



A Sample Analysis of CCDR Data

Are the Data Credible and Useful?

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A collage of various military and defense-related images, including a satellite, a fighter jet, a rocket launch, a helicopter, a tank, a submarine, and a large transport aircraft. The images are arranged in a grid-like fashion with overlapping elements.

**The On-line
DoD Cost
Research
Library**

Enhancing DoD Cost Analysis

The Defense Cost and Resource Center
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<http://dcarc.pae.osd.mil>



Proprietary Disclaimer

- *A number of measures are taken so as to not reveal proprietary data in this presentation*
 - *Names of systems are withheld*
 - *Variable scales are removed*
 - *Variable definitions are somewhat imprecise*



Agenda

- ***Background***
 - *CCDR Validation*
 - *Data Issues*
- ***Putting CCDR Data for Missile Z in Context***
 - *CCDR Relationship to Budget*
 - *Top Level Cost Trends*
- ***Examples of CCDR Data Analysis***
 - *Hardware CER Development*
 - *Support Cost Estimating Factor Development*



CCDR Validation & Data Issues Overview



DCARC CCDR Validation

Past – Prior to 2001

- ***No consistent review process – responsibility of Commands/Program Offices***
- ***Reports may contain math errors, omissions of data, and improper Work Breakdown Structures***
- ***Resulted in a major DoD cost data repository with numerous data issues***

Present – 2001 to Today

- ***Every CCDR submission reviewed, and feedback provided to contractor and Program Office within 3 weeks***
- ***Verified that each report is complete, arithmetically correct, and in accordance with CAIG-approved plan***
- ***No validation of cost assignment to WBS, recurring/nonrecurring, or functional elements***

Future

- ***Efforts to answer the question, “Does the data make sense?”***

**Feedback and questions regarding report validations are encouraged
(703) 601-4850 x151**



CCDR Data Issues

- ***There are many data issues which can appear in CCDRs (especially older reports). Issues may include:***
 - ***Misreporting of quantity***
 - ***Misreporting of G&A and/or fee***
 - ***Reporting not in accordance with MIL-HDBK-881 (i.e., no WBS standardization, lack of sufficient detail)***
 - ***Misassignment of recurring/nonrecurring cost***
 - ***Misassignment of cost to WBS***
- ***DCARC validation process will increasingly identify reporting errors and initiate corrections***
 - ***Checks for consistency with previous submissions and/or similar programs***
 - ***DCARC attempts to solicit input from data users as reports are submitted and being reviewed***



CCDR Data in Context

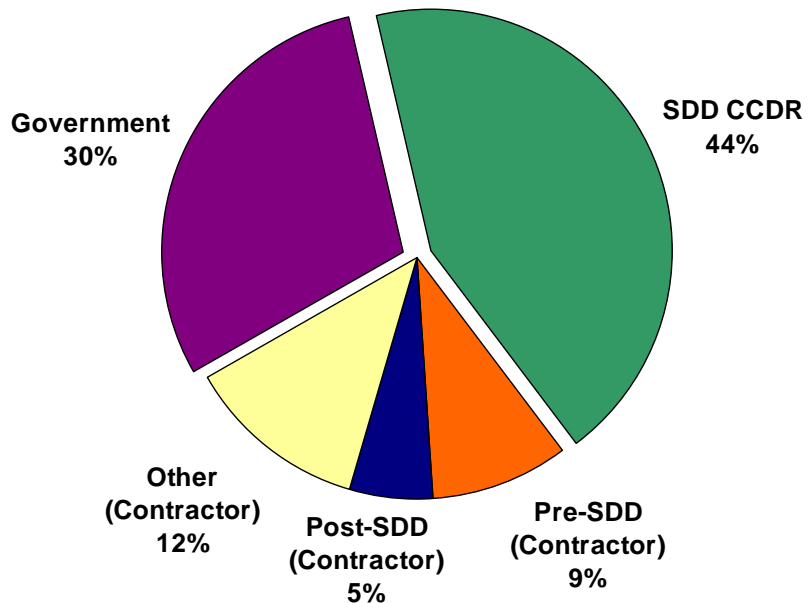
Comparison with Budget for Missile Z



Missile Z CCDR Scope Compared to Budget

Development

Missile Z RDT&E Budget



CCDR data accounts for 62% of RDT&E budget attributed to contractors

Production

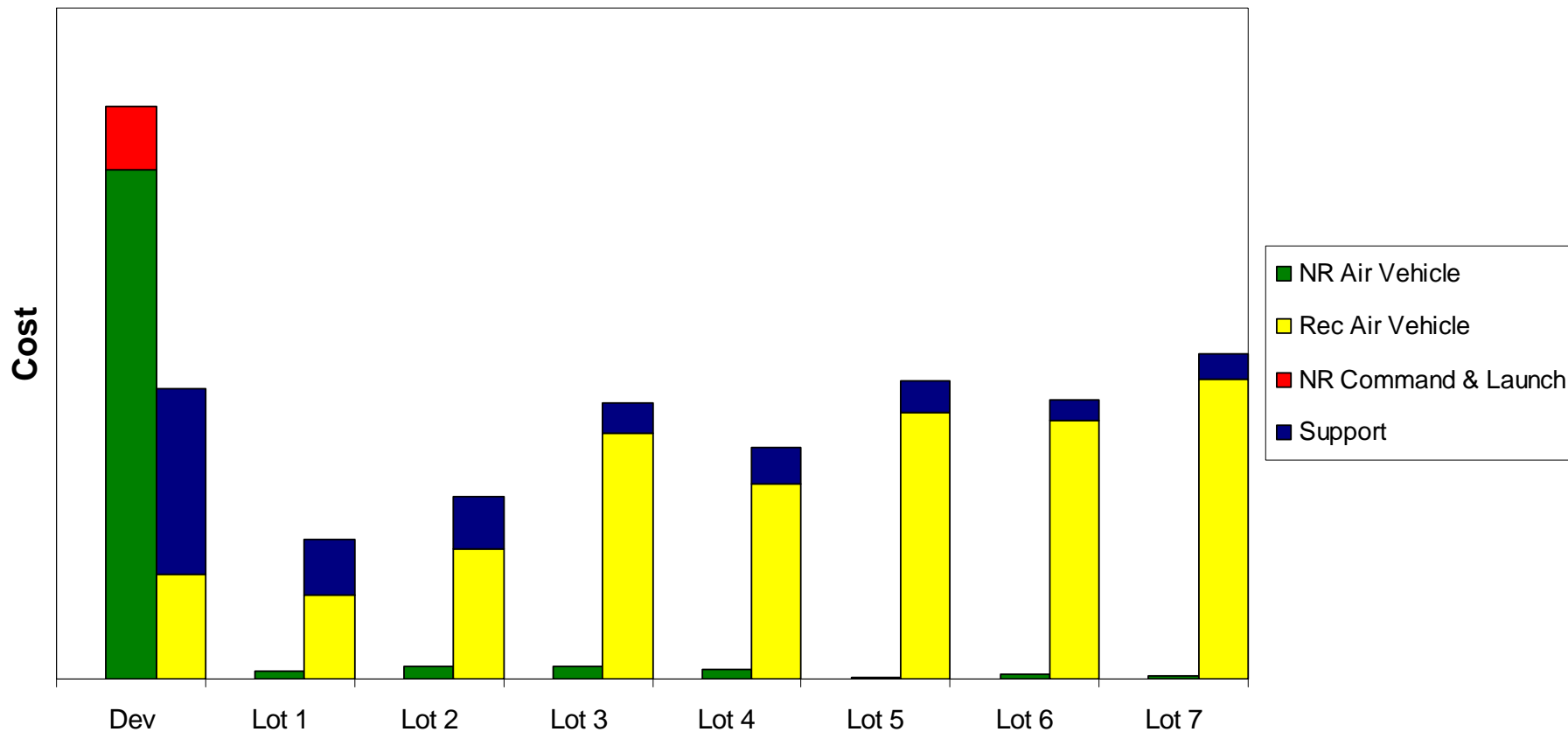
- Early Lots: Prime contractor CCDR accounts for mean of ~90% of procurement budget.
- Later Lots: Prime contractor CCDR exceeds budget by mean of ~40% of procurement budget, due to inclusion of FMS cost.



Missile Z Top Level Cost Trends

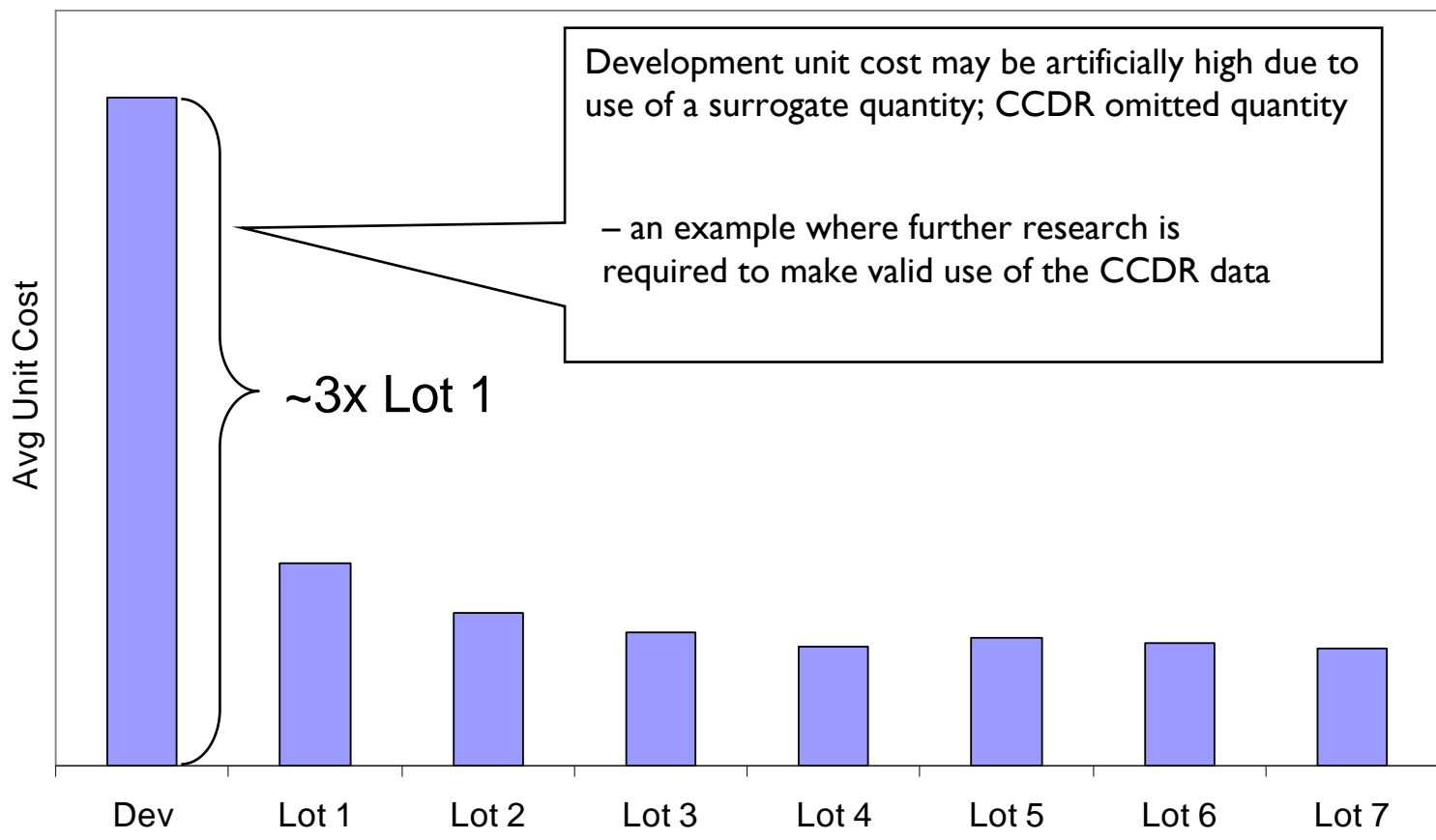


Missile Z Cost by Lot



Missile Z Recurring Air Vehicle Unit Cost

Average Recurring Air Vehicle Unit Cost



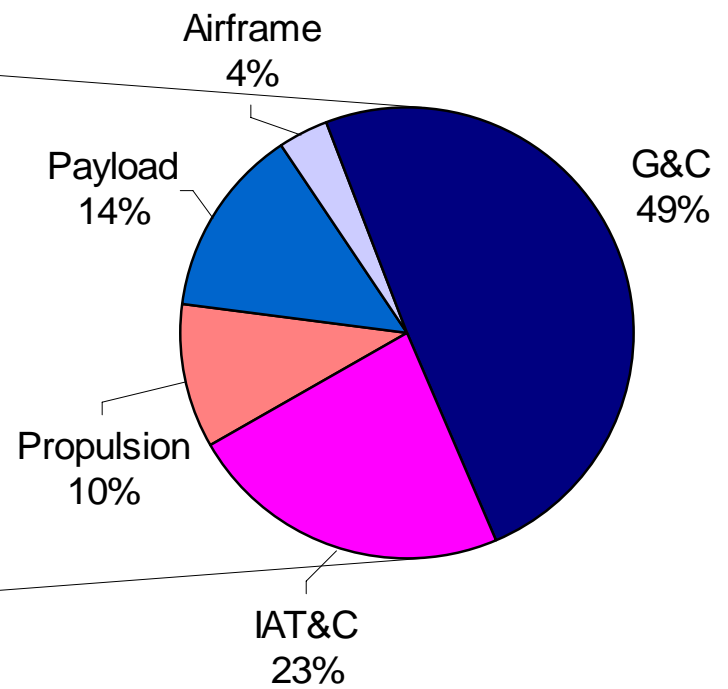
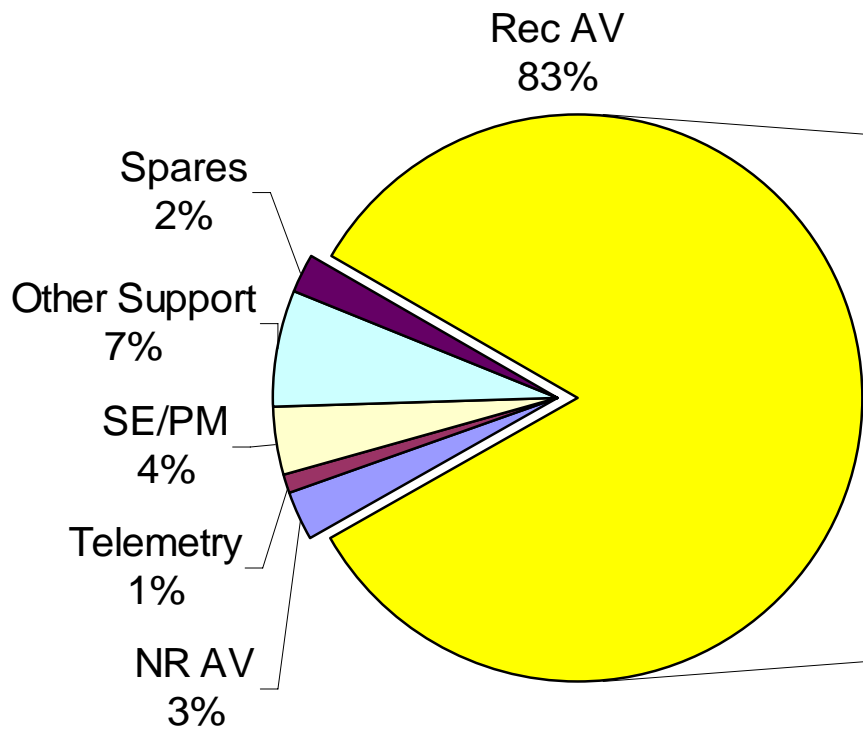
Development and Lot 1 quantity from SAR/budget



Missile Z Cost by WBS

Total Production Contract Cost (all lots)

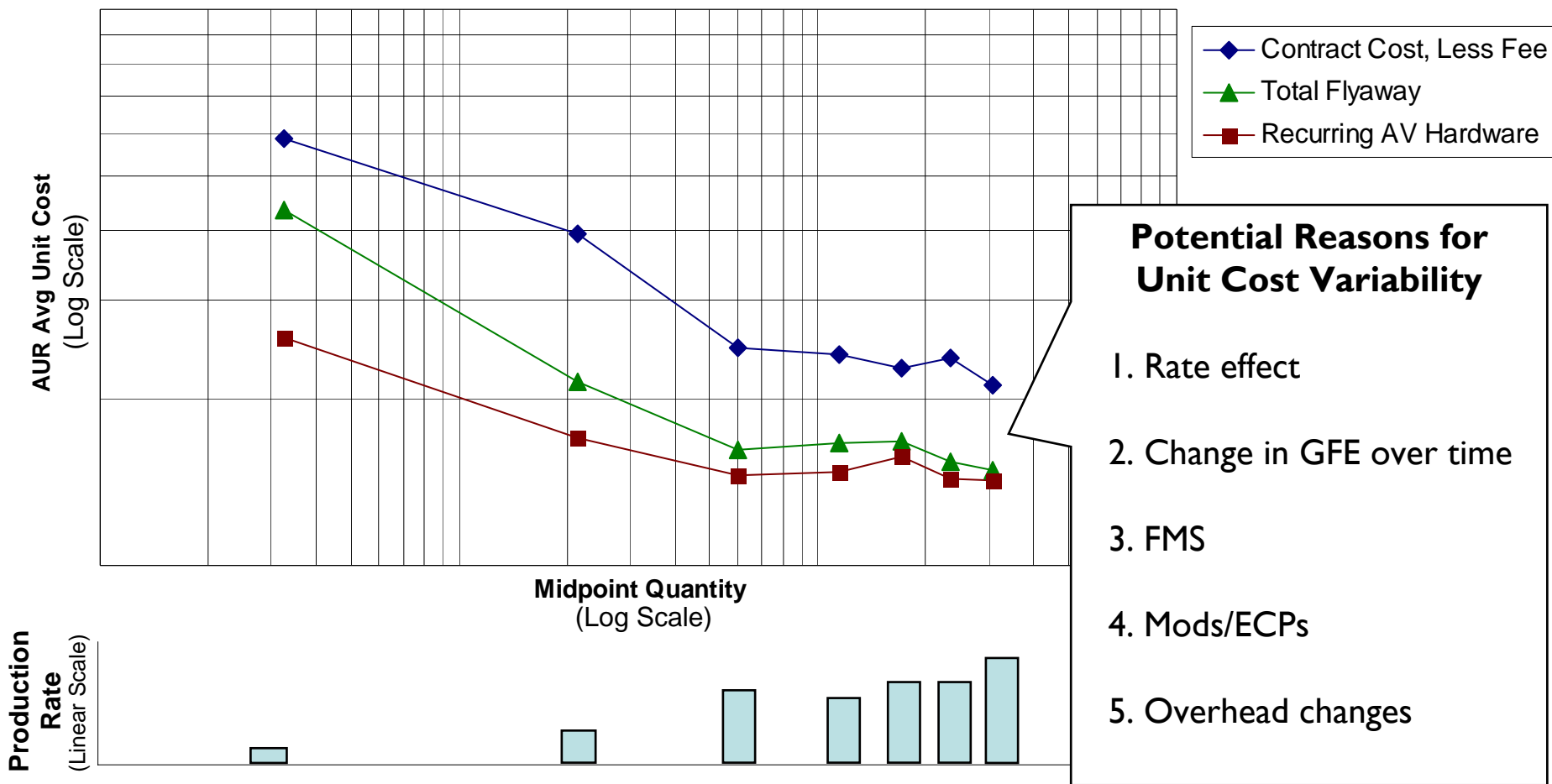
Recurring Air Vehicle





Contract Cost, Flyaway, & Rec Hw

Missile Z All-Up Round Average Unit Cost





Missile Z Context Summary

- ***It's important to understand cost covered by CCDR in the context of total program cost***
 - ***Individual reports are usually for a development contract, a production lot contract, or a subcontract***
- ***Top level cost and cost trends are fairly easy to establish if reports are valid***
- ***Robust CCDR report dimensions allows for rigorous analysis of contract cost for a multitude of purposes***



Example of HW CER Development



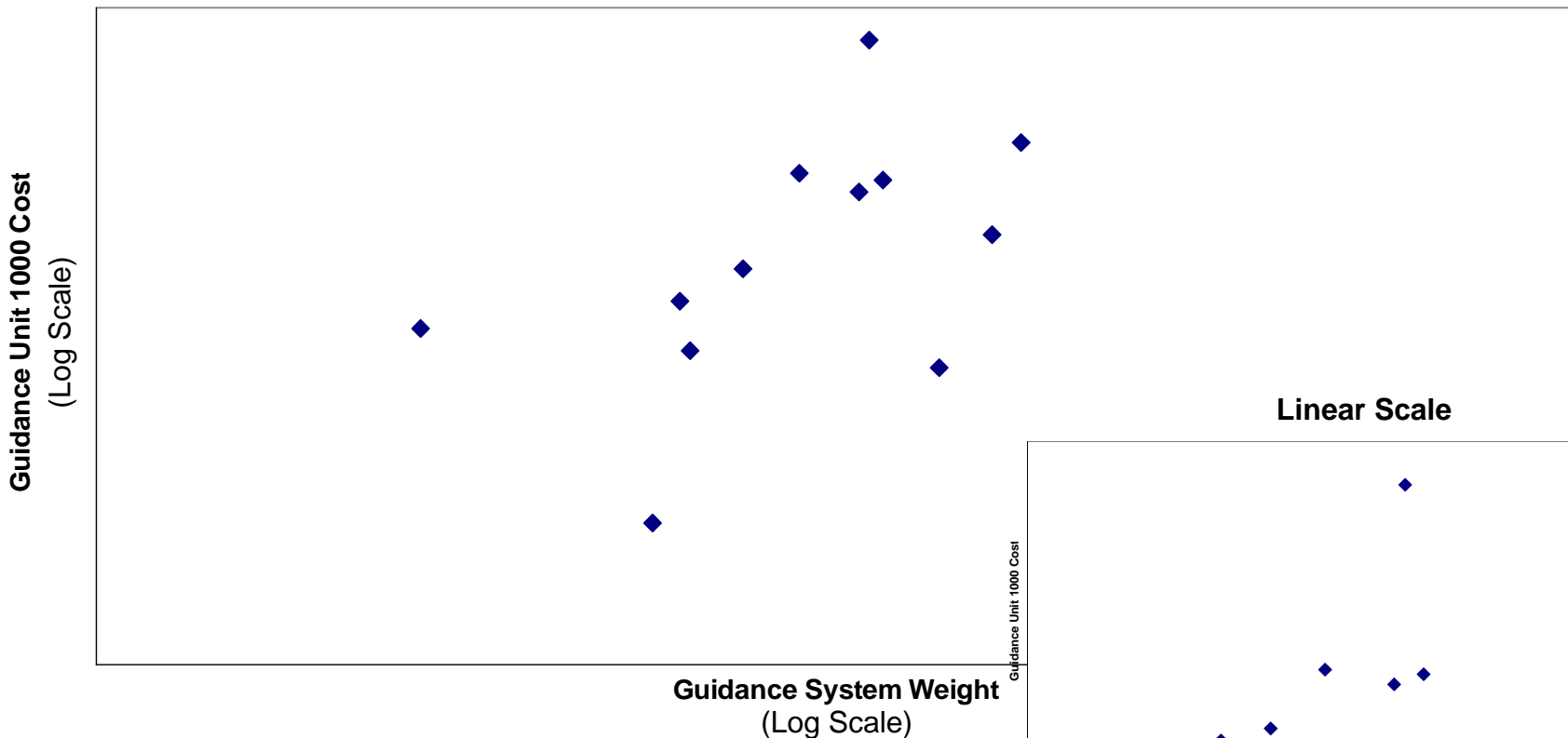
Guidance Section CER Development

- ***Established Unit 1000 cost (IUC_{1000}) for a number of missiles, and correlated with cost drivers***
 - ***Analyzed 12 radar guided missiles, using radar guidance set average unit cost***
 - ***Normalized to constant dollars, using OSD and Service indices***
 - ***Used recurring fabrication cost, less fee***
 - ***Correlation started with weight***

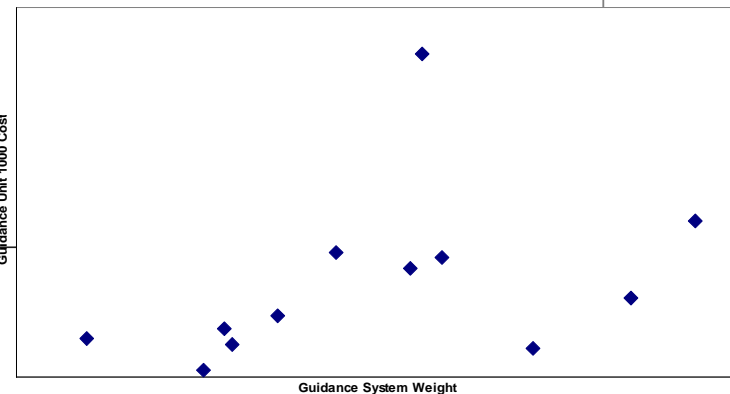


First Attempt at CER

Radar Guidance IUC₁₀₀₀ vs. Guidance System Weight



Linear Scale



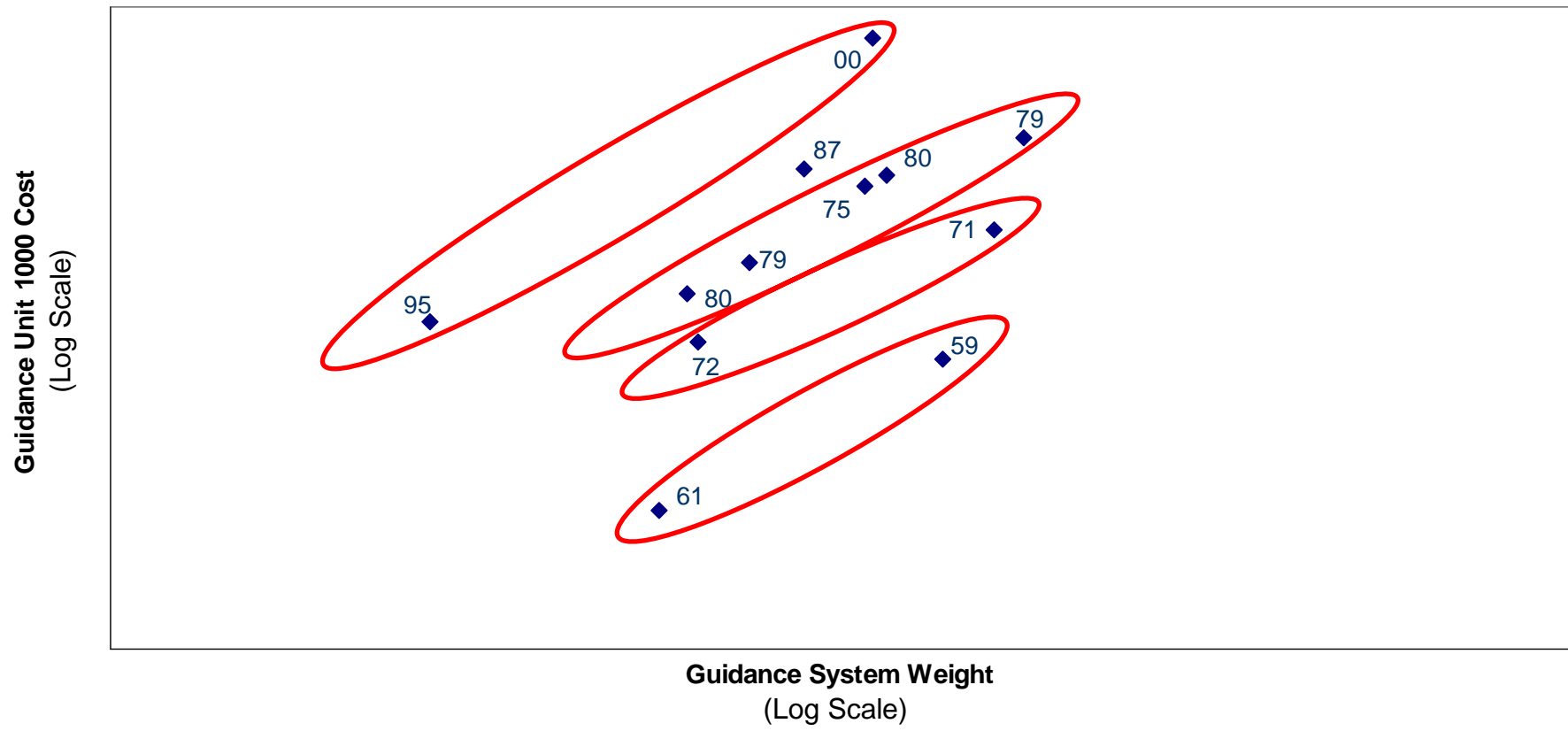
$R^2 = .27$ $SE = .80$



Add Additional Variable

Year - Representing Technology Factor

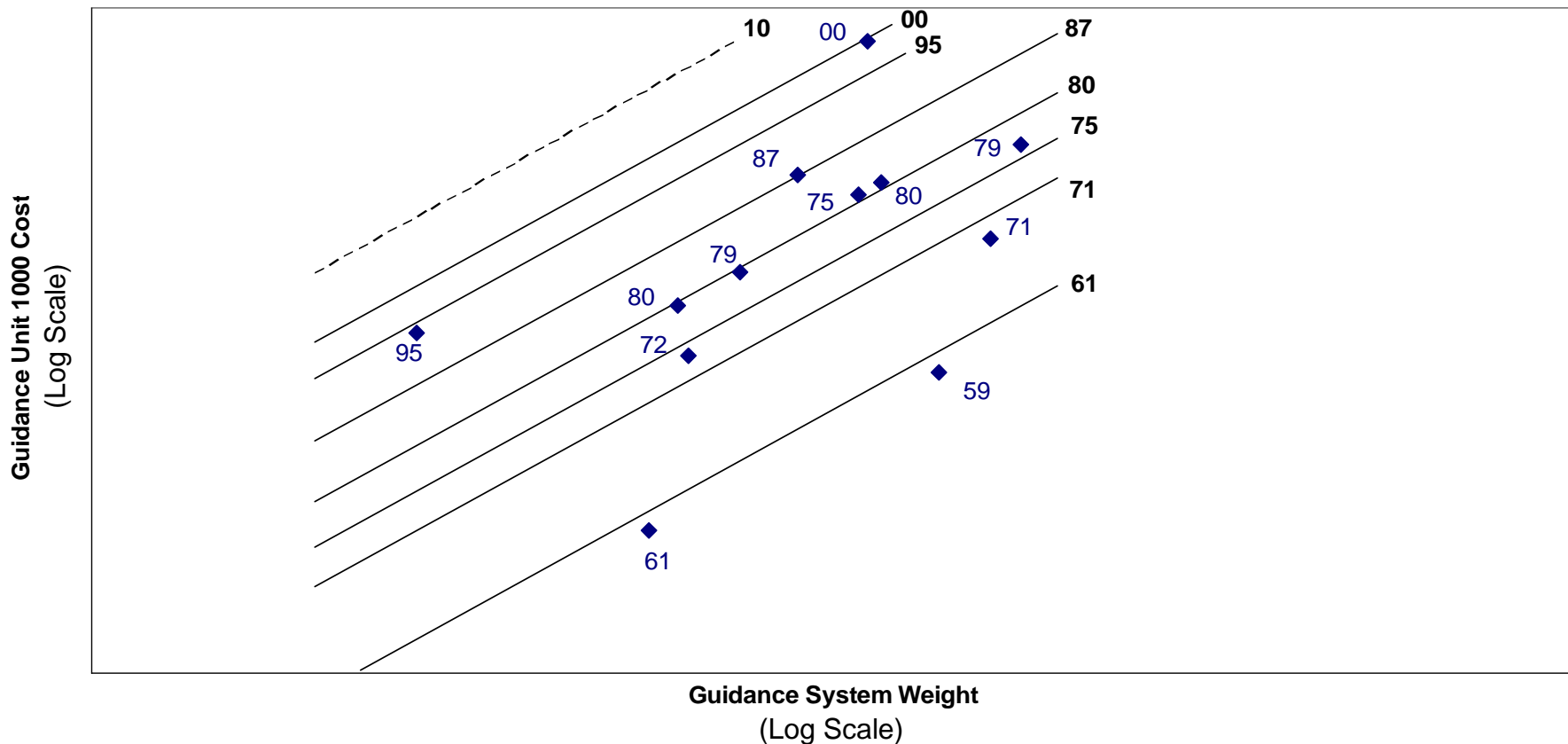
Radar Guidance IUC1000 vs. Guidance System Weight & Year





Results with Weight and Time

Radar Guidance IUC1000 vs. Guidance System Weight & Year

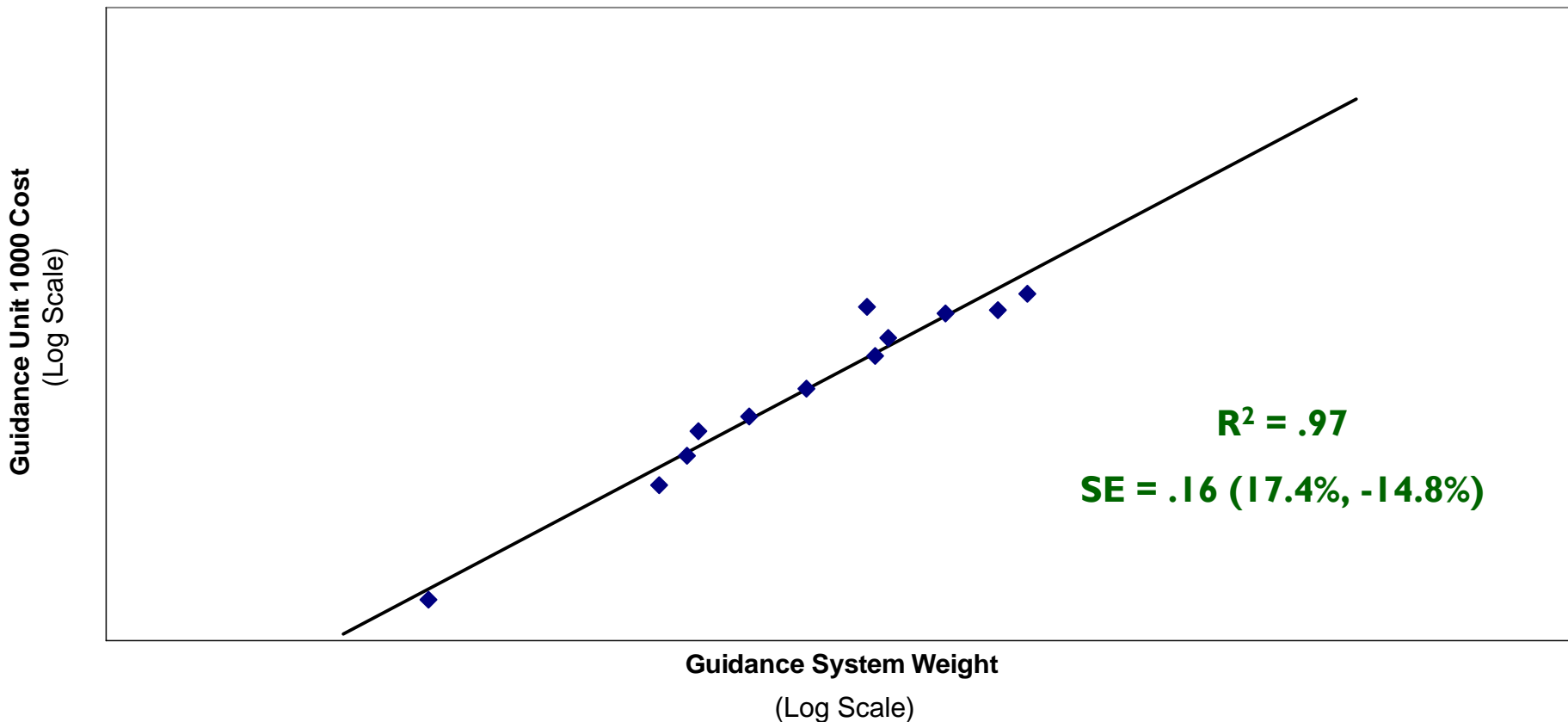


$$\text{Guidance T1000 \$} = a * \text{GuidWT}^b * \text{Year}^c$$



Results, Year Normalized

Radar Guidance IUC1000 vs. Guidance System Weight (Year Normalized)





CER Conclusion

- ***Establishing valid cost improvement curves at a summary level, using CCDR data, is reasonably straightforward***
 - ***Data adjustments for consistency among programs may be necessary (e.g., assignment of recurring engineering)***
- ***Data normalization and research/analysis of outliers and data anomalies is where most of the effort occurs***
- ***CCDR data for comparable hardware elements can exhibit correlation/consistency across programs***



Support Cost Estimating Factor Development



Support Factor Development

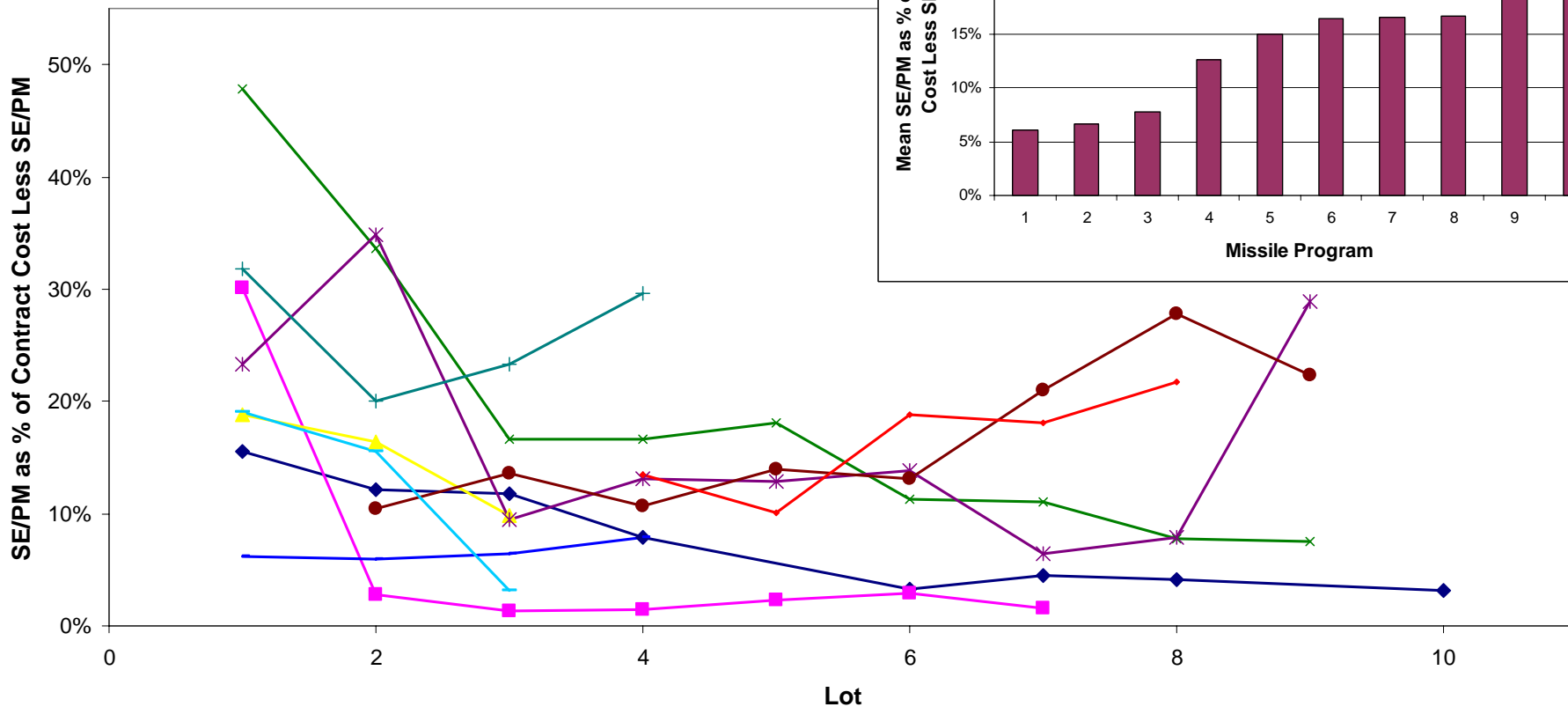
- **Compiled support costs for 60 production lots across 10 missile programs:**

Support WBS Element	% of Production Lots With Cost	Average % of Total Cost (All 60 Lots)
Systems Engineering/Program Management	100%	11.9%
Data	78%	1.1%
System Test & Evaluation	62%	0.7%
Initial Spares and Repair Parts	40%	1.6%
Peculiar Support Equipment	38%	0.7%
Training	35%	1.7%
Industrial Facilities	3%	0.4%
Common Support Equipment	0%	0.0%
Operational/Site Activation	0%	0.0%

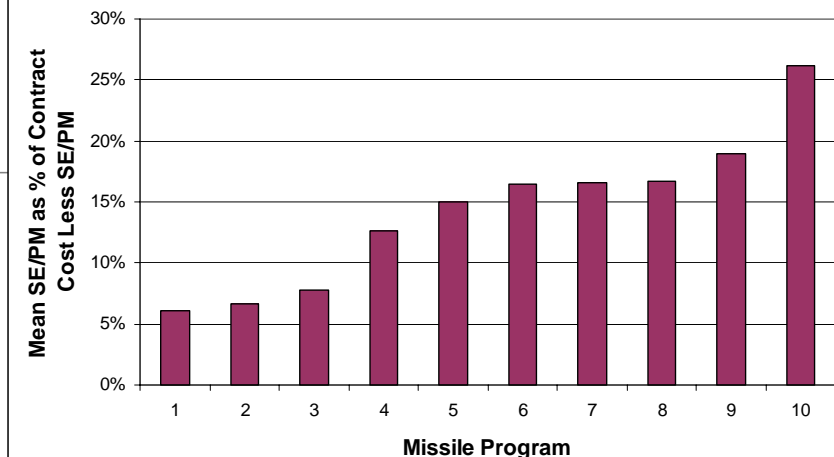


SE/PM Across Lots

Change in Relative SE/PM Over Lots



SE/PM Average By Program





Making Some Sense of the Data

- **Reasons for Variability in Data**
 - *Varying WBS structures*
 - *Accounting system differences*
 - *Cost assignment and/or allocation differences*
 - *Differences in contract content (ILS, Rec. Engr., ECPs, etc.)*
 - *FMS/# of configurations*
 - *Differences by lot*
- **Observations of Consistency in the Data**
 - *SE/PM % of Contract Cost (less SE/PM) falls within a fairly tight range for six of ten programs; and there may be explanations for outliers*
 - *The majority of programs experience a substantial decrease in relative SE/PM costs following Lot 1*



In Conclusion...

- ***CCDRs represent the best centralized source of actual cost history available for major DoD programs***
 - *They have multiple unique qualities which aid the cost analyst (e.g., quantities, recurring/non-recurring, standardized WBS)*
 - *CCDR data can be the basis for credible and useful estimating methodology, as demonstrated by the guidance CER*
- ***CCDRs are not perfect (no data is), but there are workarounds, supplementary data sources, and explanations for most issues***
 - *Data can exhibit considerable variability for some elements due to:*
 - 1) inherent nature of the data (e.g., differences in contract content)*
 - 2) reporting issues for which steps have been taken to improve (e.g., lack of WBS standardization)*
- ***DCARC is committed to a robust validation process in order to improve the consistency and credibility of CCDR data***
 - *Validations will become increasingly rigorous*



Back-up



DCARC

Defense Cost and Resource Center

- *OSD PA&E office responsible for administration of DoD Cost and Software Data Reporting (CSDR) system*
- *Facilitates submission of CSDR plans to the CAIG (documenting the WBS, reporting level of detail, and frequency)*
- *Reviews / Validates data submissions from industry*
- *Administers CSDR data repository – the Defense Automated Cost Information Management System (DACIMS)*
- *Provides CSDR training to government and industry*
- *Develops and implements CSDR policy*



CCDR

Contractor Cost Data Reporting

- *The cost half of the CSDR system (the other half, software reporting, accomplished via Software Resource Data Reporting SRDRs)*
- *Uses the DD 1921, 1921-1, 1921-2 family of forms*
- *Breakout of costs into various dimensions*
 - *By WBS*
 - *Costs To Date and At Completion*
 - *Recurring and Nonrecurring*
 - *Functional categories (engineering, tooling, manufacturing, & QC)*
- *Required for all contracts/subcontracts greater than \$50 million for ACAT I programs, and high visibility programs*



Cost Reporting Forms

1921

Cost Data Summary Report

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

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

1921-2

Progress Curve Report

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



DACIMS

Defense Automated Cost Information Management System (DACIMS)

- *DCARC's CSDR data repository*
- *Contains over 30,000 records dating back to 1966*
- *Access available to registered DoD government employees*
- *Reports organized by system type, by contract, and by submission (i.e., date)*
- *Data format:*
 - *Prior to 2000 (~90% of repository), reports in PDF/TIFF format*
 - *Post-2000, data has been submitted in Excel-compatible format*

Remember, the DCARC will assist in finding and downloading CCDR data!
(703) 601-4850 x124



Contents of DACIMS

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



CCDR Forms – DD 1921

SECURITY CLASSIFICATION Unclassified

COST DATA SUMMARY REPORT

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 8 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Executive Services Directorate (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.
PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE ABOVE ORGANIZATION.

1. PROGRAM a. MDAP: b. PHASE:		2. PRIME MISSION PRODUCT		3. CONTRACTOR TYPE (X one) <input type="checkbox"/> PRIME / ASSOCIATE <input type="checkbox"/> DIRECT-REPORTING SUBCONTRACTOR		4. NAME/ADDRESS (Include ZIP Code)		5. APPROVED PLAN NUMBER	
6. CUSTOMER (DIRECT-REPORTING SUBCONTRACTOR USE ONLY)		7. CONTRACT TYPE	8. CONTRACT PRICE	9. CONTRACT CEILING	10. TYPE ACTION a. CONTRACT NO.: b. LATEST MODIFICATION:		c. SOLICITATION NO.: d. NAME:		16. REPORT AS OF (YYYYMMDD)
11. PERIOD OF PERFORMANCE a. START DATE (YYYYMMDD): b. END DATE (YYYYMMDD):		12. APPROPRIATION <input type="checkbox"/> RDT&E <input type="checkbox"/> PROCUREMENT <input type="checkbox"/> O&M		13. REPORT CYCLE <input type="checkbox"/> INITIAL <input type="checkbox"/> INTERIM <input type="checkbox"/> FINAL		14. SUBMISSION NUMBER		15. RESUBMISSION NUMBER	
17. NAME (Last, First, Middle Initial)		18. DEPARTMENT		19. TELEPHONE NUMBER (Include Area Code)		20. EMAIL ADDRESS		21. DATE PREPARED (YYYYMMDD)	
WBS ELEMENT CODE A	WBS REPORTING ELEMENTS B	NUMBER OF UNITS TO DATE C	COSTS INCURRED TO DATE			NUMBER OF UNITS AT COMPLETION G	COSTS INCURRED AT COMPLETION		
			NONRECURRING D	RECURRING E	TOTAL F		NONRECURRING H	RECURRING I	TOTAL J
22. REMARKS									

DD FORM 1921, 20070416 PREVIOUS EDITION IS OBSOLETE. SECURITY CLASSIFICATION Unclassified





CCDR Forms – DD 1921-1

SECURITY CLASSIFICATION

Unclassified

FUNCTIONAL COST-HOUR REPORT

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 16 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Executive Services Directorate (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. PROGRAM a. MDAP: b. PHASE:		2. PRIME MISSION PRODUCT		3. CONTRACTOR TYPE (X One) <input type="checkbox"/> PRIME / ASSOCIATE <input type="checkbox"/> DIRECT-REPORTING SUBCONTRACTOR		4. NAME/ADDRESS (Include Zip Code)					
5. APPROVED PLAN NUMBER		6. CUSTOMER (Direct-Reporting Subcontractor Use Only)				7. TYPE ACTION a. CONTRACT NO.: b. LATEST MODIFICATION:					
8. PERIOD OF PERFORMANCE a. START DATE (YYYYMMDD): 20060101 b. END DATE (YYYYMMDD): 20070101		9. REPORT CYCLE <input type="checkbox"/> INITIAL <input type="checkbox"/> INTERIM <input type="checkbox"/> FINAL		10. SUBMISSION NUMBER		11. RESUBMISSION NUMBER					
12. REPORT AS OF (YYYYMMDD)		13. NAME (Last, First, Middle Initial)		14. DEPARTMENT		15. TELEPHONE NO. (Include Area Code)					
16. EMAIL ADDRESS		17. DATE PREPARED (YYYYMMDD)		18. WBS ELEMENT CODE		19. WBS REPORTING ELEMENT					
20. NUMBER OF UNITS a. TO DATE: b. AT COMPLETION:		21. APPROPRIATION <input type="checkbox"/> RDT&E <input type="checkbox"/> PROCUREMENT <input type="checkbox"/> O&M									
FUNCTIONAL DATA ELEMENTS				COSTS AND HOURS INCURRED TO DATE			COSTS AND HOURS INCURRED AT COMPLETION				
				A. NONRECURRING		B. RECURRING		C. TOTAL		D. NONRECURRING	
				E. RECURRING		F. TOTAL					
ENGINEERING											
(1) DIRECT ENGINEERING LABOR HOURS											
(2) DIRECT ENGINEERING LABOR DOLLARS											
(3) ENGINEERING OVERHEAD DOLLARS											
(4) TOTAL ENGINEERING DOLLARS											
MANUFACTURING OPERATIONS											
(5) DIRECT TOOLING LABOR HOURS											
(6) DIRECT TOOLING LABOR DOLLARS											
(7) DIRECT TOOLING & EQUIPMENT DOLLARS											
(8) DIRECT QUALITY CONTROL LABOR HOURS											
(9) DIRECT QUALITY CONTROL LABOR DOLLARS											
(10) DIRECT MANUFACTURING LABOR HOURS											
(11) DIRECT MANUFACTURING LABOR DOLLARS											
(12) MANUFACTURING OPERATIONS OVERHEAD DOLLARS (Including Tooling and Quality Control)											
(13) TOTAL MANUFACTURING OPERATIONS DOLLARS (Sum of rows 6, 7, 9, 11, and 12)											
MATERIALS											
(14) RAW MATERIAL DOLLARS											
(15) PURCHASED PARTS DOLLARS											
(16) PURCHASED EQUIPMENT DOLLARS											
(17) MATERIAL HANDLING/OVERHEAD DOLLARS											
(18) TOTAL DIRECT-REPORTING SUBCONTRACTOR DOLLARS											
(19) TOTAL MATERIAL DOLLARS											
OTHER COSTS											
(20) OTHER COSTS NOT SHOWN ELSEWHERE (Specify in Remarks)											
SUMMARY											
(21) TOTAL COST (Direct and Overhead)											
22. REMARKS											

DD FORM 1921-1, 20070416

PREVIOUS EDITION IS OBSOLETE.

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