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Predicting The Future

Peter Hayward
BAE Systems Insyte

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- Problem is, there aren't any. Anyone can predict the future. The issue is actually:

  - Recognition of what the data is telling you – getting them to believe

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Agenda

- Methods of predicting the future!
  - Statistical EACs
  - TCPIe
  - Earned Schedule

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Statistical EACs

- Most of the data looked at in Earned Value terms are backward looking, i.e. where we are today
- However, there are some good ways to take past performance trends and do a what if for the future
- Most tools will do this for you

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Statistical EACs

- The Estimate At Complete (EAC) costs are the sum of what you have spent to date, Actual Cost of Work Performed (ACWP) plus the Estimate To Complete (ETC)
- In BAE Systems Insyte, we gather the forecast (ETC) from the CAM each month, this is a manual ETC
- This can then be compared with the statistical EACs to give indications of impending problems

Statistical EACs

- Taking the performance to date (CPI) you can predict the costs in the future if there is no change in performance

$$CPI = \frac{BCWP}{ACWP} \quad \text{if} \quad BCWP = \frac{100}{133} \quad \text{then CPI} = 0.75$$

This means that for every £1 of work being done it is costing you £1.33 to do it!

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Statistical EACs

- So consider this. If you had a budget of £200k and you are performing at 0.75 then why wouldn't the EAC be £200k/0.75 = £266.7k

- OK, so you may have done half of the work then a more precise formula would be ACWP + $\frac{\text{BAC-BCWP}}{0.75}$ = £133k + $\frac{\text{£200k - £100k}}{0.75}$

  which still equals £266.7k because the performance (CPI) in this example is constant

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Statistical EACs

- Now it gets more interesting when you start to introduce the current SPI as well
- Thus if you are over spending and behind schedule (CPI and SPI <1) then the EAC will be even higher. Consider this:

$$\frac{BAC - BCWP}{CPI \times SPI} + ACWP$$

- Then you can weight what amount of the CPI or SPI that you use
- Then you can start to use average CPIs, last 3 months and last 6 months
- And then
- And then
- And then

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Statistical EACs – Some Formulas

BCWR = BAC - BCWP (CUM)

- 3 Period Av = $\frac{\text{BCWR}}{\text{3 Per Av CPI}}$
- 6 Period Av = $\frac{\text{BCWR}}{\text{6 Per Av CPI}}$
- Cum CPI = $\frac{\text{BCWR}}{\text{CPI (Cum)}}$
- Cur CPI = $\frac{\text{BCWR}}{\text{CPI (Cur Period)}}$
- CPI x SPI $\frac{\text{BCWR}}{\text{CPI (CUM)) SPI (CUM)}}$
- Cost & Sched $\frac{\text{BCWR}}{\text{CPI (CUM)) SPI (CUM)}}$

CPI and SPI x a PF

- Linear Regression
  The linear regression formula is calculated by finding the formula for the straight line that best fits the plot of cumulative ACWP vs. cumulative BCWP, then entering the BAC into that formula to calculate the EAC
- MICOM
  Uses the 6 period Av CPI x SPI

And then do you include MR or not?

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Statistical EACs

- Don’t remember the formulas
- Use the data

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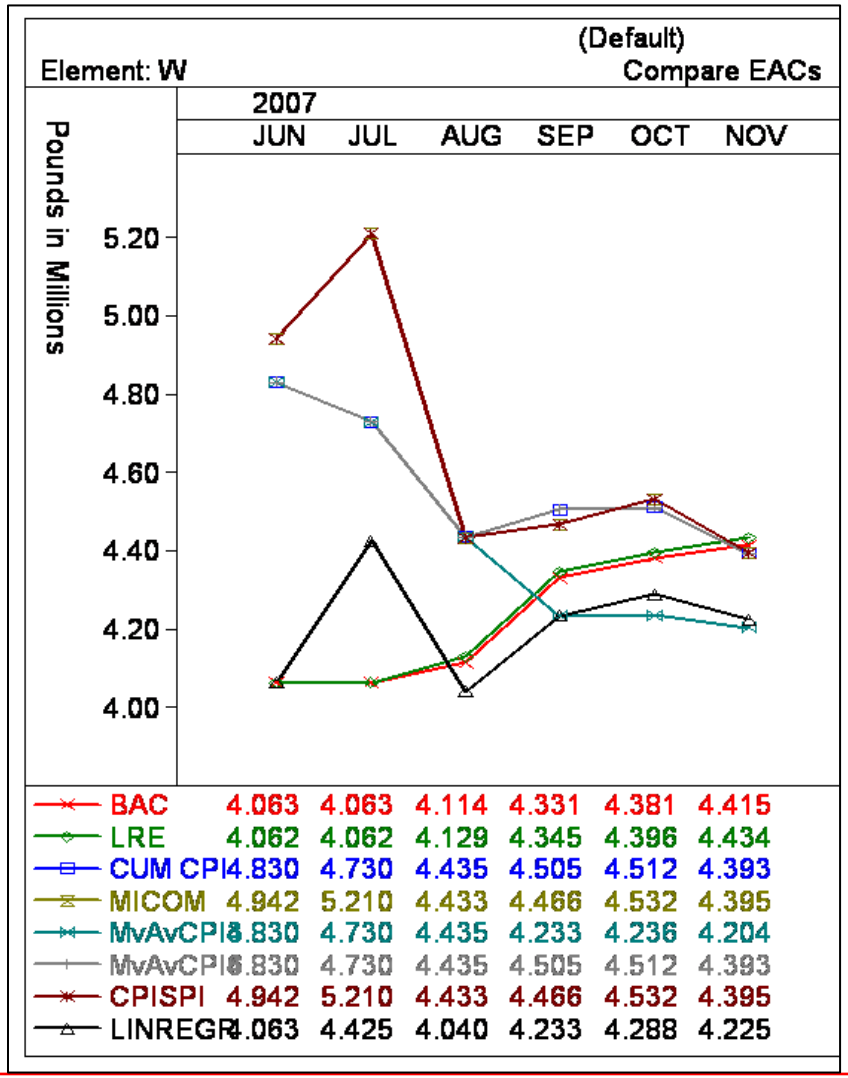
Statistical EACs – Ideal Chart?



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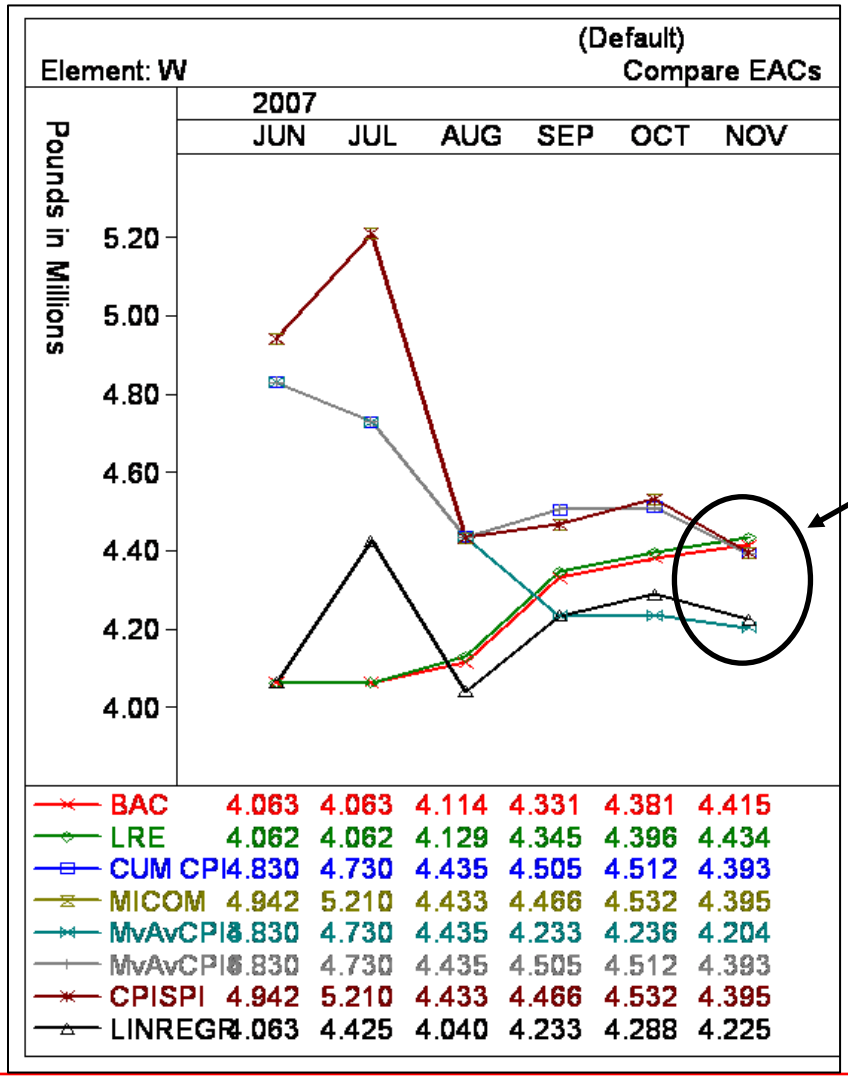
Statistical EACs – Ideal Chart?



Tight group though manual EAC (LRE) is higher than ALL statistical EACs

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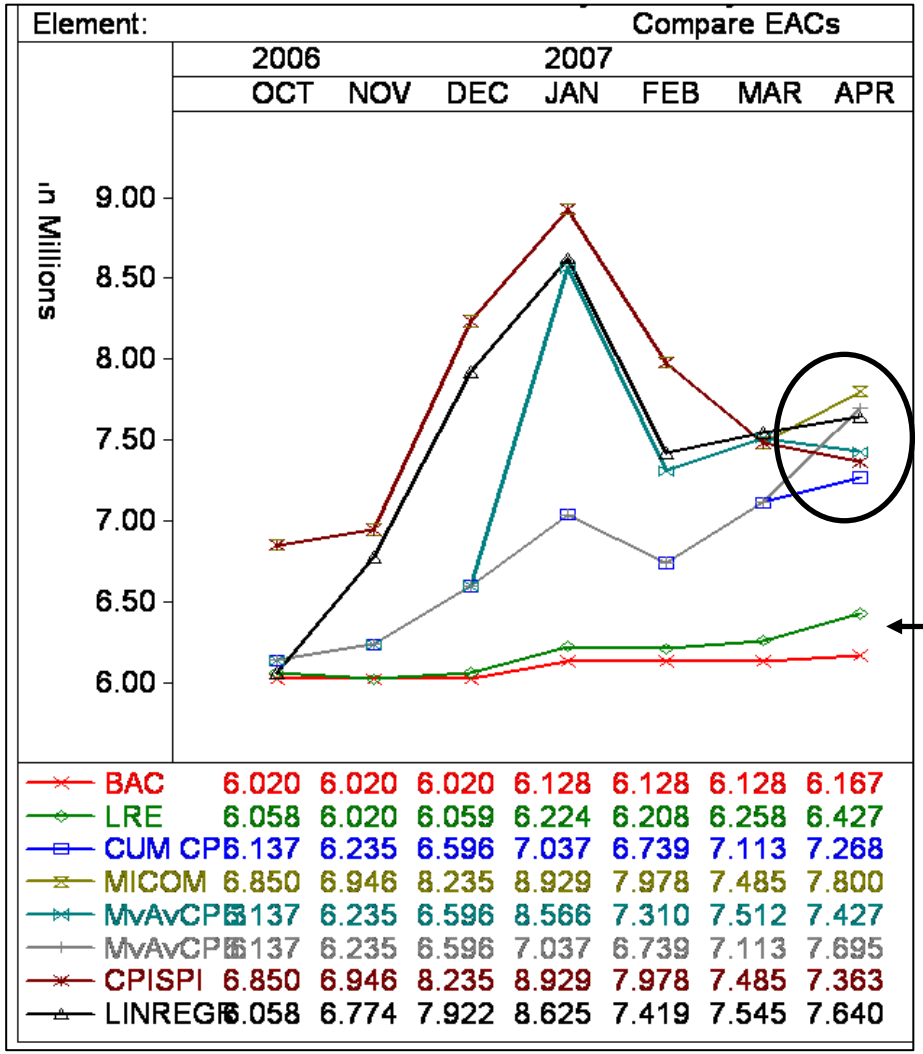
Statistical EACs – Would You Question This Chart



Statistical EACs

CAM EAC

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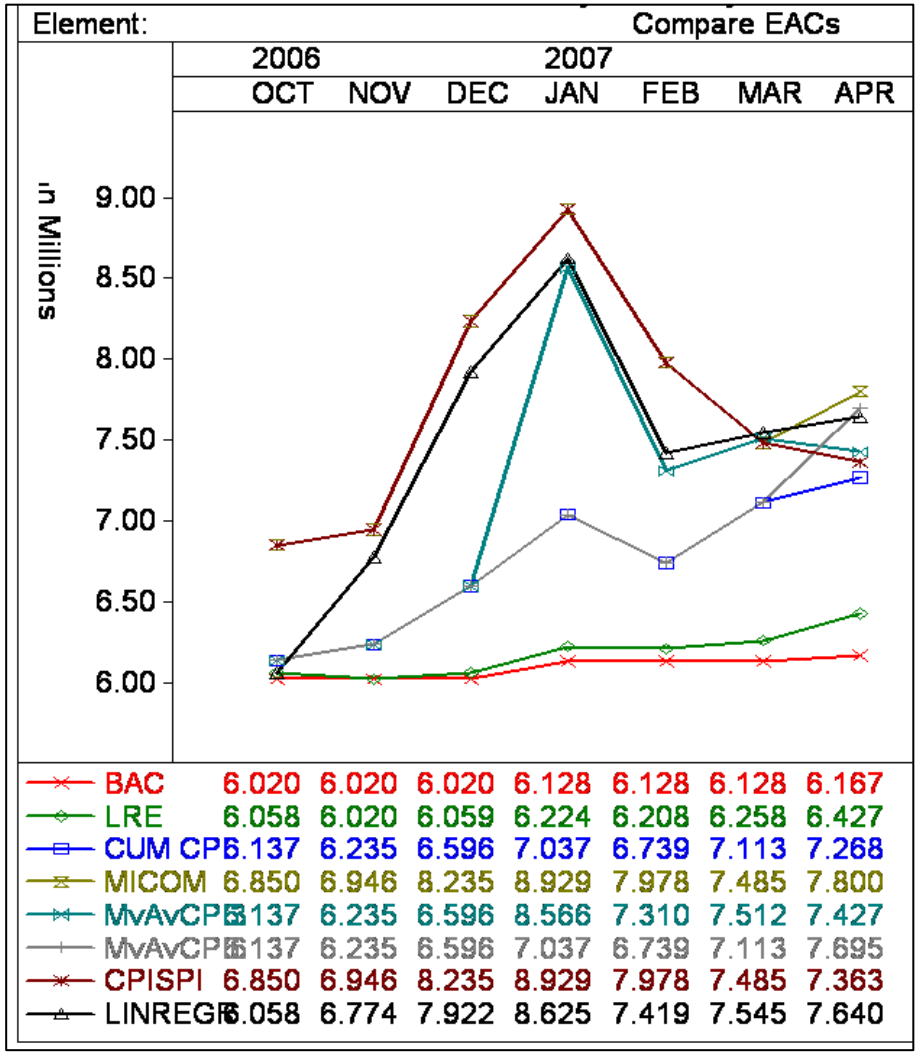
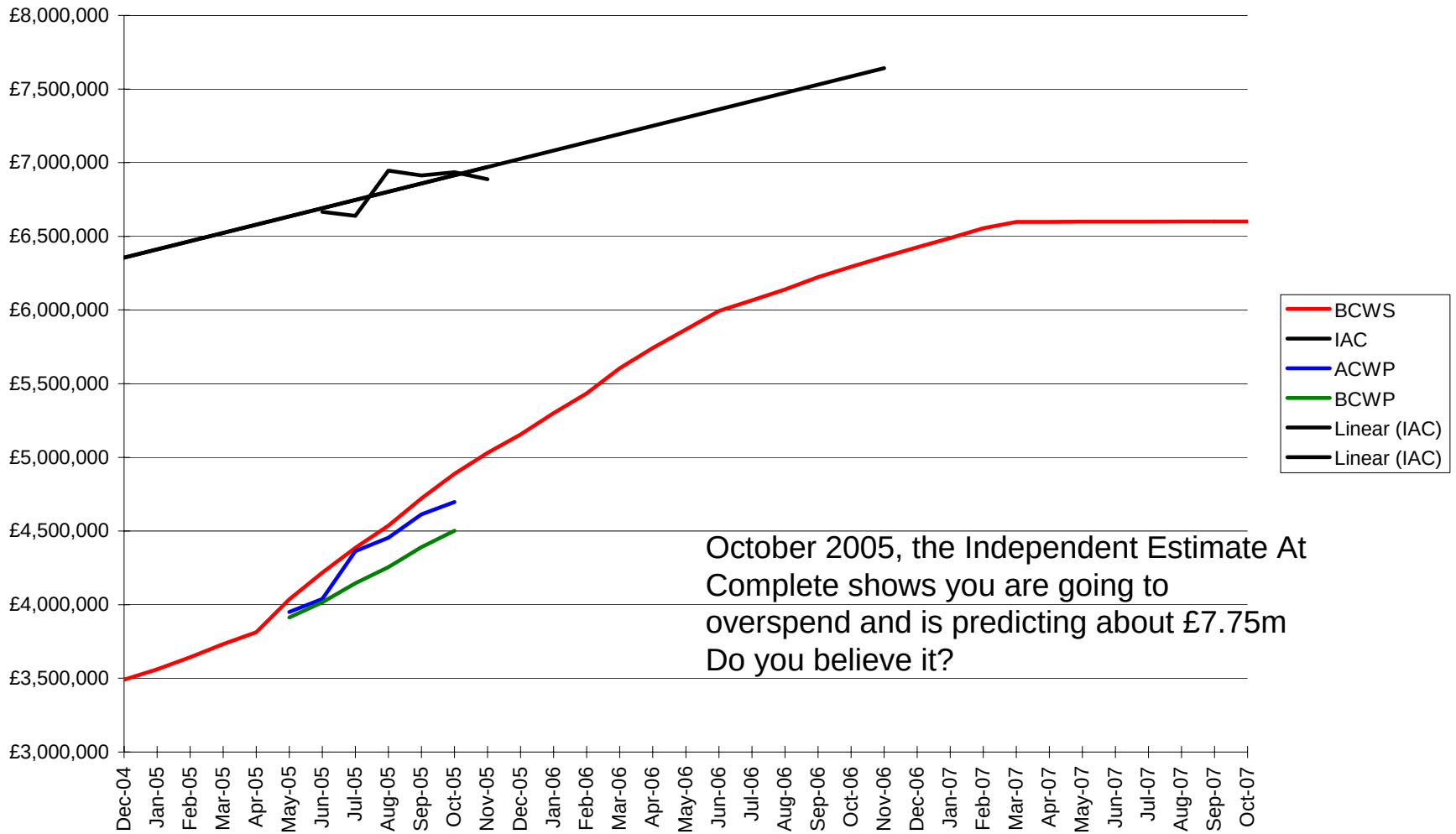
Statistical EACs – What happened so far?



Current budget as of May 09 is £12.72M
They are looking to rebaseline in the next month!!!!!

Statistical EACs - Do You Believe Yet?



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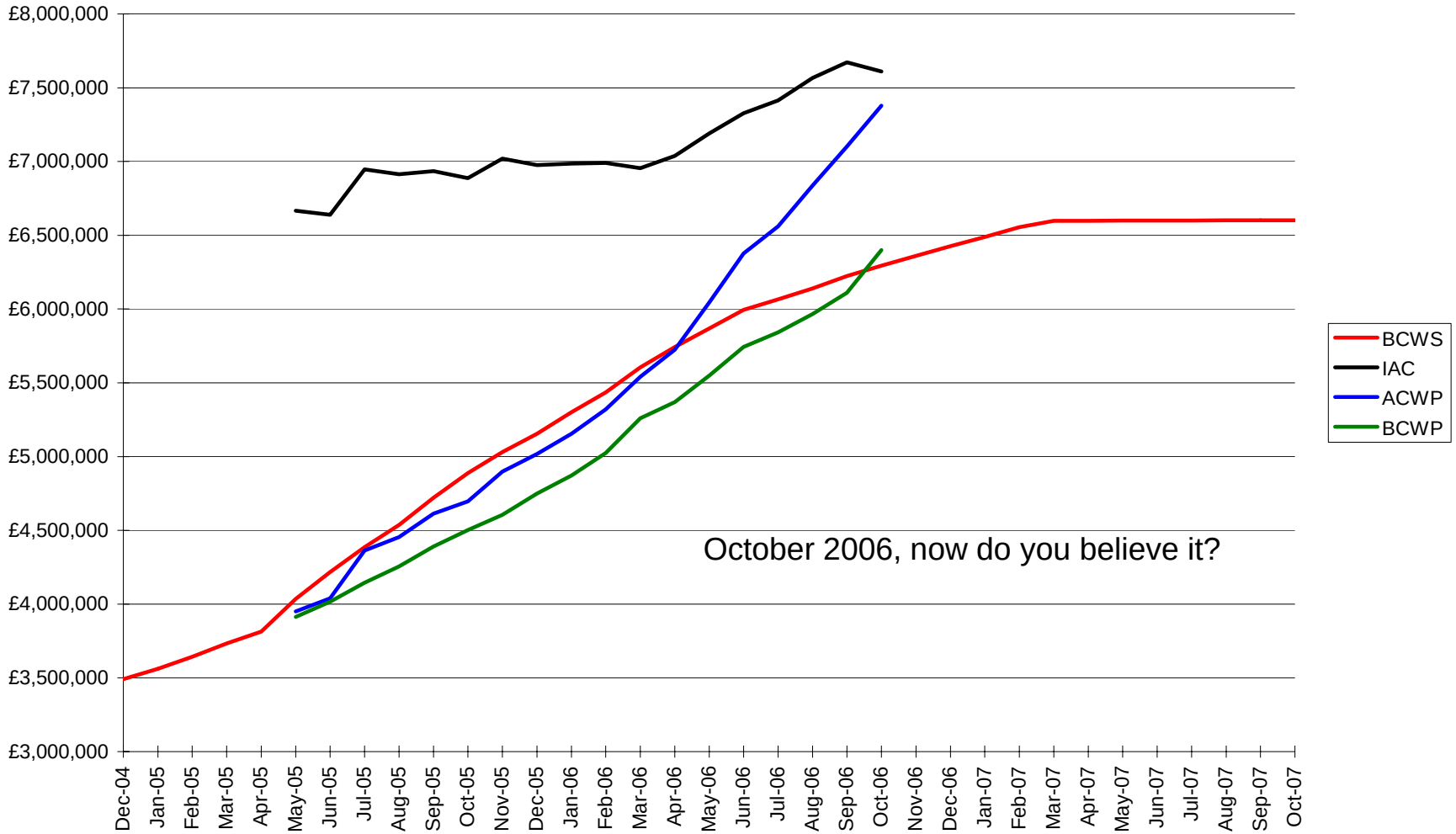
Statistical EACs - Predicts The Future



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TCPI – Now it gets really interesting

- So if the CPI gives you Cost Performance in the past, what about Cost Performance in the future
- This is where TCPI comes in, To complete Cost Performance Index
- It shows you the Cost Performance in the future required to get back to Budget (TCPIb) and to get to the Estimate (TCPIe) – remember in BAE Systems Insyte the Estimate (ETC or LRE) is from the CAM, manual ETC

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TCPIe

- Another formula

$$\frac{BCWR}{ETC}$$

or

$$\frac{BAC-BCWP}{EAC-ACWP}$$

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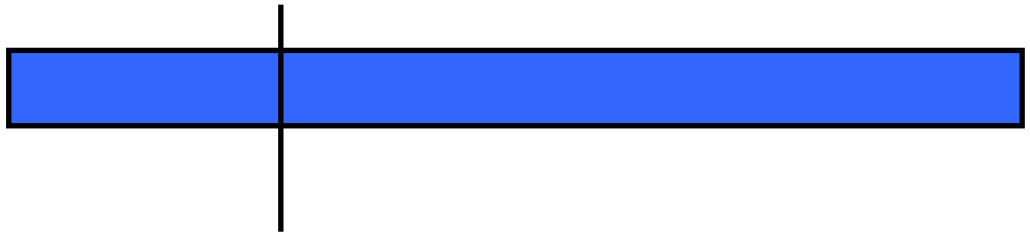
TCPIe – How Does It Work?



BAC = 500

Time Now

ACWP = 100

CPI = 80/100 = 0.8

BCWP = 80

BCWR = 500 – 80 = 420

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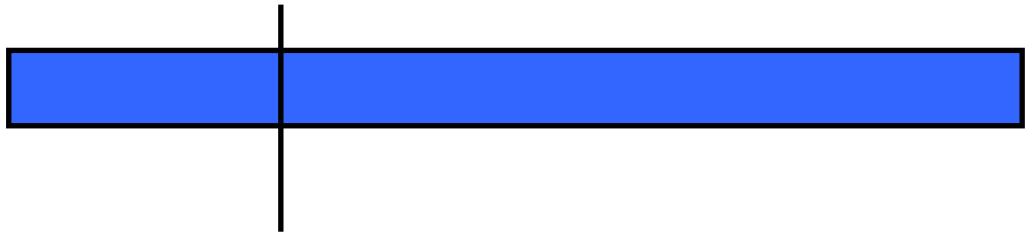
TCPIe – How Does It Work?



BAC = 500

Time Now

ACWP = 100

BCWP = 80

ETC = 400

CPI = 80/100 = 0.8

BCWR = 500 – 80 = 420

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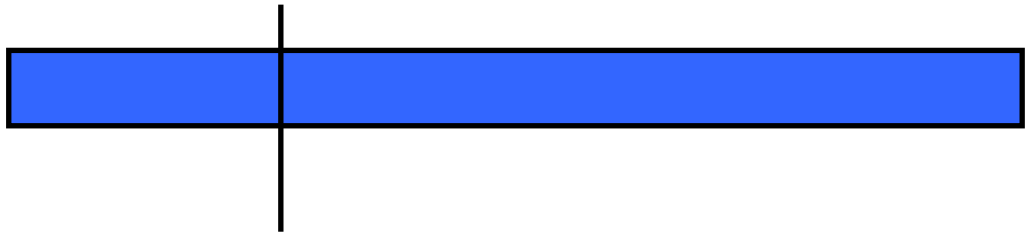
TCPIe – How Does It Work?



BAC = 500

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BCWR = 500 – 80 = 420

TCPIe = BCWR/ETC
= 420/400
= 1.05

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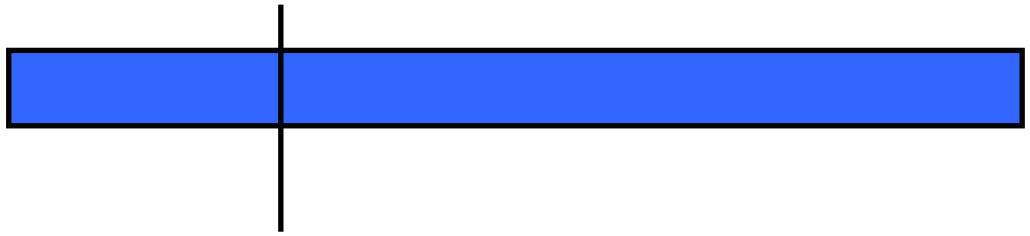
TCPIe – How Does It Work?



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TCPIe = BCWR/ETC
= 420/400
= 1.05

Question to CAM – How are you going to improve your current performance?

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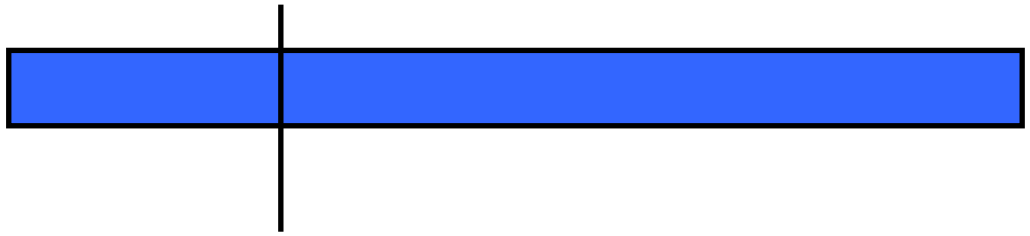
TCPIe – How Should It Work?



BAC = 500

Time Now

ACWP = 100

BCWP = 80

ETC = ~~400~~
= 525

CPI = 80/100 = 0.8

BCWR = 500 – 80 = 420

TCPIe = BCWR/ETC
= 420/525
= 0.8

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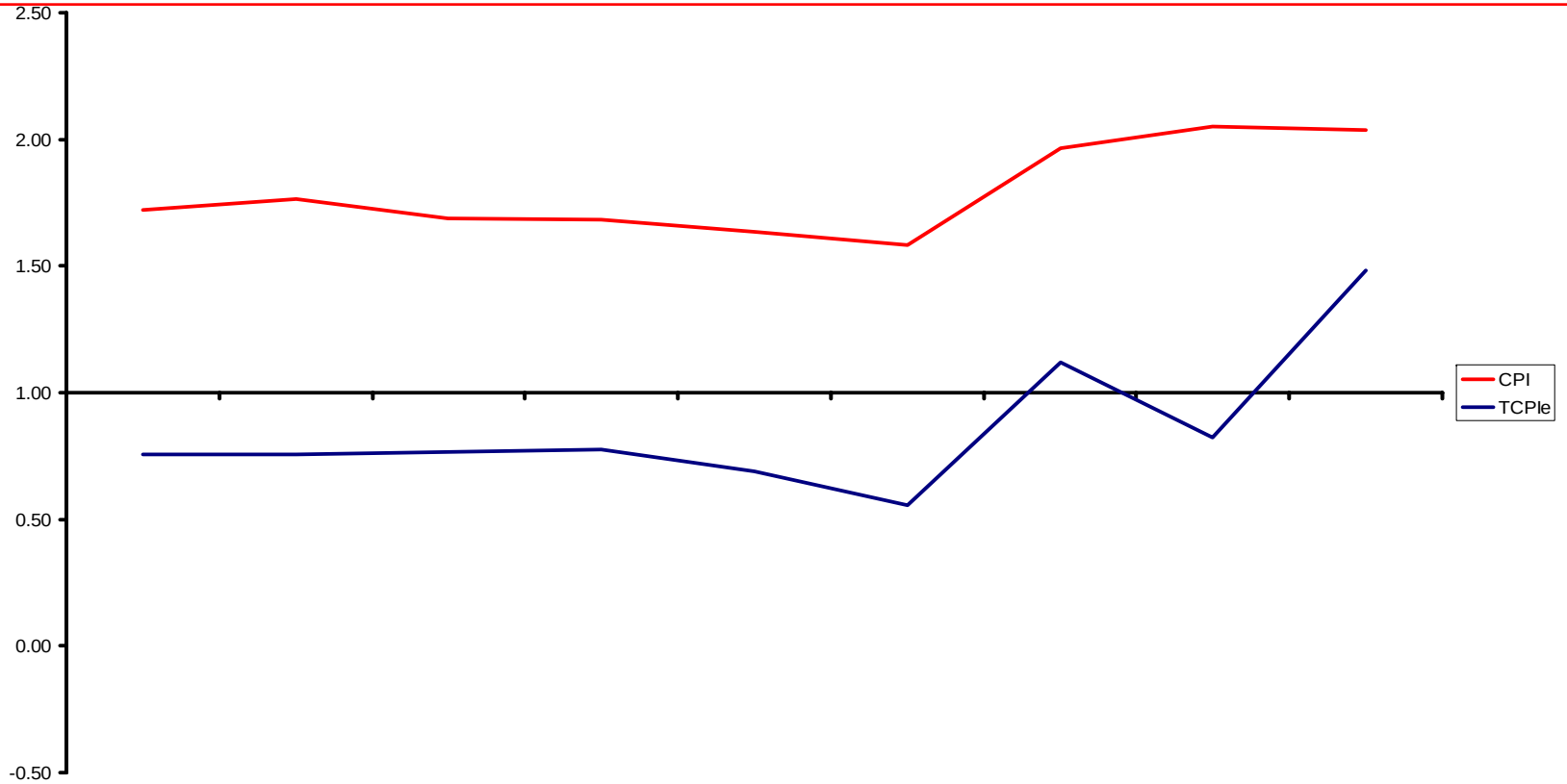
TCPIe – It works the other way as well



CPI	1.72	1.76	1.69	1.68	1.64	1.58	1.97	2.05	2.04
TCPIe	0.76	0.76	0.77	0.77	0.69	0.56	1.12	0.82	1.48
EAC	91.5	91.5	91.5	91.5	91.5	91.5	61.5	61.5	49
ACWP	39.2	39.2	39.2	39.2	40.8	42.6	42.9	42.9	43.2

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Earned Schedule

- In the summer of 2002 Walt Lipke developed a new concept – Earned Schedule and the seminal article was published in the March 2003 issue of the Measurable News (the publication of PMI-CPM).
- The new concept uses a new set of EV measures
- This is not an Earned Schedule master class – please attend the Earned Schedule workshop on Thursday of this week with Mick Higgins and Alex Davis or see Walt Lipke or Kim Henderson for that
- Web site - http://www.earnedschedule.com/
- One of the new measures is Schedule Performance Index Time (SPI(t))
- The advantage of SPI(t) is that, unlike the SPI, it DOES NOT return to 1 at completion

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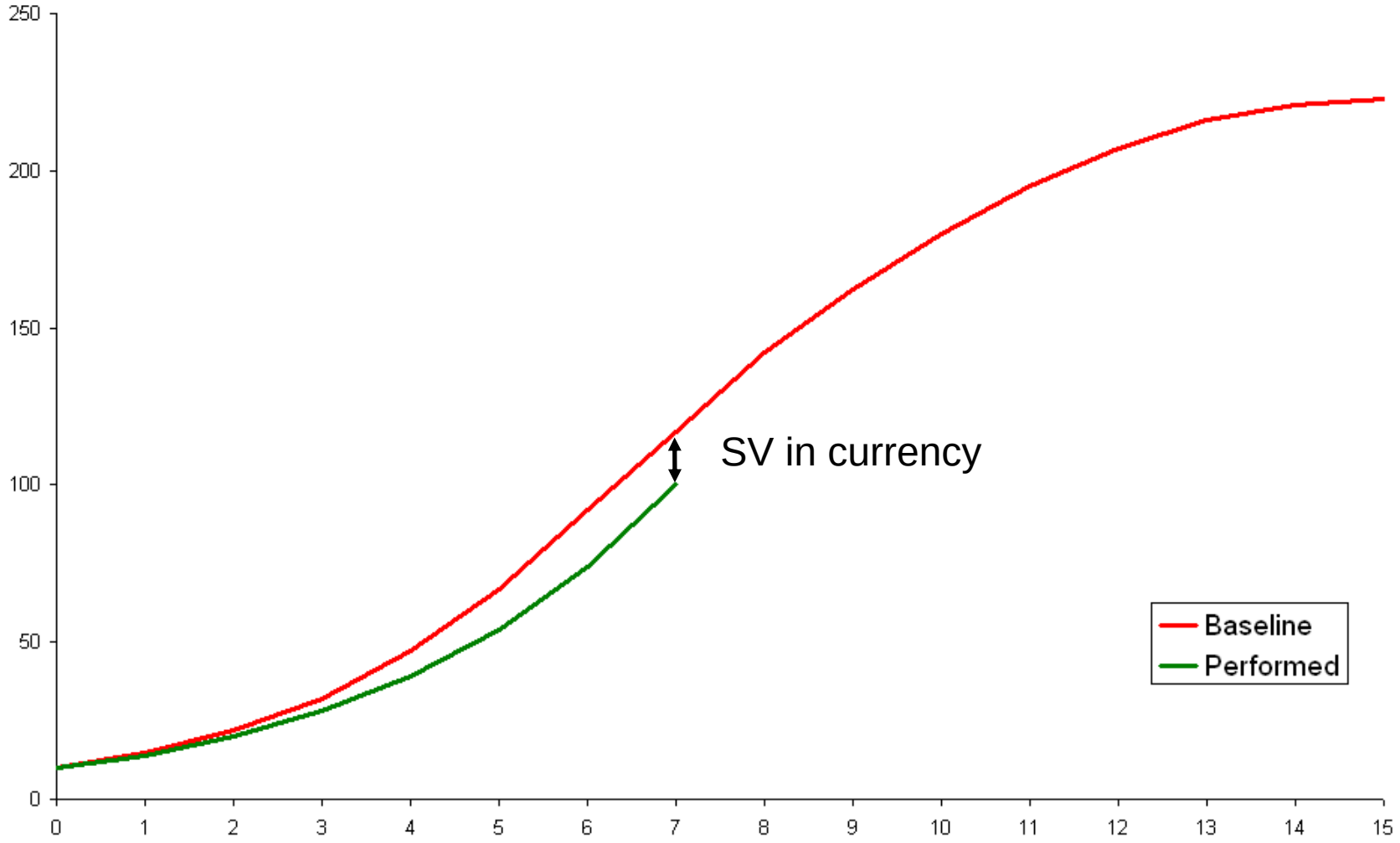
Earned Schedule – What It Isn't



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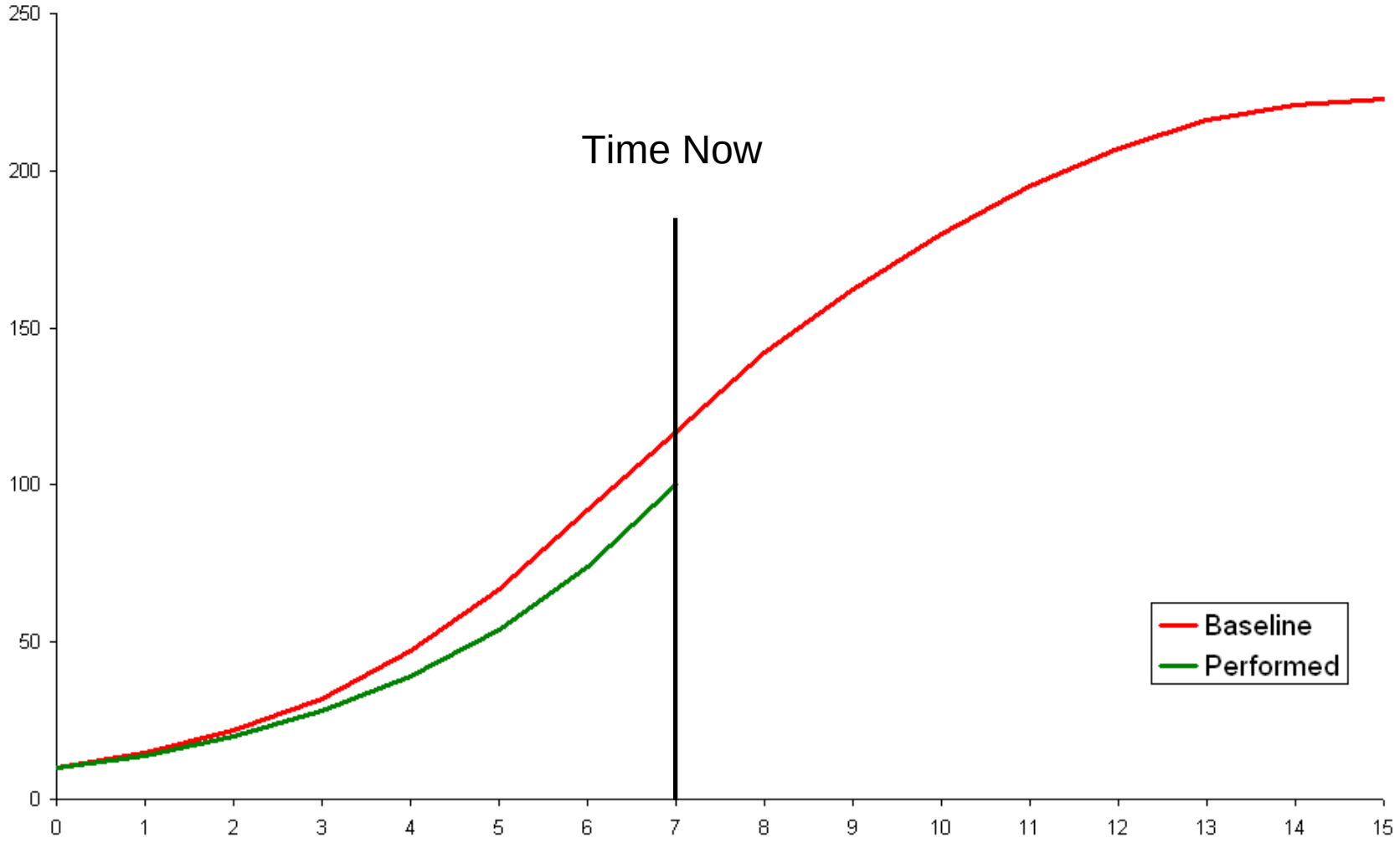
Earned Schedule – What Is It?



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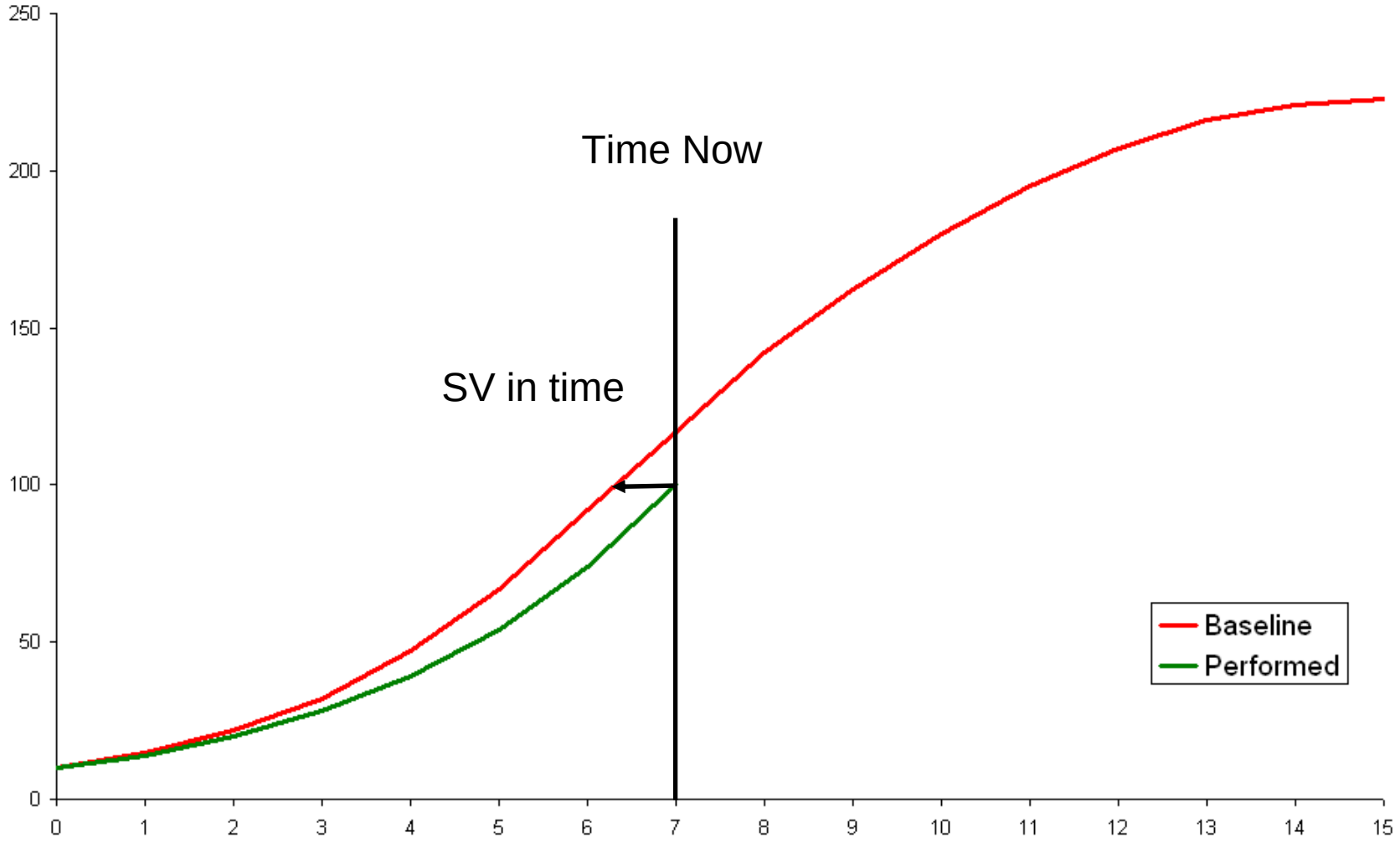

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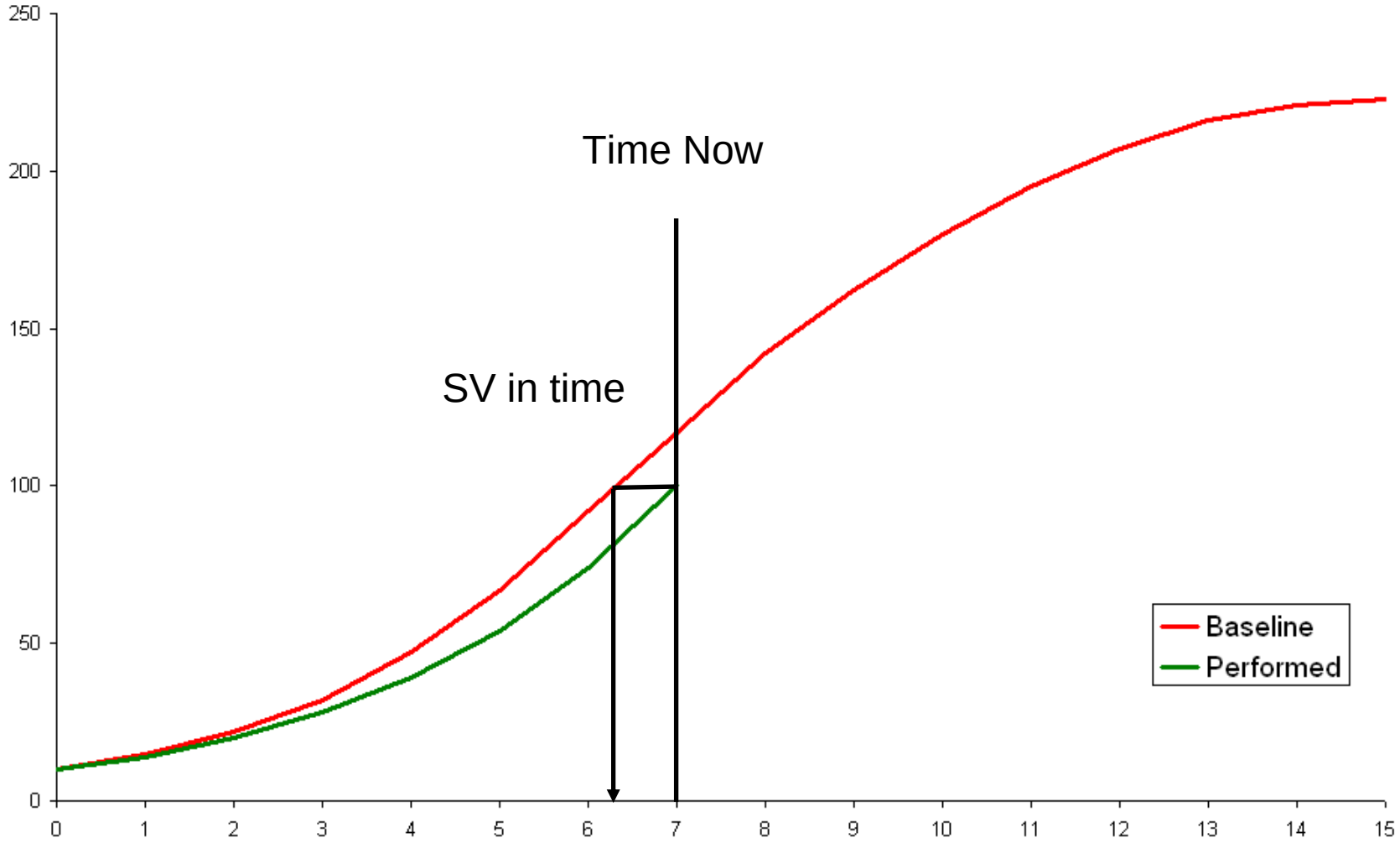
Earned Schedule – What Is It?



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Earned Schedule – What Is It?

- The amount of full periods earned plus the amount of part periods earned

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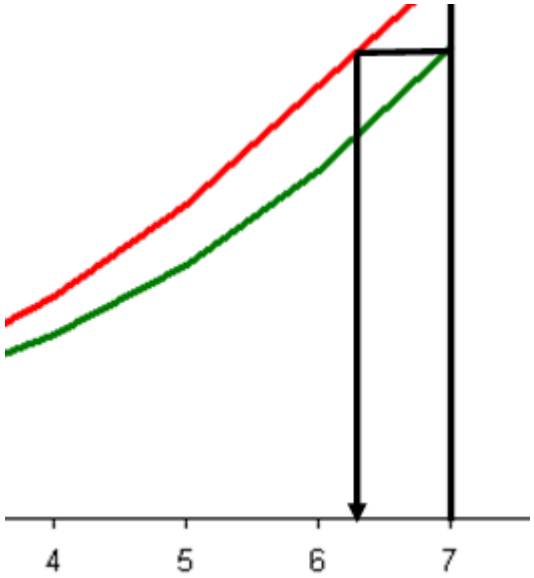
Earned Schedule – What Is It?

- The amount of full periods earned plus the amount of part periods earned
- From our chart you can see that we have earned
  6 full periods plus a fraction of a period
- The calculation for the fraction:

$$\frac{\text{BCWP(Cum)} - \text{BCWS(Last Full Period)}}{\text{BCWS(Last Full Period+1)-BCWS(Last Full Period)}}$$

ES = 6.25



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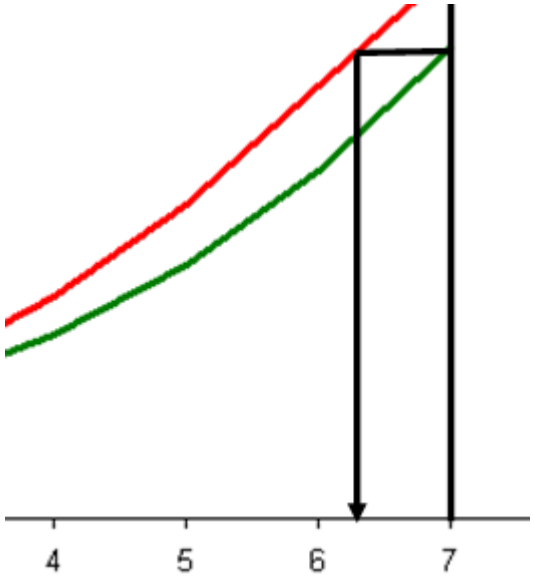
Earned Schedule – SPI(t)

- Schedule Performance Index Time SPI(t) = ES/AT where AT = Actual No periods at Time Now
- From the example

ES = 6.25
AT = 7
SPI(t) = 6.25/7
= 0.89



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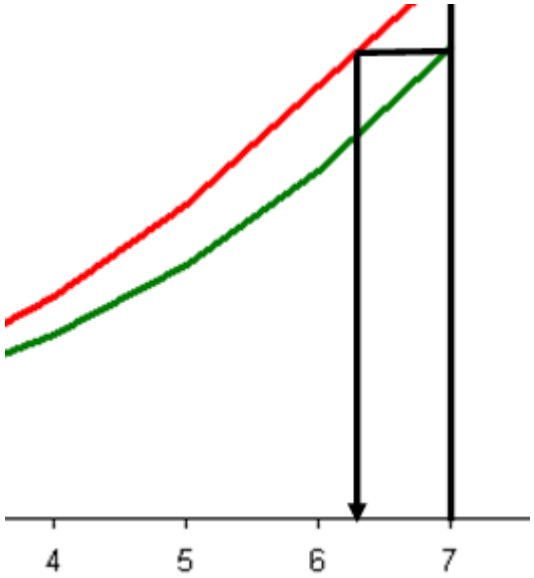
Earned Schedule – SV(t)

- Schedule Variance Time SV(t) = ES - Actual No periods at Time Now

- From the example

ES = 6.25
AT = 7
SV(t) = 6.25 - 7
= -0.75



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Earned Schedule – Plot The Data

BCWS	BCWP	AT	SPI	FULL	PART	ES	SV(t)	SPI(t)	SV
57,545,006	57,545,006	1	1.00	1	0.00	1.00	0.00	1.00	£0
59,403,990	58,471,788	2	0.98	1	0.50	1.50	-0.50	0.75	-£932,201
60,532,195	59,913,375	3	0.99	2	0.45	2.45	-0.55	0.82	-£618,820
61,809,132	60,980,401	4	0.99	3	0.35	3.35	-0.65	0.84	-£828,731
62,937,846	62,184,119	5	0.99	4	0.33	4.33	-0.67	0.87	-£753,727
64,121,992	62,964,337	6	0.98	5	0.02	5.02	-0.98	0.84	-£1,157,655
65,113,434		7							
66,278,776		8							
66,820,477		9							
67,330,672		10							
67,916,803		11							
68,324,253		12							
68,516,770		13							
68,590,164		14							
68,657,368		15							
68,705,158		16							
68,970,456		17							
69,083,982		18							
69,104,355		19							
69,128,802		20							
69,148,156		21							
69,167,510		22							
69,191,957		23							
69,192,976		24							
69,192,976		25							

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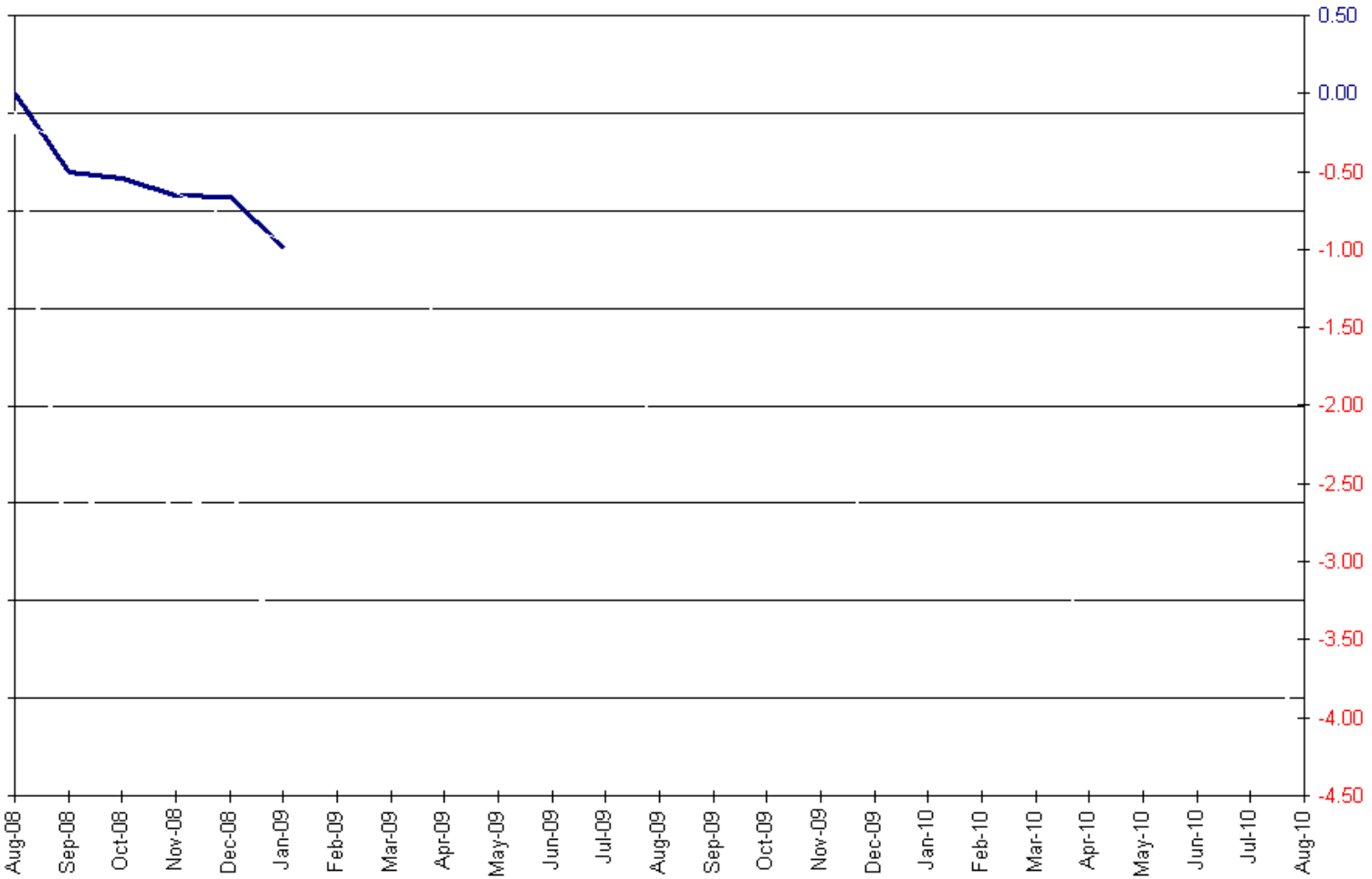
Earned Schedule – Plot The Data



SV(t)

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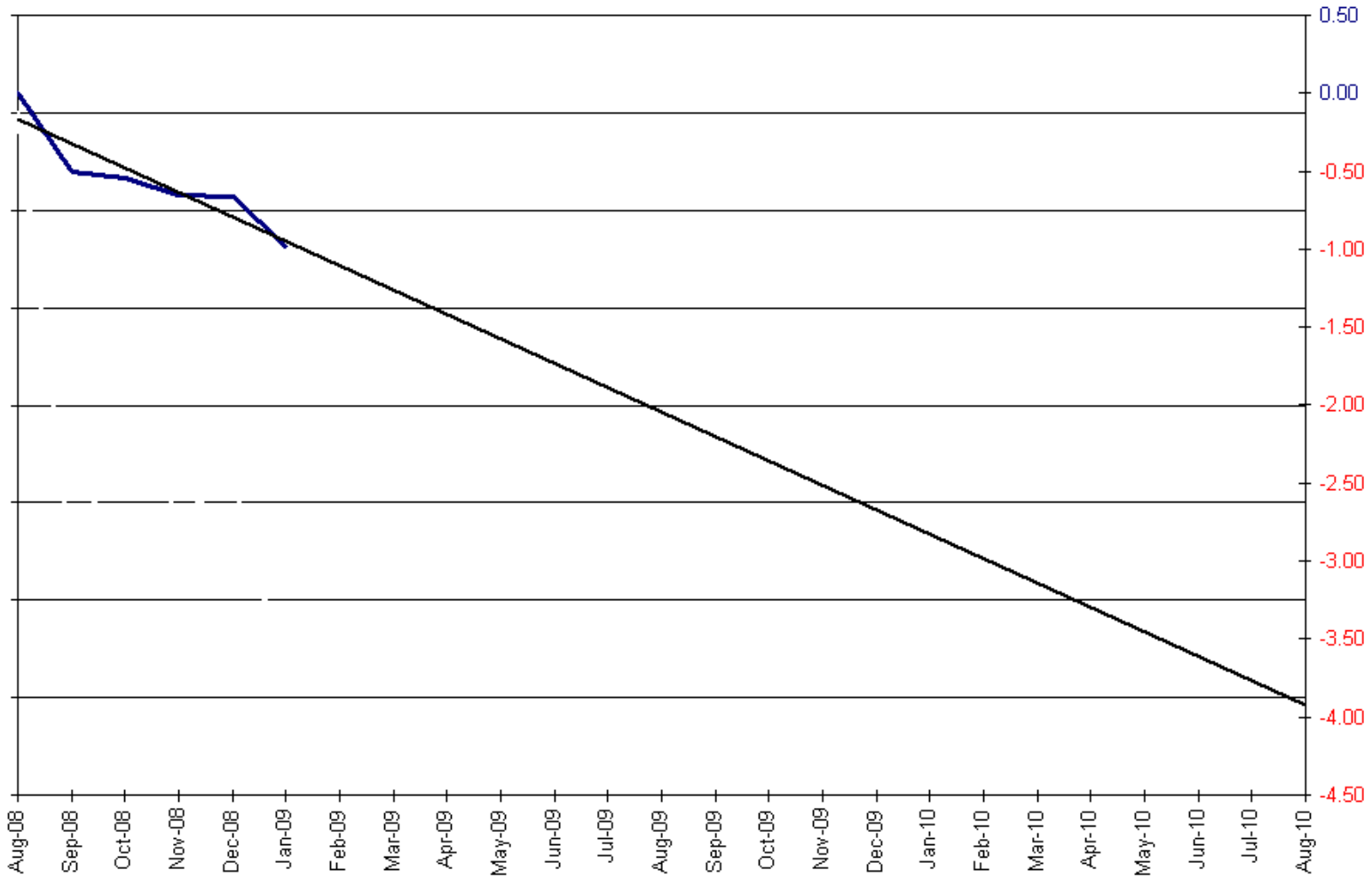
Earned Schedule – Add a Trend Line



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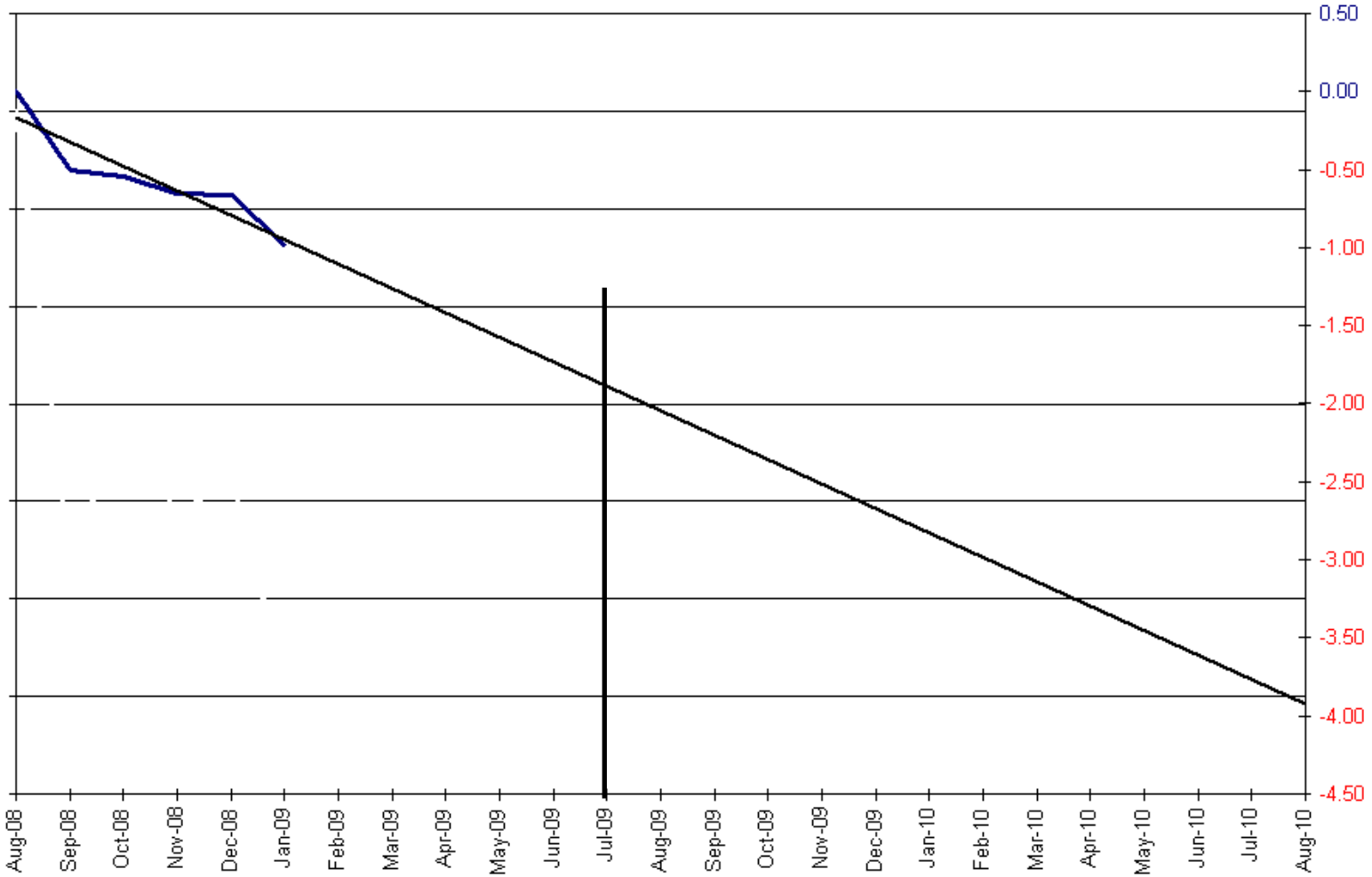
Earned Schedule – Pick a Point



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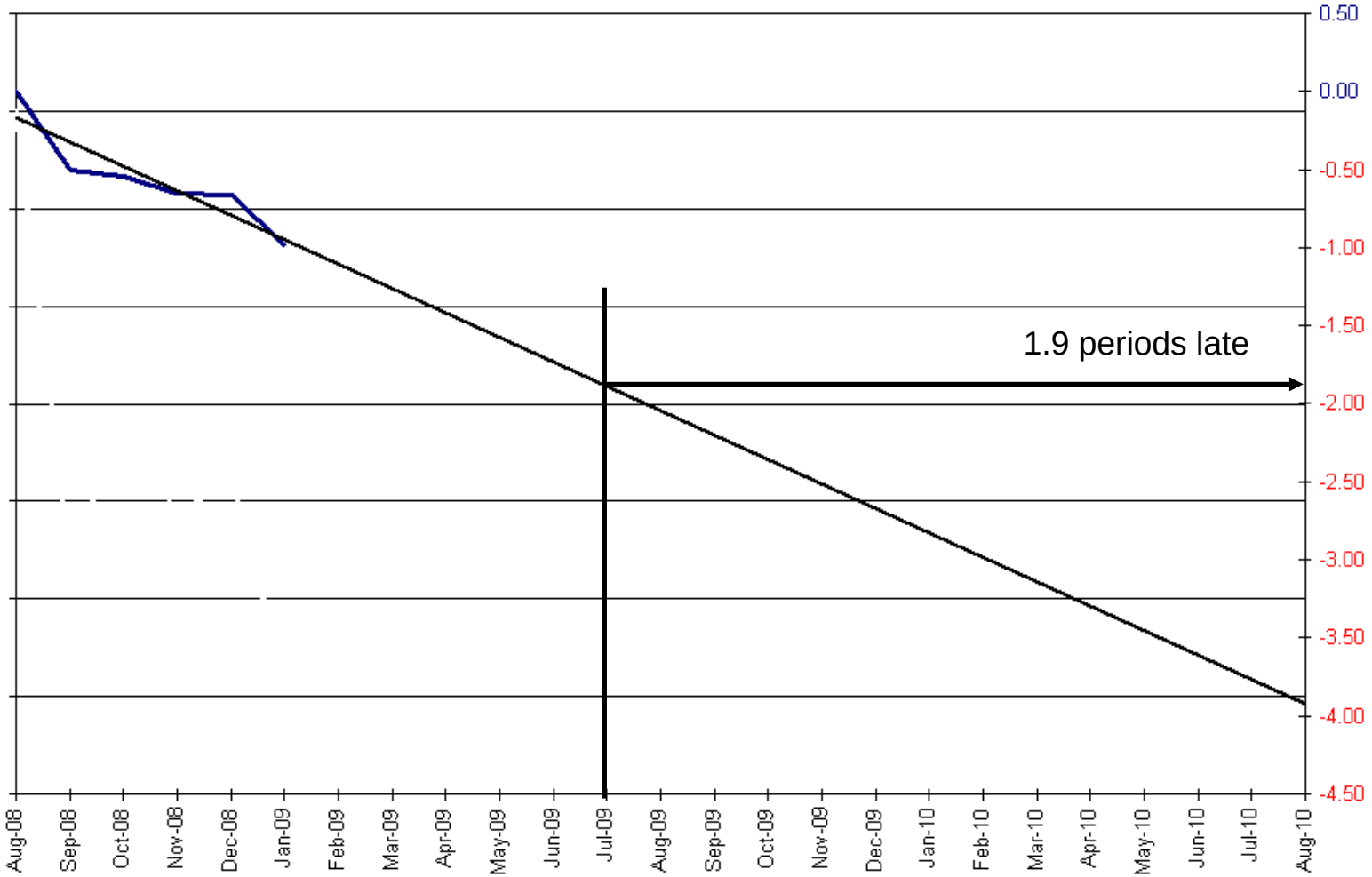

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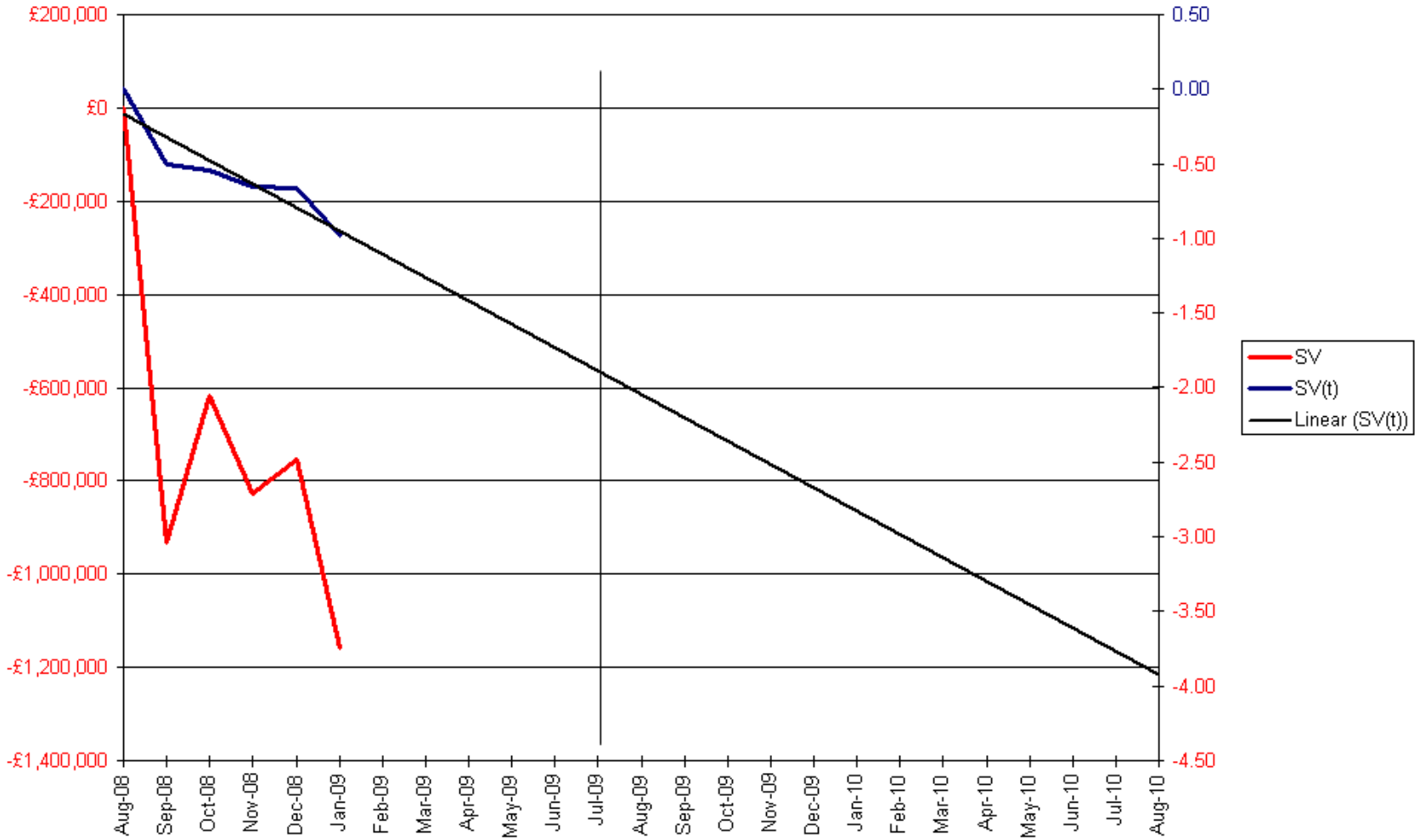
Earned Schedule – Look at SV



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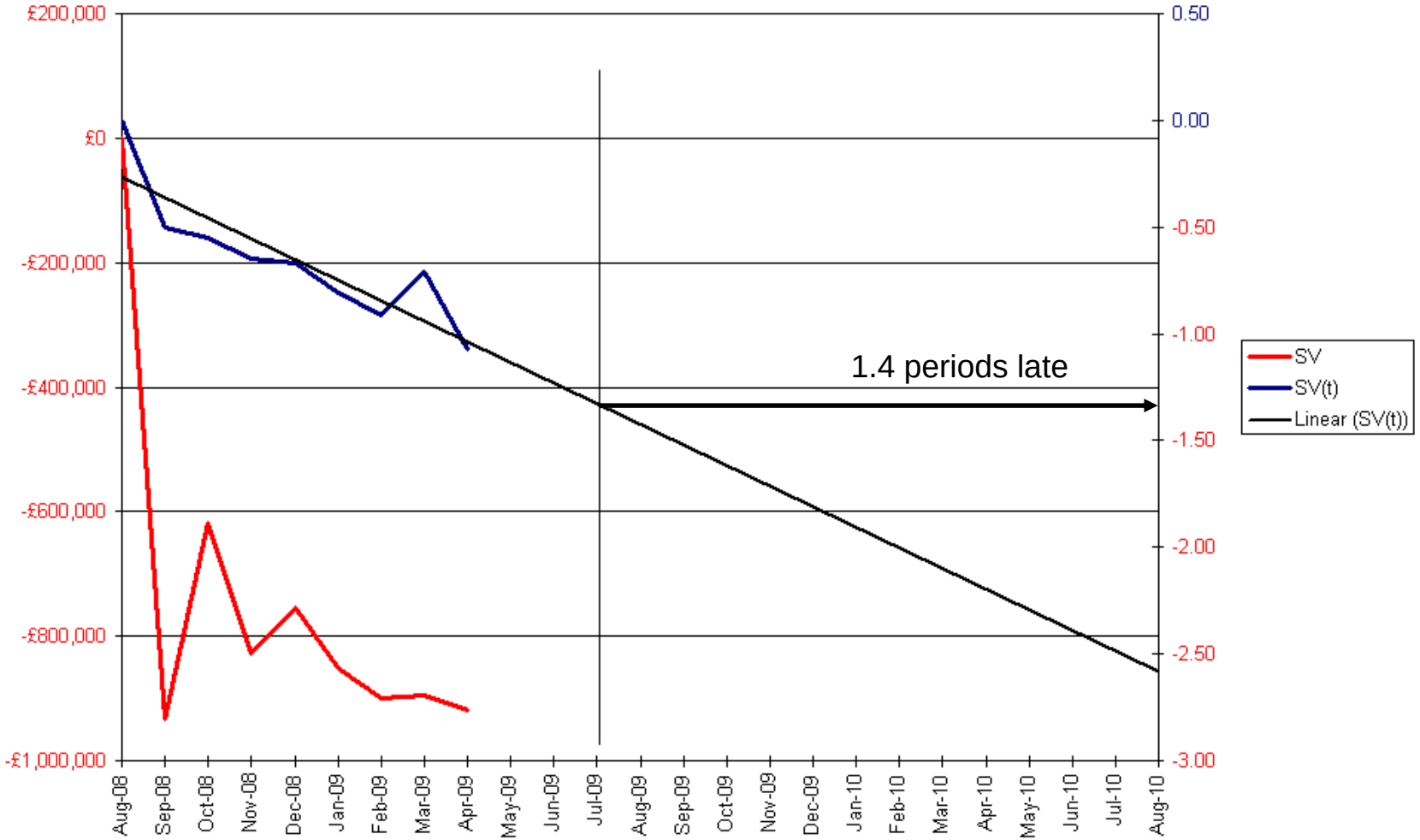
Earned Schedule – Three Months Later



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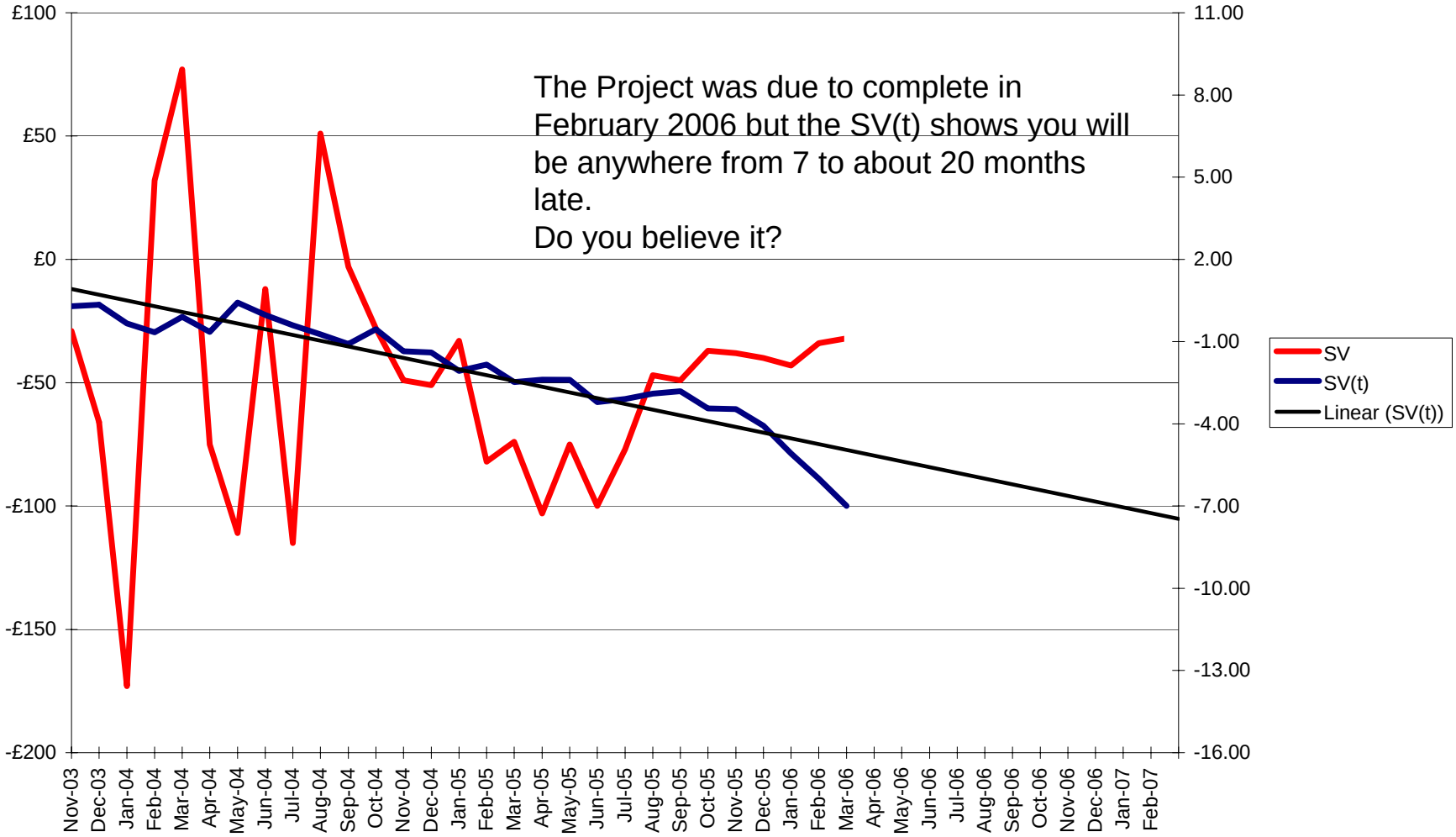
Earned Schedule – Do You Believe Yet?



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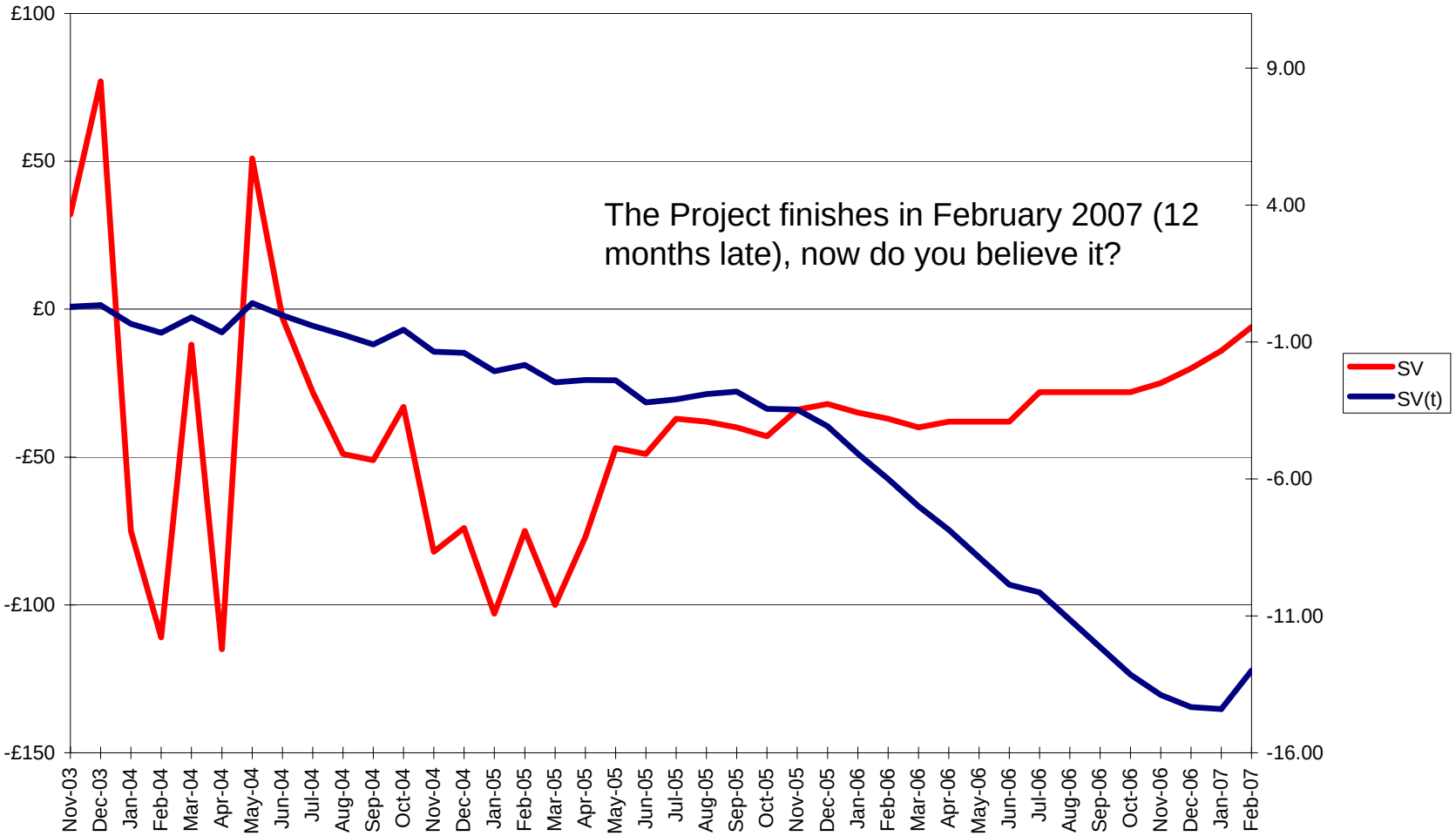
Predicts The Future



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Recap

- This has not been a master class but should be food for thought
- It’s not getting the data
- It’s getting someone to believe and do something about it….

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Questions?

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