LFEV-Y5 v0.4

Acceptance Test Plan: v0.4

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This document outlines all of the tests required to deliver LFEV-Y5. The plan is presented as an overview with the ATP number next to the test. This refers to the document that describes the test procedure. The requirements are from the SoW for 2017

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ATP overviews

None of these tests can be viewed as completed until appropriate documentation has been uploaded to the webpage.

Item	Item description	Demonstrated Requirements	Successful Test Criteria	Verification Method
ATP-01	Accumulator integration	R001a R001c R001d R001e R002a R002c R004a (TSV part) R005a R005b (Manual)	Packs power motor and all telemetry is recorded by VSCADA. Control by using the throttle. Verify by accelerating and looking at dash, pack screens, and log files remotely	Test
ATP-02	Charging Accumulator and GLV	R001b R001g R002b R002h R003a(4-7)	Packs charge by the charging port and open the safety loop VSCADA reacts correctly Verify by looking at the dash GLV battery can be charged	Test
ATP-03	CAN Bus link	R002a R002c R002d R002e R002f R002g R002j R002k R003a(8) R003d R004a (CAN Bus part) R005a (CAN Bus part) R005c (CAN Bus part) R007c	DAQ by VSCADA of TSI, GLV, TSV, Cooling. Verify by looking at cell phone and looking at dash and remote computer in each mode of VSCADA	Test

		R007d		
ATP-04	Safety loop	R001g R002b R002c R002d R002k R002m R003b R003c R003d R004a (Safety loop part) R005c (IMD fault) R007b	Fault by: Crashing BRB IMD Cooling VSCADA limit Pack fault Throttle fault Brake fault User defined limit (warn) User defined limit (halt) Pack charging Verify by looking at the dash, the remote computer and the cellphone	Test
~~**ATP-05**~~	~~Cruise Control~~	~~R002l~~ ~~R005b~~ ~~(Software)~~	~~Motor can maintain desired speed~~ ~~Verify by checking motor speed compared to target~~	~~Test~~
~~**ATP-06**~~	~~24h endurance test~~	~~GPR006~~	~~At the end of all other tests leave the car running for 24h~~	~~Test~~
ATP-07	Shutdown	R002k R002i	VSCADA works after unexpected GLV shutdown All hardware in safe state Packs stop powering motor with GLV shutdown TSI works after unexpected TSV shutdown	Test
ATP-08	GLV grounding	R003a(2)	Ensure that there is only 1 connection between ground and chassis ground	Inspection
ATP-09	Documentation	GRP001	Complete and accurate documentation	Inspection

ATP-10	Hazmat	GPR004	No hazardous materials used	Analysis
ATP-11	Safety practice	GPR005	Good practice used for safety	Inspection
ATP-12	Maintainability	GPR007	Ensure that the project is maintainable	Analysis
ATP-13	Demonstration	GPR011	Have a video and demo setup	Inspection
ATP-14	Disposal	GPR012	Dispose of all materials as required	Inspection

Compliance Matrix

All requirements should also have a QA by each subsystem before integration.

Requirement	Test(s) to demonstrate acceptance
R001a	ATP-01
R001b	ATP-02 OR https://sites.lafayette.edu/ece492-sp16/files/2016/05/QAR001b.pdf
R001c	ATP-01
R001d	ATP-01
R001e	ATP-01
R001f	https://sites.lafayette.edu/ece492-sp16/files/2016/05/QAR001e.pdf
R001g	ATP-02
R002a	ATP-01 or ATP-03
R002b	ATP-02
R002c	ATP-01 OR ATP-03 OR ATP-04
R002d	ATP-01 OR ATP-03 OR ATP-04
R002e	ATP-03
R002f	ATP-03
R002g	ATP-03
R002h	ATP-02 OR ATP-03
R002i	ATP-02
R002j	ATP-03
R002k	ATP-03
R002l	Waived
R002m	ATP-04
R003a(1)	Any ATP
R003a(2)	ATP-08
R003a(3)	QA by GLV
R003a(4)	ATP-02
R003a(5)	ATP-02
R003a(5)	ATP-02
R003a(6)	ATP-02
R003a(7)	ATP-02
R003a(8)	ATP-03
R003b	ATP-04
R003c	QA by GLV
R003d	ATP-03
R004a	ATP-01 AND ATP-03 AND ATP-04
R004b	QA by Interconnect
R005a	ATP-01 AND ATP-03
R005b	ATP-01 AND ATP-07
R005c	ATP-04
R005d	QA by TSI
R006	Any ATP
R007a	QA by Cooling

R007b	ATP-04
R007c	ATP-03
R007d	ATP-03
R007e	Waived
R007f	QA by Cooling
R007g	QA by Cooling
GPR001	ATP-09
GPR003	Waived
GPR004	ATP-10
GPR005	ATP-11
GPR006	ATP-06 and ATP-11
GRP007	ATP-12
GPR008	ATP-09
GPR011	ATP-13
GPR012	ATP-14

Deliverables

D000
Completed

D001
Completed

D002

System	Getting started	FAQ	Functions and controls	Troubleshooting calibration and maintenance
TSI				
TSV				
GLV				
Cooling				
VSCADA				
Dyno room				

D003

Check	Completed
Final report of all documents	
3x DVD presented (or flash drive)	
DVD artwork	

Maintenance manual

System	Maintenance	Calibration	Schematics	ICDs	FSM
TSI					
TSV					
GLV					
Cool					
VSCADA					

D004

Check	Completed
Compliance matrix	
Forms present	

D005

Check	Completed
All tests included	
Test date for all tests	
Photos as required	
Tester named	
Witness signature if available	
Test results	
Submitted to website	

D007

Check	Completed
All documents as portable static documents (PDF/TXT/XML)	
Original version present	
Links to any cloud storage	

D008

Check	Completed
GPR006	
GPR007	
GPR008	
GPR011	
D010	
Video for D009	Waived
Video of GPR011	
Delivered per GPR012	
Any other items disposed per GPR012	

D009

Waived

D010

Check	Completed
Poster dimensions 47"x35"	
QR code to webpage	
Web link present	

D012

Completed

D013

Check	Completed
Table for all purchases	
Summary based on team	
Summary based on week	

D014

Check	Completed
Status letter submitted	
WBS delivered	

Waived or modified requirements and questions

Requirement	Reason
R003a(4)	Cannot tell if GLV is from the battery or 24VDC
R002h	Cannot tell if GLV is from the battery or 24VDC
R007e	Waived
R005d	We've changed the switches
R002l	Waived
GPR003	Waived
D009	Waived

ATP-01 checklist

Test	Pass
Packs can deliver 200A through TSI to the motor according to current sensor on HV cable	
Voltage measured at TSVMP is as expected	
Throttle controls RPM	
Throttle implausibility causes exit of drive mode	
Two moves required to enter drive mode	
Throttle and brake together prevent drive mode from starting	
Throttle and brake together exit drive mode	
TSAL lights come on when HV present outside packs	
TSEL lights come on when AIRS closed	
RTDS come on for 1-3 seconds when drive mode entered	
HV present light comes on when HV present	
Packs display telemetry on screen	
VSCADA can set the throttle	
VSCADA can set the valve on the dyno	

Pass count: /14

ATP-02 checklist

Test	Pass
Safety loop opens when charging	
Dash board shows that packs are charging	
Packs can be left charging after they are full	
GLV battery can be charged	
GLV battery can be left charging after it is full	

Pass count: /5

ATP-03 checklist

Test	Seen by VSCADA	Seen by Remote	Seen by Cell
Cell Temperature			
Cell Voltage			
Pack Current			
Pack SoC			
Pack Status			
Pack Voltage			
GLV Voltage			
GLV SoC			
GLV Current			
GLV Temperature			
Safety loop status			
RPM gauge (Dyno)			
Strain gauge			
Throttle position			
Brake status			
IMD status			
FWD/REV status			
Precharge status			
MC temp			
MC current			
Cooling temp in			
Cooling flow			
Cooling temp out			
TSI temp			
Speed			
Safety loop status			

Pass count: /78

ATP-04 checklist

Fault	Safety loop trip	Seen on VSCADA	Seen on Remote	Seen on Cell
Driver resettable BRB				
Non driver resettable BRB				
Crash protection				
Over temperature cooling				
Under flow cooling				
IMD fault				
Cell overtemp				
Cell overcurrent				
Cell overvoltage				
Cell undervoltage				

Brake overtravel				
VSCADA defined violation				

Pass count: /48

ATP-07 checklist

Test	Pass
VSCADA powers up with no user input	
GLV shutdown prevents TSV being present at TSVMP	
TSVMS shutdown prevents TSV being present at TSVMP	
VSCADA has recorded data up to the shutdown	
TSVMS shutdown while under load does not create any issues	

Pass count: /5

ATP-09 checklist

Each document:

Check	Pass
Unique part number	
Document delivered to instructor	
Document uploaded to website	
Units defined on diagram clearly	
Have a complete BOM with document if required	
Part number on title block	
Part number on file name	
Part number on fabricated object	
Lafayette Electrical and Computer Engineering marked	
The BOM has parts that are purchasable with 1 alternative or justification why 1 supplier is acceptable	

Pass count: /10

ATP-11 checklist

For each wire:

Check	Pass
Wires correctly color coded	
Cable labeled with gauge/max temperature/max voltage	
Cable labeled with reference designator	

Pass count: /3

For each indicator and button:

Check	Pass
Clear indicator of function	

Pass count: /1

For each PCB:

Check	Pass
Silkscreens marking reference designators	
Silkscreens marking power and critical signals	
Silkscreen showing Lafayette College, Made in USA, Electrical and Computer Engineering, part number	
Space for serial number	
Bottom copper has part number and rev	

Pass count: /5

For each fuse

Check	Pass
UL listed socket as a holder	
5 spares	
Easy to access	

Pass count: /3

For enclosures

Check	Pass
Access panel present	
Pilot lights and indicators present	
All interconnect cables have at least 1 return signal	
PCBs are not mounted directly to enclosure	
Enclosures are grounded if they are conductive	
Labeled internally and externally	

Pass count: /6

For every part that dissipates >25mV (0.025W). (Basically every part)

Check	Pass
Overrated to +50% maximum expected power dissipation	
No temperature rise to >40C above ambient	
Overrated to +25% maximum expected voltage	
MTBF analysis completed	

Pass count: /4

ATP-12 checklist

For software

Check	Pass
Version controlled	
Can startup with no input from the user	
Have an install script (.exe/make/RPM)	
Configurable without requiring a recompile	
Data stored in a well-supported format	
Any files that grow should be automatically trimmed	
A procedure for backing up data	
Passwords should be avoided	
If a port is needed it should enumerate automatically	

Pass count: /9

For hardware

Check	Pass
Recommended list of spare hardware	
Basic troubleshooting guidelines for a beginner	
Advance troubleshooting for an expert	
A beginner can diagnose a simple problem (loose connector)	
An expert can diagnose a complex problem (TBA)	

Pass count: /5

ATP-13 checklist

Check	Pass
320p video supplied	
640p video supplied	
Video ~5min in length	
Slideshow of final project	
Demonstration of final project	
Standalone self-contained display provided	

Pass count: /6

ATP-14 checklist

Check	Pass
All materials stored in the same room	
Webpage updated to a final version	

Pass count: /2

The following is for REFERENCE ONLY with regards to demonstration requirements. All of this can be completed in the dyno room			
Torque Control:			
Demo		~~2.1.1~~	~~Torque control sensor actuated by a right foot pedal~~
Demo		~~2.1.2~~	~~Foot pedal returns to original position when not actuated and has positive stops to protect sensor~~
Demo		2.2.1	All plausibility detections schemes must detect and shutdown torque production within 1 second of the errors first occurrence or loss of communication.
Demo		2.2.2	Teams must be prepared to demonstrate error detection at Electrical Tech Inspection. Unplugging a connector is an acceptable method of demonstration
Safety Circuit/Shutdown			
Demo		5.8.1	The brake over-travel switch shuts down the tractive system
Demo		5.8.2	The brake over-travel switch is not driver-resettable
Demo		5.1.6	Check that motor spins freely when TS is deactivated.
Demo		1.2.7	The GLV system must be energized in order to activate the tractive system. If the GLV system shut down, the tractive system must de-activate immediately.
Demo		4.7.6 4.7.6 4.7.7	The team can remove the HVD in under 10 seconds, from the ready-to-drive condition, without the use of tools
Demo		4.8.1	The driver can make the car ready to drive without assistance. For AMS, IMD, or other inaccessible shutdown circuit opens, the driver alone cannot make the car ready-to-drive.
Demo		4.8.1	The driver must be able to re-activate or reset the tractive system from within the cockpit without the assistance of any other person except for situations in which the AMS or IMD have shut down
Demo		4.8.2	At least one action in addition to enabling the shutdown circuits is required to set the car to ready-to-drive mode. A start button shall not be such that it can inadvertently be left in the “on” position.
Demo		4.9.1	The pre-charge is disabled by an opened shutdown circuit.
Demo		4.9.5	Pre-Charge circuit must operate regardless of the sequence of operation used to energize the vehicle (i.e. restarting after automatic shutdown of safety circuit
Demo		5.1.7 5.1.8	Shutdown circuit operates to state diagram in the FSM (Figure 1 - FSM for TSI)

AMS			
Demo		3.7.8	AMS disables all electrical systems, disables TSV drive system, and opens AIRs until manually reset by other than driver.
Demo		3.7.10	Does AMS trip at level documented in ESF?
IMD			
Demo		5.1.5	The driver must not be able to re-activate the tractive system from within the car in case of an AMS or IMD fault. Wireless reset shutdown circuit is not permitted
Demo		5.9.5	TS remains inactive until manually reset by other than the driver (IMD Fault). Driver must not be able to reset an IMD fault from within the car.
Demo		5.9.6 5.9.7	A red indicator light in the cockpit indicates IMD status. It is visible in bright sunlight, and marked "IMD" or "GFD".
		7.1	The IMD test is passed if the IMD shuts down the tractive system within 30 seconds at a fault resistance of 250 ohm/volt (50% below the response value) - Note: Proper wiring proven through successful testing of the IMD
Demo			IMD test. Shuts down HV?_____ Latches off?_____ Labeled cockpit light?_____
Demo		7.2	The insulation resistance between the tractive system and control system ground will be measured during Electrical Tech Inspection. The available measurement voltages are 250 V and 500 V. All cars with a maximum nominal operation voltage below 500 V will be measured with the next available voltage level. For example, a 175 V system will be measured with 250 V; a 300 V system will be measured with 500 V etc.
Demo			The measured insulation resistance is >= 500 ohm/volt related to the maximum nominal tractive system operation voltage

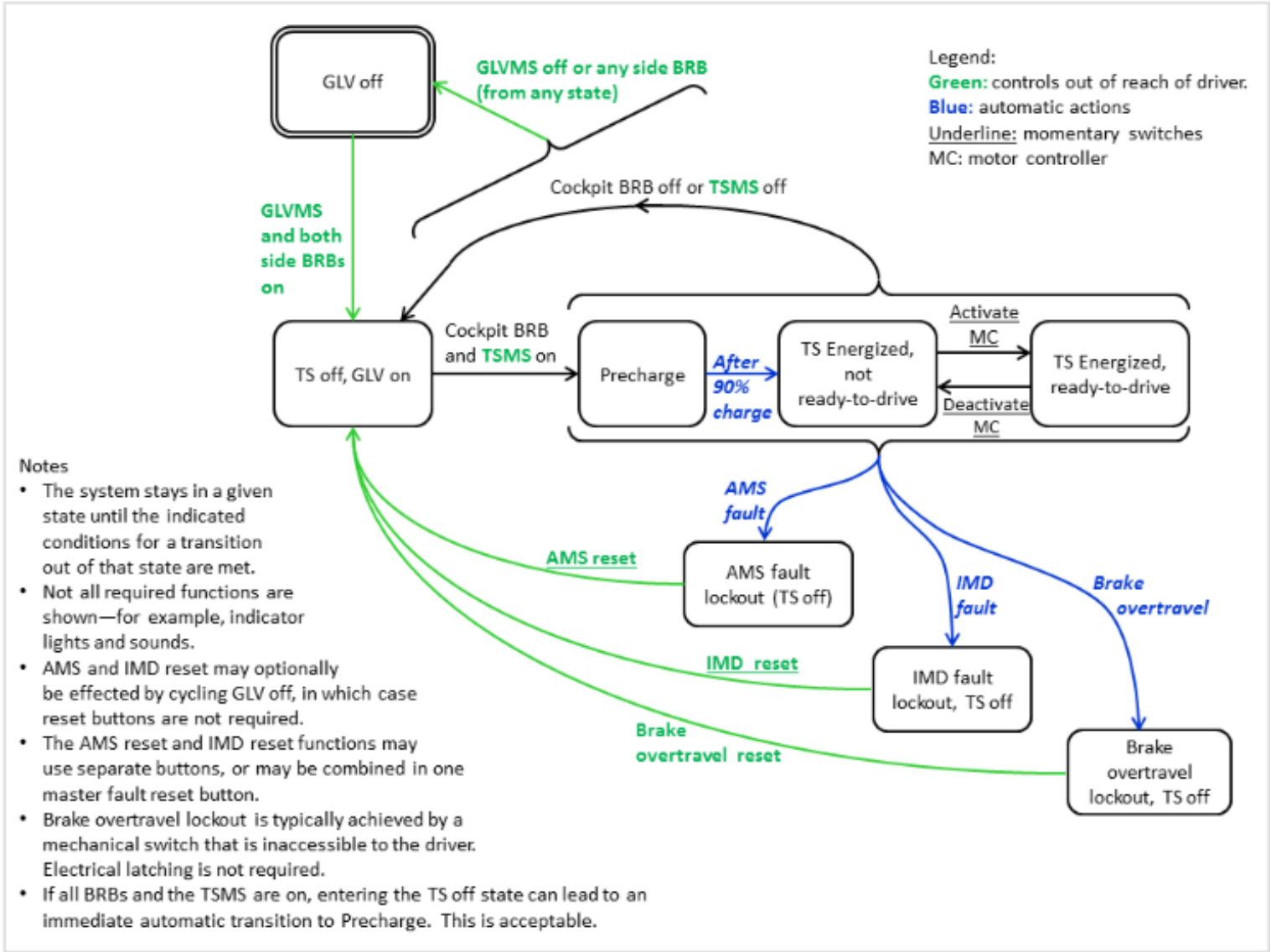

Figure 1 - FSM for TSI

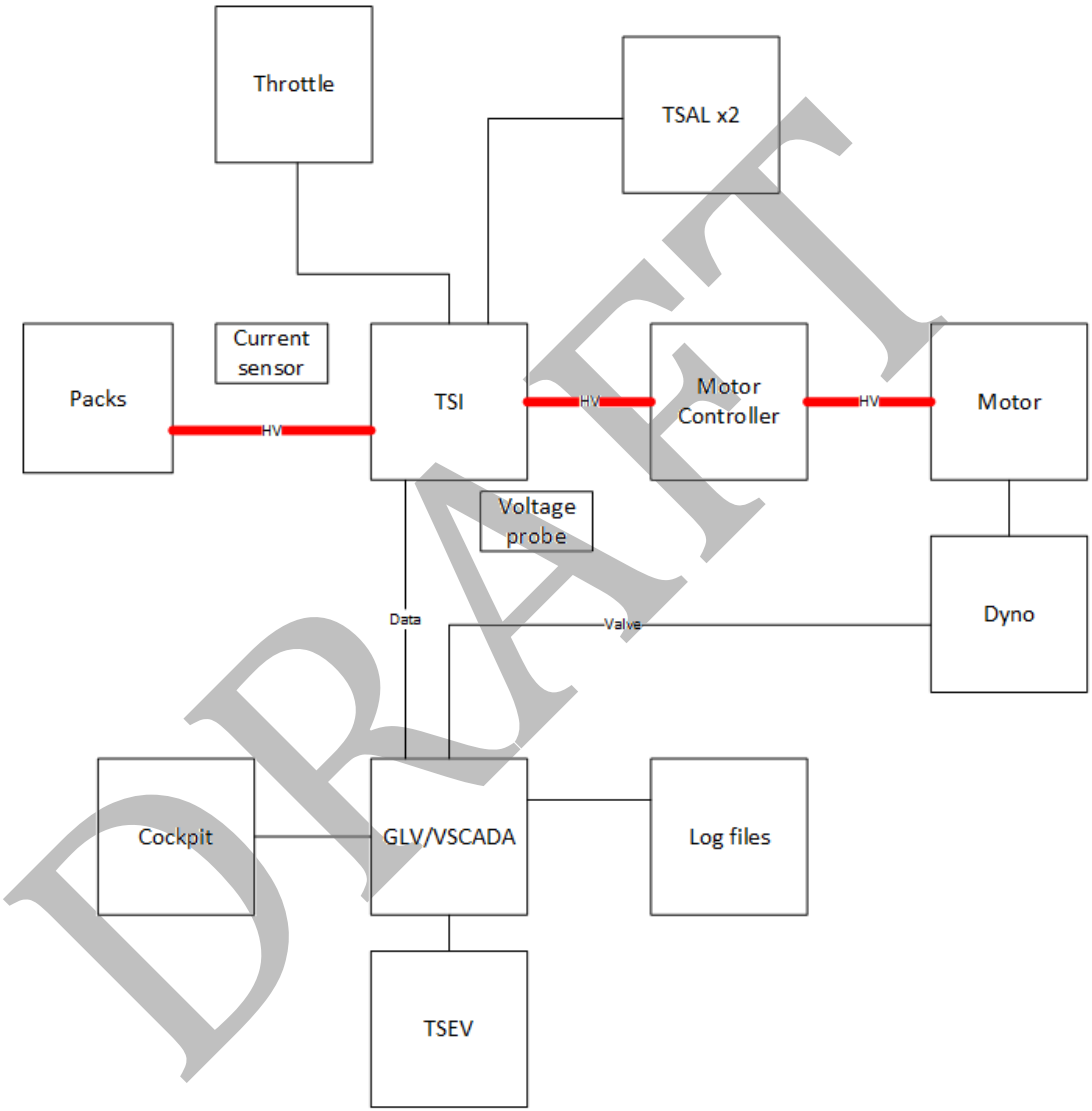

Figure 2 - ATP-01 block diagram

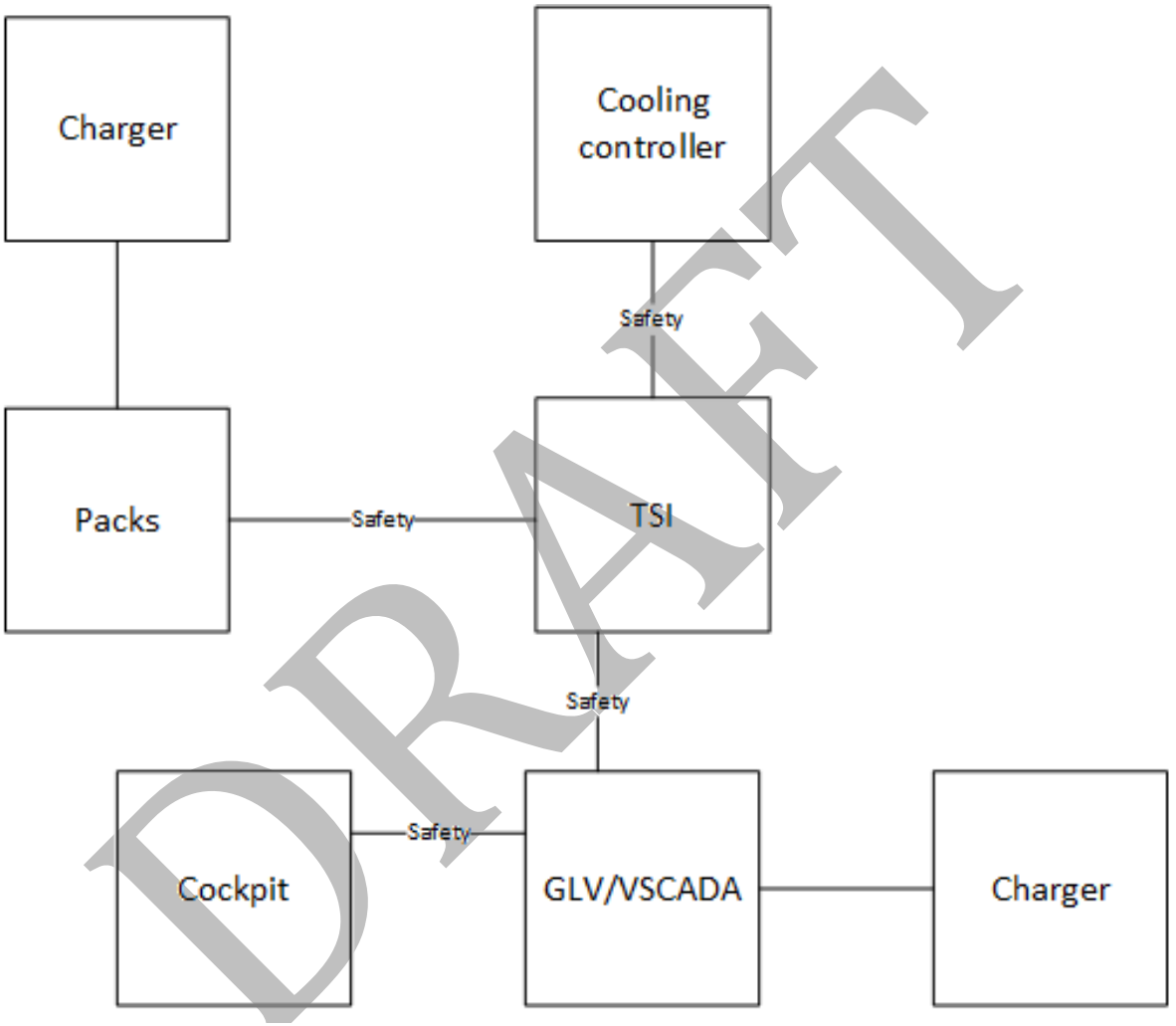

Figure 3 - ATP-02 block diagram

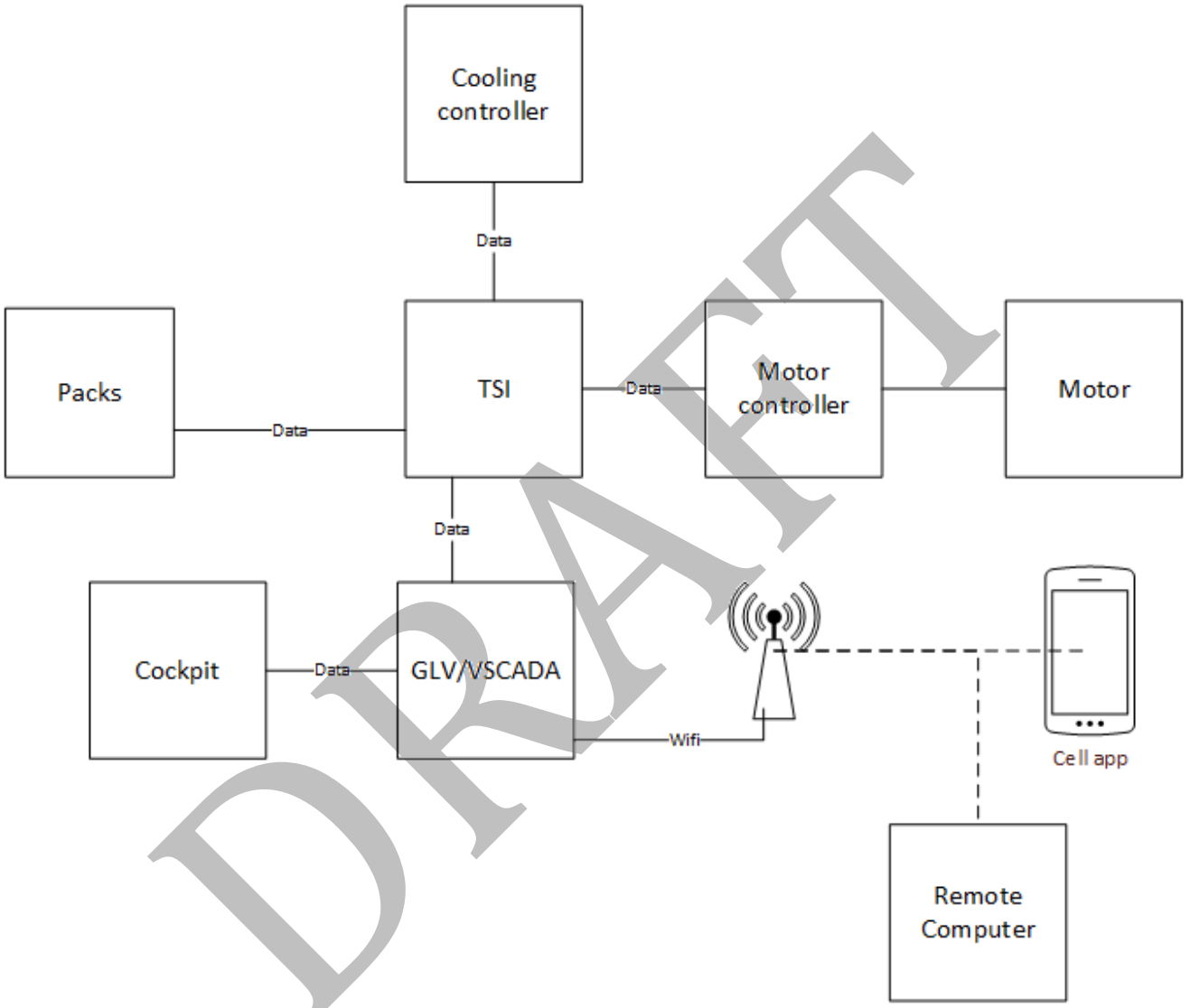

Figure 4 - ATP-03 block diagram

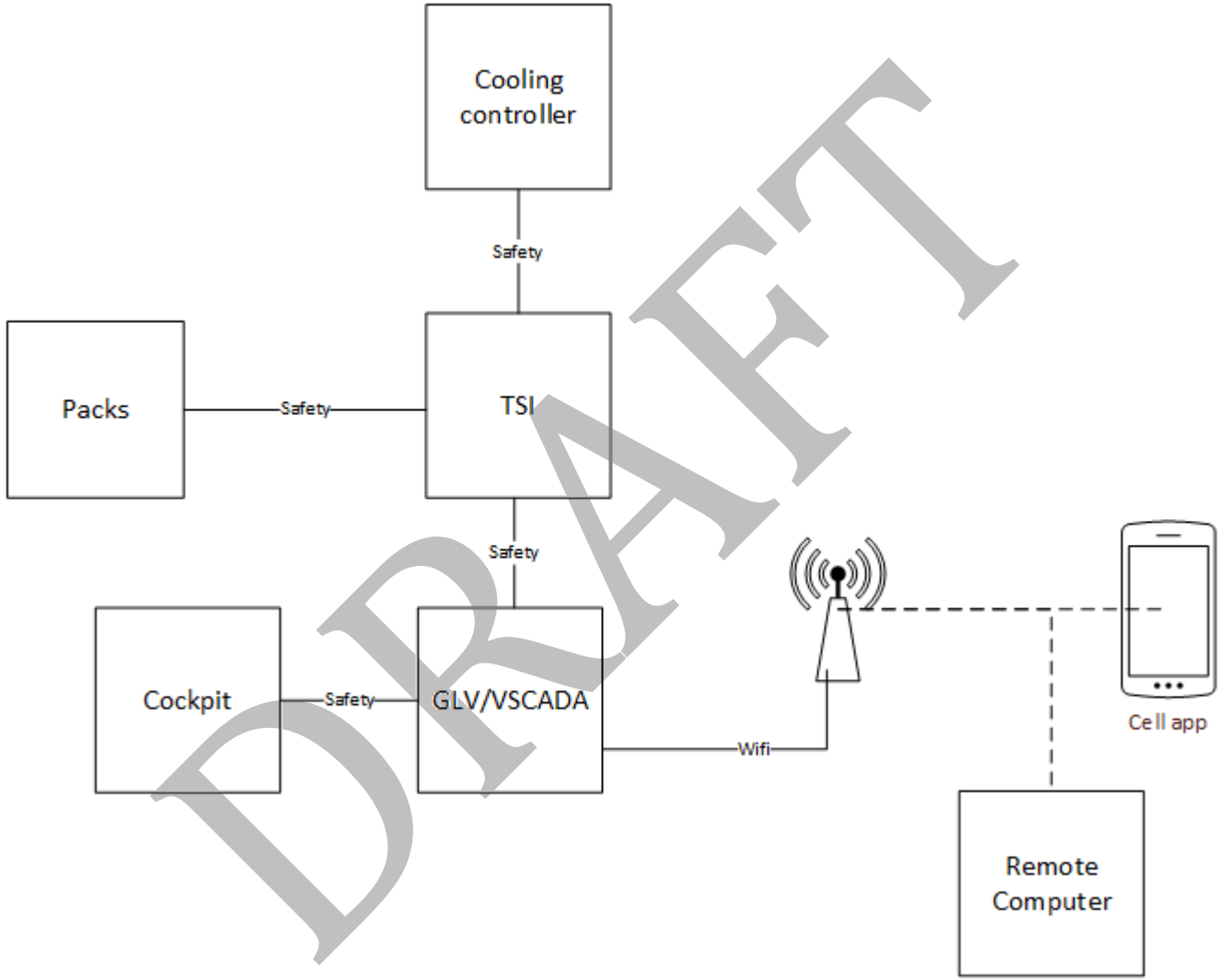

Figure 5 - ATP-04 block diagram