First Technical Deliverable

Introduction:

Pre-Track-Event, "Technical Deliverable" Reports

The requirement from all qualified PIAXP Teams for several pre-track-event reports is intended to increase the safety and reliability of PIAXP vehicles, and also to facilitate the development of competitive vehicles.

The three technical readiness reports will be designated as First Technical Deliverable, Second Technical Deliverable, and Third Technical Deliverable. The due date for each report is listed below.

First Technical Deliverable -	**Due December 15, 2009**
Second Technical Deliverable -	**Due January 30, 2010**
Third Technical Deliverable -	**Due March 30, 2010**

The Second and Third Technical Deliverable packages will be submitted to you roughly 45 days before the due dates listed above.

All Technical Deliverable reports will be submitted through a web-based template into which information, diagrams, and images are inserted and submitted electronically. (The template to fill in for First Technical Deliverable is on the following pages). The organizers will review these and may make suggestions or provide direction to Qualified Teams to address items that do not comply with the Technical Specifications.

For each successive Technical Deliverable, increasingly detailed information will be asked for by the organizers, and must be provided about each of the Teams' vehicles.

Qualified Teams that do not comply with Technical Deliverable progress report deadlines, or do not address items as directed by the organizers, may face disqualification from the Progressive Automotive X PRIZE.

Items to be addressed in the reports will include the following:

High Voltage Energy Storage Systems / other ESS
Fuel System
Powertrain and Emissions
Body and Chassis
Current Performance, Measurements, & Specs

More details about the Technical Deliverables will be discussed at the SEMA Summit.

Instructions for First Technical Deliverable Submission

1. Fill in ALL information electronically in the designated spaces of the template.

2. Make sure Team information is filled in first!

3. A separate template must be completed for every vehicle entered into the competition by each team.

4. If a section does not apply to your vehicle, do not leave blank, insert “DNA”

5. The submission of all requested photos, charts, drawings, graphs, tables, manufacturer’s sheets, etc.:

    a. Must all be in PDF format

    b. Must all be included in one PDF format file

    c. Each picture, etc. must be clearly identified or titled, with Team, Subject, and Tech Deliverable Section identifier (i.e. TD1-1-19a).

6. Completed Technical Deliverable package should be delivered electronically to Julie Zona and Bethann Buddenbaum, Team Development and Relations, on or before the deadline date, 5PM eastern.

FIRST TECHNICAL DELIVERABLE – TD1

Required Team Information

_____Team Name _____Vehicle Name

_____Vehicle # (TBD) _____ESS Technical Contact

_____Phone _____Email

Please Note:

Teams are required to complete all information on this form for each vehicle entered. Teams must provide justification why any information is not available at the end of the Sections.

Teams will be required to update the data and submit a revised specification sheet at the same time the Second and Third Technical Deliverables are submitted.

To avoid any miscommunication and help reduce work during the revision, teams are asked to fill out the form using MS Word rather than hand writing. Teams can add additional lines where necessary and check boxes (☐) can be changed by double clicking on them.

Section TD1-1

Energy Storage and High Voltage System Specification

(v2.9)

This Section is primarily designed for electrochemical batteries. If a vehicle has a different type of storage system, they are asked to contact PIAXP for additional directions.

Please note, that teams must have their ESS ordered by the first technical deliverable on December 15, 2009 date (subject to change). No changes to the ESS will be allowed after this date.

TD1-1-1 Energy Storage, General Information

☐ Lithium ☐ Nickel Metal-Hydride ☐ Lead Acid ☐ Other_____

Anode_____Cathode_____Electrolyte_____

TD1-1-2 Status of ESS (check all that have been completed)

☐ Received ☐ Purchased ☐ Exact ESS selected ☐ ESS not selected

_____ _____ _____ _____

For each action not completed, please denote anticipated completion date on the line below

TD1-1-3 ESS Manufacturer

_____Manufacturer _____Model #

Manufacturer Contact Information (name, phone, address, and website)

_____

_____

_____

_____

TD1-1-4 Cell Specifications

_____Nominal Cell Voltage _____Cell Capacity (Ah @ C/3)

_____Cell Energy (kWh @ C/3) _____Cell Weight (kg)

_____Critical Temperature *(C) _____Critical Cell Voltage*

(*Temperature and voltage where cell can automatically begin self-heating)

Provide a description of any safety requirements or devices on the cells, such as vents, shutdown separators, etc.

_____

_____

_____

_____

TD1-1-5 Pack Specifications

Status of Pack (check all that have been completed)

☐ Complete ☐ Building ☐ Design Complete ☐ Designing

_____ _____ _____ _____

For each action not completed, please denote anticipated completion date on the line below

_____Pack Capacity (Ah @ C/3) _____Pack Energy (kWh @ C/3)

_____# Packs_____# Cells per String_____# Strings per Pack

_____Nominal Pack Voltage _____Max. continuous discharge current

_____Peak discharge current _____Time for Peak discharge (s)

_____Max. Regenerative braking current_____Max operating voltage

_____Max Voltage during charging_____Max current during charging

_____Total Battery Weight (kg) _____Total Battery System Weight (kg) (including BMS, enclosure, etc)

TD1-1-6 ESS Enclosure

Status of Enclosure (check all that have been completed)

☐ Complete _____ ☐ Building _____ ☐ Design Complete _____ ☐ Designing _____

For each action not completed, please denote anticipated date on the line below

Please describe the design of your ESS enclosure. Include details on mounting points and mechanisms, weatherproofing, crash safety, protection from shock, etc. Teams should be aware that a secure ESS is a critical safety factor and teams with inadequate systems will be disqualified from the competition.

_____

_____

_____

_____

TD1-1-7 Battery Management System (BMS)

Status of BMS (check all that have been completed)

☐ Complete _____ ☐ Building _____ ☐ Design Complete _____ ☐ Designing _____

For each action not completed, please denote anticipated completion date on the line below

Status of Thermal Management System (check all that have been completed)

☐ Complete _____ ☐ Building _____ ☐ Design Complete _____ ☐ Designing _____

For each action not completed, please denote anticipated completion date on the line below

Thermal Management: ☐ Liquid Cooling ☐ Air Cooling ☐ Other_____

Temperature Monitoring: _____Total # Sensors per pack

_____Alarm Temperature(s) and actions taken

_____Alarm Temperature(s) and actions taken

_____Alarm Temperature(s) and actions taken

Voltage Monitoring: _____Total # Sensors per pack

_____Alarm Voltage(s) and actions taken

_____Alarm Voltages(s) and actions taken

_____Alarm Voltages(s) and actions taken

Please describe the design and operation of the thermal management system for your ESS. Include details on how your cooling system will maintain uniform target temperatures across the pack during the charging and discharging, including calculations on thermal load and cooling capabilities. Also provide information on the temperature monitoring system and actions that will be taken in case the event of a thermal runaway during both driving and charging. Provide a test plan on how the thermal management system will be tested under all possible simulated temperatures. Teams using advanced chemistries, such as lithium and nickel-metal hydride should be aware that the technical inspectors consider the thermal management of the pack a key safety concern and teams with inadequate systems will be disqualified from the competition.

Please describe the operation and design of your BMS for your ESS. Include details such as parameters monitored, number and placement of sensors, and safety actions in case of a thermal or voltage excursion. Teams using advanced chemistries, such as lithium and nickel-metal hydride should be aware that the technical inspectors consider the BMS of the pack a key safety concern and teams with inadequate systems will be disqualified from the competition.

TD1-1-8 Charger

Status of Charger (check all that have been completed)

☐ Received/Built ☐ Purchased ☐ Exact ESS selected ☐ ESS not selected

For each action not completed, please denote anticipated completion date on the line below the item

_____Manufacturer _____Model #

Manufacturer Contact Information (name, phone, address, and website)

Does the charger provide galvanic isolation between the ac input and vehicle: ☐ Yes ☐ No

Is the vehicle chassis connected to earth ground: ☐ Yes ☐ No

Location: ☐ On-board Vehicle ☐ Off-board Vehicle ☐ Other_____

_____Input Voltage Range _____Output Voltage Range

_____Max. Input Current _____Min. Required Current

_____Nominal Charging Efficiency (Wall to Plug)

_____UL/CSA Approved? _____Meets FCC Class B, 15?

Please describe the operation and design of your charger for your ESS. Include key components used (transformer, solid state switches, etc.) Include details such as parameters monitored, method of determining 100% SOC, charging profile, weatherproofing, unattended operation, over-charging protection, isolation fault detection, and reverse polarity protection. Teams should be aware that the technical inspectors consider the charger of the pack a key safety concern and teams with inadequate systems will be disqualified from the competition.

High Voltage System (for all electrical systems used to provide propulsion (regardless of voltage) or any systems greater than 50V)

TD1-1-9 High Voltage Schematics

Please provide a complete and detailed high voltage description of your high voltage system. You must also provide a schematic which must include the Ground Fault Isolation (GFI) monitor, Emergency Disconnect Switch (EDS), inertia disconnect switch, Manual Isolation Switch (MIS), traction battery fuses, all bulk capacitors, all capacitors from HV to vehicle chassis ("Y-Caps"), all resistors between HV positive and negative, all resistors from HV to vehicle chassis, all HV components (complete with manufacturer and part numbers of all components): including power switches (inverters and dc/dc converters), electrical motors, pumps, etc.

TD1-1-10 Status of Ground Fault Isolation (GFI) Monitor (check all that have been completed)

☐ Received/Built ☐ Purchased ☐ Exact GFI selected ☐ GFI not selected

_____ _____ _____ _____

For each action not completed, please denote anticipated completion date on the line below

_____ Manufacturer _____ Model #

In the HV schematics, please be sure to provide details exactly how and where your GFI is connected between the HV bus and vehicle chassis. Additionally, include photos if possible.

If not purchasing a GFI, please describe in detail how your GFI works and ensures < 1mA of leakage current detection.

_____

_____

_____

_____

TD1-1-11 **Status of Emergency Disconnect Switch (EDS)** (check all that have been completed)

☐ Received/Built ☐ Purchased ☐ Exact EDS selected ☐ EDS not selected

_____ _____ _____ _____

For each action not completed, please denote anticipated completion date on the line below

_____ Manufacture _____ Model #

TD1-1-11a Please provide photos showing the EDS properly installed in the two locations as required in the technical specifications. Photos or diagrams must also be provided that show the contactor associated with the EDS is < 3 feet from the HV source. This is required so that when the EDS is engaged, there is no remaining HV exposed elsewhere on the vehicle.

_____

_____

TD1-1-12 **Status of Inertia Switch** (check all that have been completed)

☐ Received/Built ☐ Purchased ☐ Exact Switch selected ☐ Switch not selected

_____ _____ _____ _____

For each action not completed, please denote anticipated completion date on the line below box

_____ Manufacture _____ Model #

TD1-1-13 **Status of Manual Isolation Switch (MIS)** (check all that have been completed)

☐ Received/Built ☐ Purchased ☐ Exact Switch selected ☐ Switch not selected

_____ _____ _____ _____

For each action not completed, please denote anticipated completion date on the line below box

_____ Manufacturer _____ Model #

TD1-1-13a Photos or diagrams must be provided that show the MIS is < 3 feet from the HV source and is located after the EDS.

TD1-1-14

If possible, provide measurement of isolation resistance:
Case: Vehicle off, all HV components connected, measure with ohm meter from HV bus to vehicle chassis.

HV positive to vehicle chassis: _____ Ω

HV negative to vehicle chassis: _____ Ω

Provide values of all HV capacitor "bleed" resistors: _____ Ω

TD1-1-15

For all HV components with a conductive enclosure/case, provide resistance values measuring from the case to the vehicle chassis:

HV Battery case-to-chassis:	Ω
Traction inverter case-to-chassis:	Ω
Dc/dc converter case-to-chassis:	Ω
Electric motor case-to-chassis:	Ω
HV Component 1 case-to-chassis:	Ω
HV Component 2 case-to-chassis:	Ω

TD1-1-16

Please provide details on prevention of erroneous (both uncontrollable and unintended) propulsion of the e-drive system. Additionally, provide full details on vehicle safety mechanisms and reaction to these erroneous propulsion events. It is important to note that OEMs are required to meet ECE R100 ("Unintentional acceleration, deceleration, and reversal of the drive train shall be prevented. In particular, a failure (e.g. in the power train) shall not cause more than 0.1 m movement of a standing un-braked vehicle.")

TD1-1-17

Please describe in detail your short-circuit, over-current, over-voltage, over-temperature, runaway motor (loss of speed sensor), and loss of low voltage (supplying your controller) protection strategy. The description should include control diagrams and software description if depending on software for protection. If providing a hardware means, all schematics should be provided. Please provide any Hardware-in-the-Loop (HIL) results if available.

TD1-1-18 **Solar Array (if applicable)**

_____Manufacturer _____Model #

_____Cell Material _____Nominal Cell Efficiency

_____Nominal Cell Voltage _____Nominal Cell Current

_____Nominal Panel Voltage _____Nominal Panel Current

_____Nominal Cell Efficiency _____Nominal Panel Efficiency

_____# Cells_____# Cells per String_____# Strings per Panel

Status of Solar Array

☐ Received ☐ Purchased ☐ Selected ☐ not selected

_____ _____ _____ _____

For each action not completed, please denote anticipated completion date on the line below box

Please provide a description of your solar array and how the energy is used on the vehicle. Also include information on how the energy from the panel will be monitored.

_____

_____

_____

_____

TD1-1-19 **Required Documentation**

Teams are asked to submit all forms in a single pdf file, with each pfd item identified by its associated ID (ie: TD1-1-19a).

TD1-1-19a ☐ ESS specification sheet

TD1-1-19b ☐ ESS manufacturer provided MSDS

TD1-1-19c ☐ CAD level technical drawing(s) of ESS showing cell placement within pack, sensor placement, wire routing etc.

TD1-1-19d ☐ Photo(s) of ESS showing cell placement pack, sensor placement, wire routing etc.

TD1-1-19e ☐ Technical drawing(s) of ESS showing battery placement and wire routing within vehicle

TD1-1-19 f ☐ Photo(s) of ESS showing battery placement and wire routing within vehicle

TD1-1-19g ☐ Electrical schematic(s) of ESS showing fuses, contactors, switches, sensors, shunts, etc

TD1-1-19h ☐ Technical drawing(s) of battery enclosure showing battery placement within vehicle, mounting points, etc.

TD1-1-19i ☐ Calculations or finite element analysis showing the ESS enclosure can withstand crash safety requirements listed in the Technical Specifications (XXX)

TD1-1-19j ☐ Teams must provide a BMS specification sheet either from the manufacturer or their own

TD1-1-19k ☐ Attach charger specification sheet from the manufacturer to this report.

TD1-1-19m ☐ Attach solar array specification sheet from the manufacturer to this report

TD1-1-19 Please add any additional information on this page, including justification why portions of the specifications sheet are incomplete.

Section TD1-2

Fueling System Specifications (1)

TD1-2-1 Fuel Type—Mark all fuels the vehicle will use during the competition

☐ Gasoline ☐ Diesel ☐ Biodiesel _____% Biodiesel
☐ E85 ☐ CNG ☐ Other_____

NOTE: Teams must finalize their fuel choice by the Second Technical Deliverable. No changes will be allowed after this date. Teams may use multiple fuels during the competition. However, the vehicle must pass all tests using all fuels, especially the emissions test. Teams not using PIAXP provided fuels are asked to contact that Fueling Director directly to coordinate fueling supplies.

TD1-2-2 Liquid Fuel Tank

Primary Tank

_____Volume (gal) _____Dimensions (in)

_____Manufacturer _____Model #

A vehicle's primary tank must be installed throughout the competition, but drained of all fuel and completely disconnected from the fuel system.

PIAXP Competition Tank

☐ Horizontal (approx 13" x 13" x 8.5") ☐ Vertical (approx 8.5" x 8.5" x 15") ☐ Custom

NOTE: Teams must select a PIAXP Competition Tank by the First Technical Deliverable. Custom tanks will be considered on a case by case basis. Teams will be required to have the tank designed and manufactured at a PIAXP certified vendor, and teams are responsible for all costs. Teams desiring custom tanks must contact the PIAXP organizers by First Technical Deliverable and have their tank design PIAXP approved by Second Technical Deliverable.

TD1-2-3 Gaseous Fuel Tank

_____Max. Pressure (bar) _____Dimensions (m)
_____Volume (l) _____Tank Material
_____Manufacturer _____Model #

Teams using CNG are required to use an NGV1 receptacle, and all fueling components prior to the high pressure regulator must be rated to at least 250 bar (3600 psi). Teams using gaseous fuels are asked to contact that Fueling Director directly to coordinate fueling supplies.

Pressure Sensor

_____Manufacturer _____Model #

_____Type

_____Resolution (0.1bar or 1 psi minimum)

_____Accuracy @ Full Scale (1% minimum)

Temperature Sensor*

_____Manufacturer _____Model #

_____Type

_____Resolution (0.1 C)

_____Accuracy @ Full Scale (1% minimum)

*Temperature sensor must read actual gas temperature inside tank

TD1-2-4 Required Documentation

Teams are asked to submit all forms in a single pdf file.

TD1-2-4a ☐ Primary tank manufacturer specification sheet

TD1-2-4b ☐ Vehicle schematics or drawings (front, top/bottom, side) showing the fuel system. The drawings should show the placement of tank, fueling lines, and all other fuel components (filters, pumps, etc.)

TD1-2-4c ☐ Photograph(s) of competition fuel tank clearly showing mounting brackets, fittings, and hoses

TD1-2-4d ☐ Photograph or video of fuel system

TD1-2-4e ☐ Fuel MSDS (not required for gasoline, diesel, biodiesel, E85, CNG, or hydrogen)

TD1-2-4f ☐ Pressure and temperature sensor specification sheets (gaseous fuels only)

TD1-2-5 Please add any additional information on this page, including justification why portions of the specifications sheet are incomplete.

Section TD1-3

Powertrain Specifications (v2)

TD1-3-1 Powertrain Type—Mark one appropriate powertrain that best describes the vehicle to be used during the competition

☐ ICE ☐ HEV Series ☐ HEV Parallel ☐ HEV Series/Parallel
☐ BEV ☐ PHEV Series ☐ PHEV Parallel ☐ PHEV Series/Parallel
☐ Other_____

TD1-3-2 Drive Type ☐ 2 Wheel ☐ 4 Wheel ☐ Other

Powertrain Status

Please mark all that apply to your powertrain.

TD1-3-3 ICE

Manufacturer_____ Model_____

Cylinders_____ Displacement (cu in)_____

Type (V, inline, DOHC etc.)_____Fuel_____

Fuel System (Multiport, Direct Injection, etc)_____Turbocharged?_____

Power (hp)_____@_____rpm Torque(ft-lbs)_____@_____rpm

Status of ICE (check all that have been completed)

☐ Complete ☐ Building ☐ Design Complete ☐ Designing

For each action not completed, please denote anticipated completion date on the line below box

Please provide a detailed description of your engine including any changes from original stock engine and features that may improve performance, efficiency, or emissions. If engine is turbocharged, please provide details, such as manufacturer, make, etc.

_____

_____

_____

_____

TD1-3-4 Transmission

Manufacturer_____Model_____
Gears_____Type (manual, automatic, etc)_____

Status of transmission (check all that have been completed)

☐ Complete _____ ☐ Building _____ ☐ Design Complete _____ ☐ Designing _____

For each action not completed, please denote anticipated completion date on the line below box

Please provide a detailed description of your transmission including any changes from original stock engine and features that may improve performance and efficiency.

_____

_____

_____

_____

TD1-3-5 Electric Motor 1

Manufacturer_____Model_____

Type_____Total quantity of this motor type_____

Power (hp)_____@_____rpm Torque(ft-lbs)_____@_____rpm

Max operating Voltage_____ Max operating current_____

Max. Regenerative braking current_____

Status of electric motors (check all that have been completed)

☐ Complete _____ ☐ Building _____ ☐ Design Complete _____ ☐ Designing _____

For each action not completed, please denote anticipated completion date on the line below box

TD1-3-6 Electric Motor 2 (if more than one type of electric motor)

Manufacturer_____Model_____

Type_____Total quantity of this motor type_____

Power (hp)_____@_____rpm Torque(ft-lbs)_____@_____rpm

Max operating voltage_____ Max operating current_____

Max. Regenerative braking current_____

Status of electric motors (check all that have been completed)

☐ Complete _____ ☐ Building _____ ☐ Design Complete _____ ☐ Designing _____

For each action not completed, please denote anticipated completion date on the line below box

TD1-3-7 Traction Inverter

Manufacturer_____Model_____

Power switch type_____Switching frequency_____

Max operating voltage_____ Max operating current_____

Max operating temperature_____Inverse diode max operating current_____

Status of traction inverter (check all that have been completed)

☐ Complete _____ ☐ Building _____ ☐ Design Complete _____ ☐ Designing _____

For each action not completed, please denote anticipated completion date on the line below box

Additional Information

TD1-3-8 Powertrain and Control Strategy

Please provide a detailed description of the operation of your powertrain and its control strategy. Include how power is transferred from the motor/engine to the wheels. For all hybrid vehicles, describe the operation of your powertrain during both charge depleting and charge sustaining modes. If a parallel hybrid vehicle, please provide how power is provided during different operating conditions (high torque, low speed, high speed, etc.) and how the control system and transmission blends the power from the engine and motor together. For series hybrids, please describe how the system determine when to turn on the engine and how the load of the engine is controlled during different operating conditions (high torque, low speed, high speed, etc.). .

_____

_____

_____

_____

TD1-3-9 Other Powertrain Components

Please provide any information on any other major powertrain components:

_____

_____

_____

_____

TD1-3-10 Vehicle Communication

Please mark all of the communication networks on your vehicle:

☐ CAN ☐ LIN ☐ J1850 ☐ Analog Signals ☐ Other_____

For CAN signals, please indicate the vehicle connector used (i.e., J1962): _____

For analog signals, please indicate the voltages of the signals: _____

TD1-3-11 Emissions

NOx (g/mi)_____(tested/estimated)

CO (g/mi)_____(tested/estimated)

NMHC (g/mi)_____(tested/estimated)

PM (g/mi)_____(tested/estimated)

Status of emissions system (check all that have been completed)

☐ Complete ☐ Building ☐ Design Complete ☐ Designing

For each action not completed, please denote anticipated completion date on the line below box

Please provide a detailed description of the operation of your emissions equipment and emissions control strategy. Include how emissions levels of all criteria pollutants will be controlled under different operating conditions (high torque, low speed, high speed, cold start etc.) and vehicle modes (charge depleting and charge sustaining modes for hybrid vehicles). Also include a description on the status of your equipment, including any testing that has been done.

_____

_____

_____

_____

TD1-3-12 Required Documentation

Teams are asked to submit all forms in a single pdf file.

TD1-3-12a ☐ Original engine specification sheet

TD1-3-12b ☐ Original transmission specification sheet

TD1-3-12c ☐ Original motor specification sheet

TD1-3-12d ☐ Photos of powertrain, including engine, motor, and transmission mounted within vehicle

TD1-3-12e ☐ A technical drawing(s) of the powertrain showing all major components and power flow during different operation conditions

TD1-3-12f ☐ Certified test data from emissions testing

Section TD1-4
Body and Chassis System Specifications

TD1-4-1 General Information

Doors_____ Seats_____ Material_____

Wheelbase (in)_____ Width (in)_____ Height (in)_____

Ground Clearance (in)_____ Curb Weight (lbs)_____

Original GVW (lbs) _____(for modified production vehicles)

☐ Modified Production Vehicle (continue below) ☐ New Construction (Skip to New Construction section)

MODIFIED PRODUCTION VEHICLES:

TD1-4-2 Base vehicle manufacturer and model_____Year_____

Status of Chassis Structure (check all that have been completed)

☐ Received _____ ☐ Purchased _____ ☐ Exact Chassis selected _____

For each action not completed, please denote anticipated completion date on the line below box

Status of Modifications to Chassis Structure (check all that have been completed)

☐ No Modifications planned _____ ☐ Modifications complete _____ ☐ Modifications Started _____

☐ Design and analysis complete _____ ☐ Design started _____ ☐ Design Not Started _____

For each action not completed, please denote anticipated completion date on the line below

TD1-4-3 Detailed description of modifications to structure:
(Include details regarding how the modifications are expected to maintain or improve structural integrity of the original equipment, especially with regard to changes in weight, placement of major components, and reduction in crush zones. regarding material selection, structural member sizing, attachment scheme, and load path confirmation.

NOTE: **Must include pictorial representation of entire structure with notations for sizing, thickness, materials, attachment, etc**. Pictorial can be CAD screen plot, scanned drawings, photos, etc.)

Chassis Structural Engineering for Modifications (check all that have been completed and are attached)

☐ Calculations ☐ Finite Element Analysis ☐ Other Simulation ☐ None

For each action not completed, please denote anticipated completion date on the line below box

Pictorial Representation of Modifications (check all that have been completed and are attached)

☐ CAD picture ☐ Scanned drawings ☐ Hand drawings ☐ Photos

Details of Modifications (check all that have been completed and are attached)

☐ Material specs

☐ Structural member sizing relative to replaced original equipment (Pictorial required with notations for section size, thickness, material, etc.)

Section Representations (Include pictorial showing dimensions, thickness, material for the following cross sections)

☐ Front/Motor compartment rail

☐ A-pillar/Windshield side member

☐ Front hinge pillar

☐ Rear compartment rail

☐ Front of dash cross-car members

☐ Front bumper beam

☐ Under-floor longitudinal support

☐ Door beam(s) and interface with structure

☐ Rocker/Door sill

☐ Roof side rail/door header

☐ B-pillar/Lock pillar

☐ Rear roof header/roll hoop

☐ Seat back/rear bulkhead (structure behind seats)

☐ Rear bumper beam

☐ Under-floor cross car support/seat bars

☐ Other

Attachment scheme for modifications

☐ Bolted ☐ Welded ☐ Bonded

Details:

Modified Vehicles skip to "ALL VEHICLES" sections below.

NEW CONSTRUCTION VEHICLES:

TD1-4-4 Status of Chassis Structure: (check all that have been completed)

☐ Complete ☐ Construction started ☐ Design complete ☐ Design started

_____ _____ _____ _____

For each action not completed, please denote anticipated completion date on the line below box

TD1-4-5 Detailed description of structure:
(Required documentation includes calculations, simulation, Finite Element Analysis, etc. used to make decisions regarding material selection, structural member sizing, attachment scheme, and load path confirmation. Must include pictorial representation of entire structure with notations for sizing, thickness, material, attachment, etc. Pictorial can be CAD screen plot, scanned drawings, photos, etc.)

Pictorial Representation of Chassis Structure: (check all that have been completed and are attached)

☐ CAD picture ☐ Scanned drawings ☐ Hand drawings ☐ Photos

_____ _____ _____ _____

Details of Structure (check all that have been completed and are attached)

☐ Material specs

_____

Section Representations (Include pictorial showing dimensions, thickness, material for the following cross sections)

☐ Front/Motor compartment rail

☐ A-pillar/Windshield side member

☐ Front hinge pillar

☐ Rear compartment rail

☐ Front of dash cross-car members

☐ Front bumper beam

☐ Under-floor longitudinal support

☐ Door beam(s) and interface to structure

☐ Rocker/Door sill

☐ Roof side rail/door header

☐ B-pillar/Lock pillar

☐ Rear roof header/Roll hoop

☐ Seat back/Rear bulkhead (structure behind seats)

☐ Rear bumper beam

☐ Under-floor cross car support/Seat bars

☐ Other

Attachment scheme for modifications

☐ Bolted ☐ Welded ☐ Bonded

Details: _____

_____

_____

_____

_____

ALL VEHICLES:

TD1-4-6 Detailed description of plan to meet FMVSS Crashworthiness Requirements:
(Reference http://www.nhtsa.dot.gov/cars/rules/standards/ for details regarding specific requirements. Per the PIAXP Guidelines, compliance with the following is required: FMVSS 201, 205, 208, 209, 210, 212, 214, 216, 301. Include calculations, simulation, Finite Element Analysis, etc. as means to demonstrate how engineering decisions were made in the design of "crush zones" and protection of vehicle occupants per US Federal standards. Of specific concern is verification that fuel systems and occupants will not be in the intrusion zones for front, rear or side impact. Please include a description of any non-structural components that may reside within crash intrusion zones and explain their interaction during a crash event – i.e. contributing to crush resistance or deflect out of the way, etc.)

Pictorial Representation of ENTIRE Structure (check all that have been completed and are attached)

☐ CAD picture ☐ Scanned drawings ☐ Hand drawings ☐ Photos

TD1-4-7 FMVSS Requirements (check all that have been completed. If not complete, please indicate anticipated completion date.)

Crashworthiness Engineering Assessment: (check all that have been completed and are attached)

☐ Calculations ☐ Finite Element Analysis ☐ Other Simulation ☐ None

For each action not completed, please denote anticipated completion date on the line below box

	Expected Completion Date
☐ FMVSS 201 – Occupant Protection on Interior Impact	
☐ FMVSS 205 – Glazing Materials	
☐ FMVSS 208 – Occupant Crash Protection	
☐ FMVSS 209 – Seat Belt Assemblies	
☐ FMVSS 210 – Seat Belt Anchorage	
☐ FMVSS 212 – Windshield Mounting	
☐ FMVSS 214 – Side Impact Protection	
☐ FMVSS 216 – Roof Crush Resistance	
☐ FMVSS 301 – Fuel System Integrity	

ALL VEHICLES:

TD1-4-8 Required Documentation

Teams are asked to submit all forms in a single pdf file.

TD1-4-8a ☐ CAD level technical drawing(s) of Chassis Structure showing packaging of structural and non-structural components.

TD1-4-8b ☐ Photos of chassis in current state if construction.

TD1-4-8c ☐ Calculations, simulation results, or Finite Element Analysis report regarding structural integrity and crashworthiness.

Section TD1-5

Current Performance, Measurements, & Specs

(No information required in this Section for First Technical Deliverable)

This concludes the Template for Submitting Data
for the First Technical Deliverable (TD1).

Include Separate File for All Required Photos, Diagrams, etc.,
Each one in PDF format