The-Shelf (COTS) Software (SW)



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Toolkit Proposal

- **Create a toolkit of Cost Estimating Relationships (CERs) that AFCAA/FMI analysts can use for estimation**
- **Produce a standard summary data sheet for each CER**
- **Collect standard uncertainty ranges for labor rates, hardware prices, DISA rates etc. using the same standard format**
- **Provide metric ratings to recognize deficiencies or missing data**

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Toolkit Sample Data Sheet

Name

Sample Methodology or CER

Applicabe WBS Element	WBS 0.0	**Rating**	
Unique Identifier		**Data Type**	
Usage Instructions:		**Applicability and Limitations**	
Base Year of Analysis	**Number of Data Points**	**Example Source Programs**	
ACE Equation / Throughput		**ACE Ri$K Specification**	
Source Data Quick Stats Low 15% Mean 85% High		**Comments and Assumptions**	

Change Log

Version Number	Date	Analyst	Description of Update
1.3	8/4/2009	Max Hodal	Added Example Source Programs, 15% and 85% fields.
1.2	8/3/2009	Max Hodal	Added SER Data Type, changed definitions of Strong and Acceptable.
1.1			Revised to add "Rating" and "Data Type" fields
1.0			Initial version of Methodology / CER.

Strong *Source Data Avaliable, more than 15 data points*
Acceptabl *Source Data not Avaliable, 5- 15 data points*
Needs Im *Source Data not Avaliable, < 5 data points*

CER
Labor Rate
Materials Cost
Growth Factor
SER
Burn Rate / LOE

Toolkit Overview

- Examples of data sheets to be shown: $ per RICE Object, DISA Server Charge, Yearly PMO, Hardware Costs, Help Desk FTEs, & PMO Step-Down
  - Data was compiled from many of the same programs and sources that were shown in the Improving ERP Estimating in the DoD presentation
  - Most of these data sheets shown today are almost a year old and have not been updated with new information!!!!
- Currently don't have these items mapped to the Mil-Std AIS WBS; as will be seen from the WBS element block on each data sheet

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ERP Work Breakdown Structure

WBS ID	Level 1	Level 2	Level 3	Level 4	Level 5
1.0	Automated Information System (AIS)				
1.1		Automated Information System Prime Mission Product Release/Increment X			
1.1.1			Custom Application Software 1..n		
1.1.2			Enterprise Service Element 1..n		
1.1.3			Enterprise Information System 1..n		
1.1.4			External System Interface Development 1..n		
1.1.5			System Level Integration		
1.2		System Engineering			
1.3		Program Management			
1.4		Acquisition Logistics			
1.5		System Test and Evaluation			
1.5.1			Development Test and Evaluation		
1.5.2			Operational Test and Evaluation		
1.6-1.7		Training/Data			
1.10		Operational/Site Activation			
1.10.X			Site Type 1…N		
1.10.X.1				Deployment Software and Hardware	
1.10.X.2				Site Activation	
1.10.X.3				User Training	
1.10.X.4				Data Migration	
1.10.X.5				Management/Engineering Support	
1.10.X.6				Interim Logistics Support	
1.10.X.6.1					Systems Engineering/Program Management
1.10.X.6.2					System Operations / Sustaining Engineering
1.10.X.6.3					Help Desk
1.10.X.6.4					System Database Administration
1.10.X.6.5					Deployment Hardware/Software Refresh
1.10.X.6.6					Software Maintenance,
1.10.X.6.7					Follow on Training
1.10.X.6.8-9					Accreditation / Independent Verification and Validation

Unpublished MIL-STD-881 References (Final Review Stage):
[1] Appendix TBD: Automated Information System Work Breakdown Structure and Definition
[2] APPENDIX I: COMMON ELEMENTS WORK BREAKDOWN STRUCTURE AND DEFINITIONS

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Practical Cost Metrics:
Mapped to ERP WBS

Practical Cost Metrics	ERP WBS Reference
■ Development	
■ Productivity ($/RICE)	WBS 1.1.3, 1.2-1.4 (contractor only), 1.5.1,1.6-1.7
■ Size (RICE Objects)	WBS 1.1.3, 1.2-1.4 (contractor only), 1.5.1, 1.6-1.7
■ Size (External System Interfaces)	WBS 1.1.4
■ Size (Business Processes)	WBS 1.1
■ Program Office Staff (FTE/yr or $/yr)	WBS 1.2-1.4 (government only)
■ Duration (Years)	WBS 1.2-1.4 (government only)
■ Procurement / Deployment	
■ User Count	WBS 1.10.X.1.1 (deployment Software)
■ Migrated Legacy Systems	WBS 1.10.X.4
■ Servers (UNIX and Windows Servers)	WBS 1.10.X.1.2 (deployment hardware)
■ Operating Locations	WBS 1.10.X.5
■ Training/Test Events	WBS 1.10.X.3
■ Interim Logistics Support / Operations and Sustainment	
■ PMO Staff (% Ramp-Down after FOC)	WBS 1.10.X.6.1 (WBS 2.1 after FOC)
■ Contractor Staff (% Ramp-Down after FOC)	WBS 1.10.X.6.6 (WBS 2.6 after FOC)
■ Help Desk (Users/FTE)	WBS 1.10.X.6.3 (WBS 2.3 after FOC)
■ Software License Fees ($/User)	WBS 1.10.X.6.5 (WBS 2.5 after FOC)
■ System/Database Administration Staff (FTE/Servers)	WBS 1.10.X.6.4 (WBS 2.4 after FOC)
■ Follow on Training Factor (% of User Training Cost)	WBS 1.10.X.6.7 (WBS 2.7 after FOC)

Note: Interim Logistics Support (WBS 1.10.X.6) is renamed to Operations and Support (WBS 2.X) after FOC

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RICEW Object CER

Name

Dollars per RICEW Object

Applicabe WBS Element	WBS 1.3.2.3 & 4	**Rating**	Strong
Unique Identifier	001	**Data Type**	CER

Usage Instructions:
This is a CER for Enterprise Resource Planning (ERP) systems. Multiply a RICEW count by this metric to estimate the cost to develop the RICEW objects.

Applicability
The data set had programs with RICEW object counts from 29 to 1,375. This does not account for potential growth in requirements count.

Base Year of Analysis
2009

Number of Data Points
14

ACE Equation / Throughput
137,905

ACE Ri$K Specification
Form=LogNormal, PE=Mean, CV=1.205

Source Data Quick Stats

Low	$8,080
Mean	$137,905
High	$690,098

Comments and Assumptions
Assumed a lognormal distribution because that is typical for software productivity. Includes Design/Build and COTS Configuration activities; does not include Plan, Analysis (Blueprinting), Initial Training, Test or Deployment.

Change Log

Version Number	Date	Analyst	Description of Update
1.0	7/29/2009	Max Hodal	Initial version of Methodology / CER.
1.1	5/6/2010	Brian Kolstad	Update of 3 programs to reflect better, more recent information

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DISA Server Charge

Name

DISA Server Charge (Mega Center)

Applicabe WBS Element	WBS 14.6	**Rating**	Strong
Unique Identifier		**Data Type**	CER

Usage Instructions:
Multiply by the number of servers to get annual cost for DISA system administration.

Applicability
Note: an assumed mix of servers was used, may need to revise using project server mix, but can re-use uncertainty range.

Base Year of Analysis
2009

Number of Data Points
5

ACE Equation / Throughput
46696

ACE Ri$K Specification
Form=Normal, PE=Mean, CV=.3394

Source Data Quick Stats

Low	$34,192
Mean	$46,696
High	$72,833

Comments and Assumptions
Assumes basic services for Unix only. This is meant to be a representative sample, the uncertainty range can be abstracted for use for other DISA charges. Price assumes 80% small servers, 13% Large, 7% enterprise. Assumed Normal Distribution due to higher and lower fluctuations.

Change Log

Version Number	Date	Analyst	Description of Update
1.0	8/3/2009	Max Hodal	Initial version.

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Yearly PMO Costs

Annual Program Management Cost

Applicabe WBS Element	WBS 16.1 & 16.2	**Rating**	Acceptable
Unique Identifier		**Data Type**	Burn Rate / LOE

Usage Instructions:
Multiply the Annual Program Management Cost by the number of years of development.

Applicability and Limitations
Do not recommend using as a primary methodology; use for crosschecks. Applicable to ERPs.

Base Year of Analysis	Number of Data Points	Example Source Programs
2008	9	

ACE Equation / Throughput		ACE Ri$K Specification
	9808850	Form=Normal, PE=Mean, CV=.68

Source Data Quick Stats	
Low	2,358,484
15%	3,106,460
Mean	9,808,850
85%	18,137,510
High	20,117,188

Comments and Assumptions
Assumed normal based on analyst judgement and inspection of data.

Change Log

Version Number	Date	Analyst	Description of Update
1.0	8/6/2009	Travis Packard	Initial version of Methodology / CER

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HW Cost

Name

Hardware Cost per User

Applicabe WBS Element	WBS 1.1.1	**Rating**	Acceptable
Unique Identifier		**Data Type**	CER

Usage Instructions:
Multiply the number of users by the hardware cost per user to receive cost of hardware.

Applicability and Limitations
Sources range from 400-17,000 $ per user. Most data points have less than 1,500 hardware $ per user. This is to be used as a crosscheck only.

Base Year of Analysis	Number of Data Points	Example Source Programs
2009	7	

ACE Equation / Throughput
3,415.93

ACE Ri$K Specification
Form=Normal, PE=Mean, CV=1.84

Source Data Quick Stats

Low	409.41
15%	689.18
Mean	3,415.93
85%	5,021.14
High	16,256.16

Comments and Assumptions
Used data analysis in Excel spreadsheet to find specifications and assume normal distribution.

Change Log

Version Number	Date	Analyst	Description of Update
1.0	8/17/2009	Travis Packard	Initial version of Methodology / CER from the source, SCP Backup.

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Help Desk FTEs

Name

Help Desk FTEs per Number of Users

Applicabe WBS Element	WBS 14.5	**Rating**	Needs Improvement
Unique Identifier		**Data Type**	CER

Usage Instructions:
Estimates Tier 1 Helpdesk FTEs. Multiply expected number of users by this factor to estimate the annual number of FTEs for a helpdesk.

Applicability
Range of data from 85 users to 450,000.

Base Year of Analysis
n/a

Number of Data Points
7

ACE Equation / Throughput

ACE Ri$K Specification

Source Data Quick Stats

Low	22,500
Mean	7,219
High	89

Comments and Assumptions
If User Count is uncertainty adjusted make sure that this uses the adjusted number. This metric is best used as a crosscheck, there is no clear trend in the data.

Change Log

Version Number	Date	Analyst	Description of Update
0.1	8/3/2009	Max Hodal	Initial version. Developed by Wilson Rosa.

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PMO Step Down

Name

PMO Step Down

Applicabe WBS Element	WBS 14.1	**Rating**	Needs Improvement
Unique Identifier		**Data Type**	CER
Usage Instructions: Compares average annual cost during development for PMO to average annual cost in sustainment. Multiply by average PMO cost or representative year during development.		**Applicability** Be careful using this factor when PMO is atypical during development.	
Base Year of Analysis n/a		**Number of Data Points** 4	
ACE Equation / Throughput 0.511		**ACE Ri$K Specification** Form=Normal, PE=Mode, CV=.4489	
Source Data Quick Stats Low 79.0% Mean 51.1% High 27.8%		**Comments and Assumptions** Step *down* factor so a 60% stepdown results in a staff that is 40% of the original. Assumed a symetrical distribution	

Change Log

Version Number	Date	Analyst	Description of Update
0.1	8/3/2009	Max Hodal	Initial version.

Other Metrics

- List of Other Toolkit Items:
  - Acquisition Support
  - COTS Software Tailoring Effort
  - ESLOC Growth Factor
  - Software Development Labor Rate
  - Software Development Productivity
  - System Admin FTEs per Server

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Discussion Points

- How does RICE compare to other software measures?
  - Is there a ‘standard’ way to size RICE?
  - Do different vendors and SI define RICE differently?
- What about the other metrics – are they standardized?
  - If so, how is the standard set?
  - If not, should they be?
- ERP is one COTS – are there other COTS that are naturally compatible or incompatible with ERPs?
  - How do we determine?
  - What should we measure?
- Database technologies are the basis for ERPs
  - What do we know about measuring databases that would help?

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RICE Object Definition

RICE+ Object	Definition
Reports	Formatted and organized presentations and collection of data. These are custom reports for displaying or input of data from/to the application in specific formats, including mathematical operations, page breaks, headers, etc. as appropriate.
Interfaces	Boundaries across which two independent systems meet and act on or communicate with each other. There is software code allowing the new implementation to exchange data with the remaining legacy systems.
Conversions	Processes that transfer or copy data from an existing system to load production systems at implementation, e.g., converting data stored as integers to data stored as floating point numbers.
Extensions	Programs added to an existing standard program but do not change core code or objects.
Workflows	System process that automate routing of information according to business rules and enables modeling, automation, and continuous business process improvement.
Bolt-Ons	Software packages that can be integrated with ERP used to support specific capabilities of the COTS software.
Security Patches	Additional security requirements for the system, such as special system ID and password functionality.

Toolkit Improvements

- Create folder structure mapped to MIL-STD 881 WBS to categorize and place data sheets
  - How can we expand on MIL-STD 881 WBS; this structure is still not set in stone!
- Come up with a system of rating how our overall metrics are for a particular WBS element
  - Something similar to the data sheet rating system?
  - How can we improve a lacking WBS element?

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Mil Std 881 WBS AIS AFCAA Revisions

Level 1	Level 2	Level 3	Level 4	Level 5
Automated Information System (AIS)				
	Automated Information System Prime Mission Product Release/Increment X			
		Custom Application Software 1..n		
			Subsystem Hardware	
			Subsystem Software CSCI (1...n)	
			Subsystem Software Integration, Assembly, Test and Checkout	
		Enterprise Service Element 1..n		
			Enterprise Service Element Hardware	
			Enterprise Service Element Software CSCI (1...n)	
			Enterprise Service Element Integration, Assembly, Test and checkout	
		Enterprise Information System 1..n		
			Business Area Hardware	
			Business Area Software CSCI (1..n)	
			Business Area Integration, Assembly, Test and checkout	
		External System Interface Development 1..n		
			External System Interface Hardware	
			External System Interface Software CSCI (1..n)	
			External System Interface Integration, Assembly, Test and checkout	
		System Level Integration		

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Mil Std 881 AIS WBS (cont'd)

Level 1	Level 2	Level 3	Level 4	Level 5
	System Engineering			
	Program Management			
	Acquisition Logistics			
	System Test and Evaluation			
		Development Test and Evaluation		
		Operational Test and Evaluation		
		Mock-ups/System Integration Labs (SILs)		
		Test and Evaluation Support		
		Test Facilities		
	Training			
		Equipment		
		Services		
		Facilities		
	Data			
		Technical Publications		
		Engineering Data		
		Management Data		
		Support Data		
		Data Depository		
	Peculiar Support Equipment			
		Test and Measurement Equipment		
		Support and Handling Equipment		
	Common Support Equipment			
		Test and Measurement Equipment		
		Support and Handling Equipment		

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Mil Std 881 AIS WBS (cont'd)

Level 1	Level 2	Level 3	Level 4	Level 5
	Operational/Site Activation			
		Site Type		
			Deployment Software and Hardware	
			Site Activation	
			User Training	
			Data Migration	
			Management/Engineering Support	
			Interim Logistics Support	
				Systems Engineering/Program Management
				System Operations / Sustaining Engineering
				Help Desk
				System Database Administration
				Deployment Hardware/Software Refresh
				Software Maintenance,
				Follow on Training
				Accreditation
				Independent Verification and Validation
				Systems Engineering/Program Management
	Industrial Facilities			
		Construction/Conversion/Expansion		
		Equipment Acquisition or Modernization		
		Maintenance (Industrial Facilities)		
	Initial Spares and Repair Parts			