HEX Top Down Risk Assessment by WBS 04.13.18

ID	Name	Hours	Direct Cost	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Tech Fac	Tech X	Cost Fac	Cost X	Sch Fac	Sch X
7.05	HEX	99,890	$25,773,808	$31,216,997	$4,454,276						
7.05.01	HEX Management	32,771	$4,083,114	$5,523,711	$0	0	2	0	1	0	1
7.05.02	HEX Design	4,844	$430,335	$546,394	$63,284						
7.05.02.01	HEX Conceptual Design	163	$15,449	$19,028	$0	0	2	0	1	0	1
7.05.02.02	HEX Preliminary Design	921	$85,500	$105,651	$12,678	4	2	4	1	0	1
7.05.02.03	HEX Final Design	3,760	$329,387	$421,714	$50,606	4	2	4	1	0	1
7.05.03	HEX Beamline Construction	13,546	$6,266,951	$7,333,429	$706,039						
7.05.03.01	HEX Photon Delivery System Procurement and Fabrication	0	$3,337,809	$3,739,494	$336,554	3	2	3	1	0	1
7.05.03.02	HEX Photon Delivery System Installation and Test	13,066	$1,114,637	$1,551,154	$186,139	4	2	4	1	0	1
7.05.03.03	HEX End Station Procurement and Fabrication	0	$1,779,512	$1,992,342	$179,311	3	2	3	1	0	1
7.05.03.04	HEX End Station Installation and Test	480	$34,994	$50,439	$4,035	2	2	4	1	0	1
7.05.04	HEX Beamlines Infrastructure	12,871	$3,703,154	$4,458,497	$611,257						
7.05.04.01	HEX Hutches	530	$1,965,507	$2,211,472	$221,147	2	2	2	1	4	1
7.05.04.02	HEX Utilities - Mechanical	2,461	$564,617	$696,816	$111,491	2	2	4	2	4	1
7.05.04.03	HEX Utilities - Electrical	2,696	$309,730	$407,267	$65,163	2	2	4	2	4	1
7.05.04.04	HEX EPS	1,100	$154,504	$205,553	$32,888	2	2	4	2	4	1
7.05.04.05	HEX PPS	5,924	$653,212	$868,291	$173,658	2	2	4	2	8	1
7.05.04.06	HEX Beamline Furniture and Office Equipment	160	$55,586	$69,098	$6,910	1	2	4	1	4	1
7.05.05	HEX Accelerator Infrastructure	23,236	$5,152,780	$6,355,673	$2,191,831						
7.05.05.01	HEX Front End	13,951	$2,233,469	$2,864,020	$687,365	2	4	6	2	4	1
7.05.05.02	HEX Source	5,155	$2,379,430	$2,784,395	$1,447,885	8	4	8	2	4	1
7.05.05.03	HEX Straight	4,130	$539,881	$707,258	$56,581	2	2	4	1	0	1
7.05.06	HEX Controls	7,300	$1,048,631	$1,389,982	$228,342						
7.05.06.01	HEX Basic System Controls	4,940	$841,666	$1,092,744	$174,839	2	2	4	1	8	1
7.05.06.02	HEX Instrument Applications	2,360	$206,965	$297,238	$53,503	3	2	4	1	8	1
7.05.07	HEX Conventional Facilities	5,322	$5,088,841	$5,609,312	$653,524						
7.05.07.01	HEX Conventional Facilities Design	1,054	$306,865	$360,136	$57,622	2	2	4	2	4	1
7.05.07.02	HEX Conventional Facilities Construction	0	$4,112,611	$4,399,201	$527,904	0	2	4	2	4	1
7.05.07.03	HEX Conventional Facilities Commissioning	4,268	$669,365	$849,975	$67,998	0	2	4	2	0	1

Refer to Contingency Analysis Report and Assumptions Document

Appendix B - Factors and Multipliers for Risk Types - Schedule, Cost and Technical

Schedule Risk Factors and Multipliers

Schedule risk based contingency (%)			Schedule risk weight (%)
			1
Schedule Risk Factors	No schedule risk	0	0
	No schedule impact on any other item	2	2
	Delays completion of non-critical-path subsystem item	4	4
	Delays completion of critical-path subsystem item	8	8

Cost Risks Factors and Multipliers

Cost risk based contingency (%)			Cost risk weight (%)	
			Material cost OR Labor	Material cost AND Labor
			1	2
Cost Risk Factors	No cost risk	0	0	0
	Off-the-shelf or catalog item	1	1	2
	Vendor quote from established drawings	2	2	4
	Vendor quote with some design sketches	3	3	6
	In-house estimate based on previous similar experience	4	4	8
	In-house estimate with minimal experience related to existing capabilities	6	6	12
	In-house estimate with minimal experience and minimal in-house capability	8	8	16
	Top down estimate from analogous programs	10	10	20
	Engineering judgment	15	15	30

Technical Risks Factors and Multipliers

Technical risk based contingency (%)			Technical risk weight (%)	
			Design OR Manufacturing	Design AND Manufacturing
			2	**4**
Technical Risk Factors	No technical risk	**0**	0	0
	Existing design and off-the-shelf hardware	**1**	2	4
	Minor modifications to an existing design	**2**	4	8
	Extensive modifications to an existing design	**3**	6	12
	New design, nothing exotic	**4**	8	16
	New design, differs from established designs or existing technology	**6**	12	24
	New design, requires R&D, but does not advance state of the art	**8**	16	32
	New design, develops new technology, advances state of the art	**10**	20	40
	New design, way beyond the current state of the art	**15**	30	60