Basis of Estimate and estimate of uncertainty in cost estimate

- BoE is a description of how cost estimate was obtained for each WBS element for which a cost is estimated (not roll-ups)
- Please use the information in the Risk Form checklist/recipe and example below to provide the Basis of Estimate

Peter H. Garbincius - 24april06 - revised 19february07

- RDR will include a risk analysis, which is based on the *probability distribution* for the cost estimate of each WBS element.
- If you can get this probability distribution from a vendor, a consultant, or your own engineering and procurement experience, *then we will use this information!*
- If this spread information is not available, the Risk Form checklist below can be used to estimate the spread of the distribution.
- This is similar to the methodology used for assigning the probability distribution by the XFEL for risk analysis

Basis of Estimate – the US DOE uses a standard method of assigning risk multipliers based on the status (maturity based on the BoE) of a cost estimate for a given WBS element. We propose using this simple checklist for each element, such as illustrated on the following page. When completed, the BoE entry for that WBS element can be shortened to something like example just below. As cost estimates are refined, the BoE must be updated by submitting a revised checklist for that WBS element.

example checklist below is from

RSVP experiment at Brookhaven National Lab

WBS Element #_____Element Name_____

	Risk Factor	Weight
Design Risk (check one of 4): **(from RSVP at BNL, similar for US CMS, NCSX)**		
__ Concept only	15%	1
__ Conceptual Design Phase: some drawings; many sketches	8%	1
__ Preliminary Design > 50 % complete; some analysis complete	4%	1
__ Detailed Design > 50% Done	0%	1
Technical Risk (check one of 8 and answer Yes or No to two questions):		
__ New design; well beyond current state-of-the art	15%	2 or 4
__ New design of new technology; advances state-of-the art	10%	2 or 4
__ New design; requires some R&D but does not advance the state-of-the-art	8%	2 or 4
__ New design; different from established designs or existing technology	6%	2 or 4
__ New design; nothing exotic	4%	2 or 4
__ Extensive modifications to an existing design	3%	2 or 4
__ Minor modifications to an existing design	2%	2 or 4
__ Existing design and off-the-shelf hardware	1%	2 or 4
(PHG: 19feb07) Yes/No – **If there are <u>either</u> Design <u>or</u> Manufacturing concerns, use weight = 2**		
(PHG: 19feb07) Yes/No – **If there are <u>both</u> Design <u>and</u> Manufacturing concerns, use weight = 4**		
Cost Risk (check one of 8 and answer Yes or No to two questions):		
__ Engineering judgment	15%	1 or 2
__ Top-down estimate from analogous programs	10%	1 or 2
__ In-house estimate for item with minimal experience and minimal in-house capability	8%	1 or 2
__ In-house estimate for item with minimal experience but related to existing capabilities	6%	1 or 2
__ In-house estimate based on previous similar experience	4%	1 or 2
__ Vendor quote (***or industrial study***) with some design sketches	3%	1 or 2
__ Vendor quote (***or industrial study***) with established drawings	2%	1 or 2
__ Off-the-shelf or catalog item	1%	1 or 2
(PHG: 19feb07) Yes/No – **If there are <u>either</u> Cost <u>or</u> Labor concerns, use weight = 1**		
(PHG: 19feb07) Yes/No – **If there are <u>both</u> Cost <u>and</u> Labor concerns, use weight = 2**		
Schedule Risk (check one):		
__ Delays completion of critical path subsystem item	8%	1
__ Delays completion of non-critical path subsystem item	4%	1
__ No schedule impact on any other item	2%	1

Prepared by: _____ date: _____

Comments:

Basis of Estimate – please submit this summary information (just appropriate lines from full table) with each cost element

WBS # 1.1.2.3 Build Framistat

Design Risk: Conceptual Design Phase: some drawings; many sketches

Technical Risk: New design; nothing exotic

Are there Design concerns? **No**

Are there Manufacturing Concerns? **Yes**

Cost Risk: In-house estimate for item with minimal experience, but related to existing capabilities

Are there Material Cost concerns? **No**

Are there Labor Rate concerns? **Yes**

Schedule Risk: Delays completion of non-critical path subsystem item

Prepared by: Joe Fysik date: 30 February 2006 .

Comments: (three examples)

industrial quotation from XYZ Magnetics, Inc.

QQQ-lab engineering estimate, built similar item recently

use unit cost for cryomodule developed in item 1.5

Basis of Estimate – example of how it is used to estimate risk multiplier

1.1.2.3 Build Framistat	Category	Risk Factor	Weight	RF*Weight
Design Risk: Conceptual Design Phase: some drawings; many sketches				
	Design Risk	8%	1	8%
Technical Risk: New design; nothing exotic				
Are there Design concerns?	No			
Are there Manufacturing concerns?	Yes			
Technical Design **OR** Manufacture Risk		4%	**2**	8%
Cost Risk: In-house estimate for item with minimal experience but related to existing capabilities				
Are there Material Cost concerns?	No			
Are there Labor Rate concerns?	Yes			
Material **OR** Labor Cost Risk		6%	**1**	6%
Schedule Risk: Delays completion of non-critical path subsystem item				
	Schedule Risk	4%	1	4%
	Suggested risk factor (sum) →			**26%**

Prepared by: **Joe Fysik** **date:** **30 February 2006**

Comments: (three examples)

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Another Example of BoE

http://www-ilcdcb.fnal.gov/RDR/BTEV_BOE.pdf

- From BTeV Proposal at Fermilab
- This section was to replace remaining conventional elements of the Fixed Target proton beam abort in the Tevatron with super conducing arcs and a Collins straight section
- This also includes WBS Dictionary for each element & BOE for both Materials & Labor for elements where costs are estimated