Senior Design Project Data Sheet

Project #	Project Name	Project Track	Project Family
13226	Power Steering Test Stand	None	FSAE Autosports Family
Start Term	**Team Guide**	**Project Sponsor**	**Doc. Revision**
2012-1	Rick Lux	Maval Manufacturing	Rev 1

Project Description

Project Background:

The objective of this project is to design and build a test stand that will validate the quality of electronic power steering units for Maval Manufacturing. In 2007 Maval Manufacturing launched its Wicked Bilt brand focusing on steering solutions, including electronic power steering (EPS) for UTVs. The Senior Design team is tasked with designing and constructing a test stand for the EPS units. Having a functional steering system is a major aspect of customer safety so it is important to test all units. As requested by Maval, we will be running several tests based on input and output torque relationships. The units will be serialized and the data will be recorded to a database. If problems arise in the future, Maval needs to be able to bring up the test data for any particular unit that has left the building.

Problem Statement:

Validate the quality of electronic power steering units by creating a test stand to test performance criteria of all electronic power steering units from Maval Manufacturing.

Objectives/Scope:

1. Validate quality by testing:
   1.1. Torsion bar integrity
   1.2. Steering current draw
   1.3. Torque input and output
   1.4. Steering symmetry
2. Record all data
3. Create an easy to use interface
4. Ensure safety of operator

Deliverables:

- Fully functioning test stand
- User manual documentation

Expected Project Benefits:

- More robust test method of steering units
- Ability to store data for manufacturer

Core Team Members:

- Travis Blais – Team Leader
- Evan Lumby – Manufacturing Leader
- Jordan Shields – Project Leader
- Samuel Slezak – Software Leader

Strategy & Approach

Assumptions & Constraints:

1. Accommodate power steering casting and splines

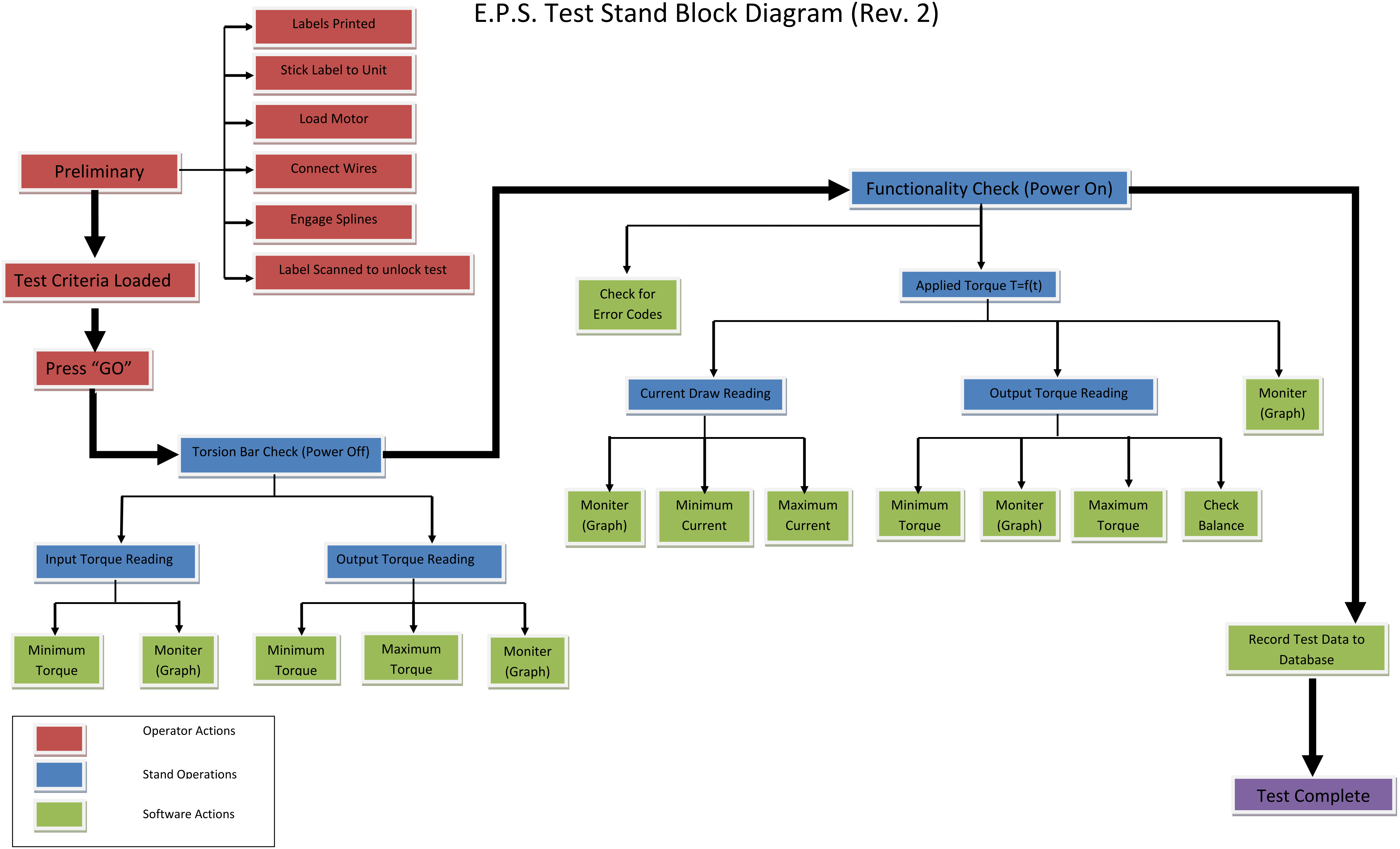
Issues & Risks:

- The integration of data acquisition software and hardware will be the biggest challenge for our senior design team.
  - To ensure success we plan on starting creation of software early in the process as well as seek advice from experts in the field.
- Error codes occurring too often may cause operator to alter software to prevent warnings (has happened on other tests at shop)
  - Password Protection of Software
  - Proper Tolerances to ensure unit quality while also minimizing error warnings
- Spline wear deteriorating piece
  - Proper material Selection
- High Cost of Parts necessary for Testing
  - Reasonable budget , cost assessment, price comparison
- Lead time on manufactured parts
  - Requests parts and notify shop on time
- Designing Intuitive Interface
  - Physical visit to Maval to speak with operator and observe process in action and receive feedback

Primary Customer Need	#	Specific Customer Needs
Ensure Safety	S1	E-stop
	S2	Safe to use
	S3	Secure EPS
Validate Quality	Q1	Repeatable Measurements
	Q2	Display Errors
	Q3	Measure/Apply Torque In
	Q4	Measure Torque Out
	Q5	Measure Supplied Current
	Q6	Check sensor calibration
	Q7	Password protect specifications
	Q8	Possible to test two units at a time
Easy to use	E1	Red/Green light for fail/pass
	E2	Failure criteria clearly expressed to user
	E3	User friendly interface
	E4	Automated test
	E5	Tool-less to secure EPS
	E6	Easily adjustable specifications
	E7	Low skill level to use
	E8	Easy to replace high wear parts
Record Data	R1	Record Torque In
	R2	Record Torque Out
	R3	Record Current
	R4	Record Errors
	R5	Keep database of all test data
	R6	Record Max torque
	R7	Record Calibration
Serialize Parts	P1	Assign new internal serial number
	P2	Record internal/external serial number with test data

Engineering Specification Number	Engineering Specification Description	Units of Measure	Preferred Direction	Nominal Value	Method of Validation	Customer Need
S1	Button to turn off power to actuation device and EPS	yes/no	-	yes	-	S1,S2
S2	EPS Current limit	Amperes	Range	30-40	Fuse/device limits	S2
S3	Area of exposed wire/connections	m^2	Exact	0	-	S2
S4	Maximum applied torque in	Nm	Increase	9	motor capability	Q3, R6
S5	Maximum measurable torque out	Nm	Increase	67.5	sensor capability	Q4, R2, R6
S6	Maximum measureable torque in	Nm	Increase	9	sensor capability	Q3, R1
S7	Voltage supplied to EPS control unit	V	Range	12-13.5	measure	E4
S8	Max measureable current	Amperes	Increase	40	sensor capability	Q5, R3
S9	Allowable EPS movement during test	degrees	Decrease	5	measure	S3
S10	Number of test fixutres	Exact	-	2	-	Q8
S11	Accuracy of measured torque	%	Decrease	10	sensor capability	Q1
S12	Calibration Accuracy	Nm	Decrease	1	measure	Q1, Q6, R7
S13	Tolerance on current measurement	%	Decrease	10	sensor capability	Q1
S14	Time to secure	minutes	Decrease	1	survey	E5
S15	Number of steps to start test stand from off	#	Less	5	-	E7
S16	Use tools to secure	yes/no	-	no	-	E5
S17	Display errors on screen	yes/no	-	yes	-	E2, E3
S18	Illuminates green/red light for pass/fail	yes/no	-	yes	-	E1, E3
S19	Time to remove spline connection	Minutes	Decrease	5	-	E8
S20	Steps to run test	#	Decrease	7	-	E4, E7
S21	Password Protected	yes/no	-	yes	-	Q7, E3
S22	Display modifiable specifications	yes/no	-	yes	-	E3, E6
S23	Min number of tests stored	#	Increase	30000	-	R1-7
S24	Minimum DAQ sample rate	Samples/sec	Increase	50	sensor capability	Q1,3,4,5
S25	Storable alphanuemeric characters for serialization	#	Increase	20	-	P1,P2

E.P.S. Test Stand Block Diagram (Rev. 2)



Software Block Diagram