Introduction to DoD's Official Cost & Software Data for Estimating Weapon Systems and MAIS Programs

http://dcarc.pae.osd.mil ● (703) 601-4850 ● DCARC@osd.mil

Robert.Currie.CTR@OSD.MIL (703) 601-4850, X153

Agenda

1. What is the Defense Cost and Resource Center (DCARC)?
2. What are CSDRs?
3. Why are they useful?
4. How can you use them?
5. How do you get them?

Defense Cost & Resource Center (DCARC)

1. *My name is Rob Currie, lead DCARC instructor for CSDRs*
2. *Who we are*
   - *A functional organization within the CAPE*
3. *Our Mission*
   - To collect MDAP and MAIS cost and software resource data and make those data available to DoD cost analysts
4. *Our Organization*
   - *Acting Director- Mr. Mike Augustus*
   - *Technical Support- Technomics, Inc.*
   - *Information Systems Support- Tecolote Research, Inc.*
5. *Primary Responsibilities*
   - *Manage the CSDR System*
   - *Ensure compliance with the CSDR requirement*
   - *Outreach & Training*
   - *CSDR Validations & Plan Development Assistance*

Important Terms

1. *ACAT- Acquisition Category*
    1. *1C- Head of DOD Component*
    2. *1D- USD(AT&L) decision authority*
    3. *1AM- USD(AT&L) or designee*
    4. *1AC- Head of DoD Component*
2. *CAPE- Cost Assessment and Program Evaluation*
3. *CBDR- Contractor Business Data Report*
4. *CCDR- Contractor Cost Data Report*
5. *CDSR- Cost Data Summary Report*
6. *CPR- Contract Performance Report*
7. *CSDR- Cost & Software Data Report*
8. *DACIMS- Defense Automated Cost Information Management System*
9. *DCARC- Defense Cost & Resource Center*
10. *FCHR- Functional Cost Hour Report*
11. *FFRDC- Federally Funded Research Development Center*
12. *MAIS- Major Automated Information System*
13. *MDA- Milestone Decision Authority*
14. *MDAP- Major Defense Acquisition Program*
15. MIL-HDBK-881A- Military Handbook Work Breakdown Structure
16. *OSD – Office of the Secretary of Defense*
17. *SRDR- Software Resource Data Report*
18. *WBS- Work Breakdown Structure*

Cost Analysis Data Sources

1. Return cost data (i.e., actuals)
   - Internal contractor accounting records
   - Deliverable contractor cost reports
     - ✓ Cost Performance Report (CPR)
     - ✓ Cost/Schedule Status Report
     - ✓ Cost & Software Data Reports (CSDRs)
2. Contract line item data (i.e., CLIN or Schedule B prices)
3. Historical obligation data (i.e., historical budgets)
4. Proposal data (i.e., bids, vendor quotes, etc.)

CSDR data is the best data for estimating DoD programs

What is a CSDR

- Contractor Cost Data Reports
  - ✓ Provide standardized cost and hours information across programs
  - ✓ Provide recurring/non-recurring split by Work Breakdown Structure element
  - ✓ Provide plan-wide direct and indirect resource data per contractor facility
  - ✓ Provide CWBS Dictionary
  - ✓ Will soon provide contractor logistics support cost data
- Software Resources Data Reports
  - ✓ Provide software information across programs
  - ✓ Provide size, effort, schedule, and other descriptive development data

CSDR = CCDR + SRDR

CCDR

DD 1921
Cost Data Summary Report

- Displays ALL applicable WBS elements
- Recurring & Nonrecurring costs for each WBS
- Contract totals
- UB, MR, G&A, and Fee

CCDR Forms

DD 1921-1
Functional Cost-Hour Report

- Select WBS elements
- Recurring & Nonrecurring
- Detailed breakout of all resource data
  - Labor hours
  - Labor dollars
  - Material dollars
  - Overhead dollars
- Reporting by all Functions
  - Engineering
  - Tooling
  - Quality Control
  - Manufacturing

DD 1921-2
Progress Curve Report

- Select WBS elements
- Unit-by-Unit or Lot-by-lot
- Recurring only
- Detailed breakout of select resource data
  - Labor hours
  - Labor dollars
  - Material dollars
- Three Functions
  - Quality Control
  - Manufacturing
  - Engineering

Please see DCARC website for detail descriptions of these forms; http://dcarc.pae.osd.mil/default.aspx

CCDR

DD 1921-3
Contractor Business Data Report

- Provides for one Report per contractor site
- Covers all DoD business
- Direct Costs by Program
- Indirect Cost Categories
- Facility-wide specifics
- Direct labor rates (Functional Categories)
- Total FPR Unit Revenue (Sales)
- Organization Changes
- Accounting Changes
- Remarks

Please see DCARC website for a detail description of this form; http://dcarc.pae.osd.mil/default.aspx

SRDR

1. SRDR formalizes contractor reporting of software development/upgrade metric data and consists of:
   - Data Reports
   - Data Dictionary

2. SRDR records both the **expectations** and **actual results** of new software developments or upgrades

SRDR

- Program Name
- Contractor
- Event (Initial, build, final)
- Contract number
- CMM/CMMI Rating
- Primary/secondary application
- GOTS/COTS used
- Personnel experience
- Peak Staff size
- Primary and secondary language
- Internal and external requirements count
- Requirements volatility
- New, modified, reuse code counts
- Counting method – logical/physical/other
- Start Month, End Month, Hours
  - Requirements Analysis
  - Architecture
  - Coding and testing
  - System testing
  - Qualification testing
  - SW Develop T&E
- Other Hours

Takeaways
1. SRDR reports are not prescriptive in format or content.
2. We accept contractor native formats as long as the data content captures these elements.

The benefits of CSDR Data

1. Return cost data (i.e. actuals)
   - Data from completed development and production contracts for ACAT 1 Programs
2. Data fields that facilitate rigorous cost analysis
   - Visibility that enables understanding
3. Comparability
   - CSDR process is designed to maximize consistency of data across companies, services, weapon systems types and programs

Comparability

1. DoD Handbook MIL-HDBK-881A "Work Breakdown Structures for Defense Materiel Items":
   - Aircraft, Appendix A
   - Electronic/Automated Software Systems (E/ASS), Appendix B
   - Missile Systems, Appendix C
   - Ordnance Systems, Appendix D
   - Sea Systems, Appendix E
   - Space Systems, Appendix F
   - Surface Vehicle Systems, Appendix G
   - Unmanned Air Vehicle Systems, Appendix H
2. MIL-HDBK-881A is currently being updated to a MIL-STD-881A

WBS standardization fosters comparability of data across companies, weapon system commodity groups, and major subassemblies

CSDRs vs other return cost data

1. CSDRs vs CPRs
   - CPRs typically (& understandably) report costs according to either a process or organizational structure that is program/contract specific
     - ✓ Facilitates program/contract management
     - ✓ Does not facilitate cross-program/contract cost analysis
     - ✓ OSD AT&L Policy Memorandum states that the CPR, CSDR and IMS should share a "common WBS" but this is not happening DoD wide
   - CPRs generally do not identify nonrecurring vs. recurring costs

2. CSDRs vs. internal contractor accounting records
   - Internal accounting records typically report costs according to a structure that does not facilitate cross-program/contract cost analysis

Cost data that is organized according to a standard, end-item product oriented WBS is highly desirable

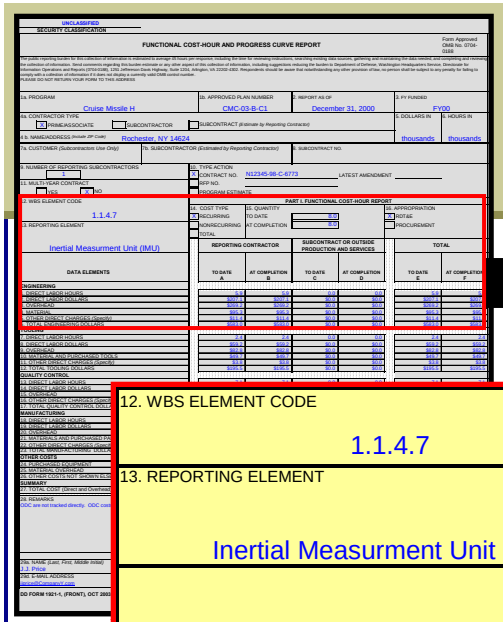
Data Application Examples

Estimating Hardware Engineering Design Cost

Enhancing DoD Cost Analysis

Estimating Hardware Engineering Design Cost

Parametric Approach example (p. 1 of 3)



12. WBS ELEMENT CODE: 1.1.4.7

13. REPORTING ELEMENT: Inertial Measurment Unit (IMU)

PART I. FUNCTIONAL COST-HOUR

14. COST TYPE: [ ] RECURRING [X] NONRECURRING [ ] TOTAL

15. QUANTITY: TO DATE 8.0; AT COMPLETION 8.0

DATA ELEMENTS	REPORTING CONTRACTOR TO DATE A	REPORTING CONTRACTOR AT COMPLETION B	SUBCONTRACT OR OUTSIDE PRODUCTION AND SERVICES TO DATE C	SUBCONTRACT OR OUTSIDE PRODUCTION AND SERVICES AT COMPLETION D	TOTAL TO DATE E	TOTAL AT COMPLETION F
ENGINEERING						
1. DIRECT LABOR HOURS	5.9	5.9	0.0	0.0	5.9	5.9
2. DIRECT LABOR DOLLARS	$207.1	$207.1	$0.0	$0.0	$207.1	$207.1
3. OVERHEAD	$269.2	$269.2	$0.0	$0.0	$269.2	$269.2
4. MATERIAL	$95.3	$95.3	$0.0	$0.0	$95.3	$95.3
5. OTHER DIRECT CHARGES *(Specify)*	$11.4	$11.4	$0.0	$0.0	$11.4	$11.4
6. TOTAL ENGINEERING DOLLARS	$583.0	$583.0	$0.0	$0.0	$583.0	$583.0

Hours data taken from Program A and pooled with several other programs to build a normalized, standardized dataset

- Analysis conducted to reveal correlation between NR Engineering Hours and physical, performance, programmatic characteristics.

- Develop estimating relationship used to project NR Engineering hours for a ***DIFFERENT*** IMU.

$$\text{NR Engr Hrs} = \alpha \times (\text{Bias}^{\beta_1}) \times (\text{Vol}^{\beta_2}) \times (\text{Sched}^{\beta_3})$$

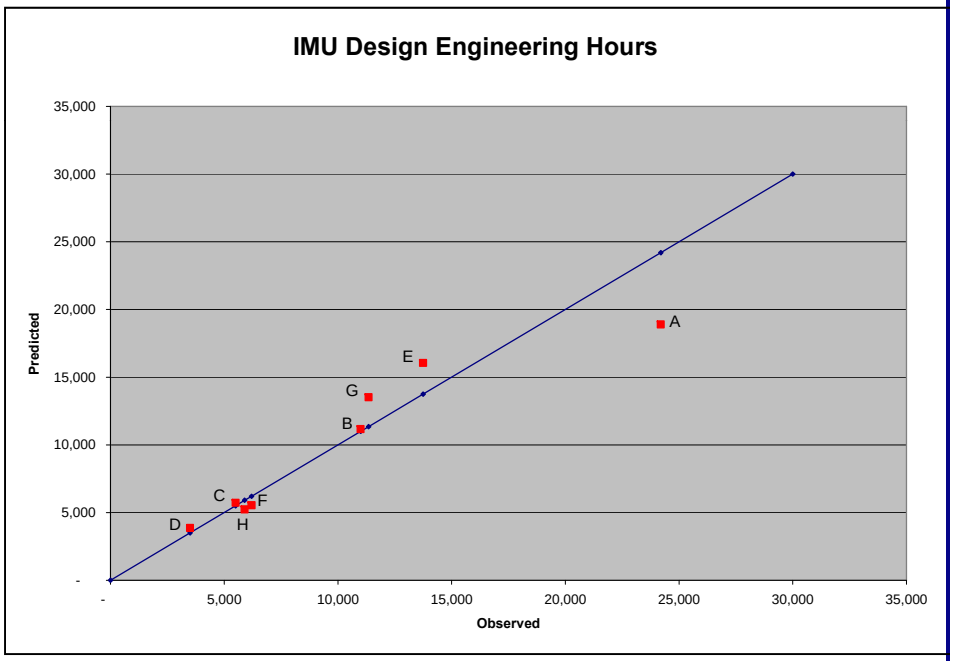
Inertial Measurement Unit	Nonrecurring Engineering Hours	Bias	Volume	Schedule
Program A				
B				
C				
D				
E				
F				
G				
H	5,900			

Estimating Hardware Engineering Design Cost

Parametric Approach example (p. 2 of 3)

$$\text{Engineering Hours} = 46.5 * (\text{Bias})^{-0.47} * (\text{Volume})^{0.43} * (\text{Schedule})^{1.12}$$

	Inertial Measurement Unit			
	Nonrecurring Engineering Hours	Bias (degrees)	Volume (cu. cm.)	Schedule (months)
Program A	24,200	1	30	54
B	11,000	2	40	40
C	5,500	2.5	20	32
D	3,500	10	30	34
E	13,750	1	28	48
F	6,200	2	30	24
G	11,350	1	30	40
H	5,900	5	25	36



Data pulled from programmatic and schedule documents

Data pulled from technical documents

Data pulled from CCDR DD Form 1921-1Functional Cost-Hour Report

Estimating Hardware Engineering Design Cost

Parametric Approach example (p.3 of 3)

$$\text{Engineering Hours} = 46.5 * (\text{Bias})^{-0.47} * (\text{Volume})^{0.43} * (\text{Schedule})^{1.12}$$

	Inertial Measurement Unit			
	Nonrecurring Engineering Hours	Bias (degrees)	Volume (cu. cm.)	Schedule (months)
Generic Supersonic Cruise Missile X	12,205	1	24	40
	estimate			

12,205	hrs
$40	engineering labor rate
$488,216	direct engineering labor dollars
115%	engineering overhead rate
$561,449	engineering overhead dollars
$120,000	material dollars
$46,787	ODC dollars
$1,216,451	Total Engineering dollars

Estimating Manufacturing Hours

Estimating Manufacturing Hours

example (p. 1 of 3)

UNCLASSIFIED

SECURITY CLASSIFICATION

Progress Curve Report

1. WBS ELEMENT CODE 1.1.3 — UNIT TOTAL OR — X LOT TOTAL OR

2. REPORTING ELEMENT Airframe — UNIT AVERAGE — LOT AVERAGE

DATA ELEMENTS	COMPLETED UNITS/LOTS A 1	2	3	4	WORK-IN-PROCESS (WIP) B	TO COMPLETE C
1. MODEL AND SERIES						
2. FIRST UNIT OF LOT/WIP UNITS	1	11	21	31	na	na
3. LAST UNIT OF LOT	10	20	30	40	na	na
4. CONCURRENT UNITS/LOTS	0	0	0	0	na	na
CHARACTERISTICS						
5.a Airframe weight	632	638	635	630		
5.b						
5.c						
PRIME CONTRACTOR						
6. DIRECT QUALITY CONTROL LABOR HOURS	1.3	1.0	0.9	0.8	na	
7. DIRECT MANUFACTURING LABOR HOURS	11.2	8.3	7.4	6.8	na	
8. TOTAL DIRECT LABOR HOURS	12.5	9.3	8.2	7.6	na	
9. DIRECT QUALITY CONTROL LABOR DOLLARS	$29.5	$21.9	$19.4	$18.0	na	
10. DIRECT MANUFACTURING LABOR DOLLARS	$223.3	$165.9	$147.1	$136.0	na	
11. TOTAL DIRECT LABOR DOLLARS	$252.7	$187.7	$166.5	$153.9	na	
12. RAW MATERIALS AND PURCHASED PARTS	$696.6	$517.5	$458.9	$424.3	na	
13. PURCHASED EQUIPMENT	$86.9	$64.5	$57.2	$52.9	na	
14. TOTAL DIRECT DOLLARS	$1,036.2	$769.7	$682.7	$631.2	na	
SUBCONTRACT/OUTSIDE PRODUCTS AND SERVICES						
15. DIRECT QUALITY CONTROL LABOR HOURS	0.0	0.0	0.0	0.0	na	
16. DIRECT MANUFACTURING LABOR HOURS	0.0	0.0	0.0	0.0	na	
17. TOTAL DIRECT LABOR HOURS	0.0	0.0	0.0	0.0	na	
18. DIRECT QUALITY CONTROL LABOR DOLLARS	$0.0	$0.0	$0.0	$0.0	na	
19. DIRECT MANUFACTURING LABOR DOLLARS	$0.0	$0.0	$0.0	$0.0	na	
20. TOTAL DIRECT LABOR DOLLARS	$0.0	$0.0	$0.0	$0.0	na	
21. RAW MATERIALS AND PURCHASED PARTS	$0.0	$0.0	$0.0	$0.0	na	
22. PURCHASED EQUIPMENT	$0.0	$0.0	$0.0	$0.0	na	
23. TOTAL DIRECT DOLLARS	$0.0	$0.0	$0.0	$0.0	na	
TOTAL PER UNIT/LOT						
24. DIRECT QUALITY CONTROL LABOR HOURS	1.3	1.0	0.9	0.8	na	
25. DIRECT MANUFACTURING LABOR HOURS	11.2	8.3	7.4	6.8	na	
26. TOTAL DIRECT LABOR HOURS	12.5	9.3	8.2	7.6	na	
27. DIRECT QUALITY CONTROL LABOR DOLLARS	$29.5	$21.9	$19.4	$18.0	na	
28. DIRECT MANUFACTURING LABOR DOLLARS	$223.3	$165.9	$147.1	$136.0	na	
29. TOTAL DIRECT LABOR DOLLARS	$252.7	$187.7	$166.5	$153.9	na	
30. RAW MATERIALS AND PURCHASED PARTS	$696.6	$517.5	$458.9	$424.3	na	
31. PURCHASED EQUIPMENT	$86.9	$64.5	$57.2	$52.9	na	
32. TOTAL DIRECT DOLLARS	$1,036.2	$769.7	$682.7	$631.2	na	
33. % SUBCONTRACT OR OUTSIDE PRODUCTION AND SERVICES	0%	0%	0%	0.0	na	

34. REMARKS

35a. NAME (Last, First, Middle Initial) J.J. Price

35d. E-MAIL ADDRESS jjprice@CompanyY.com

DD FORM 1921-1, (BACK), OCT 2003

Quantity data

DATA ELEMENTS	COMPLETED UNITS/LOTS A 1	2	3	4
1. MODEL AND SERIES				
2. FIRST UNIT OF LOT/WIP UNITS	1	11	21	31
3. LAST UNIT OF LOT	10	20	30	40
4. CONCURRENT UNITS/LOTS	0	0	0	0

Hours and Dollars data

TOTAL PER UNIT/LOT				
24. DIRECT QUALITY CONTROL LABOR HOURS	1.3	1.0	0.9	0.8
25. DIRECT MANUFACTURING LABOR HOURS	11.2	8.3	7.4	6.8
26. TOTAL DIRECT LABOR HOURS	12.5	9.3	8.2	7.6
27. DIRECT QUALITY CONTROL LABOR DOLLARS	$29.5	$21.9	$19.4	$18.0
28. DIRECT MANUFACTURING LABOR DOLLARS	$223.3	$165.9	$147.1	$136.0
29. TOTAL DIRECT LABOR DOLLARS	$252.7	$187.7	$166.5	$153.9
30. RAW MATERIALS AND PURCHASED PARTS	$696.6	$517.5	$458.9	$424.3
31. PURCHASED EQUIPMENT	$86.9	$64.5	$57.2	$52.9
32. TOTAL DIRECT DOLLARS	$1,036.2	$769.7	$682.7	$631.2

Estimating Manufacturing Hours

example (p. 2 of 3)

Quantity data taken from LRIP I are used to calculate Lot Midpoints. Hours data used to calculate lot average unit hours.

Quantity data

2. FIRST UNIT OF LOT/WIP UNITS	1	11	21	31
3. LAST UNIT OF LOT	10	20	30	40
4. CONCURRENT UNITS/LOTS	0	0	0	0
calculated Lot Midpoint	**4.2**	**15.2**	**25.3**	**35.3**

Hours data

7. DIRECT MANUFACTURING LABOR HOURS	11.2	8.3	7.4	6.8
calculated Lot Average Unit Hours	**1.12**	**0.83**	**0.74**	**0.68**

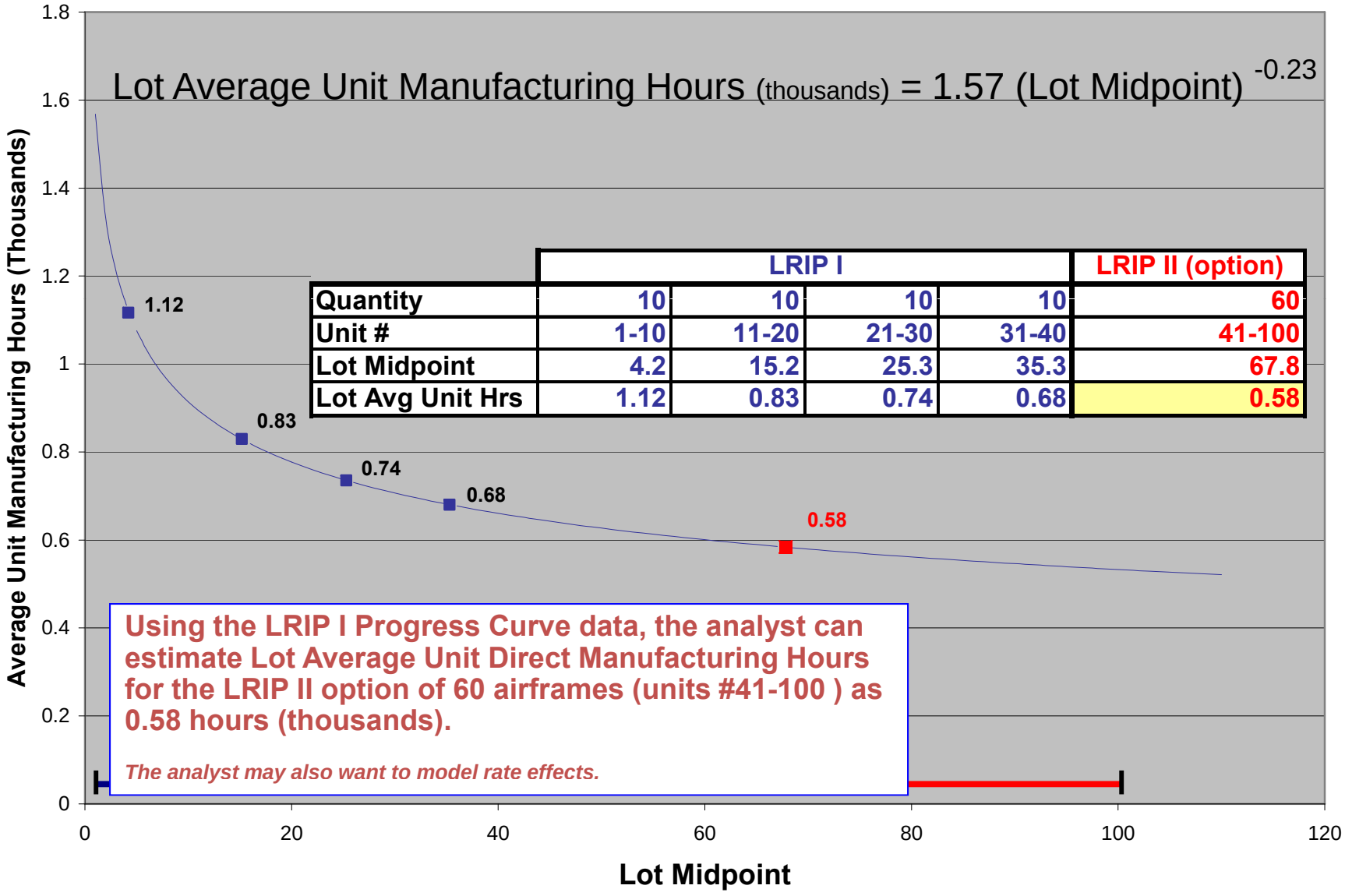
Lot Avg Unit Hrs	Lot Midpoint
1.12	4.2
0.83	15.2
0.74	25.3
0.68	35.3

- Analysis conducted to reveal relationship between lot midpoint quantity and lot average unit direct manufacturing hours
- Data plotted and regressed to calculate first unit (T1) hours and progress curve slope

$$\text{Lot Avg Unit Mfg Hrs} = T_1 \, (\text{midpoint})^b$$

Estimating Manufacturing Hours

example (p. 3 of 3)



	LRIP I				LRIP II (option)
Quantity	10	10	10	10	60
Unit #	1-10	11-20	21-30	31-40	41-100
Lot Midpoint	4.2	15.2	25.3	35.3	67.8
Lot Avg Unit Hrs	1.12	0.83	0.74	0.68	0.58

Using the LRIP I Progress Curve data, the analyst can estimate Lot Average Unit Direct Manufacturing Hours for the LRIP II option of 60 airframes (units #41-100) as 0.58 hours (thousands).

The analyst may also want to model rate effects.

CSDR Repository Content

Number of Contracts

	Development	Production
Aircraft	158	671
Missile	169	614
Electronic/Automated SW System	121	158
Space	43	64
Ground Vehicle	14	34
Ordnance	14	29
Ships	14	18
UAV	6	5
System of Systems	2	0
Total	541	1593

Number of Programs

	Development	Production
Aircraft	77	106
Missile	61	57
Electronic/Automated SW System	72	57
Space	21	21
Ground Vehicle	7	12
Ordnance	11	12
Ships	6	11
UAV	3	1
System of Systems	1	0
Total	259	277

How do you get CSDRs

- DACIMS is the DCARC's repository of CSDR type data
- CSDR data is proprietary, therefore access is controlled
- Government Employees
  - On-line access to the DACIMS repository requires registration through the DCARC website
  - A DACIMS account allows users to access CSDR data only
  - CPR data is accessed through a separate account
- Support contractors
  - Must demonstrate a Non-Disclosure Agreements (NDA) with industry
  - An NDA will not grant you on-line access
  - Access to CSDR reports must be through your registered government customer, or by ad-hoc data pulls by the DCARC staff
- FFRDC's- Employees may obtain on-line accounts
- Outside Agencies- Not currently permitted access

In Closing
Review of the Basics

- Cost and Software Data Reporting (CSDR) = CCDRs + SRDRs
- CCDRs are the 'best' standardized source of return cost (& manhour) data
  - Organized according to standard, product oriented WBS (i.e., MIL-HDBK-881)
  - Provide useful visibility into costs
- SRDRs are the 'best' standardized source of software metrics
- CSDRs are required for all
  - Major Defense Acquisition Programs (MDAP), i.e., ACAT I programs
  - Major Automated Information Systems (MAIS), i.e., ACAT IA programs
- The OSD PA&E Defense Cost and Resource Center (DCARC) manages the collection and dissemination of this data
- The Defense Automated Cost Information System (DACIMS), DCARC's repository for CCDRs & SRDRs, houses contract data for over ***250 development and 275 production programs***

An essential part of every cost analyst's toolbox

In Closing
Why CSDRs?

- Credible cost estimates enable **realistic budgets**, **executable contracts** & **program stability**
  - A win/win for DOD & industry
- DoD experience indicates that return cost data (i.e., actuals) for **completed** development & production contracts facilitate credible cost estimates
  - Used in the proper context, actuals are far & away the best basis of estimate
- CSDRs are DoD's only systematic mechanism for capturing actuals that provide the right visibility and consistency needed to develop credible cost estimates

Cost analysts must be strong CSDR advocates

Additional Resources

- Bi-annual CSDR Training sponsored by the DCARC
  - ✓ http://dcarc.pae.osd.mil/Training/index.aspx
- Complete on-line CSDR training class
  - ✓ http://dcarc.pae.osd.mil/Training/tutorials.aspx
- DCARC Website
  - ✓ http://dcarc.pae.osd.mil/
- Ad Hoc Inquires
  - ✓ Rob Currie, CSDR Lead Instructor, 703 601-4850, x153, ROBERT.CURRIE.CTR@OSD.MIL