


## Overview

This chapter covers:

- How to make plans for small programs
- How to combine these into larger consolidated plans
$\square$ Schedule planning includes:
- Resource loading
- Resource utilization
- Earned value tracking
- ...



## 

In the PSP, the resource is your time.

## - Productivity

- Hours required / unit of work
- Each job has many unique conditions and factors which affect productivity - See "cement" example, p. 148.
- Estimate productivity by calculating the average and range from prior jobs (homework assignments)


## Estimating Task Time <br> (cf. Humphrey, 1995, p. 145)

The SW development task is a special instance of general tasks for which time estimates must be made.

- See Fig. 6.3, p. 156, and general task-estimation steps.

For SW development we prefer to base our estimates on historical data.

- We have three types of historical data which may be used:
- A: Estimated object LOC \& total actual development hours
- B: Actual object LOC \& total actual development hours
- C: Actual total new/changed LOC \& total actual development hours



# Development Time Planning Example 

Walk through example on p. 153-155
See how regression parameters are calculated and used.

## Combining Multiple Estimates

(cf. Humphrey, 1995, p. 158-163)
Assume 4 estimates: $a, b, c, d$.
■ The estimated hours and standard deviations are:

- $H_{a}, H_{b}, H_{c}, H_{d}$ and $\sigma_{a}, \sigma_{b}, \sigma_{c}, \sigma_{d}$
- When estimates are independent (e.g. come from separate databases) and unbiased (not all from same project, under same manager, etc.):
- $H_{t}=$ total hourly time $=\Sigma H_{i}$
- $\sigma_{t}=$ total standard deviation $=\operatorname{sqrt}\left(\Sigma \sigma_{i}^{2}\right)$
- $H_{\text {upper }}=H_{t}+\sigma_{t}$
- $H_{\text {lower }}=H_{t}-\sigma_{t}$


## Combining Multiple Estimates 

Must use more involved calculation for the prediction interval when estimates to be combined are not statistically independent
■ Use formulas on p. 160-162

## Multiple Regression <br> (cf. Humphrey, 1995, p. 162-166)

■ The problem:

- We don't have detailed enough data.
- e.g. We have total hours, new LOC, reused LOC, \& modified LOC, but not hours by each of these LOC categories.
$\square$ The solution:
- Multiple regression estimates the relative contributions.
- Example regression equation:
- Hours $_{t}=\beta_{o}+\beta_{1}$ New $_{k}+\beta_{2}$ Reuse $_{k}+\beta_{3}$ Modified $_{k}$


## Multiple Regression (cont.) <br> (cf. Humphrey, 1995, p. 162-168)

■ Gauss's method is used to solve the simultaneous equations (cf. p. 560-564 for an example).
■ The resulting equation is:

- Hours $=6.71+0.0784 * 650+0.0150 * 3000+0.2461^{*} 155$ = 141
- $\beta_{o}=6.71$ hours overhead
- $\beta_{1}=0.0784$ hrs to develop a new LOC (12.76 LOC / hr)
- $\beta_{2}=0.0150 \mathrm{hrs}$ to reuse a LOC (66.48 LOC / hr)
- $\beta_{3}=0.2461$ hrs to modify a LOC 4.06 LOC / hr)
- The prediction interval calculation and formulas are shown on p. 166-168.
- Caution: Use regression with care. Don't apply formula outside database limits.


## Schedule Estimating: Overview <br> (cf. Humphrey, 1995, p. 168-170)

Even with good estimates, if you make incorrect assumptions about daily / weekly available time, schedules can be seriously in error.

- Only time available for direct work can be used to set a schedule.
- Many other activities demand your time: vacation, sick, mail, committees, etc.
- Over time you should gather data on how you use your time, only then can you make good schedules.
- Planning using this "unplanned time cushion" gives you some "slack" and room for adjustment for "crunch" times in your schedule.
■ Typically only 50-75\% of time can be spent on direct work.


## Schedule Estimating: The PSP Schedule Planning Procedure <br> (cf. Humphrey, 1995, p. 170-180)

- The procedure is documented by:
- Fig 6.4: PSP Schedule Planning Diagram
- Table 6.11 \& 12: Schedule Planning Template \& Example
- Table 6.13 \& 14: Task Planning Template \& Example
- NOTE:
- This is presented in a very TOP-DOWN approach, as opposed to a BOTTOM-UP approach which is commonly used in activitybased planning (cf. MGT 882).
- Look at and talk about Fig. 6.4, p. 171
- Walk through step-by-step sequence, \& forms
- Discuss relationship of this method to project networks, activity-based planning, etc.
- Show equivalent network for Humphrey's task plan
- Demonstrate project management software.


## Earned Value: Definition

(cf. Humphrey, 1995, p. 180-182)
■ "Earned value (EV) is a way to evaluate project progress. It establishes a relative value for every task and credits that value when [the task is complete]."

- EV allows progress to be tracked on different types of activities, and even when planned sequencing is changed, or tasks are added or deleted.
■ EV = Percent based on proportion of total project.


## Earned Value (cont.)

(cf. Humphrey, 1995, p. 180-182)
■ EV is credited only when a task is completed.

- No partial credit is given.
- If tasks are large enough that intermediate tracking is desired, break them down and assign EV's to all subtasks.
■ Question: What are some examples of small and large ISD/SE tasks?
■ Set checkpoints based on total project size.
- Over 2-3 weeks, 10 checks is too much
- Humphrey:
> 1 per week, < 1 per day
2-4 per week


## EV Tracking Example <br> (cf. Humphrey, 1995, p. 182-195)

Walk through:

- Tables 6.15 \& 16 - Task \& Schedule Plans
- Tables 6.17 \& 18 - Actual
- Table 6.19 - Adjusted schedule (additional task added to original schedule)
Finished on time even with all the changes.


## EV Conclusions

(cf. Humphrey, 1995, p. 195-196)
■ Get management help for problems and alert them to changes.
$\square E V$ \& motivation

- It is hard to maintain motivation when working on activities which have no EV.
- Therefore, promptly put new activities into your plan, and
- Promptly drop activities.
- Remember, you are in charge, and the plan is there to help you.


## Estimating Accuracy

(cf. Humphrey, 1995, p. 196-204)
Estimation is difficult.

- Over- and under-estimation should balance out.
- Error\% = 100 * (Act - Est) / Est
- Note student and class results in Fig's 6.6-13 on p. 197-201.
- Over- and under-estimation
- Improvement for some
- Bad estimate after good ones.
- DON'T OVERCOMPENSATE
- Learning time depends on each person


## Estimating Accuracy (cont.) <br> (cf. Humphrey, 1995, p. 202-204)

Small estimates

- Small tasks have lots of variation.
- To improve estimation, try to understand as many causes as possible.
- Do this with consistent planning, using historical data, and planning in detail.
- Composite estimates
- Composites are more reliable
- Estimates are difficult when using evolving process data


## Estimating Accuracy (cont.)

(cf. Humphrey, 1995, p. 202-204)

- Overcompensation
- Don't estimate to "average" - you'll always be off
- Don't adjust your intuition
- Get feedback from colleagues

■ Reasonableness

- Is the estimate reasonable?
- Strange $\beta$ weights can be caused by:
- Closely-clustered historical data
- Estimating above and below the historical data range
- Including outliers


## Homework \#5



