# Recognizing EVM Gaming

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# What is Gaming?

- "Gaming the system" means using the rules, policies and procedures of a system against itself for purposes outside what these rules were intended for
- Most of the time, a set of rules will be put in place towards a simple goal
- In EVM, this goal is to provide the project stakeholders visibility into the performance of the project using a set of rules called principles and guidelines
- Unfortunately, people who study the rules closely can then use this rule set to play the "game" their own, unexpected way
- With EVM, gaming the system results in erroneous performance status and faulty forecasts

# Games Projects Play

- Some organizations cannot accept bad news
  - Project managers, by nature, are optimistic and don't want to believe data that reveals pessimistic forecasts
- Some organizations punish their managers when things aren't going well, causing the managers to put off reporting bad news as long as possible
  - Some project managers do not want the visibility EVM provides, especially when things are not going well
- Some project managers intentionally delay "bad news" to give themselves a chance to improve their status
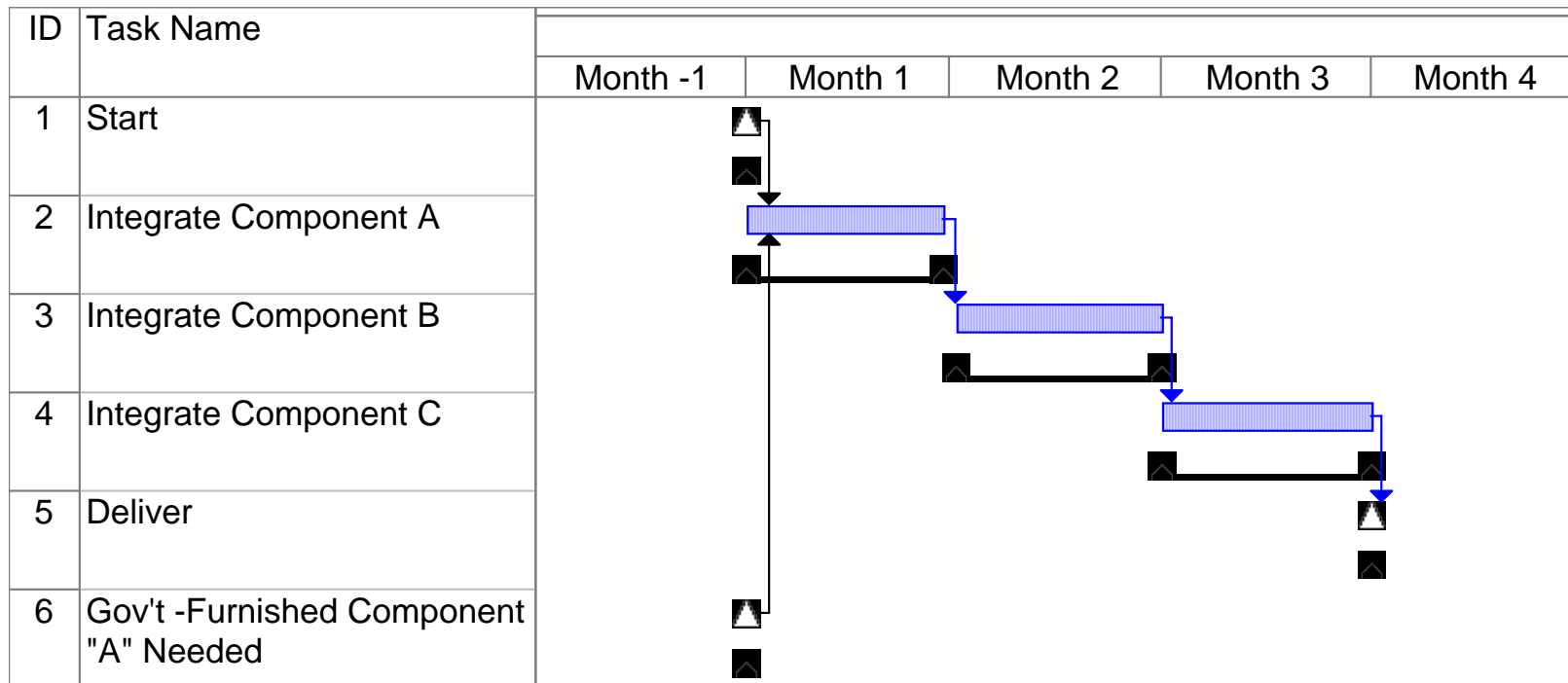
**…And some people game the system**

# Gaming, Abuse & Data Manipulation Include:

- Misrepresenting status to senior management or the customer
- Manipulating performance indices to maximize award fee
- Misuse of calendars, lags and directed constraints
- Inappropriate use of Earned Value techniques
- Activity duration padding, compression
- Improper use of Management Reserve
- Preferential sequencing, logic abuse
- Frequent rebaselining, no baseline
- Multiple sets of schedule books
- Frontloading, rubber baselining
- Zero budget work packages
- Hiding significant variances
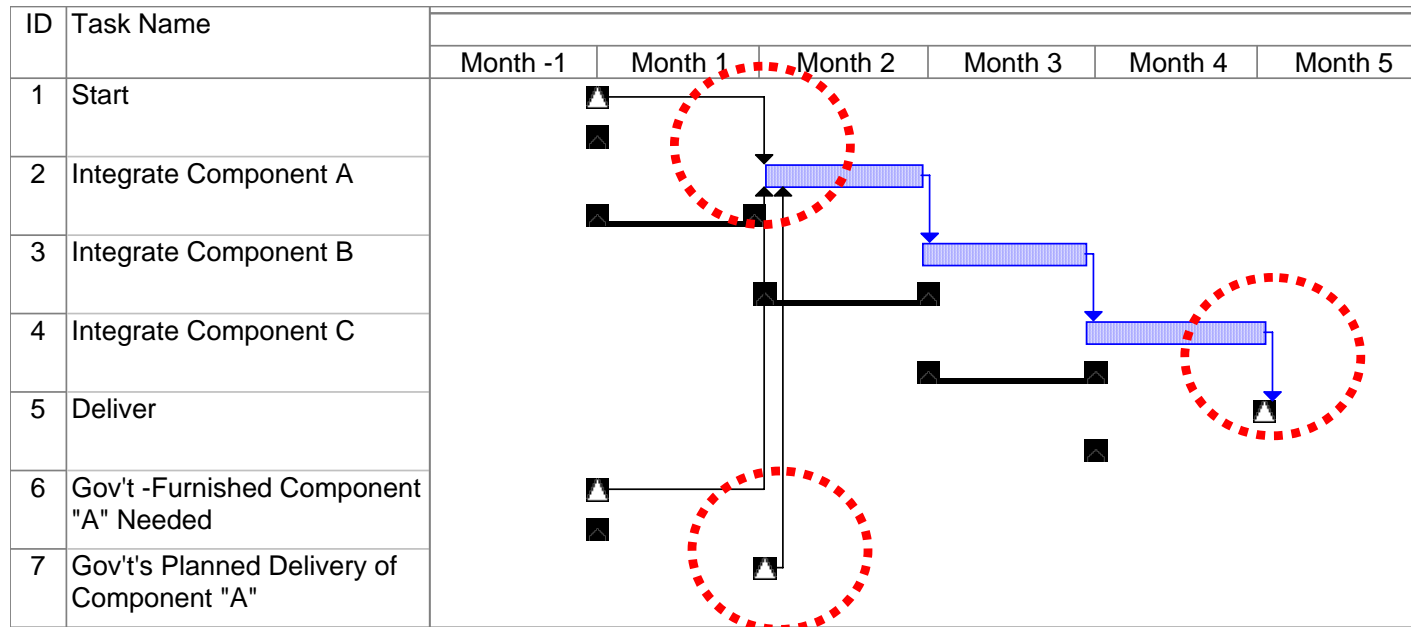- Rate manipulation
- Hiding slack/float

**Let's take a look at a few examples**

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# Preferential Sequencing

| ID | Task Name | Month -1 | Month 1 | Month 2 | Month 3 | Month 4 |
|----|-----------|----------|---------|---------|---------|---------|
| 1 | Start | | | | | |
| 2 | Integrate Component A | | | | | |
| 3 | Integrate Component B | | | | | |
| 4 | Integrate Component C | | | | | |
| 5 | Deliver | | | | | |
| 6 | Gov't -Furnished Component "A" Needed | | | | | |

- **Contractor's Planning Approach**
  - Contractor can really integrate components A, B and C in any order
  - Schedule developed and baselined with government-furnished Component A needed first in the integration flow

# Preferential Sequencing

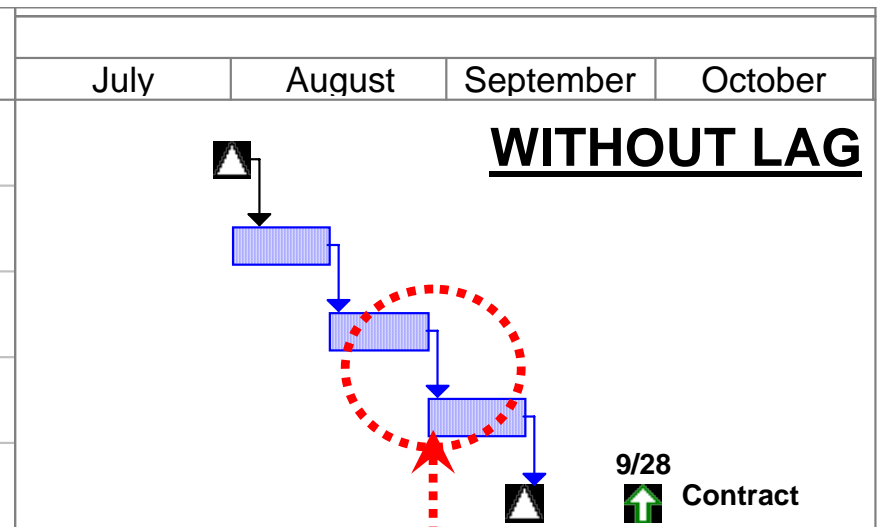| ID | Task Name | | Month -1 | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 |
|----|-----------|---|----------|---------|---------|---------|---------|---------|
| 1 | Start | | | | | | | |
| 2 | Integrate Component A | | | | | | | |
| 3 | Integrate Component B | | | | | | | |
| 4 | Integrate Component C | | | | | | | |
| 5 | Deliver | | | | | | | |
| 6 | Gov't -Furnished Component "A" Needed | | | | | | | |
| 7 | Gov't's Planned Delivery of Component "A" | | | | | | | |

- Contractor schedule threatened by "late" GFE
  - Government cannot deliver component A until the start of month 2
  - Contractor claims delay will impact it's schedule
- What should the government do?

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# Dealing with Preferential Sequencing

- Include "on-dock" delivery dates for GFE in the Prime's contract
- Consider "earlier-than-needed" delivery dates in contract with the agreement that they provide some flexibility for the contractor in swapping components during integration & test
- Pre-negotiate contract options for handling cases of late GFE
- Consider schedule slack/float as a shared resource
- Verify and validate contractor schedule no later than Integrated Baseline Review (IBR) or prior to new baselines

# Hiding Slack/Float

| ID | Task Name | Duration | Start | Finish | Total Slack |
|----|-----------|----------|-------|--------|-------------|
| 1 | Start | 0 days | 8/1/07 | 8/1/07 | 13 days |
| 2 | Activity "A" | 10 days | 8/1/07 | 8/14/07 | 13 days |
| 3 | Activity "B" | 10 days | 8/15/07 | 8/28/07 | 13 days |
| 4 | Activity "C" | 10 days | 8/29/07 | 9/11/07 | 13 days |
| 5 | Delivery | 0 days | 9/11/07 | 9/11/07 | 13 days |

| | July | August | September | October |
|---|------|--------|-----------|---------|

**WITHOUT LAG**

9/28
Contract

**Task Information**

General | Predecessors | Resources | Advanced | Notes | Custom Fields

Name: Activity "C"    Duration: 10d    ☐ Estimated

Predecessors:

3

| ID | Task Name | Type | Lag |
|----|-----------|------|-----|
| 3 | Activity "B" | Finish-to-Start (FS) | 0d |

Help    OK    Cancel

- No "lag" time Between "B" & "C"
- "C" starts as soon as "B" finishes

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# Hiding Slack/Float

| ID | Task Name | Duration | Start | Finish | Total Slack |
|----|-----------|----------|-------|--------|-------------|
| 1 | Start | 0 days | 8/1/07 | 8/1/07 | 8 days |
| 2 | Activity "A" | 10 days | 8/1/07 | 8/14/07 | 8 days |
| 3 | Activity "B" | 10 days | 8/15/07 | 8/28/07 | 8 days |
| 4 | Activity "C" | 10 days | 9/5/07 | 9/18/07 | 8 days |
| 5 | Delivery | 0 days | 9/18/07 | 9/18/07 | 8 days |



**WITH 5-DAY LAG**

9/28 **Contract**

**Task Information**

General | Predecessors | Resources | Advanced | Notes | Custom Fields

Name: Activity "C"    Duration: 10d   ☐ Estimated

Predecessors:

| ID | Task Name | Type | Lag |
|----|-----------|------|-----|
| 3 | Activity "B" | Finish-to-Start (FS) | 5d |

Help    OK    Cancel

**5 Day "lag" between "B" & "C":**
- **Delays start of "C"**
- **Conceals 5 days of slack/float**
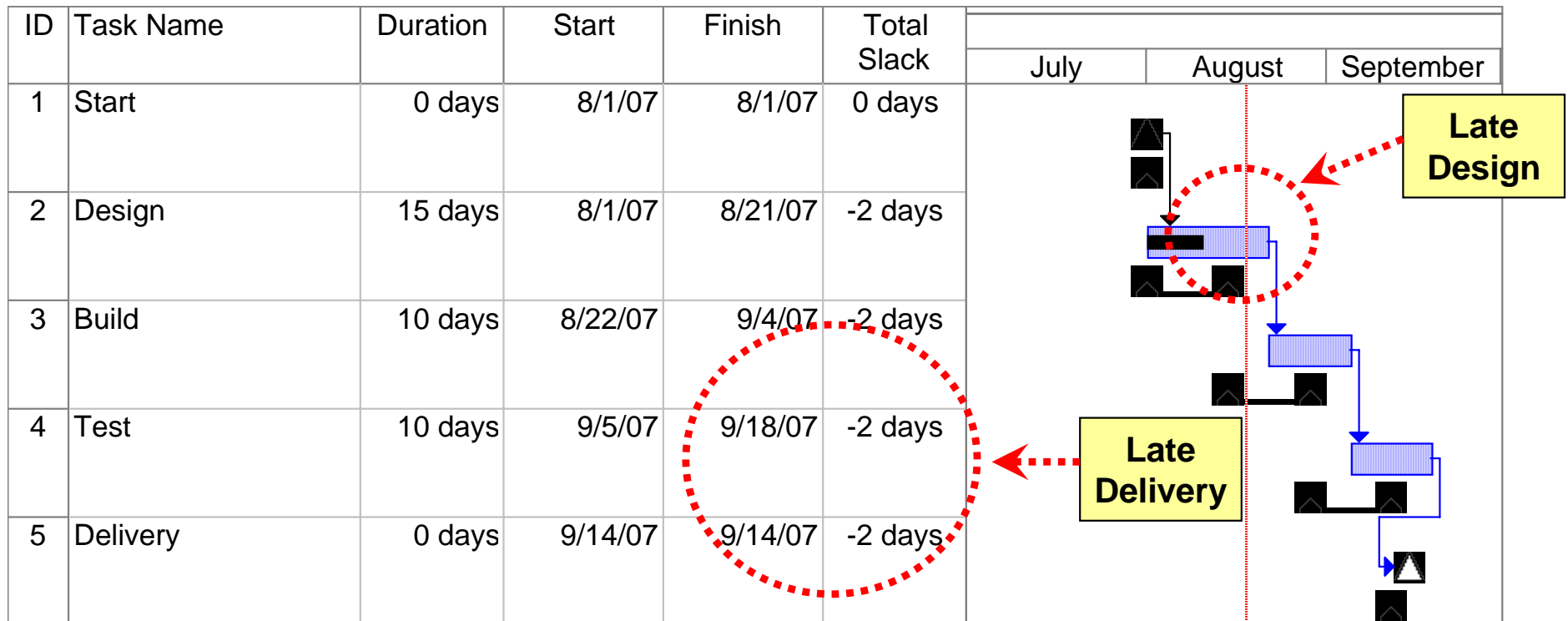
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# Dealing With Hidden Slack/Float

- Eliminate reasons for concealing slack/float by having
  - Realistic activity durations
  - Adequate schedule reserves
  - Documented schedule assumptions and programmatic constraints
  - Clear rationale for pure schedule constraints
- Consider schedule slack/float as a shared resource
- Recognize some lags may be legitimate (e.g. cure time)
- Training in schedule management

# Abusing Project Logic

| ID | Task Name | Duration | Start | Finish | Total Slack | | | |
|----|-----------|----------|-------|--------|-------------|---|---|---|
| | | | | | | July | August | September |
| 1 | Start | 0 days | 8/1/07 | 8/1/07 | 0 days | | | |
| 2 | Design | 10 days | 8/1/07 | 8/14/07 | 3 days | | | |
| 3 | Build | 10 days | 8/15/07 | 8/28/07 | 3 days | | | |
| 4 | Test | 10 days | 8/29/07 | 9/11/07 | 3 days | | | |
| 5 | Delivery | 0 days | 9/11/07 | 9/11/07 | 3 days | | | |

**Finish No Later Than 9/14**

- It's August 10th and the project is on track to beat the 9/14 target delivery date by three days!

- But one week later, engineering reports that it will be late finishing the design effort which results in . . .

# Abusing Project Logic

| ID | Task Name | Duration | Start | Finish | Total Slack | July | August | September |
|----|-----------|----------|-------|--------|-------------|------|--------|-----------|
| 1 | Start | 0 days | 8/1/07 | 8/1/07 | 0 days | | | |
| 2 | Design | 15 days | 8/1/07 | 8/21/07 | -2 days | | | |
| 3 | Build | 10 days | 8/22/07 | 9/4/07 | -2 days | | | |
| 4 | Test | 10 days | 9/5/07 | 9/18/07 | -2 days | | | |
| 5 | Delivery | 0 days | 9/14/07 | 9/14/07 | -2 days | | | |

Late Design

Late Delivery

- A four work day impact to the 9/14 customer delivery commitment (Finished Not Later Than (FNLT) 9/14)
- What should the project do?

# Abusing Project Logic

**Task Information**

| General | Predecessors | Resources | Advanced | Notes | Custom Fields |

Name: Test    Duration: 10d    ☐ Estimated

Predecessors:

3

| ID | Task Name | Type | Lag |
|----|-----------|------|-----|
| 3 | Build | Finish-to-Finish (FF) | 5d |

Help

**Change the Finish to Start (FS) relationship between "Build" and "Test" to a Finish to Finish (FF) relationship with a 5 day lag and the problem is "fixed"!**

| ID | Task Name | Duration | Start | Finish | Total Slack | July | August | September |
|----|-----------|----------|-------|--------|-------------|------|--------|-----------|
| 1 | Start | 0 days | 8/1/07 | 8/1/07 | 0 days | | | |
| 2 | Design | 15 days | 8/1/07 | 8/21/07 | 3 days | | | |
| 3 | Build | | 8/22/07 | 9/4/07 | 3 days | | | |
| 4 | Test | | 8/29/07 | 9/11/07 | 3 days | | | |
| 5 | Delivery | 0 days | 9/11/07 | 9/11/07 | 3 days | | | |

**3 days slack is back with the "original" delivery!**

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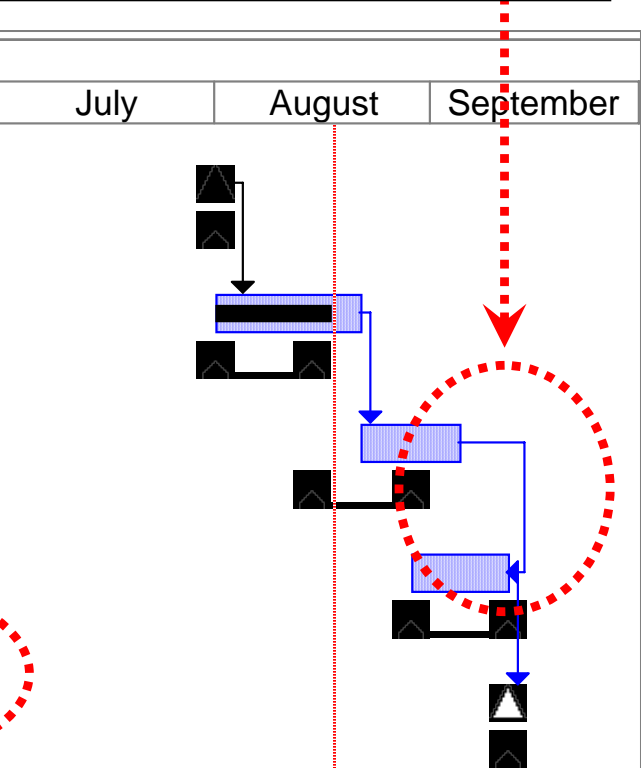
# Dealing with Project Logic Abuse

- Schedule "health check" and "detective" tools can screen for activities without predecessors and successors
- Custom reports/filters can identify suspicious activity relationships and questionable leads/lags
- Logic traces of network diagrams are best for understanding context of specific relationships and lags
- Include a requirement for explanation of logic changes in contractor's monthly schedule status reports
- Receivables/Deliverables (Rec/Del) Lists help validate logic
- Develop the integration & test schedule early to a level of detail sufficient for identifying hardware and software delivery need dates
- Include "on-dock" delivery dates for GFE in contracts
- Rules-of-Thumb:
  - Use Finish-to-Start relationships whenever feasible
  - Don't use lags if an activity better defines the schedule condition
  - Finish-to-Start relationships with negative lags are a "red flags"

# Inappropriate Use of EVM Techniques: Overestimating Task Percentage Completions

## Before Manipulation

| Cum | Period 1 | Period 2 | Period 3 | Period 4 |
|-----|----------|----------|----------|----------|
| PV  | 100      | 225      | 368      | 500      |
| EV  | 95       | 212      | 296      | 438      |
| AC  | 105      | 239      | 335      | 505      |
| CPI | 0.905    | 0.887    | 0.884    | 0.867    |
| SPI | 0.950    | 0.942    | 0.804    | 0.876    |

## After Manipulation

| Cum | Period 1 | Period 2 | Period 3 | Period 4 |
|-----|----------|----------|----------|----------|
| PV  | 100      | 225      | 368      | 500      |
| EV  | 95       | 212      | 296      | 480      |
| AC  | 105      | 239      | 335      | 505      |
| CPI | 0.905    | 0.887    | 0.884    | 0.950    |
| SPI | 0.950    | 0.942    | 0.804    | 0.960    |

By increasing EV by a small amount, performance indices improve a lot

# Inappropriate Use of EVM Techniques: Offsetting Performance Problems with LOE

|  | PV | EV | AC | BAC | IEAC* |
|---|---|---|---|---|---|
| Spacecraft | 55,900 | 25,000 | 33,251 | 125,000 | 166,255 |
| Instrument | 170,070 | 67,500 | 175,500 | 225,000 | 585,000 |
| Mission Mgmt | 35,000 | 35,000 | 20,250 | 60,000 | 34,714 |
| S&MA | 40,000 | 40,000 | 14,750 | 95,000 | 35,031 |
| Total | 300,970 | 167,500 | 243,751 | 505,000 | 821,001 |

In this example, Mission Management and Safety and Mission Assurance (S&MA) are LOE activities. Note that underrunning LOE tasks (EV-AC) causes the projected EAC to be lower than the BAC. LOE can effectively mask overruns in other activities.

* - BAC/CPI

# Dealing with Inappropriate Use of EVM Techniques

- Milestones should be discrete, objective, and verifiable – rather than simply marking the passage of time
- Percent Compete should be based on some objective criteria when possible
  - Consider "Percent Complete with Milestone Gates" for more objectivity
  - Control Account Plan (CAP) subjective percent complete estimates at 80% until task is 100% finished
- LOE should not exceed 10% of PMB and BAC
  - Consider "quarantining" LOE from baseline
- 50/50 Method should only apply to short duration work packages (one or two accounting periods)
- Carefully examine material work package phasing for billing and booking lag problems
- Include examination of EVM techniques in IBR

# Declining Rates

|  | Feb 02 Actual | Mar 02 Plan | Apr 02 Plan | Balance of Contract | Estimate at Completion |
|---|---|---|---|---|---|
| **Labor dollars** | $831,000 | $1,029,000 | $1,177,000 | $41,889,000 | $56,394,000 |
| **Labor hours** | 12,645 | 27,908 | 29,394 | 1,006,295 | 1,266,475 |
| **Hourly Labor Rate** | $65.72 | $36.87 | $40.04 | $41.63 | $44.53 |

**While some fluctuation in labor rates are expected, it's unlikely that the rate will suddenly drop by a third for the entire remaining period of the contract.**

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# Overhead (indirect) Rate Manipulation

- Erroneous use of different rates for indirect cost PV and EV

- This causes EV to build at a faster rate than PV, causing favorable cost and schedule variances that will offset negative variances at the total level

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# Overhead (Indirect) Rate Manipulation

|  | Labor Dollars | OH Rate | OH Dollars with Correct OH Rates | OH Dollars with Manipulated OH Rates |
|---|---|---|---|---|
| PV | 1,000 | 1.25 | 1,250 | 1,250 |
| EV | 1,000 |  | 1,250 | 1,300 |
| AC | 1,000 | 1.30 | 1,300 | 1,300 |

|  | CV | SV |
|---|---|---|
| Correct Variances | -50 | 0 |
| Manipulated Variances | 0 | 50 |

So instead of correctly reporting an unfavorable cost variance of -50, this rate manipulation results in a favorable schedule variance of 50, with no cost variance.

# Dealing with Rate Manipulation

- Perform simple analysis of rates on a regular basis

- Some fluctuation in rates from one period to another is expected due to labor mix and inflation. Big differences need to be explained by the contractor

- In all elements that involve rates, the rate used for PV should always be the same rate used for EV. Only the AC rates can reflect differences.

# Gaming EV to Improve Performance Indices and Increase Award Fee

## ABC Total Contract (before EV manipulation)

|  | Oct | Nov | Dec | Jan | Feb | Mar | Cum thru Jan |
|---|---|---|---|---|---|---|---|
| PV | 3,020 | 3,780 | 5,500 | 8,100 | 6,900 | 3,100 | 20,400 |
| EV | 1,960 | 3,850 | 8,800 | 3,390 | | | 18,000 |
| AC | 1,980 | 4,115 | 9,600 | 7,505 | | | 23,200 |
| CPI | 0.990 | 0.936 | 0.917 | 0.452 | | | 0.776 |
| SPI | 0.649 | 1.019 | 1.600 | 0.419 | | | 0.882 |

# Gaming EV to Improve Performance Indices and Increase Award Fee

## ABC Total Contract (after EV manipulation)

| | Oct | Nov | Dec | Jan | Feb | Mar | Cum thru Jan |
|---|---|---|---|---|---|---|---|
| PV | 3,020 | 3,780 | 5,500 | 8,100 | 6,900 | 3,100 | 20,400 |
| EV | 1,960 | 3,850 | 9,200 | 6,450 | | | 21,460 |
| AC | 1,980 | 4,115 | 9,600 | 7,505 | | | 23,200 |
| CPI | 0.990 | 0.936 | 0.958 | 0.859 | | | 0.925 |
| SPI | 0.649 | 1.019 | 1.673 | 0.796 | | | 1.052 |

If the Performance Evaluation Plan awarded fee for having a CPI of 0.9 or higher, the subtle manipulations needed in EV within work packages would be difficult to detect.

# Dealing with Award Fee and EVM

- Don't tie award fee to performance indices – this incentive entices the contractor to get the best indices possible at the expense of meaningful EVM data.

- Do tie award fee to satisfactory and verifiable completion of milestones

# So What if the EVMS is Gamed?

"If you have bad data you can't make good decisions"
**- Unknown**

# How to Avoid or Detect Gaming, Abuse and Data Manipulation

1. Conduct Integrated Baseline Reviews with experts in the Project's technical, financial and scheduling areas
2. Use analysis tools (e.g. schedule health check/detective)
3. Get training in gaming/abuses
4. EVM training for project team in contractor EVM system
5. Remove enablers to gaming (e.g. weak schedule specifications, CPI-based award fee milestones)
6. Beware of perfect performance – in real life, it never happens
7. Analyze the data regularly and watch for trends, patterns and outliers
8. Conduct surprise audits (e.g. timecards/name runs, schedule integration)

# How to Avoid or Detect Gaming, Abuse and Data Manipulation Cont'd

9. Talk to people who previously worked with organization/ contractor you are dealing with

10. Make sure that change order, proposal, revision and contract mod processing are done in a timely manner

11. Ensure that detailed change logs are used and understood (e.g. schedules, MR, UB)

12. Investigate reasons for LOE budget greater than 10% of PMB and monitor effect of changes

13. Measure what matters (e.g. proper EVM methods)

14. Consider modifying the reporting requirements

15. Specify a dollar amount **OR** percentage for the variance reporting thresholds

# The Last Word

"You can only game the system until you run out of money."

– Senior OMB official, 2006