

Practical Look at How Private Sector Entrepreneurial Contractors Use Earned Value (And what “Lessons Learned” this might offer for State and Federal Governments)

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The fact remains- for state and federal governments as well as large, private sector owner companies, the track record in producing “successful” projects (defined to be delivered reasonably on time, reasonably within budget; in substantial conformance to the technical requirements without killing anyone or despoiling the environment has been abysmal. (Whether or not the product of the project failed or succeeded it not the topic of this paper, only whether the project itself was a success in terms of the more traditional time, cost, quality, safety, health and the environment)

In the June, 2013 issue of PM World Journal, <http://goo.gl/LorHj> I explored whether or not small to medium sized contractors, working under the traditional “design>bid>build” contracting process, complied with ANSI 748, and concluded that yes, we do, but with several very important differences.

In this paper, I pick up where I left off in June and will explore in greater detail exactly how small to medium sized contractors (“entrepreneurial contractors” as opposed to large corporate contractors) apply and use earned value and how, by understanding better how we use earned value, the state and federal governments can modify the relevant laws or regulations to gain full advantage that EVM offers.

To start, the simple facts are:

- 1) Contractors, in a normally competitive market are working on single digit EBIT margins. There is no room for mistakes. (In a highly competitive or “tough times” market the EBIT margins may well be zero)
- 2) Because of the competitive nature of the design>bid>build contracting, where the “lowest responsive bidder” wins the contract, the market forces us from building in too much contingency into our selling price.
- 3) On the other hand, with single digit EBIT margins, if we do make a large enough mistake, or a series of mistakes in estimating our costs then we will quickly and unmercifully be driven into bankruptcy.

Thus the cost estimating and scheduling competencies are a core to any successful contractor. We can neither be too high or too low. And that range is incredibly small. Meaning our cost and duration estimates MUST be accurate, reliable and precise.

As I closed out last month's article, I offered a graphic which I have been using for over 40 years. It dates back to the early 1970's and my undergrad days where I was taking a course at Worcester Polytechnic Institute (WPI) taught by Marvin Gates, PE. This was when Earned Value was first becoming talked about in construction management and I wrote a now long gone paper, which featured this graphic in explaining how Earned Value worked.

This graphic is important because from the contractors perspective, there is clearly a link between work performed and cash flows. Yet the way Earned Value is used in most government applications, this clear and unambiguous link is missing. And that is one of the first weaknesses that needs to be corrected IF we want earned value to become more widely used as a project and program management tool. Both from the owner and contractors perspective, cash flows are important and you cannot divorce work being completed on a project from the cash flow analysis necessary to fund this work.

SOURCE: Giammalvo, P D, 2013 "Do Private Sector Small To Medium Sized, Entrepreneurial General Contractors Comply With ANSI 748? If yes, how, if not, why not?" PM World Journal <http://goo.gl/0frUA>

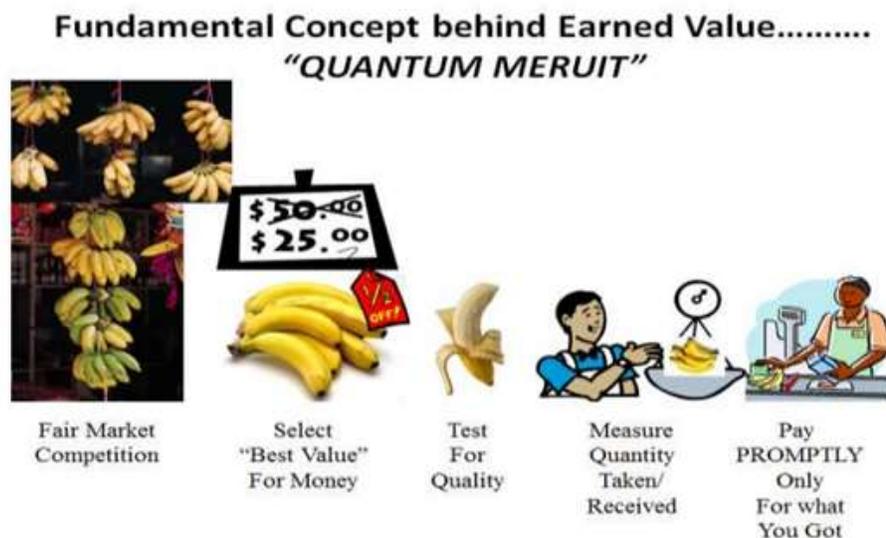


Illustration 1- Earned Value from the Private Sector Contractor's Perspective⁷

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Figure 1- Earned Value as Firm Fixed Price Contractors Perceive It.

The above graphic, which I originally produced for an undergraduate term paper back in the early 1970's represents how the private sector firm fixed price ("hard money") contractors, working in the traditional design>bid>build environment perceive and use earned value. This model has proven accurate and reliable over many years as an entrepreneurial, small to medium sized business enterprise.

Fair Market Competition- As a CONTRACTOR I MUST know the fair market value of the goods/services I am providing. Why? Because if I am bidding higher than “fair market value” then I will not win work and if I am bidding too low, then I will not be able to make any profit. So the range between being too high and being too low is only about -5% to +5% or a 10% range. The primary tool I use to perform this analysis is “Target Costing”ⁱ.

From the OWNERS perspective, they too MUST know the fair market value of what they are purchasing. This is the very essence behind Deputy Secretary of Defense, Mr. Ashton Carter’s “will cost vs should cost” estimates. (ref memo dated 22 Apr 2011 <http://goo.gl/t7nxL>) It is imperative that a QUALIFIED quantity surveyor or cost estimating company produce an INDEPENDENT “will cost” estimate, that is at least P90 (mean +1.29 σ) to P98 (mean + 2.00 σ) This high number is used as the basis upon which to make the business decision whether the project is a go or a no go. (And this is consistent with Butt’s figure 39 below) That means POLITICS needs to be taken out of the equation to as great an extent as possible and only sound business decisions (those projects with independently calculated positive benefit :cost analysis) should go forward.

For a contractor, as we are committing contractually to a firm fixed price, the cost estimate we provide to the owner is a “Will Costⁱⁱ” estimate. The basis for our bid is a “Should Costⁱⁱⁱ” estimate marked up to include our contingency for risk events (“Known Unknowns”) and our profit margin, which for a contractor, is our “Management Reserve”. Likewise, the owner too should have produced their OWN “should cost” and “will cost” estimates to compare the contractors’ prices. To accomplish this, owners often hire “Quantity Surveyors” or “Cost Engineers” to create their own detailed “will cost” estimates.

Select Best Value for Money- From the perspective of a private sector contractor, this is often the case. The owner will obtain more than one bid and then is free to negotiate with the apparent low bidder to obtain a “better” price. While taken to an extreme, this is known “bid shopping” but it is common practice and those of us who are contractors understand these are the rules of the game and price our work accordingly. (As illustrated by the graphic)

Test the product- A key element of the private sector contractor is the burden of proof is on the CONTRACTOR to prove to the OWNER that he/she has fulfilled three criteria:

- 1) I have physically completed the work (as evidenced by site visits or photographic submittals)
- 2) The work I have completed is in substantial conformance to the technical requirements (as evidenced by whatever test reports are required by the owner)
- 3) I have fulfilled the contractual terms and conditions of the contract (the “shall clauses”)

Measure the Amount Taken or Received- The form illustrating this fundamental practice is shown below (AIA document AIA G702) Relevant to this paper is billing is based on ACTIVITIES completed and not WBS deliverables completed. In project management “God (or the devil) lies in the details”. (Rudy Giuliani in his book, Leadership^{iv}) If you manage the details then the bigger picture will take care of itself. Lose control of the details and the project will quickly turn into a nightmare. This is perhaps one of the most important “core concepts” which

separates owners from contractors. Because we work on single digit EBIT margins we MUST manage the details otherwise we are quickly driven out of business. However, for cost plus contracts or even the owners portion of fixed price contracts, the key is to manage the details. You CANNOT manage projects successfully at a high level.

Pay PROMPTLY for work completed in substantial conformance to the specs and in conformance to the contract terms and condition- Contractor's, regardless of their size, live and die by their cash flows. Unfortunately, this fundamental concept is totally missing in the ANSI 748 and other standards related to Earned Value Management. You CANNOT divorce the cost budgeting process from the cash flow analysis, whether from the owner or contractor perspective. The two are inseparable and to lose that connection is to lose the ability to better manage the projects.

Informal research analysis has shown that USUALLY, when a contractor fails to perform on a contract, the root cause problem can almost always be traced back to cash flow problems.

SOURCE: Butts, Glenn with Linton, K, 2010 "Mega Projects- A History of Denial"
<http://goo.gl/uDLMw>

statistics for more complex projects would likely be worse: Page 11

How Do We Underestimate?

- Let Me Count The Ways -

1. OMIT PROBABLE SCOPE from estimate
2. OMIT POSSIBLE RISKS from analysis
 - Internal & External
3. UNREALISTIC, OPTIMISTIC assumptions

} RAND Study – Reason for 74% of Cost Growth

4. Use historically LOW ESCALATION projections
 - RAND Study – Reason for 11.2% of Cost Growth
5. Issue cost estimates in BASE YEAR dollars
 - Estimates should be in then year dollars (escalated to year in which it is spent)
6. Many estimates NOT PREPARED BY A BONA FIDE ESTIMATOR
 - Everyone's a estimator
 - Being certified no guarantee of having necessary experience
7. REWARD failure, PUNISH honesty
8. NOT ENOUGH TIME to prepare CREDIBLE estimates
 - Time often spent doing "what if" exercises, or splitting dollars into arbitrary buckets

"I reject a system that rewards failure and protects a person from its consequences"
- Barack Obama -

Escalation Assumptions Should be Realistic Page 12

I am advocating that we need to look not only at the TECHNICAL issues but also the soft or PEOPLE issues, SPECIFICALLY, ACCOUNTABILITY

While the Rand Study touched on SOME of the ROOT CAUSE PROBLEMS it did not cover ALL of them.

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Figure 2- Root Cause Problems in Estimating Costs and Durations From Glenn Butts

This graphic is taken from Glenn Butt's 2010 presentation "Mega Projects- A History of Denial". While it cites Rand's "Improving the Cost Estimation of Space Systems"^v (<http://www.rand.org/pubs/monographs/MG690.html>) study, Butt's recommendations go beyond the Rand study and add ADDITIONAL criteria that the Rand Study missed. It is my professional opinion that fixing the first 5 problems are mostly technical or political problems which cannot or will NOT be solved until the last 3 are put in place. That is, until or unless cost estimators, schedulers, along with project and program managers have LEGAL and FINANCIAL accountability for the numbers they create and accept, both in term of cost and time, there will NEVER be any improvement.

Again, speaking as a hard money contractor, IF I am too high then I will never win any work. On the other hand, if I am too low, I will soon be bankrupt, with the potential to lose not only my job, but also putting my assets on the line in the form of a performance bond or investments in the project. So because I have considerable "skin in the game" I am VERY cautious about my cost and time estimates. IF we want state and federal government projects to be completed on time and within budget OR if we want projects from any owner organization to be completed on time and within budget, there must be some SERIOUS "skin in the game" and that means people getting FIRED if the numbers they produced or have agreed to in accepting a project, are not met.

Just like professional engineers and doctors, unless there is legal and financial accountability, including losing one's license to practice, there will never be any significant improvement in the delivery of projects, ESPECIALLY for state and federal government project and program managers.

SOURCE: Butts, Glenn with Linton, K, 2010 "Mega Projects- A History of Denial"
<http://goo.gl/uDLMw>

Blue S-Curve is model estimate based on as built configuration.

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Possible Solutions

- ♦ Hold project managers accountable for the original estimate
 - Project Managers will THEN begin demanding credible estimates
 - Recognize that historically many original assumptions are OPTIMISTIC or simply NOT valid
 - Resist the legacy practice of labeling COST growth as "SCOPE" growth
 - Rather than scope "growth" historically, scope "reduction" is often what has actually occurred. Real requirements are often trimmed - NOT expanded
 - Space Station was originally touted with 8 functions - but cut down to 1
 - Shuttle's original requirement was for a payload of 65,000 lbs. - Maximum current payload capability is 49,000 lbs.
 - Mercury Program deleted two monkey passenger test flights
 - Etc., etc...

OR

- ♦ Include all possible risks in cost projections (internal and external)
 - Projects tendency to spend everything available must be constrained
 - Congress budget constraints aggravate issue - they demand that all money is spent.
 - Make it fashionable to be austere and frugal and encourage "under run"
 - It's always possible to spend more time and money

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In the mining case study I shared, these were the guiding factors we relied upon when advising our client on how to create a reliable, accurate and precise cost estimate.

How English Government Deals With Bad Estimates

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Figure 3- Solutions Proposed By Glenn Butts to the Root Cause Problems

So what else do we have to do besides just holding cost estimators, schedulers and project managers financially and legally accountable?

Earned Value is a well-established tool/technique to manage projects; however, in order for Earned Value to work, it is dependent upon an accurate, reliable and precise cost estimate. Without a realistic baseline estimate, everything else in Earned Value falls apart. So the first priority needs to be to invest sufficient "front end loading"^{vi} to ensure that the budget contains contingency to cover every single KNOWN risk event (contingency) as well as a sum of money set aside for UNKNOWN-UNKNOWN risk events which is Management Reserve. (Note for a CONTRACTOR, our profit margin is our "management reserve").

Just to be clear, Earned Value is NOT a "solution" to the problem. EVM is the "canary in the cage"- it is a tool to measure our performance against the approved baseline plan, with the expectation that it is management's fiduciary responsibility to the stakeholders to either complete the project "reasonably" within the time and budget constraints OR to be required to justify why or how the project will not finish reasonably within time or budget constraints.

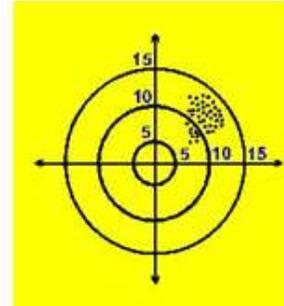
SOURCE: Adapted from Rizos, Chris, 1999. "Precision, Accuracy and Reliability Illustrated"
<http://goo.gl/IS9x3>



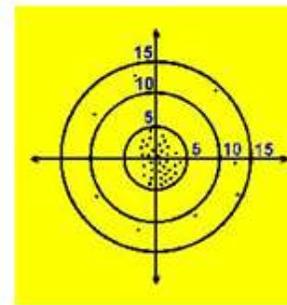
PRECISION- The spread or dispersion of the data as measured by Standard Deviations



ACCURACY- How close is the estimate To the TRUE or FINAL COST or DURATION



RELIABILITY- is the sensitivity to outlying values. You want a cost or duration estimate which makes it easy to identify deviant costs or durations from the plan



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Figure 4- Precision, Accuracy and Reliability of Cost Estimates Explained.

Before getting into any recommendations on HOW to realize or fulfill the solutions proposed by Glenn Butts, I have been using a graphic created by Chris Rizoz, SNAP-UNSW, Australia to illustrate the differences between the PRECISION, ACCURACY and RELIABILITY of cost and duration estimates. While Chris' paper was created for GPS analysis the graphics themselves and the description Chris has provided us with are readily adaptable for use in cost and duration estimating. These terms are something all professional organizations and organizations should be standardizing on and referencing when talking about any estimate, be it time or cost.

PRECISION- is a measure of how closely clustered the data is around a central point or target. This is the essence behind AACE's RP 17-R-97, 18-R-97 and graphic 4.1 on page 12 of the DoE's G 413.3-21 "Cost Estimating Guide" <http://goo.gl/GRx60> The whole objective of "progressive elaboration" of the scope, time, cost and risk in a project over time, using the phased gate process is to refine the time and cost numbers to be more PRECISE. This is or should be measured by using statistical analysis (standard deviations as the basis for estimates of both time and cost. While this is being done, the terminology has not been standardized and should be.

ACCURACY- is the measure of how close the actual values- either time or duration- are to the estimate. This is why CPI and SPI are so important to us. The target CPI for a “hard money” contractor is within +/-5% of the contractors target cost or schedule. (Not necessarily the owner’s cost or schedule) That means a CPI between 0.95 to 1.05, understanding that if the contractor is consistently running a CPI greater than 1.05, under normal competitive conditions, it means his costing/pricing model is probably too high and he is losing work. And if the contractor is consistently running a CPI of 0.95, given single digit EBIT margins for most work, it means he/she is probably losing money. Ideally, at the end of the project, the accuracy should be right on the bullseye, however anything within a range of +/-5% is considered very well done for a contractor. (And this includes the impacts of all approved change orders.

In terms of SPI, the criteria are tighter. Why? Because it is much harder to gain back TIME than it is to gain back MONEY. So the target SPI for a hard money contractor is +/-3% from the contractors target schedule, modified of course by any approved change orders. This table illustrates the KPI CPI and SPI values for a hard money, firm fixed price contractor, working in a normally competitive market under traditional design>bid>build contracting methods.

	Green	Yellow Zone		Red Zone	
	Target	Lo Value	Hi Value	Lo Value	Hi Value
CPI	0.95 - 1.05	0.96 - 0.85	1.06 - 1.15	<0.85	>1.15
SPI	0.97 - 1.03	0.96- 0.85	1.04- 1.15	<0.85	>1.15

Table 1- Typical SPI and CPI values for private sector, “hard money” (FFP) contractors

While owner companies can get away with greater spreads, given they are accountable to their shareholders, if too many of their projects do not perform well it will show up in the dividends and/or the market price, so there is some accountability for owner company project managers. But for the purposes of this paper, because state and federal governments have a fiduciary duty to the taxpayers of their country and because they do not have the clear accountability to shareholders we find in the private sector, I am proposing governmental organizations should be held to the same standards as entrepreneurial contractors. This is consistent with Butt’s recommendations on how to fix the problems we are seeing with state and federally funded projects and Ed Merrow, IPA has documented with private sector oil, gas and mining companies in the private sector with his book “*Industrial Megaprojects: Concepts, Strategies, and Practices for Success*”^{vii}.

RELIABILITY- is the impact outliers have on the mean or average value. The tools/techniques we use to measure the reliability are Statistical Process Control Charts and Process Capability Analysis. For a contractor, this is one of the tools/techniques we use to prove the cumulative impact that multiple small but frequent change orders has on a project, both in terms of time and cost.

DoE Figure 4.1 on page 16 MODIFIED to reflect statistical ranges instead of percentages

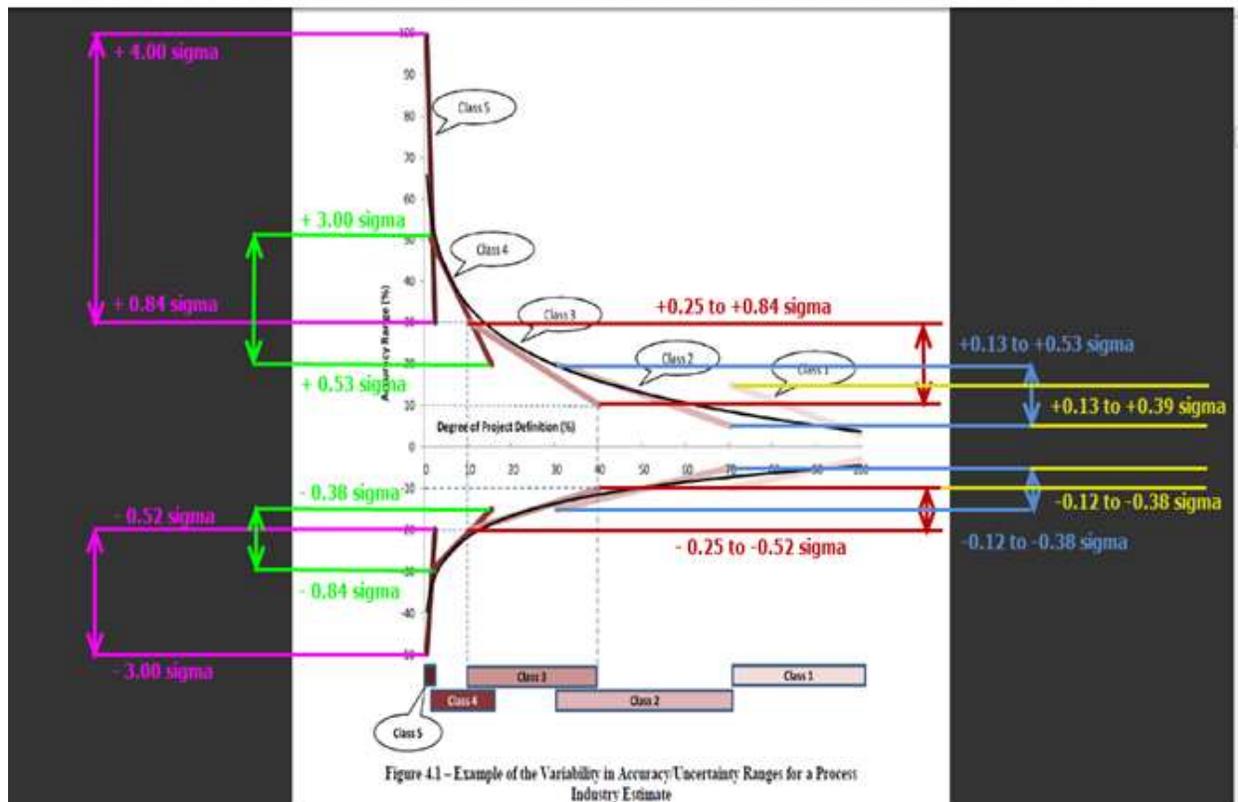


Figure 4.1 - Example of the Variability in Accuracy Uncertainty Ranges for a Process Industry Estimate

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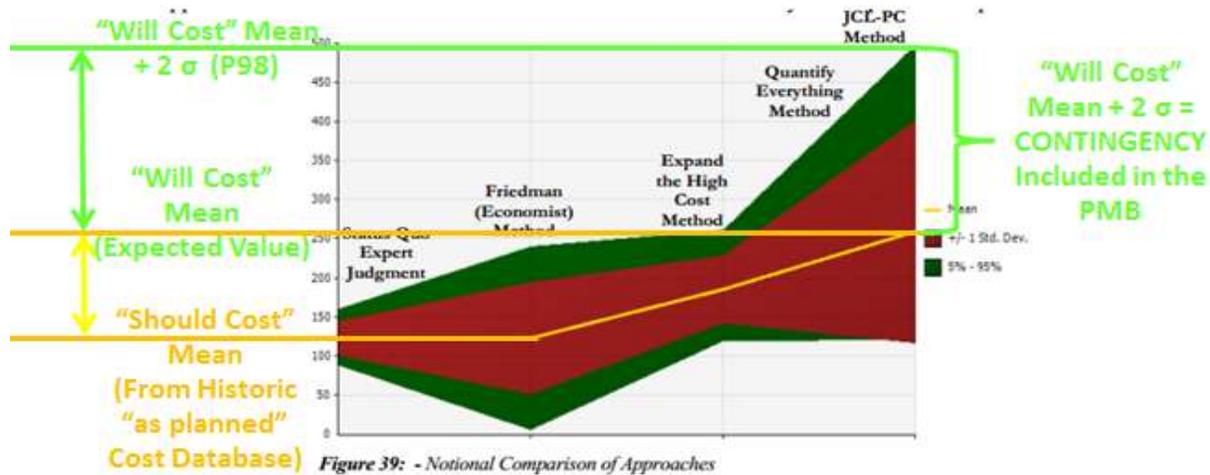
Figure 5- DoE Range Estimates Converted from Percentages to Standard Deviations

So the question becomes how do we create cost and duration estimates which, when executed, meet the CPI and SPI criteria from Table 1?

Figure 5 came from the DoE's G 413.3-21 "Cost Estimating Guide" <http://goo.gl/GRx60> which was based on AACE's RP 17-R-97 "Cost Estimate Classification System". Consistent with the definition of "PRECISION" and applying "best proven practices" the recommendation to AACE (and to the DoE or others who adopt this approach) is to change from a range estimate using percentages to a range estimating system based on statistical analysis using standard Z Tables. By using a Phased Gate approach to project definition, done correctly and appropriately, by the time the project is actually FUNDED, all the risks along with the amount of contingency to cover the identified risks should already be incorporated into the budget.

What is important for state and federal governments to recognize is this process is consistent with the concept of "will cost" and "should cost" estimating methods mandated (to the DoD) by Mr. Ashton Carter in his April 11, 2011 memo. It appears as though the government does NOT build in sufficient risk contingency into their cost structure, including the risk that scope may change. (i.e. "Scope Creep" or "Mission Creep")

SOURCE: Butts, Glenn with Linton, K, 2009 "The Joint Confidence Level Paradox: -A History of Denial" NASA Cost Symposium
<http://goo.gl/LPZXR>



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Figure 6- Illustration Showing How Glenn Butt’s JCL-PC Method was Adapted to Will Cost Method

Taking the work of Butts and combining it with the directive issued by Mr. Carter, this illustrates how we mentored one of our clients in adapting the recommendations of Butts to come up with a “Will Cost” estimate which incorporates contingency to cover ALL the KNOWN risks into the BCWS or Performance Measurement Baseline. (PMB)

This is how we calculated the BCWS (PMB) for the mining case study below. We started with Glenn Butt’s JCL-PC method (without the simulation- see his 2009 paper <http://goo.gl/LPZXR>, figure 39 on page 46) We looked at the existing database they were using which we knew was grossly over optimistic, as it was based on the approved AFE and not the as-built costs. Then we went out and found the ACTUAL “AS BUILT” costs of similar projects in less risky locations. We updated those costs reflect a robust risk analysis of all the possible risk events, no matter how slight, and then adjusted those numbers into the FUTURE (+2 year) dollar values (the year the project was scheduled to be constructed and finished in, NOT the current year when the project was being budgeted.) We also adjusted the mean costs for KNOWN risk events over and above those risks already build into the actual cost database. We did this for all the comparables in the database. Then we ran a statistical analysis on those comparables and used P98 (mean plus 2 sigma), we generated a P98 cost estimate which we took to management for them to use in creating and analyzing the business case. So the business case was not based on

some pie in the sky optimistic estimate but what amounts to pretty near the worst case scenario. Because the business case still held up, the project was given the OK and towards the end of the following year it was started . (almost 19 months from the time the project was first proposed and the budget cost estimate was created till it was started and over 28 months before the project was actually completed)

CASE STUDY

LOWER WANAGON STEP DRAIN CONSTRUCTION -- Week -13 (08-14 March 2010) DASHBOARD

Page 4 of 5

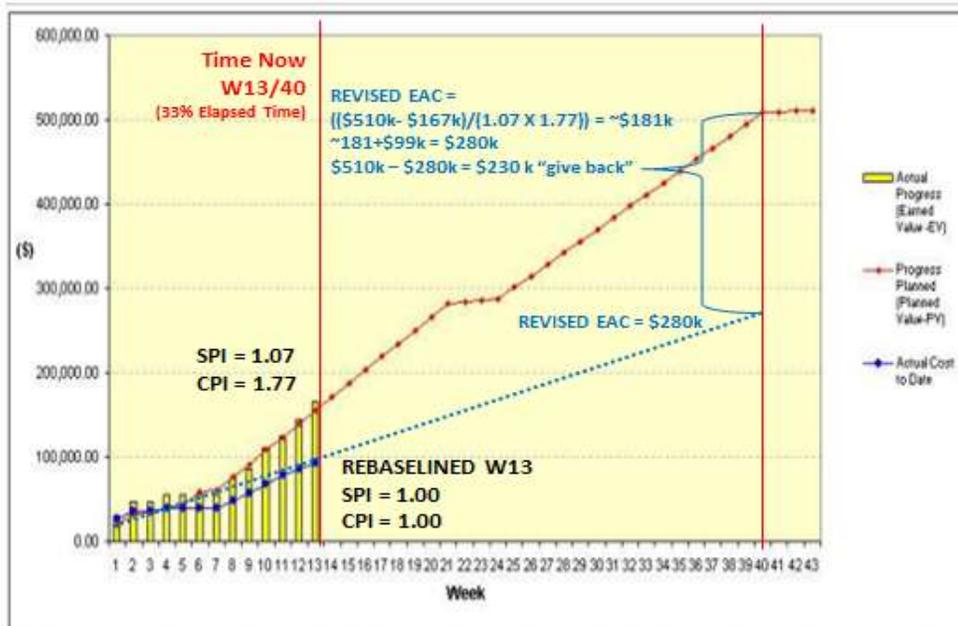


Figure 7- Photo of the Case Study Project

This is an case study from one of our clients (a MAJOR US based copper and gold mining company working at a remote site in West Papua, Indonesia.) It illustrates the whole idea behind why following Glenn Butts, Steen Lichtenberg or Bent Flyvbjerg’s concept and using a beyond “worst case” cost estimating approach is better. In this specific project it was not possible to use the existing database as the area is totally new and quite remote even from the base camp.

(Which itself is remote). This meant the cost estimator had to take the existing cost database and update it not only to reflect the future year dollars, but also to incorporate all known risk events, INCLUDING the probability that the scope of work would actually increase. Thus the PMB contained contingency for all identified risk events, with the clear understanding that around 25% elapsed time an analysis would be done and consistent with Butt’s admonition to “give money back”

SOURCE: Dangdua, Danny, Advanced Project Management Course Case Study
<http://goo.gl/ZgN82>



Regards,

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Figure 8- Case Study Analysis at the 33% Elapsed Time

This 2010 case study illustrates what we believe to be a perfect example of an owner’s project estimated and run according to Butt’s JPL-PC concept.

The baseline estimate was a created using the “Will Cost” estimating method, which included CONTINGENCY for all risk and reasonably anticipated scope growth at P90. (Mean + 1.29 σ) The BUSINESS CASE was based on the RISK ADJUSTED P90 cost estimate and duration estimate. (Contingency is INCLUDED in this baseline estimate, but MANAGEMENT RESERVE is not)

In this case, using the “best practices formula” to calculate EAC ($EAC = ((BAC - BCWP) / (SPI \times CPI)) + ACWP$) the actual costs to date, projected into the future using the SPI X CPI formula, indicate the original estimate was “fat” by \$510k (BAC) - \$280k (EAC) = \$230k. The $\$230k / 510k = 45\%$ represents the total ALLOCATED risk contingency or “buffer”, which is consistent with Butt’s JCL-PC approach. (He talks about triple digit growth for aerospace but this is pretty fundamental construction so the growth is unlikely to be that high) Consistent with Butt’s admonition that excess money be RETURNED BACK, at the 33% elapsed time (13/40 weeks) based on the actual performance to date and a better and more complete understanding of the true risks and scope involved, this project manager “gave back” to his boss the \$230,000 in what amounts to unused risk and scope growth contingency.

Most importantly, consistent with Butt’s advice, this project manager received an AWARD for having turned back money he no longer needed. This is EXACTLY what we should be seeing in the government sector as well.

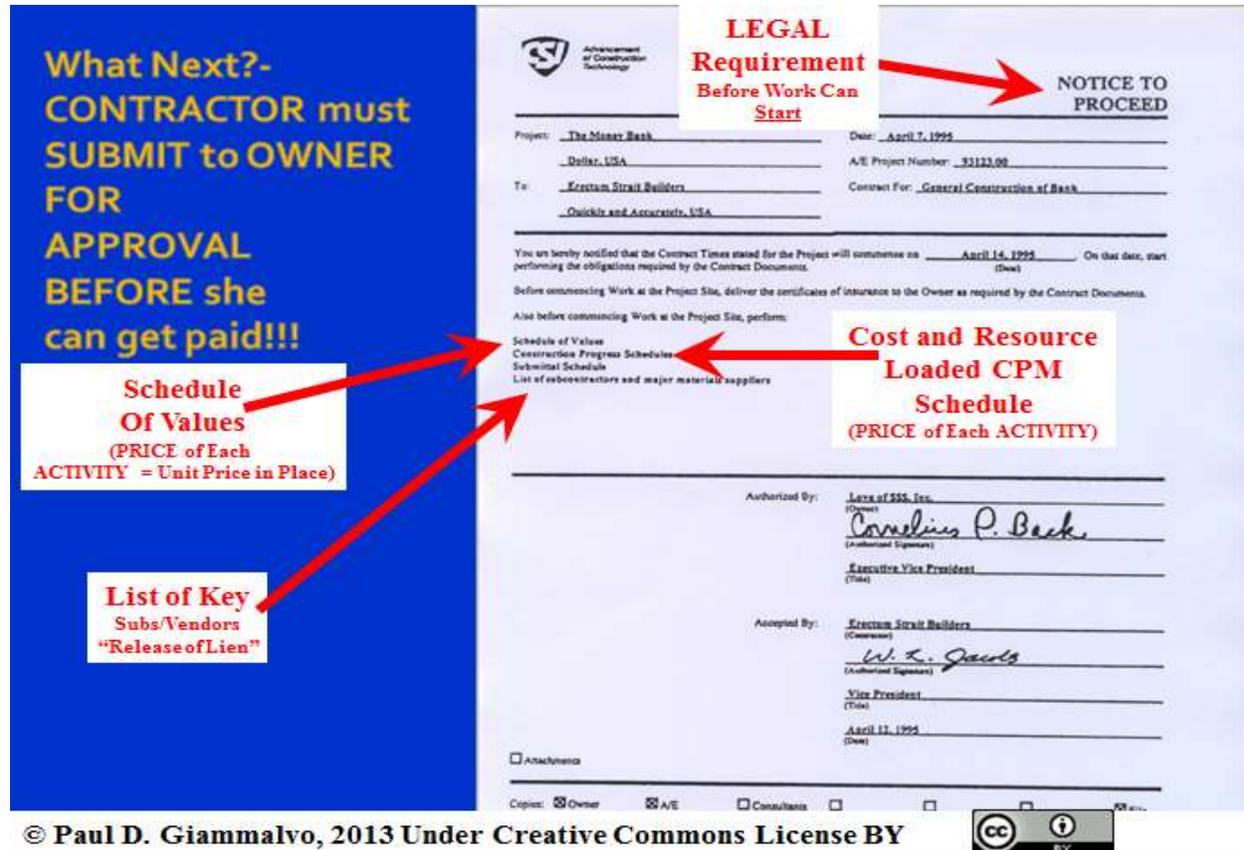


Figure 9- Implementing Earned Value in the World of “Hard Money” General Contracting.

The above sample comes from CSI’s “Notice To Proceed” document. BEFORE I (as a hard money contractor) can start a project, we are obligated to provide our unit prices. Why? Because in the event of a change order, this becomes the basis for any negotiations or equitable adjustments, either up or down depending on the actual quantities vs the contractors estimated quantities.

This also requires that the CONTRACTOR submit to the OWNER a fully cost and resource loaded CPM schedule. When we say “COST LOADED” we do NOT mean the CONTRACTORS cost but his/her SELLING PRICE. The cost and resource loaded schedule produces a baseline BCWS which is exactly equal to the contract value. This becomes the BAC, and is subject to any approved change orders.

Important to note is the OWNER MUST take the cost loaded CPM schedule as submitted by the CONTRACTOR and ADD TO this schedule the owners project indirect expenses (project manager, QA/QC, Safety) plus any owner supplied equipment or services. Thus the owners

managers for ACCEPTING these numbers when they accept the position of project/program manager.

Without that clear and unambiguous accountability for the cost estimate and the CPM schedule we are NEVER going to see any significant improvement in project management. With no legal or financial accountability, project and program managers are subject to pressure from “politicians” whether they be the corporate variety or the state or federal official variety. This MUST stop. ALL projects must have a business case and if the business case is not positive, then the project should not be undertaken. PERIOD.

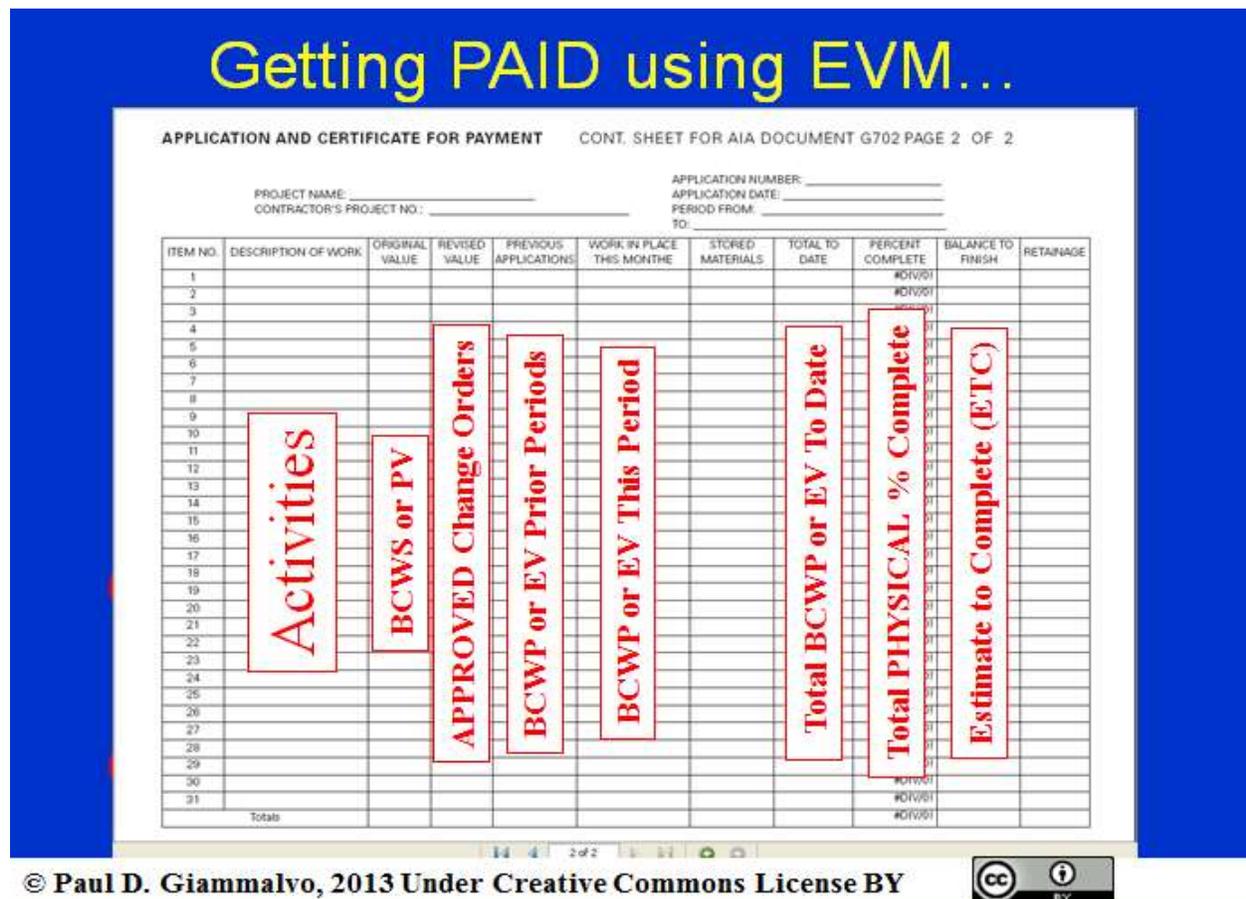


Figure 11- AIA Document G702 Application for Payment Using Earned Value, Page 2 of 2

This is page 2 of 2 of the same document, illustrating that as private sector contractors our billing is NOT based on the WBS but on the ACTIVITY. This is CRITICALLY important IF you want your contractors focusing on the approved schedule and NOT on merely achieving milestones, which is the most common method of using earned value at least in most private sector projects. The most important element for owners (be they governmental or private sector) to understand is that CONTRACTORS LIVE OR DIE BY OUR CASH FLOWS. Once owners understand that fundamental principle, the reward system becomes very Pavlovian. Not to demean contractors, but just as you train your dog by rewarding him with a doggie biscuit when he performs a trick,

rewarding contractors for completing ACTIVITIES is just as effective. This is what we call “Doggie Biscuit Project Management”©

To reiterate, managing projects is about effectively and efficiently managing DETAILS and in order for a project to have any hope for success, the OWNER must take responsibility to manage the detailed activities they need to perform to enable the contractor to do his/her job and the contractor likewise must be responsible for his/her detailed activities. IF the activities go smoothly, then the project will go smoothly. If the activities do NOT go smoothly, it provides both owner and contractor alike with an early warning sign that the project is heading for trouble. But by focusing on the greater detail, problems can be identified when there is still time to FIX the problems.

Total Float is >0	SPI >1.0 Ahead of schedule on critical path, more work being done than planned on all activities. Possible padding?
	SPI = 1.0 Ahead of schedule on critical path, exactly on plan for non critical work. Cautious project manager
	SPI < 1.0 Ahead of schedule on critical path, falling behind on non-critical work. Balance allocation of specific resources
Total Float is = 0	SPI >1.0 Critical Path on schedule, more work being done on non-critical activities than planned. Balance Resources
	SPI = 1.0 Critical Path on schedule, total work volume exactly as planned. Optimum use of resources
	SPI < 1.0 Critical Path on schedule, shortfall (falling behind) in non-critical work. Add more near critical resources.
Total Float is <0	SPI >1.0 Behind schedule on critical path activities, ahead in total work. Balance/reallocate resources to critical activities.
	SPI = 1.0 Behind schedule on critical path, exactly per plan in total work effort. Resource shortage/imbalance.
	SPI < 1.0 Behind schedule on critical path, total work less than planned. Need more total work effort.

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Figure 12- How to Combine SPI and Float Analysis to Identify a Common Problem on Many Projects.

This graphic has been adapted from AACE’s Skills and Knowledge of Cost Engineering 5th Edition, Chapter 16, Figure 16.9 by Dr. Joe Orczyk. This is used PRIMARILY by owners as an “early warning sign” or “trigger” that the project is understaffed, however contractors too should be looking at the same metrics.

By comparing SPI and Total Float, it is possible to identify “Early Warning Signs” that a project is headed for trouble BEFORE it is too late, specifically related to having insufficient or the wrong kinds of resources on the project.

And one of the primary reasons behind having insufficient resources on a project (assuming they are available, which the contractor probably has no control over) can be traced to insufficient cash flows on the part of the contractor. How can we help prevent this? Ideally by paying contractors within 2 weeks of work being satisfactorily COMPLETED or at the outside 30 days after the work is done. Yes, 14-28 days after the work has been PHYSICALLY COMPLETED, not 30 days after the contractor has billed you or 14-28 days after the accounting department gets around to processing it, but 14-28 days after the work has been DONE. Try it and you will a MARKED improvement in your contractor’s performance.

TO CONCLUDE:

Project management is clearly NOT working. Projects are consistently finishing late, over budget, some with quality, safety and/or environmental problems, not to mention the PRODUCT of many projects is not delivering the value for which they were undertaken.

Business As Usual (BaU) is no longer acceptable. Glenn Butts, representing an owner company has produced a hard hitting set of recommendations which I, as a Contractor, also believe will dramatically improve the delivery of projects.

- 1) Cost Estimators, CPM Schedulers, Project and Program Managers MUST be held financially and legally accountable for the cost and duration estimates they produce and sign off on, just as doctors and engineers are legally and financially responsible for their errors and omissions.
- 2) As we cannot have ACCOUNTABILITY without AUTHORITY commensurate to that accountability, we must empower our cost estimators, CPM schedulers, Project and Program Managers to make independent decisions without being over-ridden by clients, customers, bosses or politicians. (Reward Success and Punish Failure)
- 3) Both TIME and COST estimates need to incorporate the probability that there will be both SCOPE and COST growth as well as impacts from all risk events, both internal and external. The performance measurement baseline MUST include CONTINGENCY allocated against each and every identified risk.
- 4) No project regardless of how desirable or expedient should be allowed to proceed without a solid business case and project sponsors and program managers should be held accountable for the projects in their portfolio substantially realizing the value or purpose for which the project was undertaken to achieve in the first place. Explained another way, project sponsors and program managers are not only responsible for the PROJECT, but the PRODUCT of the project.

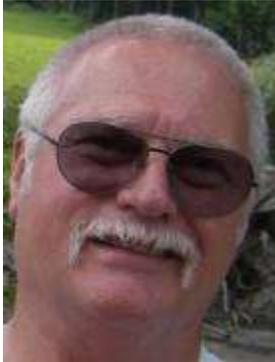
- 5) Earned Value is not and SHOULD not be an onerous bureaucratic requirement. The concept of earned value is nothing more than applied “common sense” that each and every one of us use whenever we go grocery shopping. For state and federal agencies in particular, you have made earned value into something much more complicated than it need be.
- 6) Earned Value Management is NOT the SOLUTION to all these problems but the “canary in the cage” which warns of impending problems. Earned Value Metrics (as shown on the DAU Gold Card plus the SPI vs Float and Contingency Drawdown vs Physical % Complete) are no different than the gauges on your automobile dashboard. They warn of problems only.
- 7) Organizations such as PMI, AACE and all governmental agencies must focus on teaching your program managers not only how to generate the numbers but more importantly how to interpret what they are telling us and what we, as managers must do to fix the problem.
- 8) No project should be started without 100% funding committed prior to commencement, regardless of whether it is one year or 10 years long, and all projects must be estimated using inflated (time adjusted) dollars, not budget year dollars.

Given that the USA and European Union are for all intents, bankrupt, and that a good portion of that bankruptcy has come about because of failed projects, we no longer have the luxury of accepting Business as Usual. Earned Value is not the silver bullet to cure all the problems.

However Earned Value Management, applied in a “common sense” manner, can provide us with a way to measure and manage those projects in a way that should ensure that the PROJECT is “successful”- on time, within budget, in substantial conformance to the technical and contractual requirements. And if used appropriately, EVM affords us a great tool to identify problems when there is still time to fix them and if the problems are not fixed, then EVM provides a great audit trail to identify those who should be held legally and financially accountable for the failure.

BUT, before we can expect ANY worthwhile value from the use of Earned Value, we MUST start out with a realistic “will cost” estimate and an equally realistic “will take” schedule. Failing an accurate, reliable and precise budget in terms of time and cost, will render the potential benefit from earned value management largely useless.

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For 20+ years, he has been providing Project Management training and consulting throughout South and Eastern Asia, the Middle East and Europe. He is also active in the Global Project Management Community, serving as an Advocate for and on behalf of the global practitioner. He does so by playing an active professional role in the Association for the Advancement of Cost Engineering International, (AACE); Construction Specifications Institute (CSI) and the Construction Management Association of America, (CMAA). He also sat on the Board of Directors of the Global Alliance for Project Performance Standards (GAPPS), www.globalpmstandards.org, Sydney, Australia and is active as a regional leader in the International Guild of Project Controls. <http://www.planningplanet.com/guild>

He has spent 18 of the last 35 years working on large, highly technical international projects, including such prestigious projects as the Alyeska Pipeline and the Distant Early Warning Site (DEW Line) upgrades in Alaska. Most recently, he worked as a Senior Project Cost and Scheduling Consultant for Caltex Minas Field in Sumatra and Project Manager for the Taman Rasuna Apartment Complex for Bakrie Brothers in Jakarta. His current client list includes AT&T, Ericsson, Nokia, Lucent, General Motors, Siemens, Chevron, Conoco-Philips, BP, Dames and Moore, SNC Lavalin, Freeport McMoran, Petronas, Pertamina, UN Projects Office, World Bank Institute and many other multi-national companies and NGO organizations.

Dr. Giammalvo holds an undergraduate degree in Construction Management, his Master of Science in Project Management through the George Washington University and was awarded his PhD in Project and Program Management through the Institute Supérieur De Gestion Industrielle (ISGI) and Ecole Supérieure De Commerce De Lille (ESC-Lille- now SKEMA School of Management) under the supervision of Dr. Christophe Bredillet, CCE, IPMA A Level. Paul can be contacted at pauldgphd@gmail.com.

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ⁱ Definition of Target Costing- Target costing is a process of determining the actual cost price of any product or service after considering the desired profit margin behind the same.

Formula: Target Cost = Expected selling price – Desired profit

ⁱⁱ Definition of “Will Cost Estimate”- Contract pricing based on what the bidder or offeror estimates it will cost to do a particular job within a specified timeframe. Such projections are based usually on current and historical cost data and, therefore, require analysis to eliminate the likelihood of perpetuating past inefficiencies. <http://www.businessdictionary.com/definition/will-cost.html#ixzz2WwNXrye>

ⁱⁱⁱ Definition for “Should Cost Estimate” - Approximation of a contract-price, developed by the customer's accounting, engineering, procurement, and other costing staff. The staff conducts a thorough, in-depth review of the contractor's plan to identify and eliminate inefficiencies and diseconomies, and quantifies their effect on the total cost of the project. The resulting cost figure is the should-cost estimate. <http://www.businessdictionary.com/definition/should-cost-estimate.html#ixzz2WwO1NiYg>

^{iv} Giuliani, Rudolph W., (2005) Leadership <http://goo.gl/YCHJ7>

^v Rand Corporation (ND) “Improving the Cost Estimation of Space Systems: Past Lessons and Future Recommendations” <http://www.rand.org/pubs/monographs/MG690.html>

^{vi} “Front End Loading” or FEL- A term coming from the oil and gas sector which advocates that more effort be expended in the conceptual

^{vii} Merrow, Edward W. (2011), “Industrial Megaprojects” <http://www.amazon.com/dp/047093882X>