



This is a sample Bill of Material Template (BOM) for use in the 2015 FIRST[®] Robotics Competition Game, *RECYCLE RUSHSM*. All parts required by T11 should be entered into the BOM. The BOM helps Inspectors verify part use and legality on Robots. **This year teams do not have to report individual COTS items that are less than \$1 USD each or are Kit of Parts items.**

**2015 FIRST Robotics Competition
Bill of Materials**

Team Name: <u>TORC</u>	Team #: <u>2137</u>	Date: <u>3/2/15</u>
Event: <u>Waterford District</u>	City: <u>Oxford</u>	State: <u>Michigan</u>

Item	Description	Material	Source	Quantity	Measurement	Unit Price	Total Price
<i>Major System Names Here</i>	<i>Describe the Part (Axle, Bearing, Lifter, Solenoid)</i>	<i>What is it made from</i>	<i>Where did you buy it (Home Depot, AndyMark, Supply House, Etc.)</i>	<i>How Many</i>	<i>Piece, Inch, Etc.</i>	<i>Cost Per Unit (\$)</i>	
Subsystem 1:	Driveline						
	6" OMNI Wheel		Vexpro	4	ea	\$22.99	\$91.96
	6" OMNI Wheel		AndyMark	1	ea	\$100.00	\$100.00
	42 tooth Pulley		Vexpro	4	ea	\$4.99	\$19.96
	319 tooth Belt		Motion Industries	2	ea	\$29.98	\$59.96
	WCP Single Speed Gearbox		Vexpro	2	ea	\$74.99	\$149.98
	WCP SS 60:14 Ratio Kit		Vexpro	2	ea	\$21.98	\$43.96
	13T CIM Motor Gear Kit		Vexpro	4	ea	\$7.99	\$31.96
	CIM Motor		KOP	3	ea	\$0.00	\$0.00
	Mini-CIM Motor		KOP	2	ea	\$0.00	\$0.00
	Versahub - Hex		Vexpro	4	ea	\$8.99	\$35.96
	Bearing - 1/2" Hex		Vexpro	4	ea	\$4.99	\$19.96
	Versablock Kit		Vexpro	2	ea	\$24.99	\$49.98
	Toughbox Nano		AndyMark	1	ea	\$78.00	\$78.00
	Pneumatic Cylinder		McMaster-Carr	1	ea	\$42.54	\$42.54
	Shaft Collar - 1/2" Hex		Vexpro	7	ea	\$2.99	\$20.93
	Aluminum Shaft - 1/2" Hex		Vexpro	2	feet	\$4.00	\$8.00
	Aluminum Tubing - 1"x2"x1/8"		Metal Mart	10	feet	\$3.40	\$34.00
	Aluminum Angle - 1"x1"x1/8"		Metal Mart	1	feet	\$1.20	\$1.20
	Talon SR Motor Control		KOP	4	ea	\$0.00	\$0.00
	Talon SR Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	2	ea	\$60.13	\$120.26
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	2	ea	\$9.80	\$19.60
	FESTO Double Solenoid		FIRST CHOICE	1	ea	\$0.00	\$0.00
							\$0.00
						Subtotals:	\$987.21
Subsystem 2:	Elevator/Claw						
	Chain		Vexpro	12	feet	\$0.99	\$11.88
	Elevator Roller Kit		Competition Robot Parts	1	ea	\$80.95	\$80.95
	Chain Tensioner		Misumi	1	ea	\$16.83	\$16.83
	Mini-CIM motor		KOP	1	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	1	ea	\$39.99	\$39.99
	Ring gear Kit - 5:1		Vexpro	1	ea	\$24.99	\$24.99
	Ring gear Kit - 7:1		Vexpro	1	ea	\$24.99	\$24.99
	Aluminum Tubing - 1"x2"x1/8"		Metal Mart	20	feet	\$3.40	\$68.00
	Aluminum Angle - 1"x1"x1/8"		Metal Mart	2	feet	\$1.20	\$2.40
	Aluminum Angle - 1"x1"x1/16"		Metal Mart	2	feet	\$1.20	\$2.40
	Sprocket - 15T		Vexpro	2	ea	\$6.99	\$13.98
	Shaft Collar - 1/2" Hex		Vexpro	5	ea	\$2.99	\$14.95
	Steel Shaft - 1/2" Hex		McMaster-Carr	0.5	inches	\$5.48	\$2.74
	Bearing - 1/2" Hex		Vexpro	2	ea	\$4.99	\$9.98
	Versaplanetary CIM Adapter		Vexpro	1	ea	\$4.99	\$4.99
	Versaplanetary Bracket		Vexpro	1	ea	\$9.99	\$9.99
	Aluminum Tubing - 1"x1"x1/8"		Metal Mart	4	feet	\$2.33	\$9.32
	Bushing - 1/2"		McMaster-Carr	16	ea	\$0.71	\$11.36
	Pneumatic Cylinder		McMaster-Carr	2	ea	\$29.80	\$59.60
	Stainless Steel - 3"wide		McMaster-Carr	1	feet	\$12.27	\$12.27
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	1	ea	\$60.13	\$60.13
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	1	ea	\$9.80	\$9.80
	Talon Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
	FESTO Single Solenoid		Shaltz Automation	1	ea	\$0.00	\$0.00
	18 mm Plastic General Purpose Sensors Photoeye		Rockwell Automation	1	ea	\$55.00	\$55.00
							\$0.00
							\$0.00
						Subtotals:	\$605.54

Subsystem 3:	Roller Arm						
	Versablock Kit	Vexpro	2	ea	\$24.99	\$49.98	
	Aluminum Tubing - 1"x2"x1/8"	McMaster-Carr	3	feet	\$3.40	\$10.20	
	Bearing - 1/2" Hex	Vexpro	4	ea	\$4.99	\$19.96	
	4" Colson Wheel	Vexpro	2	ea	\$9.99	\$19.98	
	Aluminum Shaft - 1/2" Hex	Vexpro	1	feet	\$4.00	\$4.00	
	Shaft Collar - 1/2" Hex HD	Vexpro	4	ea	\$4.99	\$19.96	
	Shaft Collar - 3/8" Round	Vexpro	4	ea	\$1.99	\$7.96	
	Bushing - 3/8"	McMaster-Carr	8	ea	\$0.73	\$5.84	
	Steel Shaft - 3/8" Round	McMaster-Carr	1	feet	\$3.00	\$3.00	
	BAG Motor	KOP	2	ea	\$0.00	\$0.00	
	Versaplanetary Gearbox Kit	Vexpro	2	ea	\$39.99	\$79.98	
	Ring gear Kit - 4:1	Vexpro	2	ea	\$24.99	\$49.98	
	Ring gear Kit - 10:1	Vexpro	2	ea	\$24.99	\$49.98	
	200 Tooth Belt	Vexpro	2	ea	\$12.49	\$24.98	
	Versapulley - 18T	Vexpro	4	ea	\$9.99	\$39.96	
	Pneumatic Cylinder	McMaster-Carr	1	ea	\$40.01	\$40.01	
	Talon Motor Control	AndyMark 2014	2	ea	\$59.00	\$118.00	
	FESTO Double Solenoid	FIRST CHOICE	1	ea	\$0.00	\$0.00	
						\$0.00	
					Subtotals:	\$543.77	
Subsystem 4:	Container Grabber						
	Tape measure - 16'	Home Depot	1	ea	\$18.00	\$18.00	
	4" Tetrix Wheel	KOP	1	ea	\$0.00	\$0.00	
	Tetrix Framing Material	KOP	1	ea	\$0.00	\$0.00	
	Versaplanetary Gearbox Kit	Vexpro	1	ea	\$34.99	\$34.99	
	Ring gear Kit - 3:1	Vexpro	1	ea	\$24.99	\$24.99	
	Ring gear Kit - 10:1	Vexpro	1	ea	\$24.99	\$24.99	
	BAG Motor	KOP	1	ea	\$0.00	\$0.00	
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing	U.S Digital	1	ea	\$60.13	\$60.13	
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length	U.S Digital	1	ea	\$9.80	\$9.80	
	Talon Motor Control	AndyMark 2014	1	ea	\$59.00	\$59.00	
						\$0.00	
					Subtotals:	\$231.90	
Subsystem 5:	Pneumatics						
	VIAIR 90C Compressor	KOP	1	ea	\$0.00	\$0.00	
	Clippard Air Storage Tanks	Clippard	2	ea	\$15.40	\$30.80	
	Pressure Relief Valve	KOP	1	ea	\$0.00	\$0.00	
	Pressure Switch	KOP	1	ea	\$0.00	\$0.00	
	Pressure Regulator	KOP	1	ea	\$0.00	\$0.00	
	Pressure Gauge	KOP	1	ea	\$0.00	\$0.00	
	1/4" od Tubing - 20M	Andy Mark	2	ea	\$18.00	\$36.00	
					Subtotals:	\$66.80	
Subsystem 6:	Electrical						
	NI roboRIO	KOP	1	ea	\$0.00	\$0.00	
	Voltage Regulator Module (VRM)	KOP	1	ea	\$0.00	\$0.00	
	Pneumatic Control Module (PCM)	KOP	1	ea	\$0.00	\$0.00	
	Power Distribution Panel (PDP)	KOP	1	ea	\$0.00	\$0.00	
	Main Circuit Breaker	KOP	1	ea	\$0.00	\$0.00	
	Ethernet Cable	KOP	1	ea	\$0.00	\$0.00	
	Battery	KOP	1	ea	\$0.00	\$0.00	
	Battery Connector	KOP	2	ea	\$0.00	\$0.00	
	Xtreme N Duo Wireless Bridge/ Access Point	KOP	1	ea	\$0.00	\$0.00	
	DC/DC Power Converter 12/24V to 5V	KOP 2014	1	ea	\$0.00	\$0.00	
	40A Snap Action Breakers	KOP	8	ea	\$0.00	\$0.00	
	30A Snap Action Breakers	KOP	1	ea	\$0.00	\$0.00	
	Energy Chain Product	KOP	3	ft	\$0.00	\$0.00	
	CAN Wire	KOP	4	ft	\$0.00	\$0.00	
	Fuel Line For Encoders	3/16 id	1	ft	\$1.50	\$1.50	
	Banner Engineering T18 S2 (Bus Network)	Banner Engineering	1	ea	\$91.00	\$91.00	
	REV Robotics More Board	AndyMark	1	ea	\$30.00	\$30.00	
	Gyro Sensor	KOP	1	ea	\$0.00	\$0.00	
	Limit Switch	Automation Direct-KOP Voucher	2	ea	\$14.50	\$29.00	
	Axis Camera	AndyMark	1	ea	\$189.00	\$189.00	
						\$0.00	
						\$0.00	
					Subtotals:	\$340.50	
					Totals:	\$2,775.72	



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**2015 FIRST Robotics Competition
Bill of Materials**

Team Name: <u>TORC</u>	Team #: <u>2137</u>	Date: <u>3/2/15</u>
Event: <u>Waterford District</u>	City: <u>Oxford</u>	State: <u>Michigan</u>

Item	Description	Material	Source	Quantity	Measurement	Unit Price	Total Price
<i>Major System Names Here</i>	<i>Describe the Part (Axle, Bearing, Lifter, Solenoid)</i>	<i>What is it made from</i>	<i>Where did you buy it (Home Depot, AndyMark, Supply House, Etc.)</i>	<i>How Many</i>	<i>Piece, Inch, Etc.</i>	<i>Cost Per Unit (\$)</i>	
Subsystem 1:	Driveline						
	6" OMNI Wheel		Vexpro	4	ea	\$22.99	\$91.96
	6" OMNI Wheel		AndyMark	1	ea	\$100.00	\$100.00
	42 tooth Pulley		Vexpro	4	ea	\$4.99	\$19.96
	319 tooth Belt		Motion Industries	2	ea	\$29.98	\$59.96
	WCP Single Speed Gearbox		Vexpro	2	ea	\$74.99	\$149.98
	WCP SS 60:14 Ratio Kit		Vexpro	2	ea	\$21.98	\$43.96
	13T CIM Motor Gear Kit		Vexpro	4	ea	\$7.99	\$31.96
	CIM Motor		KOP	3	ea	\$0.00	\$0.00
	Mini-CIM Motor		KOP	2	ea	\$0.00	\$0.00
	Versahub - Hex		Vexpro	4	ea	\$8.99	\$35.96
	Bearing - 1/2" Hex		Vexpro	4	ea	\$4.99	\$19.96
	Versablock Kit		Vexpro	2	ea	\$24.99	\$49.98
	Toughbox Nano		AndyMark	1	ea	\$78.00	\$78.00
	Pneumatic Cylinder		McMaster-Carr	1	ea	\$42.54	\$42.54
	Shaft Collar - 1/2" Hex		Vexpro	7	ea	\$2.99	\$20.93
	Aluminum Shaft - 1/2" Hex		Vexpro	2	feet	\$4.00	\$8.00
	Aluminum Tubing - 1"x2"x1/8"		Metal Mart	10	feet	\$3.40	\$34.00
	Aluminum Angle - 1"x1"x1/8"		Metal Mart	1	feet	\$1.20	\$1.20
	Talon SR Motor Control		KOP	4	ea	\$0.00	\$0.00
	Talon SR Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	2	ea	\$60.13	\$120.26
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	2	ea	\$9.80	\$19.60
	FESTO Double Solenoid		FIRST CHOICE	1	ea	\$0.00	\$0.00
							\$0.00
						Subtotals:	\$987.21
Subsystem 2:	Elevator/Claw						
	Chain		Vexpro	12	feet	\$0.99	\$11.88
	Elevator Roller Kit		Competition Robot Parts	1	ea	\$80.95	\$80.95
	Chain Tensioner		Misumi	1	ea	\$16.83	\$16.83
	Mini-CIM motor		KOP	1	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	1	ea	\$39.99	\$39.99
	Ring gear Kit - 5:1		Vexpro	1	ea	\$24.99	\$24.99
	Ring gear Kit - 7:1		Vexpro	1	ea	\$24.99	\$24.99
	Aluminum Tubing - 1"x2"x1/8"		Metal Mart	20	feet	\$3.40	\$68.00
	Aluminum Angle - 1"x1"x1/8"		Metal Mart	2	feet	\$1.20	\$2.40
	Aluminum Angle - 1"x1"x1/16"		Metal Mart	2	feet	\$1.20	\$2.40
	Sprocket - 15T		Vexpro	2	ea	\$6.99	\$13.98
	Shaft Collar - 1/2" Hex		Vexpro	5	ea	\$2.99	\$14.95
	Steel Shaft - 1/2" Hex		McMaster-Carr	0.5	inches	\$5.48	\$2.74
	Bearing - 1/2" Hex		Vexpro	2	ea	\$4.99	\$9.98
	Versaplanetary CIM Adapter		Vexpro	1	ea	\$4.99	\$4.99
	Versaplanetary Bracket		Vexpro	1	ea	\$9.99	\$9.99
	Aluminum Tubing - 1"x1"x1/8"		Metal Mart	4	feet	\$2.33	\$9.32
	Bushing - 1/2"		McMaster-Carr	16	ea	\$0.71	\$11.36
	Pneumatic Cylinder		McMaster-Carr	2	ea	\$29.80	\$59.60
	Stainless Steel - 3"wide		McMaster-Carr	1	feet	\$12.27	\$12.27
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	1	ea	\$60.13	\$60.13
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	1	ea	\$9.80	\$9.80
	Talon Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
	FESTO Single Solenoid		Shaltz Automation	1	ea	\$0.00	\$0.00
	18 mm Plastic General Purpose Sensors Photoeye		Rockwell Automation	1	ea	\$55.00	\$55.00
							\$0.00
							\$0.00
						Subtotals:	\$605.54

Subsystem 3:	Roller Arm						
	Versablock Kit		Vexpro	2	ea	\$24.99	\$49.98
	Aluminum Tubing - 1"x2"x1/8"		McMaster-Carr	3	feet	\$3.40	\$10.20
	Bearing - 1/2" Hex		Vexpro	4	ea	\$4.99	\$19.96
	4" Colson Wheel		Vexpro	2	ea	\$9.99	\$19.98
	Aluminum Shaft - 1/2" Hex		Vexpro	1	feet	\$4.00	\$4.00
	Shaft Collar - 1/2" Hex HD		Vexpro	4	ea	\$4.99	\$19.96
	Shaft Collar - 3/8" Round		Vexpro	4	ea	\$1.99	\$7.96
	Bushing - 3/8"		McMaster-Carr	8	ea	\$0.73	\$5.84
	Steel Shaft - 3/8" Round		McMaster-Carr	1	feet	\$3.00	\$3.00
	BAG Motor		KOP	2	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	2	ea	\$39.99	\$79.98
	Ring gear Kit - 4:1		Vexpro	2	ea	\$24.99	\$49.98
	Ring gear Kit - 10:1		Vexpro	2	ea	\$24.99	\$49.98
	200 Tooth Belt		Vexpro	2	ea	\$12.49	\$24.98
	Versapulley - 18T		Vexpro	4	ea	\$9.99	\$39.96
	Pneumatic Cylinder		McMaster-Carr	1	ea	\$40.01	\$40.01
	Talon Motor Control		AndyMark 2014	2	ea	\$59.00	\$118.00
	FESTO Double Solenoid		FIRST CHOICE	1	ea	\$0.00	\$0.00
							\$0.00
						Subtotals:	\$543.77
Subsystem 4:	Container Grabber						
	Tape measure - 16'		Home Depot	1	ea	\$18.00	\$18.00
	4" Tetrix Wheel		KOP	1	ea	\$0.00	\$0.00
	Tetrix Framing Material		KOP	1	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	1	ea	\$34.99	\$34.99
	Ring gear Kit - 3:1		Vexpro	1	ea	\$24.99	\$24.99
	Ring gear Kit - 10:1		Vexpro	1	ea	\$24.99	\$24.99
	BAG Motor		KOP	1	ea	\$0.00	\$0.00
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	1	ea	\$60.13	\$60.13
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	1	ea	\$9.80	\$9.80
	Talon Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
							\$0.00
						Subtotals:	\$231.90
Subsystem 5:	Pneumatics						
	VIAIR 90C Compressor		KOP	1	ea	\$0.00	\$0.00
	Clippard Air Storage Tanks		Clippard	2	ea	\$15.40	\$30.80
	Pressure Relief Valve		KOP	1	ea	\$0.00	\$0.00
	Pressure Switch		KOP	1	ea	\$0.00	\$0.00
	Pressure Regulator		KOP	1	ea	\$0.00	\$0.00
	Pressure Gauge		KOP	1	ea	\$0.00	\$0.00
	1/4" od Tubing - 20M		Andy Mark	2	ea	\$18.00	\$36.00
						Subtotals:	\$66.80
Subsystem 6:	Electrical						
	NI roboRIO		KOP	1	ea	\$0.00	\$0.00
	Voltage Regulator Module (VRM)		KOP	1	ea	\$0.00	\$0.00
	Pneumatic Control Module (PCM)		KOP	1	ea	\$0.00	\$0.00
	Power Distribution Panel (PDP)		KOP	1	ea	\$0.00	\$0.00
	Main Circuit Breaker		KOP	1	ea	\$0.00	\$0.00
	Ethernet Cable		KOP	1	ea	\$0.00	\$0.00
	Battery		KOP	1	ea	\$0.00	\$0.00
	Battery Connector		KOP	2	ea	\$0.00	\$0.00
	Xtreme N Duo Wireless Bridge/ Access Point		KOP	1	ea	\$0.00	\$0.00
	DC/DC Power Converter 12/24V to 5V		KOP 2014	1	ea	\$0.00	\$0.00
	40A Snap Action Breakers		KOP	8	ea	\$0.00	\$0.00
	30A Snap Action Breakers		KOP	1	ea	\$0.00	\$0.00
	Energy Chain Product		KOP	3	ft	\$0.00	\$0.00
	CAN Wire		KOP	4	ft	\$0.00	\$0.00
	Fuel Line For Encoders		3/16 id	1	ft	\$1.50	\$1.50
	Banner Engineering T18 S2 (Bus Network)		Banner Engineering	1	ea	\$91.00	\$91.00
	REV Robotics More Board		AndyMark	1	ea	\$30.00	\$30.00
	Gyro Sensor		KOP	1	ea	\$0.00	\$0.00
	Limit Switch		Automation Direct-KOP Voucher	2	ea	\$14.50	\$29.00
	Axis Camera		AndyMark	1	ea	\$189.00	\$189.00
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Event: <u>Waterford District</u>	City: <u>Oxford</u>	State: <u>Michigan</u>

Item	Description	Material	Source	Quantity	Measurement	Unit Price	Total Price
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	Versahub - Hex		Vexpro	4	ea	\$8.99	\$35.96
	Bearing - 1/2" Hex		Vexpro	4	ea	\$4.99	\$19.96
	Versablock Kit		Vexpro	2	ea	\$24.99	\$49.98
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	Aluminum Shaft - 1/2" Hex		Vexpro	2	feet	\$4.00	\$8.00
	Aluminum Tubing - 1"x2"x1/8"		Metal Mart	10	feet	\$3.40	\$34.00
	Aluminum Angle - 1"x1"x1/8"		Metal Mart	1	feet	\$1.20	\$1.20
	Talon SR Motor Control		KOP	4	ea	\$0.00	\$0.00
	Talon SR Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	2	ea	\$60.13	\$120.26
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	2	ea	\$9.80	\$19.60
	FESTO Double Solenoid		FIRST CHOICE	1	ea	\$0.00	\$0.00
							\$0.00
						Subtotals:	\$987.21
Subsystem 2:	Elevator/Claw						
	Chain		Vexpro	12	feet	\$0.99	\$11.88
	Elevator Roller Kit		Competition Robot Parts	1	ea	\$80.95	\$80.95
	Chain Tensioner		Misumi	1	ea	\$16.83	\$16.83
	Mini-CIM motor		KOP	1	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	1	ea	\$39.99	\$39.99
	Ring gear Kit - 5:1		Vexpro	1	ea	\$24.99	\$24.99
	Ring gear Kit - 7:1		Vexpro	1	ea	\$24.99	\$24.99
	Aluminum Tubing - 1"x2"x1/8"		Metal Mart	20	feet	\$3.40	\$68.00
	Aluminum Angle - 1"x1"x1/8"		Metal Mart	2	feet	\$1.20	\$2.40
	Aluminum Angle - 1"x1"x1/16"		Metal Mart	2	feet	\$1.20	\$2.40
	Sprocket - 15T		Vexpro	2	ea	\$6.99	\$13.98
	Shaft Collar - 1/2" Hex		Vexpro	5	ea	\$2.99	\$14.95
	Steel Shaft - 1/2" Hex		McMaster-Carr	0.5	inches	\$5.48	\$2.74
	Bearing - 1/2" Hex		Vexpro	2	ea	\$4.99	\$9.98
	Versaplanetary CIM Adapter		Vexpro	1	ea	\$4.99	\$4.99
	Versaplanetary Bracket		Vexpro	1	ea	\$9.99	\$9.99
	Aluminum Tubing - 1"x1"x1/8"		Metal Mart	4	feet	\$2.33	\$9.32
	Bushing - 1/2"		McMaster-Carr	16	ea	\$0.71	\$11.36
	Pneumatic Cylinder		McMaster-Carr	2	ea	\$29.80	\$59.60
	Stainless Steel - 3"wide		McMaster-Carr	1	feet	\$12.27	\$12.27
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	1	ea	\$60.13	\$60.13
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	1	ea	\$9.80	\$9.80
	Talon Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
	FESTO Single Solenoid		Shultz Automation	1	ea	\$0.00	\$0.00
	18 mm Plastic General Purpose Sensors Photoeye		Rockwell Automation	1	ea	\$55.00	\$55.00
							\$0.00
							\$0.00
						Subtotals:	\$605.54

Subsystem 3:	Roller Arm						
	Versablock Kit		Vexpro	2	ea	\$24.99	\$49.98
	Aluminum Tubing - 1"x2"x1/8"		McMaster-Carr	3	feet	\$3.40	\$10.20
	Bearing - 1/2" Hex		Vexpro	4	ea	\$4.99	\$19.96
	4" Colson Wheel		Vexpro	2	ea	\$9.99	\$19.98
	Aluminum Shaft - 1/2" Hex		Vexpro	1	feet	\$4.00	\$4.00
	Shaft Collar - 1/2" Hex HD		Vexpro	4	ea	\$4.99	\$19.96
	Shaft Collar - 3/8" Round		Vexpro	4	ea	\$1.99	\$7.96
	Bushing - 3/8"		McMaster-Carr	8	ea	\$0.73	\$5.84
	Steel Shaft - 3/8" Round		McMaster-Carr	1	feet	\$3.00	\$3.00
	BAG Motor		KOP	2	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	2	ea	\$39.99	\$79.98
	Ring gear Kit - 4:1		Vexpro	2	ea	\$24.99	\$49.98
	Ring gear Kit - 10:1		Vexpro	2	ea	\$24.99	\$49.98
	200 Tooth Belt		Vexpro	2	ea	\$12.49	\$24.98
	Versapulley - 18T		Vexpro	4	ea	\$9.99	\$39.96
	Pneumatic Cylinder		McMaster-Carr	1	ea	\$40.01	\$40.01
	Talon Motor Control		AndyMark 2014	2	ea	\$59.00	\$118.00
	FESTO Double Solenoid		FIRST CHOICE	1	ea	\$0.00	\$0.00
							\$0.00
						Subtotals:	\$543.77
Subsystem 4:	Container Grabber						
	Tape measure - 16'		Home Depot	1	ea	\$18.00	\$18.00
	4" Tetrix Wheel		KOP	1	ea	\$0.00	\$0.00
	Tetrix Framing Material		KOP	1	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	1	ea	\$34.99	\$34.99
	Ring gear Kit - 3:1		Vexpro	1	ea	\$24.99	\$24.99
	Ring gear Kit - 10:1		Vexpro	1	ea	\$24.99	\$24.99
	BAG Motor		KOP	1	ea	\$0.00	\$0.00
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	1	ea	\$60.13	\$60.13
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	1	ea	\$9.80	\$9.80
	Talon Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
							\$0.00
						Subtotals:	\$231.90
Subsystem 5:	Pneumatics						
	VIAIR 90C Compressor		KOP	1	ea	\$0.00	\$0.00
	Clippard Air Storage Tanks		Clippard	2	ea	\$15.40	\$30.80
	Pressure Relief Valve		KOP	1	ea	\$0.00	\$0.00
	Pressure Switch		KOP	1	ea	\$0.00	\$0.00
	Pressure Regulator		KOP	1	ea	\$0.00	\$0.00
	Pressure Gauge		KOP	1	ea	\$0.00	\$0.00
	1/4" od Tubing - 20M		Andy Mark	2	ea	\$18.00	\$36.00
						Subtotals:	\$66.80
Subsystem 6:	Electrical						
	NI roboRIO		KOP	1	ea	\$0.00	\$0.00
	Voltage Regulator Module (VRM)		KOP	1	ea	\$0.00	\$0.00
	Pneumatic Control Module (PCM)		KOP	1	ea	\$0.00	\$0.00
	Power Distribution Panel (PDP)		KOP	1	ea	\$0.00	\$0.00
	Main Circuit Breaker		KOP	1	ea	\$0.00	\$0.00
	Ethernet Cable		KOP	1	ea	\$0.00	\$0.00
	Battery		KOP	1	ea	\$0.00	\$0.00
	Battery Connector		KOP	2	ea	\$0.00	\$0.00
	Xtreme N Duo Wireless Bridge/ Access Point		KOP	1	ea	\$0.00	\$0.00
	DC/DC Power Converter 12/24V to 5V		KOP 2014	1	ea	\$0.00	\$0.00
	40A Snap Action Breakers		KOP	8	ea	\$0.00	\$0.00
	30A Snap Action Breakers		KOP	1	ea	\$0.00	\$0.00
	Energy Chain Product		KOP	3	ft	\$0.00	\$0.00
	CAN Wire		KOP	4	ft	\$0.00	\$0.00
	Fuel Line For Encoders		3/16 id	1	ft	\$1.50	\$1.50
	Banner Engineering T18 S2 (Bus Network)		Banner Engineering	1	ea	\$91.00	\$91.00
	REV Robotics More Board		AndyMark	1	ea	\$30.00	\$30.00
	Gyro Sensor		KOP	1	ea	\$0.00	\$0.00
	Limit Switch		Automation Direct-KOP Voucher	2	ea	\$14.50	\$29.00
	Axis Camera		AndyMark	1	ea	\$189.00	\$189.00
							\$0.00
							\$0.00
						Subtotals:	\$340.50
						Totals:	\$2,775.72



This is a sample Bill of Material Template (BOM) for use in the 2015 FIRST[®] Robotics Competition Game, *RECYCLE RUSHSM*. All parts required by T11 should be entered into the BOM. The BOM helps Inspectors verify part use and legality on Robots. **This year teams do not have to report individual COTS items that are less than \$1 USD each or are Kit of Parts items.**

**2015 FIRST Robotics Competition
Bill of Materials**

Team Name: <u>TORC</u>	Team #: <u>2137</u>	Date: <u>3/2/15</u>
Event: <u>Waterford District</u>	City: <u>Oxford</u>	State: <u>Michigan</u>

Item	Description	Material	Source	Quantity	Measurement	Unit Price	Total Price
<i>Major System Names Here</i>	<i>Describe the Part (Axle, Bearing, Lifter, Solenoid)</i>	<i>What is it made from</i>	<i>Where did you buy it (Home Depot, AndyMark, Supply House, Etc.)</i>	<i>How Many</i>	<i>Piece, Inch, Etc.</i>	<i>Cost Per Unit (\$)</i>	
Subsystem 1:	Driveline						
	6" OMNI Wheel		Vexpro	4	ea	\$22.99	\$91.96
	6" OMNI Wheel		AndyMark	1	ea	\$100.00	\$100.00
	42 tooth Pulley		Vexpro	4	ea	\$4.99	\$19.96
	319 tooth Belt		Motion Industries	2	ea	\$29.98	\$59.96
	WCP Single Speed Gearbox		Vexpro	2	ea	\$74.99	\$149.98
	WCP SS 60:14 Ratio Kit		Vexpro	2	ea	\$21.98	\$43.96
	13T CIM Motor Gear Kit		Vexpro	4	ea	\$7.99	\$31.96
	CIM Motor		KOP	3	ea	\$0.00	\$0.00
	Mini-CIM Motor		KOP	2	ea	\$0.00	\$0.00
	Versahub - Hex		Vexpro	4	ea	\$8.99	\$35.96
	Bearing - 1/2" Hex		Vexpro	4	ea	\$4.99	\$19.96
	Versablock Kit		Vexpro	2	ea	\$24.99	\$49.98
	Toughbox Nano		AndyMark	1	ea	\$78.00	\$78.00
	Pneumatic Cylinder		McMaster-Carr	1	ea	\$42.54	\$42.54
	Shaft Collar - 1/2" Hex		Vexpro	7	ea	\$2.99	\$20.93
	Aluminum Shaft - 1/2" Hex		Vexpro	2	feet	\$4.00	\$8.00
	Aluminum Tubing - 1"x2"x1/8"		Metal Mart	10	feet	\$3.40	\$34.00
	Aluminum Angle - 1"x1"x1/8"		Metal Mart	1	feet	\$1.20	\$1.20
	Talon SR Motor Control		KOP	4	ea	\$0.00	\$0.00
	Talon SR Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	2	ea	\$60.13	\$120.26
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	2	ea	\$9.80	\$19.60
	FESTO Double Solenoid		FIRST CHOICE	1	ea	\$0.00	\$0.00
							\$0.00
						Subtotals:	\$987.21
Subsystem 2:	Elevator/Claw						
	Chain		Vexpro	12	feet	\$0.99	\$11.88
	Elevator Roller Kit		Competition Robot Parts	1	ea	\$80.95	\$80.95
	Chain Tensioner		Misumi	1	ea	\$16.83	\$16.83
	Mini-CIM motor		KOP	1	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	1	ea	\$39.99	\$39.99
	Ring gear Kit - 5:1		Vexpro	1	ea	\$24.99	\$24.99
	Ring gear Kit - 7:1		Vexpro	1	ea	\$24.99	\$24.99
	Aluminum Tubing - 1"x2"x1/8"		Metal Mart	20	feet	\$3.40	\$68.00
	Aluminum Angle - 1"x1"x1/8"		Metal Mart	2	feet	\$1.20	\$2.40
	Aluminum Angle - 1"x1"x1/16"		Metal Mart	2	feet	\$1.20	\$2.40
	Sprocket - 15T		Vexpro	2	ea	\$6.99	\$13.98
	Shaft Collar - 1/2" Hex		Vexpro	5	ea	\$2.99	\$14.95
	Steel Shaft - 1/2" Hex		McMaster-Carr	0.5	inches	\$5.48	\$2.74
	Bearing - 1/2" Hex		Vexpro	2	ea	\$4.99	\$9.98
	Versaplanetary CIM Adapter		Vexpro	1	ea	\$4.99	\$4.99
	Versaplanetary Bracket		Vexpro	1	ea	\$9.99	\$9.99
	Aluminum Tubing - 1"x1"x1/8"		Metal Mart	4	feet	\$2.33	\$9.32
	Bushing - 1/2"		McMaster-Carr	16	ea	\$0.71	\$11.36
	Pneumatic Cylinder		McMaster-Carr	2	ea	\$29.80	\$59.60
	Stainless Steel - 3"wide		McMaster-Carr	1	feet	\$12.27	\$12.27
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	1	ea	\$60.13	\$60.13
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	1	ea	\$9.80	\$9.80
	Talon Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
	FESTO Single Solenoid		Shultz Automation	1	ea	\$0.00	\$0.00
	18 mm Plastic General Purpose Sensors Photoeye		Rockwell Automation	1	ea	\$55.00	\$55.00
							\$0.00
							\$0.00
						Subtotals:	\$605.54

Subsystem 3:	Roller Arm						
	Versablock Kit		Vexpro	2	ea	\$24.99	\$49.98
	Aluminum Tubing - 1"x2"x1/8"		McMaster-Carr	3	feet	\$3.40	\$10.20
	Bearing - 1/2" Hex		Vexpro	4	ea	\$4.99	\$19.96
	4" Colson Wheel		Vexpro	2	ea	\$9.99	\$19.98
	Aluminum Shaft - 1/2" Hex		Vexpro	1	feet	\$4.00	\$4.00
	Shaft Collar - 1/2" Hex HD		Vexpro	4	ea	\$4.99	\$19.96
	Shaft Collar - 3/8" Round		Vexpro	4	ea	\$1.99	\$7.96
	Bushing - 3/8"		McMaster-Carr	8	ea	\$0.73	\$5.84
	Steel Shaft - 3/8" Round		McMaster-Carr	1	feet	\$3.00	\$3.00
	BAG Motor		KOP	2	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	2	ea	\$39.99	\$79.98
	Ring gear Kit - 4:1		Vexpro	2	ea	\$24.99	\$49.98
	Ring gear Kit - 10:1		Vexpro	2	ea	\$24.99	\$49.98
	200 Tooth Belt		Vexpro	2	ea	\$12.49	\$24.98
	Versapulley - 18T		Vexpro	4	ea	\$9.99	\$39.96
	Pneumatic Cylinder		McMaster-Carr	1	ea	\$40.01	\$40.01
	Talon Motor Control		AndyMark 2014	2	ea	\$59.00	\$118.00
	FESTO Double Solenoid		FIRST CHOICE	1	ea	\$0.00	\$0.00
							\$0.00
						Subtotals:	\$543.77
Subsystem 4:	Container Grabber						
	Tape measure - 16'		Home Depot	1	ea	\$18.00	\$18.00
	4" Tetrix Wheel		KOP	1	ea	\$0.00	\$0.00
	Tetrix Framing Material		KOP	1	ea	\$0.00	\$0.00
	Versaplanetary Gearbox Kit		Vexpro	1	ea	\$34.99	\$34.99
	Ring gear Kit - 3:1		Vexpro	1	ea	\$24.99	\$24.99
	Ring gear Kit - 10:1		Vexpro	1	ea	\$24.99	\$24.99
	BAG Motor		KOP	1	ea	\$0.00	\$0.00
	S4 Shaft Encoder, 120 CPR, 1/4" Dia Shaft, Single-Ended, Ball Bearing		U.S Digital	1	ea	\$60.13	\$60.13
	Cable Assembly, Shielded cable, MIC4 Connector to No Connector, 4 ft length		U.S Digital	1	ea	\$9.80	\$9.80
	Talon Motor Control		AndyMark 2014	1	ea	\$59.00	\$59.00
							\$0.00
						Subtotals:	\$231.90
Subsystem 5:	Pneumatics						
	VIAIR 90C Compressor		KOP	1	ea	\$0.00	\$0.00
	Clippard Air Storage Tanks		Clippard	2	ea	\$15.40	\$30.80
	Pressure Relief Valve		KOP	1	ea	\$0.00	\$0.00
	Pressure Switch		KOP	1	ea	\$0.00	\$0.00
	Pressure Regulator		KOP	1	ea	\$0.00	\$0.00
	Pressure Gauge		KOP	1	ea	\$0.00	\$0.00
	1/4" od Tubing - 20M		Andy Mark	2	ea	\$18.00	\$36.00
						Subtotals:	\$66.80
Subsystem 6:	Electrical						
	NI roboRIO		KOP	1	ea	\$0.00	\$0.00
	Voltage Regulator Module (VRM)		KOP	1	ea	\$0.00	\$0.00
	Pneumatic Control Module (PCM)		KOP	1	ea	\$0.00	\$0.00
	Power Distribution Panel (PDP)		KOP	1	ea	\$0.00	\$0.00
	Main Circuit Breaker		KOP	1	ea	\$0.00	\$0.00
	Ethernet Cable		KOP	1	ea	\$0.00	\$0.00
	Battery		KOP	1	ea	\$0.00	\$0.00
	Battery Connector		KOP	2	ea	\$0.00	\$0.00
	Xtreme N Duo Wireless Bridge/ Access Point		KOP	1	ea	\$0.00	\$0.00
	DC/DC Power Converter 12/24V to 5V		KOP 2014	1	ea	\$0.00	\$0.00
	40A Snap Action Breakers		KOP	8	ea	\$0.00	\$0.00
	30A Snap Action Breakers		KOP	1	ea	\$0.00	\$0.00
	Energy Chain Product		KOP	3	ft	\$0.00	\$0.00
	CAN Wire		KOP	4	ft	\$0.00	\$0.00
	Fuel Line For Encoders		3/16 id	1	ft	\$1.50	\$1.50
	Banner Engineering T18 S2 (Bus Network)		Banner Engineering	1	ea	\$91.00	\$91.00
	REV Robotics More Board		AndyMark	1	ea	\$30.00	\$30.00
	Gyro Sensor		KOP	1	ea	\$0.00	\$0.00
	Limit Switch		Automation Direct-KOP Voucher	2	ea	\$14.50	\$29.00
	Axis Camera		AndyMark	1	ea	\$189.00	\$189.00
							\$0.00
							\$0.00
						Subtotals:	\$340.50
						Totals:	\$2,775.72