PROGRAM PERFORMANCE

EARNED VALUE MANAGEMENT

BEHAVIORAL ECONOMICS

The Psychology of Variance

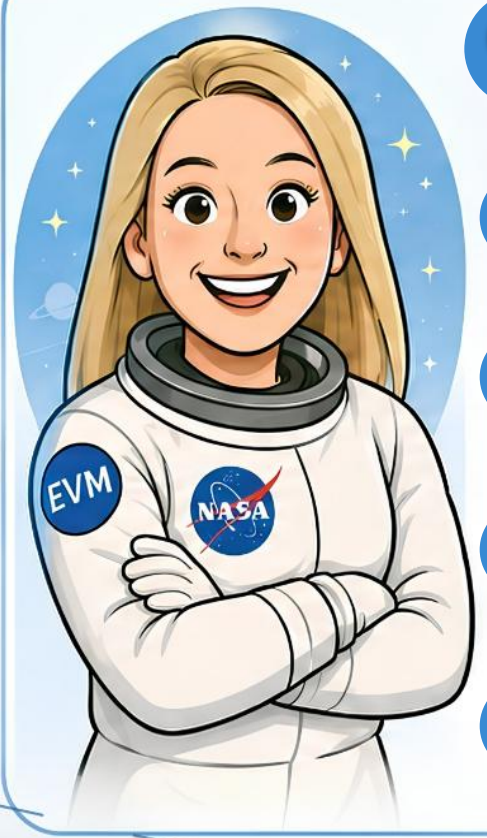
A Philosophical Journey Of How Human Behavior Distorts EVM Data

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Meet The Presenters

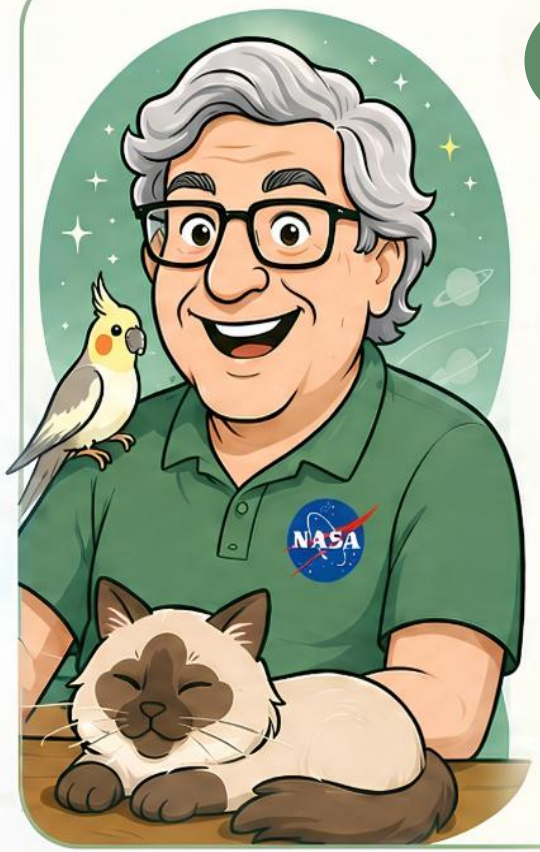
NASA Cost & Schedule Symposium 2026



Briannah Smith

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- 12+ years in program controls, project management, and EVM across aerospace, defense, NASA.
- Experience in PP&C, manufacturing, supply chain, and project management (Textron Systems, Northrop Grumman, NASA OCFO).
- Joined NASA in 2019 to support Agency EVM capability through surveillance, compliance evaluations, policy, processes, tools, & training.
- Current role; support NASA OCFO Agency-level EVM initiatives and surveillance of major spaceflight projects.



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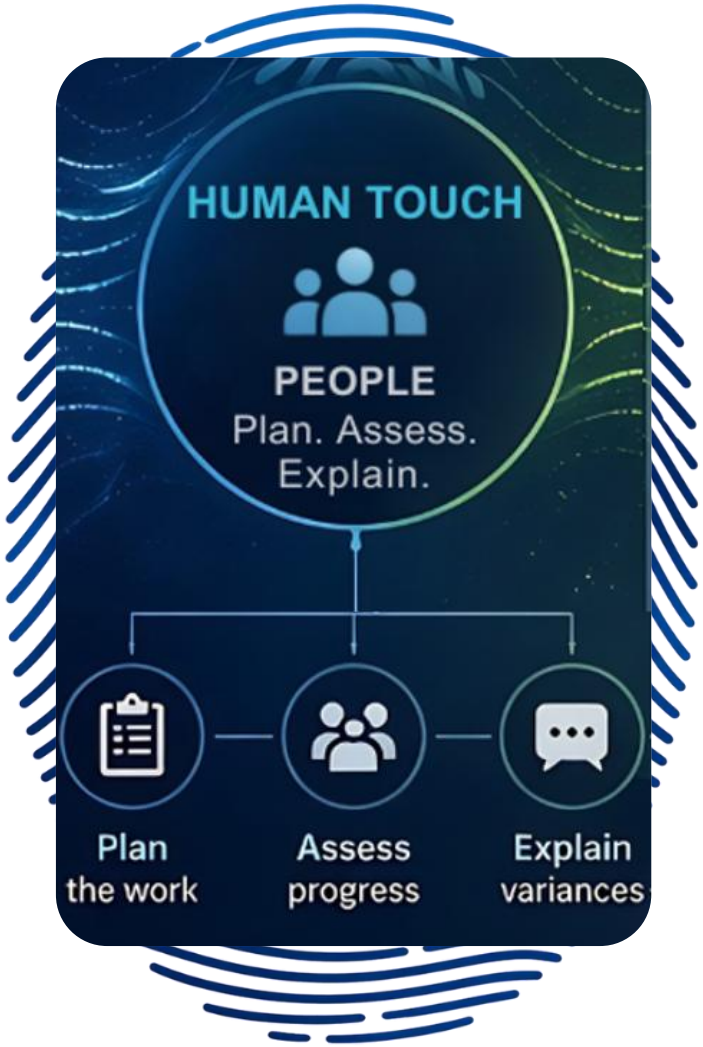
- 49 years in program controls (earned value management practitioner).
- Experience in construction management, manufacturing, and aerospace (Parsons, Moldex-Metric, Lockheed Martin Skunkworks, NASA JPL, and NASA OCFO).
- Joined JPL to help secure DCMA acceptance of their EVMS. Former JPL EVM focal point and EVM process owner.
- Current role; support NASA OCFO Agency-level EVM initiatives and surveillance of major spaceflight projects.

AI

We utilized AI to assist with the research in the creation of this presentation.
No NASA Projects were harmed while making this... (No NASA CUI data used)

EVM Is Technical... Until Humans Touch It

- Earned value numbers are calculated in applications — *but they originate with people.*
- The gap between actual performance and reported performance can widen in ways that are difficult to detect.
- Understanding the human side of EVM is the first step toward better data.
  - *The goal.* EVM is designed as a peer-to-peer information system.
  - But bias introduces levels – judgment and a sense of caution or optimism.
  - Responses that influence data before it reaches decision-makers.
  - The gap between actual and reported performance is often a symptom of “non” peer-to-peer transactions.





COGNITIVE BIAS #1 OF 4

Optimism Bias: Overestimating Progress, Underestimating Effort

What it is:

Projects genuinely believe they are further along than they are. We are wired to assume things will go well — even when the evidence says otherwise. This is not dishonesty. It's human nature.

How it shows up in EVM:

- Percent-complete assessments are not quantified in the IMS
- ETCs (Estimate to Complete) are systematically underestimated
- Forecasts remain optimistic after the data signals potential trouble
- CUM CPI/SPI trends look better than the underlying work warrants (Current period CPI/SPI trending is absent from reporting)



IMPACTS ON EVM

- SPI reads 0.95 when real progress is 0.80
- EAC keeps shrinking despite cost overruns
- Re-planning keeps 'recovering' without ever recovering
- Variance explanations say 'catching up' — indefinitely

Interaction:

Crossed. Is progress optimistic, or accurate. Redirect to peer-to-peer by asking for specific, quantified evidence: **What discrete work is complete and what remains?**

COGNITIVE BIAS #2 OF 4

Anchoring: Stuck on the Estimate

What it is:

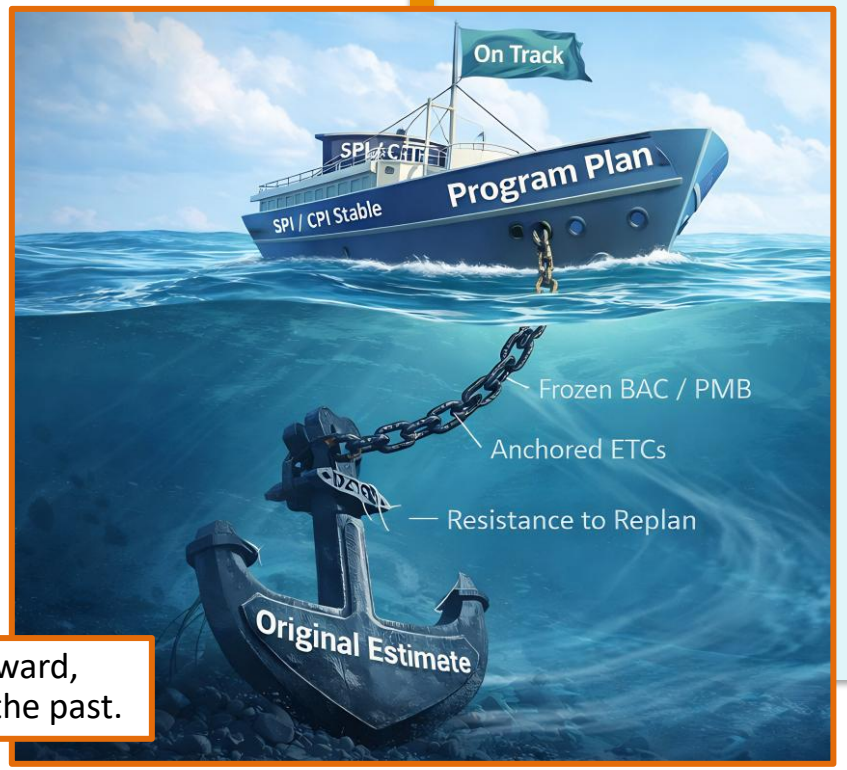
When the estimate becomes the psychological truth. Even when new information emerges, projects hesitate to revise. The baseline becomes a comfort zone — and some projects report to forecast plans that adjust performance reality.

How it shows up in EVM:

- BAC and PMB remain essentially unchanged despite major performance shifts
- EAC/ETCs are frozen, not current reality
- CAMs resist replanning even when the plan is clearly broken
- EAC trends close to the budget regardless of actuals

IMPACTS ON EVM

- EAC never adjusts upward until too late
- Earned value plans show impossible catch-up curves
- Schedule variance accumulates while the plan says 'on track'
- Re-planning/Re-baselining is resisted even when clearly necessary



You can't move forward,
if you're anchored to the past.

Interaction:

Crossed. A revised ETC based on current data is received. Is the response defensive, could this response potentially influence the estimate. The request is met with resistance — a textbook Crossed transaction.

COGNITIVE BIAS #3 OF 4

Loss Aversion: Avoiding Bad News at All Costs

What it is:

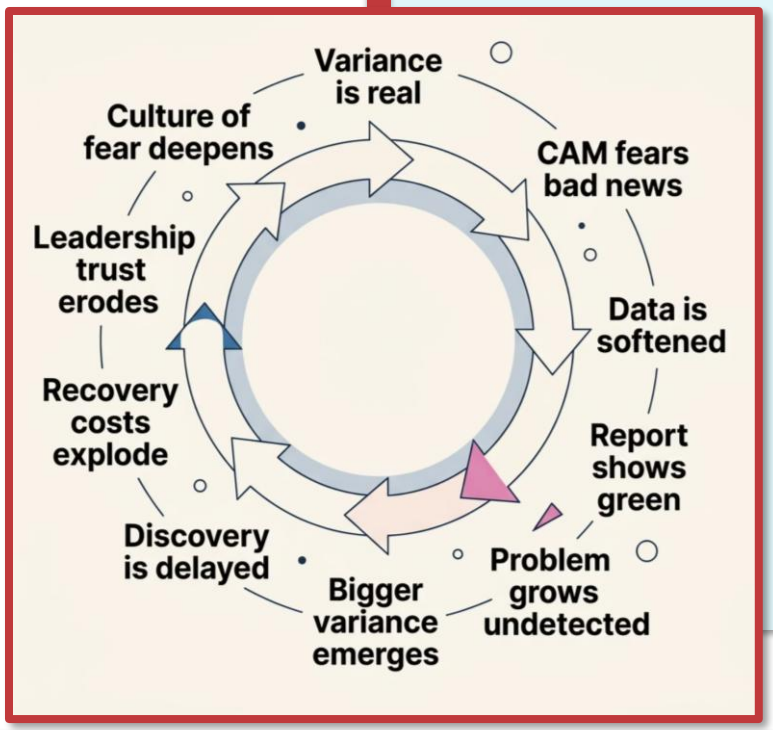
People fear reporting bad news more than they value reporting accurate news. The concern of being 'red' is stronger than the desire to be accurate. This leads to delayed variance reporting and optimistic forecasts.

How it shows up in EVM:

- 'Green-shifting' — managing data to influence red indicators
- Variances are offset and go "under-reported"
- CAMs submit optimistic ETCs to avoid continued scrutiny
- Schedule variances are explained away rather than addressed

THE GREEN-SHIFTING CYCLE

- Variance is real → fear of bad news
- Data is managed → Report reflects the preferred story
- Discovery is delayed → Recovery costs explode
- Leadership trust erodes → Culture of fear deepens



Interaction:

Crossed. Ulterior. The surface transaction appears peer-to-peer. But the hidden layer is managing the reviewer's emotional response. This is a classic Ulterior transaction — and the most dangerous, because it is invisible on the dashboard.

COGNITIVE BIAS #4 OF 4

Confirmation Bias: Seeing What We Want to See

What it is:

We interpret performance data through the lens of a preferred narrative. If leadership expects green, people look for evidence that supports green. This is how programs drift into trouble without anyone noticing.

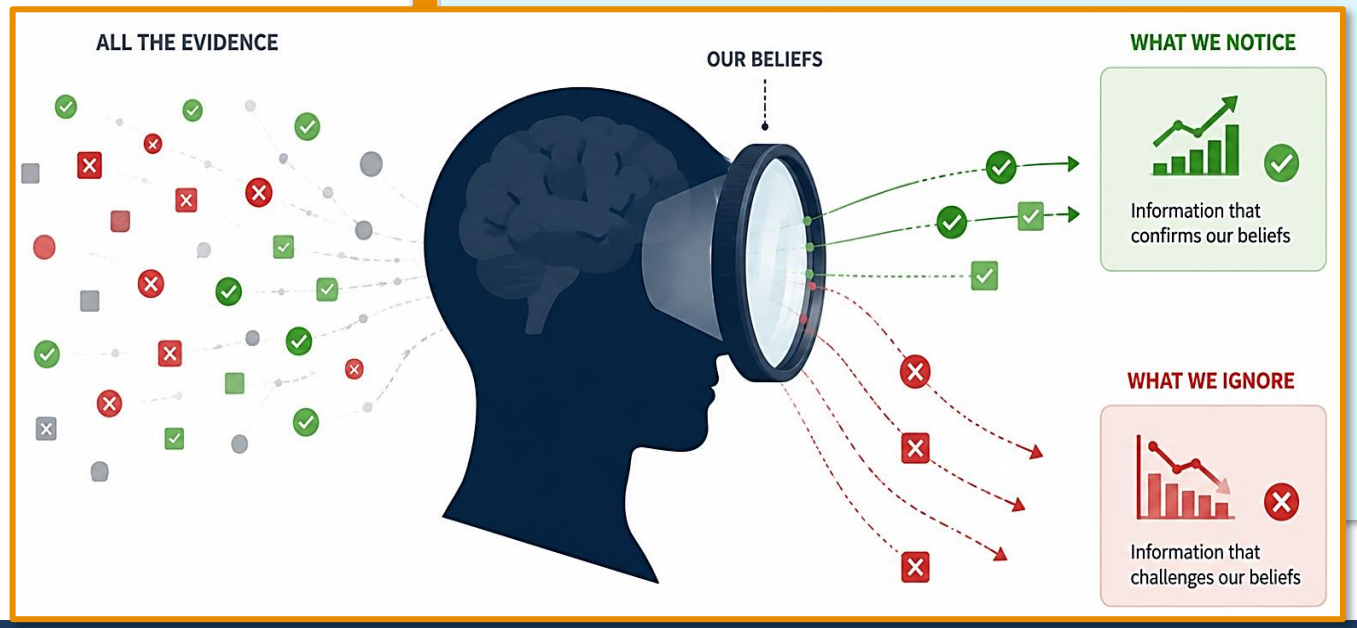
How it shows up in EVM:

- Variance analysis could cherry-pick favorable data points
- CEAC focus on reasons performance will recover
- Unfavorable trends are at times dismissed as anomalies
- EAC narratives explain away negative CPI trends

IMPACTS ON EVM

- Objective metrics are reframed to support the narrative
- Early warning signals go unheeded
- Independent assessments are dismissed
- Data-driven decisions get replaced with story-driven ones

Interaction: Crossed. A data request is received, but the organizational response comes filtered through a narrative lens. The intended Complementary exchange — ask for data, receive data — becomes Crossed: Request in, filtered story out.



Culture Shapes the Data

Individual bias is amplified, or suppressed, by the organizational environment. Culture determines whether people feel comfortable telling the truth about performance.

Fear-Based Reporting

When the environment punishes bad news, people hide it. Negative variances get softened, explanations get vague, and the dashboard stays green while the program deteriorates.



Bad news gets hidden



Explanations get vague



Dashboard stays green

The Green Dashboard Syndrome

Stakeholders who encourage all-green dashboards create a self-fulfilling prophecy: teams deliver what's rewarded — green indicators, not accurate ones.



All-green is expected



Teams are rewarded



Perception over accuracy

Schedule Pressure & % Complete

When a program is behind schedule, teams face intense pressure to show progress. Percent-complete assessments become aspirational rather than factual — compressing schedule variance on paper.



Pressure to show progress



Aspirational assessments



Variance gets compressed



Interaction: Crossed (pervasive and systemic). In cultures that are driven by concerns, the dominant transaction type is Crossed: leadership expectations are green, and teams respond with filtered data. There is no open Peer-Peer channel for honest performance discussion — the channel has been systematically closed by the culture.

Culture determines what is reported, how it is reported, and what leaders believe.

Change the culture, improve the data.

EVM PROCESS IMPACT

Bias Touches Every Step of the EVM Lifecycle

Baseline Planning



Optimism Bias, Anchoring:
- Overly aggressive schedules
- Insufficient buffers
- Poorly sized work packages

% Complete Assessments



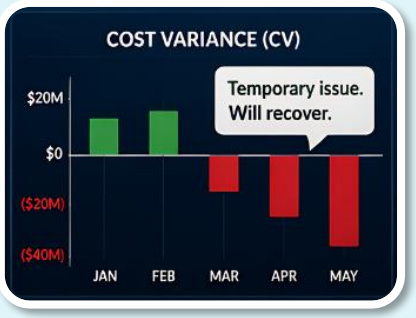
Optimism Bias, Loss Aversion:
- Inflated progress claims
- Fear of negative SPI
- Subjective milestones

ETC & EAC Development



Anchoring, Confirmation:
- ETCs anchored to original plan
- EAC dismisses negative CPI
- Unrealistic recovery plans

Variance Explanations



Loss Aversion, Confirmation:
- Softened narratives
- Root causes not addressed
- 'Will recover' language

Interaction: Mixed — each lifecycle stage has a dominant Crossed or Ulterior transaction pattern. The most dangerous are Ulterior transactions in variance explanations, where the surface message is 'we are recovering' but the hidden message is 'please do not scrutinize us.'

Bias doesn't just influence outcomes; it shapes decisions at every step.
Recognize it. Challenge it. Improve the data.

See It › Question It › Fix It › Drive Better Outcomes

SOLUTIONS — PART 1 OF 3

Process Solutions: Making EVM Bias-Resistant

Process fixes reduce bias by adding structure and requiring evidence — turning subjective judgments into defensible, repeatable assessments.

Structured % Complete Reviews

Replace subjective assessments with defined criteria: milestone-based, formula-based, or level-of-effort methods. Require CAMs to document the basis for their claim.



Independent Assessments

Periodic reviews by parties outside the control account — Peer-to-peer (IPT/CAM) leads, program control analysts, or external reviewers — provide fresh eyes and reduce groupthink.



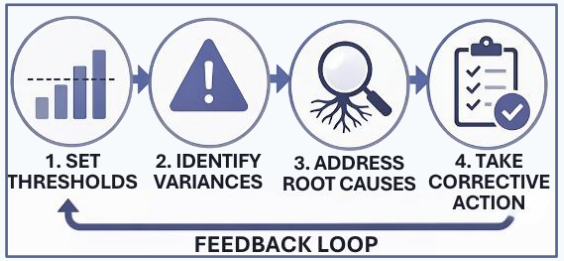
Quantitative ETC Justification

Require bottoms-up ETC calculations with documented assumptions. ETCs that simply re-target the original plan must be challenged and supported with credible logic. Ensure all risks and opportunities are clearly identified in the ETC.



Variance Threshold Enforcement

Apply variance reporting consistently and ensure VARs address root causes, not just symptoms.
Use the corrective action process as a feedback mechanism, not just a reporting requirement.



Interaction: Complementary by design. Well-designed process solutions create structural conditions for Complementary transactions. When ETC justification requires documented assumptions and reviewers apply structured challenges, the exchange between CAM and reviewer is anchored in peer-to-peer exchanges: evidence in, evidence out.

Behavioral Solutions: Improving the Human Side

Behavioral solutions address the root cause: the people and incentive structures that shape how EVM data is created, reported, and interpreted.

Build Psychological Safety



- People must feel safe reporting reality, including bad news.
- Remove consequences for accurate (negative) reporting.
- Reward early identification of problems — not just solutions.
- Normalize variance as information, not failure.

Bias Awareness Training for CAMs



- Teach CAMs to recognize optimism bias in their own planning.
- Introduce anchoring concepts in ETC development training.
- Use historical accuracy data as a mirror for self-assessment.
- Make bias recognition part of the control account review process.



- Celebrate programs that surface problems early.
- Avoid cultures that equate accuracy with accountability for problems.
- Make variance identification a performance positive, not a risk.
- Shift recognition from 'always green' to 'always honest.'

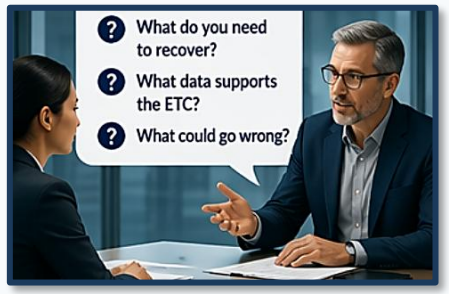
Interaction:
Complementary as the goal. The behavioral solutions collectively aim to replace the dominant Crossed/Ulterior transactions of a concern-based culture with Complementary peer-to-peer exchanges. 'Normalize variance as information, not failure' is the reframe that enables this shift.

Leadership Solutions: Setting the Tone from the Top

Technical and behavioral fixes fail without leadership modeling. When leaders treat bad news as information — not failure — data quality improves across the entire organization.

Ask Better Questions

Shift from 'Why are you red?' to 'What do you need to recover?'
Ask what data supports the ETC. Ask what could go wrong.
Model curiosity over accountability.



Model Honest Reporting

Share your own uncertainty.
Acknowledge when forecasts are wrong.
Show that accurate data, even negative data, is valued and rewarded at every level of the organization.



Remove Fear from Variance Discussions

Make reviews a problem-solving forum, not a prosecution.
Separate variance identification from performance evaluation.
Protect CAMs who surface issues early.



Create a 'No-Surprises' Culture

Define 'surprise' as the enemy, not a variance. Reward programs that forecast problems accurately.
Make early escalation a sign of strength, not weakness.



Interaction: Complementary. Leaders who ask, 'What do you need to recover?' instead of 'Why are you red?' are modeling Complementary transactions. This shift in transaction type propagates through the entire organization, gradually replacing Crossed and Ulterior patterns with Complementary ones.

Leaders set the tone | When leaders understand the bad news, good decisions follow

PRACTICAL TOOLS

Tools & Practices That Reduce Bias

These practical aids don't replace judgment — they sharpen it by grounding assessment in evidence and history rather than intuition alone.

Historical Accuracy Data

Compare current ETC estimates to past accuracy rates. If a team's ETCs have historically been 20% too low, use that as a calibration factor in reviews.



Bias-Resistant Forecasting Models

Use statistical EAC formulas (e.g., BAC/CPI, BAC/(CPI×SPI)) as independent checks against management-adjusted EACs that ignore trend data.



Structured Variance Analysis Templates

Require variance explanations to include: root cause, schedule impact, corrective action, and a quantified recovery plan — preventing vague narrative responses.



Independent CEAC/ETC Reviews

Periodic reviews by program control analysts or independent assessors provide unbiased challenges to anchored estimates and optimistic % complete claims.



Percent-Complete Criteria Definitions

Pre-define completion criteria at the work package level before execution begins. Removes subjective interpretation and makes assessment defensible and consistent.



Trend Chart Reviews

Display CPI, SPI, and EAC trends incrementally over time (not just cumulative indices) to make drifts visible. Trend direction matters as much as current value.



Interaction: Complementary by design. These tools enforce Complementary transactions by making the CAM-reviewer exchange evidence-based and repeatable. When a CAM must document assumptions and a reviewer applies a statistical EAC formula, both parties are operating from a peer-to-peer state — the definition of a Complementary transaction.

ADDRESSING THE OBJECTION

Accountability and Safety Are Not Opposites

The most common objection: "If we remove consequences, no one will perform." Effective leaders reject this false choice. The goal is not less accountability — it is accountability for the right things.

The False Choice	The Leadership Reframe	What Leaders Actually Do	The Outcome
"If we stop punishing bad news, people will stop trying." This assumes safety and accountability are a zero-sum trade. Fear-based accountability produces hidden risk — not better performance.	**Hold people accountable for data quality** — not for having variance. **Reward early problem identification** — not late surprise avoidance. **Measure forecast accuracy** — not dashboard color.	Publicly acknowledge teams that escalate early, even when the news is negative. Ask "What recovery plan do you need?" before asking "Why did this happen?" Tie performance reviews to ETC accuracy and transparency — not to green status.	Problems surface months earlier when recovery options still exist. EAC forecasts become reliable because teams report reality, not narratives. Leadership trust deepens because the data tells the truth.



Interaction: Complementary. When leaders hold teams accountable for transparency rather than for having problems, they model peer-to-peer exchanges. Accountability shifts from "who caused the variance" to "who identified it early enough to act." Safety and ownership reinforce each other.

Key Takeaways

1. **COGNITIVE BIASES** — optimism, anchoring, loss aversion, confirmation — systematically distort EVM data at every stage of the lifecycle.
2. **CULTURE** is often a stronger driver than technical process. Fear-based reporting environments produce green dashboards, not accurate ones.
3. **PROCESS FIXES** (structured reviews, independent assessments, quantitative ETC justification) reduce the opportunity for bias to operate unchallenged.
4. **BEHAVIORAL AND LEADERSHIP SOLUTIONS** address root causes: psychological safety, transparency incentives, and modeling honest reporting from the top.
5. **BETTER BEHAVIOR** leads to better data — and better data leads to better program outcomes.



THE BOTTOM LINE

> *"EVM isn't just a technical system.*
>
> *It's a human system."*



Questions & Discussion

Where have you seen bias influence EVM data?

What cultural or process changes made the biggest difference?

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