



Cost Management Implementation

U.S. Army PEO STRI

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- **Who** - PEO STRI Overview
- **Why** - Improving Software Cost Estimates
- **How** – Cost Management Implementation Detail





U.S. ARMY

PEO STRI

Major General Jonathan A. Maddux

Program Executive Officer for Simulation,
Training, and Instrumentation (PEO STRI)

United States
Department of the Army



PEO STRI

PROGRAM EXECUTIVE OFFICER



U.S. Army Acquisition Structure

As of 9/13/13

**Office of the Assistant Secretary
of the Army
(Acquisition, Logistics and Technology)**

Vacant
Special Assistant to the
AAE SAAL-ZA



Hon. Heidi Shyu
ASA(ALT)
AAE & SPE
SAAL-ZA



LTG Raymond
Mason *
Deputy Chief of Staff
G-4 Logistics



LTG Susan
Lawrence *
Chief Information
Officer G-6

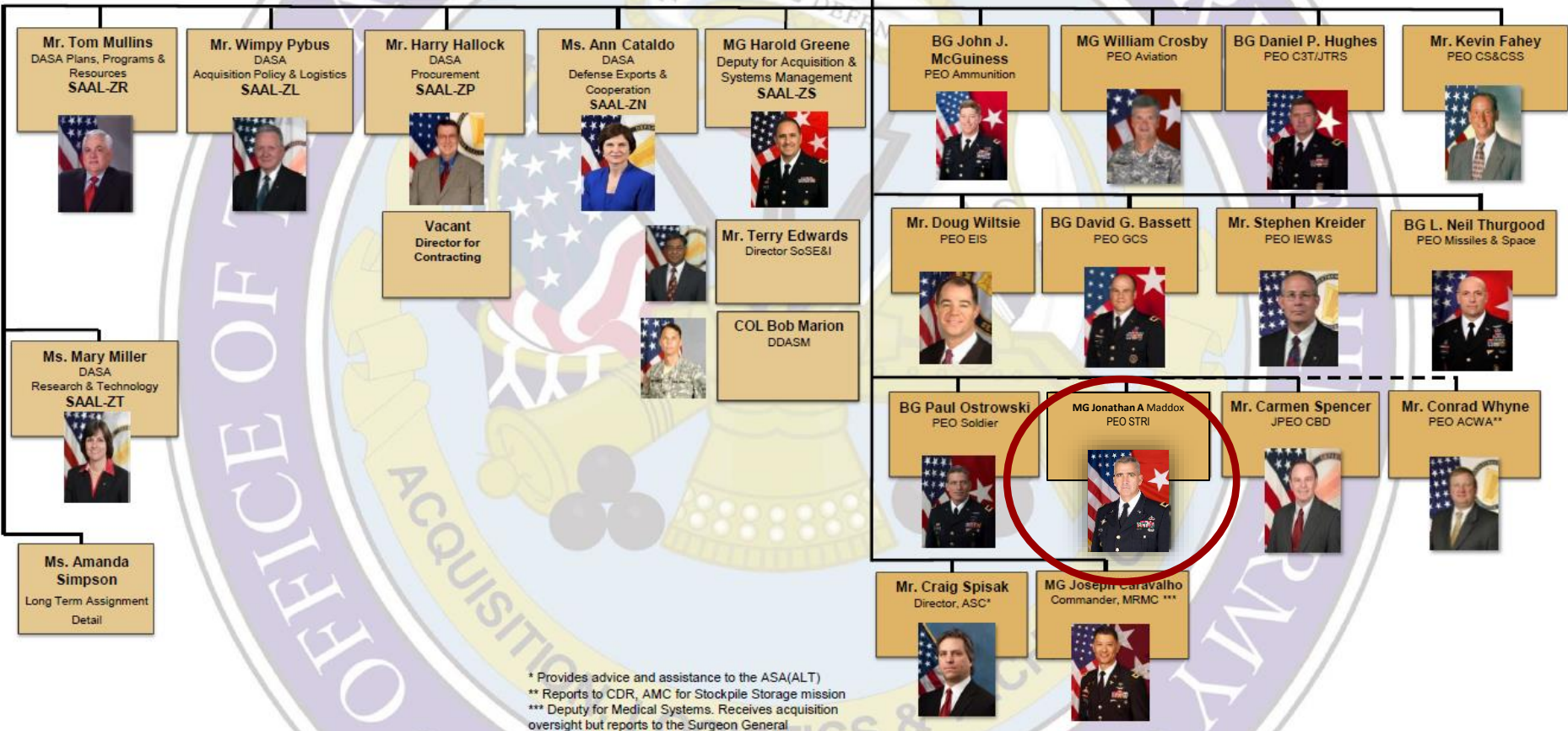


Mr. Gabriel
Camarillo
Principal Deputy
SAAL-ZX



LTG William
Phillips
Principal Mil Dep
DACM CIO
SAAL-ZB

Vacant
Asst to the Principal Military
Deputy



* Provides advice and assistance to the ASA(ALT)
 ** Reports to CDR, AMC for Stockpile Storage mission
 *** Deputy for Medical Systems. Receives acquisition oversight but reports to the Surgeon General

“WHEN AND WHERE”

- **Army Training Inventory**

- 335,000 training devices located at over 600 sites worldwide
- Sustained by 7,000 people
- Valued at \$3.9B



- **Headquartered in Orlando, FL**

- Redstone Arsenal, AL
- Fort Bliss, TX
- Fort Huachuca, AZ.

- **Field OPS operates 24/7 around the world – “the sun never sets on their support”**

- **1618 contracts valued at more than \$21.9 billion**

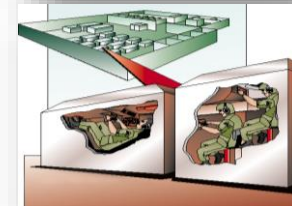
- **HQ Orlando, FL; Redstone Arsenal, AL; Fort Bliss, TX; Fort Huachuca, AZ.**

WHY SIMULATION?

Simulation Is Safe, Saves Time, Money, Fuel and the Environment



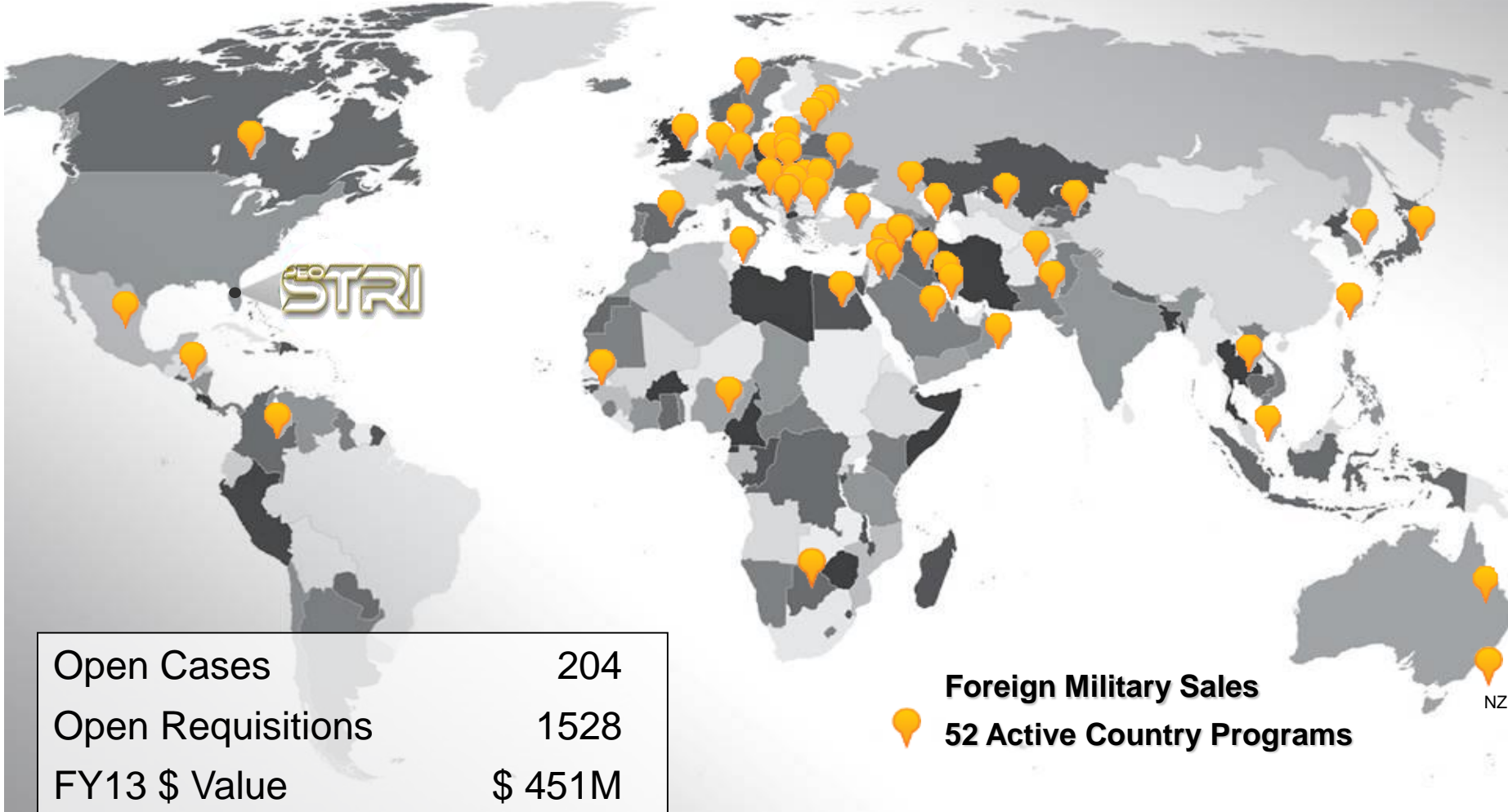
- Safety – less training injuries
- Minor Fuel Needs
- No Ammo Required
- Limits Environmental Impact
 - Air Pollution
 - Noise Pollution
 - Terrain Damage
- Inexpensive to Operate



Simulation Enhances Live Training

Approved for public release; distribution is unlimited.

Foreign Military Sales - Across the World



Open Cases	204
Open Requisitions	1528
FY13 \$ Value	\$ 451M
Total Value	\$2.11B

 **Foreign Military Sales**
52 Active Country Programs

Approved for public release; distribution is unlimited.

- **The Situation: No Data.**
 - No process in place to collect data
 - No official requirement to collect data
 - No authoritative database with project data to support estimation.
 - Estimates presented to ODASA-CE are asked, “Where is the supporting data?”
- **The Problem:** ODASA CE adds a cost “plus up” (growth factor) from 30% to 60% for software cost estimates that are not informed by actual data from the past.
- **The Implications:** Program(s) become unaffordable.
 - Less budget available for other PEO STRI programs
 - Less scope for the program being estimated (OneSAF)
 - Contractors perform to budget available

Approved for public release; distribution is unlimited.

■ The Need

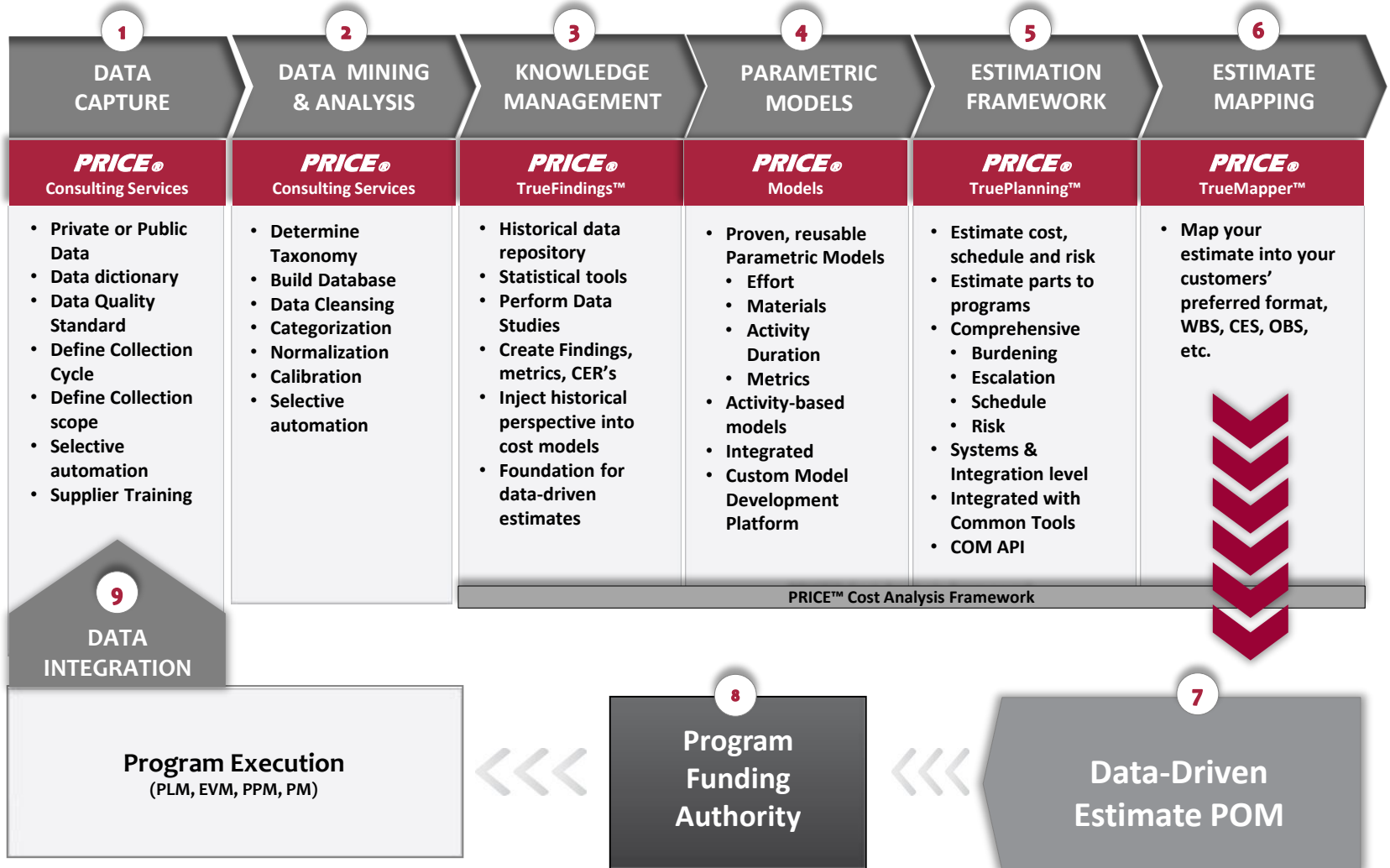
- Significantly reduce growth factors in software cost. (PEO STRI)
- A repeatable process for collecting the data required to defend estimates to oversight organization(s)

■ The Payoff

- Improved AFFORDABILITY of software-intensive programs.
- More delivered CAPABILITY; eliminate arbitrary growth factors.
- Decreased CYCLE TIME to develop software cost estimates enabling more analysis
- DEFENDABLE and CREDIBLE software cost estimates
- Improved organizational ability to defend estimates
- Better foundation for cost management

THE SOLUTION.

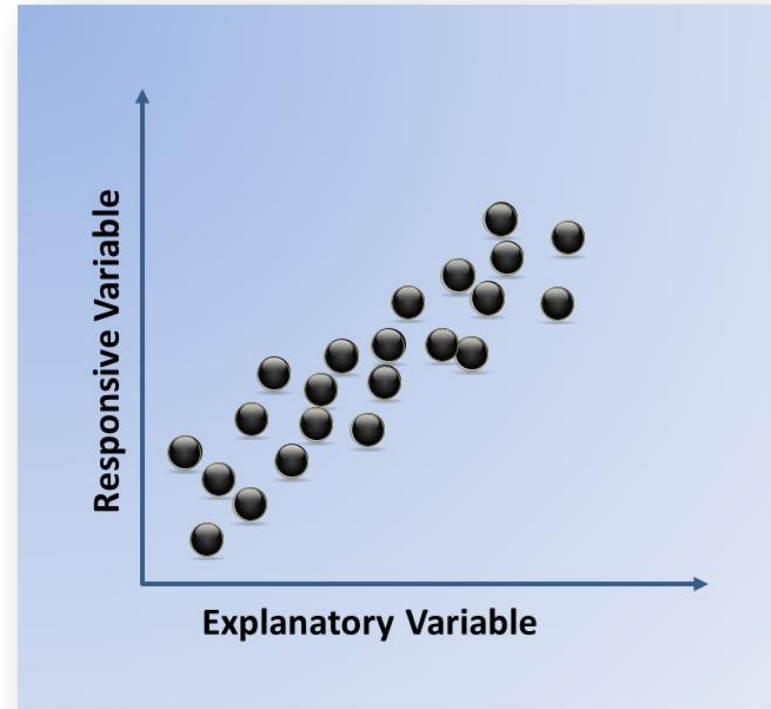
Data-Driven Estimation.



Data Driven Estimation

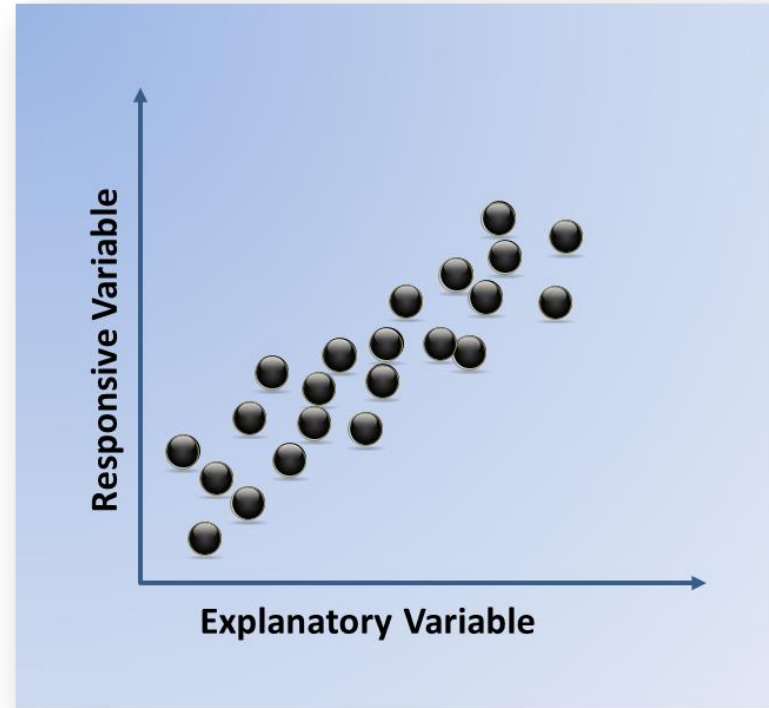
“Data-driven” estimation **IS...**

- Not a new idea – just a increased focus on what’s behind an estimate
- More credible and lends a sense of defendability to any estimate



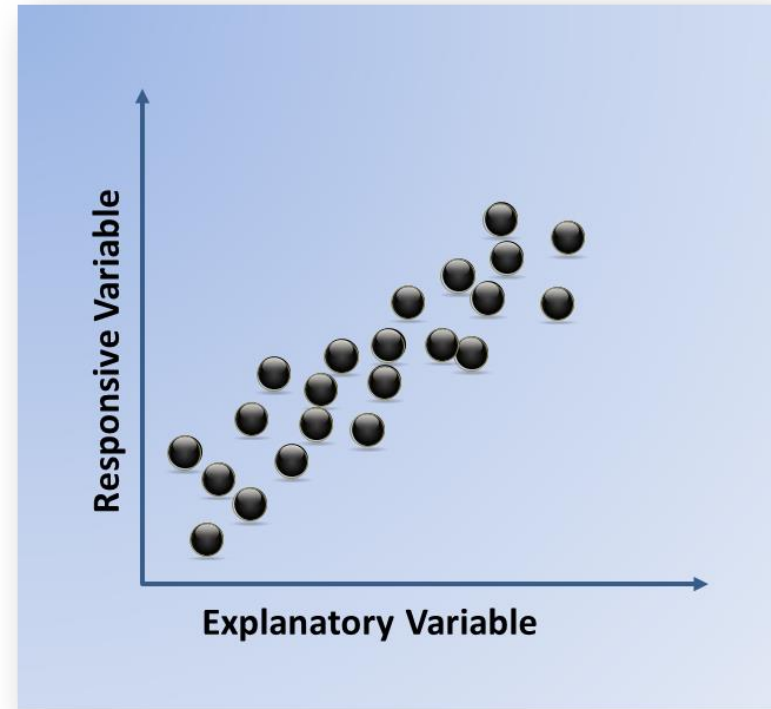
A “data-driven” estimate **MAY BE...**

- Based on data extrapolation from analogous systems
- Based on a model using analogous systems to determine model inputs
- Based on a model calibrated to historical data

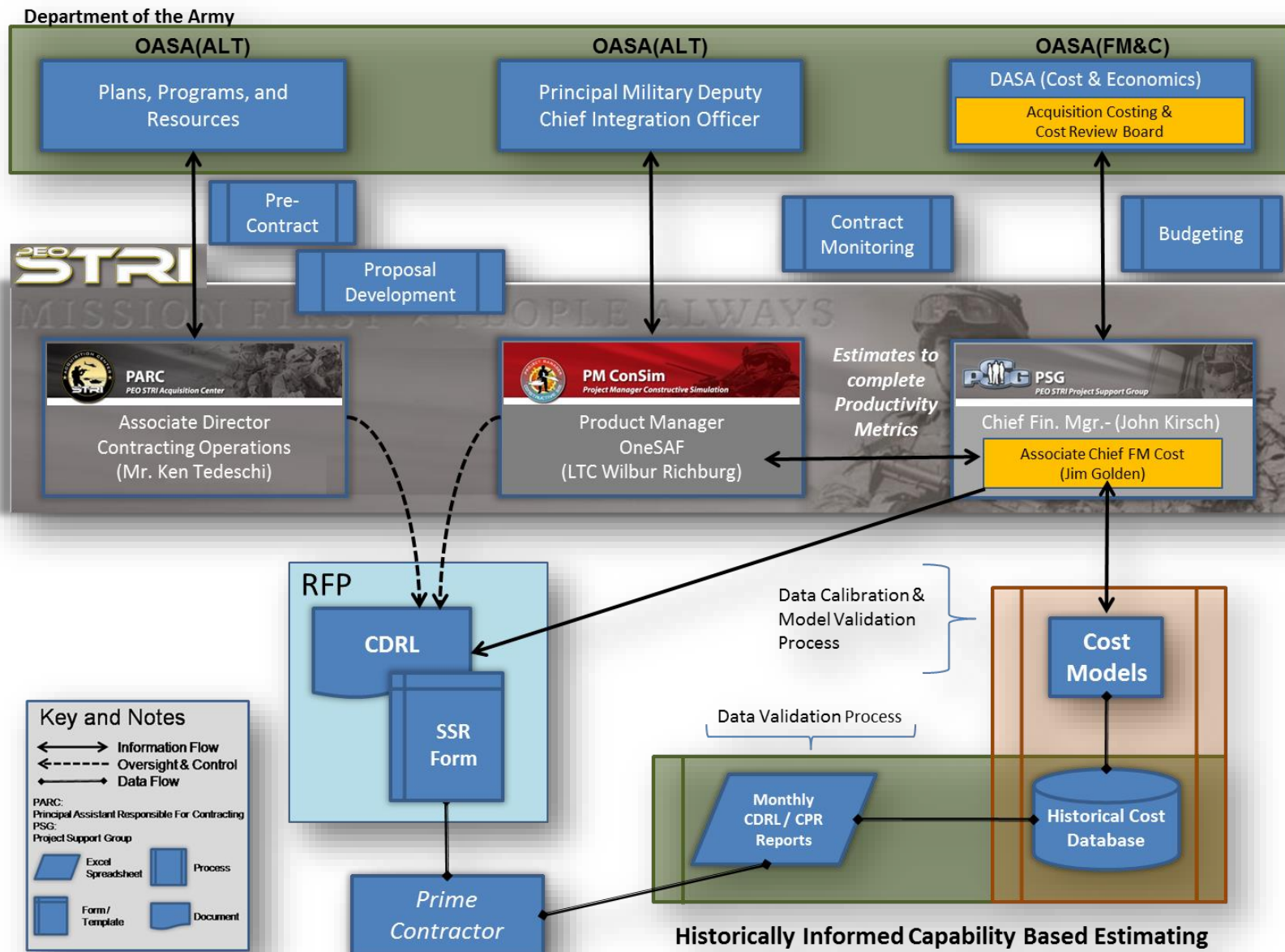


A “data-driven” estimate **MUST BE...**

- **Transparent** as to what data was used
- Obtained from a **credible, identifiable source**
- Clear about **how** that data was used

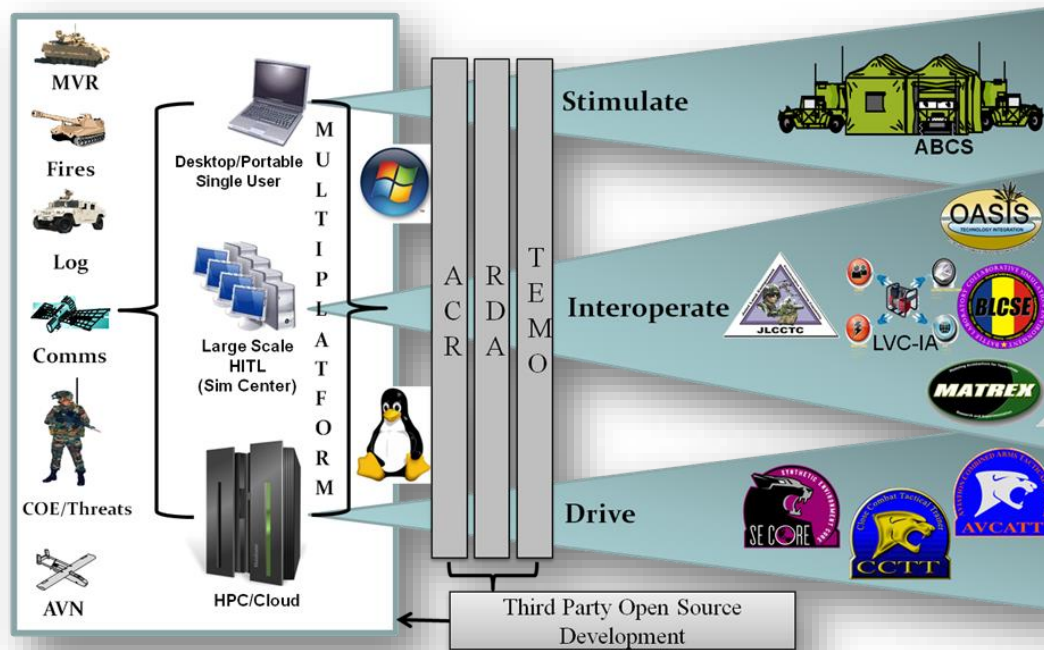


PEO STRI Strategy



What Is OneSAF?

- OneSAF is a “composable,” next generation computer generated forces simulation that represents a full range of operations, systems, and control processes from an individual combatant and platform to brigade level



OneSAF Characteristics

- One large, complex, open source development program
- Two contractors
 - A - Exclusively Capability development
 - B - Primarily integration and some capability development
- Design Complexity
 - Huge amount of reused code
 - Multiple languages per single capability
 - Open source system with allied government handovers
 - Agile development environment – 10 week sprints



- Minimize the impact to the government program office
- Minimize the impact to the contractors
- Ensure repeatability process
- Ensure consistency of the data
- Ensure the data collected is not in a proprietary format
- Future estimates will be developed with TruePlanning, but could be with other solutions.
- Don't design a "point solution." The solution should be in large part re-usable across programs, PEO's and/or Departments.

Data Capture - Overview

- **Integrated Product Team (IPT) developed**
 - PRICE, Vendor A, Vendor B, PEO STRI, PM CONSIM
 - Process of growth and trust
 - Excellent collaboration
- **Data Item Dictionary (DID)**
 - What data to collect
 - How often to collect it
 - A clear understanding of the data and potential uses
 - How to align project specific data to more general categories (across multiple contractors)
- **Software Resource Report (SRR)**
- **Requirement added to Contract Deliverable Requirements List (CDRL) making data collection a contractor requirement**

- Private or Public Data
- Data dictionary
- Data Quality Standard
- Define Collection Cycle
- Define Collection scope
- Selective automation
- Supplier Training

Data Capture - Overview

- **Semi-automated Excel Workbook**
 - Skill hours (Resource Effort) from the contractor reporting system
 - Provided to the program office by contractors and summarized into consolidated report
- **USC CodeCount[®]**
 - SLOC count based on logical lines of code as defined by the University of Southern California (USC) Code Counting Tool
 - Code counts are automated using the USC Code Counting Tool and a PRICE Systems provided Excel-based Companion App
- **Collection of the appropriate amount of data necessary to provide defensible cost estimates based on historical data**
- **Identify and validate the collection process**
 - DRAFT SRR presented to IPT and **worked together** to minimize impact and maximize quality

- Private or Public Data
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Data Capture – Software Resources Report

- Software Resources Report developed to integrate and aligned with output of code counting tool and automate activity & resource mapping processes
- Global Inputs (Program & Organization)
 - 1.1. Release context and development organization
 - 1.2 Product Release and Development Description
 - 1.3 Activity and Resource Mapping
 - 1.4 POC Information
- Build Report Template
 - 2.1 Build ID Information
 - 2.2 Product Build Description
 - 2.3 Development Resources
 - 2.4 Requirement Reporting
 - 2.5 Product Size Reporting
 - 2.6 POC Information

SECTION 2.5.1 Requirement Name	Capability	SECTION 2.5.2 Standardized Capability Name	SECTION 2.5.3 Language	SECTION 2.5.4 % Auto Generated	SECTION 2.5.5 New Code	SECTION 2.5.6 Deleted Code	SECTION 2.5.7 Modified Code	SECTION 2.5.8 Unmodified Cod
CR 65774 Reduced System Footprint - SCAMT Multiple Applications on Single Node	Complex Capability	Complex Capability	Java		1,891	3,740	628	2,492.45
CR 65774 Reduced System Footprint - SCAMT Multiple Applications on Single Node	Complex Capability	Complex Capability	XML		63	36	36	8,242.06
CR 67136 Crowd Formation	Moderate Capability	Moderate Capability	Java		978	-	-	2,499.44
CR 67136 Crowd Formation	Moderate Capability	Moderate Capability	XML		779	-	-	8,208.57
CR 67136 Crowd Formation	Moderate Capability	Moderate Capability	XLS File		121	-	-	815.75
CR 67136 Crowd Formation	Moderate Capability	Moderate Capability	CSV file		7	-	-	276.97
CR 67154 Dynamic UHRB Aperture	Complex Capability	Complex Capability	C++		12	41	34	673.8

- Private or Public Data
- Data dictionary
- Data Quality Standard
- Define Collection Cycle
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Data Capture - Automation

- Creation of **automated** code counting solution by wrapping USC's Code Counting tool with Excel
- Unified Code Count (UCC)
 - Free code counting tool developed by University of Southern California Center for Software Excellence (USC-CSE)
 - Implements popular code counting standards
 - Supports over 21 software languages and performs source differencing
 - **Key to identify new, deleted, modified and reused code base by capability by language.**

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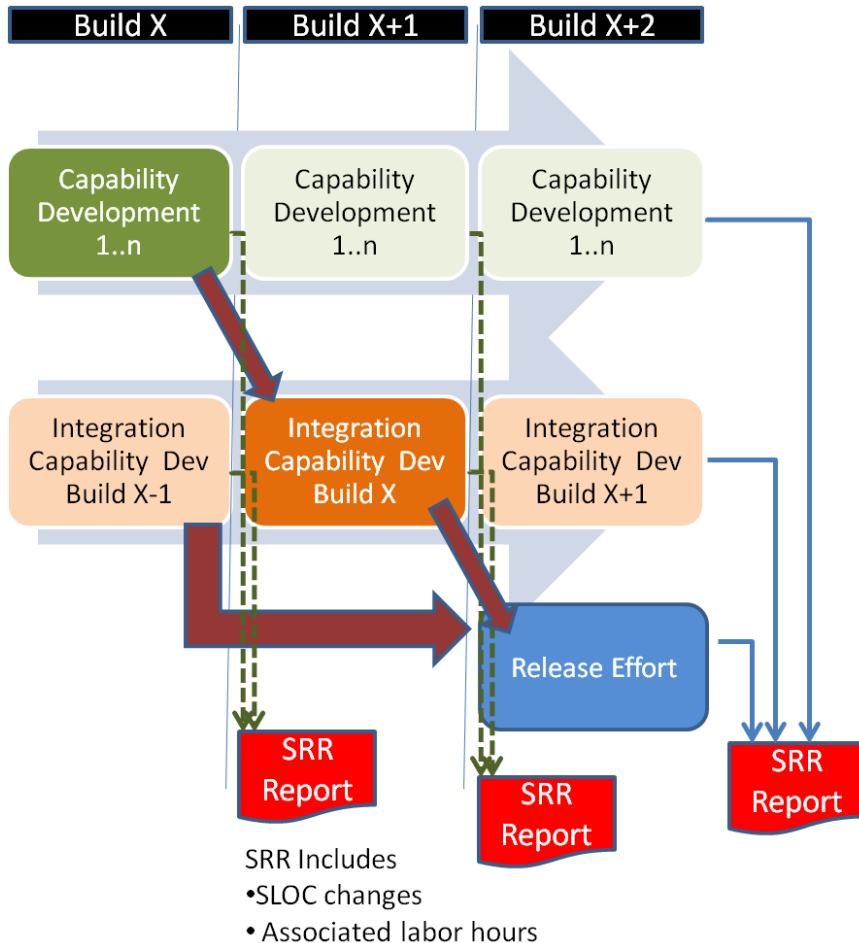
greggles@biff: ~/funtimes
File Edit View Terminal Help
greggles@biff:~/funtimes$ ohcount -s custom/
Examining 137 file(s)

Ohloh Line Count Summary

Language      Files      Code      Comment  Comment %  Blank      Total
-----
php            53      12315      5386      30.4%      1217      18918
javascript    18       1089       169       13.4%       273       1531
css            4         548        37        6.3%       129        714
html          53         131         1         0.8%         3         135
-----
Total         128      14083      5593      28.4%      1622      21298
greggles@biff:~/funtimes$
    
```

Data Capture – Reporting Process

- Private or Public Data
- Data dictionary
- Data Quality Standard
- Define Collection Cycle
- Define Collection scope
- Selective automation
- Supplier Training



- Frequency
 - 10-12 weeks
- Data collection
 - Three “lanes”
 - Capability Development
 - Integration and Test
 - Release
- Allows for segregation of effort to indicate productivity levels

Step 2 – Data Mining & Analysis

- Taxonomy included metadata to align with PRICE[®] Software Model
 - Program attributes
 - Organization attributes
 - Development team attributes
- Development Effort captured by Activity and Resource
- Normalization guidelines developed & applied
- TruePlanning[®] Calibration Companion helps
 - Automate some of the normalization and calibration of the data
 - Ensure consistency in the process
 - Organizational Productivity
 - Functional Complexity by capability by language
- Clear and concise documentation of the cost research process ensures that the process is transferrable and repeatable process.

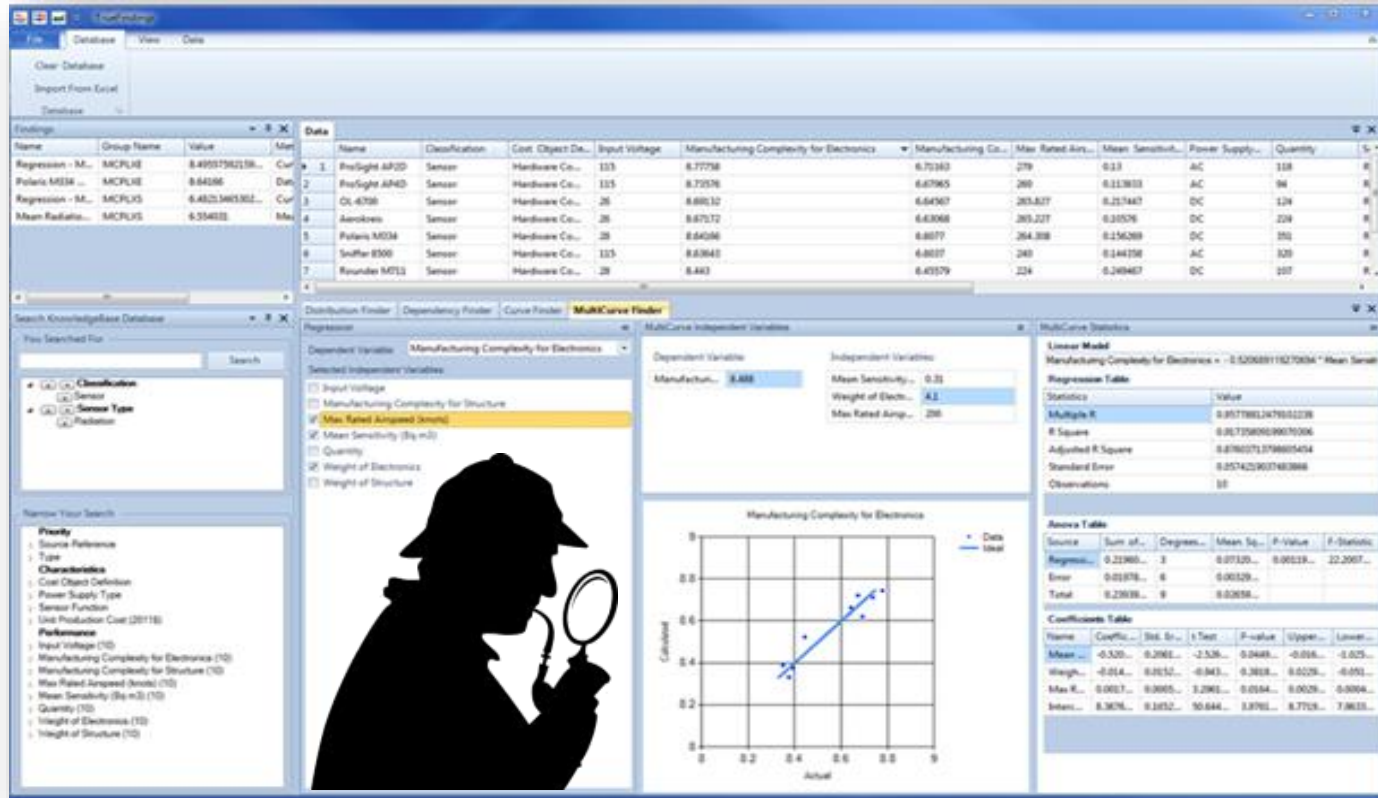


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DATA MINING & ANALYSIS

PRICE[®]
Consulting Services

- Determine Taxonomy
- Build Database
- Data Cleansing
- Categorization
- Normalization
- Calibration
- Selective automation

Data Becomes Knowledge (Management)



- Historical data repository
- Statistical tools
- Perform Data Studies
- Create Findings, metrics, CER's
- Inject historical perspective into cost models
- Foundation for data-driven estimates

TrueFindings®

- Import the calibrated inputs into TrueFindings®
- Drive input values using the “findings” from TrueFindings™ inside TruePlanning® to create defensible estimates.

Step 4 – Produce Estimates with Calibrated Data

5

ESTIMATION
FRAMEWORK

PRICE®
TruePlanning™

- Estimate cost, schedule and risk
- Estimate parts to programs
- Comprehensive
 - Burdening
 - Escalation
 - Schedule
 - Risk
- Systems & Integration level
- Integrated with Common Tools
- COM API

PRICE TruePlanning 14.0 - [OneSAF Program Build 14 Estimate]

File Edit View Reports Tools Window Help

Product Breakdown Structure

Simple Detailed

OneSAF Program Build 14 Estimate

Build 14 Design, Integration and Test

Capability 1

Capability 2

Capability 3

Capability 4

Capability 5

Results

Cost Objects | Input Sheet | Attributes | Results | Metrics | Schedule | Risk Analysis

Build 14 Design, Integration and Test

Cost: \$11,956,622 100.00% Labor Requirement: 86,035.23 hours

Project Cost: \$11,956,622 Project Labor Requirement: 86,035.23 hours

Costs : Build 14 Design, Integration and Test - [Assembly] Currency in USD (\$) (as spent)	Total	Development
1 Build 14 Design, Integration and Test	2,217,536	2,217,536
2 Capability 1	1,526,691	1,526,691
3 Capability 2	5,237,002	5,237,002
4 Capability 3	299,271	299,271
5 Capability 4	99,304	99,304
6 Capability 5	2,576,817	2,576,817
7 Total	11,956,622	11,956,622

Chart: Build 14 Design, Integration and Test

Build 14 Design, Integration and Test

Cost: \$11,956,622 100.00% Labor Requirement: 86,035.23 hours

Project Cost: \$11,956,622 Project Labor Requirement: 86,035.23 hours

Cost Object	Costs
Capability 2	5,237,002
Capability 5	2,576,817
Build 14 Design, Integration and Test	11,956,622
Capability 1	1,526,691
Capability 3	299,271
Capability 4	99,304

Ready

Connected to: '(local)' as 'TruePlanningAdmin'

NUM

Step 4 – Contour Projects to FY Funding

5

ESTIMATION
FRAMEWORK

PRICE®
TruePlanning™

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- Estimate parts to programs
- Comprehensive
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PRICE TruePlanning 14.0 - [OneSAF Program Build 14 Estimate]

File Edit View Reports Tools Window Help

Product Breakdown Structure

Simple Detailed

1 OneSAF Program Build 14 Estimate

2 Build 14 Design, Integration and Test

3 Capability 1

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Results

Cost Objects Input Sheet Attributes Results Metrics Schedule Risk Analysis

OneSAF Program Build 14 Estimate

Cost: \$11,956,622 100.00% Labor Requirement: 86,035.23 hours

Project Cost: \$11,956,622 Project Labor Requirement: 86,035.23 hours

Costs : OneSAF Program Build 14 Estimate - [System Folder] Currency in USD (\$) (as spent)	Total	Development
1 Build 14 Design, Integration and Test	2,217,536	2,217,536
2 Capability 1	1,526,691	1,526,691
3 Capability 2	5,237,002	5,237,002
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Chart: OneSAF Program Build 14 Estimate

OneSAF Program Build 14 Estimate

Cost: \$11,956,622 100.00% Labor Requirement: 86,035.23 hours

Project Cost: \$11,956,622 Project Labor Requirement: 86,035.23 hours

Labor Requirements

Fiscal Year

Legend:

- Capability 5
- Capability 4
- Capability 3
- Capability 2
- Capability 1
- Build 14 Design, Integration and Test

Ready

Connected to: '(local)' as 'TruePlanningAdmin'

NUM

Step 5 – Map to Army Cost Budget Structure

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ESTIMATE
MAPPING

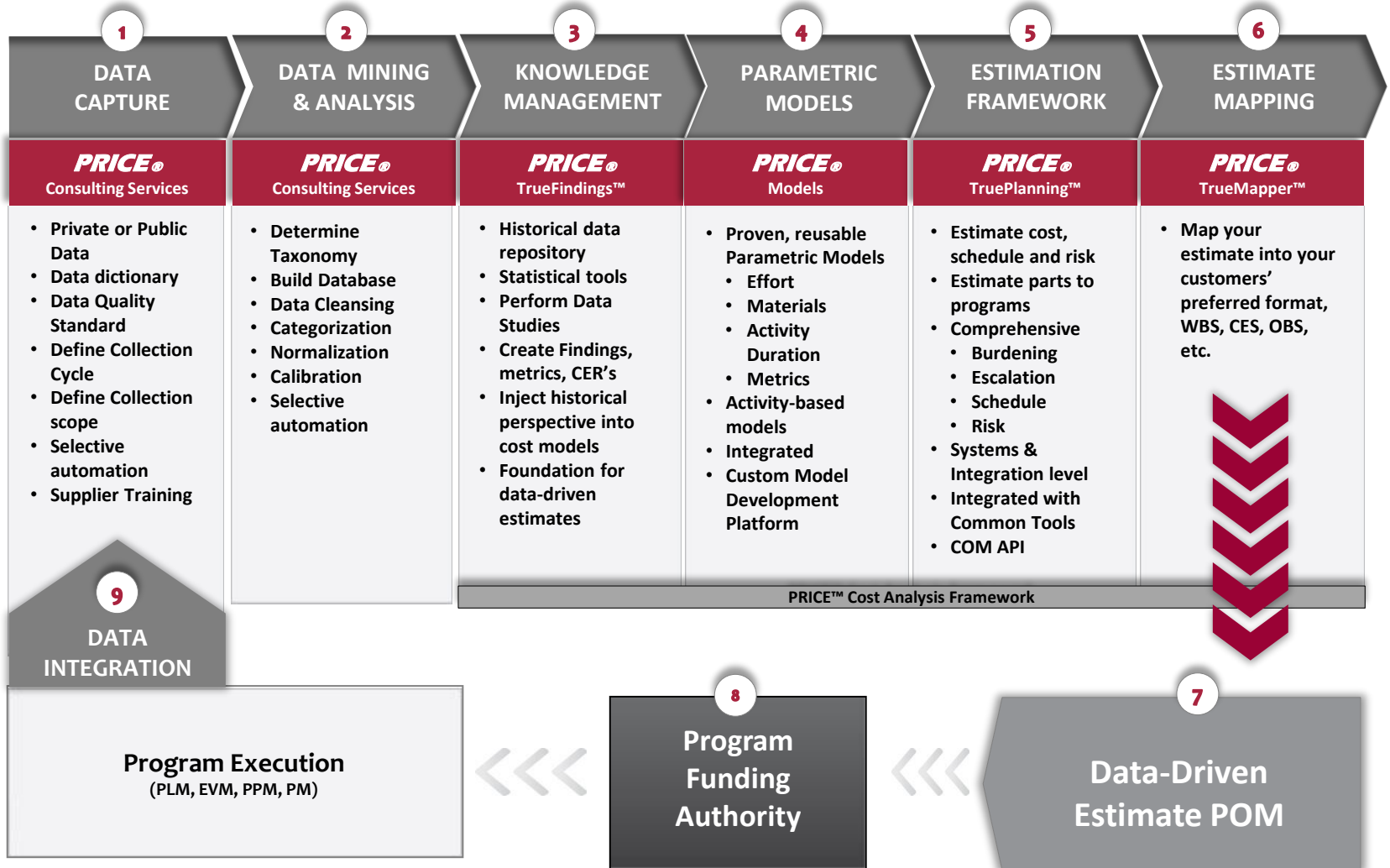
PRICE®
TrueMapper™

- Map your estimate into your customers' preferred format, WBS, CES, OBS, etc.

The screenshot shows the TruePlanning Mapper Assign* interface. On the left, under the 'Generic Activity' tab, is a tree view for 'OneSAF Program Build 14 Estimate'. It includes categories like 'Assembly', 'Software Component', and 'System', each with a list of sub-activities. On the right, under the 'Detailed Activity' tab, is a tree view for 'Wbs' (Work Breakdown Structure) with hierarchical levels from 1 to 2.11. A blue arrow points from the 'Software Component' category on the left to the '2.1 NON-RECURRING PROD' category on the right, indicating a mapping relationship.

THE SOLUTION.

PEO STRI has implemented data-driven estimation.



Keys to Success



- High level support & a motivated lead
- Collaboration & Teamwork
- Integrated Product Team (IPT)
 - **Transparency** builds Trust
(Entire team needs to understand motivation for data collection)
 - **Trust** enhances Communication
(Alleviate contractor concern about being ‘measured’ or misuse of data)
 - **Communication** allows Flexibility
(Negotiation of what can be collected)
 - **Flexibility** allows Consensus
(Facilitate determination of data collection targets)
 - **Consensus** provides opportunity to move forward
(Need buy-in from the data collectors)
- Automation for efficiency and consistency
- Making this a contractor deliverable requirement list (CDRL)

- **Qualitative Benefits:**

- **Compliance** – valid and reasonable software cost estimate
- **Quality** – standardized methodology across PEO STRI domains
- **Efficiency** – faster cycle time to gather data and estimate costs
- **Credibility** – defensible estimates based on historical data
- **Accuracy** – improved accuracy of cost estimates and funding requests
- Improved contractor software data collection process

■ Quantitative Benefits:

- Program cost savings of over \$90M indicated by pilot
 - *Across six years – life cycle usually full operational capability +20*
 - *Using only a 15% reduction in growth factor – actual reduction higher*
 - *Pilot looked at only eight software-intensive programs*
- Cost savings on program life cycle costs significantly reduced
- Cost savings can be reinvested in new technology and to reduce funding requests
- Revenue generation increases as PEO STRI lowers cost to take on more work
- Effective measurement of the productivity of contractors' software development efforts for future pricing/cost estimates.

- The need for data driven estimation is driving many organizations to look for new ways to collect and leverage data
- Data driven estimation is really nothing new – we have been using data (real or experiential) to justify our estimates forever. The new requirement is **transparency and openness** about the data and how it is being used.
- To support this effort organizations need to establish **formal processes** for collecting and managing their project data.
 - CDRL, Data Collection Form with Definitions (Software Resources Report)
 - Standard Code Counting Capability (USC CodeCount®)
 - Standard Estimating Tool (PRICE TruePlanning®)
- When doing this it is important to understand the importance of
 - Team Building
 - Communication
 - Transparency
 - Automation
 - Flexibility





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