项目进度管理 2017

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Homework Assignment 1
Network Planning Techniques

Out: Sep 22, 2018
Due: Oct 13, 2018

Learning Objective
In this homework you will create a project plan using the Critical Path Method (CPM), you will draw a project graph, estimate the early finish time (EF) of the project and identify the critical path and slack times. You will think about the impact of changes in individual task times on the critical path.

Readings
[1] (draft textbook), (Network Planning Techniques)
[2] K.F. Levy, G. L Thompson and J.D. Wiest, "The ABCs of the Critical Path Method", Harvard Business Review, #63508, Harvard Business School Publishing, 1963

Other Resources
[3] Optional: H. Kerzner, "Project Management: A Systems Approach to Planning, Scheduling and Controlling", John Wiley & Sons, 1998 – Chapter on PERT/CPM

Notes:
- This homework can be solved without the assistance of project management software, but you can use MS Project or other software if you so desire (This is not recommended because you will learn more doing it manually and it won't take longer)

- Turn in your answers with the homework rubric attached as the cover sheet.

Situation

You have recently been promoted to Project Manager at *New Millennium Aerospace (NMA) Inc*., a leading manufacturer of unmanned aerial vehicles (UAVs) for the government. Your new job is to plan and execute the development project for a UAV, to be used for surveillance purposes. A rough specification and sketch of the new vehicle is shown in Figure 1. The payload is provided by the government as modified GFE (government furnished equipment), while the engine will be supplied by a well-established commercial company (ECC) under a subcontract. The remainder of the vehicle, including integration and testing is NMA's - and therefore your - responsibility. Your task today is to create a project schedule, find the critical path and to estimate the finish time of the project. The subsequent project description is hypothetical, but will help you establish the plan.

UAV Project Description (NMA-X1)

The UAV "pusher" vehicle concept is shown in Figure 1. In a pusher aircraft, the engine is rear-mounted which can lead to higher propulsive efficiency. The vehicle can be decomposed into the following assemblies: fuselage (houses the avionics), wings, empennage, payload (a visual and an IR camera, incl. transmitter) and the engine (incl. propeller).

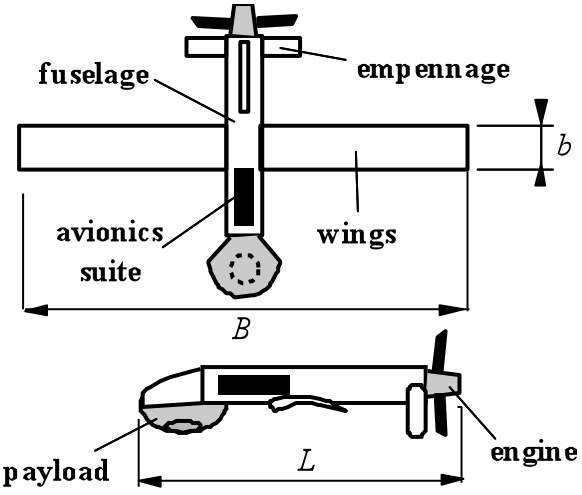

Fig 1. UAV concept, Specifications: L=2000 mm, B=3500 mm, b=500 mm

What follows is a description of the likely tasks necessary to develop the vehicle, incl. the dependencies between tasks. The task ("job") descriptions are underlined the first time they are mentioned, and the task ID and normal duration in working weeks are given in parentheses. Example: engine integration (x,17), means that there is a task called "engine integration", identified by the symbol "x", whose nominal duration is 17 work weeks.

After the project start (a,0) you first have to complete the overall requirements definition (b,10) step. Once this is accomplished you can carry out the following jobs in parallel: negotiate the engine specification (c,5) with ECC, define your payload specification (d,5), determine the vehicle layout (e,8) and write the software specification (g,12). You can initiate (GFE) avionics design (f,15) after (b,10), however the tasks (c,5) and (d,5) must also have been completed before the GFE design can be started. This is so that the avionics equipment will be able to control both the engine and payload in a synchronized fashion.

Once the engine specs (c,5) have been defined, the supplier (ECC) informs you that it will take 30 weeks for engine development (i,30) based on experience with a previous variant. Once engine development is complete, delivery and checkout (n,2) can take place at NMA's facilities. After (d,5) is done, payload development (j,15) can take place in parallel with engine development. Once the payload is developed (j,15) and the engine delivered (n,2), both the engine and payload are integrated (electrically) in the power system integration (o,10) step.

Fuselage design (k,17) and empennage/wing design (l,15) begin in parallel after the vehicle layout (e,8) has been established. Internal fittings (m,8) can be designed after these two jobs are completed. Also, structural airframe prototyping (r,10) consists of building a physical frame for the vehicle after jobs (k,17) and (l,15) are completed.

Once avionics design (f,15) has been completed, this leads to avionics delivery and checkout (p,12) and subsequent avionics/software integration (q,5). Obviously, in order for this last step to take place, software development (h,25) which depends both on (g,12) and (f,15) must have also been completed.

The project is continued by performing vehicle integration (s,10) which requires prior completion of power system integration (o,10), airframe prototyping (r,10) and avionics/software integration (q,5). After vehicle integration (s,10) and internal fitting design (m,8) have been achieved , final vehicle assembly (t,5) can begin. After final assembly, the completed vehicle is subjected to laboratory testing (u,5), followed by an outdoor flight test campaign (v,10) leading to completion of the prototype development project, finish (x,0). Note that throughout the project starting with (a,0) and ending with (x,0) project management itself (w,*) must be accomplished as a necessary task.

The asterisk * in (w,*) indicates that the duration of this task is as long as it takes to complete all the other tasks.

Notes:

- task descriptions are underlined
- (n,25) means that the task is tagged as "n" and is expected to take 25 work weeks
- tasks are hypothetical, but in a notionally meaningful sequence

Tasks: **Plan the Project**

1. Construct a task table from the NMA-X1 project description. Clearly designate each task with its tag, description and identify immediate predecessors and nominal task completion times. See [CH9, Fig. 9.4] for an example. Try to arrange the task table in "technological order" (see Levy, Thompson and Wiest (1963) for an explanation of that term).

2. Create a project graph [similar to CH9, Fig. 9.8] by hand or using a computer program.

3. What is the earliest finish (EF) for the project as a whole (in units of work weeks)? Show how you arrived at this result.

4. What is the critical path? (e.g. a-b-k-t-w). Highlight the critical path in the project graph obtained in step 2.). Explain in a few sentences what this means for you as the project manager.

5. The *start* date of the project (a,0) has been fixed as January 2, 2012. What is the earliest calendar finish date of the project, assuming that everyone (incl. suppliers) works only

Monday through Friday and that there are no holidays? The 2012-2014 calendars have been posted to the homework folder.

6. After some negotiation, the CEO of NMA has set a target date (T) of November 22, 2013 for completion of the project. Figure out, for each task, what the total slack (TS) and what the free slack (FS) is in units of weeks. Which task in your project has the largest free slack? How do you suggest to best use this free slack as a project manager?

7. Set specific target dates (e.g. December 1, 2012) for both delivery of the engine (n,2) from ECC and for delivery of the avionics package (p,12) from GFE. Why did you choose those dates? Which of the two dates is more critical for the overall project completion date and why?

8. You just successfully finished the requirements definition (b,10), engine specification (c,5) and payload specification (d,5) steps on time. It is now Friday, April 13, 2012 at 5:00 p.m. As you get ready to leave your office for happy hour and a nice weekend, the phone rings and you get a call from the engine supplier, ECC. They inform you that engine development (task i) will now take 40 working weeks instead of 30 working weeks due to the more stringent engine requirements agreed to in task c.

    - How does this impact the critical path of the project?
    - Revise the project plan with the changed information, i.e. task (i,40).
    - What is the impact on the earliest finish (EF) date of the project?
    - Does it impact the target date (T) set by the CEO? What do you report to her?
    - How does this phone call change your focus as a project manager? Explain and contrast with what you answered earlier to question 4.