



NAVAL
POSTGRADUATE
SCHOOL

COST ESTIMATING RESEARCH AT NAVAL POSTGRADUATE SCHOOL

Presented at
Naval Operations Research Workshop
Vina del Mar, Chile
December 2009
Daniel A. Nussbaum, OR Department



NAVAL
POSTGRADUATE
SCHOOL

Agenda

- Bottom Lines Up Front (BLUF)
- Cost Estimating
 - Is a well developed discipline
 - Still, there are problems
 - What are the Solutions?
- Cost Estimating Curriculum and Research at NPS
- Questions?



NAVAL
POSTGRADUATE
SCHOOL

Bottom Lines Up Front (BLUF)

- DoD Requires Cost Estimates for EVERY
 - Cost-Benefit Analysis
 - Analysis of Alternatives
 - Budget development and justification
- We still mis-estimate, sometimes badly.
- We need Cost Estimating Research to address deficiencies in
 - Costs in the R&D phase
 - Return on investment (ROI) for new technologies
 - Costs of software development
 - Fully Burdened Costs of Energy

Cost Estimating Has High Visibility



NAVAL
POSTGRADUATE
SCHOOL

Cost Estimating: We Know

- What it is
- Who customers are
- How to execute a standard process to develop a cost estimate
- Names for our results
- Rules of thumb for developing cost estimates
- Standard methodologies
- How to conduct Risk Analyses
- A sound cost estimate when we see one

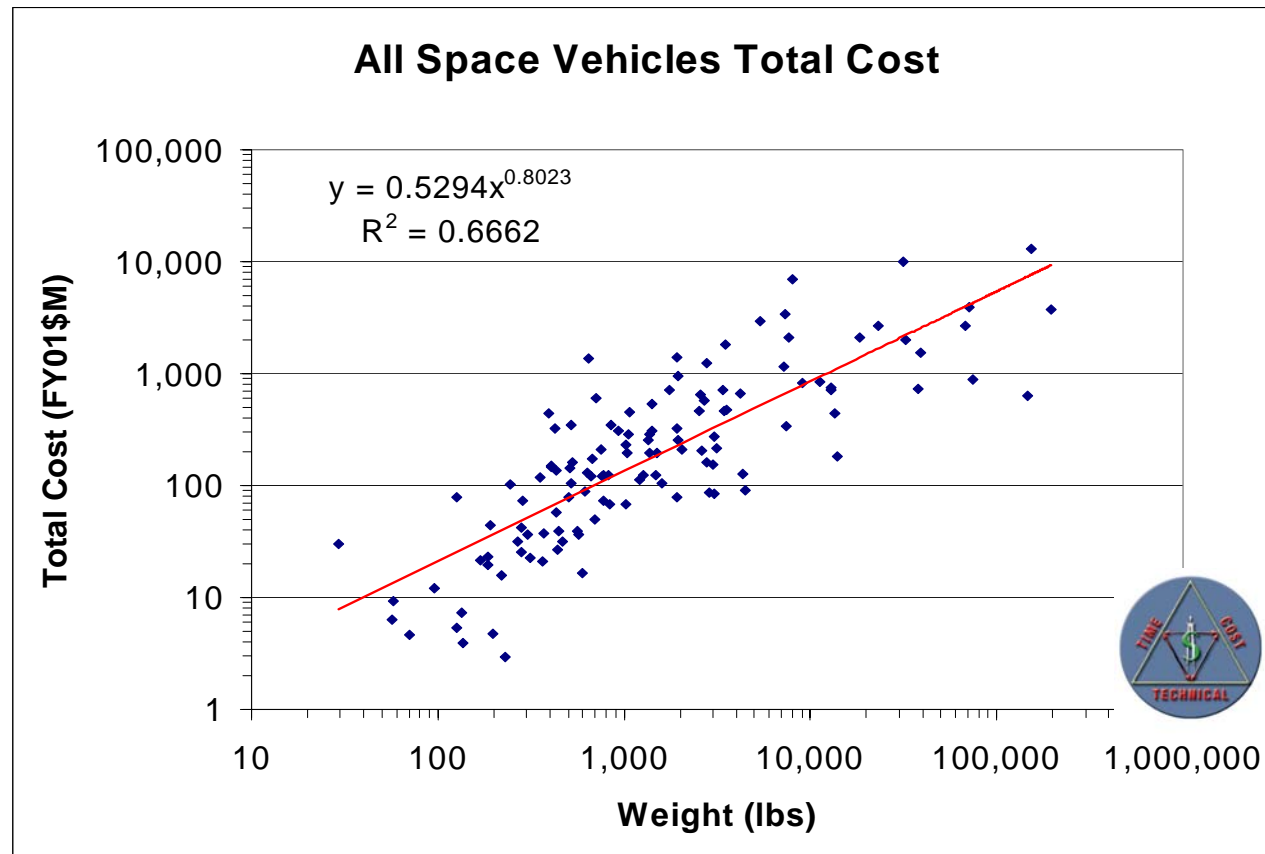
There are detailed Back-Up Slides on each of the Above Topics



NAVAL
POSTGRADUATE
SCHOOL

Example: Weight vs. Total Cost for Spacecraft

- *All Things being Equal, Size and Cost are Positively Correlated*
- **Weight is Usually an Early Design Parameter**

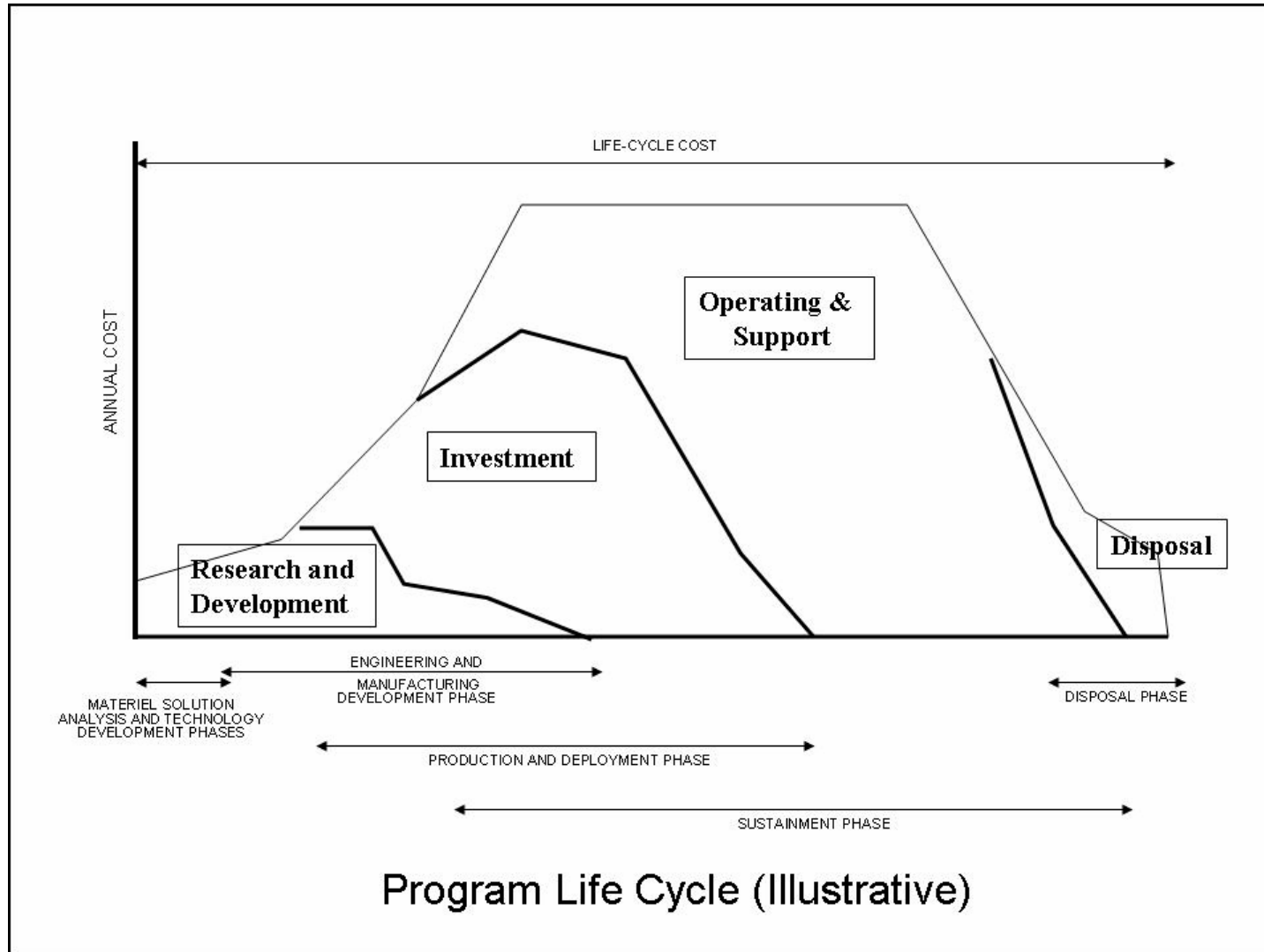


**Engineering
Cost
Office**



NAVAL
POSTGRADUATE
SCHOOL

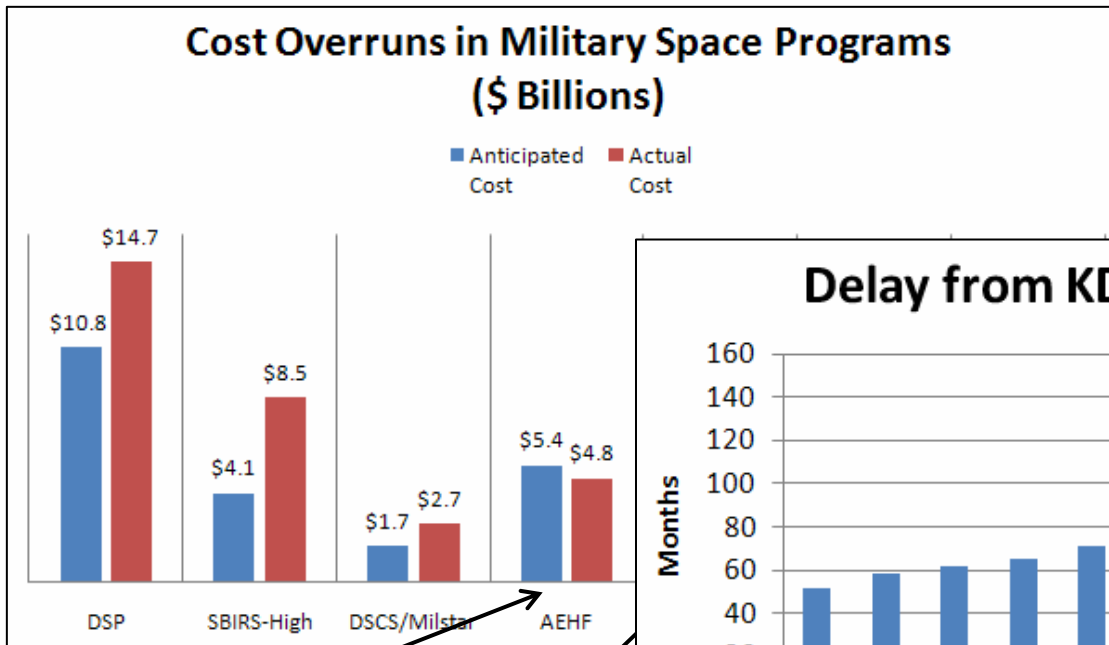
We Know *What* It Looks Like When Done



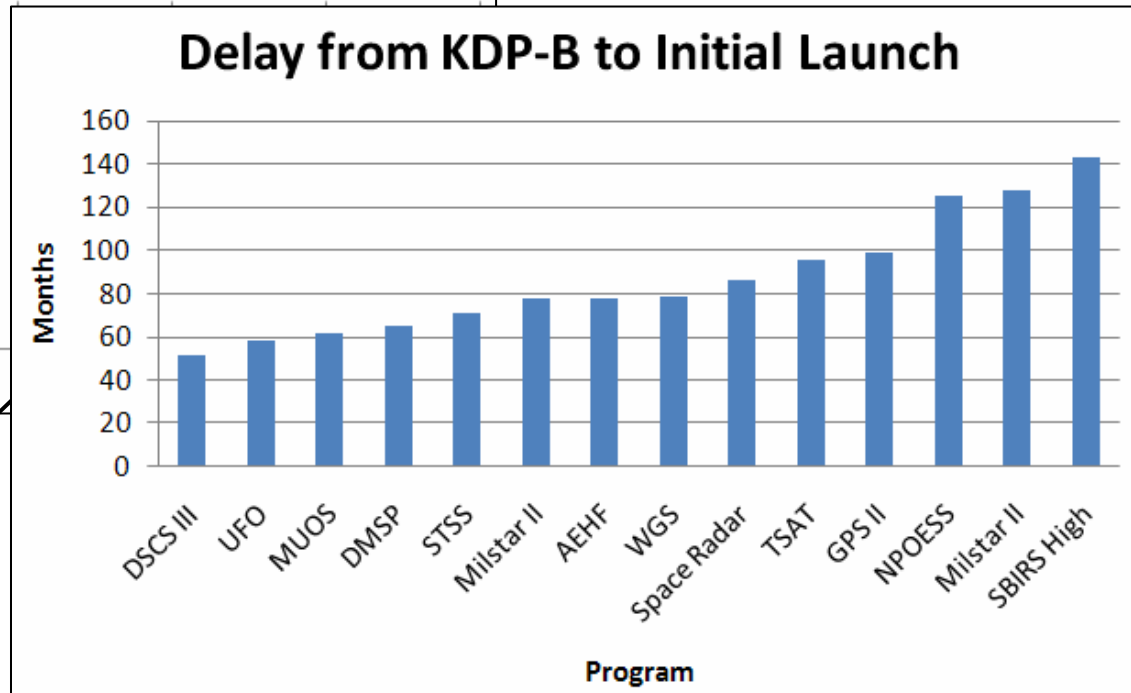


The Problems---The Estimator's View

- Military Space Programs:



Averages:
37.1% over cost
79 months total time



Decrease from 4 satellites to 3

Increase from 3 satellites to 5



Problems- Software Code Growth

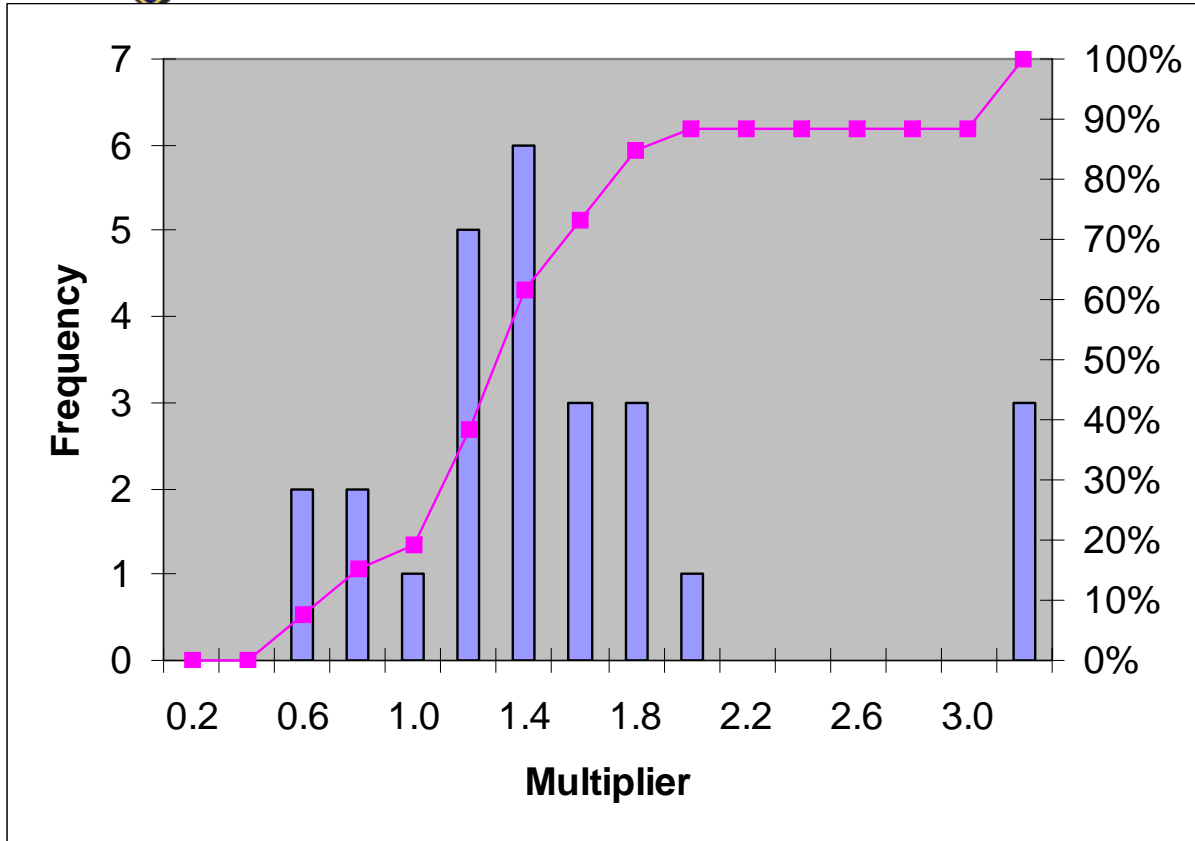


Table 1. Code Growth Multiplier for Military Mobile Operating Environment

Serial No.	Estimated LOC	Actual LOC	Multiplier
25	30,900	20,712	0.67
33	7,500	23,630	3.15
53	21,300	29,360	1.38
59	34,900	44,972	1.29
80	618,000	709,000	1.15
87	7,500	11,082	1.48
90	41,800	46,303	1.11
98	15,700	25,637	1.63
127	39,294	119,400	3.04
136	15,500	26,513	1.71
180	10,400	13,837	1.33
214	37,600	25,304	0.67
243	36,800	19,207	0.52
256	7,900	9,455	1.20
268	18,100	26,953	1.49
281	13,800	12,115	0.88
294	22,000	30,000	1.36
304	7,900	8,718	1.10
308	10,100	19,619	1.94
356	8,700	11,702	1.35
369	23,549	25,804	1.10
370	100,000	122,000	1.22
379	20,500	14,519	0.71
392	14,000	70,143	5.01

Figure 4. Distribution of Military Mobile Environment Code Growth Multipliers. Bin intervals are $0.2(k-1) \leq m \leq 0.2k$, $k = 1, 2, \dots, 15$, and the right-most bin being $m > 3.0$, where m represents the multiplier value.



NAVAL
POSTGRADUATE
SCHOOL

The Problems- GAO's View

Program	Total Cost (FY09\$M)		Total quantity		Acquisition unit cost
	First full estimate	Current estimate	First full estimate	Current estimate	Percentage change
Joint Strike Fighter	206,410	244,772	2,866	2,456	38
Future Combat System	89,776	129,731	15	15	45
Virginia Class Submarine	58,378	81,556	30	30	40
F-22A Raptor	88,134	73,723	648	184	195
C-17 Globemaster III	51,733	73,571	210	190	57
V-22 Joint Services Advanced Vertical Lift Aircraft	38,726	55,544	913	458	186
F/A-18E/F Super Hornet	78,925	51,787	1,000	493	33
Trident II Missile	49,939	49,614	845	561	50
CVN 21 Nuclear Aircraft Class Carrier	34,360	29,914	3	3	-13
P-8A Poseidon Multi-mission Maritime Aircraft	29,974	29,622	115	113	1



NAVAL
POSTGRADUATE
SCHOOL

The Problems- GAO's View

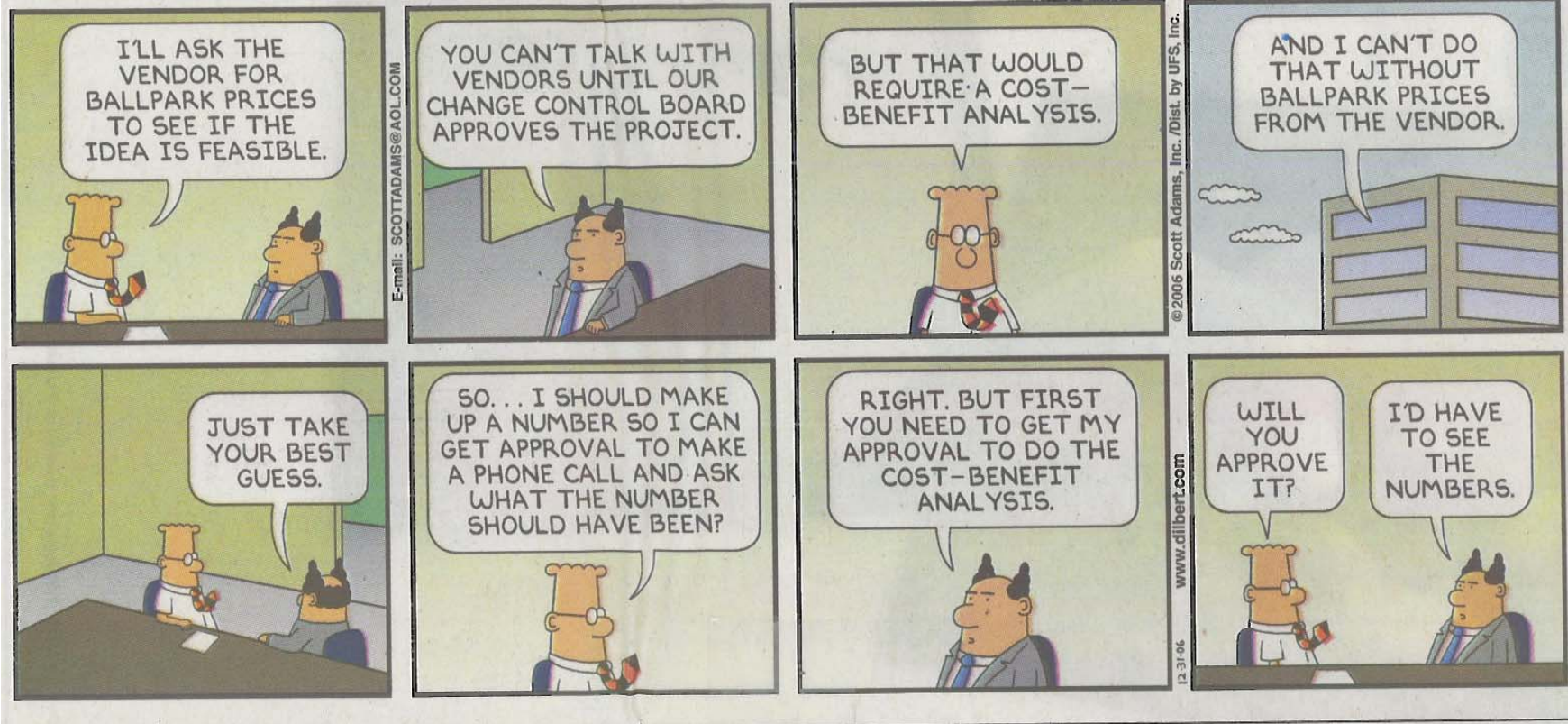
- **“Since 2003, DOD’s portfolio of major defense acquisition programs**
 - Number has grown from 77 to 96 programs
 - Investment has grown from \$1200 to \$1600 (FY09\$B).
 - Cumulative **cost growth** is higher than it was 5 years ago.
 - At \$296 billion, it is less than last year when adjusted for inflation.
 - For 2008 programs, **research and development** costs are now 42 percent higher than originally estimated and the average delay in delivering initial capabilities has increased to 22 months.
- **DOD’s performance in some of these areas is driven by older programs, as newer programs, on average, have not shown the same degree of cost and schedule growth.”**
- <http://www.gao.gov/new.items/d09326sp.pdf>
 - (GAO: March 2009, Assessments of Selected Weapon Programs)



NAVAL
POSTGRADUATE
SCHOOL

The Problem---The Estimator's View

DILBERT By Scott Adams



From: Penn, Heather [mailto:hpenn@unitedmedia.com]

Sent: Friday, January 05, 2007 8:13 AM

To: Nussbaum, Daniel (Dan) (CIV)

Subject: RE: request for permission

Daniel:

You may use this strip for educational use free of charge.

Best,

Heather Penn



NAVAL
POSTGRADUATE
SCHOOL

What are the Solutions?

- Focus
 - Expansion in US Government Cost Estimating Resources NASA, DHS, DOE, DOD, GAO
 - Weapon System Acquisition Reform Act (WSARA) of 2009
- Standards
 - Defense Acquisition Workforce Improvement Act (DAWIA)
 - General Accountability Office (GAO) Handbook
 - Society for Cost Estimating and Analysis (SCEA) Certification
- Training
 - NPS current graduate course and research opportunities
 - Request for Master's in Cost Estimating at NPS
 - SCEA Cost Estimating Book of Knowledge (CEBOK)
- Research



Explosion in Government and Commercial Estimating Requirements

GOVERNMENT	COMMERCIAL
<ul style="list-style-type: none">• Expansion in US Government Cost Estimating Resources NASA, Homeland security, Energy, Defense, and GAO, FAA• DoD and Intelligence Community – By statute, every major program requires an independent cost estimate (ICE)• FAA – Need to expand, enhance and professionalize cost estimating• NASA – International Space Station overruns, failed missions, Challenger tragedy, etc.• OMB Requirement for Earned Value Management System (EVMS)	<ul style="list-style-type: none">• Federal Acquisition Regulation (FAR) drives requirements for Cost Estimating System (CES)• Competitive Environment forces need to understand and control costs• Mergers and Acquisitions force focus on enterprise-wide consistency issues



NAVAL
POSTGRADUATE
SCHOOL

Weapon Systems Acquisition Reform Act of 2009 (Public Law 111-23, 22 May 2009)

- Creates Director of Cost Assessment & Program Evaluation, a new position requiring confirmation by Senate:
 - Director, Cost Assessment
 - Director, Program Evaluation
- Creates Director, Development Test and Evaluation (DT&E)
- Creates Director, Systems Engineering (SE)
- Requires Assessment of Technology Maturity



NAVAL
POSTGRADUATE
SCHOOL

Assessment of Technology Maturity

- Requires Director, Defense Research & Engineering to periodically review and assess the technology maturity and integration risk of critical technologies of Major Programs
- Requires annual report to Congress on technological maturity and integration risk
- Requires report to Congress on additional resources required to implement the legislation, including Technology Readiness Assessments (TRAs) and the overall Acquisition process (so-called “DoD 5000”)
- Requires Director of Defense Research and Engineering (DDR&E) to develop knowledge-based standards against which to measure technology maturity and integration risk

- What are costs to develop this capability?
- What does it cost to advance a technology 1 level?



Establishment of formal career paths, education, training standards, requirements, and courses for the civilian and military Acquisition work.

Functional Communities	ARMY	NAVY/ USMC	AIR FORCE	4 th Estate	TOTAL
Auditing	0	0	0	3,638	3,638
Business, Cost Estimating, & Financial Management	3,350	1,935	1,530	270	7,085
Contracting	7,714	5,245	6,834	5,887	25,680
Information Technology	1,764	903	950	317	3,934
Life Cycle Logistics	7,134	4,355	1,727	145	13,361
Production, Quality & Manufacturing	1,952	2,005	383	4,798	9,138
Program Management	3,690	4,085	4,105	901	12,781
SPRDE	10,912	16,767	6,472	866	35,017
Test and Evaluation	2,135	2,476	2,622	187	7,420
Other/Not Listed	1,618	5,295	204	496	7,825
Total	40,269	43,066	24,827	17,717	125,879



NAVAL
POSTGRADUATE
SCHOOL

Standards

- **GAO Cost Estimating Guidebook**
 - GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs, March 2009, GAO-09-3SP, <http://www.gao.gov/products/GAO-09-3SP>
- **Society for Cost Estimating and Analysis (SCEA)**
 - **Certified Cost Estimator/Analyst (CCE/A) Program**
 - Professional recognition to those possessing requisite educational and/or job experience.
 - Certification good for five years.
 - Re-certification through re-examination or for maintaining currency in the field.
 - Industry Standard of Competence--Endorsements from Boeing, Northrop Grumman, Lockheed Martin, and UK MoD.
 - Cited in RFPs (tenders) and in employment criteria.
 - **SCEA Cost Estimating Book of Knowledge (CEBOK)**
 - Patterned after PMBOK
 - desktop training and reference system





NAVAL
POSTGRADUATE
SCHOOL

Standards

- **GAO Cost Estimating Guidebook**

- GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs, March 2009, GAO-09-3SP, <http://www.gao.gov/products/GAO-09-3SP>

- **Society for Cost Estimating and Analysis (SCEA**
<http://www.sceaonline.org/index.cfm>)

- Certified Cost Estimator/Analyst (CCE/A) Program

- Professional recognition to those possessing requisite educational and/or job experience.
- Certification good for five years.
- Re-certification through re-examination or for maintaining currency in the field.
- Industry Standard of Competence--Endorsements from Boeing, Northrop Grumman, Lockheed Martin, and UK MoD.
- Cited in RFPs (tenders) and in employment criteria.

- SCEA Cost Estimating Book of Knowledge (CEBOK)

- Desktop training and reference system
- Patterned after Program Management Book of Knowledge (PMBOK)





NAVAL
POSTGRADUATE
SCHOOL

Cost Estimating Curriculum and Research at NPS

- **OA 4702: Introduction to Cost Estimating**
 - OR Curriculum (Syllabus in Back-Up)
 - Taken by OR, Systems Engineering, Business, and other students
- **Cost Management Certificate Course (CMCC)**
 - Army sponsor; Hosted in NPS Business School.
 - How to manage Army operations efficiently (Cost Management, Operations Management, Control, and Strategic Management)
- **Very Recent Request for Distance-Learning Master's program in Cost Estimating at NPS**
 - NAVSEA made initial request
 - NAVAIR, NCAA and AFIT have indicated strong interest
 - NPS OR and SE personnel in discussions to make it a reality



NAVAL
POSTGRADUATE
SCHOOL

Cost Estimating Research at NPS

- Energy
- Software
- Investment Cost Estimating
- Operations Cost estimating

Examples of
These on
Next Slides

- Research in Process

- Fully Burdened Cost of Fuel
- Fully Burdened Cost of Batteries
- Economic returns from Shipbuilding
- Analysis of US Marine Corps Operating and Support Budgets
- Develop metrics for analysis of the cost of power and energy



NAVAL
POSTGRADUATE
SCHOOL

Density as a Cost Driver in Naval Submarine Design and Procurement

•Purposes:

- Reveal inadequacies of weight as a parametric cost estimator.
- Develop a means to measure submarine density.
- Consider density reduction as a means to reverse the unsustainable trend of weapon system cost growth in excess of inflation.

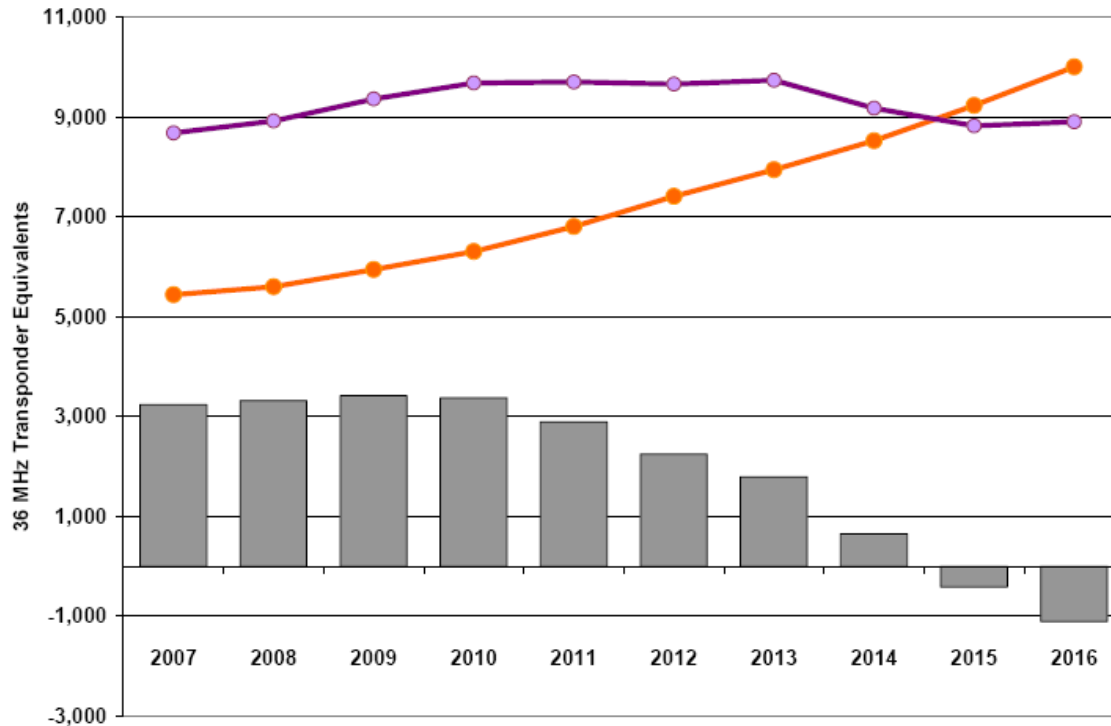
•Summary of Findings

- Density vs. cost = family of U-shaped curves.
- Capping size or weight tends to *increase* costs.
- Density is a previously unexplained driver of historic cost growth in excess of inflation.



NAVAL
POSTGRADUATE
SCHOOL

AN ECONOMIC AND TECHNICAL ANALYSIS OF HOSTED PAYLOADS AS A MEANS OF PROVIDING SATELLITE COMMUNICATIONS



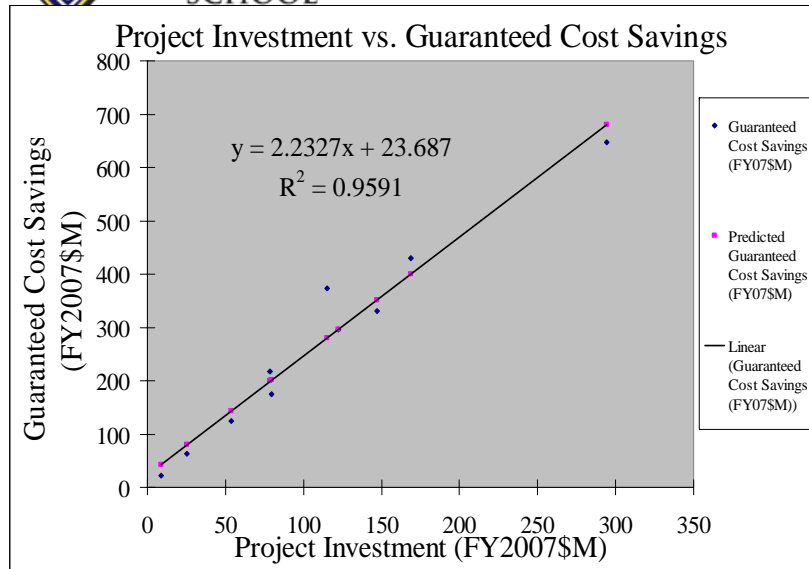
Over/Undersupply
 Transponder Demand
 Transponder Supply

Global Capacity Supply and Demand Gap (From Maletier 14)

Capability	Hosted Payloads	Commercial Leases	Military Procurements
Technical	●	●	●
Legal/Policy	●	●	●
Connectivity	●	●	●
Information Assurance	●	●	●
Operational Management	●	●	●
Interoperability	●	●	●
Operational Suitability	●	●	●



Determining The Return Of Energy Efficiency Investments In Domestic And Deployed Military Installations



Objectives:

- To Determine the financial return on energy efficiency investments in domestic and forward operating bases
- There are two Current Options for increasing Energy Efficiency
 - The use of Energy Savings Performance Contracts (ESPC) to fund energy efficiency improvements at domestic military installations
 - The use of waste to energy refinery devices at military forward operating bases

Description/Methodology

Gather Data

- .Domestic- Direct fuel and utility cost offsets
- .Deployed- Burdened cost of fuel studies Waste disposal costs

Analyze Data

- .Domestic- Guaranteed savings vs contract price
- .Deployed- TGER LCCE vs Standard genset LCCE

Major Assumptions

- .Domestic- Greater efficiency is possible
- .Deployed- Burdened fuel costs are variable

Key Participants:

Lt. Nathan J. Gammache USN

Thesis Advisor: Dr. Daniel Nussbaum

Second Reader: Dr. Peter Coughlan

Key Deliverables: Domestic and Deployed:

– Domestic bases

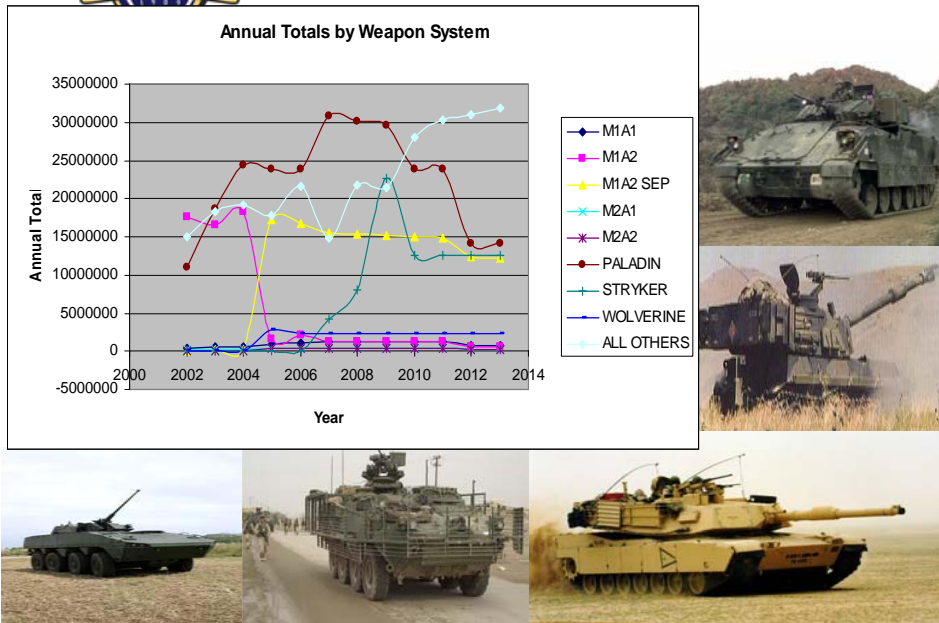
- ESPCs allow installation facility improvements without additional direct government funding
- Majority of possible energy savings (\$1.6B) passed on to private equity lenders
- Agency return is compliance with mandates, not necessarily financial gain

– Deployed bases

- Costs spread out among numerous accounts create split incentives
- Tremendous theoretical savings possible but hard to realize



Estimating Costs of Post Production Software Support



Objectives: “How much will software maintenance cost”

What are the important factors?

What data is available to quantify these factors?

Can we formulate a rigorous model to estimate these costs?

What expertise can we obtain from software maintenance professionals to build a better informed model?

Description:

A database on Post Production Software Support (PPSS) of weapon systems under the Army’s Tank-Automotive Command (TACOM) was provided by the Army’s G-4 DALO-RIL (Resource Integration Division)

Density Data was obtained from the Army’s Operating and Support Management Information System (OSMIS)

The bulk of the analysis was performed on the columnar data sets, namely on the planned funding amounts, year of request, and weapon system that each software project mapped to. The validity of discarding these columns was analyzed using SPSS (Statistical Package for the Social Sciences) Clementine Version 11.1

Key Participants:

Captain Chris Cannon USMC
Thesis Advisor: Dr. Daniel Nussbaum
Second Reader: Gregory Mislick (LtCol Ret.)

Key Deliverables: Tentative Conclusions:

- There is no difference in the annual totals spent on Software support
- There is a difference in the amount programs are allocated within years.
- The amounts allocated to different programs within years are NOT independent.
- The most expensive programs are receiving an increasing share.

There is no rigorous model to predict software maintenance costs.



A Statistical Analysis Of Pacific Fleet Los Angeles Class OPTAR Spending By Activity



Objectives:

Challenges faced by the Commander Submarine Force U.S. Pacific Fleet (COMSUBPAC) Comptroller are to determine the quarterly allocation of funds to each individual submarine and to determine the realistic risk of various funding levels. Historical data shows that actual spending varies widely for any given submarine from month to month. The Comptroller thought the variation could be related to the marines' operating schedules. The purpose of this research is to test the Comptroller's theory:

Is there a statistical relationship between a submarine's schedule and it's operating costs?

Description: *Methodology*

Collect operating and maintenance cost data with the granularity required for the analysis

Convert the data to a common base year

Examine the nature of the distributions of operating and maintenance costs to determine which statistical methods can be used to analyze the dataset

Analyze cost data for relationships among variables other than schedule, which may interfere with an analysis of cost-schedule relationships

Statistically analyze the cost and schedule data to determine if a relationship exists

Key Participants:

Vincent A. Kahnke
Thesis Advisors: Dr. Daniel Nussbaum
Alan Laverson
Phil Candra

Key Deliverables: Relationship between a submarine's schedule and operating costs :

1. SR spending accounts for 85 percent of average monthly OPTAR spending and, therefore, drives the budget.
2. Results indicate there are three main factors that affect monthly SR and SO spending for submarines: (1) the activity being performed, (2) the home-port, and (3) the month of the fiscal year. Factors that did not have a statistically significant effect on monthly spending are the age of the submarine and the squadron (other than Squadron 15).



A Statistical Analysis of Los Angeles Class OPTAR Expenditures Between Pacific Fleet Homeports



Objectives:

For the past several years, average OPTAR expenditures for Los Angeles class submarines have differed between their three homeports in the Pacific Ocean.

Research question: Is there a statistically significant difference between OPTAR spending totals at different homeports in the Pacific Fleet?

Description: "OPTAR"

Data Collection: Cost Data set identified/ Ship homeport data/ Ship underway schedules

Data Analysis: Statistical analysis/ Regression analysis

Three sources of spending data:

Comptroller's Certified Obligation Reports (CORs)
FY2002-FY2006

Comptroller's Budgeted OPTAR Report (BOR)
FY2006

Visibility and Management of Operating and Support Costs Database (VAMOSC)

Relationship between VAMOSC, the CORs and BOR
Allowed expansion of the data set
1996-2006

Key Participants:

LT Joseph C. Rysavy, USN

Thesis Co-Advisor: Dr. Daniel Nussbaum

Thesis Co-Advisor: Cpt. John Mutty USN (ret)

Key Deliverables: Statistical Analysis:

- No statistically significant differences between ports
 - Guam shown to have the most expensive Repair OPTAR
 - Pearl Harbor had the most expensive Other OPTAR
 - High probabilities
- Statistically significant spending differences seen when schedule data applied schedule data may be the most accurate predictor of OPTAR expenditures
- Depending upon the analysis, there are differences observed in Other OPTAR category between homeports



NAVAL
POSTGRADUATE
SCHOOL

Cost Analysis of Electric Grid Enhancement Utilizing Distributed Energy Generation in Post-War Reconstruction

Distributed Generation in Post-War Reconstruction



Objective:

To assist in determining whether or not a distributed generation systems are economically/strategically viable in post-war reconstruction.

Key Participants:

Author: LT Darol D. M. Fiala

Thesis Advisor: Dr. Daniel Nussbaum

Second Reader: Dr. Jomana Amara

Description:

- Develop DG/Large-scale generation data-set.
- Calculate the annual, levelized life-cycle costs of each technology, including fuel and security cost estimates.
- Provide decision makers with relevant information in order to make an informed decision.

Key Deliverables:

- Determine the impact of variable security conditions and fuel costs on distributed generation systems and compare these systems with large-scale generation projects.

- When fuel is at FY\$09 domestic prices, microturbines are the most attractive choice. Security and capital costs are controlling factor.
- When fuel prices rise, PV and wind become more attractive.

	Fuel at Base-Line Price, No Threat	Fuel at Base-Line Price, Low-Threat	Fuel at Base-Line Price, High-Threat	Fuel at 2000% of Base-Line Price, No Threat	Fuel at 2000% of Base-Line Price, Low-Threat	Fuel at 2000% of Base-Line Price, High-Threat
Diesel Generator	Red	Yellow	Red	Red	Red	Red
Microturbine	Green	Green	Green	Red	Red	Red
Photovoltaic	Yellow	Red	Yellow	Green	Green	Green
Wind Turbine	Red	Red	Red	Yellow	Yellow	Yellow
Large-Scale Nat. Gas	Red	Red	Red	Red	Red	Red



NAVAL
POSTGRADUATE
SCHOOL

QUESTIONS?



NAVAL
POSTGRADUATE
SCHOOL

BACK-UP SLIDES



NAVAL
POSTGRADUATE
SCHOOL

We Know *What It Is*

- Cost Estimating:
 - The process of collecting and analyzing historical data and applying quantitative models, techniques, tools, and databases to predict the future cost of an item, product, program or task



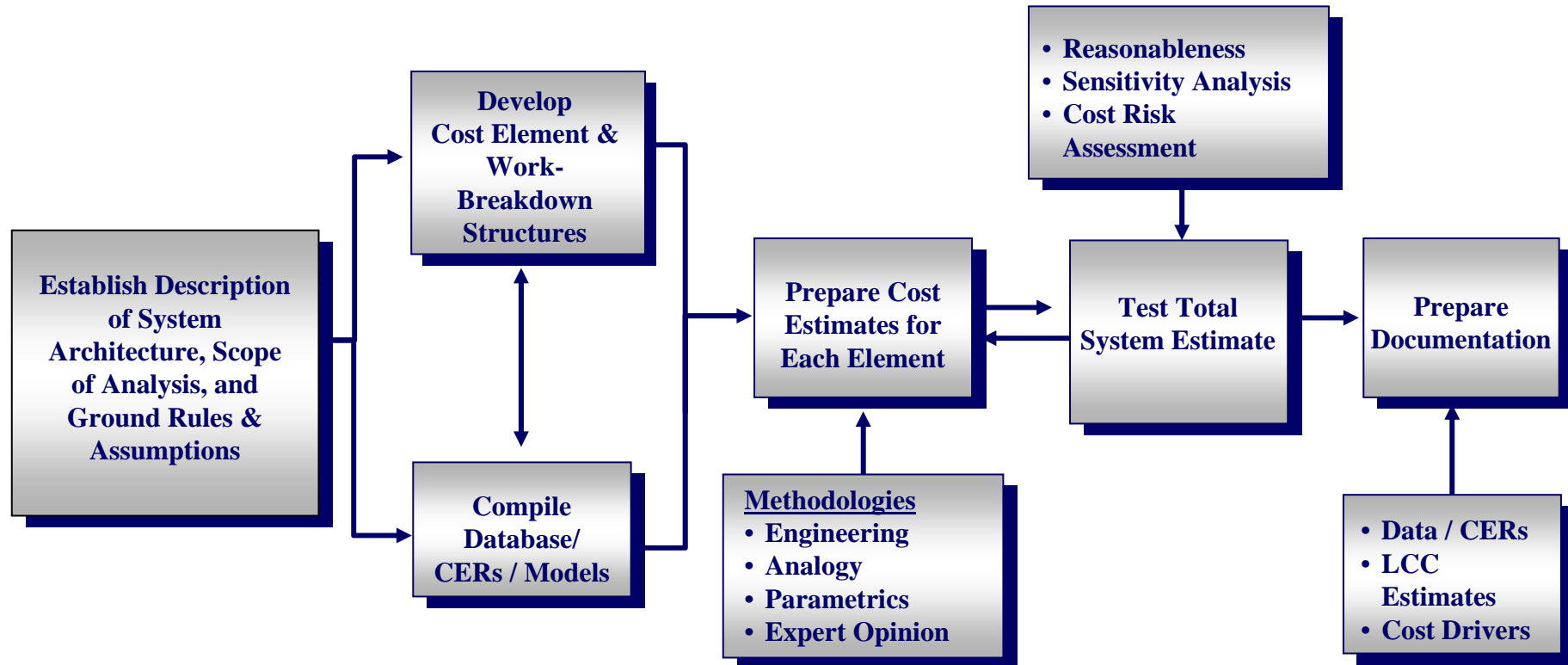
NAVAL
POSTGRADUATE
SCHOOL

We Know Who Our *Customer* Is





We Know *How To Do It* Standard Cost Estimation Methodology



As with any scientific undertaking, there is, at the core, a

Repeatable, Auditable, Analytic process



NAVA
POSTGRADUATE
SCHOOL

We Have *Names* for Our Results

- **Recurring vs. Nonrecurring Costs**
- **Direct Costs vs. Indirect Costs**
- **Fixed Costs vs. Variable Costs**
- **Overhead Costs**
- **Sunk Costs**
- **Opportunity Costs**
- **Life Cycle Costs**

Cost is not a uniquely defined term



We Have Standard Methodologies

Analogy: “It’s like one of these” subjectively compares the new system with one or more existing similar systems for which there is accurate cost and technical data

Parametric: “This pattern holds” sometimes known as the statistical method, this technique generates an estimate based on system performance or design characteristics. It uses a database of elements from similar systems. It differs from analogy in that it uses multiple systems and makes statistical inferences about the cost estimating relationships.

Build-Up: “It’s made up of these” “bottom-up” method of cost analysis that is the most detailed of all the techniques and the most costly to implement. Each WBS element must be costed to build the cost estimate for the entire program.

Expert Opinion: “The other methods are not available”

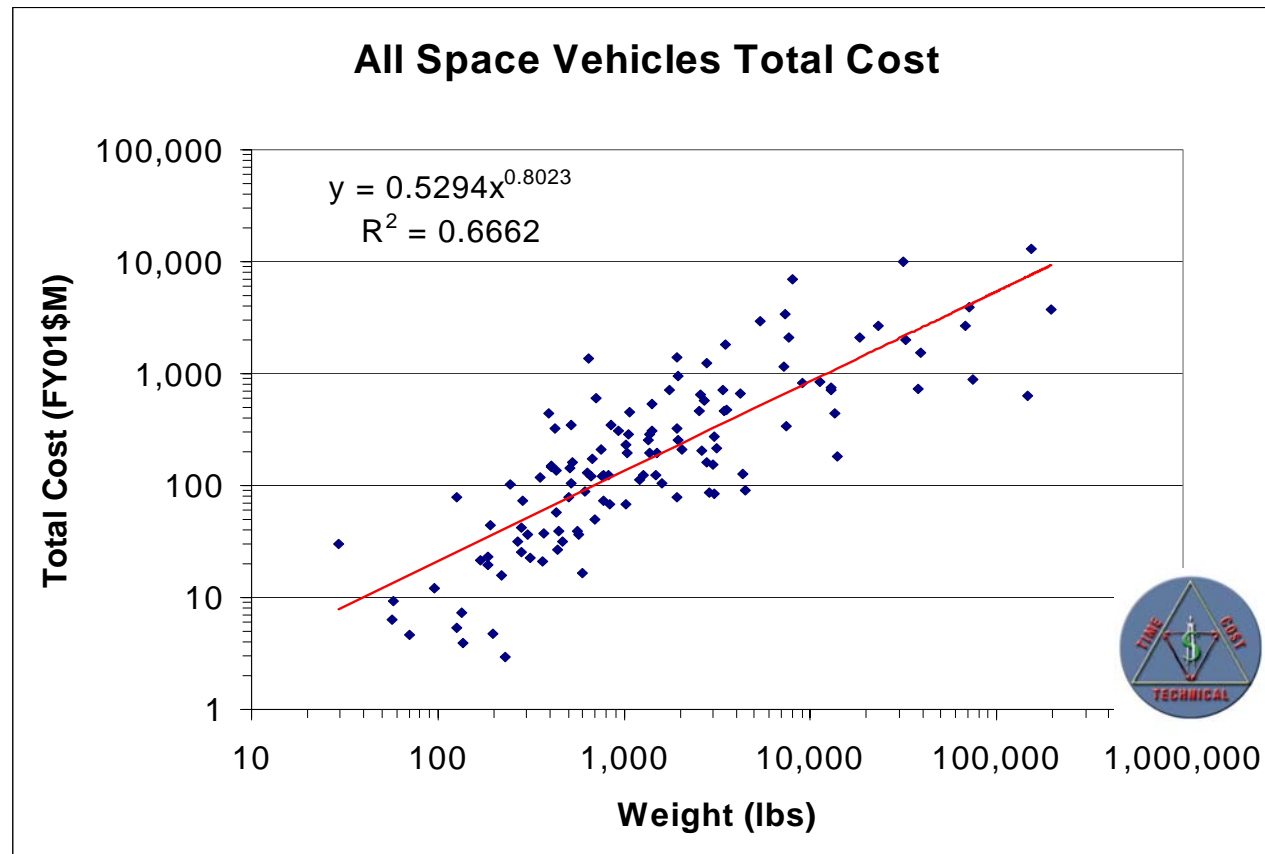
Costing Techniques rely on statistical properties, logical relationships, emotional appeal, and they are based on historical data



NAVAL
POSTGRADUATE
SCHOOL

Example: Weight vs. Total Cost for Spacecraft

- *All Things being Equal, Size and Cost are Positively Correlated*
- **Availability: Usually an Early Design Parameter**

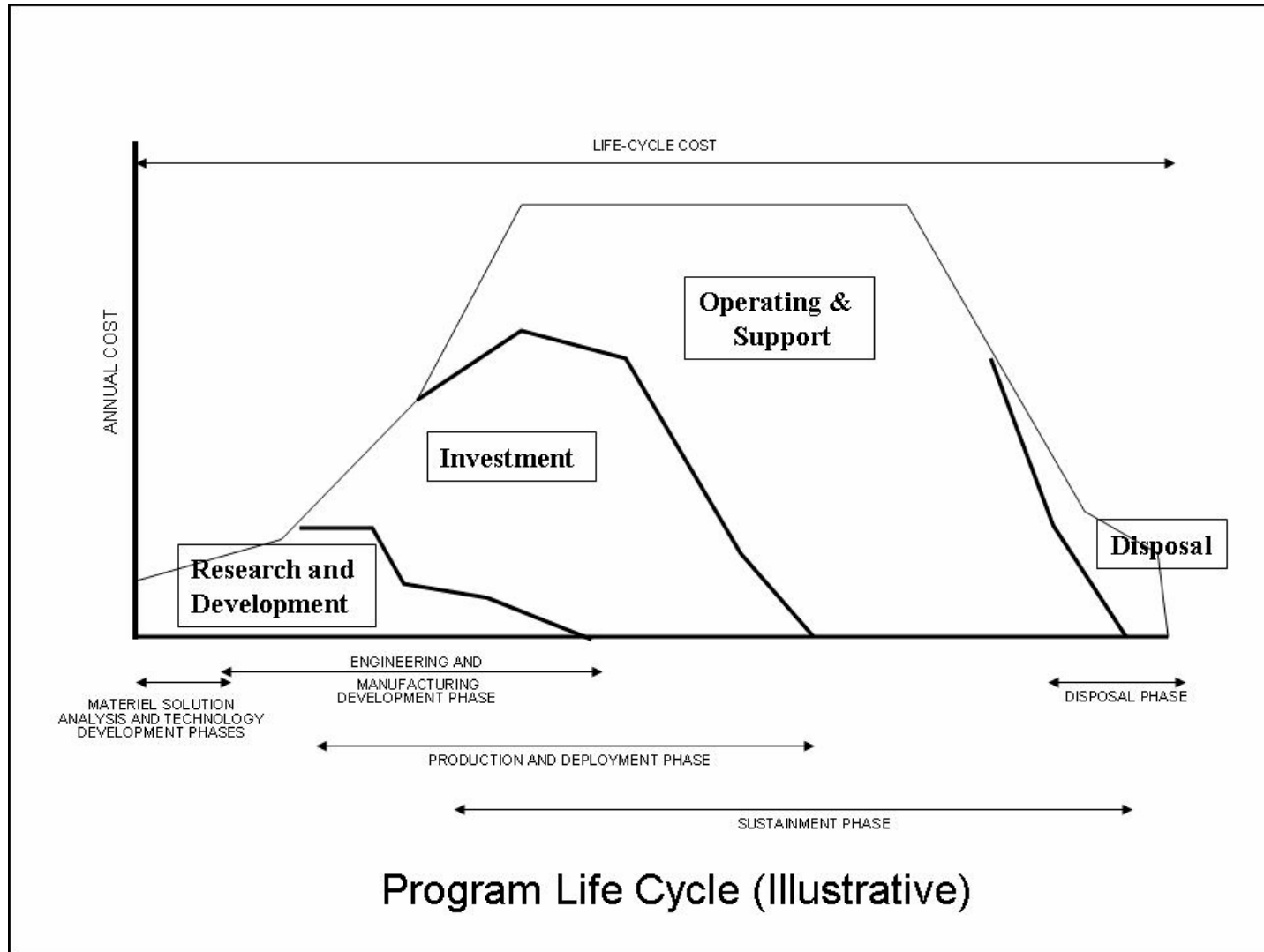


**Engineering
Cost
Office**



NAVAL
POSTGRADUATE
SCHOOL

We Know *What* It Looks Like When Done

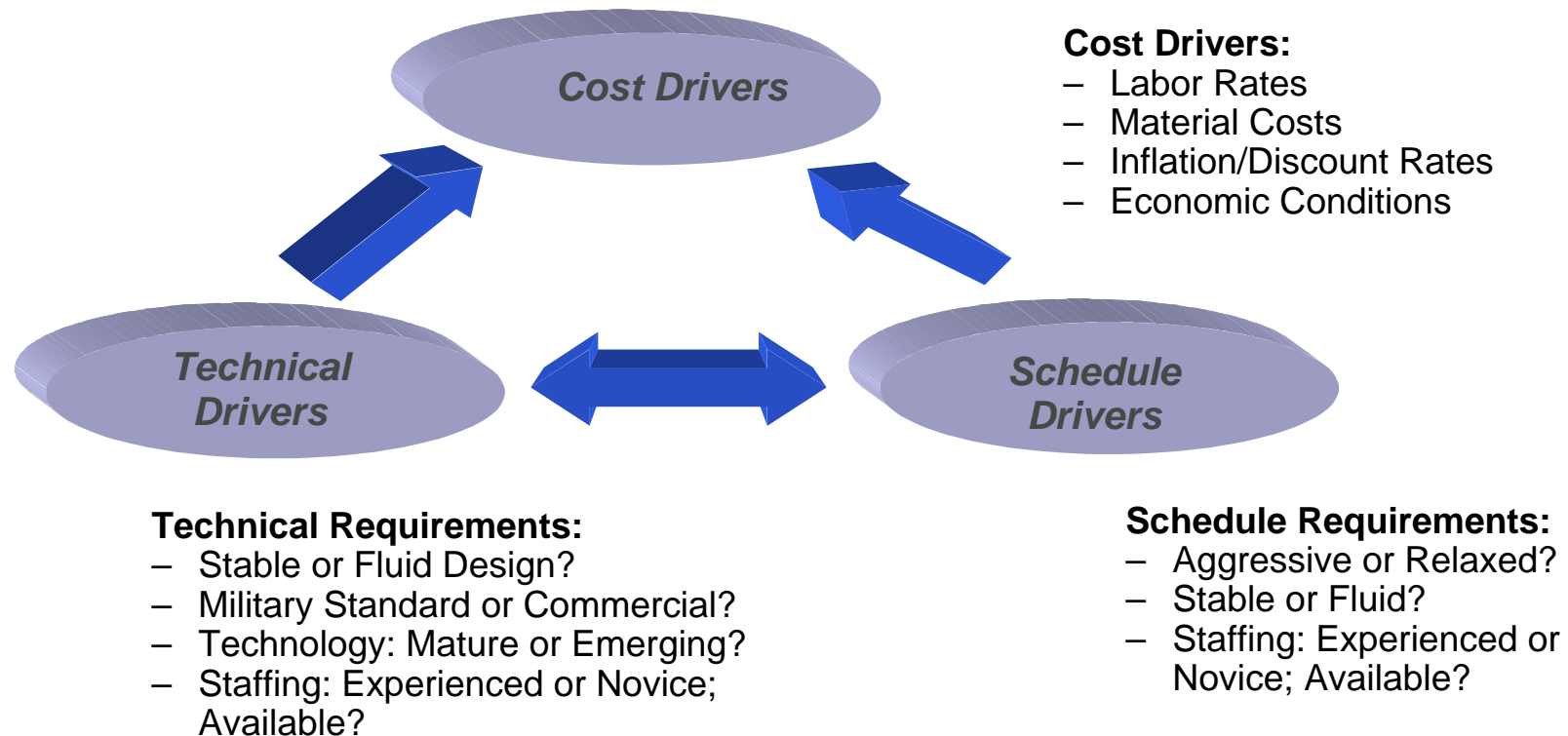




NAVAL
POSTGRADUATE
SCHOOL

We Know We Must Adjust Estimates for Risk

Concurrent with identifying data sources and estimating methodologies, identify, assess, and understand the relationships and risk factors between the variables

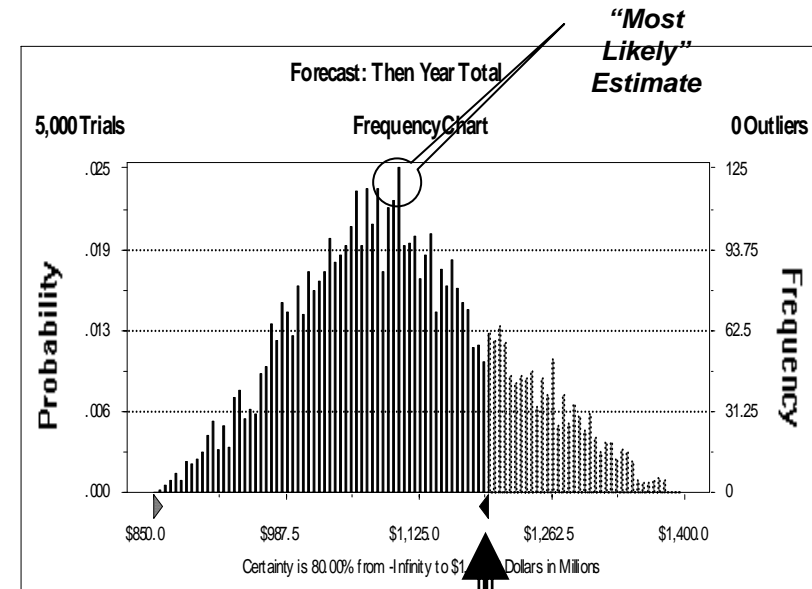




NAVAL
POSTGRADUATE
SCHOOL

We Know How to Adjust Estimates for Risk

- Crystal Ball uses Monte Carlo techniques to repeatedly calculate program costs, sampling values from the probability distributions for the uncertainty variables and using those values for the cost elements
- Based on collecting the results of thousands of scenario runs, Crystal Ball generates a probability distribution of predicted program costs



The DoD typically budgets to the predicted cost that will not be exceeded 50 percent of the time (the “risk-adjusted” value). There are voices that want 80% budgeting.



NAVAL
POSTGRADUATE
SCHOOL

We Know a Good Estimate When We See One

Hallmarks of a good Cost Estimate

- **Good Cost Estimating Practices**
 - Anchored in historical program performance
 - Reflects future process and design improvements
 - Understood by program and business leaders
 - Addresses Risks and Uncertainties
- **Major Attributes of Credible Cost Estimates**
 - Requirements Driven – programmatic and system requirements documented
 - Well-defined content and risk areas – technical basis for estimating methods
 - Can be validated by independent means – within estimating/modeling accuracy
 - Traceable and Auditable – can be re-created from basis of estimates
- **Major Attributes of Credible Cost Estimating Process**
 - Consistent WBS – fixed reference for requirements and performance
 - Consistent ground rules & assumptions for annual estimates
 - Validated estimating methodologies – technically based models correlated to empirical data
 - Cost data collection in sufficient detail and structure to support cost model development
 - Explainable to variety of audiences
- **Cost leadership provides**
 - Confidence in cost estimates
 - Understanding of financial issues and risks



NAVAL
POSTGRADUATE
SCHOOL

Certification Exam

General Certification Exam
(CCEA)

Part I
(PCEA)

Part II

Foundational
Knowledge

Practical
Application I

Practical
Application II

Case Study

Train, Attain, Sustain ... Certification Matters!



NAVAL
POSTGRADUATE
SCHOOL

OA 4702: Introduction to Cost Estimating

I. THE ENVIRONMENT

INTRODUCTION

DEFINITIONS

THE DOD PROCESSES: REQUIREMENTS; ACQUISITION; FINANCIAL, AND
CONTRACTING

WHY AND WHEN DO WE DO COST ESTIMATES

II. SOME INTRODUCTORY PROCESSES

COST ESTIMATING PROCESSES

WORK BREAKDOWN STRUCTURE

STATISTICS

III. COST ESTIMATING TECHNIQUES

METHODOLOGIES (ANALOGY, PARAMETRIC, BUILD-UP, FACTORS,...)

REGRESSION ANALYSIS

MULTI-COLLINEARITY

LEARNING CURVES

EXPERT OPINION

COST FACTORS

WRAP RATES

RISK AND UNCERTAINTY

IV. ECONOMIC ANALYSIS AND TIME VALUE OF MONEY

V. SOFTWARE COST ESTIMATING



NAVAL
POSTGRADUATE
SCHOOL

CCMC

- Four weeks with six hours instruction per day
- Program content: one week each on:
 - **Cost Management:** Cost Measurement, Analysis, and Management
 - **Operations Management:** Cost Estimating and Statistics, EOQ and Safety Stocks, Total Quality Mgmt, Lean Six Sigma, Continuous Improvement
 - **Control:** 75% case studies related to the above and 25% related to Army cost command and control plans
 - **Strategic Management:** Organization Development, Change Mgmt, Strategic Communications



Cost Management Certificate Course

NAVY POSTGRADUATE SCHOOL
Naval Postgraduate School - Monterey, CA



Advanced Cost Management
Senior Cost Analysts, Assistants to the Commander for the Enterprise (ACEs),
GFEBS Cost Management Advocates and Cost Instructors

Cost Management Certificate Course (CMCC)

- Week 1 – Managerial Costing
- Week 2 – Operations Management
- Week 3 – Cost Control
- Week 4 – Organization Development

Four-week graduate education course that teaches candidates how to manage Army business operations efficiently and effectively through the accurate measurement and thorough understanding of the "Full Cost" of business processes, products, and services. The CMCC program of instruction (POI) is designed to teach the fundamentals of cost management with a view to developing a cadre of Army personnel who are professionally knowledgeable, analytically competent, and personally motivated to serve as senior cost analysts, proactive change agents within their respective Enterprise line and staff organizations, or cost advocates in concert with GFEBS. Commands select candidates and pay for travel and per diem; tuition and books are centrally funded by ASA(FM&C).

We recommend that instructors of cost courses at all levels attend this course as preparation.

POST COMPLETION:

Certificate holders will become part of the Cost Management Community of Practice—they will be mentored and coached to produce sustained results. Within six months of completion, they are required to prepare a paper and brief that describes how education has helped them inculcate cost management. Annually, they will compete projects—best efforts will be briefed to Enterprise Management Center of Excellence (EM-COE)* Executive Council. Competitors strive to become Center of Excellence Fellows.

*NOTE: The EM-COE is a nascent organization; HQDA is discussing how the Army will credential the EM-COE Fellows Program.

- All CEs should sponsor participants in the CMCC; application materials at: <https://www.us.army.mil/suite/page/616700>
- Commands endorse and prioritize multiple nominations
- Each offering holds a cadre of a maximum of 25 students

CMCC Course Schedule for FY10

CLASS NO	DATES
1	19 OCT - 13 NOV 2009
2	11 JAN - 5 FEB 2010
3	1 MAR - 26 MAR 2010
4	3 MAY - 28 MAY 2010
5	12 JUL - 6 AUG 2010
6	30 AUG - 24 SEP 2010