

PROJECT MANAGEMENT FOR SCIENTISTS

WORK BREAKDOWN STRUCTURE

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OUTLINE

- Project Planning
- Work Breakdown Structure (WBS)
- WBS Entries
- Successful WBS Creation
- Level of Detail
- Work Package Content
- Potential Problems
- Checklist

PROJECT PLANNING

- KISS (Keep it Simple, Stupid)
- As simple as possible, in relation to project size
- 0.5 pages for BSc, MSc thesis
- Start with meeting of project team
- Create draft plan and have team agree to it
- Discuss and have sponsor agree with it
- Finalize plan
- Plan becomes *baseline* to track project against

PROJECT PLANNING ACTIVITIES

- Project Summary
- Work Breakdown Structure
- Resource Assignment
- Project Schedule
- Project Budget
- Risk Assessment
- Communications
- Change Control Process

WORK BREAKDOWN STRUCTURE

- Also known as WBS or task or activity list
- Decomposition of project into manageable units
- Understand the whole project by understanding its parts
- Family tree of all project work required to deliver the final product or service
- Used to capture and control scope of project
- Powerful project management technique

OTHER USES OF WBS

- Provides structure for other planning activities
- Framework for detailed cost estimates and control
- Guidance for schedule development and control
- Resource assignment
- Scope change control
- Variance analysis and control
- Status reporting
- Dynamic tool that can be revised and updated
- Systems engineering
- Not only for project but for any major work

WBS USES

- Detailed illustration of project scope (statement of work only provides scope at conceptual level)
- Create accurate cost and schedule estimates
- Monitor progress (each task is a measurable unit of work)
- Build project teams
 - Shows work assignments
 - Shows how work fits into whole project
 - Increase commitment by including them in WBS definition

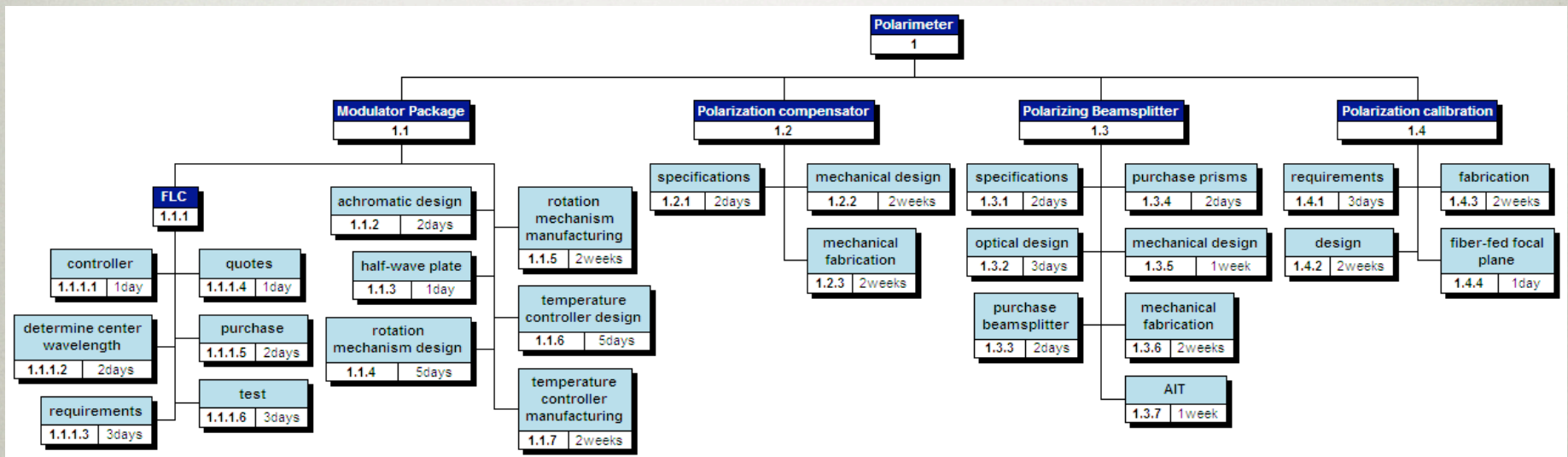
WBS ENTRIES

- *Summary tasks*
 - Include several subordinate tasks
 - By accomplishing all subordinate tasks, summary task is accomplished
 - Summary tasks are not executed
 - Summary of subordinate work packages
- *Work Packages or Terminal tasks*
 - Have no subordinate tasks
 - Are executed

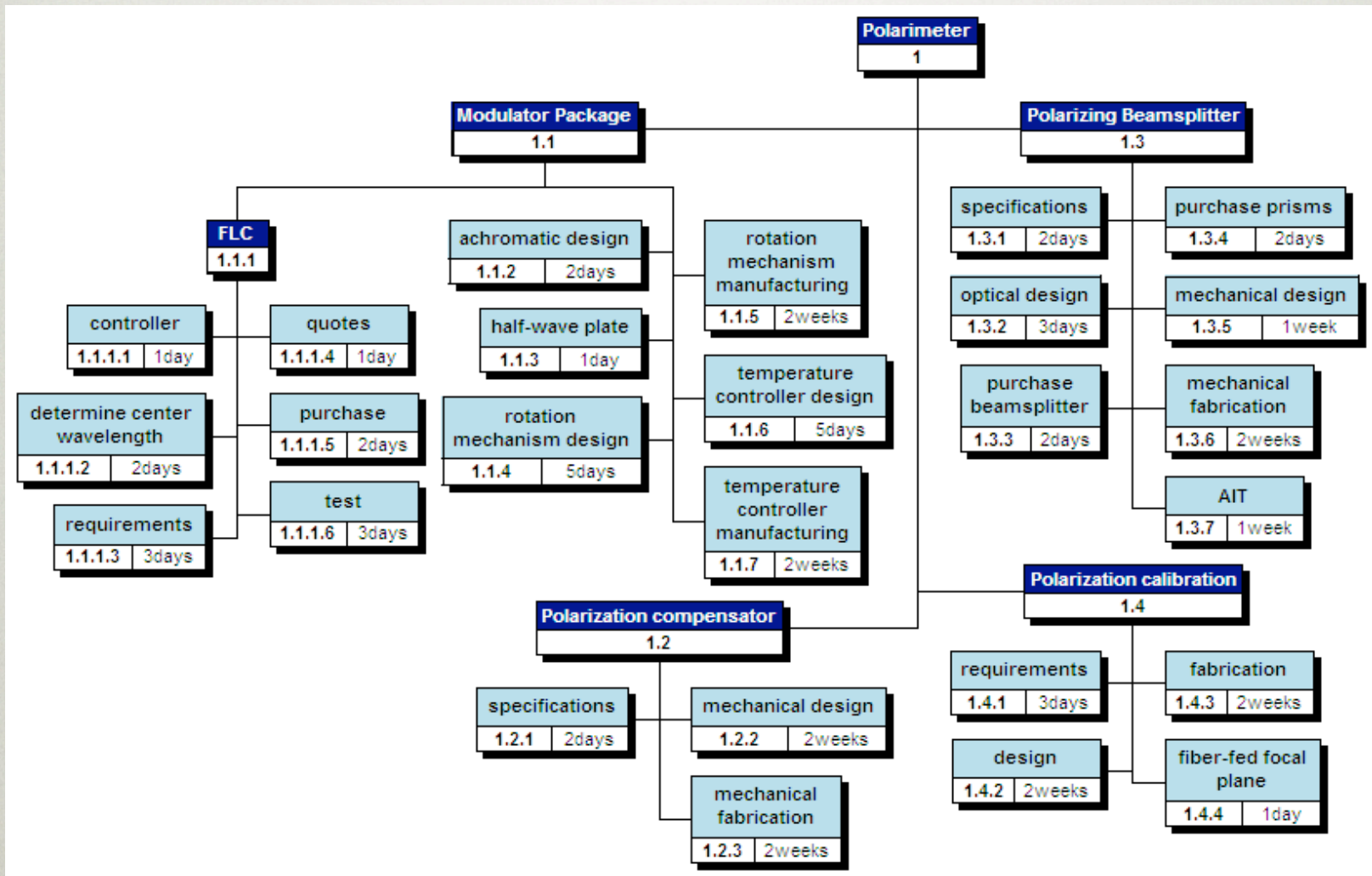
WBS AS TASK LIST

ID	WBS	Task Name	Duration
1	1	Polarimeter	87 days
2	1.1	Modulator Package	82 days
3	1.1.1	FLC	28 days
4	1.1.1.1	controller	1 day
5	1.1.1.2	determine center wavelen	2 days
6	1.1.1.3	requirements	3 days
7	1.1.1.4	quotes	1 day
8	1.1.1.5	purchase	2 days
9	1.1.1.6	test	3 days
10	1.1.2	achromatic design	2 days
11	1.1.3	half-wave plate	1 day
12	1.1.4	rotation mechanism design	5 days
13	1.1.5	rotation mechanism manufactu	2 wks
14	1.1.6	temperature controller design	5 days
15	1.1.7	temperature controller manufa	2 wks
16	1.2	Polarization compensator	79 days
17	1.2.1	specifications	2 days
18	1.2.2	mechanical design	2 wks
19	1.2.3	mechanical fabrication	2 wks
20	1.3	Polarizing Beamsplitter	76 days
21	1.3.1	specifications	2 days
22	1.3.2	optical design	3 days
23	1.3.3	purchase beamsplitter	2 days
24	1.3.4	purchase prisms	2 days
25	1.3.5	mechanical design	1 wk
26	1.3.6	mechanical fabrication	2 wks
27	1.3.7	AIT	1 wk
28	1.4	Polarization calibration	60 days
29	1.4.1	requirements	3 days
30	1.4.2	design	2 wks
31	1.4.3	fabrication	2 wks
32	1.4.4	fiber-fed focal plane	1 day

EXAMPLE WBS



EXAMPLE WBS



CREATING A GOOD WBS (1)

- Top-down approach
 - Start tier 1 with major deliverables, products, or high-level tasks from Statement of Work (SOW)
- Name all tasks to produce deliverables
 - Names have nouns and verbs (design this, produce that, ...)
 - Break down each task into more detailed tasks
 - Most difficult part of WBS as process is defined

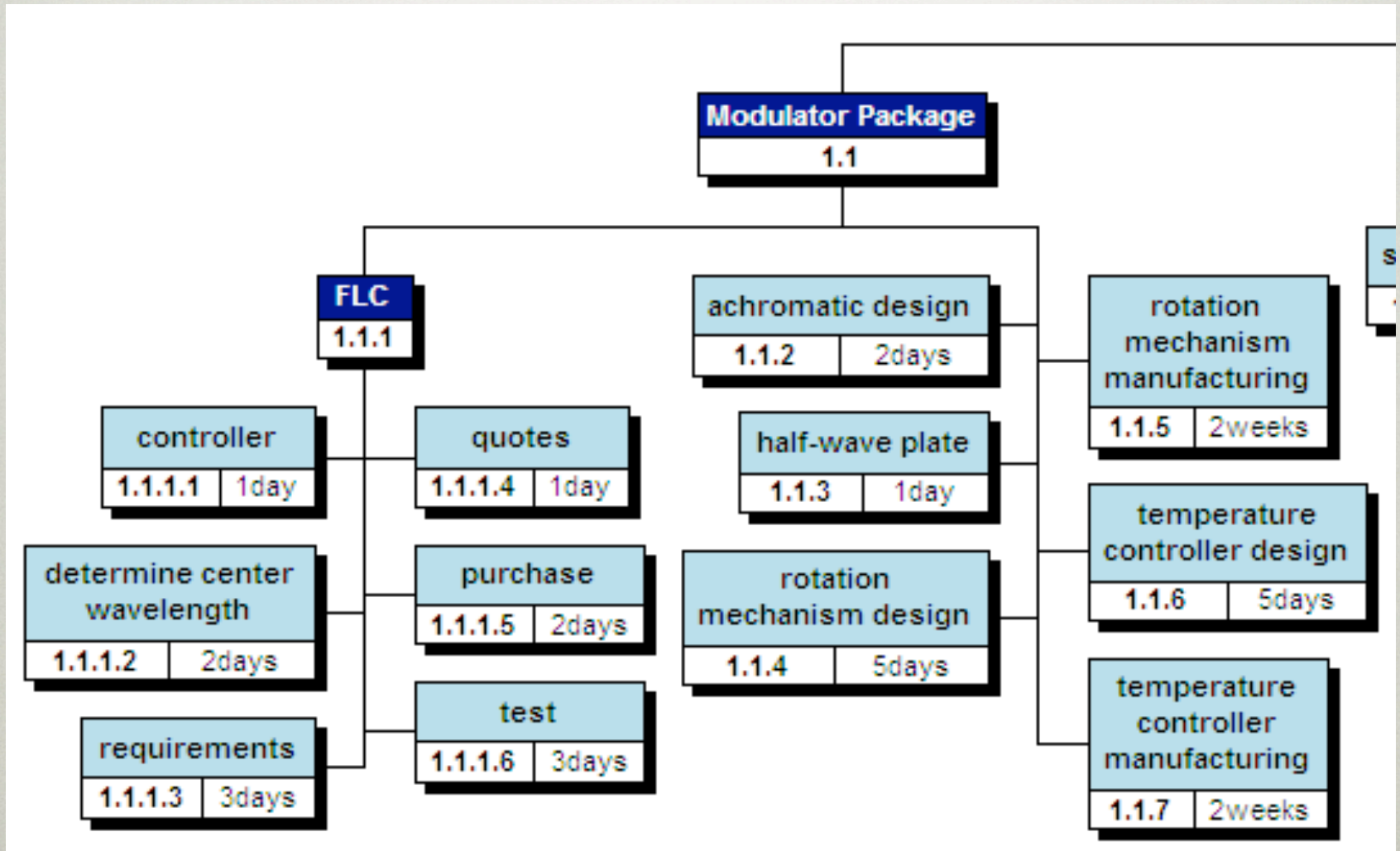
CREATING A GOOD WBS (2)

- Organize the WBS
 - Work packages can be moved under different summary tasks
 - Focus on major components vs. major project phases
 - Summary tasks are for communication or visibility
 - No summary tasks with no audience

SUCCESSFUL WBS CRITERIA

- Top-down decomposition
 - Each work package is subset of its summary task
 - Summary tasks provide meaningful project information
- Work packages must add up to summary task
 - No necessary tasks omitted
 - Subordinate tasks together must produce outcome of summary task
- Each summary task named as activity that produces a product (verb and noun)
 - No open-ended tasks
 - No nouns without verbs

EXAMPLE WBS



LEVEL OF DETAIL

- Large tasks are not manageable
- How large should the smallest WBS tasks (work packages) be?
 - ≥ 1 day
 - ≤ 2 weeks
 - \leq reporting period
- When to break tasks down further? Only if useful.
 - Task is easier to estimate
 - Task is easier to assign
 - Task is easier to track

SMALLEST DETAILS

- Can be realistically and confidently estimated
- Makes no sense to break down any further
- Produce measurable deliverable
- Forms work package that can be contracted

WORK PACKAGE INFORMATION

- Unique, hierarchical number (1, 1.1, 1.1.1, ...)
- Descriptive name
- Required Input
- Dependence on other WSB entries
- Constraints
- Deliverable(s)
- Cost and time estimates
- Resources needed / assigned
- Due date

WORK PACKAGE EXAMPLE PART 1

Work package number	04000	Start date / End date	1 / 36				
Work Package Title	Optical Design						
Activity type	RTD						
Participant nr.	4	2					
Participant short name ¹	THEMIS	KIS					
Person-months per participant ²	4 (3)	0					
Personnel costs (kEUR)	20	0					
Travel costs (kEUR)	2	2					
Equipment (kEUR)	0	0					
Subcontracts (kEUR)	0	0					
Other costs (kEUR)	0	0					
Total Direct Costs: 24,0 kEUR	22	2					

Objectives:

Coordinate and control the main optical design production process and optical design subpackages in compliance with general project methodology, providing feedback to Project system engineering and management.

WORK PACKAGE EXAMPLE PART 2

Description of work (possibly broken down into tasks), and role of participants

Required input:

- Science requirements
- Project plan
- sWP reports
- sWP deliverables

Specific Tasks:

- Organization of TST1 meetings
- Supervision of WP04000 subpackages development
- Interfacing with Project management
- Interfacing with System engineering

WORK PACKAGE EXAMPLE PART 3

Deliverables (brief description and month of delivery)

4000.1 Minutes of meetings (*periodically*)

4000.2 Input for project plan updates (periodically)

4000.3 Input for system engineering (periodically)

4000.4 WP reports (*periodically*)

4000.5 Identification of critical design points (15)

4000.6 Roadmap to the other optical design documents (15)

4000.7 Comprehensive summary of all optical designs and specifications (30)

POTENTIAL WBS PROBLEMS

- WBS is not a project plan, project schedule or chronological list
- WBS is not an organizational hierarchy
- WBS is not a logic model or a strategy map
- Project schedule was done before WBS
- WBS changes, except for working out details, require formal change control

WBS CHECKLIST

- no content overlap between two elements of WBS
- Unambiguous WBS element names
- Needs to include all project work
- Should include project management tasks
- Needs to include project closure efforts