

WBS (Work Breakdown Structure) creation

I have been asked to outline some ideas about how to create a WBS (Work Breakdown Structure), and can do so briefly, based on the crane building case that I talked about in my guest lecture. If any of the students have questions concerning this example, they can come to see me, email or call. They also have to beware that many different WBSs are possible, many of which will be just as good. Or bad.

I have tried to color-code the explanation. Not sure if it works, but ask me, if it seems problematic.

Scope: Let us assume that we have been asked to build a crane of the LARS (Launch and Recovery System) type that can handle subsea/sea-bottom remotely operated vehicles. They need a **heave-compensation system**, which is the technically tricky part. We need to know the ship design and its dynamic positioning system (DPS) to get it to work, and at some point, test the crane at the relevant depths to fine-tune it. Our design is based on an **A-frame plus a winch**, which are separate. For simplicity, we get the entire A-frame complete from one supplier and the winch consisting of an **engine and drum plus cabling**, from 3 separate, so we have to assemble them ourselves. It also needs a **control system** (which included engines and drives and electrical wiring). **The control system is where we are innovative and stand apart from the competition.** The crane is **installed** in the deck of a ship, with two interaction points, which are the skid (like a sled on rails) and the doors. The supplier of the steel work has agreed to assemble the crane and do the **Functional Acceptance Testing (FAT)**, but we have to do the fine-tuning and handover ourselves (**Commissioning**), which includes indexing documentation, bringing the manuals on-board and training the chief and captain.

In general I think there are two fundamentally different, and complementary, approaches to high-level planning departing from a scope statement, which is how I see this. Either a time-line oriented Gantt-diagram with milestones or a work breakdown structure (WBS) which focuses much more on the deliverables. A WBS can have milestones as well, and that is where I see these planning perspectives as intersecting, but it is usually on a lower level, i.e., inside the work packages [I base this on Pinto, J. K., "Project management. Achieving competitive advantage, 3ed"].

A WBS is deliverable-oriented, so I would start by making a list of such "outcomes". Ideally, they should be manifested and measurable. So in this case, **explicitly from the scope statement above and implicitly matching "best practice"** (for instance by adding the (mandatory) **"Closeout"**) I got the following list of Deliverables:

"Building a Crane" project Work Breakdown Structure

D1: Heave-compensation system

D2: A-frame

D3: Winch

D4: Control system

D5: Closeout

I would add to it "deliverables" connected to the less tangible outputs, which are transportation, integration, FAT (even if the supplier performs it) and Commissioning. The terms do not denote physical "things" as such, although that can be arranged with creative re-writing, such as

Commissioning = Documentation system plus Complete audit certification set plus Training diplomas etc. – I just would not bother about it since people in the business would know what it comprises. So next, then:

"Building a Crane" project Work Breakdown Structure

D1: Heave-compensation system

D2: A-frame

D3: Winch

D4: Control system

D5: Transportation

D6: Integration

D7: Functional Acceptance Test

D8: Commissioning

D5: Closeout

Next, I would **pick/deduct Work Packages from the scope statement**. WPs I see as clusters of activities = tasks that have a suitable size to be assigned to identifiable organizational units. We need to make reasonable assumptions with regards to which deliverables they support, and I think there can be more than one good answer, since they contribute, usually, to more than one (such as the fine-tuning of the crane: Is it part of Commissioning or the Heave Comp?). I would still list it only once. Then we get:

"Building a Crane" project Work Breakdown Structure

D1: Heave-compensation system

WP1.1: Transfer the general assembly and CAD-drawings of the vessel from the owner/yard.

WP1.2: Model our crane installed in vessel

WP1.3: Run simulations based on the model of crane and vessel integrated

WP1.4: Technical integration of heave-comp with DPS

D2: A-frame

WP2.1: Specify A-frame

WP2.2: Procure A-frame

WP2.3: Completion (i.e., subsystem testing)

D3: Winch

WP3.1: Engineer the drum

WP3.2: Specify engine

WP3.3: Select cabling system

WP3.4: Place and follow-up orders

WP3.5: Subassembly and completion

D4: Control system

D4.1: Engine

WP4.1.1: Specify performance requirements

WP4.1.2: Procure engine

WP4.1.3: Subsystem test

D4.2: Drives

WP4.2.1: Engineer electrical components

WP.2.2: Assemble

WP.2.3: Qualify for certification in operational area

D4.3: Electrical cabling

WP4.3.1: Draw wiring diagram

WP4.3.2: Specify dimensions and lengths

WP4.3: Integrate with main system

D5: Transportation

[...]

D6: Integration

[...]

D7: Functional Acceptance Test

[...]

D8: Commissioning

WP8.1: Fine-tune heave comp and test to parameter with margins

WP8.2 Documentation system preparation by indexing

WP8.2: Complete audit certification and QA

WP8.4: Training course in HSE routines related to control system

WP8.4.1: Design the course, modify standard templates, and check with requirements

WP8.4.2: Organize course and examination with chief and captain

MS8.4.1: Chief has passed examination

MS8.4.2: Captain has passed examination

D9: Closeout

WP9.1: Contract review

WP9.2: Collect and index all reports

WP9.3: Financial and cash flow termination

WP9.4: Human resource reallocation

WP9.5: Lessons learned and QA: Compile and adjust routines and templates

Notice that I have put the innovative/competitive elements on a more detailed level, i.e., with sub-deliverables, since they are bigger deliverables and potentially more critical.

I have tried to number everything uniquely and hierarchically. The Ds vs. WPs and 1.2.3.....n numbering is important since we can allow subdeliverables, subworkpackages (a little weird, but still possible), but (more reasonably), a new set of deliverable embedded in a (big) WP and then, consequently, new WP under that again. Milestones can also be included in a WP.

The natural next step now would be to connect this part of the plan to the Gantt-diagram (linking the milestones) or the organizational chart (in a matrix where the WPs are connected to Department, for instance) or a Responsibility Assignment Matrix, similarly, where people are linked to Deliverables. So people are responsible for deliverables. Departments are where work takes place.

You can also allocate cost and make a project budget per D or WP.

Feel free to comment or ask me questions, if you like. This was pretty quickly put together, so I cannot guarantee that it is error-free.

Good luck with your exam!

Best regards

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