# Tracking / Advanced

*More on the project tracking techniques*



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## Basics

If you think you took the wrong turn, go here for the basics on tracking

## Kinds of progress quantities

Generally, one will encounter three types of progress quantities that can be registered at the task level:

1. physical progress
2. cost progress - cost incurred
3. labor progress - man hours spent

All three of them can be monitored in a static way or even in a dynamic way, in which case they will produce timelines with the known S-curve shape.
They tell different stories:

1. The physical progress tells the story of the development of the project in physical terms. It tells us how much of the of the project has been realised in the real, the physical world. In our opinion, this is the only quantity that maps the physical reality. We think that the physics of any project prevail.
2. The cost "progress" tells the history of the spent cost. It is related to the physical progress, it can be correlated with it, but the image produced by the cost history cannot replace the image of the physical progress.
3. The man hours spent history tells us yet another story. It is related to the physical progress and to the cost history, but cannot replace either of them.

## The physics prevail

Any project is about creating or transforming real (physical) objects. This is done over a period of time, the project duration.
The project is finished when the physical completeness (original, augmented or reduced scope) has been achieved. Not before, not after. The project is finished , when the final real object is finished.
The only parameter that can tell us where we stand, how fast we move and what the ETA (expected time of arrival / finish)is, is the physical progress of the project and all its component processes.
You cannot define the ETA of an airliner by monitoring its fuel consumption. Its present position, speed and true course - the physical reality - will. Available fuel and fuel consumption will tell you if you will be able to reach the destination, or if you will have to refuel en route.
With the physical progress history at hand, one can estimate future developments within

acceptable error margins: see this and this

## The finance follows

The cost incurred, or financial history of the project, is always obtained through some cost registration system, typically bookkeeping, which by nature are slow systems. They generally lag behind actual dates and statuses by many weeks or even months.

From a viewpoint of feedback control (see this article) such system is useless, because of the large lags they generate.

These systems cannot be used to predict outcomes on their own. Again: the final date is determined by the physics of the project. The only environment that is capable of estimating the final date is the physical progress. This means that if a cost at completion estimate must be produced, one must follow this track:

1. produce an estimate of the end date within the physical progress history
2. use that input in the cost history to produce an estimate of total cost at completion

On it's own the cost history is incapable of producing such estimated, because it is incapable to produce an estimate of the physical finish date.

## Man hours lie

Man hours can be registered through some time registration system, time sheets, etc.
This information is mandatory, but doesn't serve the goal of making reliable statements about the physical progress or estimated of man hours spent at physical completion.

Between man hours spent and the corresponding physical progress stands the productivity.
*This factor can be the aggregation of many components, is not stable in time, it actually can vary wildly.*
A low productivity will provoke a faster man hours consumption than physical progress and vice versa.
As we generally don't know the instantaneous values of all productivity components, the history of man hours consumption on its own is also useless to compute an estimate of the physical completion date.

## Conclusion

- The physics prevail.
- The physical progress prevails.
- Only the physical progress reports can produce reliable estimates for the finish date.

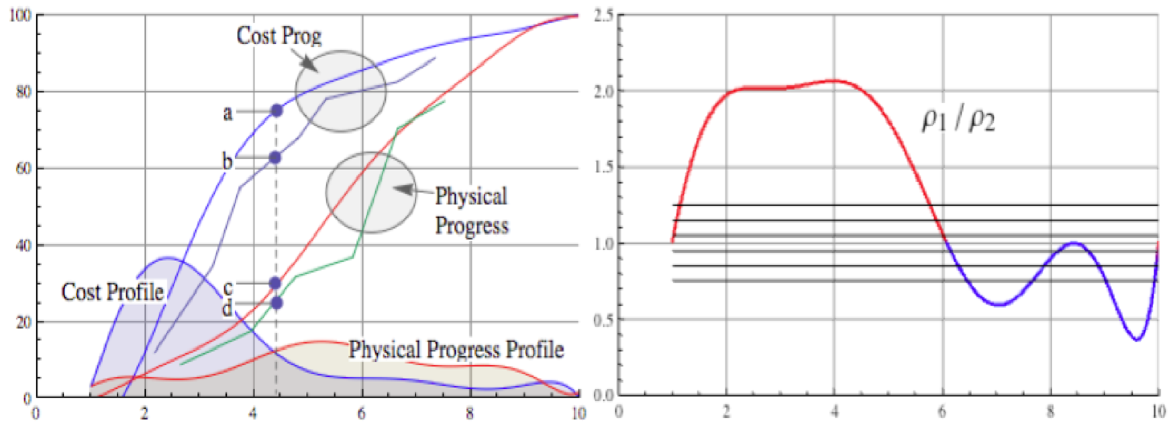
To obtain an estimate of total cost at completion:

- rebaseline the schedule to match with the finish date estimate obtained from the physical progress
- modify the cost models according to the known history (real unit costs, etc)
- run the model

# Correlating

It can sometimes be interesting to produce correlation curves, by which physical progress binds with the cost incurred.
Here are some examples

## Combining cost and physical progress(*)




The left diagram shows a set of cost and physical progress.

- a planned cost
- b cost incurred
- c scheduled physical progress
- d actual physical progres

Please notice that the cost and progress curves have very different shapes, which is often the case in the real world.
The left diagram is an aggregated diagram that shows this quantity:

$$\eta = \varrho 1 \div \varrho 2$$

where

$$\varrho 1 = b \div a,$$

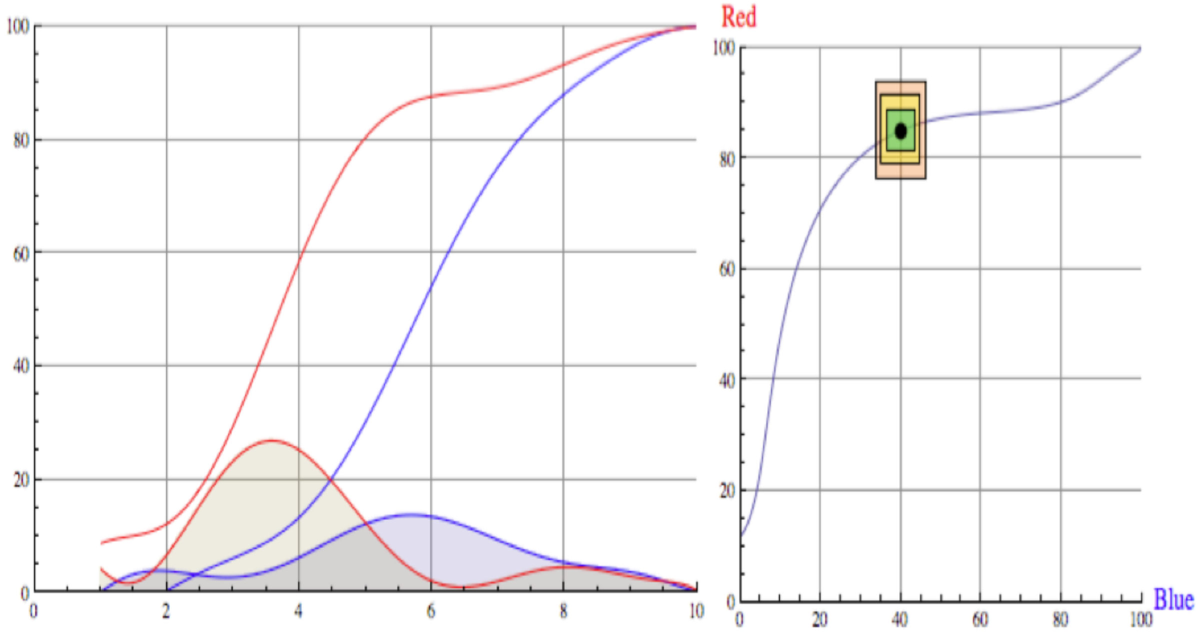
and

$$\varrho 2 = d \div c$$

In other words, we monitor the ratio of the relative cost to the relative physical progress.
The reading is simple:
$\eta > 1$:  red, cost is ahead of progress; over budget phase
$\eta = 1$: black, cost in phase with progress
$\eta < 1$: bleu; cost behind progress, under budget phase

With such devise one could easily use SPC (statistical progress control)

### Correlation curve(*)




Left we show two classical S-curves, say cost and physical progress.
The left curve is obtained by eliminating the time between both curves, effectively constructing a parametric plot, which is the correlating curve.
The game then consist in keeping the track point within a reasonable range of the curve.
When this is the case, then we know that real cost and real progress are in sync.

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(*) EVM Europe 2010

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## Further reading

Article: Tracking / Light

The next links bring you to video's showing the workflow of a fairly advanced automated system for project tracking. It also shows how detailed analysis can be performed using the dynamic information.

MS project users: go here
Smartsheet users: go here
ProjectLibre users: go here

These two links lead you to detailed demo on interactive tools for estimating physical finsih dates:
Navigation chart        Predictor

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