



**2009**

**Mini-**

**Conference**

# Balancing Cost, Performance, Schedule, and Risk

2009 INCOSE-LA Mini Conference

Dr. Edmund H. Conrow CMC, CPCM, CRM, PMP  
Consultant  
(310) 374-7975

[www.risk-services.com](http://www.risk-services.com)  
[conrow@risk-services.com](mailto:conrow@risk-services.com)

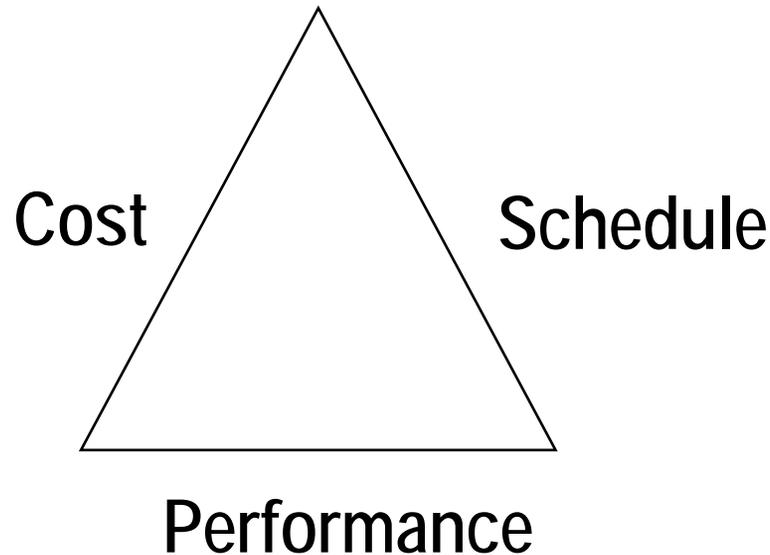
# Author Biography

- 30+ years experience in technical and management positions evaluating C,P,S and risk on “programs of the highest national importance”
- Risk manager or mentor to risk managers 25+ times on actual programs/proposals
- Publically credited with helping to develop risk management processes and policies that are in widespread use across industry and government
- Project manager and consultant to PMs numerous times on a variety of technical and management concerns
- Author and co-author of highly regarded risk management and project management texts (e.g., Effective Risk Management: Some Keys to Success, Second Edition, American Institute of Aeronautics and Astronautics, 2003)
- Ph.D. general engineering, M.S. and B.S.N.E. nuclear engineering, Ph.D. and M.Phil. policy analysis (all from accredited programs)
- Associate Fellow/Life Member AIAA, Senior Member IEEE, Member INCOSE, Certified Management Consultant (IMC), Certified Professional Consultant to Management (NBCC), Certified in Risk Management (IIPER), Project Management Professional (PMI), etc.

# Overview

- Examine historical DoD program outcomes—should we be concerned?
- Explore causes of inadequate balancing of C,P,S and risk
- Discuss approaches to more effectively balance C,P,S and risk

# Introduction: Key Variables



- Almost all variables can be translated to C,P,S
  - For example, quality (e.g., reliability) is a subset of performance
- Variables are complexly inter-related
  - Dominant variable varies by participant, industry, etc.
- Each dimension (C,P,S) also includes risk

# Observations From Analytical Framework, Confirmed With 52 DoD Major Development Programs

- Relatively few programs have performance slips or performance advances beyond those contractually required
- The variation in development phase performance change is much smaller than variations in cost and schedule change
- Systems will often have development phase cost growth and/or schedule slips
- The distribution of development phase performance change tends to be symmetrical, whereas cost and schedule change are right-hand skewed
- No simple relationship exists between C,P,S change and the beginning of the final development phase start date vs. time

# Causes of Inadequate C,P,S and Risk Balancing (1)

- An unrealistic C,P,S program starting point often exists
  - Due to high performance requirements (that are also unstable and unverified) for an insufficient budget (C) and S
- Utility preferences of government and contractor are typically unspecified and unknown
- Government and contractor preferences jointly only favor performance, not cost or schedule
- Possibility curves and constraints may not be identified early enough to positively influence the design
- Feasible limit of performance achievable for a given cost and schedule is unclear (e.g., what is a feasible solution?)

# Causes of Inadequate C,P,S and Risk Balancing (2)

- Systems engineering and risk management are often weakly implemented (see Charette, Dwinnell, McGarry)
- Major program decisions are made before the relationship between C,P,S and risk is understood
- Development phase dynamics clearly favor performance
- An asymmetric merit system rewards meeting performance far more than cost or schedule

# Better Balancing C,P,S and Risk (1)

- Need stable, approved requirements with initial verification at program start
- Need adequate budget and schedule given the requirements
- Prior to initiation, look for opportunities associated with/and by trading C,P,S and risk
- Recognize that the government and contractor are heterogeneous entities and each is a buyer and seller
- Following initiation, consciously trade C,P,S and risk continuously and throughout the program
- Perform C,P,S and risk trades for all new candidate requirements/baseline changes

## Better Balancing C,P,S and Risk (2)

- Consider estimating and ranking  $U = f(C,P,S)$
- Provide contractual incentives/disincentives for C and S
- Need effective systems engineering and risk management
- Initiate better C,P,S and risk education at universities.  
Engineering courses rarely/never explicitly address:
  - C,P,S and risk trades
  - Integrating cost and schedule together with performance
- Improve knowledge level within INCOSE
  - INCOSE SE Handbook Version 3.1 does not explicitly address C,P,S and risk trades or the inter-relationship of C,P,S and risk

# Observations to Consider (1)

"Typically, in weapons development great emphasis is placed on performance. Most new weapons are developed around specific detailed performance requirements laid down by the military—requirements that are taken very seriously. The penalties incurred by the contractors for not meeting performance requirements are more severe than for failure to meet availability schedules or failure to live within original cost estimates. As a result, whenever circumstances dictate a retreat from early plans, it is usually the costs and/or availability that gives ground... Degradations in performance are seldom tolerated."

*Andrew W. Marshall and William H. Meckling, "Predictability of the Costs, Time, and Success of Development", The Rand Corporation, P-1821, October, 1959, pp. 20-21.*

# Observations to Consider (2)

"The contractor and government program management team overestimates technology readiness, downplays potential problems, and fails to plan and perform adequate risk management at program initiation and throughout the program, resulting in unexpected cost overruns, schedule delays, and technical compromise. Initial impacts surface as early as Dem/Val and continue throughout succeeding program phases. These effects exist on all programs to varying degrees."

*"U. S. Air Force Acquisition Process Review Team: Clear Accountability in Design," Final Report, April 1991, pg. 3.*

# Closing Comments

- Delays in deriving and verifying requirements, plus unrealistic requirements, budget, and schedule can substantially increase risk and lead to eventual program problems
- Initiating programs with these shortfalls contributes to eventual cost and/or schedule overruns
  - Present in the vast majority of DoD, NASA, and similar programs
- C,P,S and risk are infrequently traded—should be done continuously and throughout the program
- Provide contractual incentives/disincentives for C,P,S
- Need effective systems engineering and risk management
- Need university-level training on C,P,S and risk

# Key References

- *Robert Charette, Laura Dwinell, John McGarry, "Understanding the Roots of Process Performance Failure," CrossTalk, August 2004*
  - <http://www.stsc.hill.af.mil/crosstalk/2004/08/0408charette.html>
- *Edmund H. Conrow, "Effective Risk Management: Some Keys to Success," Second Edition, American Institute of Aeronautics and Astronautics, 2003*
  - <http://www.risk-services.com/aiaabok1.htm>
- *Defense Acquisition University, Risk Management Guide for DoD Acquisition, Fifth Edition, Version 2, 2003*
  - <http://www.risk-services.com/RMG20June2003.pdf>



**2009**  
**Mini-**  
**Conference**

# Contact Information

Dr. Edmund H. Conrow, CMC, CPCPM, CRM, PMP

Consultant

Redondo Beach, CA

(310) 374-7975

[www.risk-services.com](http://www.risk-services.com)

[conrow@risk-services.com](mailto:conrow@risk-services.com)