

Guidelines for Developing Schedule Milestones

What These guidelines serve to provide guidance for creating, tracking, and reporting two types of milestones.

Why Why do we use milestones? A milestone represents a significant event in a project that occurs at a point in time. Milestones are especially of interest to managers and sponsors, since they provide a high-level snapshot of how the project is tracking against its work plan.

1 Glossary of Terms and Acronyms

CAM – Control Account Manager
CD - Critical Decision
DOE – U.S. Department of Energy
DTI – Desk Top Instruction
EVMS - Earned Value Management System
FPD – Federal Project Director
MS - Milestone
PEP - Project Execution Plan
PM – Project Manager
PMP – Project Management Plan
PO – Purchase Order
OHEP – Office of High Energy Physics
UDF – User Defined Field

2 Intent of Desk Top Instruction (DTI)

The intent of this DTI is to provide further clarification of intent and direction found in Fermi Research Alliance Earned Value Management System (EVMS) procedures. It is expected that all Project personnel are first familiar and compliant with the EVMS procedures, and then seek clarification from the DTI. Compliance with the procedures is expected; therefore, if there are conflicts between procedures and the DTI, the EVMS procedures are to be followed. Some milestone considerations may not be identified or clarified in the DTI because they are adequately addressed in the procedures.

3 General Considerations for Structuring Milestones for EVMS Compatibility

3.1 General Guidance

A manager may be tempted to overuse milestones as a motivation tool to keep the team moving along; however, don't fall into the trap of labeling every task completion as a milestone. In turn, don't adopt the other extreme approach by ignoring or not recognizing significant and relevant events as milestones, particularly at junctions of the critical path. A good compromise is to consistently designate important deliverables as milestones. For example - significant decision points, significant deliverables, important installations, accomplishment of significant tests, receipt of critical material/equipment, placement of significant POs, date of beneficial occupancy.

3.2 Milestone Dictionary

- Verify a MS dictionary entry exists for each milestone in the schedule.
- The MS Dictionary is a description of the requirements that define the completion of each milestone. (Example: 100 prototype ASICs have been tested and accepted for use.)

- The MS dictionary should contain information regarding tier level, requirements, and agreements per FPD and PM, such as original float between tiers, which MS are PEP/PMP required.
- The MS Dictionary may exist in a note field or UDF (Milestone Description, Milestone Description Continuation) in the schedule file, or a separate file may be used to track the Milestone Dictionary. It is the PM's decision to pick the preferred tool used to create and maintain the Milestone Dictionary.

Documenting MS in UDF to create Milestone Dictionary

In the Notebook tab under Notebook Topic, select Milestone Description, input a description of what has to be completed (acceptance criteria) for the milestone to achieve 100% complete. This description needs to be sufficiently detailed that people other than the person that created the milestone can understand what has to be accomplished to status the milestone as complete. (Example: 100 prototype ASICs have been tested and accepted for use.)

Example of a Milestone Dictionary utilizing UDFs

Activity ID	Activity Name	Milestone Tier	CAM	Finish	Milestone Description	Milestone Description Continuation
Milestone Tier: T0 Milestone - DOE Acquisition Executive for Critical Decision						
47501.1.001010	T0 - DOE Approval of CD-0 (PEP)	T0	09462N	11/25/09 A	Formal sign-off of CD-0 Mission Need statement by Acquisition Executive.	
47501.4.3.001110	T0 - DOE CD-4 Approval (PEP)	T0	09462N	12/29/22*	Project completion including schedule float.	
Milestone Tier: T1 Milestone - DOE Program						
47501.3.2.001027	T1 - DOE CD-3a Approval	T1	09462N	7/10/14*	Formal sign-off of CD-3a approval by Acquisition Executive to procure long-lead solenoid conductor.	
47501.4.2.001044	T1 - Key Performance Parameters Achieved (PEP 1.13)	T1	09462N	9/30/21*	Key Performance Parameters that define project completion have been achieved.	
47501.4.3.001104	T1 - DOE CD-4 Approval	T1	09462N	12/30/21*	Formal sign-off of CD-4 approval by Acquisition Executive.	
Milestone Tier: T2 Milestone - DOE Federal Project Director						
47501.2.2.001160	T2 - DOE CD-1 Approval, release of PED funding	T2	09462N	7/2/12 A	Formal sign-off of CD-1 approval by Acquisition Executive that releases PED funds to the Project.	
47501.2.2.001165	T2 - Release of PED funding by DOE	T2	09462N	7/2/12 A	Authorization to begin spending PED funds on Mu2e design activities after approval of CD-1.	
47501.3.2.001198	T2 - DOE CD-2/3a Approval	T2	09462N	3/31/15*	Formal sign-off of CD-2 approval by Acquisition Executive. Formal sign-off of CD-3 approval by acquisition Executive for the specific scope for which CD-3 was requested simultaneous with CD-2.	
47501.3.3.001103	T2 - DOE CD-3c Approval	T2	09462N	12/14/16*	Formal sign-off of CD-3c approval by acquisition Executive for the specific scope for which CD-3c (remainder of project beyond CD-3a and CD-3b approvals)	
47501.4.2.001008	T2 - Cosmic Ray System Test Complete (PEP 2.40)	T2	09462N	5/3/21*	Cosmic ray test of the Tracker, Calorimeter and Cosmic Ray Veto is completed.	
47501.4.2.001033	T2 - KPP 3 - Detector System is Ready for Commissioning (PEP 2.41)	T2	09462N	3/2/21*	Key Performance Parameter - Tracker, Calorimeter, Cosmic Ray Veto and DAG have been tested with cosmic rays in the garage position.	
47501.4.2.001043	T2 - Key Performance Parameters Achieved (PEP 2.43)	T2	09462N	5/24/21*	Key Performance Parameters that define project completion have been achieved.	
47501.4.3.001103	T2 - DOE CD-4 Approval	T2	09462N	8/11/21*	Formal sign-off of CD-4 approval by Acquisition Executive.	

3.3 Milestone Types (instructions for use is defined below):

1st type - Milestones without built in float (schedule contingency).

2nd type - Milestones which have built in float (schedule contingency) as identified in a PEP or PMP document. These are also known as Reporting Milestones.

3.4 Milestone Tier (Activity Code = Milestone Tier):

T0 Milestones – DOE Acquisition Executive for Critical Decision

T1 Milestones – DOE Program Office (OHEP Federal Program Manager)

T2 Milestones – DOE Fermi Site Office (Federal Project Director)

T3 Milestones – Fermilab Directorate (Lab line manager with oversight responsibility)

T4 Milestones – Project Manager (PM)

T5 Milestones – Sub-project Managers

T6 Milestones – Control Account Managers (CAM)

T7 Milestones - Others

4 Instructions BEFORE baseline approval:

4.1 Type 1 Milestones

- Look at the number of milestones within a given time period (e.g. year to year) to determine if there are sufficient milestones to demonstrate progress is or is not being accomplished. It is also appropriate to coordinate with the Federal Project Director (FPD) regarding the number of milestones to be included each year.
- Verify milestones add value and are logically tied.
- Activity Name should indicate the type of milestone, for example “T4 Milestone – CD3 Approval”.
- Verify the schedule captures all the milestones identified by control account managers.
- Critical Decision (CD-1, 2, 3 and 4) Milestones are to be included in the schedule.
- Ensure that there are no lags leading to or constraints on the type 1 milestones, as this is considered a type of float suppression and is not acceptable.

4.2 Type 2 Milestones

- Verify the schedule captures all the upper tier milestones (0, 1, 2, 3 ...) contained in the PEP (0-2), PMP (3 and lower), and others identified by project management.
- Milestones tier 0-3 have float built into them (schedule contingency). An example of the amount of float to be associated with each tier of milestones is reflected in the table below. However, the project and the DOE FPD may negotiate something different, which should be documented. NOTE: for CD-4 approval, the early completion date will be at Tier 4. The late date will be at Tier 0 and the schedule contingency (lag/float) will be per DOE direction (in the example below, 24 months).

Milestone Tier	Lag (reporting float)
5	0 months
4	2 months
3	3 months
2	6 months
1	1 year
0	DOE direction

If float is built in the milestones, a duplicate milestone is required.

- Create the duplicate milestone(s) (see example below)
- Add the original milestone (lowest tier) as a predecessor
- Add lag as agreed to by the stakeholders to represent reporting float. Be sure the reporting milestones do NOT drive anything. To avoid open ends in your schedule, create a lower tier milestone (such as CAM Tier 5/6) for “All Reporting Milestones Complete,” and have it finish on a date which is equal to the Tier 4 CD-4 approval date (early finish). The successor for this milestone will be the project completion date (i.e., T0 CD-4 approval late date).

Reporting Milestones are Successors with Lag to Original T5 Milestone

Activity ID	Activity Name	Relations	Lag
47501.4.3.001100	T5 - DOE CD-4 Approval		12/29/20
47501.4.3.001101	T4 - DOE CD-4 Approval	FF	40
47501.4.3.001102	T3 - DOE CD-4 Approval	FF	61
47501.4.3.001103	T2 - DOE CD-4 Approval	FF	126
47501.4.3.001104	T1 - DOE CD-4 Approval	FF	251
47501.4.3.001110	T0 - DOE CD-4 Approval	FF	502

Reporting Milestone has Successor to Avoid Open End

Activity ID	Activity Name	Finish	Total Float
47501.4.3.001101	T4 - DOE CD-4 Approval	2/26/21	462

Predecessors					Successors				
Activity ID	Activity Name	Relations	Lag	Finish	Activity ID	Activity Name	Relations	Lag	Finish
47501.4.3.001100	T5 - DOE CD-4 Approval	FF	40	12/29/20	47501.4.3.001055	T5 - Reporting Milestones Complete	FF	0	12/29/21

After the schedule is pretty well developed, it's time to tie the milestone dates from the schedule to the PEP, PMP, and other milestone type documents developed by the project.

5 Instructions AFTER baseline approval:

5.1 Baseline file:

- Remove Lag value
- Add to the activity name for any Tier 1 or Tier 2 milestones, the PEP assigned milestone number (e.g., "PEP 1.1")
- Add Primary Constraint "Finish On or Before" to the early date for CD-4 approval.
- Add Primary Constraint "Finish On or After" Date from PEP or PMP type documents for other reporting milestones.

Lag Removed and PEP Milestone # Added to Activity Name

Activity ID	Activity Name	Relations	Lag
47501.4.2.001030	T5 - KPP 3 - Detector System is Ready for Commissioning	FS	0

Constraint Assigned

Activity ID	Activity Name	Finish	Primary Constraint
47501.4.2.001005	T5 - Cosmic Ray System Test Complete	9/2/20*	Finish On
47501.4.2.001030	T5 - KPP 3 - Detector System is Ready for Commissioning	9/2/20	
47501.4.2.001031	T4 - KPP 3 - Detector System is Ready for Commissioning	11/2/20*	Finish On or After
47501.4.2.001032	T3 - KPP 3 - Detector System is Ready for Commissioning	12/2/20*	Finish On or After
47501.4.2.001033	T2 - KPP 3 - Detector System is Ready for Commissioning (PEP 2.41)	3/2/21*	Finish On or After

5.2 Working file:

- Make a copy of the P6 baseline file.
- Open the copy and find all the type 2 milestones.
- Remove the Primary Constraint from all type 2 milestones.
- Calculate the file, this will allow the milestone to move in the working schedule (the copy).
 - All milestone tiers will align on the same date (notice the variance is now equal to the lag you removed).
 - The difference between the baseline and the working schedules will be part of the monthly analysis and reporting.
- Your file is ready to progress.

Example of Primary Constraint Removed in Working Schedule Note that Variance to BL Initially Equals Lag

Activity ID	Activity Name	Finish	Variance - BL Finish
47501.4.2.001005	T5 - Cosmic Ray System Test Complete	9/2/20*	0
47501.4.2.001030	T5 - KPP 3 - Detector System is Ready for Commissioning	9/2/20	0
47501.4.2.001031	T4 - KPP 3 - Detector System is Ready for Commissioning	9/2/20	42
47501.4.2.001032	T3 - KPP 3 - Detector System is Ready for Commissioning	9/2/20	62
47501.4.2.001033	T2 - KPP 3 - Detector System is Ready for Commissioning (PEP 2.41)	9/2/20	121

6.1 Using P6 Layout to Report

This example shows the current progressed file and how it relates to the approved baseline and the prior month stauted schedule. It is in the format requested by the DOE FPD for the Mu2e Project and is filtered to activities with “PEP” in the name.

It tells us that we are losing schedule for any Tier 1 milestone with less than 252 positive days of variance (baseline was 1 year of reporting float for Tier 1 milestones). It also shows those milestones that improved (positive change) or worsened (negative change) from prior month.

WBS	Activity Name	Planned	Forecast	Variance in Working Days	Change from Prior Month	Mu2e Tier 1 and Tier 2 Milestone Status															
						FY2016	FY2017	FY2018													
						Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
Milestone Tier: T1						9/30/21	2/24/21	166	9												
475.04W.03.02.03	T1 - PO issued for TS module fabrication (PEP 1.2)	4/29/16	8/31/15	166	29																
475.07W.02	T1 - Technology choice for crystal and photosensor completed (PEP 1.3)	5/31/16	2/4/16	82	-4																
475.04W.02	T1 - PS magnet Construction authorized (PEP 1.5)	2/28/17	7/5/16	162	0																
475.04W.04	T1 - DS construction authorized (PEP 1.4)	2/28/17	7/5/16	162	0																
475.07W.02	T1 - PO issued for production crystals (PEP 1.6)	1/31/18	4/14/17	198	-44																
475.02W.09.02	T1 - Proton Target Delivered to Fermilab (PEP 1.8)	10/12/18	3/15/18	148	-22																
475.09W.03.02	T1 - Production extrusions complete (PEP 1.7)	5/31/18	3/21/18	50	-49																

6.2 Using Excel to Report

The Excel format allows you to compare the same data and make other quick comparisons. To create the spreadsheet, copy/paste data from the baseline file. Each month, the columns in blue and the Current Float column can be copy/pasted from the Working file. The Original Float, Last Month Float, and the Variance Last Month data will need to be maintained and updated in Excel. The best way to do this is via a Lookup table, sorted by Activity ID, which would be replaced with prior month data each time the Excel file was updated.

Activity ID	Activity Name	Dates			Float			Variance
		Baseline	Prior Month	Current	Original	Last Month	Current	Last Month
13001.20555	L4 Milestone - String A	5-Jul-10	30-Jun-10	20-Jul-10	20	5	-15	-20
13001.20505	L0 Milestone - CD-1 Approval	22-Aug-10	30-May-10	1-Aug-10	90	84	21	-63
13001.20465	L0 Milestone - CD-2 Approval	1-Sep-10	28-Aug-10	24-Aug-10	0	4	8	4
13001.20465R	L0 Milestone - CD-2 Approval REPORT	30-Nov-10	28-Aug-10	24-Aug-10	90	94	98	4

7 Document Revision History

Date	Version	Author	Description
08/27/2013	1.0	Dean.A.Hoffer	This is the initial release of this document.
12/09/2015	2.0	Richard Marcum	General updates to every section