

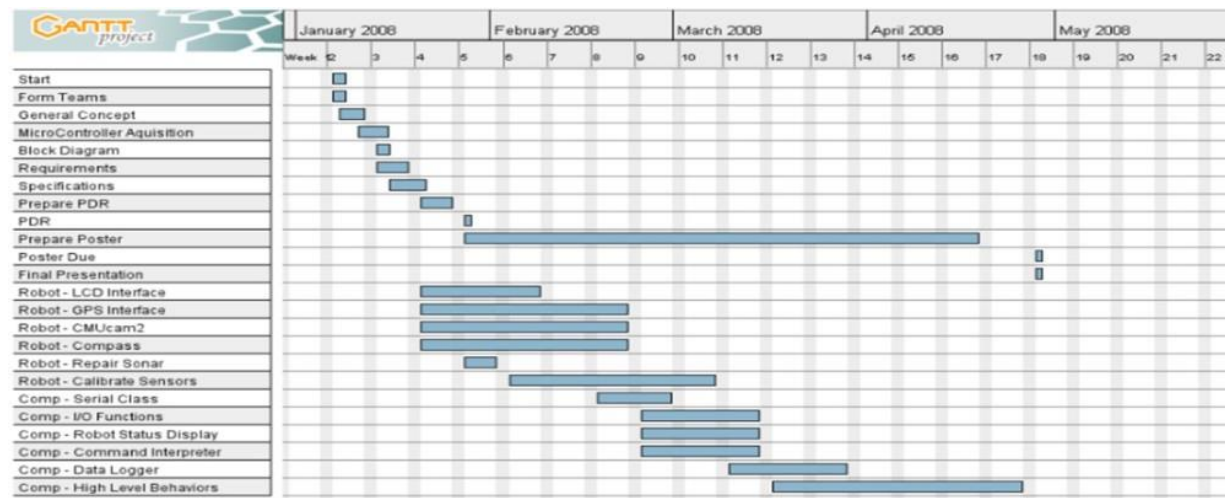
TAKE THE GUESS OUT OF GUESS-TIMATING: Use MILESTONES to Monitor Project Performance ¹

Dr. Kenneth F. Smith, PMP

At a recent PMI Philippines Chapter face-to-face ‘Happy Hour’ I sat between two young participants – *they are all young nowadays!* – discussing the ever-increasing intricacies in software to manipulate micro data. I interjected, lamenting the loss of an erstwhile app that produced **time-scaled Critical Path charts**; noting flaws embedded in extant scheduling software, as well as their consequent misuse in monitoring project performance. That experience inspired me to write this article to also enlighten the contemporary world-wide community of Project Practitioners.

Evolving from a combination of **Gantt Bar charts** representing **tasks**, and **Milestone charts** representing **checkpoints**, during the late 1950’s the **Critical Path Method (CPM)** merged both concepts into an interlocking **Network** sequence of ‘Activities’ and ‘Events’ – *i.e. ‘Milestones.’*

Figure 1
Gantt Chart



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Figure 2
Milestone Chart

Event	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Subcontracts Signed			△▼					
Specifications Finalized			△▼					
Design Reviewed				△▼				
Subsystem Tested					△			
First Unit Delivered						△		
Production Plan Completed							△	

Comprised of arrows and milestone nodes, initially these Critical Path networks took one of two forms -- either Precedence, or Time-scaled:

Figure 3
Activity on Arrow (Precedence) Network

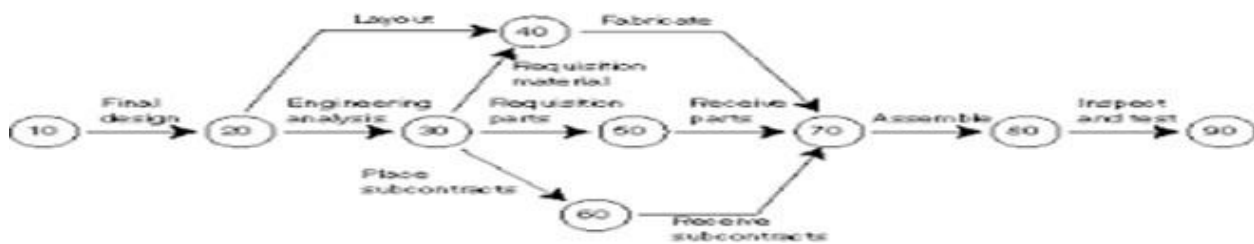
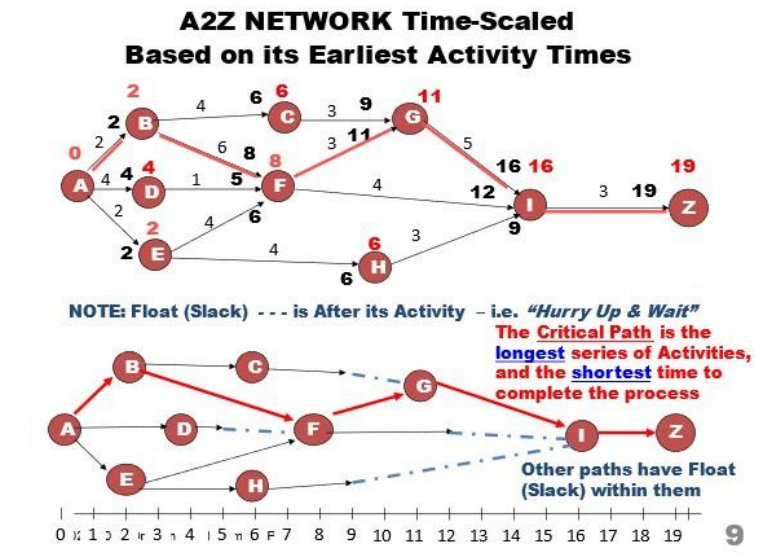


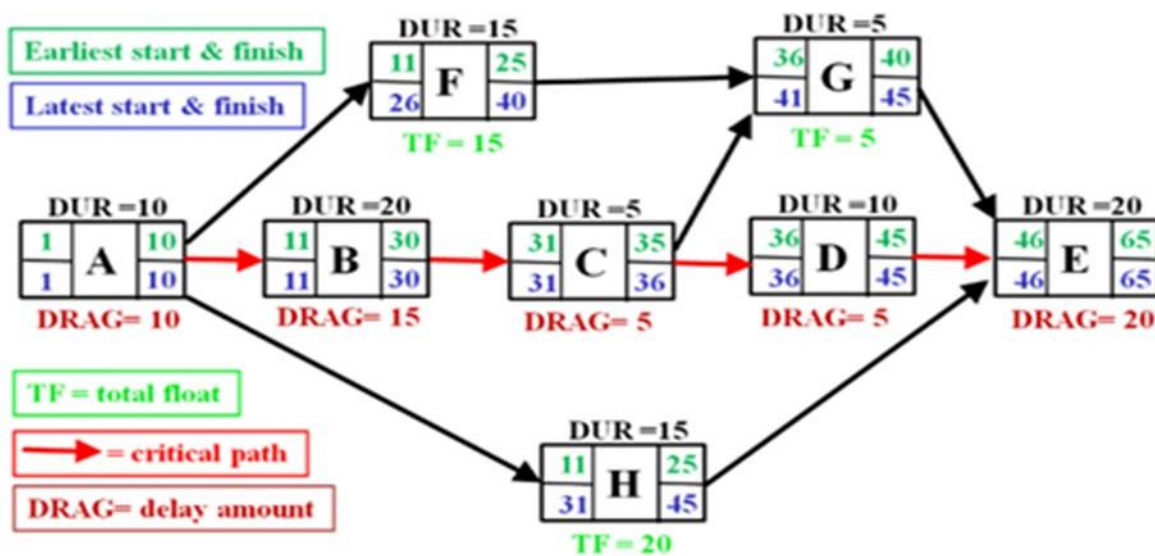
Figure 4
Activity on Arrow (AOA) Precedence and Time Scaled Networks



NOTE: Initial network sequencing was by the AOA Precedence format – *then time estimates were developed afterwards*. **Subsequent time-scaling combined the best features of Gantt charting, facilitating visible displays highlighting the eponymous ‘Critical Path’ for baseline scheduling, as well as for detecting variances during performance monitoring, and facilitating adjustments.**

However, with the advent of microcomputers, IT programmers were ignorant of the critical path concept, unschooled in the utility of graphic time-scaled networks for scheduling, and oblivious to their facility for monitoring, analysis and updating. Instead, they conceived of the CPM networks as mere flow charts and ignored the time-honored adage “*If it ain’t broke, don’t fix it!*” Consequently, they created a 3rd format for dedicated software – such as MS Project -- **with both Activities & Milestones as nodes**. Milestones were also minimal, or even dispensed with -- replaced by numerous computations embedded in the activities as illustrated below.²

Figure 5
Activity on Node (This example is without Milestones)



Although activity precedence was retained in this format, the *arrows were relegated to mere linkages*. Although the software supplemented this new network format with a traditional Gantt

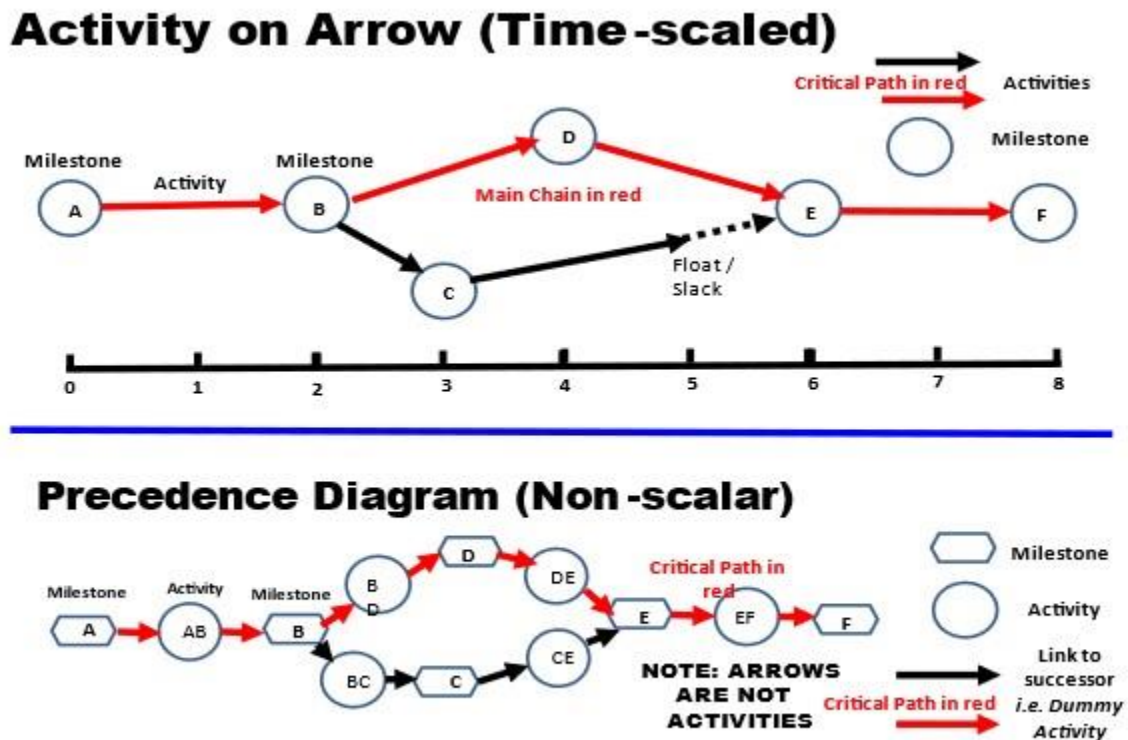
² [NOTE: I still can’t figure out how the DRAG is computed, or its purpose!]

Chart,³ derived from the same data, the **exemplary visual time-scaled network** for planning, monitoring & control was discarded, so **graphic scheduled representation** -- of merging predecessor activities to milestones at intervals in the process to facilitate analysis -- was lost.⁴

These format differences are compared and contrasted in **Figure 6**.

Figure 6

Comparison of Activity on Arrow & Node Formats



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³ **Gantt charts are useful for presentations**, but without linkages between activity bars it is impossible to see predecessor-successor relationships, while given those linkages as a software option, still difficult to trace, as well as extremely cumbersome to switch back and forth for analysis in the precedence format.

⁴ For a while, an excellent ancillary software add-on -- **Project Partner** -- was available that could create time-scaled Activity on Arrow networks from MS Project files. However, Project Partner eventually fell victim to constant MS Project upgrades.

Milestones⁵ represent definite intervals along a highway from a reference point, as checkpoints for measuring distance traveled. Similarly, Project Milestones at the start and completion of activities and other significant stages in the project can be utilized to measure and assess project implementation performance; i.e. how much of the project has been completed; whether it is On, Ahead or Behind Schedule; and if so, by how much. **Thus milestones provide an objective quantitative basis for performance – usually expressed in percentage terms.**

However, dedicated software drives usage and while various versions of Precedence Diagrams are now the norm, **time-scaled networks are no longer available, so utilization of Milestones for monitoring project implementation performance has fallen by the wayside.**

Relating activity costs to their successor completion milestones also provides a definitive means for measuring Cost performance⁶ when monitoring integrated Schedule & Cost performance with **Earned Value methodology (EVM).**

Unfortunately, software algorithms also compute activity Earned Values incorrectly as unit duration running costs.

For instance, *rather than \$600 on completion of a 2 week activity*, a 2 week activity duration for \$600 would be calculated at a ‘burn rate’ of \$300 per week; dividing the total cost by the duration, Even if/when milestones are incorporated in the project network, milestone durations are -- *correctly* -- treated as ‘0’ duration. So assigning an activity’s cost to its completion milestone (*in accordance with Earned Value Methodology*) results in \$0 cost – i.e. \$600/0 duration, or ‘error’!

The ‘workaround’ – which I concocted after my shock & chagrin when I discovered the reason for temporarily ‘losing’ \$75 million on a World Bank project -- is to assign one time unit to milestones, and subtract one time unit from their predecessor activities.

Moreover, the software algorithm ‘burn rate’ approach incorrectly assigns a proportional earned value to on-going activities, which defeats the purpose of the methodology,⁷ and can result in high earned value but nevertheless incomplete ‘white elephant’ projects.

⁵ Or ‘Kilometer’ stones

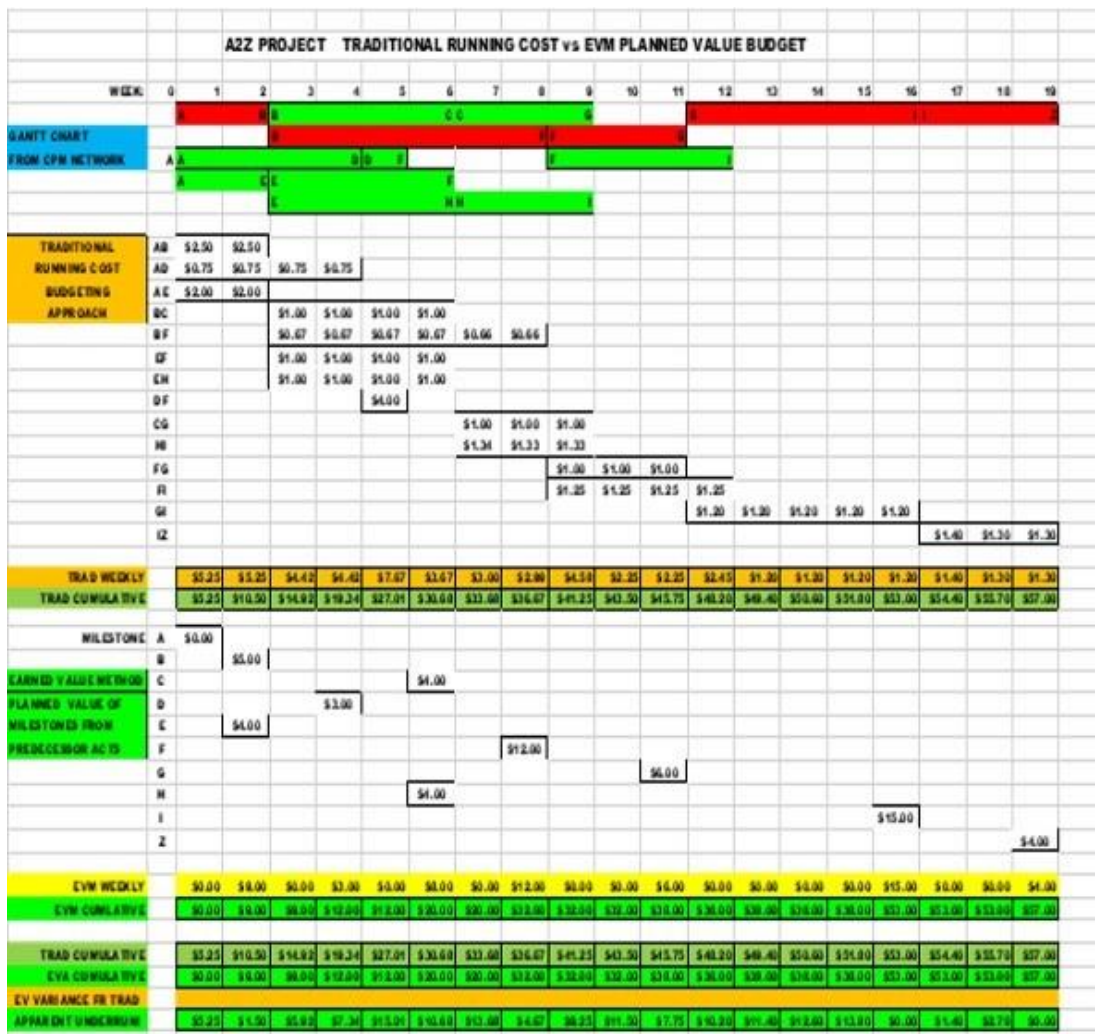
⁶ i.e. Number of milestones completed vs number of milestones planned, as well as cumulative **Earned Value** vs cumulative **Planned Value** of milestones—expressed as percentages.

⁷ **With the Earned Value Methodology (EVM) -- just like the ‘piecework’ concept from which it was derived – you ‘earn’ 100% of the PV when the work is complete; not an incremental amount when the work is still in progress -- such as 50% in my example.**

I have also observed on project consulting assignments – as well as witnessed in my innumerable workshops -- that with a paucity of milestones, estimating implementation performance in projects has deteriorated in accuracy by reverting to ‘Ceiling Estimating.’⁸

The variance between traditional financial assessment and earned value monitoring is also exacerbated at the outset, as illustrated in Figure 7.

Figure 7



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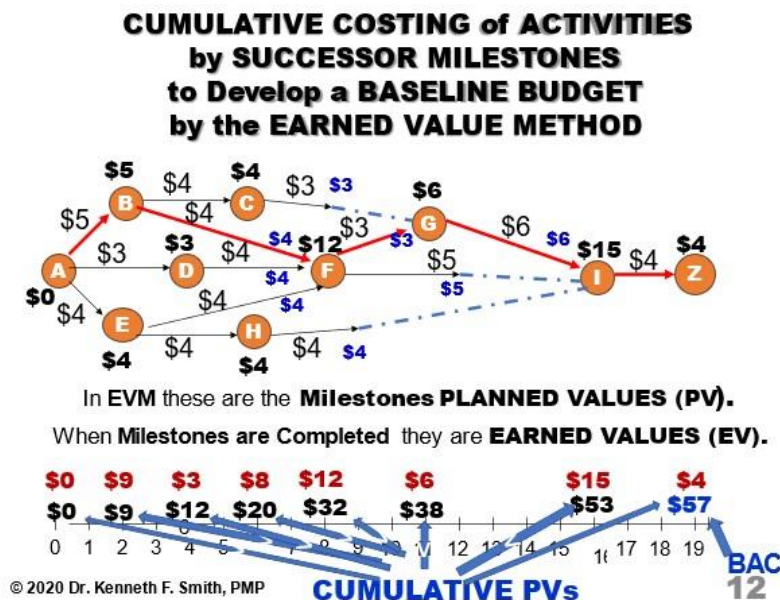
⁸ i.e. looking at the ceiling and hazarding a ‘best guess.’

NOTE: Until the project is completed, the traditional budgeted running cost is Greater than the Project's cumulative Planned Value (PV).

During implementation Monitoring & Reporting this gives an *erroneous impression* that the Baseline Budget was *over-estimated*; *creating false expectations* for higher level management that cost savings can be realized; and also masks any *actual cost overruns* unless / until the running-cost budget is exceeded!

These defects are all obscured by precedence network diagramming software and Gantt chart portrayals. However they can be readily detected, and overcome, if supplemented with a time-scaled activity-on-arrow, and milestone-on-node network.

Figure 8



Another consideration during planning – emphasized by Dr. Paul Giammalvo and elucidated in his recent PMWJ article⁹ -- is that activity durations are almost always overly optimistic; so merely showing how far you may be behind the baseline schedule on some activities during implementation is insufficient. **What is really important for management control is being able to track the integrated status** of the cumulative Actual Cost and Earned Value¹⁰ in terms of the **scheduled Latest Finish PV**; as once the Earned Value breaches that line, your project is behind schedule and/or over budget; necessitating adjustment – i.e. schedule extension &/or budget increase, or project curtailment.

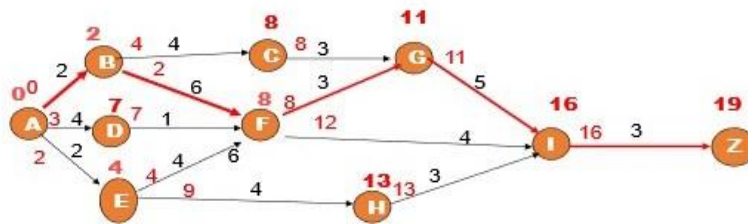
⁹ Giammalvo, P. D. (2023). Applied Earned Value Management Based on “Cost Engineering Principles”- With Practical Case Studies for Validation Purposes, PM World Journal, Vol. XII, Issue IV, April.

¹⁰ Also known as the Budgeted Cost of Work Performed (BCWP)

Again, a time-scaled Activity-on-Arrow network with Milestones is the most effective format for depicting the Latest Times for the Planned Values, as shown in Figures 9 & 10.

Figure 9

ReCalculating the “A2Z” NETWORK on its LATEST Activity Times to ReSchedule the Baseline Budget (PV) for Each Milestone



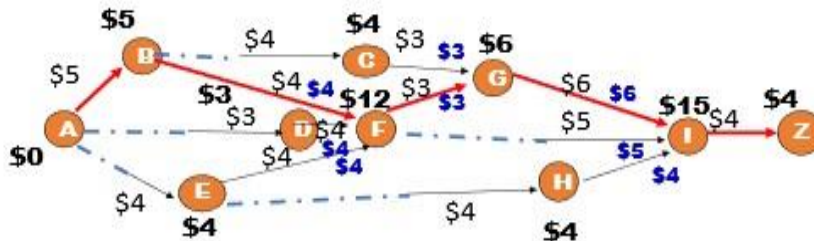
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Line of Balance

Slide 1

Figure 10

CUMULATIVE PLANNING of ACTIVITIES & MILESTONES BY THEIR LATEST TIMES TO MONITOR IMPLEMENTATION PERFORMANCE by the EARNED VALUE METHOD RESULTS IN AN ENTIRELY DIFFERENT BASELINE BUDGET (PV) CONFIGURATION



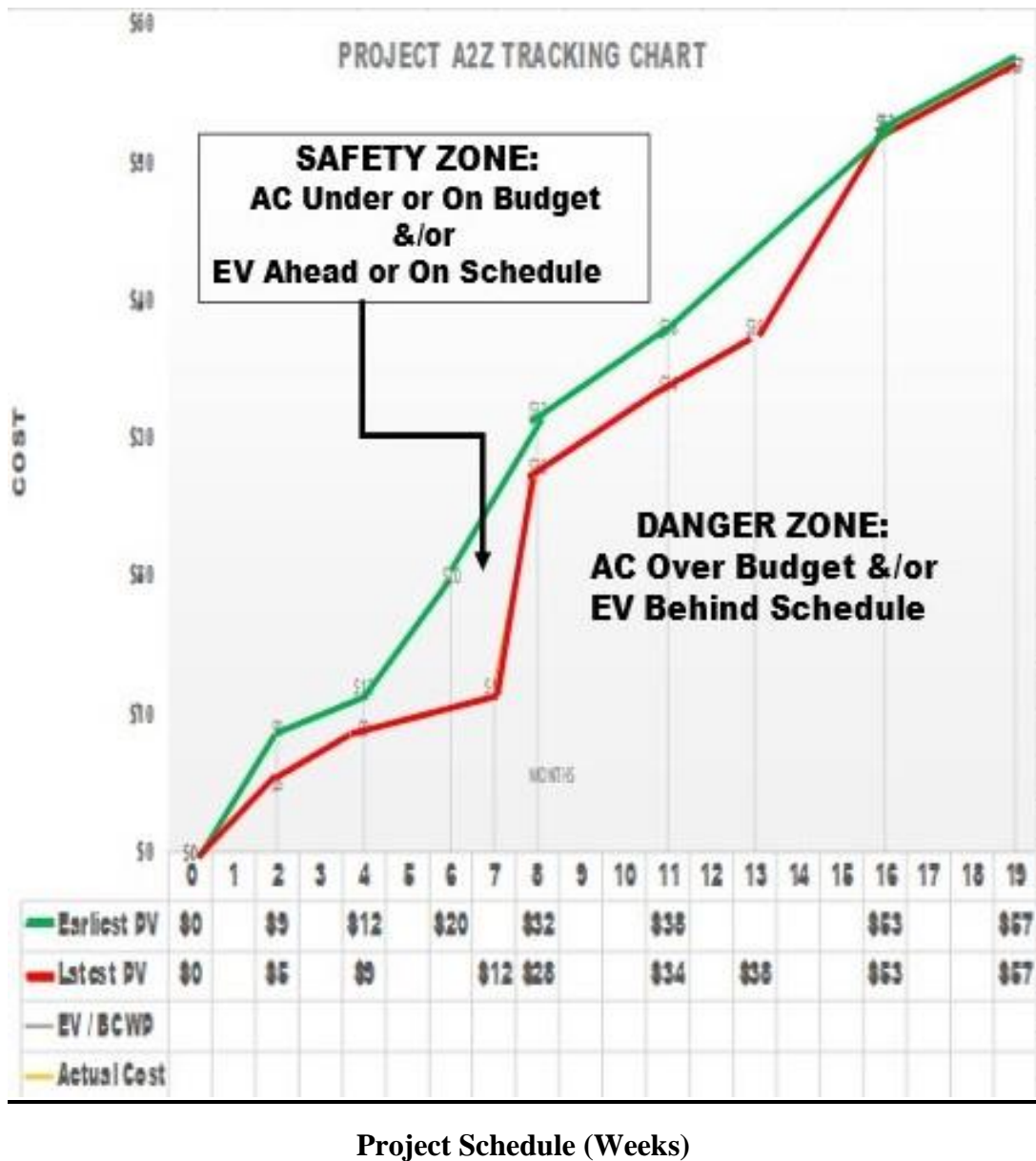
In EVM these are the **Milestones PLANNED VALUES (PV)**. BUT VALUES ARE NOT **EARNED (EV)** UNTIL ACTIVITY SUCCESSOR MILESTONES ARE COMPLETED!



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These Earliest and Latest cumulative PVs can then be incorporated in an excel chart for comprehensive tracking of all the pertinent variables, as depicted in Figure 11.

Figure 11¹¹



Unfortunately, until such time as a replica of the defunct ‘Project Partner’ app is recreated or added to existing scheduling software, a **time-scaled Network** of the ‘activity-on-arrow with milestone node’ variety must still be created the ‘old school’ way – i.e. hand drawn for display and analysis.

¹¹ NOTE: See the aforementioned April 2023 PMWJ Giammalvo article for a more comprehensive coverage of this aspect and analytical process.

In the meantime, I have developed several excel templates to facilitate and somewhat rectify this situation -- depicted in the remaining figures¹² on the following pages -- which are available for free on proof of purchase of my book **Project Management PRAXIS, available from Amazon.**

In conclusion, I strongly advocate that you pepper your project networks with milestones, and use them to improve planning and monitoring your projects.

See figures 12, 13 and 14 on the following pages

¹² Your data is entered in the 'yellow' cells; and the analysis is computed from embedded formulae.

Figure 12

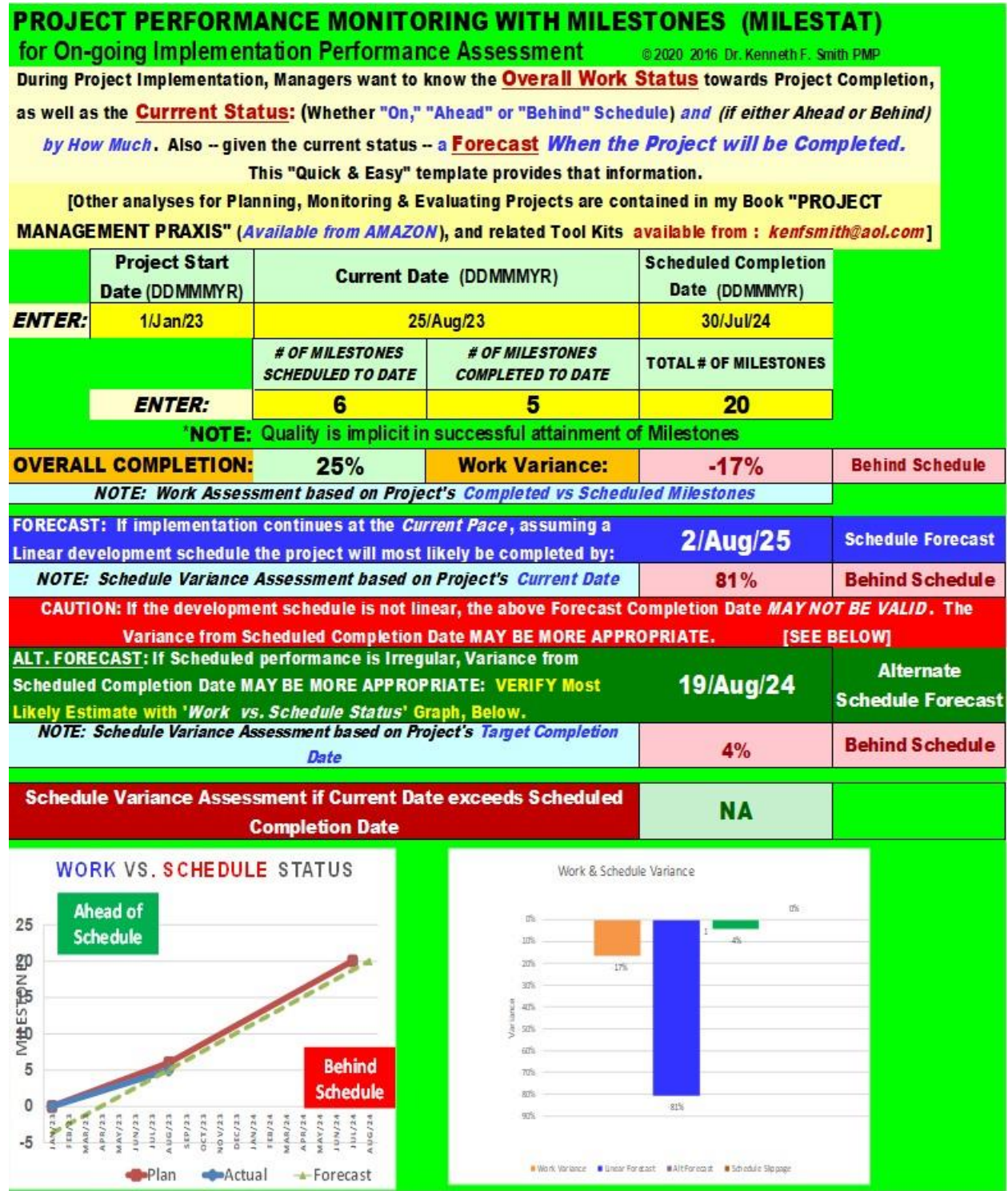


Figure 13

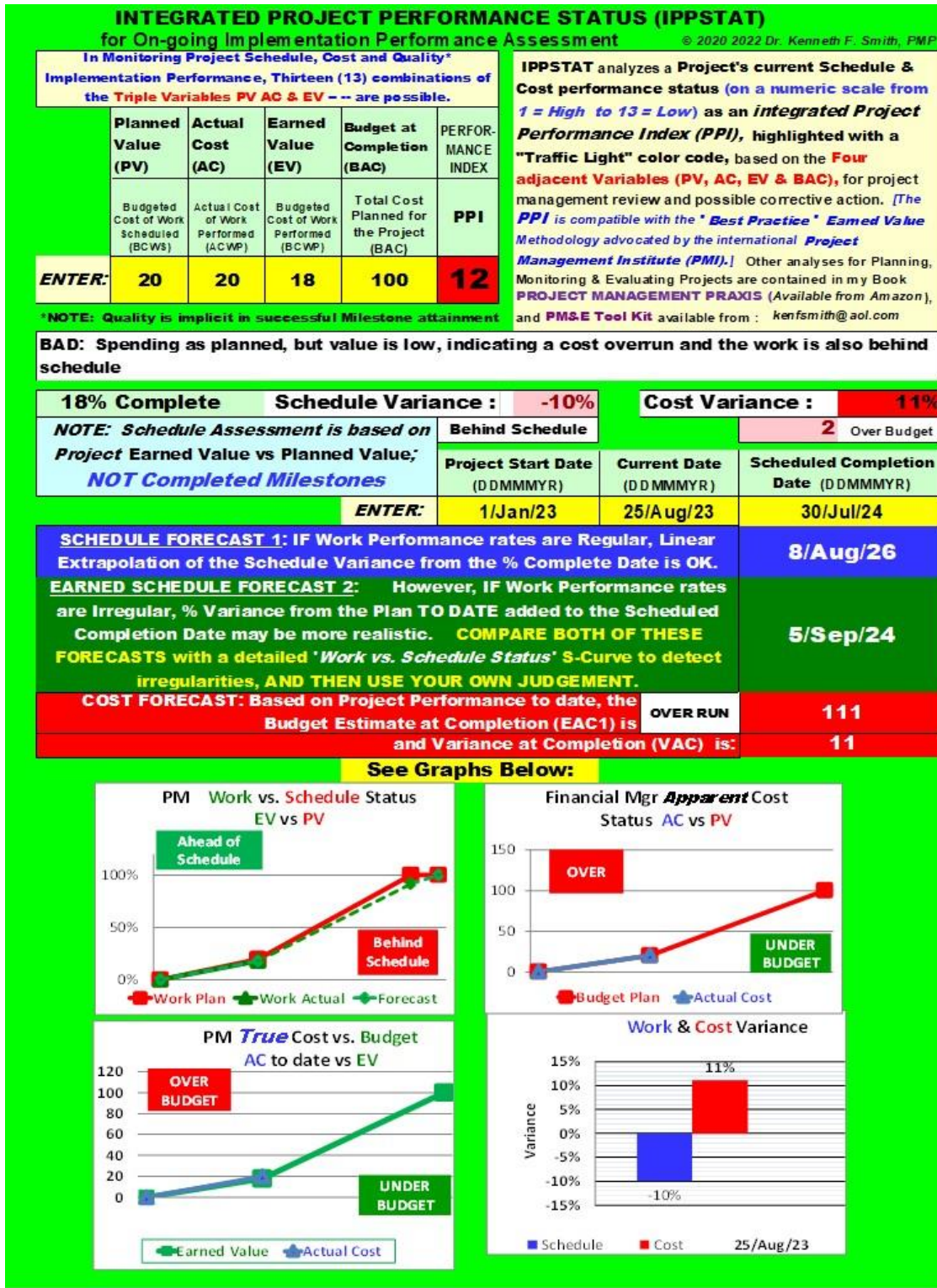
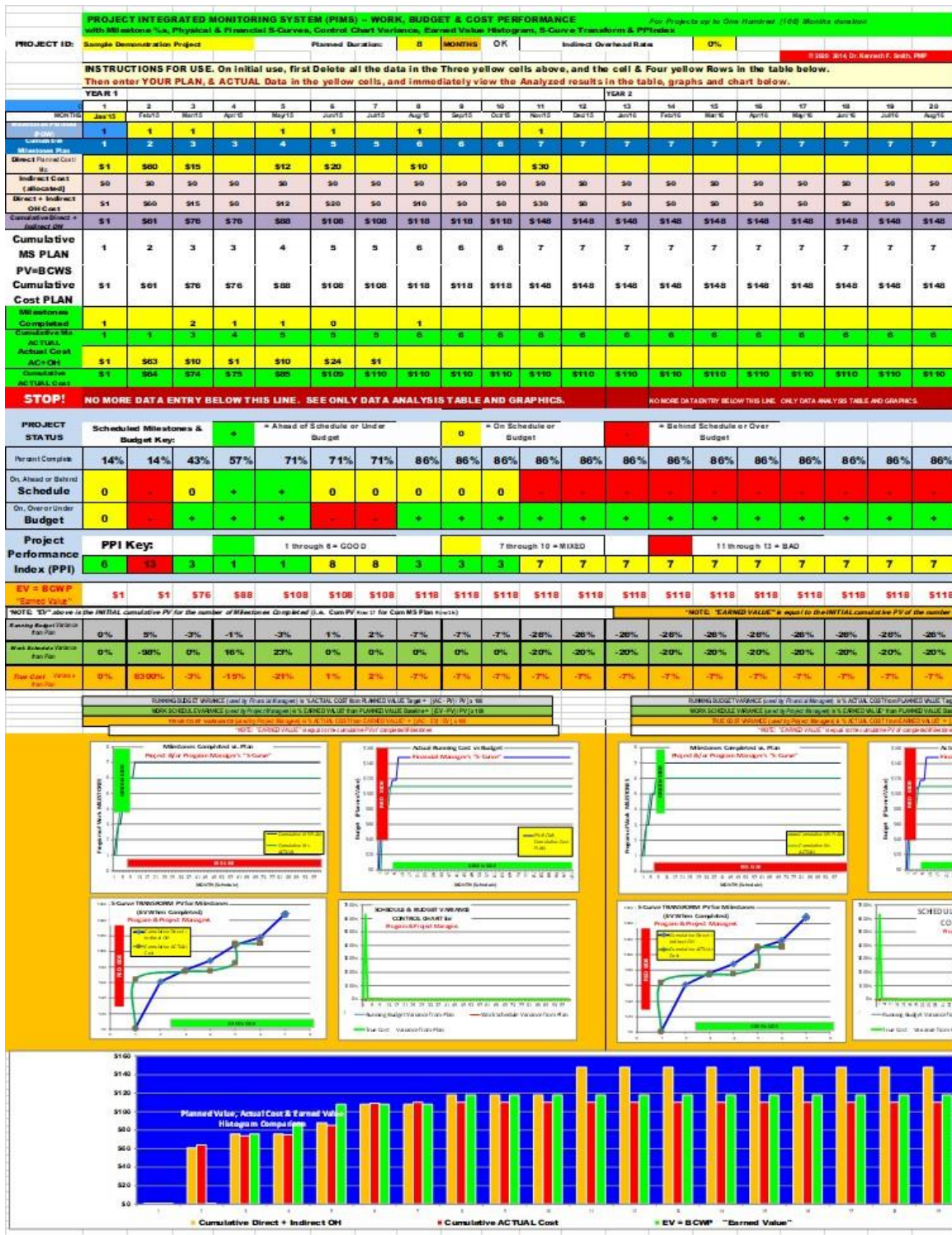


Figure 14



About the Author



Dr. Kenneth Smith

Honolulu, Hawaii
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Initially a US Civil Service Management Intern, then a management analyst & systems specialist with the US Defense Department, Ken subsequently had a career as a senior foreign service officer -- management & evaluation specialist, project manager, and in-house facilitator/trainer -- with the US Agency for International Development (USAID). Ken assisted host country governments in many countries to plan, monitor and evaluate projects in various technical sectors; working ‘hands-on’ with their officers as well as other USAID personnel, contractors and NGOs. Intermittently, he was also a team leader &/or team member to conduct project, program & and country-level portfolio analyses and evaluations.

Concurrently, Ken had an active dual career as Air Force ready-reservist in Asia (Japan, Korea, Vietnam, Indonesia, Philippines) as well as the Washington D.C. area; was Chairman of a Congressional Services Academy Advisory Board (SAAB); and had additional duties as an Air Force Academy Liaison Officer. He retired as a ‘bird’ colonel.

After retirement from USAID, Ken was a project management consultant for ADB, the World Bank, UNDP and USAID.

He earned his DPA (Doctor of Public Administration) from the George Mason University (GMU) in Virginia, his MS from Massachusetts Institute of Technology (MIT Systems Analysis Fellow, Center for Advanced Engineering Study), and BA & MA degrees in Government & International Relations from the University of Connecticut (UCONN). A long-time member of the Project Management Institute (PMI) and IPMA-USA, Ken is a Certified Project Management Professional (PMP®) and a member of the PMI®-Honolulu and Philippines Chapters.

Ken’s book -- **Project Management PRAXIS** (available from Amazon) -- includes many innovative project management tools & techniques; and describes a “**Toolkit**” of related templates available directly from him at kenfsmith@aol.com on proof of purchase of PRAXIS.