

Test Name	Subsection	Pass (1) / Fail (0)	Inspections	Pass	Fail	Total	% Passed	Compliance Matrix	Requirements	% Complete	Average %
1.1	a	1	I1	24	6	30	80.00%		GPR001	80%	81%
	b	1	I2	32.25	5.75	38	84.87%		GPR005	67.80%	
	c	1	I3	44.5	5.5	50	89.00%		GPR006	25%	
	d	1	I4	4	6	10	40.00%		GPR007	72.22%	
1.2	a	1	I5	4	5	9	44.44%		GPR008	100%	
	b	1	I6	1	3	4	25.00%		GPR011	100%	
	c	0	I7	9	0	9	100.00%		GPR012	100%	
	d	0	I8	2	2	4	50.00%		T7.3	96.30%	
	e	0	I9	26	1	27	96.30%		T7.4	94.50%	
	f	1	I10	8	0	8	100.00%		T8.1	100%	
	g	1	I11	2	1	3	66.67%		T8.2.1	25%	
1.3	a	0	I12	3	0	3	100.00%		T8.3	100%	
	b	0	I13	15	3	18	83.33%		EV1	100%	
	c	0	I14	6	0	6	100.00%		EV2.1.1	80%	
	d	0	I15	6	0	6	100.00%		EV2.1.3	80%	
1.4	a	1	I16	1	0	1	100.00%		EV2.8.1	94.50%	
1.5	a	1				Average %	78.73%		EV2.8.2	83.33%	
	b	1		187.75	38.25	226	83.08%		EV2.8.3	0%	
	c	0							EV2.8.4	100%	
1.6	a	1							EV2.8.5	83.33%	
	b	1							EV2.8.6	83.33%	
	c	0							EV2.9.1 - EV2.9.	100%	
1.7	a	1							EV2.9.5	89%	
	b	1							EV2.9.6	100%	
	c	1							EV2.9.7	100%	
	d	1							EV2.9.8	84.87%	
	e	1				0.8571428571			EV2.10	100%	
	f	1							EV2.10.1	50%	
	g	1							EV2.10.3	33%	
1.8	a	1							EV2.10.4	100%	
	b	1							EV2.10.5	100%	
	c	1							EV2.10.7	40%	
2.1	a	1						EV2.11.1	0%		
2.2	a	1							EV2.11.2	25%	
	b	1							EV2.11.3	96.30%	
	c	1							EV2.11.4	0%	
	d	1							EV2.11.5	0%	
	e	1							EV2.11.6	62.43%	
	f	1							EV2.11.7	98.15%	
2.3	a	1							EV2.11.8	83.33%	
	b	1							EV2.11.9	44.44%	
	c	1							EV3.1.1	41.67%	
	d	1							EV3.1.2	41.67%	
2.4	a	1							EV3.1.3	0%	
	b	1							EV3.1.4	100%	
2.5	a	1							EV3.1.5	89%	
	b	1							EV3.2.1 - EV3.2.	84.87%	
	c	1							EV3.2.9	84.87%	
2.6	a	1							EV3.3	84.87%	
	b	1							EV3.4	84.87%	
2.7	a	1							EV3.5.1	92.43%	
	a	1							EV3.5.4	57.14%	

7.6	a	0
7.7	a	0
7.8	a	0
	b	0
7.9	a	0
	b	0
7.10	a	0
7.11	a	0
7.12	a	0
8.1	a	0
	b	0
	c	1
	d	0
9.1	a	0
9.2	a	0
9.3	a	0
	b	0
	c	0
	d	0
9.4	a	1
	b	1

EV9.3.3	81.96%
EV9.3.4	75.95%
EV9.4.1	96.33%
EV9.4.2	96.33%
EV9.6	72.25%
EV10.1	100%
EV10.1.2	100%
EV10.3	100%
EV10.4	66.67%
EV13	80%

















Test Number	1.1														
Test Name	Non- Drive State Throttle Demo														
Measurements	N/A														
Pass Criteria	a. Pre-charge Relay Closed b. SSOK Lights Illuminated c. TSAL Illuminated d. Motor does not spin when throttle is applied														
Pass/Fail	a. PASS b. PASS c. PASS d. PASS														
Test Number	1.2														
Test Name	Drive State Throttle Demo														
Measurements	Time RTDS is played (seconds)	2.53	2.38	2.85	2.69	2.49	2.49	2.63	2.42	2.68	2.62	2.62	2.56	2.53	
	Sample Size (n)	13													
	Mean Time	2.5775													
	Std Dev (sample std dev)	0.1305321277													
	Std Error (sample std dev/sqrt(n))	0.03620309843													
	t-statistic (assuming H_o: population mean time >= 3 sec or <= 1 sec)	-205.0238881													
	p-value for (n-1 degrees of freedom)														
	The null hypothesis fails with 90% confidence. Mean Time to play is between 1 and 3 seconds														
	Time For Motor to Begin Slowing down		seconds												
	RTDS Loudness from 2 meters away (dB)	86	85	91	91	88	90	88	92	107	96	103	100	100	
	Sample Size (n)	13													
	Mean Loudness	93.61538462													
	Std Dev (sample std dev)	6.9466834													
	Std Error (sample std dev/sqrt(n))	1.926663322													
	t-statistic (assuming H_o: population mean time <= 80 dB)	43.39906388													
	p-value for (n-1 degrees of freedom)														
	The null hypothesis fails with 90% confidence. Mean loudness is greater than 80 dB														
Pass Criteria	a. RTDS lasts for 1-3 seconds b. Motor does not rotate without throttle c. Motor rotates when throttle is applied d. Motor stops when throttle pot is in original position e. Motor slows down within 1 second after interrupting toque command signal f. SCADA indicates Throttle Implausibility after interrupting torque command signal g. RTDS is at least 80 dB fro 2 meters away from sound source														
Pass/Fail	a. PASS b. PASS c. FAIL d. FAIL e. FAIL f. PASS g. PASS														
Test Number	1.3														
Test Name	Pre-charge System Integration														
Measurements	Plot of Voltage across R33 of TSI PCB vs. Time														
	Plot of Pre_Charge_Ready signal on TSI PCB vs. Time														
	Tractive System Voltage														
	Output voltage of Precharge Relay														
Pass Criteria	a. Precharge is not completed when Cockpit BRB is opened during Precharge b. Precharge is allowed to complete when Cockpit BRB is closed during Precharge c. Pre_Charge_Ready signal intersects with Voltage of R33 above 90% TSV d. 24 V present at Precharge Relay after 90% TSV charged														
Pass/Fail	a. FAIL b. FAIL c. FAIL d. FAIL														
Test Number	1.4														
Test Name	Brake Over Travel Switch During Drive State Demo														
Measurements	N/A														
Pass Criteria	a. SSOK lights are not illuminated after Brake Overtravel Switch is opened b. AIRs are open after Brake Overtravel Switch is pressed c. Motor stops spinning within 60 seconds of pressing switch														

Test Number	2.1		
Test Name	Grounded Low Voltage Master Switch (GLVMS)		
Measurements	N/A		
Pass Criteria	a. System only turns on when Left and Right BRBs are closed and GLVMS is closed		
Pass/Fail	a. PASS		
Test Number	2.2		
Test Name	Master Reset Button and SSOKs		
Measurements	N/A		
Pass Criteria	a. SSOKs light up when MReset is pressed		
	b. SSOKs remain on when MReset is released		
	c. SSOKs do not light up if the GLVMS is off but the fault light is off		
	d. SSOKs do not light up if the IMD fault light is on and the GLVMS is on		
	e. SSOKs do not light up if the Brake Overtravel button is pushed and the GLVMS is on		
	f. SSOKs do not light up if the SCADA relay is open and the GLVMS is on		
Pass/Fail	a. PASS		
	b. PASS		
	c. PASS		
	d. PASS		
	e. PASS		
	f. PASS		
Test Number	2.3		
Test Name	Cockpit BRB and Cockpit Reset		
Measurements	N/A		
Pass Criteria	a. AIRs light turns on when following Startup Procedure when Cockpit Reset is pressed		
	b. AIRs light turns off when Cockpit BRB is pressed		
	c. AIRs light turns off when Cockpit BRB is opened and Cockpit Reset is pressed		
	d. AIRs light remains off when Cockpit BRB is pressed and the Cockpit Reset is pressed		
Pass/Fail	a. PASS		
	b. PASS		
	c. PASS		

	d. PASS		
Test Number	2.4		
Test Name	Tractive System Master Switch (TSMS)		
Measurements	N/A		
Pass Criteria	a. AIRs light illuminated after TSMS is turned on and Cockpit Reset is pressed		
	b. AIRs light turns off after TSMS is turned off		
Pass/Fail	a. PASS		
	b. PASS		
Test Number	2.5		
Test Name	SCADA Relay		
Measurements	N/A		
Pass Criteria	a. SSOKs turn off when throttle voltage exceeds configured threshold		
	b. SSOKs turn off when GLV Temperature sensor exceeds configured threshold		
	c. SSOKs turn off when the Motor RPM exceeds configured threshold		
Pass/Fail	a. FAIL		
	b. FAIL		
	c. FAIL		
Test Number	2.6		
Test Name	AIRs Operation		
Measurements	N/A		
Pass Criteria	a. AIRs light is off before pressing Cockpit Reset and turning on TSMS		
	b. AIRs light illuminates after turning on TSMS and pressing Cockpit reset		
Pass/Fail	a. PASS		
	b. PASS		
Test Number	2.7		
Test Name	GLV System Voltage and Current measurement		
Measurements	XXXX		plot attached
	XXXX		

Test Number	2.8		
Test Name	Grounding Test		
Measurements	Resistance between Chassis Ground and TSI Enclosure		mΩ
	Resistance between Chassis Ground and TSI PCB		mΩ
	Resistance between Chassis Ground and MCS Mounting plate		mΩ
	Resistance between Chassis Ground and GLV panel		mΩ
	Resistance between Chassis Ground and TSI High Voltage plate		mΩ
	Resistance between Chassis Ground and Left Side Panel		mΩ
	Resistance between Chassis Ground and Right Side Panel		mΩ
	Resistance between Chassis Ground and Cockpit Panel		mΩ
Pass Criteria	a. Resistance measurement between the TSI enclosure and chassis ground is less than 300 mΩ		
	b. Resistance measurement between the TSI PCB mounting plate and chassis ground is less than 300 mΩ		
	c. Resistance measurement between the MCS mounting plate and chassis ground is less than 300 mΩ		
	d. Resistance measurement between the GLV panel and chassis ground is less than 300 mΩ		
	e. Resistance measurement between the TSI high voltage plate and chassis ground is less than 100 Ω		
	f. Resistance measurement between the Left Side panel and chassis ground is less than 100 Ω		
	g. Resistance measurement between the Right Side panel and chassis ground is less than 100 Ω		
	h. Resistance measurement between the Cockpit panel and chassis ground is less than 100 Ω		
Pass/Fail	a. PASS		
	b. PASS		
	c. PASS		
	d. PASS		
	e. PASS		
	f. PASS		
	g. PASS		
	h. PASS		
Test Number	2.9		

Test Name	Finger Probe Test		
Measurements	N/A		
Pass Criteria	a. Probe does not touch TS connection on AIRs		
	b. Probe does not touch Amphenol connectors		
Pass/Fail	a. PASS		
	b. PASS		

Test Number	3.1
Test Name	Start Up Procedure
Measurements	N/A
Pass Criteria	a. GLV light turns on after side panel BRBs are closed and GLVMS is turned on
	b. SSOKs turn on after MReset button is pressed
	c. Safe light turns on after MReset Reset button is pressed
	d. AIRs light and TSAL turn on after Cockpit BRB is closed and TSVMS is turned on
	e. Drive light stays off if drive button is pressed and brake is not pressed
	f. Pressing the drive button and the brake at the same time before turning the TSVMS on does nothing
	g. Safe light will not illuminate if Cockpit reset button is pressed while GLVMS is off
	h. TSAL and AIRs lights remain off after Cockpit BRB is closed if the GLVMS is still off
	i. TSAL and AIRs lights remain off after Cockpit BRB is closed if the side panel BRBs are closed
	j. TSAL and AIRs lights remain off after Cockpit BRB is closed if the MReset button has not been pressed
Pass/Fail	a. PASS
	b. PASS
	c. PASS
	d. PASS
	e. PASS
	f. PASS
	g. PASS
	h. PASS
	i. PASS
	j. PASS

Test Number	4.1		
Test Name	Discharge		
Measurements	Voltage across discharge resistors		
Pass Criteria	a. The signal across the discharge resistors is below 30 V within 5 seconds.		V
Pass/Fail	a. PASS		
Test Number	4.2		
Test Name	Drive - Over Current Transitions		
Measurements	N/A		
Pass Criteria	a. The motor stops spinning when in the over-current state		
	b. The Drive Light in the cockpit flashes while in the over-current state.		
	c. The drive state field on the SCADA display shows that the system is in the over current state		
	d. The system does not leave the overcurrent state until the current is under the TSI over current threshold and the throttle is less than 0.5 V		
	e. The TSI overcurrent setting is not set by re-compiling and uploading firmware to the TSI microprocessor		
Pass/Fail	a. FAIL		
	b. FAIL		
	c. FAIL		
	d. FAIL		
	e. FAIL		
Test Number	4.3		
Test Name	Return to Drive Setup or Idle State Transitions		
Measurements	N/A		
Pass Criteria	a. The drive state field on the SCADA display shows that the system is in the Idle State when the safety loop is broken		
	b. The drive light turns off when the safety loop is broken		
Pass/Fail	a. PASS		
	b. PASS		
Test Number	4.4		
Test Name	Drive to Drive Setup State Transition		
Measurements	N/A		
Pass Criteria	a. The drive light turns off when in Drive Setup state		
	b. SCADA displays the current state as Drive Setup after the throttle is implausible		
	c. SCADA displays the current state as Drive Setup after turning off the motor controller		
	d. SCADA displays the current state as Drive Setup after pressing the drive button		
Pass/Fail	a. PASS		
	b. PASS		
	c. FAIL		

	d. FAIL		
Test Number	4.5		
Test Name	High Voltage Indicator Lights		
Measurements	TS Voltage when TSAL and HVPL turn on and off		
Pass Criteria	a. TSAL turns off when the power supply is less than 40 V.		V
	b. HVPL turns off when the power supply is less than 40 V.		V
	c. The difference between the voltages when the TSAL and HVPL turn off is less than 2V		
	d. TSAL is on when the power supply is greater than 60 V.		V
	e. HVPL is on when the power supply is greater than 60 V.		V
	f. The difference between the voltages when the TSAL and HVPL turn on is less than 2V		
Pass/Fail	a. FAIL		
	b. FAIL		
	c. PASS		
	d. PASS		
	e. PASS		
	f. PASS		
Test Number	4.6		
Test Name	Tractive System Active Light		
Measurements	N/A		
Pass Criteria	a. When high voltage is turned on, TSAL is flashing		
	b. When high voltage is turned off, the TSAL turns off		
Pass/Fail	a. PASS		
	b. PASS		
Test Number	4.7		
Test Name	Brakes		
Measurements	N/A		
Pass Criteria	a. The brake light is illuminated when the brake button is being pressed.		
	b. The brake light is not illuminated when the brake button is not being pressed.		
Pass/Fail	c. SCADA display indicates that the brake is being pressed when the brake button is being pressed		
	d. SCADA display indicates that the brake is not being pressed when the brake button is not being pressed		
	a. PASS		
	b. PASS		
	c. PASS		
	d. PASS		

Test Number	5.1
Test Name	SCADA Motor Data Acquisition
Measurements	N/A
Pass Criteria	a. SCADA produces a CSV only containing Motor RPM, Motor Torque, TS Current, and TS Voltage data
Pass/Fail	a. FAIL

Test Number	6.1		
Test Name	Uncooled Motor Controller and Cooled Motor Controller		
Measurements	Plot of Uncooled Motor Controller Temperature vs. Time		plot attached
	Plot of Cooled Motor Controller Temperature vs. Time		plot attached
Pass Criteria	a. Plot of motor controller temperature vs time for cooled and uncooled conditions		
	b. Plot of cooled motor controller temperature always less than or equal to uncooled motor controller temperature		
Pass/Fail	a. FAIL		
	b. FAIL		
Test Number	6.2		
Test Name	Motor and Cooling Stress Test		
Measurements	Plot of Motor Controller Temperature vs Time		plot attached
Pass Criteria	a. Motor Controller Temperature does not exceed 60 C in 30 minutes		
	b. No cooling leaks are observed during or immediately after the 1 hour stress test		
Pass/Fail	a. FAIL		
	b. FAIL		

Test Number	7.1																				
Test Name	Motor Temperature																				
Measurements	Motor Temperature from External Thermometer (deg C)																				
	Motor Temperature from Motor Controller (deg C)																				
	Error																				
	Number of Observations (n)																				
	RMS of Error																				
	STD Dev of Error (sample std dev)																				
	STD Error of Error (sample std dev/sqrt(n))																				
	T* Statistic for n-1 degrees of freedom																				
	Confidence Interval																				
Pass Criteria	a. 90% Confidence Interval of observed uncertainty contains the expected uncertainty																				
Pass/Fail	#N/A																				
Test Number	7.2																				
Test Name	Motor Controller Temperature																				
Measurements	Motor Temperature from External Thermometer (deg C)																				
	Motor Temperature from Motor Controller (deg C)																				
	Error																				
	Number of Observations (n)																				
	RMS of Error																				
	STD Dev of Error (sample std dev)																				
	STD Error of Error (sample std dev/sqrt(n))																				
	T* Statistic for n-1 degrees of freedom																				
	Confidence Interval																				
Pass Criteria	a. 90% Confidence Interval of observed uncertainty contains the expected uncertainty																				
Pass/Fail	#N/A																				
Test Number	7.3																				
Test Name	Motor Velocity at Motor Shaft																				
Measurements	Motor Velocity - Handheld Tachometer																				
	Motor Velocity - Motor Controller																				
	Error																				
	Number of Observations (n)																				
	RMS of Error																				
	STD Dev of Error (sample std dev)																				
	STD Error of Error (sample std dev/sqrt(n))																				
	T* Statistic for n-1 degrees of freedom																				
	Confidence Interval																				
Pass Criteria	a. 90% Confidence Interval of observed uncertainty contains the expected uncertainty																				
Pass/Fail	#N/A																				
Test Number	7.4																				
Test Name	Huff Box Motor Output Shaft Torque																				
Measurements	Weight Put On Torque Arm (lbs)																				
	Static Torque Generated (load above at 1.5 ft) (ft-lbs)																				
	Torque Reported by SCADA																				
	Error																				
	Number of Observations (n)																				
	RMS of Error																				
	STD Dev of Error (sample std dev)																				
	STD Error of Error (sample std dev/sqrt(n))																				
	T* Statistic for n-1 degrees of freedom																				
	Confidence Interval																				
Pass Criteria	a. 90% Confidence Interval of observed uncertainty contains the expected uncertainty																				
Pass/Fail	#N/A																				
Test Number	7.5																				
Test Name	Motor Controller Motor Torque																				
Measurements	Motor Torque - SCADA																				
	Motor Torque - Motor Controller																				
	Error																				
	Number of Observations (n)																				
	RMS of Error																				
	STD Dev of Error (sample std dev)																				
	STD Error of Error (sample std dev/sqrt(n))																				
	T* Statistic for n-1 degrees of freedom																				
	Confidence Interval																				
Pass Criteria	a. 90% Confidence Interval of observed uncertainty contains the expected uncertainty																				
Pass/Fail	#N/A																				
Test Number	7.6																				
Test Name	TS Voltage and MC Voltage Sensors on TSI																				
Measurements	TS Voltage - Handheld Multimeter																				
	TS Voltage - SCADA																				
	Error																				
	Number of Observations (n)																				
	RMS of Error																				
	STD Dev of Error (sample std dev)																				
	STD Error of Error (sample std dev/sqrt(n))																				
	T* Statistic for n-1 degrees of freedom																				
	Confidence Interval																				
	MC Voltage - Handheld Multimeter																				
	MC Voltage - SCADA																				
	Error																				
	Number of Observations (n)																				
	RMS of Error																				
	STD Dev of Error (sample std dev)																				
	STD Error of Error (sample std dev/sqrt(n))																				

	TSI PCB Temperature - SCADA			
	Error			
	Number of Observations (n)	0		
	RMS of Error	#N/A		
	STD Dev of Error (sample std dev)	#N/A		
	STD Error of Error (sample std dev/sqrt(n))	#N/A		
	T* Statistic for n-1 degrees of freedom	1.9	http://ursgina.ca/~gingrich/tt.pdf	
	Confidence Interval	#N/A	#N/A	
Pass Criteria	a. 90% Confidence Interval of observed uncertainty contains the expected uncertainty (deg C)			
Pass/Fail	#N/A			
Test Number	7.12			
Test Name	Cooling Temperature Sensors			
Measurements	Coolant Temperature 1 - Fluke Thermometer	25	25	25
	Coolant Temperature 1 - SCADA	90	90	90
	Error	65	65	65
	Number of Observations (n)	4		
	RMS of Error	65		
	STD Dev of Error (sample std dev)	0		
	STD Error of Error (sample std dev/sqrt(n))	0		
	T* Statistic for n-1 degrees of freedom	1.9	http://ursgina.ca/~gingrich/tt.pdf	
	Confidence Interval	65	65	
	Coolant Temperature 2 - Fluke Thermometer			
	Coolant Temperature 2 - SCADA			
	Error			
	Number of Observations (n)	0		
	RMS of Error	#N/A		
	STD Dev of Error (sample std dev)	#N/A		
	STD Error of Error (sample std dev/sqrt(n))	#N/A		
	T* Statistic for n-1 degrees of freedom	1.9	http://ursgina.ca/~gingrich/tt.pdf	
	Confidence Interval	#N/A	#N/A	
Pass Criteria	a. 90% Confidence Interval of observed uncertainty contains the expected uncertainty (deg C)			
	b.			
Pass/Fail	a. FAIL			
	#N/A			

Test Number	8.1		
Test Name	24 Hour Demonstration		
Measurements	24 Time Period without Fault		Hours:Minutes:Seconds
Pass Criteria	a. Timer reaches 24 hours without powering system down as a result of fault, error, or system failure		
	b. Motor runs above 1000 RPM at least 3 times		
	c. Cooling runs for at least 30 minutes without leaks		
	d. Motor runs above 1000 RPM for 1 minute after 24 hours of the system being on		
Pass/Fail	a. FAIL		
	b. FAIL		
	c. PASS		
	d. FAIL		

