Revision #: 12 March 17, 2009

Eng. Spec. #	Source	Specification (description)	Unit of Measure	Marginal Value	Ideal Value
		Simulation			
ES01	CN01	Computer model needs to be able to predict collisions	Boolean		TRUE
ES02	CN02	Computer model needs to be able to predict the forces acting on the arm components	Boolean		TRUE
ES03	CN03	Computer model needs to prove the design feasibility	Boolean		TRUE
		Prototype			
ES04	CN04	Wrist has same number of degrees of freedom as the human hand	degrees of freedom		2
ES05	CN04	Forearm has same number of degrees of freedom as the human hand degrees of freedom	degrees of freedom		1
ES06	CN04	Elbow has same number of degrees of freedom as the human hand	degrees of freedom		1
ES07	CN04	Hand length, wrist to fingertips	Inches	5-15	7
ES08	CN04	Bicep length	Inches	10-15	12
ES09	CN04	Forearm length	Inches	9-17	12
		Test Stand			
ES10	CN03	Large enough to contain arm motion	Inches	24	36
ES11	CN03	Withstand catastrophic air muscle failure (safety glasses standard: 1/4" steel ball shot at s	ft/sec	150	250
		Movement			
ES12	CN07	Wrist Sagittal Flexion replicates human motion (Wrist Down)	Degrees	60	80
ES13	CN07	Position Tolerance for Both the SolidWorks Model and the Prototype	Degrees	±8	±1
ES14	CN07	Wrist Sagittal Extension replicates human motion (Wrist Up)	Degrees	55	70
ES15	CN07	Position Tolerance for Both the SolidWorks Model and the Prototype	Degrees	±7	±1
ES16	CN07	Wrist Radial Deviation replicates human motion (Wrist Left)	Degrees	12	20
ES17	CN07	Position Tolerance for Both the SolidWorks Model and the Prototype	Degrees	±2	±1
ES18	CN07	Wrist Ulnar Deviation replicates human motion (Wrist Right)	Degrees	20	30
ES19	CN07	Position Tolerance for Both the SolidWorks Model and the Prototype	Degrees	±2	±1
ES20	CN07	Forearm Pronation (thumb in) resembles human motion (Rotate CCW)	Degrees	60	80
ES21	CN07	Position Tolerance for Both the SolidWorks Model and the Prototype	Degrees	±8	±1
ES22	CN07	Forearm Supination (thumb out) resembles human motion (Rotate CW)	Degrees	60	80
ES23	CN07	Position Tolerance for Both the SolidWorks Model and the Prototype	Degrees	±8	±1
ES24	CN07	Elbow Flexion resembles human motion (Elbow)	Degrees	130	150
ES25	CN07	Wrist Movement speed (median)	Degrees/Second	60	180
ES26	CN07	Forearm Movement speed (median)	Degrees/Second	90	210
ES27	CN07	Elbow Movement speed (median)	Degrees/Second	180	215
		Controls			
ES28	CN05	Control system able to control both SolidWorks and Prototype	Boolean		TRUE
ES29	CN05	Control system able to take feedback from both SolidWorks and Prototype	Boolean		TRUE
ES30	CN06	Control system operates fast enough to control prototype (USB, Relay, DAQ, and Calculat	milliseconds	100-500	<100