

ICEAA 2023 Workshop – San Antonio, Texas

WBS#	Level 1	Level 2	Level 3	Level 4	Level 5
1.0	Aircraft System				
1.1		Aircraft System, Integration, Assembly, Test and Checkout			
1.2		Air Vehicle			
1.2.1			Air Vehicle Integration, Assembly, Test and Checkout		
1.2.2			Air Frame		
1.2.2.1				Airframe Integration, Assembly, Test, and Checkout	
1.2.2.2				Fuselage	
1.2.2.3				Wing	
1.2.2.4				Empennage	
1.2.2.5				Nacelle	
1.2.2.6				Other Airframe Components 1...n (Specify)	
1.2.3			Propulsion		
1.2.4			Vehicle Subsystems		
1.2.4.1				Vehicle Subsystem Integration, Assembly, Test, and Checkout	
1.2.4.2				Flight Control Subsystem	
1.2.4.3				Auxiliary Power Subsystem	
1.2.4.4				Hydraulic Subsystem	
1.2.4.5				Electrical Subsystem	
1.2.4.6				Crew Station Subsystem	
1.2.4.7				Environmental Control Subsystem	
1.2.4.8				Fuel Subsystem	
1.2.4.9				Landing Gear	
1.2.4.10				Rotor Group	
1.2.4.11				Drive Group	
1.2.4.12				Vehicle Subsystem Software Release 1...n (Specify)	
1.2.4.13				Other Subsystems 1...n (Specify)	
1.2.5			Avionics		
1.2.5.1				Avionics Integration, Assembly, Test, and Checkout	
1.2.5.2				Communication/Identification	
1.2.5.3				Navigation/Guidance	
1.2.5.4				Mission Computer/Processing	
1.2.5.5				Fire Control	
1.2.5.6				Data Display and Controls	
1.2.5.7				Survivability	
1.2.5.8				Reconnaissance	
1.2.5.9				Electronic Warfare	
1.2.5.10				Automatic Flight Control	
1.2.5.11				Health Monitoring System	
1.2.5.12				Stores Management	
1.2.5.13				Avionics Software Release 1...n (Specify)	
1.2.5.14				Other Avionics Subsystems 1...n (Specify)	
1.2.6			Armament/Weapons Delivery		
1.2.7			Auxiliary Equipment		
1.2.8			Furnishings and Equipment		
1.2.9			Air Vehicle Software Release 1...n (Specify)		
1.2.10			Other Air Vehicle 1...n (Specify)		

Figure 5: MIL-STD 881F Aircraft System Work Breakdown Structure⁹

The burden on the cost estimator then becomes an exercise in reparameterization. Indirect and calculated data must be explored in detail. All uncertainties which are qualitative in nature, such as in the previous example, must be replaced with some adjacent quantitative measure. Otherwise, differing supporting data sets must be employed for each option. Via the application of these principles, the overall system level specifications and performance parameters can be translated to the component-level.

For a recent transatmospheric program estimate, the component-level parametric estimate was validated to < 4% of the system-level parametric approach. This comes with a tighter prediction interval and additional sensitivity to secondary cost drivers excluded by the system-level model. Galorath has also used this approach in providing credible cost estimates for hypersonics and other systems. These include Experimental Space Plane, Tactical Boost Glide, Advanced Full Range Engine, the Hypersonic Airbreathing Weapon Concept, SCIFIRE, among others.

⁹ Department of Defense Standard Practice Work Breakdown Structures for Defense Materiel Items. DoD, 21 Feb 2023. https://cade.osd.mil/Content/cade/files/coplan/MIL-STD-881F_Final.pdf

