

Second 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 Third Technical Deliverable package will be submitted to you roughly 45 days before the due date 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 Second Technical Deliverable is on the following pages). The organizers will review all the team’s submissions and may make suggestions or provide direction to Qualified Teams to address items that do not comply with the Technical Specifications.

All requested detailed information 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

Instructions for Second Technical Deliverable Submission

1. The Second Technical Deliverable will be used to determine teams requiring pre-event visits in person by a member of the technical advisory team. The basis of the visit will determine if the team should continue to the next stage of the competition based on safety and vehicle construction concerns.
2. The new content of the Second Technical Deliverable is in section TD2-1.
3. Please provide a status update on all sections TD2-2 to TD2-5, covering all material from the First Technical Deliverable. Photographs are required to prove status of each section. Please clearly mark if a section has been updated or not. If you have updated a section, please provide the original First Technical Deliverable with all changes marked in either **RED** font, or highlighted with **yellow**.
4. Fill in ALL information electronically in the designated spaces of the template.
5. Make sure Team information is filled in first!
6. A separate template must be completed for every vehicle entered into the competition by each team.
7. If a section does not apply to your vehicle, do not leave blank, insert "DNA"
8. 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. [TD2-2-15](#)).
9. Completed Technical Deliverable package should be delivered electronically to Julie Zona and Bethann Buddenbaum, Team Development and Relations, on or before the deadline date, 5 p.m. eastern standard time.

SECOND TECHNICAL DELIVERABLE – TD2

Required Team Information

_____ Team Name _____ Vehicle Name
_____ Vehicle # (TBD) _____ ESS Technical Contact
_____ Phone _____ Email
_____ Powertrain Type _____ Fuel Type

Mainstream Alternative – Side-by-Side Alternative – Tandem

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.

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 TD2-1

Current Component and System Status

TD2-1-1 Evidence of Progress and Implementation of Vehicle Construction and Component Integration

A key ingredient in determining in-person visits will be based on the status of all hardware components and systems. It is expected that by the due date of the Second Technical Deliverable that all hardware is received and in-house. Below is a check list of all major components and systems of the vehicle. Please provide sufficient photographs for each section to easily convince the technical advisory team that you are fully in compliance of receiving all major components. Mark the box “Y” if you fully comply and provide photos; mark the box “N” if you do not fully comply, provide photos of any existing components and describe in detail why you do not comply; mark the box “n/a” if it doesn’t apply to your vehicle:

- | Y | N | n/a | |
|--------------------------|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | All critical HV electrical components received (if applicable)
- Inverters, converters, HV cables, etc. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | All critical ESS components received (if applicable)
- HV battery, BMS, etc. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | All critical fuel system components received (if applicable)
- Fuel tank, pumps, etc. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | All critical powertrain components received
- Transmission, axles, shafts, etc. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | All critical emissions components received (if applicable)
- Catalytic converter, Diesel particulate filter, air pumps, control modules |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | All critical body materials received
- Any non-typical materials, carbon fiber, formed panels, windshield, body panels, etc |

- Evidence that the chassis is fully complete
- In addition to pictures, a video must be submitted showing suspension being articulated and a rolling chassis moving and maneuvering under its own power.

TD2-1-2 Proof of a running vehicle

Please provide a video showing that all major systems are integrated and operational. The video should show that the powertrain is able to operate as intended including regenerative brakes if equipped, all driving modes (electric only, fuel only, combined, etc.), and show ability to disconnect drive system for coast down. It is not required for the vehicle to be driving on a road, but should be able to clearly see that it is running and the powertrain is installed.

TD2-1-3 Vehicle Mass

Please provide the mass of the vehicle and a description on how the mass was determined. An estimate based on components is acceptable. Please note that the Third Deliverable will require a mass measurement of the completed vehicle.

Vehicle Mass: _____ Unit: _____

Please provide a description of how the vehicle mass value was calculated or measured:

TD2-1-4 Ground Clearance

Please provide a photo of the vehicle ground clearance meeting or exceeding the 4 inch requirement. The vehicle can be at standstill.

TD2-1-5 Emissions Control Status (if applicable)

Please provide photographic evidence that shows all of the physical hardware that makes up your emission control system and it's installation in your vehicle. In addition, please provide a detailed schematic for the emission control system you will use in the competition. Please show a minimum of 4 or 5 gas analyzer results during a neutral sweep (in vehicle neutral, sweep 4 to 5 different rpm levels allowing enough time at an rpm to allow the analyzer to indicate a stable reading). For series hybrid configurations, a single rpm is acceptable, but various loads should be applied thru electrical controls. A similar set of 4 to 5 gas analyzer results is required for series hybrid configurations. Please provide your test plan for developing and verifying that your system meets the Tier 2 Bin 8 cold start requirement.

TD2-1-6 ESS Thermal Management System Test Results (if applicable)

Please provide the results from your HV thermal management system testing based on the required test plan from the First Technical Deliverable. The results should demonstrate a design working as intended with the proper vehicle and battery reaction to prevent any damage or safety issue. The results should clearly include at minimum the vehicle operating state, a description of how the battery temperature was simulated, and the vehicle reaction from testing compared to the expected vehicle reaction at every defined temperature threshold. The temperature thresholds should align properly with the battery manufacturer's recommended temperature limits. Videos, photos, diagrams, are some acceptable ways to provide evidence of a properly working HV battery thermal management system.

TD2-1-7 Evidence of Progress and Implementation of HV Safety (if applicable)

Another key ingredient in determining in-person visits will be based on the status of the HV safety implementation. Below is a list of minimum safety items that shall be discussed in detail with evidence provided, including sufficient photographs when needed, to communicate to the technical advisory team that you are fully in compliance of implementing all major HV safety items:

- Photos of how the hold-downs are made to secure the ESS. Evidence that all hold-downs are rated to a minimum of 8 G of peak vertical force for two seconds.
- Evidence that the complete ESS containment design, including battery hold down, battery enclosure support structure, and enclosure to chassis attachment, show compliance with 15 G peak lateral and 8 G vertical static loads for 2 seconds.
- Evidence showing how HV isolation from vehicle chassis is fully achieved to meet the 500 Ω/V requirement.
- Evidence of isolation fault detection, EDS, MIS, inertia switch, orange HV cable indication, warning labels, etc. as required.
- Evidence that there are no unintended conductive components or hardware within the HV battery enclosure which could come into contact with the HV battery terminals, causing a short across the terminals or to the vehicle/case ground, during normal driving conditions (assuming vibrations).

Section TD2-2

Energy Storage and High Voltage System Specification

This Section is primarily designed for electrochemical batteries. If your vehicle has a different type of energy storage system, please contact PIAXP for additional directions.

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

TD2-2-1 Energy Storage, General Information

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-2 Status of ESS

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-3 ESS Manufacturer

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-4 Cell Specifications

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-5 Pack Specifications

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-6 ESS Enclosure

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-7 Battery Management System (BMS)

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-8 Charger

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-9 High Voltage Schematics

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-10 Status of Ground Fault Isolation (GFI) Monitor

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-11 Status of Emergency Disconnect Switch (EDS)

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-11a Please provide photos showing the EDS properly installed in the two locations as required in the technical specifications.

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-12 Status of Inertia Switch

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-13 Status of Manual Isolation Switch (MIS)

Are there any updates from the First Technical Deliverable? Updates No Updates

Progressive Insurance Automotive X Prize

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-13a Photos or diagrams must be provided that show the MIS is < 3 feet from the HV source and is located after the EDS.

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-14 Provide Isolation Resistance

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-15 Equipotential Bonding

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-16 Prevention of Erroneous Propulsion

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-17 Details on Protection Strategy (over-current, over-temperature, etc.)

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-18 Solar Array

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-2-19 Required Documentation

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

Section TD2-3

Fueling System Specifications

TD2-3-1 Fuel Type

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

NOTE: Teams must finalize their fuel choice by the completion date of the Second Technical Deliverable. No changes will be allowed after this date. Teams are not allowed to switch from gasoline to diesel or CNG at the completion date of the Second technical Deliverable. Only changes allowed are from gasoline to E85. B-20 is the only diesel fuel available. 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.

TD2-3-2 Liquid Fuel Tank

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

NOTE: Teams must select a PIAXP Competition Tank by the completion date of 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 approved by the PIAXP organizers by the Second Technical Deliverable.

TD2-3-3 Gaseous Fuel Tank

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-3-4 Required Documentation

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

Section TD2-4

Powertrain Specifications

TD2-4-1 Powertrain Type

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-2 Drive Type

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-3 ICE

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-4 Transmission

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-5 Electric Motor 1

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-6 Electric Motor 2 (if more than one type of electric motor)

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-7 Traction Inverter

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

Additional Information

TD2-4-8 Powertrain and Control Strategy

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-9 Other Powertrain Components

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-10 Vehicle Communication

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-11 Emissions

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

TD2-4-12 Required Documentation

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either RED font or yellow highlights so the judging panel can easily recognize new material.

Section TD2-5

Body and Chassis System Specifications

TD2-5-1 General Information

Basic vehicle dimension:

Wheelbase:	_____	Units:	_____
Track Width:	_____	Units:	_____
Vehicle Height:	_____	Units:	_____
Vehicle Width:	_____	Units:	_____
Vehicle Length:	_____	Units:	_____

Suspension type (SLA, double wishbone, etc.):

	Front:	_____	
	Rear:	_____	
Wheel sizes:	Front:	_____	Rear: _____
Tire sizes:	Front:	_____	Rear: _____
Brakes:	Front:	_____	Rear: _____

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either **RED** font or **yellow highlights** so the judging panel can easily recognize new material.

MODIFIED PRODUCTION VEHICLES:

TD2-5-2 Chassis Structure

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either **RED** font or **yellow highlights** so the judging panel can easily recognize new material.

TD2-5-3 Detailed description of modifications to structure

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either **RED** font or **yellow highlights** so the judging panel can easily recognize new material.

NEW CONSTRUCTION VEHICLES:

TD2-5-4 Chassis Structure:

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either **RED** font or **yellow highlights** so the judging panel can easily recognize new material.

TD2-5-5 Detailed description of structure

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either **RED** font or **yellow highlights** so the judging panel can easily recognize new material.

ALL VEHICLES:

TD2-5-6 Detailed description of plan to meet FMVSS Crashworthiness Requirements

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either **RED** font or **yellow highlights** so the judging panel can easily recognize new material.

TD2-5-7 FMVSS Requirements

Are there any updates from the First Technical Deliverable? Updates No Updates

If there are any updates, please mark clearly in either **RED** font or **yellow highlights** so the judging panel can easily recognize new material.

ALL VEHICLES:

TD2-5-8 Required Documentation - No other performance, measurements, or specs are required beyond what is noted previously in this document (example: vehicle mass). Third Technical Deliverable will require filling in a complete Spec/Performance sheet.

*This concludes the Template for Submitting Data
for the Second Technical Deliverable (TD2).*

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